Harley-Davidson, Inc.

SERVICE MANUAL

FL / FX models 1200 / 1340cc 4-Speed
1978 ½ to 1984

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, Inc.

1978½ TO 1984
FL/FX
1200/1340cc
4-SPEED

SERVICE MANUAL

The information in this manual applies to the 1978½ and later FL/FX 1200/1340cc 4-Speed models manufactured after January 1, 1978

PRODUCT 1

CHASSIS 2

ENGINE 3

FUEL SYSTEM 4

ELECTRIC STARTER 5

DRIVE 6

TRANSMISSION 7

ELECTRICAL 8

PART NO. 99482—84

HG-4M-9/93

Printed in U.S.A. on Recycled Paper

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1978½-84
FL/FX

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Harley-Davidson, Inc.
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 product and assist him in performing basic maintenance and repair. Secondly, it will introduce to the professional Harley-Davidson mechanic 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:

   Adjustments
   Removal
   Disassembly
   Cleaning, Inspection and Repair
   Assembly
   Installation

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 part 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, use only genuine Harley-Davidson parts or parts with equivalent characteristics including type, strength and material. Failure to do so may result in product malfunction and possible injury to the operator and/or passenger.

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
29874 Little Mack
Roseville, Michigan 48066

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.

Application	Product
Lock fender braces, master cylinder bolts, brake anchors, exhaust flanges and general body hardware.	Lock N' Seal* Adhesive
Locking crank pin and flywheel nuts.	Retaining Compound RC/620
Secure upper and lower fork assemblies, shock absorber mounts, fittings, axle nuts, shift lever screws, cylinder head and crankcase studs, and handle bar clamps.	Stud N' Bearing Mount Adhesive
Lock adjustment screws and assembled parts. Secure foot rests and kick starters.	Wick N' Lock* Adhesive
Retain brake pedal bushings, main shaft sprockets, counter shafts, oil seals, drive train, linkage, clutch hub and sprocket assemblies.	Retaining Compound No. 601
Bond brake pedal and kick starter pads. Secure loose hand grips. Repair loose windshield moldings, and other rubber, vinyl and plastic parts.	SuperBonder* Adhesive
Seal threaded fuel line fittings, hydraulic brake line fittings and engine plugs.	Pipe Sealant with Teflon*
Make emergency gaskets on-the-spot. Seal crankcase cover, cylinder blocks to crankcase, fuel and oil pumps, and rocker arm covers.	Gasket Eliminator* Sealant
Prevent galling, seizing and corrosion on oil drain plugs, spark plugs, front fork and shock assemblies, swing arm, pivot shaft and axles.	Anti-Seize Lubricant
Dissolve grease, dirt and oil from parts quickly and safely. Prepare mating surfaces for Loctite products.	Cleaning Solvent

*Reg. TM DuPont Corp.

* Reg. TM Loctite Corp.

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 Motor Co., 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.

Harley-Davidson products are manufactured under one or more of the following patents: U.S. Patents — 2986162, 2987934, 2998809, 3116089, 3144631, 3144860, 3226994, 3229792, 3434887, 3559773, 3673359, 3709317, Des. 225 626.

TABLE OF CONTENTS

SECTION 1 - PRODUCT

Page No.

Service 1-1
Servicing a New Motorcycle 1-1
Check At First 500 Miles 1-1
Safe Operating Maintenance 1-1
Regular Service Intervals 1-2
Storage 1-9
Removal From Storage 1-9
Fluid Requirements 1-9
Metric Conversion 1-11
Troque Requirements 1-12

Troubleshooting 1-13
Engine 1-13
Lubrication System 1-14
Electrical System 1-14
Carburetor 1-14
Transmission 1-14
Clutch 1-14
Brake 1-15
Handling 1-15
Tools 1-17

SECTION 2 - CHASSIS

Specifications 2-1
Dimensions 2-1
Vehicle Weight 2-1
Capacities 2-1
Front Fork 2-1
Adjustments 2-1
Torques 2-1
Brake Disc Size 2-1
Tire Data 2-1
Vehicle Identification Number — 1978½-1980 2-3
Vehicle Identification Number — 1981 and Later 2-3

Wheels 2-5
Front Wheel — FL Models 2-5
Front Wheel — FX Models 2-8
Front Wheel — 1984 FXST/FXWG/FXE Models 2-11
Rear Wheel — All FL/FX Models 2-13
Lacing Wheels — 16 Inch 2-17
Lacing Wheels — 19 Inch 2-18
Lacing Wheels — 21 Inch 2-20
Truing Laced Wheel 2-21
Checking Cast Rim Runout 2-22
Tires 2-22

Brakes 2-29
General 2-29
Adjustments 2-29

Page No.

Front Brake Master Cylinder — 1981 and Earlier 2-30
Front Brake Master Cylinder — 1982 and Later 2-31
Rear Brake Master Cylinder — 1978½ - Early 1979 2-34
Rear Brake Master Cylinder
Late 1979-1983 FL/FXE and Late 1979-1982 FX 2-35
Rear Master Cylinder
1983 Models (Except FL/FXE) 2-36
Front Caliper — FL 2-36
Front Caliper — FX 2-40
Front Caliper — 1984 - FX 2-42
Rear Caliper
1978½-1980 FL/FX Models 2-45
Rear Caliper
1981-1984 FL Models 2-46
1981-1982 FX Models, 1983 FXE 2-47
Rear Brake Caliper — 1983 FX/FLHS (Except FXE) 2-49
Brake Discs 2-51
Bleeding The Hydraulic Brake System 2-51
Stoplight Switch 2-52

Front Forks — FL Models 2-53
General 2-53
Adjustments 2-53
Changing The Fork Oil 2-53
Front Fork 2-54
Non-Adjustable Fork Stem And Bracket 2-55
Adjustable Fork Stem And Bracket 2-57

Front Forks — FX Models 2-59
General 2-59
Changing The Fork Oil 2-59
Front Forks — FX Models (Except FXWG & FXST) 2-59
Fork Stem And Bracket Assembly
FX Models (Except FXWG/FXST and FXDG) 2-62
Front Fork — FXWG and FXST 2-64
Fork Stem And Bracket Assembly — FXWG/FXST 2-67

Frame And Rear Swing Arm 2-69
Rear Swing Arm — FL/FX (Except FXST) 2-69
Rear Swing Arm — FXST 2-69

Rear Shock Absorber 2-73
Adjustment 2-73
FXST Swing Arm Shock Dampening 2-73
Removal 2-73
Disassembly FL/FX (Except FXST) 2-73
Cleaning, Inspection And Repair — FL/FX
(Except FXST) 2-73
Assembly — FL/FX (Except FXST) 2-74
Installation — FL/FX (Except FXST) 2-74
Removal — FXST 2-74
Disassembly — FXST 2-74
Installation — FXST 2-74

Page No.

Handlebar Controls And Instruments . 2-77
Throttle Control — 1978½-1980 2-77
Throttle Control — 1981 and Later 2-78
Clutch Hand Control 2-84
Speedometer/Tachometer 2-85
Handlebar Switches 2-86

Seats 2-87
Solo Saddle 2-87
Comfort Flex Seat 2-88
Frame Mounted Seat 2-94

Fiberglass And Fenders 2-95
Fairing And Windshield
FL Models 2-95
Saddlebags — FL Models 2-96
Tour-Pak — FL Models (Early) 2-96
Tour-Pak — FL Models (Late) 2-96
Front Fender Replacement
FL Models 2-97
Front Fender Replacement
FX Models (1983 and Earlier) 2-97
Front Fender Replacement — FX 1984 Models 2-98
Rear Fender Replacement
FL Models 2-98
Rear Fender Replacement
FX Models 2-100

SECTION 3 - ENGINE
FL/FX (Except FXST)

Specifications 3-1

General Information 3-5
Description 3-5
Gasoline 3-5
Lubrication 3-5
Repair and Diagnostic Procedure 3-10
Stripping Motorcycle For Engine Repair 3-12

Cylinder Head 3-15
Removing 3-15
Disassembling 3-15
Cleaning and Inspection 3-15
Repairing Rocker Arms and Bushings 3-17
Reconditioning or Replacing Valve Seats 3-18
Grinding Valve Faces and Seats 3-19
Lapping Valve Faces and Seats 3-19
Assembling Cylinder Head 3-20
Installing and Adjusting Push Rods 3-20
Checking Push Rod Adjustment 3-21

Page No.

Cylinder and Piston 3-23
Disassembling Cylinder and Piston 3-23
Cleaning and Inspecting 3-23
Refinishing Cylinders 3-24
Connecting Rod Bushing 3-26
Twisted Connecting Rods 3-27
Assembling Cylinder and Piston 3-27

Gearcase 3-29
Oil Pump 3-29
Valve Tappets and Guides 3-30
Gearcase Cover and Timing Gears 3-33

Crankcase 3-39
General 3-39
Flywheel End Play Check 3-39
Disassembling Crankcase 3-39
Flywheels 3-41
Assembling Crankcase 3-48

FXST

Specifications V3-1
Description V3-3
Gasoline V3-3
Lubrication V3-3
Diagnostic and Repair Procedures V3-6
Stripping Motorcycle for Engine Repair V3-10

Cylinder Head V3-13
Removal V3-13
Disassembly V3-15
Cleaning and Inspection V3-16
Repairing Rocker Arms and Bushings V3-16
Replacing Valve Guides V3-17
Grinding Valve Faces and Seats V3-18
Replacing Valve Seats V3-19
Lapping Valve Faces and Seats V3-19
Assembling Cylinder Head V3-19
Installing Cylinder Head V3-20
Installing and Checking Push Rod Length V3-20

Cylinder and Piston V3-23
Removal Cylinder and Piston V3-23
Cleaning and Inspection V3-23
Refinishing Cylinder V3-24
Straigtening Connecting Rods V3-26
Assembling Cylinder and Piston V3-26

Gearcase V3-27
Oil Pump V3-27
Valve Tappets and Guides V3-28
Gearcase Cover and Timing Gears V3-29

Page No.

Crankcase V3-35
General V3-35
Flywheel End Play Check V3-35
Disassembly Crankcase V3-35
Installing Cylinder Studs V3-36
Flywheels V3-37
Assembling Crankcase V3-44

SECTION 4 - FUEL SYSTEM

Specifications 4-1
Jet Sizes 4-1
Fuel Tank Capacity 4-1
Torques 4-1

Carburetor 4-3
General 4-3
Operation 4-4
Adjustments 4-7
Troubleshooting 4-9
Removal 4-11
Disassembly 4-11
Assembly 4-11
Installation 4-12

Air Cleaner 4-15
General 4-15
Servicing Air Cleaner — FL/FX (Except FXST) 4-15
Removal 4-16
Installation 4-16

Servicing Air Cleaner — FXST 4-16
Removal 4-17
Installation 4-17

Fuel Supply Valve 4-19
General 4-19
Removal 4-19
Cleaning, Inspection and Repair 4-19
Installation 4-19

Fuel Tank 4-21
General 4-21
Removal 4-21
Cleaning, Inspection and Repair 4-22
Installation 4-22

Page No.

SECTION 5 - ELECTRIC STARTER

General Information 5-1
Specifications 5-1
Description 5-1
Troubleshooting 5-1
Starter Relay 5-1

Starter Motor - 1978½ to 1982 FL, FLH, FLH-80 And 1979 to 1981 Classic 5-3
Starter Draw Test 5-3
Removal 5-3
Disassembly 5-3
Cleaning, Inspection and Repair 5-3
Assembly 5-5
Installation 5-6

Starter Motor - 1978½ to 1984 FX, 1982 Classics And 1983-1984 FL Models 5-7
Starter Draw Test 5-7
Removal 5-7
Disassembly 5-7
Cleaning, Inspection and Repair 5-7
Assembly 5-9
Installation 5-10

Solenoid 5-11
General 5-11
Testing the Solenoid 5-11
Removal 5-11
Disassembly 5-12
Cleaning, Inspection and Repair 5-12
Assembly 5-12
Installation 5-12

Starter Shaft And Gear Housing (1984 and Earlier All Models Except FXB/FXSB/FXDG) 5-15
Removal 5-15
Cleaning, Inspection and Repair 5-15
Installation 5-15

Starter Shaft And Gear Housing (FXB/FXSB/FXDG) 1982 FLHC, 1983-1984 FLH Models And 1984 FXWG 5-19
Removal 5-19
Cleaning, Inspection and Repair 5-19
Installation 5-19

SECTION 6 - DRIVE

Specifications 6-1
Chains 6-1
Belts 6-1
Clutch 6-1
Lubricants 6-1
Sprockets 6-1
Primary Case 6-1
Torques 6-1

Chains And Sprockets 6-3
Primary Chain 6-3
General 6-3
Adjustment 6-3
Disassembly 6-3
Cleaning, Inspection and Repair 6-4
Sprocket alignment dry clutch 6-4
Sprocket alignment wet clutch 6-4
Assembly 6-6

Secondary Chain And Sprockets 6-6
Adjustment 6-6
Lubrication 6-7
Removing and Installing 6-8

Transmission Sprocket 6-8
Removal 6-8
Cleaning, Inspection and Repair 6-8
Installation 6-8

Belts And Sprockets 6-11
Primary Belt 6-11
General 6-11
Adjustment (1980 and Early 1981) 6-11
Adjustment (Late 1980 and Later) 6-11
Disassembly and Assembly 6-11
Sprocket Alignment 6-12

Secondary Drive Belt and Sprocket 6-14
Adjustment and Alignment 6-14
Removal and Installation 6-15

Transmission Sprocket 6-15
Removal 6-15
Cleaning, Inspection and Repair 6-15
Installation 6-15

Dry Clutch 6-17
General 6-17
Adjustments 6-17
Disassembly 6-17
Cleaning, Inspection and Repair 6-18
Assembly 6-20

Wet Clutch 6-23
General 6-23
Adjustments 6-23
Disassembly 6-25
Cleaning, Inspection and Repair 6-25
Assembly 6-26

Primary Chain/Belt Case 6-29
General 6-29
Disassembly 6-29
Cleaning, Inspection and Repair 6-29
Assembly 6-29

SECTION 7 - ENGINE

Specifications 7-1
Mainshaft Main Drive Gear 7-1
Mainshaft 7-1
Countershaft 7-1
Shifter Cam (1978½ - Early 1979) 7-1
Torques 7-1
Lubricants 7-1
Service Wear Limits 7-1

General Information 7-3
Description 7-3
Adjustments 7-3

Shifter Assembly 7-5
Shifter Cover - Drum Shifter
1978½ - Early 1979 7-5
Shifter Cover - Plate Shifter
Later 1979 And Later 7-9

Shifter Forks 7-13
Adjustment 7-13
Disassembly 7-14
Cleaning, Inspection and Repair 7-15
Assembly 7-15

Transmission Case 7-17
Removal 7-17
Cleaning, Inspection and Repair 7-18
Installation 7-18
Replacing the Main Drive
Gear Bearing Spacer Oil Seal 7-18
Side Cover - Electric Start 7-19
Side Cover - Kick Start 7-20
Starter Clutch - Kick Start Models Only 7-21
Countershaft 7-23
Mainshaft and Main Drive Gear 7-25

SECTION 8 · ELECTRICAL

Specifications 8-1

Ignition System 1979 And Earlier 8-3
Ignition Timer 8-3
Troubleshooting 8-4
Adjusting Sensor Air Gap 8-4
Checking Advance Timing With Strobe Timing Light 8-5
Setting Retarded Timing With Circuit Tester 8-5
Disassembling And Assembling 8-7

Ignition System 1980 And Later 8-9
Description 8-9
Troubleshooting 8-10
Checking Advance Timining With Inductive Timing Light 8-11
Vacuum Operated FXST Electric Switch (V.O.E.S.) 8-11
Setting Retarded Timing 8-12
Removing Ignition Components 8-12
Inspecting And Replacing Parts 8-13
Installing Ignition Components 8-14

Spark Plugs 8-15
General 8-15
Inspecting Spark Plugs 8-15
Setting Spark Plugs 8-15
Installing Spark Plugs 8-15

Ignition Coil 8-17
Description 8-17
Troubleshooting 8-17
Replacing Spark Plug Cables 8-17

Ignition-Light Switch 8-19
General 8-19
Disassembling Ignition-Light Switch FL/FLHS/FXWG 8-19
Cleaning, Inspection And Repair 8-20
Assembling Ignition-Light Switch 8-20

Charging System 8-21
General 8-21
Troubleshooting 8-21
Disassembling Alternator 8-23
Cleaning, Inspection And Repair 8-23
Assembling Alternator 8-23
Replacing The Regulator 8-23

Battery 8-25
General 8-25
Battery Care 8-25
Testing The Battery 8-25
Charging The Battery 8-26

Lights 8-27
Headlamp (1978½-1980 FL) 8-27
Headlamp (1981 and Later FL) 8-27
Headlamp - FX Models 8-28
Headlamp Adjustment 8-28
Passing Lamps 8-29
Turn Signals 8-29

Horn 8-31

Wiring Diagrams

SUBJECT PAGE NO.

1. Service 1-1
2. Troubleshooting 1-13
3. Tools 1-17

PRODUCT

SERVICE

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 operation of the motorcycle.

Service Operations to be performed before delivery to customer are specified in the Motorcycle Set-Up Manual, Part No. 99946-84. Also, the Important Instructions included with each new motorcycle.

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 and again at approximately 2500 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. Clean tappet oil screen.
4. Clean primary chain housing magnetic drain plug.*
5. Inspect air cleaner and service as required.
6. Check and adjust chains/belts.
7. Check battery electrolyte level. Check and clean connections.
8. Check rear brake pedal adjustment and free play.
9. Inspect brake pad linings and discs for wear.
10. Check brake fluid level and condition.
11. Check clutch adjustment.
12. Inspect fuel valve, lines and fittings for leaks.
13. Inspect oil lines and brake system for leaks.
14. Oil the following: front brake handlever, throttle control cables, choke control cable, clutch control cable and handlever, seat suspension bushings*, seat post roller and bolt.*
15. Grease the following: foot shift lever bearings*, seat bar bearings*, seat post*, rear fork pivot bearings.
16. Check tightness of all fasteners.
17. Check tire pressure and inspect tread.
18. Check engine low and fast idle speed adjustment.
19. Check operation of throttle and choke controls.
20. Check operation of all electrical equipment and switches.
21. Check wheel spoke tightness.*
22. Lubricate rear chain if required.*
23. Check primary case vacuum.*
24. Change transmission oil and clean magnetic drain plug.
25. Clean fuel tank filter screen.*
26. Check front and rear fork bearing adjustment.
27. Road test.

* If applicable to equipment.

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. Chain/belt for proper tension and lubrication.
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 and transmission fluid levels.
7. Wheel spoke tightness, if applicable.
8. Headlight, taillight and directional light operation.

REGULAR SERVICE INTERVALS

The following chart outlines recommended Maintenance and Lubrication intervals after performance of service on a new motorcycle and the initial break-in period.

IMPORTANT

To prevent over-greasing, use hand grease gun on all grease fittings.

Regular Maintenance Intervals — FL/FX

SERVICE TO BE PERFORMED	MILEAGE INTERVALS					
	Every 500	First 500	Every 2500	Every 5000	Every 7500	Every 10,000	Every Spring or Fall
Change engine oil		X	X	X	X	X	X
Replace oil filter		X	X	X	X	X	X
Check tappet oil screen		X	X	X	X	X	
Clean primary housing magnetic drain plug*		X	X	X	X	X	
Inspect air cleaner and service as required		X	X	X	X	X	
Check and adjust chains/belts		X	X	X	X	X	
Check battery electrolyte level, check and clean connections		X	X	X	X	X	X
Check rear brake pedal adjustment and free play		X	X	X	X	X	
Check brake pad linings and discs for wear		X	X	X	X	X	
Check brake fluid level and condition		X	X	X	X	X	X
Check clutch adjustment		X	X	X	X	X	
Inspect fuel valve, lines and fittings for leaks		X	X	X	X	X	
Inspect oil lines and brake system for leaks		X	X	X	X	X	
Oil the following: front brake handlever, throttle control cables, choke control cable, clutch control cable and handlever, seat suspension bushings*, seat post roller and bolt*		X	X	X	X	X	
Check tightness of all fasteners (Except head bolts)		X	X	X	X	X	
Check tire pressure and inspect tread		X	X	X	X	X	X
Check engine low and fast idle speed adjustment		X	X	X	X	X	
Check operation of throttle and choke controls		X	X	X	X	X	
Check operation of all electrical equipment and switches		X	X	X	X	X	
Check wheel spoke tightness*		X	X	X	X	X	
Lubricate rear chain if required*	X	X	X	X	X	X	
Check ignition timing and vacuum hose			X	X	X	X	
Check condition of spark plugs and replace if necessary			X		X		
Replace spark plugs				X		X	
Check transmission oil level			X		X		
Change transmission oil		X		X		X	X
Check primary case vacuum*		X					
Clean fuel tank filter screen		X	X	X	X	X	
Check front and rear fork bearing adjustment		X		X		X	
Check condition of rear shock absorber rubber bushing				X		X	
Lubricate the following: foot shift lever bearing*, seat bar bearings*, seat post*, rear fork pivot bearings		X	X	X	X	X	
Lubricate throttle control grip sleeve and speedometer cable				X		X	
Change front fork oil				X		X	X
Repack wheel bearings with grease						X	X
Lubricate the belt drive compensating sprocket rubber dampers with Harley Davidson POLY-OIL* *						X	
Road test		X	X	X	X	X	
Date Completed							

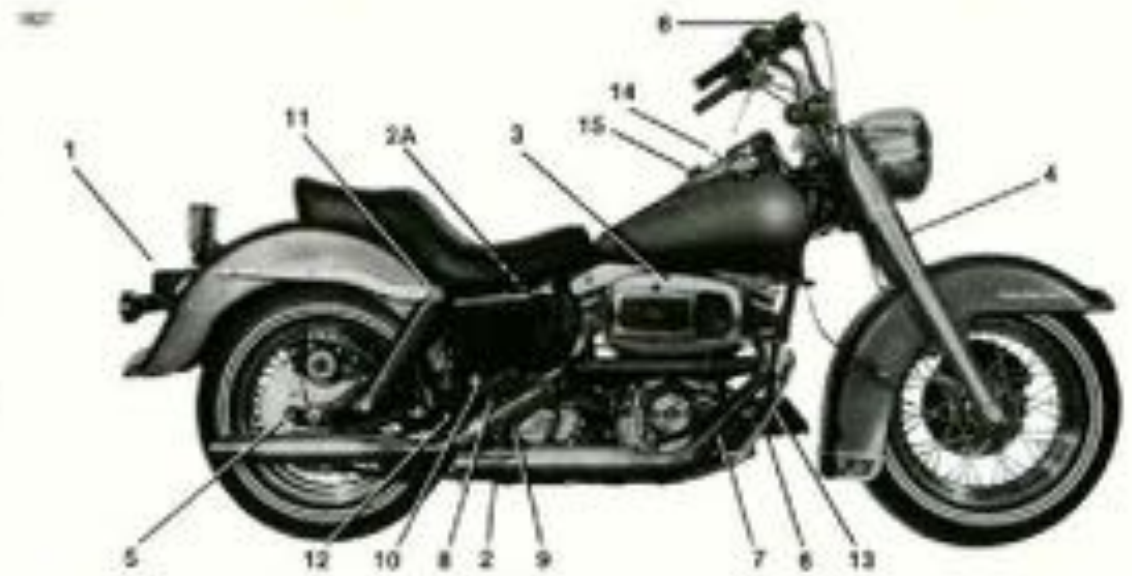
*If applicable to equipment

2134

1. Tail/stop lamp
2. Oil filter
2A. Oil filter — 1982 & earlier
3. Carburetor air cleaner

6. Brake master cylinder
7. Engine serial number
8. Oil pump and pressure switch
9. Start

12. Hydraulic shock absorber
13. Adjustable passenger footrest

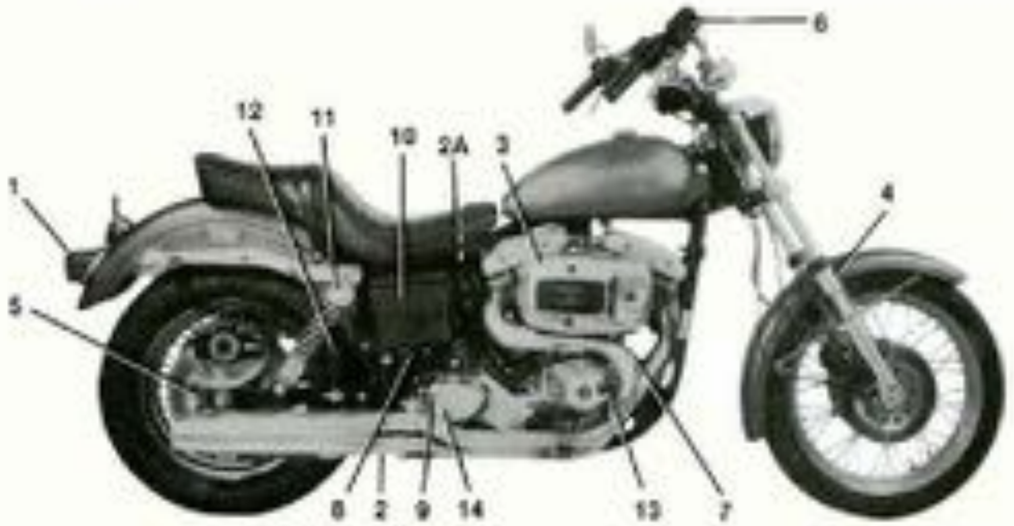


1. Tail/stop lamp
2. Oil filter
2A. Oil filter — 1982 & earlier
3. Carburetor air cleaner
4. Hydraulic fork
5. Rear belt adjuster
6. Brake master cylinder
7. Engine serial number
8. Starter motor and relay
9. Transmission oil filter plug
10. Battery
11. Hydraulic shock absorber
12. Passenger footrest
13. Brake pedal
14. Choke knob
15. Ignition-light switch

Figure 1-3. FLHS Right Side View

1. Turn signal lamps
2. Headlamp
3. Carburetor choke knob
4. Gas tank valve
5. Ignition coil
6. Rear belt
7. Oil tank drain plug
8. Oil tank fill plug and dipstick
9. Clutch inspection cover
10. Front chain inspection cover
11. Jiffy stand
12. Timing inspection hole plug
13. Rectifier/regulator module
14. Steering lock
15. Shifter
16. Ignition/light switch

Figure 1-4. FLHS Left Side View



1. Tail/stop lamp
2. Oil filler
2A. Oil filter — 1982 & earlier
3. Carburetor air cleaner
4. Hydraulic fork
5. Rear chain adjuster
6. Brake master cylinder
7. Engine serial number
8. Starter motor and relay
9. Transmission oil filler plug
10. Battery
11. Hydraulic shock absorber
12. Passenger footrest
13. Brake pedal rear
14. Transmission oil level plug

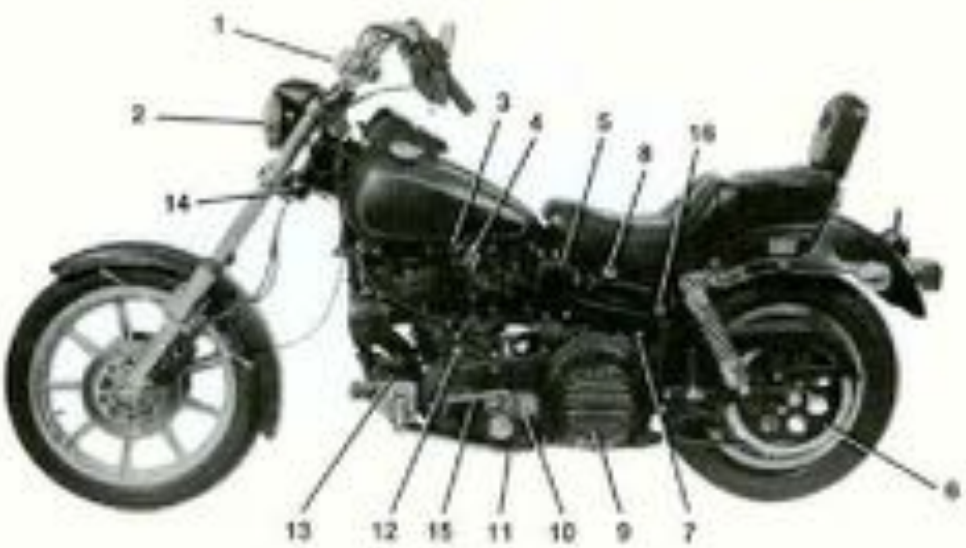
Figure 1-5. FXE Right Side View

1. Turn signal lamps
2. Headlamp
3. Carburetor choke knob
4. Gas tank valve
5. Ignition coil
6. Rear sprocket and chain
7. Oil tank drain plug
8. Oil tank fill plug and dipstick
9. Clutch inspection cover
10. Front chain inspection cover
11. Jiffy stand
12. Timing inspection hole plug
13. Rectifier, regulator module
14. Steering lock
15. Shifter
16. Ignition-light switch
17. Chain case drain plug

Figure 1-6. FXE Left Side View

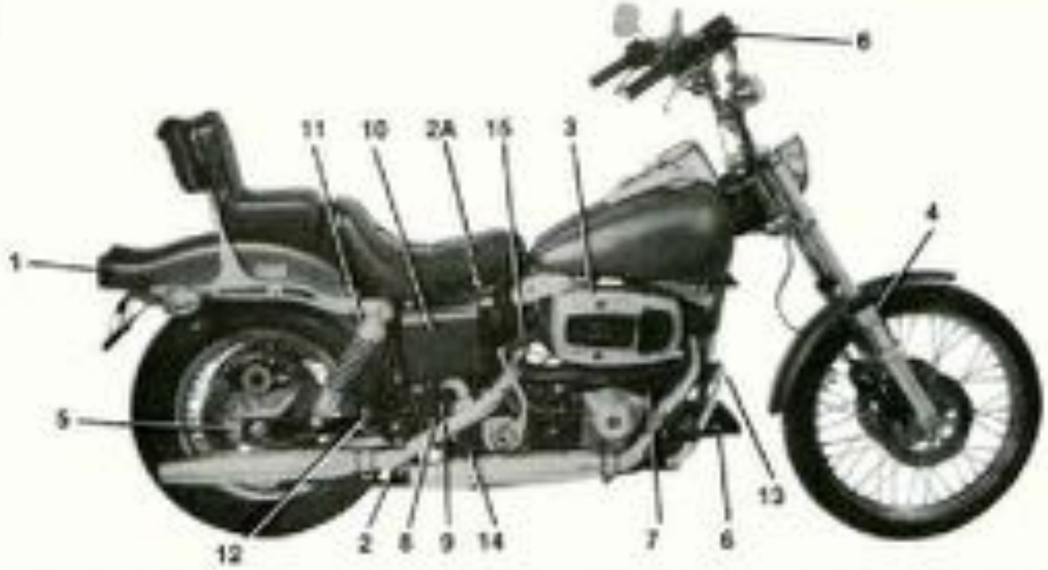
1. Tail/stop lamp
2. Oil filter
2A. Oil filter — 1982 & earlier
3. Carburetor air cleaner
4. Hydraulic fork
5. Rear belt adjuster
6. Brake master cylinder
7. Engine serial number
8. Starter motor and relay
9. Transmission oil filler plug
10. Battery
11. Hydraulic shock absorber
12. Passenger footrest
13. Brake pedal rear
14. Transmission oil level plug

Figure 1-7. FXSB Right Side View



1. Turn signal lamps
2. Headlamp
3. Carburetor choke knob
4. Gas tank valve
5. Ignition coil
6. Rear sprocket and belt
7. Oil tank drain plug
8. Oil tank fill plug and dipstick
9. Clutch inspection cover
10. Front belt inspection cover
11. Jiffy stand
12. Timing inspection hole plug
13. Rectifier, regulator module
14. Steering lock
15. Shifter
16. Ignition-light switch

Figure 1-8. FXSB Left Side View

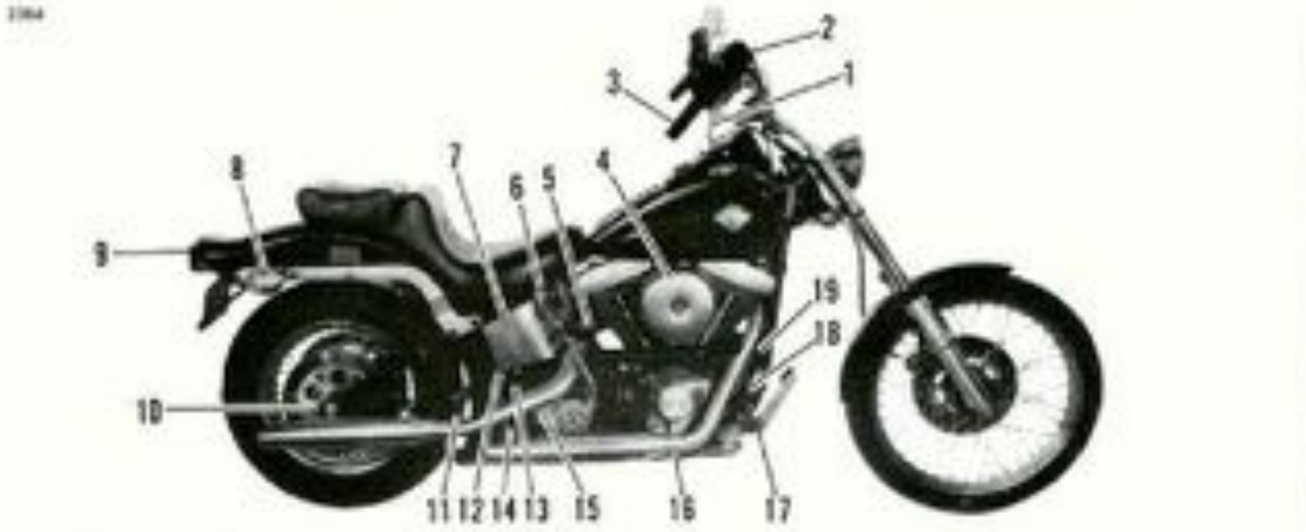


1. Tail/stop lamp
2. Oil filter
2A. Oil filter — 1982 & earlier
3. Carburetor air cleaner
4. Hydraulic fork
5. Rear chain adjuster
6. Brake master cylinder
7. Engine serial number
8. Starter motor and relay
9. Transmission oil filler plug
10. Battery
11. Hydraulic shock absorber
12. Passenger footrest
13. Brake pedal rear
14. Transmission oil level plug
15. Kick starter

Figure 1-9. FXWG Right Side View

1. Turn signal lamps
2. Headlamp
3. Carburetor choke knob
4. Gas tank valve
5. Ignition coil
6. Rear sprocket and chain
7. Oil tank drain plug
8. Oil tank fill plug and dipstick
9. Clutch inspection cover
10. Front chain inspection cover
11. Jiffy stand
12. Timing inspection hole plug
13. Rectifier, regulator module
14. Steering lock
15. Shifter
16. Ignition-light switch
17. Chain case drain plug

Figure 1-10. FXWG Left Side View



1. Front brake hand lever
2. Front brake master cylinder
3. Throttle grip control
4. Carburetor air cleaner
5. Kick starter
6. Oil tank fill plug & dipstick
7. Battery (under seat)
8. Rear turn signal lamp
9. Tail/stop lamp
10. Rear chain adjuster
11. Passenger footrest
12. Oil tank drain plug
13. Electric starter motor
14. Transmission oil drain plug
15. Transmission oil filler plug
16. Rear brake master cylinder
17. Rear brake pedal
18. Ignition module
19. Rear brake fluid reservoir

Figure 1-11. FXST Right Side View

1. Front turn signal lamp
2. Clutch hand lever
3. Headlamp
4. Steering lock
5. Horn
6. Oil filter
7. Shift lever
8. Voltage regulator
9. Timing inspection hole plug
10. Primary chain inspection cover
11. Jiffy stand
12. Clutch inspection cover
13. Chain case drain plug
14. Rear sprocket & drive chain
15. Ignition coil
16. Fuel supply valve
17. Ignition/light switch
18. Carburetor choke knob

Figure 1-12. FXST Left Side View

STORAGE

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

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.

1. Fill gas 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.

   OR

   Drain all fuel from the gas tank and carburetor float bowl and coat the inside of the float bowl with light oil. Spray the inside of the gas tank with one of the commercially available rust preventatives. Follow the manufacturer's instructions.
2. Fill the oil tank and pinch off or remove and 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.
3. Remove the spark plugs, inject a few squirts of engine oil into each cylinder and crank the engine 5 or 6 revolutions. Reinstall spark plugs.
4. Adjust the chains/belts.
5. 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.
6. Wash painted and chrome plated surfaces and apply a light film of oil to exposed unpainted surfaces.

WARNING

Do not apply any oil to brake discs or brake pads.

7. Remove the battery from the motorcycle and fully charge. Store the battery above freezing temperatures, trickle charge once a month and keep the electrolyte level above the plates.
8. 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.

REMOVAL FROM STORAGE

1. Fill the battery with 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. Remove the carburetor float bowl, clean it and check the float level.
5. If fuel tank was drained, fill it with fresh gasoline.
6. If oil feed line was pinched off or plugged, unplug it and reconnect.
7. Start the engine and run until it reaches normal operating temperature.
8. Drain and flush the oil tank. Install a new oil filter and fill oil tank with the proper grade oil. Check the transmission oil level.
9. Perform all of the checks in the PRE-RIDING CHECK LIST in the Owner's Manual.

FLUID REQUIREMENTS

Harley-Davidson Oil

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

Air Temperature (Cold Engine Starting Conditions)	Use Harley-Davidson Oil Grade
10°to 100°F. - Normal and severe operating conditions	Power Blend Super Premium
Above 80°F.	Premium II™ Extra Heavy Grade 60
Above 60°F.	Regular Heavy
Above 40°F.	Medium Heavy
− 20° to 40°F.	Special Light

Harley-Davidson Chain Grease, Chain Saver and Chain Spray

Designed especially as a chain lubricant. Penetrates inner bearings for a long chain life.

Harley-Davidson Poly-Oil

Designed especially for lubricating the FXB/FXSB compensating sprocket rubber dampers.

Gasoline

Use a good quality leaded or unleaded gasoline. For 1980 and earlier models, use premium grade (94 pump octane or higher). For 1981 and later models, use any grade gasoline (89 pump octane or higher).

Brake Fluid

Use only D.O.T. 5 Hydraulic Brake Fluid.

METRIC CONVERSION TABLE

MILLIMETERS to INCHES (mm x 0.03937 = inches)								INCHES to MILLIMETERS (inches x 25.40 = mm)							
mm	in.	mm	in.	mm	in.	mm	in.	in.	mm	in.	mm	in.	mm	in.	mm
.1	.0039	25	.9842	58	2.283	91	3.582	.001	.025	.6	15.240	1 15/16	49.21	3 5/16	84.14
.2	.0078	26	1.024	59	2.323	92	3.622	.002	.051	5/8	15.875	2	50.80	3 3/8	85.72
.3	.0118	27	1.063	60	2.362	93	3.661	.003	.076	11/16	17.462	2 1/16	52.39	3.4	86.36
.4	.0157	28	1.102	61	2.401	94	3.701	.004	.102	.7	17.780	2.1	53.34	3 7/16	87.31
.5	.0197	29	1.142	62	2.441	95	3.740	.005	.127	3/4	19.050	2 1/8	53.97	3 1/2	88.90
.6	.0236	30	1.181	63	2.480	96	3.779	.006	.152	.8	20.320	2 3/16	55.56	3 9/16	90.49
.7	.0275	31	1.220	64	2.519	97	3.819	.007	.178	13/16	20.638	2.2	55.88	3.6	91.44
.8	.0315	32	1.260	65	2.559	98	3.858	.008	.203	7/8	22.225	2 1/4	57.15	3 5/8	92.07
.9	.0354	33	1.299	66	2.598	99	3.897	.009	.229	.9	22.860	2.3	58.42	3 11/16	93.66
1	.0394	34	1.338	67	2.638	100	3.937	.010	.254	15/16	23.812	2 5/16	58.74	3.7	93.98
2	.0787	35	1.378	68	2.677	101	3.976	1/64	.397	1	25.40	2 3/8	60.32	3 3/4	95.25
3	.1181	36	1.417	69	2.716	102	4.016	.020	.508	1 1/16	26.99	2.4	60.96	3.8	96.52
4	.1575	37	1.456	70	2.756	103	4.055	.030	.762	1.1	27.94	2 7/16	61.91	3 13/16	96.84
5	.1968	38	1.496	71	2.795	104	4.094	1/32	.794	1 1/8	28.57	2 1/2	63.50	3 7/8	98.42
6	.2362	39	1.535	72	2.834	105	4.134	.040	1.016	1 3/16	30.16	2 9/16	65.09	3.9	99.06
7	.2756	40	1.575	73	2.874	106	4.173	.050	1.270	1.2	30.48	2.6	66.04	3 15/16	100.01
8	.3149	41	1.614	74	2.913	107	4.212	.060	1.524	1 1/4	31.75	2 5/8	66.67	4	101.6
9	.3543	42	1.653	75	2.953	108	4.252	1/16	1.588	1.3	33.02	2 11/16	68.26	4 1/16	102.19
10	.3937	43	1.693	76	2.992	109	4.291	.070	1.778	1 5/16	33.34	2.7	68.58	4.1	104.14
11	.4331	44	1.732	77	3.031	110	4.331	.080	2.032	1 3/8	34.92	2 3/4	69.85	4 1/8	104.77
12	.4724	45	1.772	78	3.071	111	4.370	.090	2.286	1.4	35.56	2.8	71.12	4 3/16	106.36
13	.5118	46	1.811	79	3.110	112	4.409	.1	2.540	1 7/16	36.51	2 13/16	71.44	4.2	106.68
14	.5512	47	1.850	80	3.149	113	4.449	1/8	3.175	1 1/2	38.10	2 7/8	73.02	4 1/4	107.95
15	.5906	48	1.890	81	3.189	114	4.488	3/16	4.762	1 9/16	39.69	2.9	73.66	4.3	109.22
16	.6299	49	1.929	82	3.228	115	4.527	.2	5.080	1.6	40.64	2 15/16	74.61	4 5/16	109.54
17	.6693	50	1.968	83	3.268	116	4.567	1/4	6.350	1 5/8	41.27	3	76.20	4 3/8	111.12
18	.7086	51	2.008	84	3.307	117	4.606	.3	7.620	1 11/16	42.86	3 1/16	77.79	4.4	111.76
19	.7480	52	2.047	85	3.346	118	4.645	5/16	7.938	1.7	43.18	3.1	78.74	4 7/16	112.71
20	.7874	53	2.086	86	3.386	119	4.685	3/8	9.525	1 3/4	44.45	3 1/8	79.37	4 1/2	114.30
21	.8268	54	2.126	87	3.425	120	4.724	.4	10.160	1.8	45.72	3 3/16	80.96	4 9/16	115.89
22	.8661	55	2.165	88	3.464	121	4.764	7/16	11.112	1 13/16	46.04	3.2	81.28	4.6	116.84
23	.9055	56	2.205	89	3.504	122	4.803	1/2	12.700	1 7/8	47.62	3 1/4	82.55	4 5/8	117.47
24	.9449	57	2.244	90	3.543	123	4.842	9/16	14.288	1.9	48.26	3.3	83.82	4 11/16	119.06

TORQUE REQUIREMENTS

Torque specifications for specific components are listed in each respective section. For all other fasteners, use the values listed in the table below. Torque figures are in ft-lbs except those marked with an asterisk (*) which are in in-lbs.

FASTENER	TYPE	MINIMUM TENSILE STRENGTH	MATERIAL	Body Size or Outside Diameter																
				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	700
	SOCKET HEAD CAP SCREW	160,000 PSI	HIGH CARBON QUENCHED TEMPERED								16	33	54	84	125	180	250	400	640	970
	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.																		

TROUBLESHOOTING

The following check list of possible operating troubles and their probable causes will be helpful in keeping your 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 defective.
5. Electric starter shaft pinion gear not engaging.

Engine Turns Over But Does Not Start

1. Gas tank empty.
2. Gasoline valve turned off.
3. Gasoline valve or filter clogged.
4. Discharged battery, loose or broken battery terminal connections.
5. Fouled spark plugs.
6. Spark plug cables in bad condition and arcing 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. Defective ignition coil.
10. Defective ignition module or sensor.
11. Sticking or damaged valve or tappets too tight.
12. Engine flooded with gasoline as a result of overchoking.
13. Engine and transmission oil 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 and arcing.
3. Battery nearly discharged.
4. Loose wire connection at one of the battery terminals or at coil.
5. Carburetor controls not adjusted correctly.
6. Defective ignition coil.
7. Engine and transmission oil too heavy (winter operation).
8. Timing advance weight sticking in advanced position (1979 and earlier).
9. Ignition not timed properly.
10. Gasoline tank cap bent or plugged, or carburetor fuel line closed off restricting fuel flow.
11. Water or dirt in fuel system and carburetor.
12. Choke disc stuck in open position.
13. 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 arcing.
3. Spark plug gap too close or too wide.
4. Defective ignition coil.
5. Defective 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. Gasoline 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 carburetor trouble chart).
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 for the kind of service.
3. Defective 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.
5. Low power - timing advance weights sticking in retarded position (1979 and earlier).

Valve Train Noise

1. Low pressure caused by oil feed pump not functioning properly or oil screen obstructed.
2. Hydraulic tappets not adjusted properly.
3. Defective hydraulic tappets.
4. Bent push rod.

5. Cam or cam gears worn.
6. Rocker arm binding on shaft.
7. Valve sticking in guide.
8. Excessive cold oil pressure.

Excessive Vibration

1. Upper mounting bracket loose, broken or improperly spaced.
2. Lower mounting bolts loose.
3. Broken frame.
4. Front or rear chain badly worn or links tight as a result of insufficient lubrication.
5. Transmission and/or transmission sub-mounting plate loose in chassis.
6. Wheels and/or tires defective.
7. Internal engine problem.

LUBRICATION SYSTEM

Oil Does Not Return to Oil Tank

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

Engine Uses Too Much Oil or Smokes Excessively

1. Breather valve incorrectly timed.
2. Piston rings badly worn or broken.
3. Chain oiler adjusting screw adjusted for an excessive amount of oil (1982 and earlier).
4. Insufficient chain case vacuum.
5. Valve guides worn.

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. Insufficient chain case vacuum.
2. Oil not returning to oil tank.
3. Oil lines or passages restricted.
4. Gearcase cover gasket not sealing.
5. Leakage between passages and pockets in gear case 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. Defective regulator-rectifier module.
2. Module not grounded.
3. Loose or broken wires in charging circuit.
4. Defective stator coils.
5. Defective rotor.

Alternator Charge Rate Is Below Normal

1. Defective regulator-rectifier module.
2. Defective stator coils.
3. Weak or defective battery.
4. Loose or corroded connections.

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 defective float.
6. Float misadjusted.

TRANSMISSION

Shifts Hard

1. Bent shifter rod.
2. Clutch dragging slightly.
3. Transmission oil 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 and/or soaked friction discs.

Drags or Does Not Release

1. Clutch controls improperly adjusted.
2. Clutch spring tension too tight.
3. Friction discs gummy.
4. Clutch shell keys or hub studs badly worn.
5. Clutch discs warped.

Chatters

1. Clutch hub friction disc rivets loose.
2. Friction discs or steel discs worn or warped.

BRAKE

Does Not Hold Normally

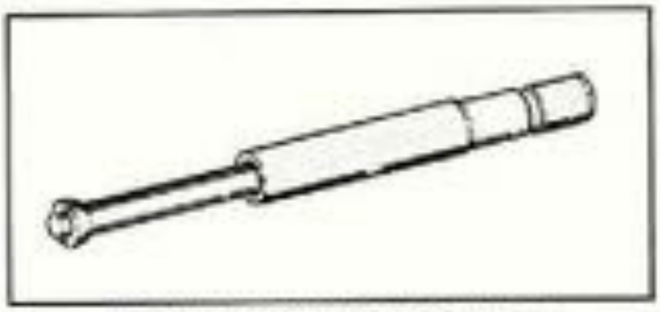
1. Master cylinder low on fluid.
2. Brake line contains air bubbles.
3. Master or wheel cylinder piston worn or parts defective.
4. Brake pads impregnated with grease or oil.
5. Brake pads badly worn (1/16 in. minimum lining thickness).
6. Brake disc badly worn or warped.
7. Brake fades due to heat build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

HANDLING

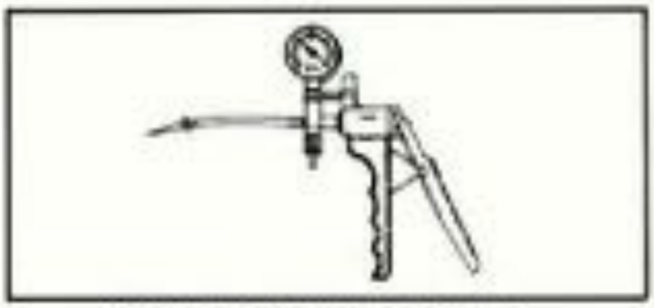
Irregularities

1. Loose wheel axle nuts. Tighten to 50 ft-lbs maximum.
2. Excessive wheel hub bearing play.
3. Rear wheel out of alignment with frame and front wheel.
4. Rims and tires out-of-true sideways (tire run-out should not be more than 3/32 in.).
5. Rims and tires out-of-round or eccentric with hub (tire run-out should not be more than 3/32 in.).
6. Irregular or peaked front tire tread wear.
7. Tires improperly inflated. Check TIRE DATA, Section 2.
8. Tire and wheel unbalanced.
9. Steering head bearings loose. Correct adjustment and replace pitted or worn bearings and races. See FORKS.
10. 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.
11. Off-center loading.

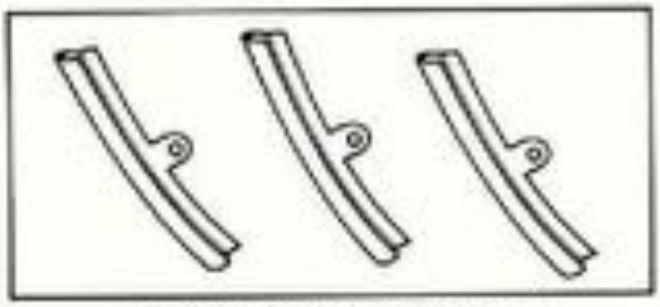
TOOLS



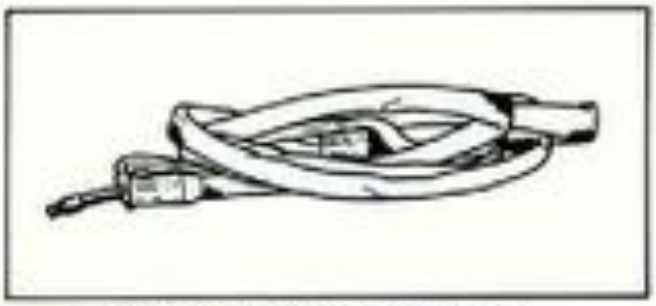
Part No. J 26900-14 Small Hole Gauge



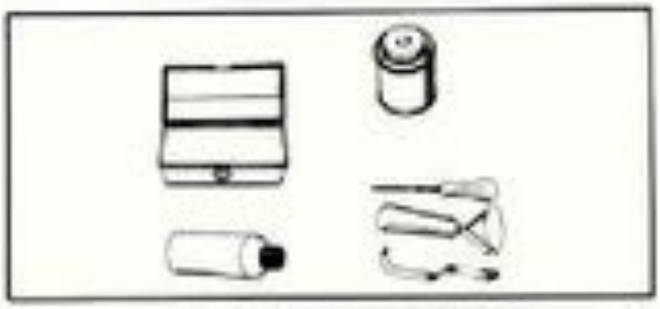
Part No. HD-23738 Vacuum pump



Part No. HD-01289 Rim Protectors



Part No. HD-28700 Bead Expander



Part No. HD-20000 Tire Repair Kit

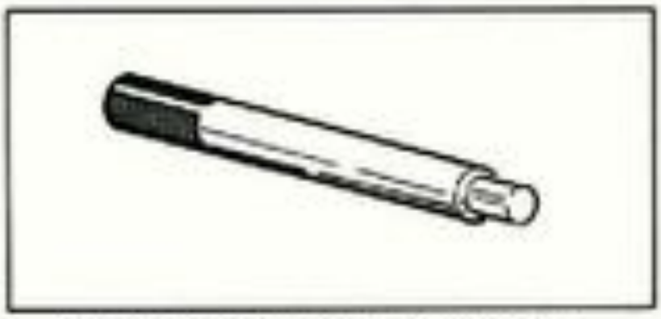
Part No. HD-33030 Piston Squaring Plate

Part No. HD-21000 Tire Spreader

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

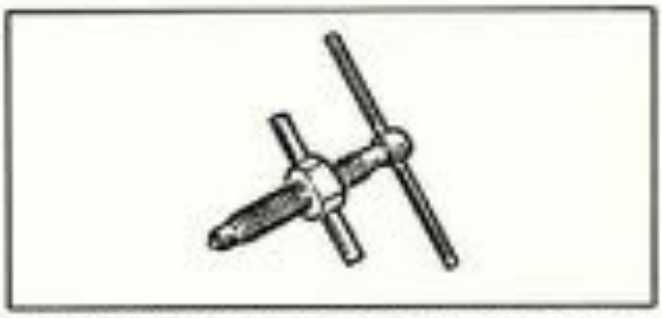
Part No. HD-33413 Carburetor Idle Adjustment Tool

Part No. HD-33443 Tappet Guide Alignment Tool



Part No. HD-33416 Universal Driver Handle

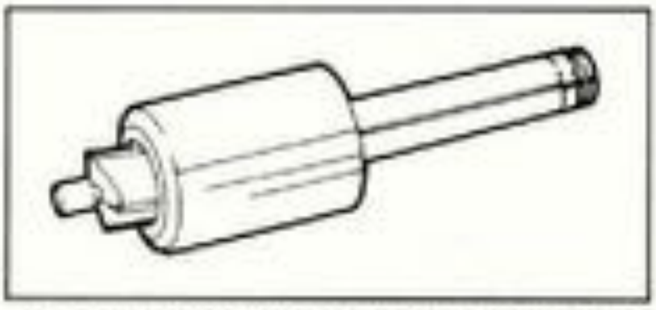
Part No. HD-33446 Cylinder Torque Plates



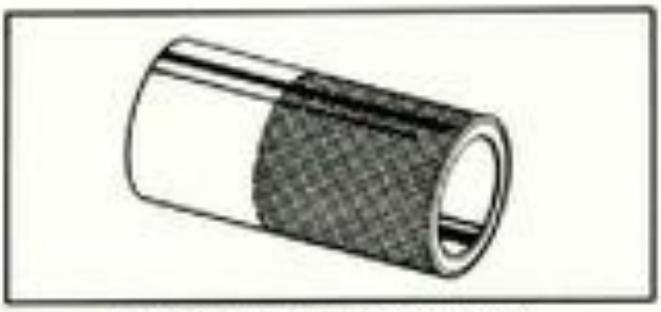
Part No. HD-33418 Universal Puller Forcing Screw

Part No. HD-33813 Inductive Timing Light

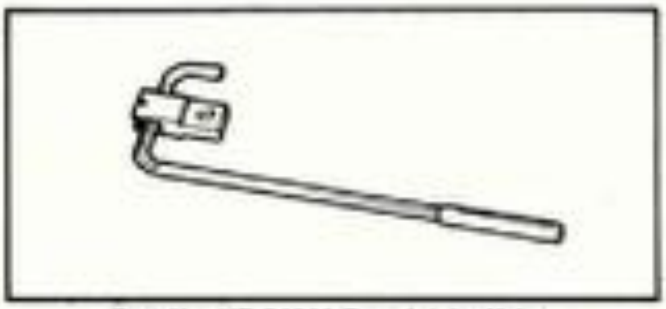
Part No. HD-33428-A Main Drive Gear Bearing Installer



Part No. HD-34107 Valve Guide Gauge/Cutting Tool

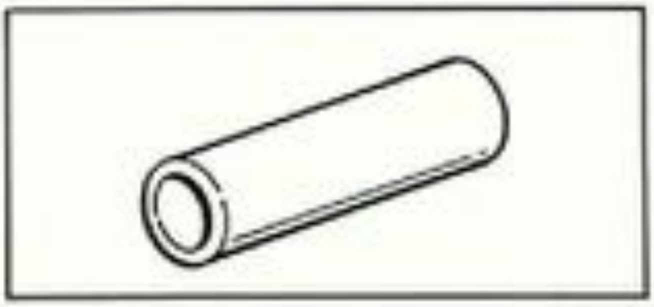


Part No. HD-34190 Fork Seal (FX)
Part No. HD-34634 Fork Seal (FXWG - FXST)

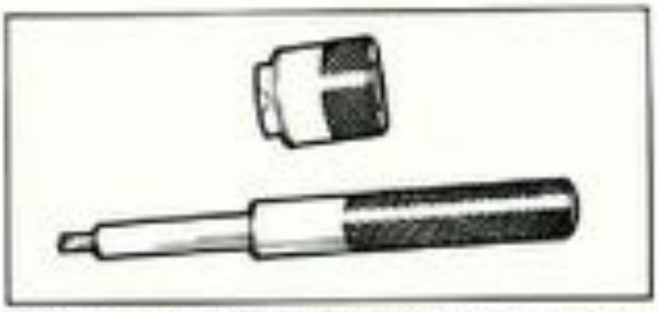


Part No. HD-34641 Rear Intake Valve Spring Compressor

Part No. HD-34199 Pushrod Height Gauge

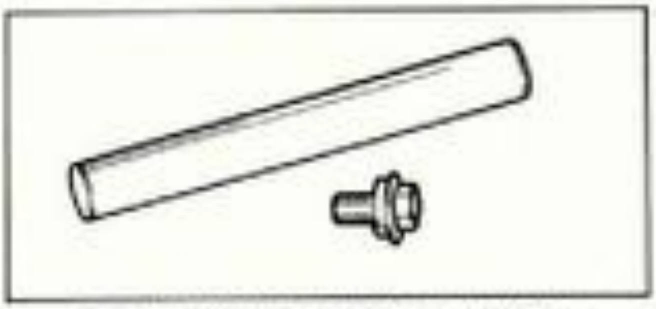


Part No. HD-34643 Valve Guide Seal Tool



Part No. HD-34623 Piston Pin Retaining Ring Installer

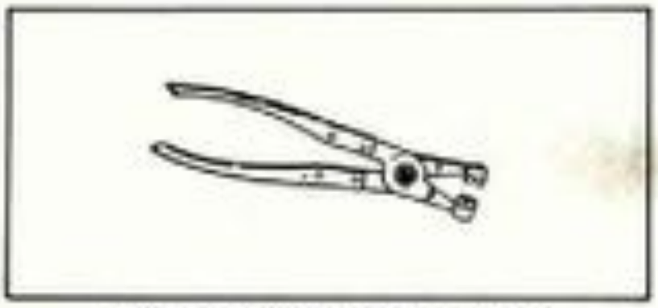
Part No. HD-34723 Valve Guide Hone (8 mm)



Part No. HD-34624 Cylinder Stud Installer

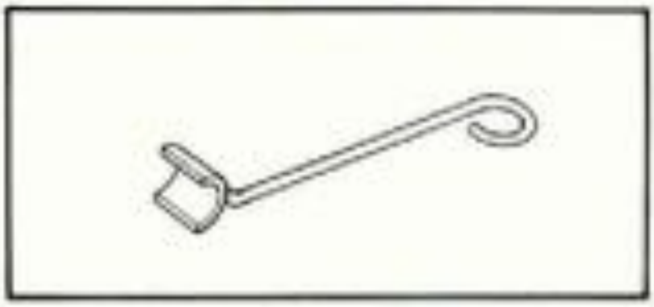
Part No. HD-34724 Valve Guide Hone (9 mm)

Part No. HD-34731 Shoulderless Valve Guide Installer

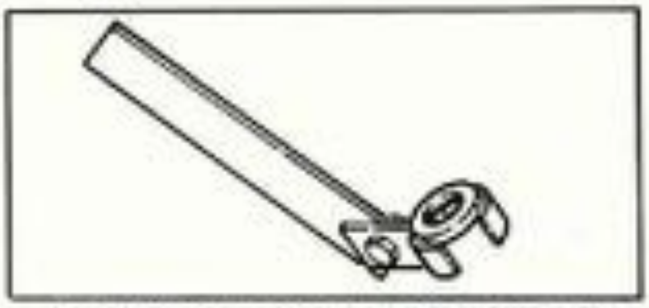


Part No. HD-8404 Hose Clamp Tool

Part No. HD-34736 Valve Spring Compressor



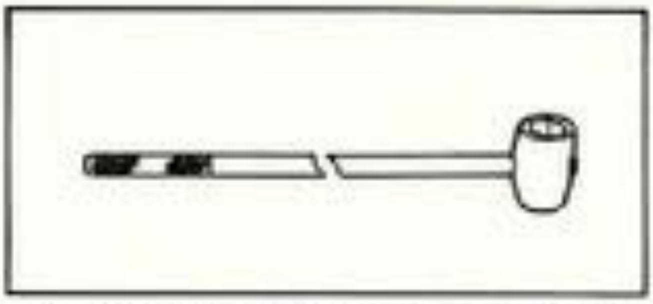
Part No. HD-94438-79 Push Rod Adjustment Gauge



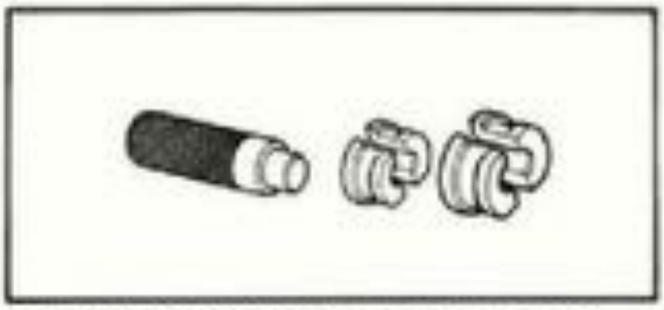
Part No. HD-34815 Oil Pressure Switch Wrench

Part No. HD-94465-81 Ignition Test Adapter

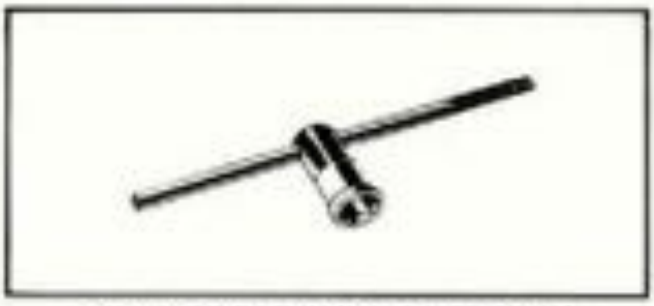
Part No. HD-34902 Mainshaft Primary Bearing Race Remover and Installer



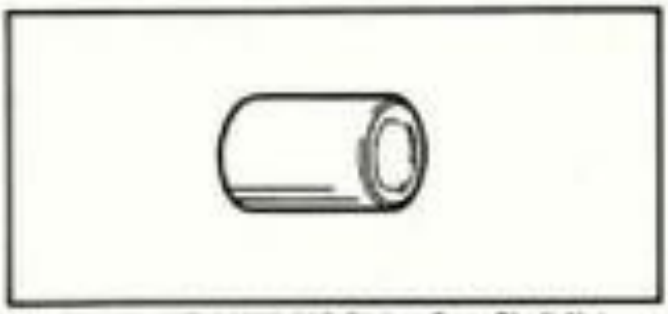
Part No. HD-94546-41 Flywheel Shaft Nut Wrench



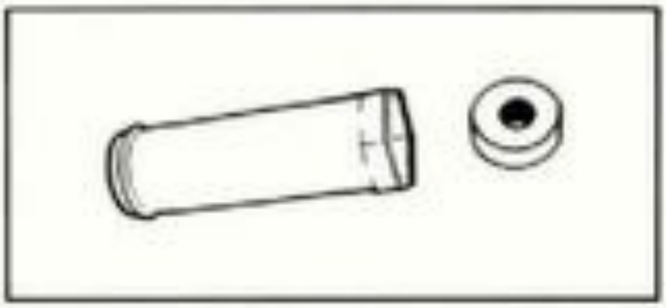
Part No. HD-94547-80 Crankshaft Bearing Tool



Part No. HD-94645-41 Clutch Hub Nut Wrench

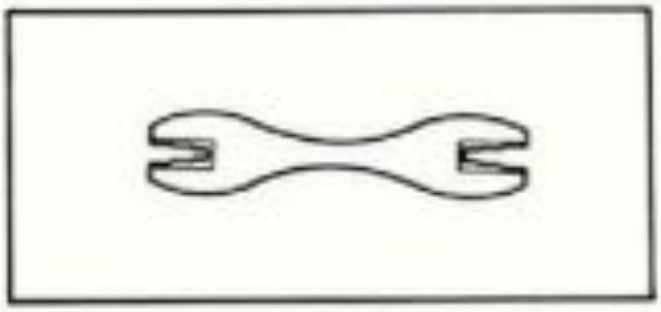


Part No. HD-94555-55C Pinion Gear Shaft Nut Socket

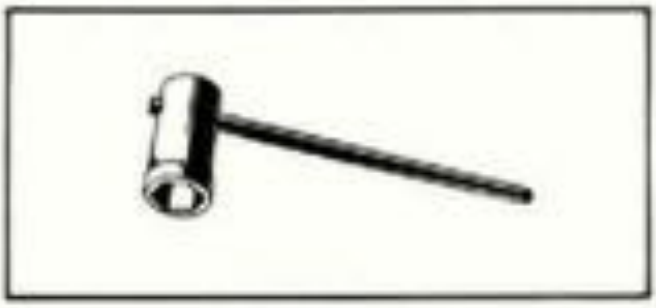


Part No. HD-94660-37A Mainshaft Locknut Wrench

Part No. HD-94585-30A Cylinder Base Nut Wrench (9/16")

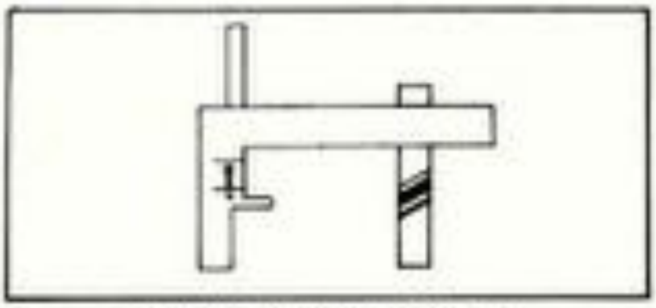


Part No. HD-94681-80 Spoke Nipple Wrench

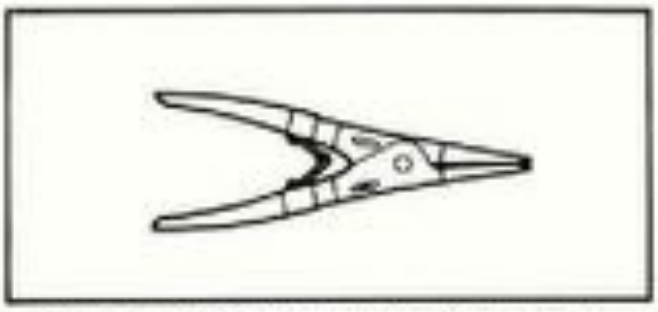


Part No. HD-94635-41 Mainshaft Ball Bearing Lock Nut Wrench

Part No. HD-94700-52B Shock Absorber Spanner Wrench

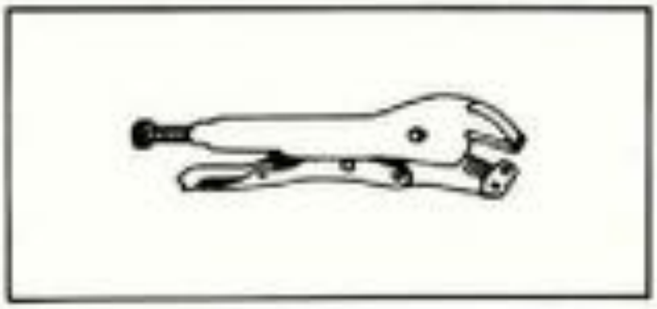


Part No. HD-94752-77 Float Gauge



Part No. HD-95017-61 Lock Ring Pliers External

Part No. HD-94800-26 Spiral Expansion Reamer

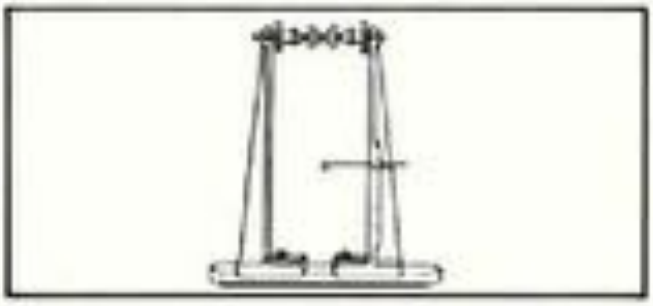


Part No. HD-95020-66 Rear Chain Link Press Tool

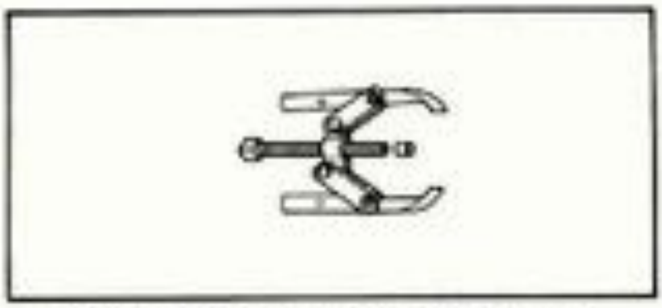
Part No. HD-94804-57 Rocker Arm Bushing Reamer

Part No. HD-95021-29A Chain Breaking Tool

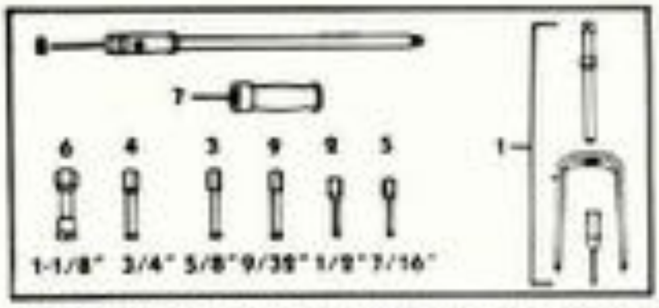
Part No. HD-94805-57 Pinion Shaft Bushing Reamer and Pilots



Part No. HD-95500-80 Wheel Truing Stand



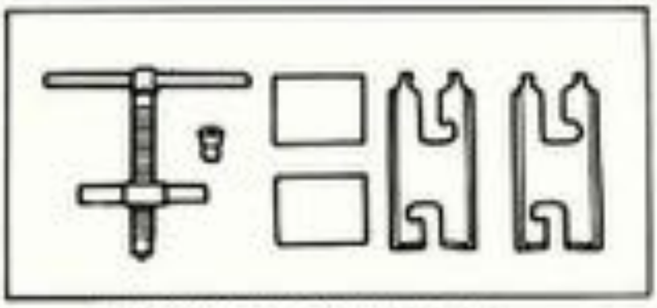
Part No. HD-95635-46 All Purpose Claw Puller



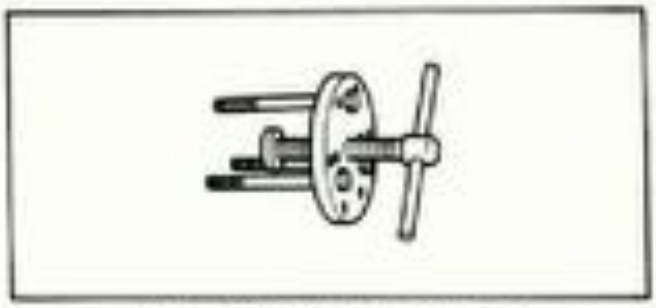
Part No. HD-95760-69 Bushing and Bearing Puller Tool Set (Includes Items 1, 2, 3 and 4) Items 5 (HD-95768-69), 6 (HD-95769-69), 7 (HD-95770-69) and 8 (HD-95771-69) are optional extras.

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

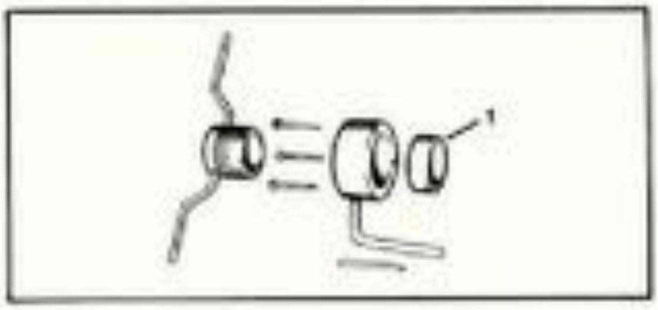
Part No. HD-95952-33A Connecting Rod Clamping Tool



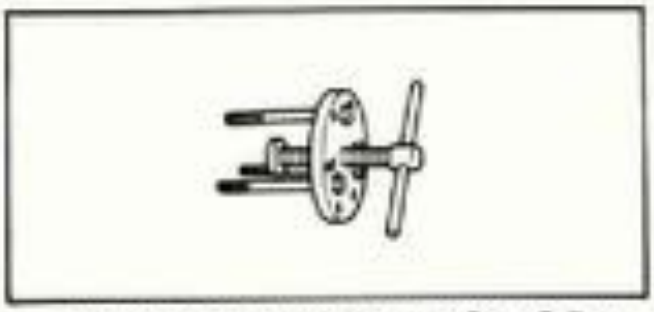
Part No. HD-95650-42 Transmission Mainshaft Starter Clutch and Bearing Puller



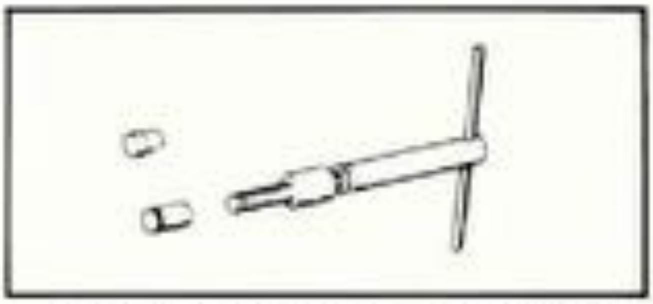
Part No. HD-95960-41A Clutch Hub and Chain Housing Puller



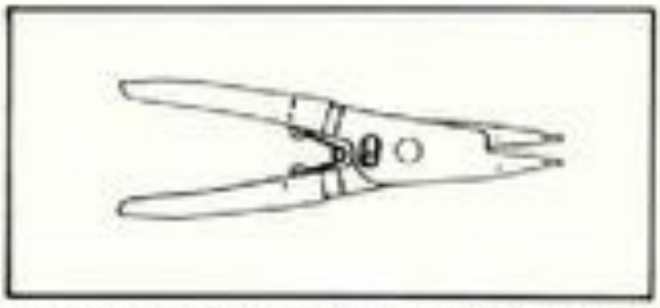
Part No. HD-95660-42 Main Drive Gear Oil Seal Tool
Part No. HD-95666-42A Sleeve (1)



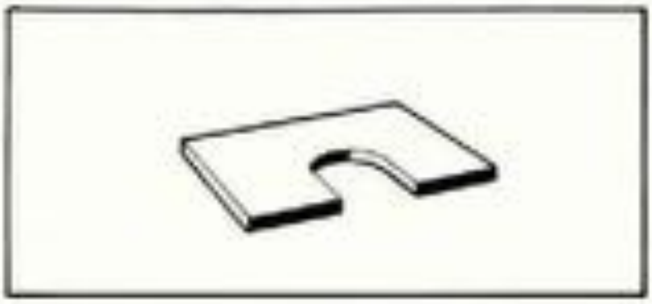
Part No. HD-95960-52B Alternator Rotor Puller



Part No. HD-95970-32A Piston Pin Bushing Tool

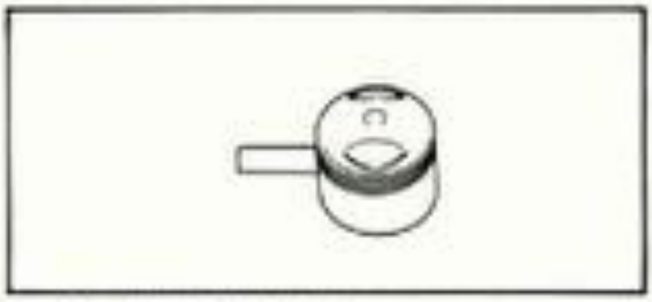


Part No. HD-96216-49 Large Internal Lock Ring Pliers



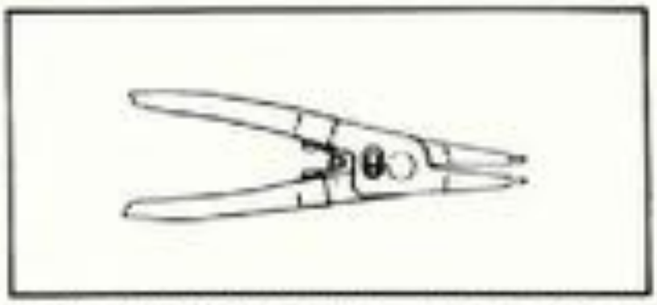
Part No. HD-96137-52A Flywheel Support Plate

Part No. HD-96221-80 Oil Filter Wrench

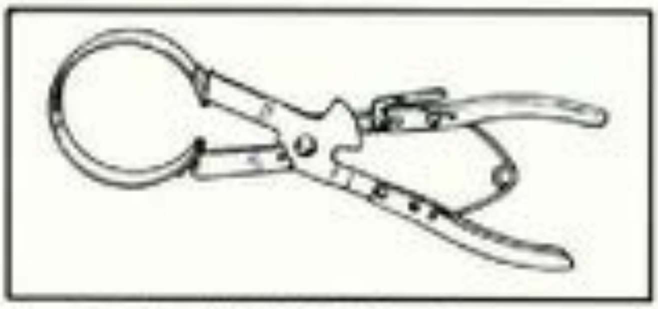


Part No. HD-96180-76 Special Piston with Pin

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

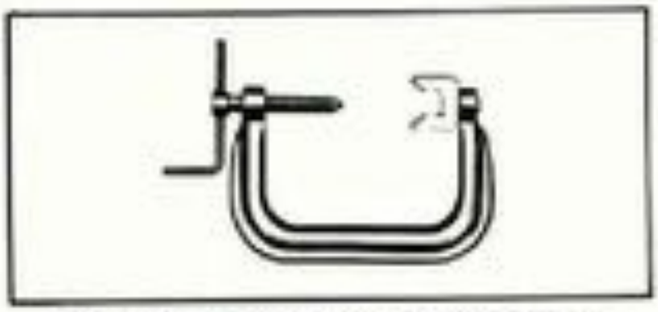


Part No. HD-96215-49 Small Internal Lock Ring Pliers

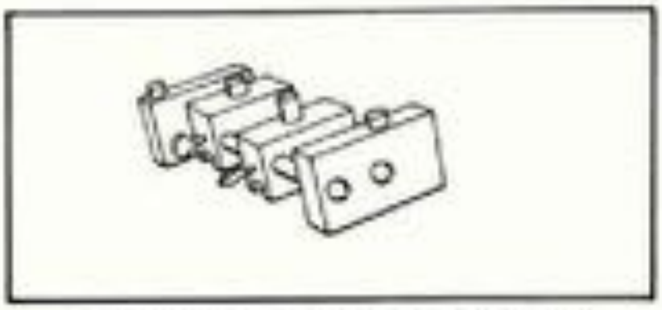


Part No. HD-96333-51B Ring Compressor

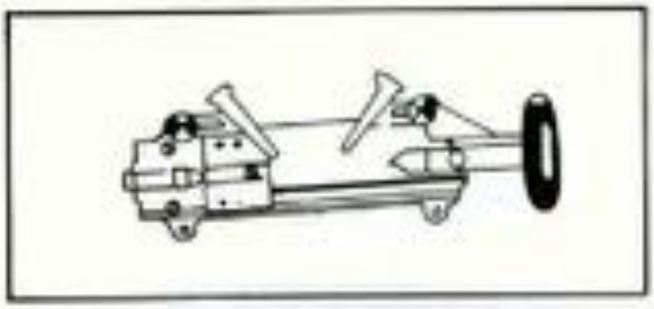
Part No. HD-96384-39 Fork Shifter Gauge



Part No. HD-96600-36 Valve Spring Compressor

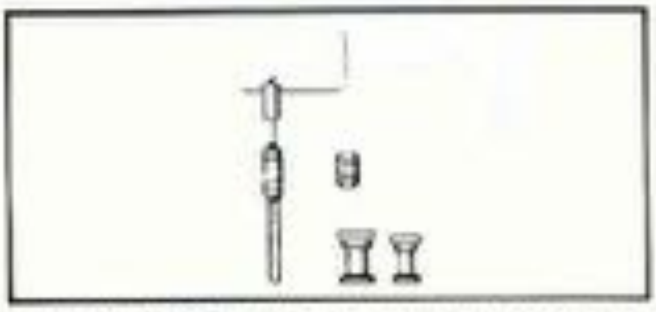


Part No. HD-96385-78 Fork Shifter Gauge

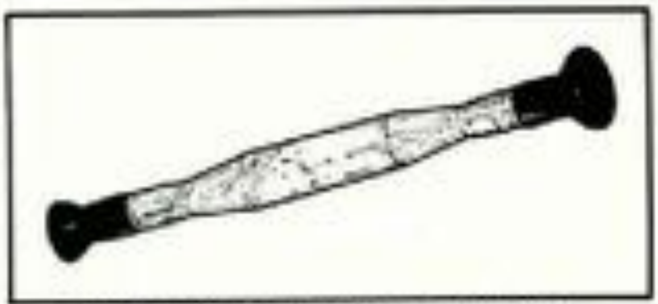


Part No. HD-96650-80 Flywheel Truing Stand

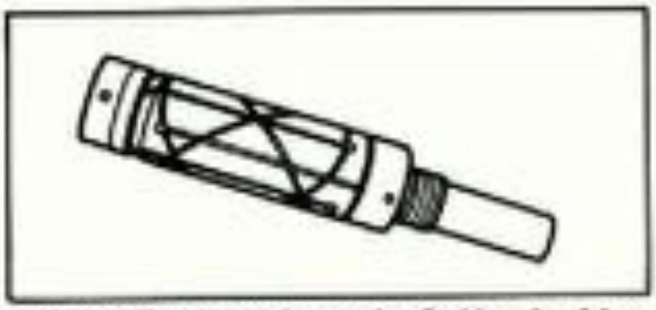
Part No. HD-96489-63 Valve Seating Gauge



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

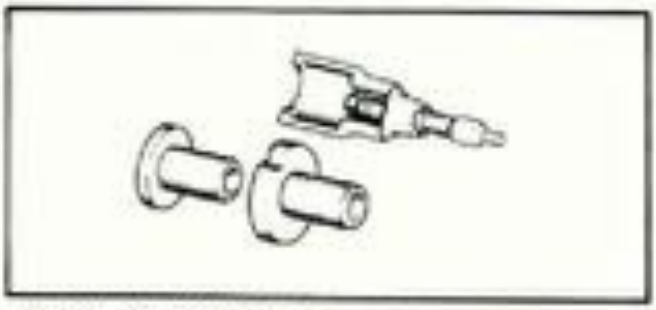


Part No. HD-96550-36A Valve Lapping Tool

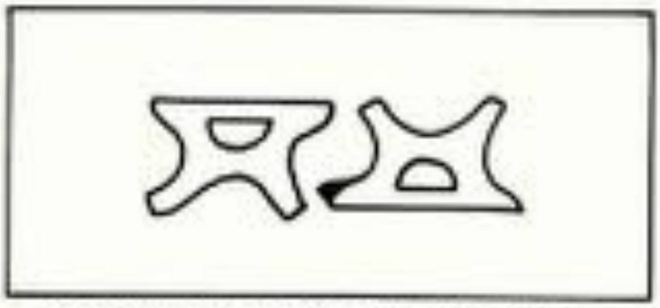


Part No. HD-96740-36 Connecting Rod Lapping Arbor

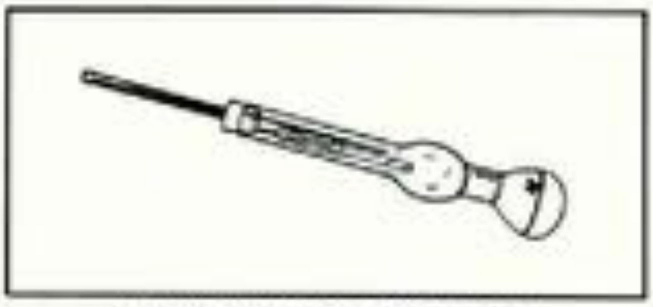
Part No. HD-96796-47 Valve Spring Tester



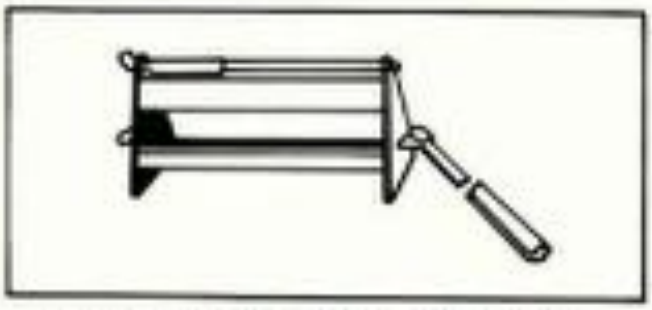
Part No. HD-96830-51A Pinion Gear Puller and Collars



Part No. HD-96798-43 Set of Copper Vise Jaws

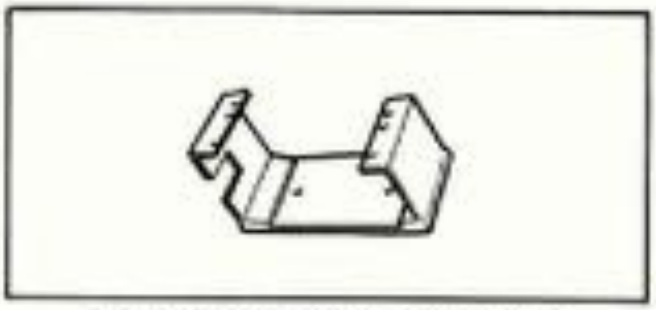


Part No. HD-96910-35 Hydrometer

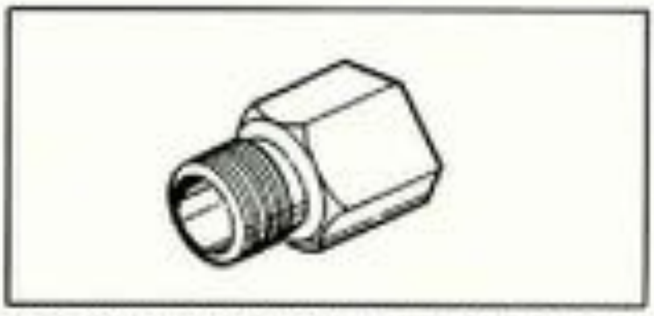


Part No. HD-96810-63 Motorcycle Shop Stand

Part No. HD-96921-52 Oil Pressure Gauge

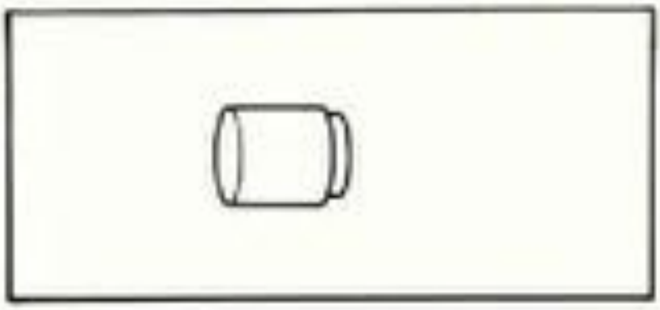


Part No. HD-96815-46 Engine Repair Stand

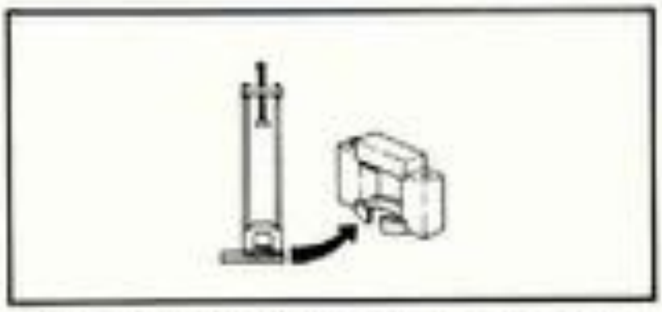


Part No. HD-96921-107 Oil Pressure Gauge Adapter

Part No. HD-96950-68 Vacuum Gauge, 30" Water

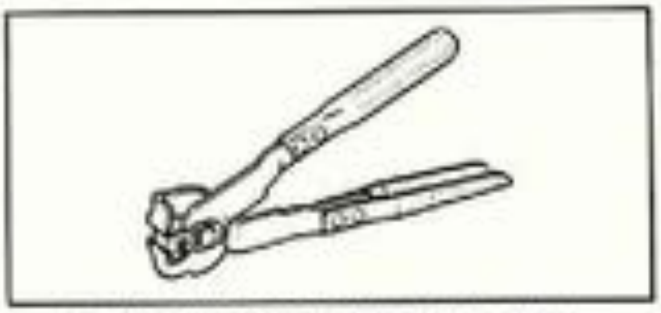


Part No. HD-97194-57 Timken Bearing, Outer Race Press Plug

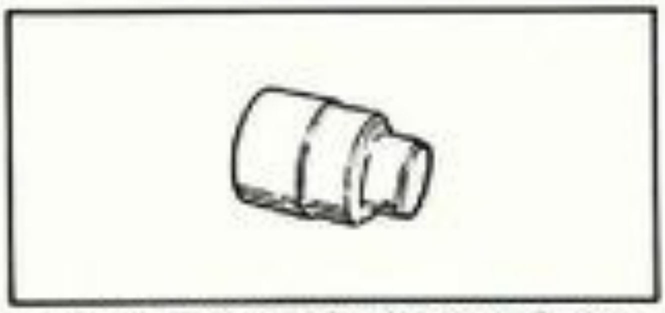


Part No. HD-97010-52A Rear Shock Absorber Tool

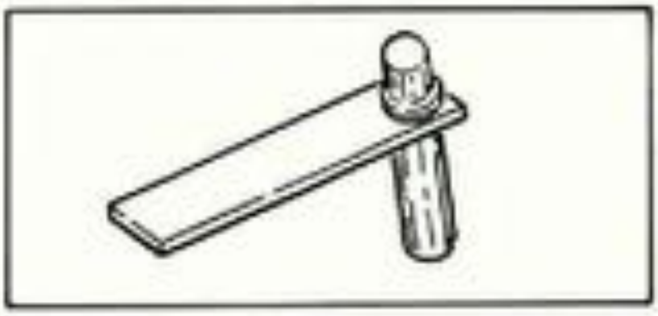
Part No. HD-97225-55 Sprocket Shaft Bearing Tool



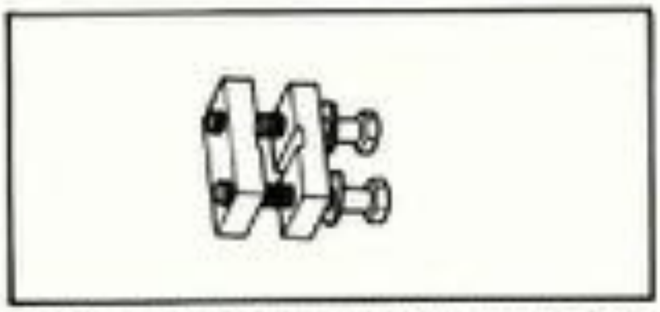
Part No. HD-97087-65A Hose Clamp Pliers



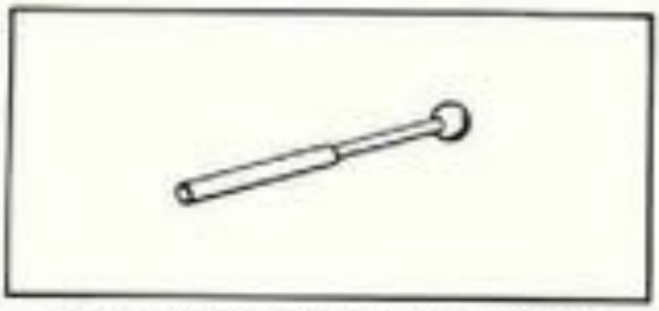
Part No. HD-97272-60 Camshaft Needle Bearing Installer



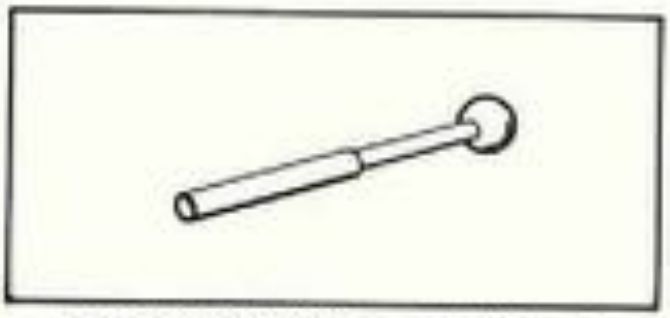
Part No. HD-97102-61 Valve Lifter Remover



Part No. HD-97234-60 Connecting Link Assembly Tool



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



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

CHASSIS

SUBJECT PAGE NO.

1. Specifications 2-1
2. Wheels 2-5
3. Brakes 2-29
4. Front Forks — FL Models 2-53
5. Front Forks — FX Models 2-59
6. Frame and Rear Swing Arm 2-69
7. Rear Shock Absorber 2-73
8. Handlebar Controls and Instruments 2-77
9. Seats 2-87
10. Fiberglass 2-95

CHASSIS

SPECIFICATIONS

DIMENSIONS (in.)

	WHEEL BASE	OVERALL LENGTH	OVERALL WIDTH	OVERALL HEIGHT
FLH	61.12	92.88	42.50	63.25
FLHS	61.12	92.88	33.75	48.12
FXB/FXSB	63.50	92.00	29.00	41.75
FXE	63.00	91.50	33.75	45.75
FXEF	63.00	91.50	33.75	45.75
FXS	63.50	92.00	29.00	41.75
FXWG	65.00	93.00	27.50	47.00
FXST	66.30	94.30	29.00	47.00

VEHICLE WEIGHT (lbs.)

FLH 722
FLHS 626
FXB/FXSB 572
FXE 572
FXEF 572
FXS 572
FXWG 572
FXST 612

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
FLH/FLHS	1180	410	770
FXB/FXSB	1085	390	695
FXE	1085	390	695
FXEF	1085	390	695
FXS	1085	390	695
FXWG	1085	390	695
FXST	1085	390	695

CAPACITIES

Fuel Tank

FLH/FLHS	Total	5 Gallons (US)
	Reserve	1.2 Gallons (US)
FXE	Total	3.2 Gallons (US)
	Reserve	.6 Gallons (US)
FXS/FXEF/ FXB/FXSB	Total	3.5 Gallons (US)
	Reserve	1 Gallon (US)
FXWG/FXST	Total	5 Gallons (US)
	Reserve	1.2 Gallons (US)

Front Fork (oz.)

	WET	DRY
FLH/FLHS	7¼	8½
FXB/FXSB	5	6
FXE	5	6
FXEF	5	6
FXS	5	6
FXWG/FXST	9¼	10

ADJUSTMENTS

Brakes

Rear Master Cylinder Plunger Free Play .... 1/16 in.

TORQUES

Slider Cap Nuts .... 11 ft-lbs
Front Axle Nut .... 50 ft-lbs
Rear Axle Nut .... 65-70 ft-lbs
Brake Disc Screws
  Laced 16 and 21 in. .... 23-27 ft-lbs
  19 in. .... 16-19 ft-lbs
  Cast 16 in. .... 23-27 ft-lbs
  19 in. .... 14-16 ft-lbs
Brake Caliper Mounting Bolts .... 115-120 in-lbs
Brake Bleeder Nipple .... 32-40 in-lbs
Rear Wheel Sprocket Screws
  Laced .... 35 ft-lbs
  Cast .... 45-50 ft-lbs
Fender Supports (FSXT) .... 115-130 ft-lbs
Shock Absorber Mounting Bolts (FXST) .. 115-130 ft-lbs
Swing Arm Mounting Bolts (FXST) .... 120-150 ft-lbs

BRAKE DISC SIZE

Model	Front	Rear	Minimum Thickness	
			Front	Rear
FL	10 in.	12 in.	.20 in.	.30 in.
FX	11.5 in.	11.5 in.	.20 in.	.20 in.

TIRE DATA

The following tire inflation pressure are based on rider and passenger weights of approximately 150 lbs each. For each 50 lbs. extra weight, increase pressure of rear tire 2 psi, front tire 1 psi and sidecar tire 1 psi.

		Tire Pressure — PSI (Cold)		
		Front	Rear	Sidecar
Solo rider	FL Models	28	28	
	FX Models (except FXWG)	30	32	
	FXWG/FXST	30	28	
Rider and one passenger	FL Models	28	36	
	FX Models (except FXWG)	30	36	
	FXWG/FXST	30	36	
Rider and one sidecar passenger or 140 lbs.	FL Models	28	36	28

WARNING

The maximum cold inflation pressure of these tires must not exceed the maximum pressure specified on the tire sidewall.

TIRE FITMENT

MODEL	REAR WHEEL: TIRE SERIES (From Rim Label)	REAR WHEEL: TIRE	REAR WHEEL: TUBE OR VALVE	REAR WHEEL: WHEEL DESCRIPTION	FRONT WHEEL: TIRE SERIES (From Rim Label)	FRONT WHEEL: TIRE	FRONT WHEEL: TUBE OR VALVE	FRONT WHEEL: WHEEL DESCRIPTION
FXE, FXEF FXS, FXB FXR, FXRS FXSB	WWW	C F	H J	16 in. Laced or Cast	YYY	D G	K K	19 in. Laced or Cast
FXWG FXDG FXST	TTT	V	J	16 in. Laced or Cast	ZZZ	E	L	21 in. Laced
FLH	TTT	A V	H J	16 in. Laced or Cast	TTT	A V	H J	16 in. Laced or Cast

TIRES

TIRE GROUP	MANUFACTURER	DESIGN	SIZE	PLY RATINGS
A	Goodyear	Speed Grip	MT90-16	6
B	Goodyear	Speed Grip	MT90-16	4
C	Goodyear	Eagle A/T	MT90-16	4
D	Goodyear	Eagle A/T	MJ90-19	4
E	Dunlop	"F" Rib	MH90-21	4
F	Dunlop	K-181	MT90-16	4
G	Dunlop	K-181	MJ90-19	4
M	Dunlop	K-291T*	MT90H-16	4
N	Dunlop	K-291T*	MM90H-19	4
P	Dunlop	K-291S*	130/90V-16	4
R	Dunlop	K-291S*	100/90V-19	4
U	Goodyear	Eagle SG*	MT90-16	6
V	Dunlop	K101A*	MT90-16	8

* = Tubeless tires

INNER TUBES (See Notes below)

TUBE GROUP	SIZE	VALVE STEM TYPE	VALVE STEM POSITION
H	H-16 (MT90-16)	Metal (1)	Side
J	G 5.10-16	Rubber (2)	Side
K	MJ90-19	Rubber	Center
L	3.00-21 (MH90-21)	Metal	Center

(1) Fits 11/32 in. (.345) diameter valve stem hole. (2) Fits 5/8 in. (.625) diameter valve stem hole.

TUBELESS TIRE VALVES

VALVE GROUP	H-D PART NUMBER	RIM VALVE HOLE DIAMETER
S	43157—83	.34 in.
T	43150—83	.45 in.

NOTES:

Rim strips must be used with all laced wheels.

Inner tubes are available from various manufacturers.

Next Five Model	First Two Digits (Model)	Digits (Sequential Number)	Second Last Digit (Manufacturer)	Last Digit (Model) (Season)
FLH-1200	2A		Harley-Davidson	
FX-1200	2C			8
FXE-1200	9D	60,000	H	(1978½)
FXEF-1200	5E	and		
FXEF-80	6E	up	H	9
FXS-1200	2E	10,000		(1979)
FXB	1H	and		
FLH-80	3G	up		
FXE-80	6G			
FXS-80	7G			
FXWG-80	9G			
FLH-80				
Classic	3H			
FLHS-80	5H			
FL-80	6H	10,000	J	0
FLH-1200		and		(1980)
Police	7H	up		
FLH-1200				
Shrine	8H			
FLH-80				
Police	9H			
FLH-80				
Shrine	1K			

Examples: 1979 FLH-1200, 2A12141H9
1980 FLH-1200, 2A12141J0

VEHICLE IDENTIFICATION NUMBER — 1978½-1980

The vehicle identification number (V.I.N.) is stamped on the right side of the engine crankcase, right side of frame steering head, and on a label on the right front frame downtube. It consists of a model code, a serial number, a manufacturer's identification and model year as shown in the chart above. The manufacturer's identification used for model years 1978 and 1979 is an H. 1980 and later model years use the letter J.

VEHICLE IDENTIFICATION NUMBER — 1981 and LATER

The full 17 digit 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 right side crankcase near the front of the engine. See the chart below.

Always give one of these numbers when ordering parts or making any inquiry about your motorcycle.

Model Designation

Engine Type

Model Year

Sequential Number

Model Year	
B	1981
C	1982
D	1983
E	1984

Model Designation	
AA	FLH-80
AB	FLHP-80 Police - Chain
AC	FLH-80 Shrine - Chain
AH	FLHP-80 Police - Belt
AK	FLHS-80
AL	FLH-80 Shrine - Belt
BA	FXE-80
BE	FXWG-80
BF	FXSB-80
BD	FXB
BH	FXST
BG	FXDG

1 HD 1 **AA** **K** or **L** 1* ** **E** Y **010000**

Large letters and numbers indicate V.I.N. on engine.

*May be 1, 2 or 3 (Factory use)

**Varies - can be 0 thru 9 or X (Check digit for factory use)

Sample V.I.N. as it appears on the steering head - 1 HD1AAK11 EY010000

Sample abbreviated V.I.N. as it appears on the engine - AAKE 010000

FRONT WHEEL — FL MODELS

Removal

1978½ - 1980

1. Block motorcycle underneath frame until front wheel is raised off the ground.
2. See Figure 2-1. Remove the axle caps (1), axle nut (2), lockwasher (3) and flat washer (4).
3. Loosen the two slider cap nuts (5) and remove the axle (6).
4. Remove the front wheel, hub cap (7) and spacer (8).

Figure 2-1. FL Front Wheel Mounting — 1978½-1980

1981 - 1982

1. Block motorcycle underneath frame until front wheel is raised off the ground.
2. See Figure 2-2. Remove the axle caps (1). Remove axle nut (2), lockwasher (3) and washer (4) from left side of wheel.
3. Loosen the slider cap nuts (7) on the right fork.
4. Pull the axle (5) out and remove the wheel, spacer (6), speedometer drive (8) and hub cap (9).

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.

Disassembly

LACED WHEEL (Figure 2-3)

1. Remove the retaining rings (1), washers (2), spacers (3), oil seals (4), bearings (5) and spacer (7).
2. If it is necessary to remove the bearing races (6) use a standard bearing puller.
3. Remove the screws (9), nuts (10), brake disc (11) and spacer (12).
4. If it is necessary to remove the hub (8) from the wheel, unscrew all the spoke nipples and remove the rim and spokes from the hub.

CAST WHEEL (Figure 2-4)

1. Remove the retaining rings (1), washers (2), spacers (3), oil seals (4), bearings (5) and spacer (7).
2. If it is necessary to remove the bearing races (6), use a wheel bearing race remover and installer HD-33071 and driver HD-33416.
3. Remove the bolts (9), external tooth lockwashers (10), brake disc (11) and spacer (12).

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 races for wear and replace them if necessary. Replace them in sets only.
4. Replace the oil seals.
5. On laced wheels, replace the spokes, rim or hub if damaged.

Assembly

LACED WHEEL (Figure 2-3)

1. If the hub and rim were disassembled, reassemble the hub, spokes and rim as described in LACING WHEELS — 16 INCH.
2. Make sure brake disc and spacer are clean, then install the spacer (12) and brake disc (11) using the five nuts (10) and bolts (9). Tighten the bolts to 23-27 ft-lbs torque.
3. If bearing races (6) were removed for replacement, coat the new races with bearing grease and press one into each side of the hub.

1. Axle cap
2. Axle nut
3. Lockwasher
4. Washer
5. Axle
6. Spacer
7. Slider cap nuts
8. Speedometer drive
9. Hubcap

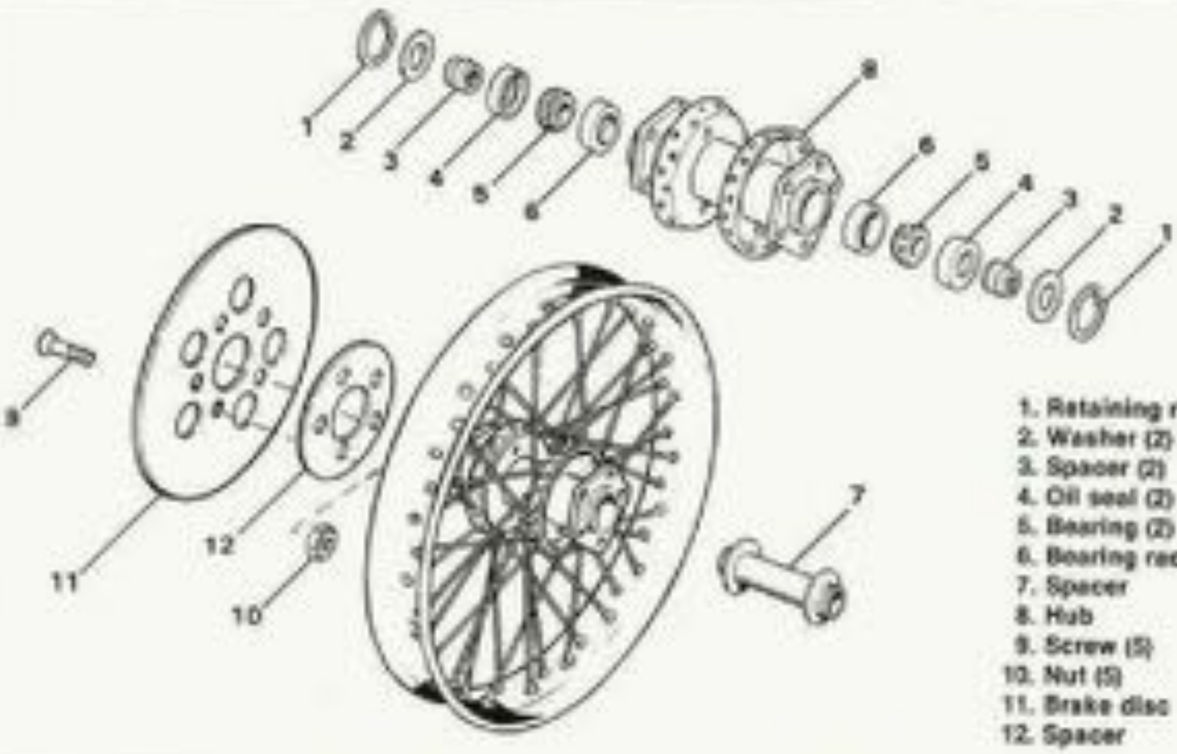
Figure 2-2. FL Front Wheel Mounting — 1981 and Later

4. Place the spacer (7) into the hub. Coat the bearings (5) with bearing grease and install one in each side of the hub.

5. Lightly coat the outside lip of each oil seal (4) with engine oil. Press one seal into each side of the hub so it is 13/64 to 7/32 in. below outside of hub.

6. Install the spacers (3), washers (2) and retaining rings (1).

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



1. Retaining ring (2)
2. Washer (2)
3. Spacer (2)
4. Oil seal (2)
5. Bearing (2)
6. Bearing race (2)
7. Spacer
8. Hub
9. Screw (5)
10. Nut (5)
11. Brake disc
12. Spacer

Figure 2-3. FL Laced Front Wheel

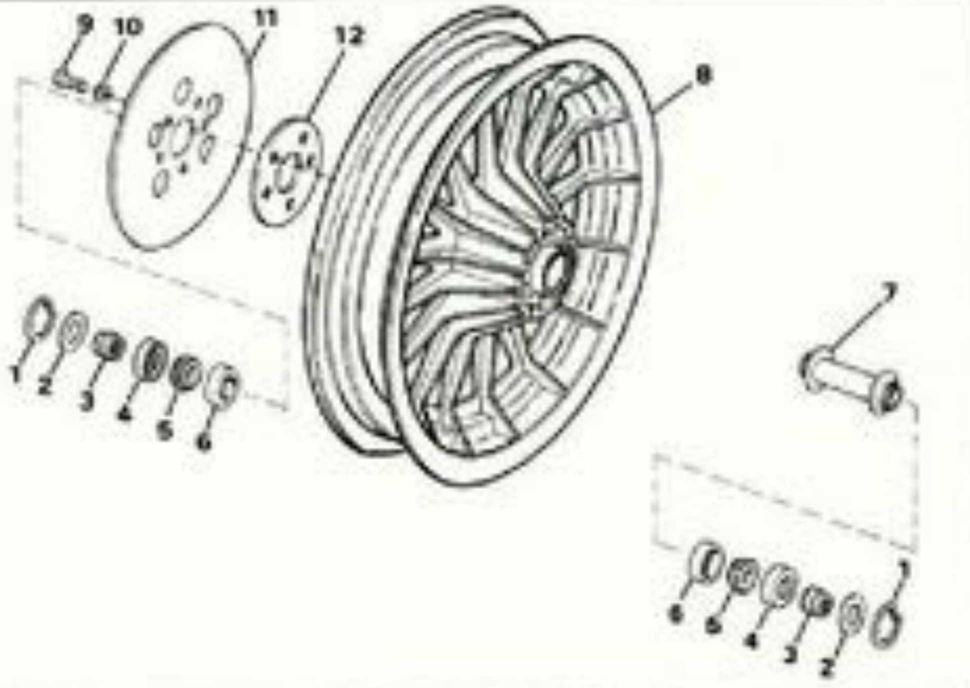


Figure 2-4. FL Cast Front Wheel

CAST WHEEL (Figure 2-4)

1. Make sure brake disc and spacer are clean, then install the spacer (12) and brake disc (11) using the external tooth lockwashers (10) and bolts (9). Tighten the screws to 23-27 ft-lbs torque.

2. If bearing races (6) were removed for replacement, coat the new races with bearing grease and press one into each side of the wheel hub.

3. Place the spacer (7) into the wheel. Coat the bearings (5) with bearing grease and install one in each side of the wheel hub.

4. Lightly coat the outside lip of each oil seal (4) with engine oil. Press one seal into each side of the wheel so it is 13/64 to 7/32 inches below outside edge of wheel hub.

5. Install the spacers (3), washers (2) and retaining rings (1).

6. Wheel and tire must be true. See CHECKING CAST RIM RUNOUT.

Installation

1978½-1980

1. Place wheel between fork legs with the brake disc centered between the brake pads.

2. See Figure 2-1. Apply Loctite ANTI-SEIZE to axle shaft and insert the axle (6) from right fork side through wheel, spacer (8), hub cap (7) and left fork side.

3. Install the flat washer (4), lockwasher (3) and axle nut (2). Tighten the axle nut to 45-50 ft-lbs torque.

4. Tighten the slider cap nuts (5) to 11 ft-lbs torque.

5. Install the axle caps (1).

1981 and Later

1. Place wheel between fork legs with brake disc centered between brake pads.

2. See Figure 2-2. Apply Loctite ANTI-SEIZE to axle shaft. Insert axle through right fork leg, speedometer drive (8), hubcap (9), wheel, spacer (6) and left fork leg.

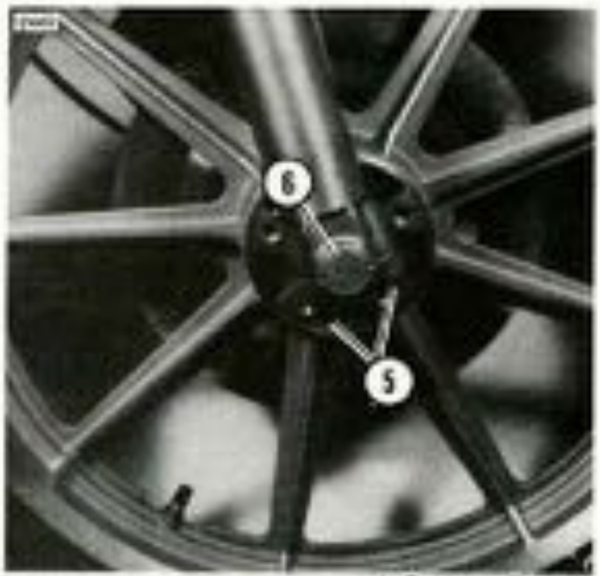
3. Install the flat washer (4), lockwasher (3) and axle nut (2). Tighten the axle nut to 45-50 ft-lbs torque.

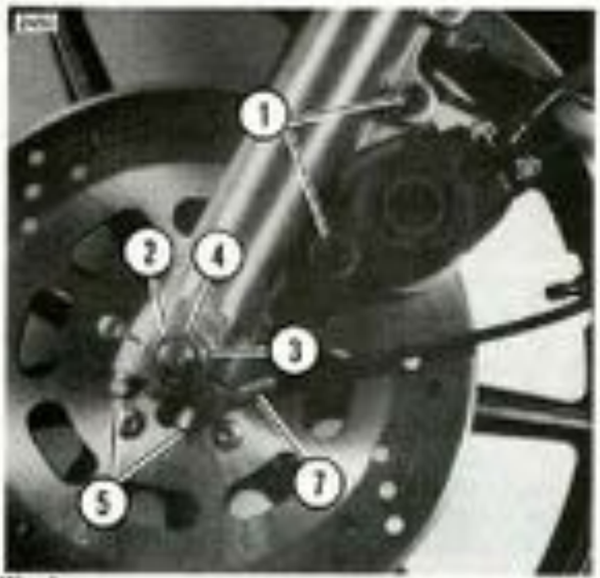
4. Tighten the slider cap nuts (7) to 11 ft-lbs torque.

5. Install the axle caps (1).

WARNING

Wheel bearing end play has been set by the factory at .004 to .018 inches and should not be altered. End play should be checked after tightening axle nut to 45-50 ft-lbs torque and slider cap nuts to 11 ft-lbs torque. If end play does not fall within this range, substitute a slightly longer or shorter spacer (7, Figure 2-3, 2-4) as necessary. When correct end play has been obtained, retighten axle nut and slider cap nuts to specified torque.





1. Brake caliper mounting hardware
2. Axle nut
3. Lockwasher
4. Washer
5. Slider cap nuts
6. Axle
7. Speedometer drive

Figure 2-5. FX Front Wheel Mounting (Except FXST/FXWG & FXDG)

FRONT WHEEL — FX MODELS
(Except 1984 FXE/FXST/FXWG)

Removal (Figure 2-5)

1. Block motorcycle underneath frame until front wheel is raised off the ground.

NOTE

1984 FXB models have single disc front brakes. The single disc without exception is mounted at the left side of the wheel hub.

2. Remove the brake caliper mounting hardware (1) and let the brake caliper or calipers hang loose on each 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).

NOTE

FXWG models 1983 and earlier do not have a speedometer drive on the front wheel. Also, the FXWG has a spacer between the front wheel and the left fork leg on 1983 and earlier models, and a spacer with a groove on the outside diameter between the front wheel and right fork leg on 1983 models. Spacer with groove must go on the right side.

Disassembly

19" LACED WHEEL (Figure 2-6)

1. Remove the oil seals (1), spacer (2), bearings (3) and spacer (5).
2. If it is necessary to remove the bearing races (4), use a standard bearing puller.
3. Mark the brake discs, if applicable, and wheel sides RIGHT and LEFT so they will be assembled correctly later. Remove the screw (7) and brake discs (6).
4. If it is necessary to disassemble the hub (9 or 10) from the wheel, unscrew all the spoke nipples and remove the spokes and rim from the hub.

21" LACED WHEEL (Figure 2-7)

1. Remove the retaining rings (1), washers (2), spacers (3), oil seals (4), bearings (5) and spacer (7).
2. If it is necessary to remove the bearing races (6) use a standard bearing puller.
3. Mark the brake discs, if applicable, and wheel sides RIGHT and LEFT for later re-assembly. Remove the screws (9), nuts (10) and brake discs (11).
4. If it is necessary to remove the hub (8) from the wheel, unscrew all the spoke nipples and remove the rim and spokes from the hub.

CAST WHEEL (Figure 2-8)

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

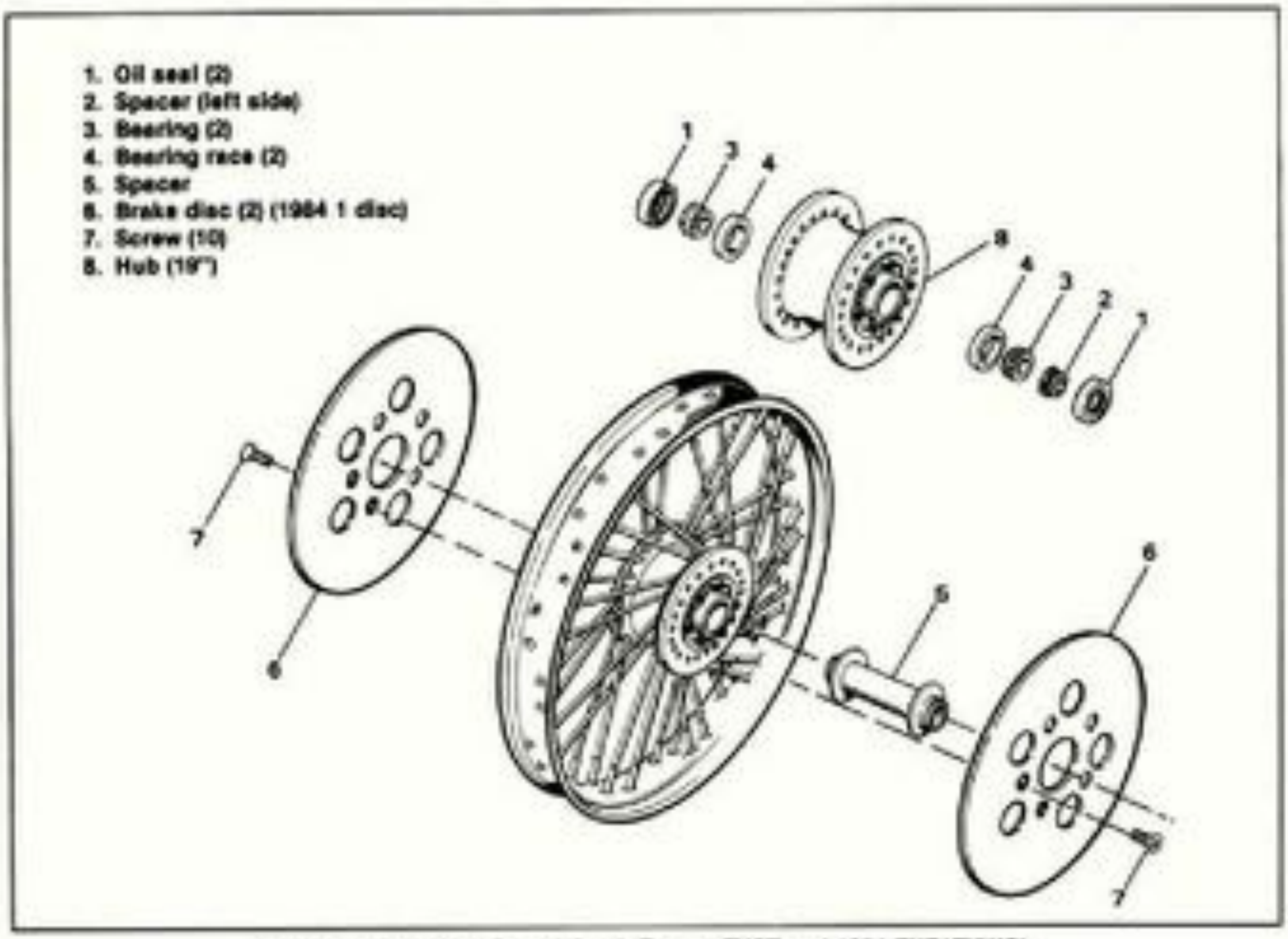


Figure 2-6. FX Laced Front Wheel (Except FXST and 1984 FXE/FXWG)

2. If it is necessary to remove the bearing races (4), use a standard bearing puller.

3. Mark the brake discs, if applicable, and wheel sides RIGHT and LEFT so they will be assembled correctly later. Remove the screws (7) and discs (6).

Cleaning, Inspection And Repair

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

2. Replace the brake discs if they are warped, scored or worn beyond the minimum thickness stamped on the disc. See SPECIFICATIONS.

3. Check the bearings and races for wear and replace them if necessary. Replace them in sets only.

4. Replace the oil seals.

5. On laced wheels, replace the spokes, rim or hub if damaged.

Assembly

19" LACED WHEEL (Figure 2-6)

1. If the hub and rim were disassembled, reassemble the hub, spokes and rim as described in LACING WHEELS — 19 IN.

2. Make sure brake discs (6) are clean, then install them using screws (7) to the side of the wheel from which they were removed. Apply Loctite STUD 'N BEARING MOUNT to the screw threads and tighten to 16-19 ft-lbs torque.

3. If bearing races (4) were removed for replacement, coat the new races with bearing grease and press one into each side of the hub.

4. Place the spacer (5) into the hub. Coat the bearings (3) with bearing grease and install one into each side of the hub.

5. Place the spacer (2) in one side of hub. This side (with spacer) becomes the left side of the wheel. Press an oil seal (1) into each side of the hub. The seals should be pressed in flush with the hub outside edge.

6. Wheel and tire must be true. See TRUING LACED WHEELS.

21" LACED WHEEL (Figure 2-7)

1. If the hub and rim were disassembled, reassemble

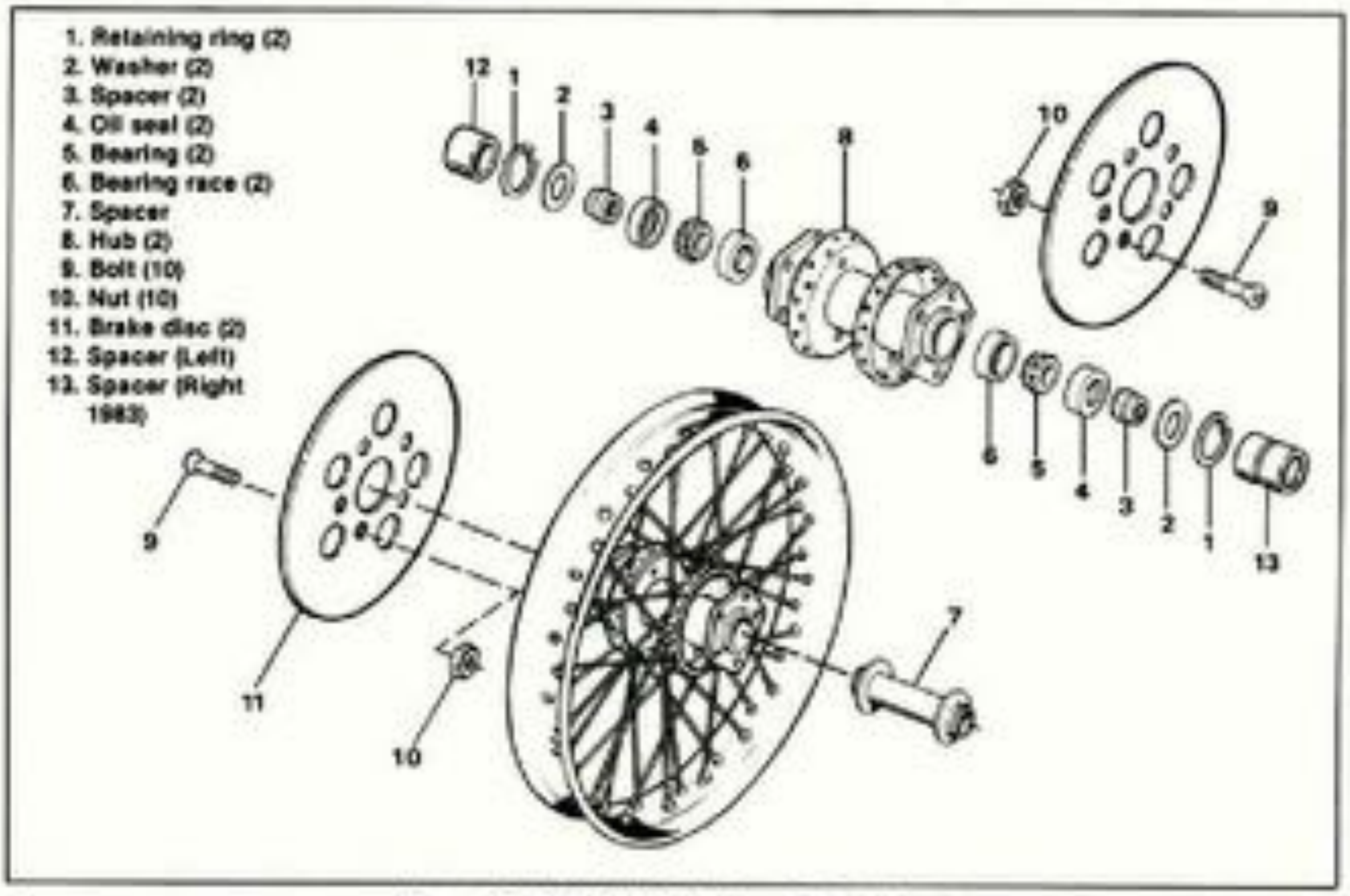


Figure 2-7. 1983 FXWG 21" Laced Front Wheel

the hub, spokes and rim as described in LACING WHEELS — 21 IN.

2. Make sure brake discs are clean, then install the brake discs (11) using the nuts (10) and bolts (9). Tighten the bolts to 23-27 ft-lbs torque.

3. If bearing races (6) were removed for replacement, coat the new races with bearing grease and press one into each side of the hub.

4. Place the spacer (7) into the hub. Coat the bearings (5) with bearing grease and install one in each side of the hub.

5. Press an oil seal (1) into each side of the hub. The seals should be pressed in flush with the hub outside edge.

6. Install spacers (3) at each side and position against the bearing cone. Position washer (2) at each side against spacer (3).

7. Compress retaining ring (1) into the internal groove at each end of the wheel hub. Place spacer (12) at one side of the hub and spacer (13) at the other side. The wheel must be installed with the grooved spacer at the right side of the vehicle.

8. Wheel and tire must be true. See TRUING LACED WHEELS.

CAST WHEEL (Figure 2-10)

1. Make sure brake discs are clean, then install them to the side of the wheel they were removed. Apply Loctite STUD 'N BEARING MOUNT to screw threads and tighten to 14-16 ft-lbs torque.

2. If bearing races were removed for replacement, coat the new races with bearing grease and press one into each side of the wheel hub.

3. Place the spacer (5) into the hub. Coat the bearings (3) with bearing grease and install one into each side of the wheel hub.

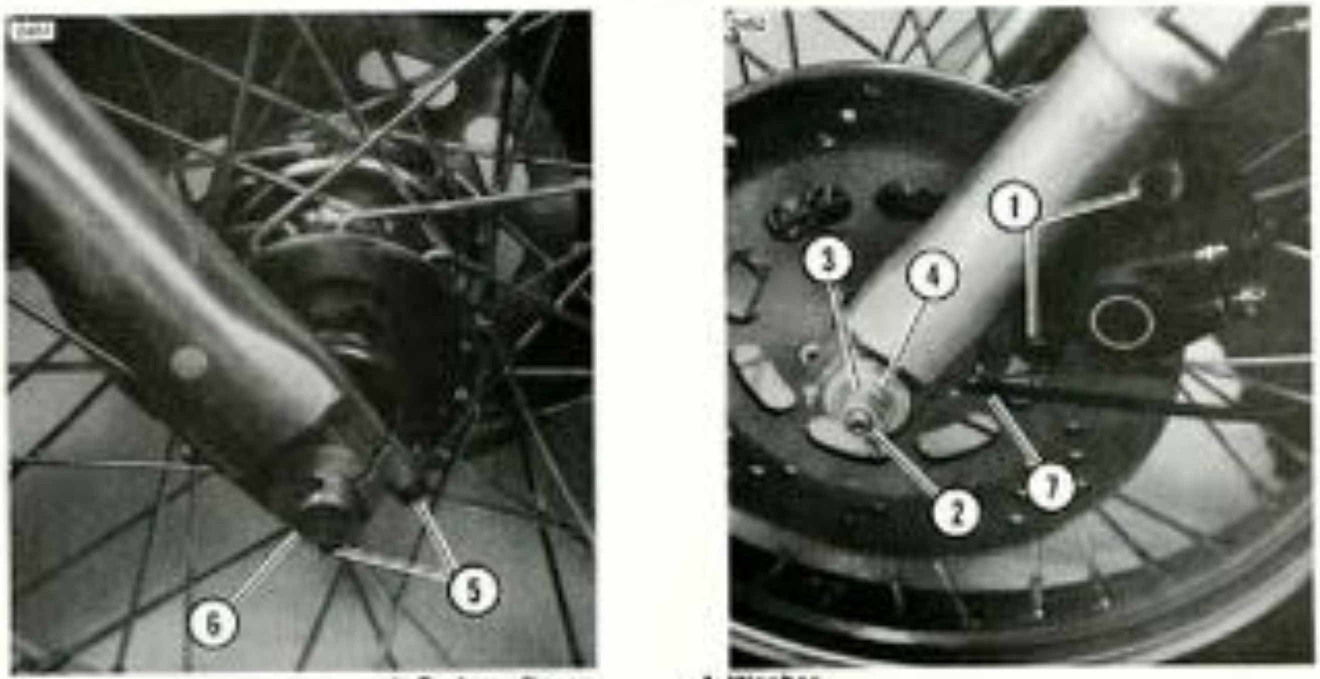
4. Place the spacer (2) in one side of hub. This side (with spacer) becomes the left side of the wheel. Press an oil seal (1) into each side of the hub flush with the outside edge.

5. Wheel and tire must be true. See CHECKING CAST RIM RUNOUT.

Installation

1. Place wheel between fork legs with spacer (2, Figure 2-10) facing to the motorcycle left side.

2. See Figure 2-5. Install axle through right fork leg, speedometer drive (7), wheel and left fork leg.



1. Brake caliper mounting hardware
2. Axle nut
3. Lockwasher
4. Washer
5. Slider cap nuts
6. Axle
7. Speedometer drive

Figure 2-6. FXST/FXWG/FXDG Front Wheel Mounting

Secure the axle with the washer (4), lockwasher (3) and axle nut (2). Tighten the axle nut to 50 ft-lbs torque. Tighten the slider cap nuts (5) to 11 ft-lbs torque.

NOTE

FXWG models 1983 and earlier do not have a speedometer drive on the front wheel. Also, the FXWG has a spacer between the wheel and left fork leg on 1983 and earlier models, and a spacer with a groove on the outside diameter between the front wheel and right fork leg on 1983 models. Spacer with groove must go on the right side.

WARNING

Wheel bearing end play has been set by the factory at .004 to .018 inches and should not be altered. End play should be checked after tightening axle nut to 50 ft-lbs torque and slider cap nuts to 11 ft-lbs torque. If end play does not fall within this range, substitute a slightly longer or shorter spacer (5, Figures 2-6, 2-7) as necessary. When correct end play has been obtained, retighten axle nut and slider cap nuts to specified torque.

3. Install the brake calipers to the fork sides. Use new mounting nuts when installing the calipers because the nut threads are destroyed when nuts are removed. Tighten the caliper mounting bolts to 11 ft-lbs torque.

FRONT WHEEL — 1984 FXST/FXWG/FXE MODELS

Removal (Figure 2-8)

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 each 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 by pulling toward the non-threaded end of the axle.

Disassembly (Figure 2-9)

1. Pull spacer (4) and seal (1) from the right end of the wheel hub. The right hand seal may pull free with the spacer due to the small shoulder on the spacer, at the inboard side of the seal.

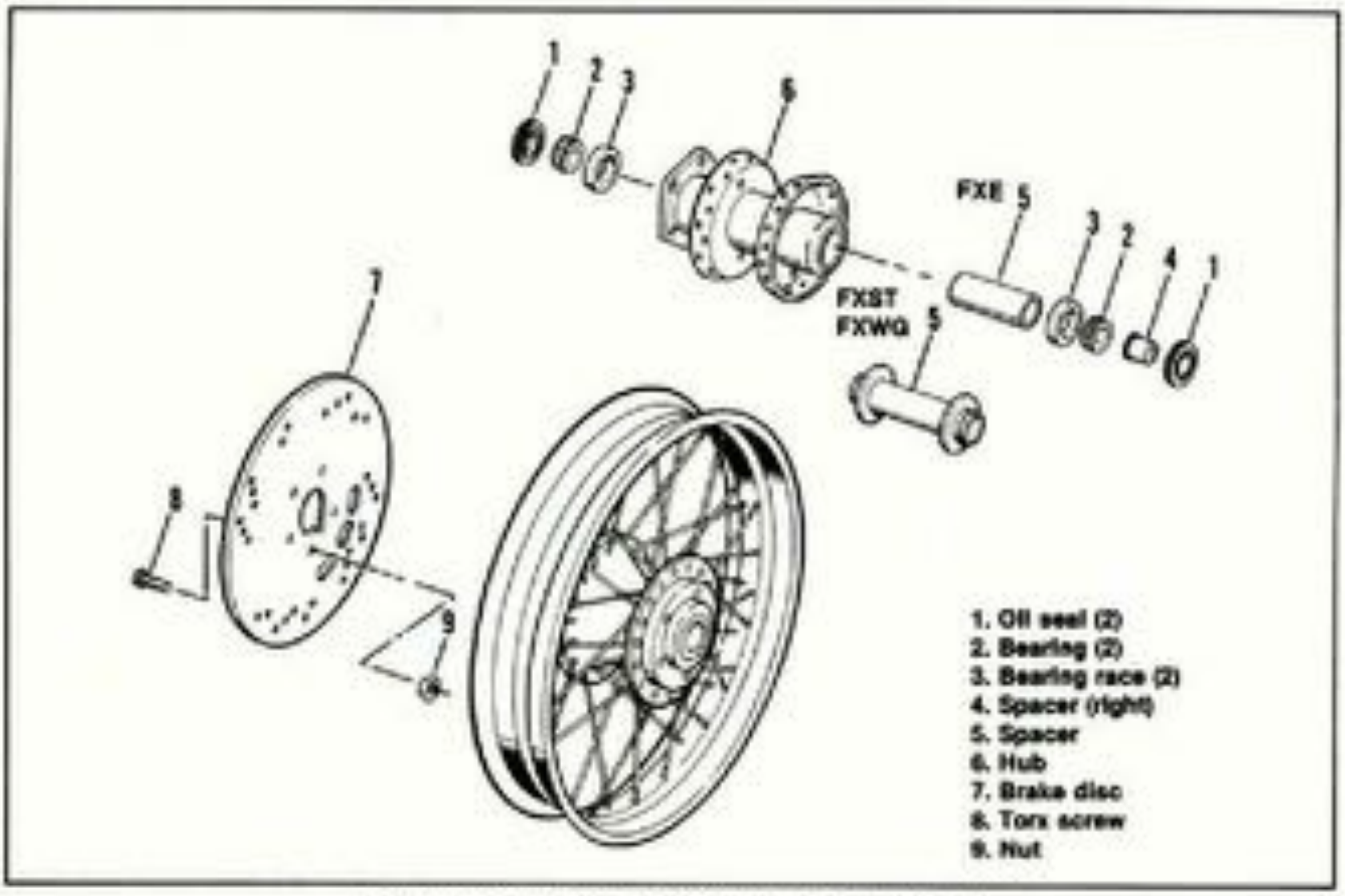


Figure 2-9. 1984 FXST/FXWG/FXE Laced Front Wheel

2. Pull seal (1) out of the left side of the wheel hub.

3. Remove bearing cones (2) and spacer (5).

4. If it is necessary to remove the bearing races (3) use a standard bearing puller.

5. Remove screws (8) using a special socket wrench adaptor Torx T-40 or equivalent.

6. 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. Check the bearings and races 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 2-9)

1. If the hub and rim were disassembled, reassemble the hub, spokes and rim as described under LACING WHEELS 21 in., later in this Section.

2. Apply LOCTITE STUD 'N BEARING MOUNT to the threads of screws (8). 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 16-18 ft-lbs torque.

3. If bearing races (3) were removed for replacement, coat the new races with bearing grease and press one into each side of the hub against the shoulder of the counterbore.

4. Place spacer (5) into the hub. Coat bearing cones (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.

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

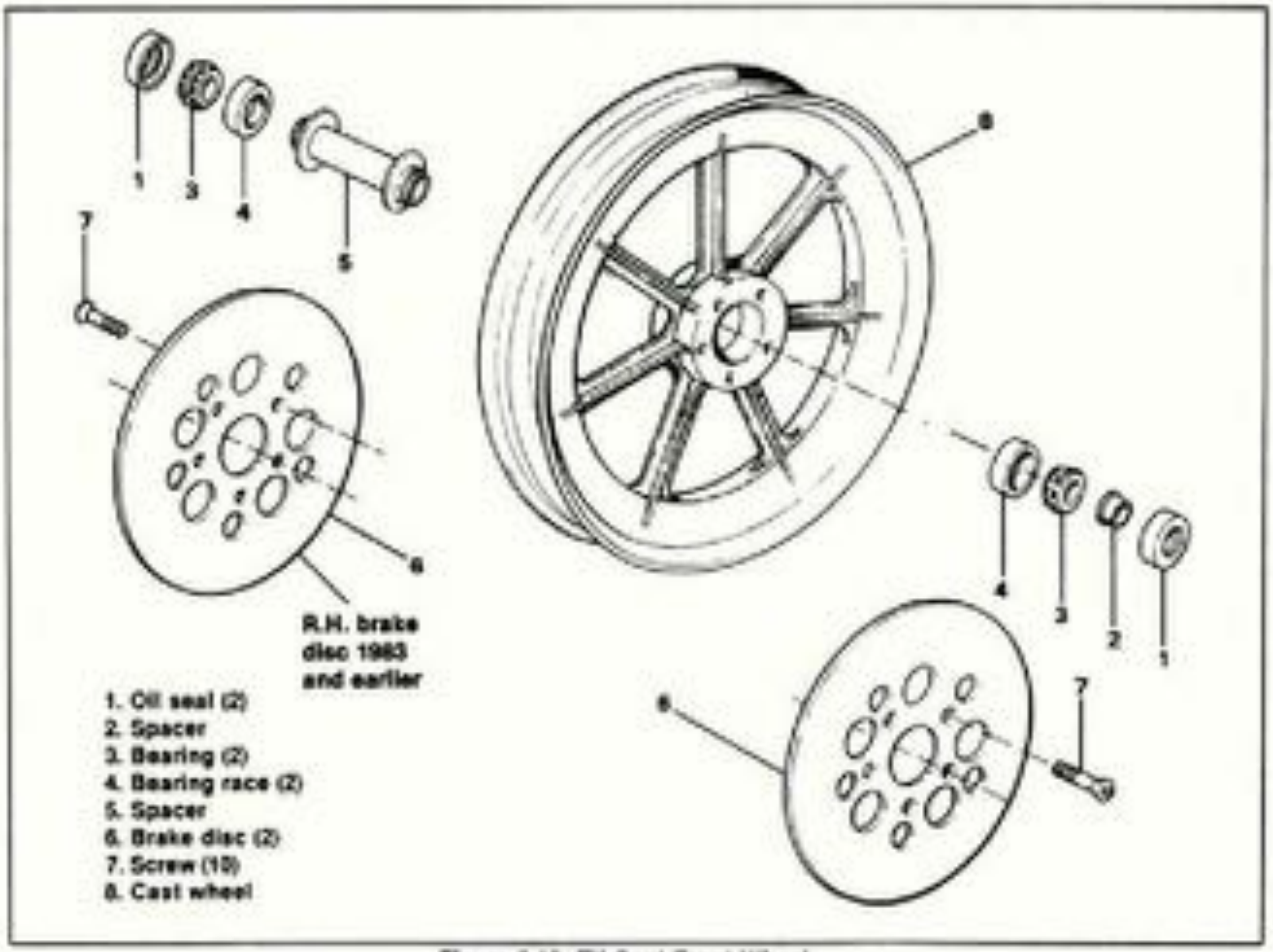


Figure 2-10. FX Cast Front Wheel

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 .015" inside the hub end surfaces.

7. If the hub (6) was removed see LACING WHEELS 21 inch for assembly and wheel truing information.

REAR WHEEL — ALL FL/FX MODELS

Removal (Figure 2-11)

1. Block motorcycle underneath frame until rear wheel is raised off the ground.

NOTE

Remove the saddlebags on FL models before continuing.

2. Remove the axle nut (1), lockwasher (2), and washer (3).
3. Pull axle (4) out left side of motorcycle and let the wheel drop down. Remove the spacer (5).
4. Lift the chain or belt off the rear wheel sprocket and remove the wheel assembly.

Disassembly

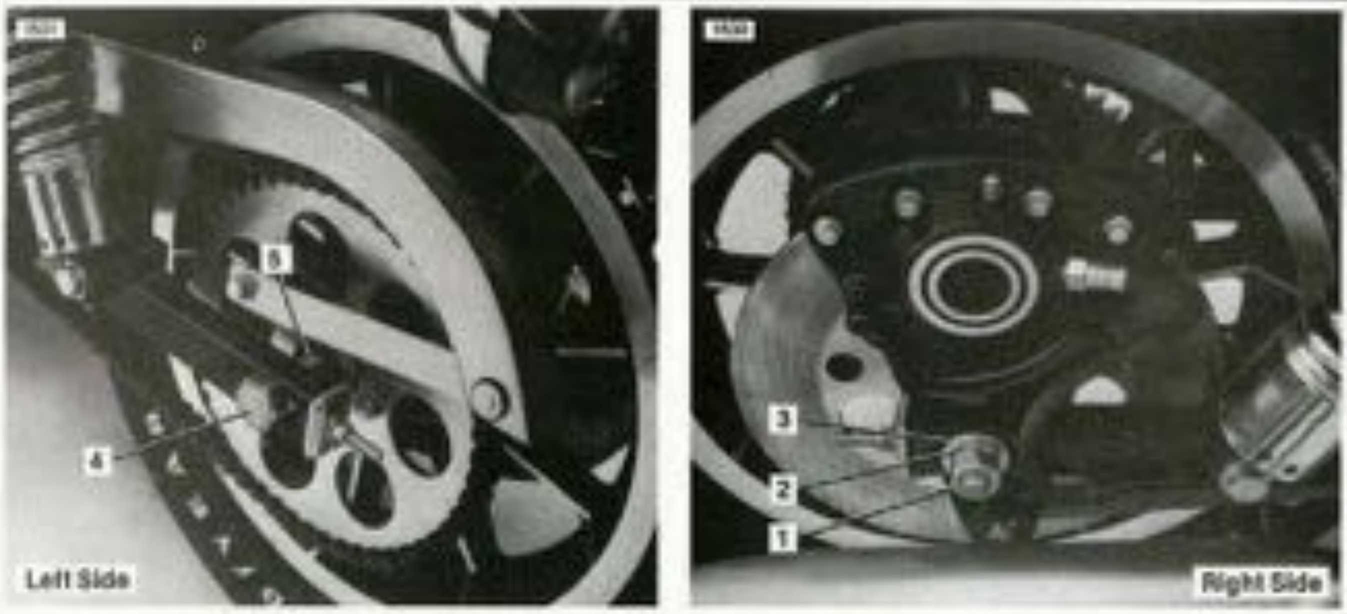
LACED WHEEL (Figure 2-12)

1. Remove the two retaining rings (1), washers (2), spacers (3), oil seals (4), bearings (5) and spacer (7).

NOTE

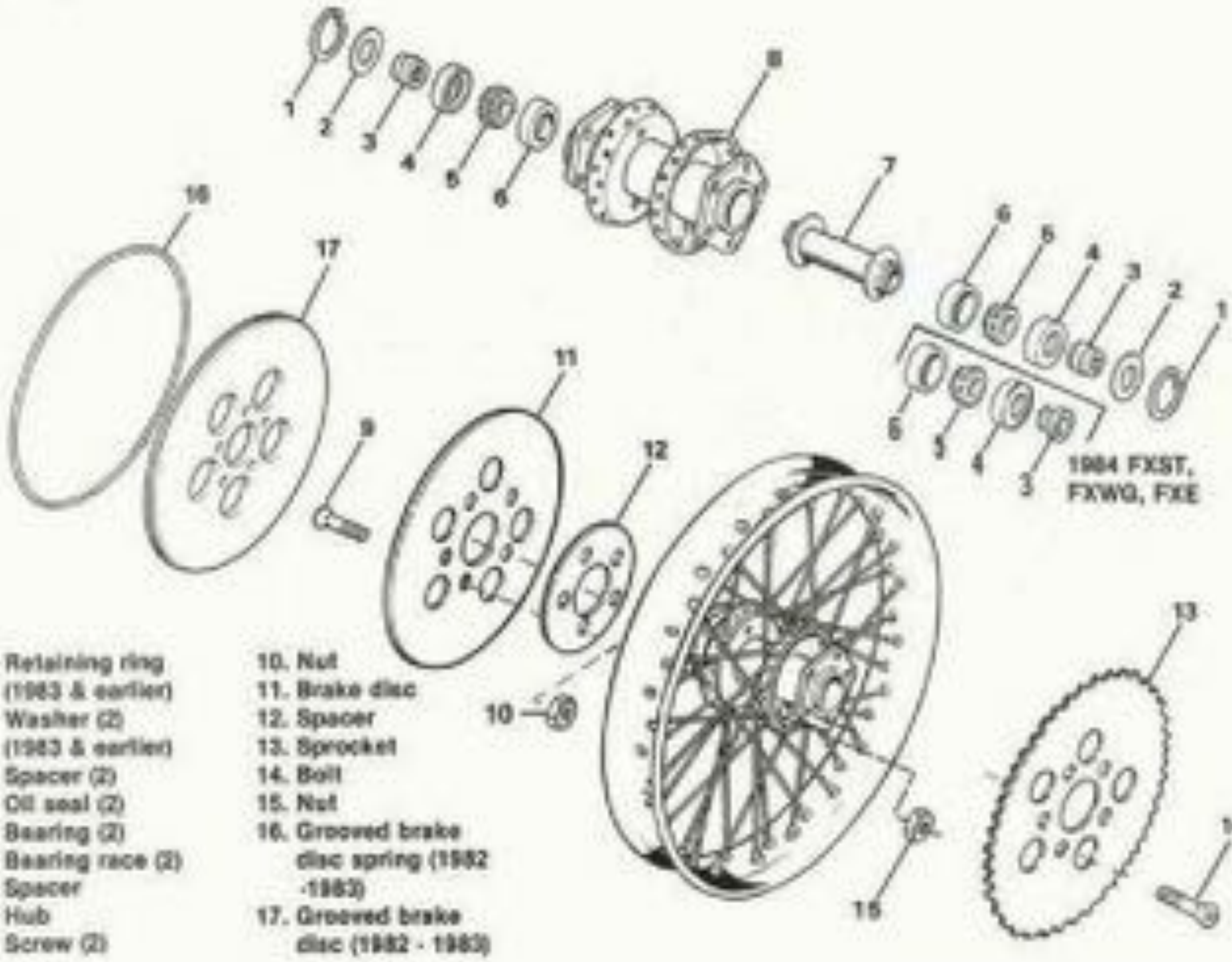
The FXST/FXE/FXWG hub assembly does not have a retaining ring or washer at the outboard side of grease seal (4).

2. If it is necessary to remove the bearing races (6) use a standard bearing puller.
3. Remove the screws (9), bolts (10), brake disc (11) and spacer (12).



1. Axle nut
2. Lockwasher
3. Washer
4. Axle
5. Spacer

Figure 2-11. Rear Wheel Mounting



1. Retaining ring (1983 & earlier)
2. Washer (2) (1983 & earlier)
3. Spacer (2)
4. Oil seal (2)
5. Bearing (2)
6. Bearing race (2)
7. Spacer
8. Hub
9. Screw (2)
10. Nut
11. Brake disc
12. Spacer
13. Sprocket
14. Bolt
15. Nut
16. Grooved brake disc spring (1982 -1983)
17. Grooved brake disc (1982 - 1983)

Figure 2-12. Laced Rear Wheel — All Models

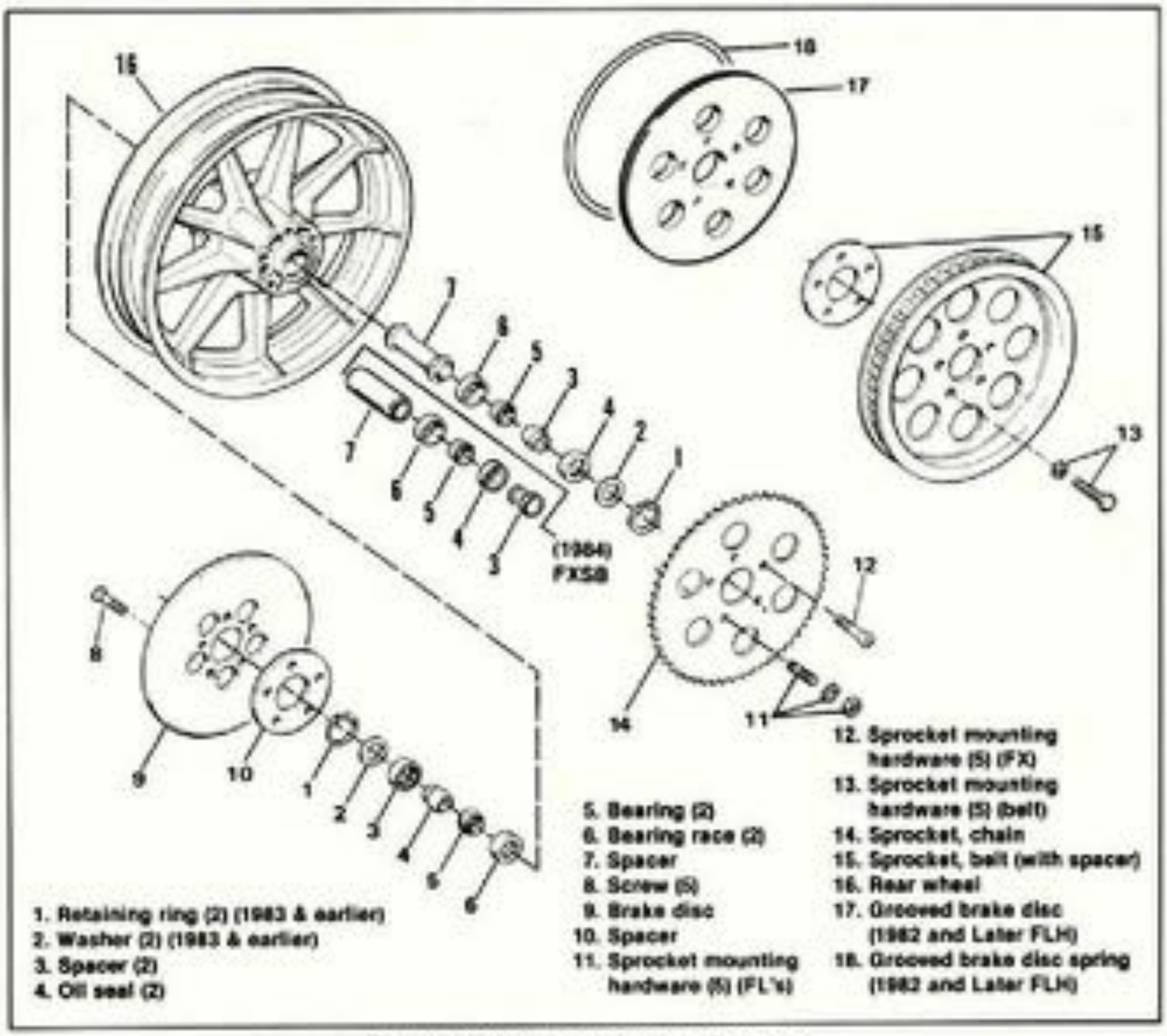


Figure 2-13. Cast Rear Wheel — All Models

NOTE

All FX Vehicles 1981 and later do not have a spacer between the brake disc and wheel hub.

4. Remove the bolt (14), nut (15) and sprocket (16).

5. If it is necessary to remove the hub (8) from the wheel, unscrew all the spoke nipples and remove the rim and spokes from the hub.

CAST WHEEL (Figure 2-13)

1. Remove the retaining rings (1), washers (2), spacers (3), oil seals (4), bearings (5) and spacer (7).

NOTE

The 1984 FXSB or the 1983 FXDG hub assembly does not have a retaining ring or washer at the outboard side of grease seal (4).

2. If it is necessary to remove the bearing races (6) use a standard bearing puller.

3. Remove the screws (8), brake disc (9) and spacer (10).

NOTE

The 1984 FXSB or the 1983 FXDG does not have a spacer between the sprocket and wheel hub.

4. Remove the sprocket mounting hardware (11, 12, 13) and sprocket (14) or sprocket with spacer (15).

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 races for wear and replace them if necessary. Replace them in sets only.

5. Replace the oil seals if there is any sign of leakage.

6. On laced wheels, replace the spokes, rim or hub if damaged.

Assembly — All Models except FXST/FXWG/FXE

LACED WHEEL (Figure 2-12)

1. If the hub and rim assembly were disassembled, reassemble the hub, spokes and rim as described in LACING WHEELS — 16 IN.

2. Make sure brake disc (11) and spacer (12) are clean, then install them using the five screws (9) and nuts (10). Tighten the screws to 23-27 ft-lbs torque.

3. Install the sprocket (13) using the bolts (14) and nuts (15). Tighten the bolts to 35 ft-lbs torque.

4. If bearing races (6) were removed for replacement, coat the new races with bearing grease and install one in each side of the hub.

5. Place the spacer (7) into the hub. Coat the bearings (5) with bearing grease and install one in each side of the hub.

6. Lightly coat the outside lip of each oil seal (4) with engine oil. Press one seal into each side of the hub so it is 13/64 to 7/32 in. below outside of hub.

7. Install the spacers (3), washers (2) and retaining rings (1).

8. Wheel and tire must be true. See TRUING LACED WHEELS.

LACED WHEEL — FXE/FXWG/FXST (Figure 2-12)

1. If the hub and rim assembly were disassembled, reassemble the hub, spokes and rim as described in LACING WHEELS — 16 IN.

2. Make sure brake disc (11) and spacer (12) are clean, then install them using the five screws (9) and nuts (10). Tighten the screws to 23-27 ft-lbs torque.

3. Install the sprocket (13) using the bolts (14) and nuts (15). Tighten the bolts to 35 ft-lbs torque.

4. If bearing races (6) were removed for replacement, coat the new races with bearing grease and install one in each side of the hub.

5. Place the spacer (7) into the hub. Coat the bearings (5) with bearing grease and install one in each side of the hub.

6. Coat the lip and outside diameter of each seal (4) with bearing grease and press into wheel hub to a position where the outer face of the seal is .22"-.20" from the outer face of the wheel hub.

7. Pack the cavity between the seal and the bearing with bearing grease.

8. Insert the spacer through the seal opening and abut the seal against the bearing cone.

CAST WHEEL — ALL MODELS EXCEPT 1984 FXSB AND 1983 FXDG (Figure 2-13)

1. Make sure brake disc (9) and spacer (10) are clean, then install them using five screws (8). Tighten the screw to 23-27 ft-lbs torque.

2. Install the sprocket (14) or sprocket with spacer (15) using the appropriate mounting hardware (11, 12, 13). Tighten the mounting hardware to 45-50 ft-lbs torque.

3. If bearing races (6) were removed for replacement, coat new races with bearing grease and press one into each side of the wheel hub.

4. Place the spacer (7) into the wheel hub. Coat the bearings (5) with bearing grease and install one in each side of the wheel hub.

5. Lightly coat the outside lip of each seal (4) with engine oil. Press one seal into each side of the hub so it is 13/64 to 7/32 in. below outside edge of wheel hub.

6. Install the spacers (3), washers (2) and retaining rings (1).

7. Wheel and tire must be true. See CHECKING CAST RIM RUNOUT.

CAST WHEEL — 1984 FXSB AND 1983 FXDG (Figure 2-13)

1. Make sure brake disc (9) and spacer (10) are clean, then install them using five screws (8). Tighten the screw to 23-27 ft-lbs torque.

2. Attach sprocket (15) to the wheel hub using screw and washer (13). Tighten the mounting screws to 50-55 ft-lbs torque.

3. If bearing cups (6) were removed for replacement

coat bearing cups with LUBRI KOTE A1040 and press one into each side of the wheel hub using a cup driver.

4. Place the spacer (7) into the wheel hub. Coat the bearings (5) with bearing grease and install one in each side of the wheel hub.

5. Coat the lip and outside diameter of each seal (4) with bearing grease and press into wheel hub to a position where the outer face of the seal is .32"-.30" from the outer face of the wheel hub.

6. Pack the cavity between the seal and the bearing with bearing grease.

7. Insert the spacer through the seal opening and abut the seal against the bearing cone.

Installation (Figure 2-11)

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

2. Coat axle with Loctite ANTI-SEIZE. Install axle (4) through left side of swing arm, spacer (5), wheel, rear bracket and right side of swing arm.

3. Install the washer (3), lockwasher (2) and nut (1). Tighten axle nut 65-70 ft-lbs torque.

WARNING

Wheel bearing end play has been set by the factory at .004 to .018 in. and should not be altered. End play should be checked after tightening axle nut to 65-70 ft-lbs torque. If end play does not fall within this range, substitute a slightly longer or shorter spacer (7, Figure 2-12, 2-13) as necessary. When correct end play has been obtained, adjust the belt or chain as described in the DRIVE, section 6.

LACING WHEELS — 16 IN.

WHEEL LACING

1. There are two styles of wheel hubs and they are identified as follows:

   Early Style Hub — See Figure 2-14. Pick any outside spoke hole and sight straight across the hub. The first spoke hole to the right of the centerline is an inner spoke hole. Also, with the wheel assembled, all inner spokes on opposite sides of the wheel angle in the same direction and all outer spokes on opposite sides of the wheel angle in the same direction. See Figure 2-16.

   Late Style Hub — See Figure 2-15. 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. Also, 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. See Figure 2-17.

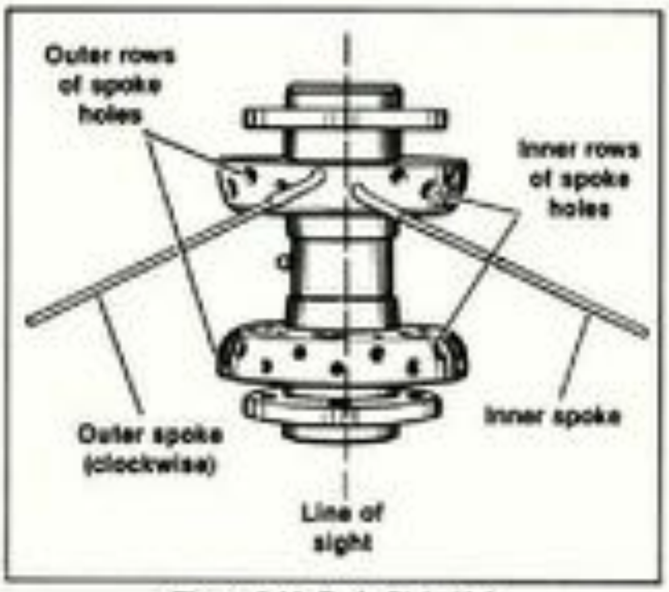


Figure 2-14. Early Style Hub

2. There are two thread patterns used on the spokes and nipples. Align all the spokes next to each other on a table. Match the fine-threaded spokes with fine-threaded nipples and coarse-threaded spokes with coarse-threaded nipples. Do not intermix the thread patterns. Also, straighten or replace any bent spokes.

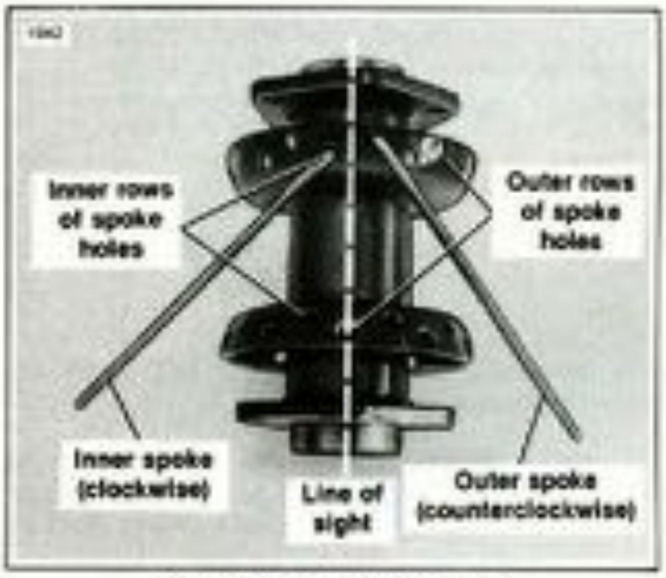


Figure 2-15. Late Style Hub

3. Place the hub on the bench with either flange up.

4. See Figure 2-14 and 2-15. Insert 10 spokes into the upper flange inner spoke holes. Swing the loose ends clockwise as far as they will go.

NOTE

When lacing an early style hub, inner spokes may be started clockwise or counterclockwise because all inner spokes angle in the same direction.

5. See Figure 2-16 and 2-17. The rim is divided into ten groups of spoke holes, 4 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, either side up, and insert the spokes into these holes. Secure each spoke with a nipple screwed on the end about 3 turns, just enough to hold it in place.

6. When all 20 inner spokes are installed, insert a spoke into an outside spoke hole on the same flange side. See Figure 2-13 and 2-14.

7. See Figure 2-18. Swing the outer spoke in the opposite direction crossing over 4 inner spokes, and secure the spoke in the nearest hole angled towards it. Repeat the procedure for all outer spokes.

NOTE

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

8. Carefully flip the hub and rim assembly over and repeat the process. If lacing an early style hub, start by swinging the inner spokes in the same direction as the other side. On late style hubs, swing the inner spokes in the opposite direction as the other side so the inner spokes cross each other.

9. See TRUING LACED WHEELS.

LACING WHEELS — 19 INCH

NOTE

The following procedure applies for both single and dual disc wheels.

1. See Figure 2-19. Divide spokes into 2 groups. Inner spokes have long heads, outer spokes have short heads. There are also fine and coarse threaded spokes and nipples. Match up fine-threaded spokes with fine-threaded nipples and coarse-threaded spokes with coarse-threaded nipples. Do not inter-mix the thread patterns.

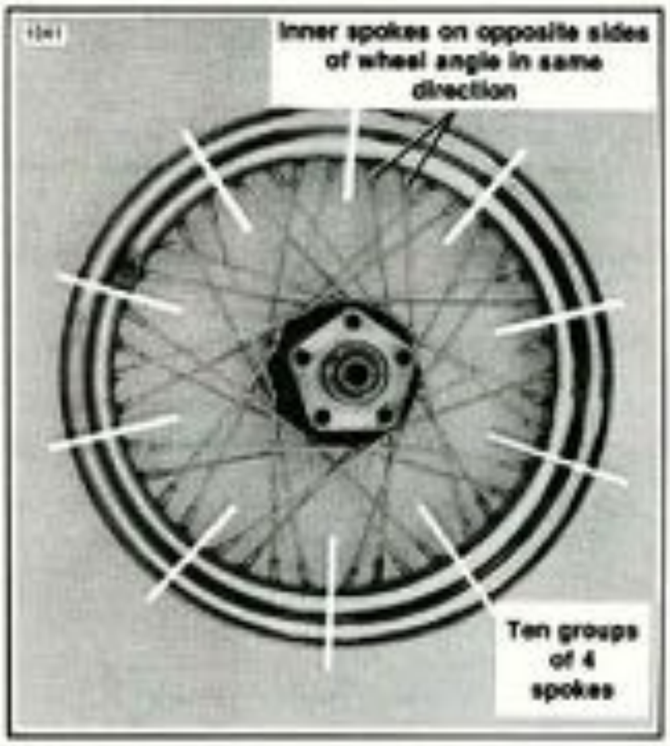


Figure 2-16. Early Style Laced Wheel

2. See Figure 2-20. Place hub on bench either side up. Insert one outer spoke (short-head) into any bottom flange hole and swing it clockwise. Insert an inner spoke (long-head) in the next hole to the left of the outer spoke. Swing the inner spoke counterclockwise over the outer spoke.

3. See Figure 2-20. Insert an inner spoke into the hole on the top flange that directly bisects the two spokes in the bottom flange. Insert all remaining spokes in both hub flanges alternating the inner and outer spokes.

4. See Figure 2-22. With all 40 spokes inserted in hub, group all spokes on top flange into 2 bundles. Secure each group with throttle grips or tape to keep the spokes together.

5. Swing all bottom flange outer spokes (short-head)

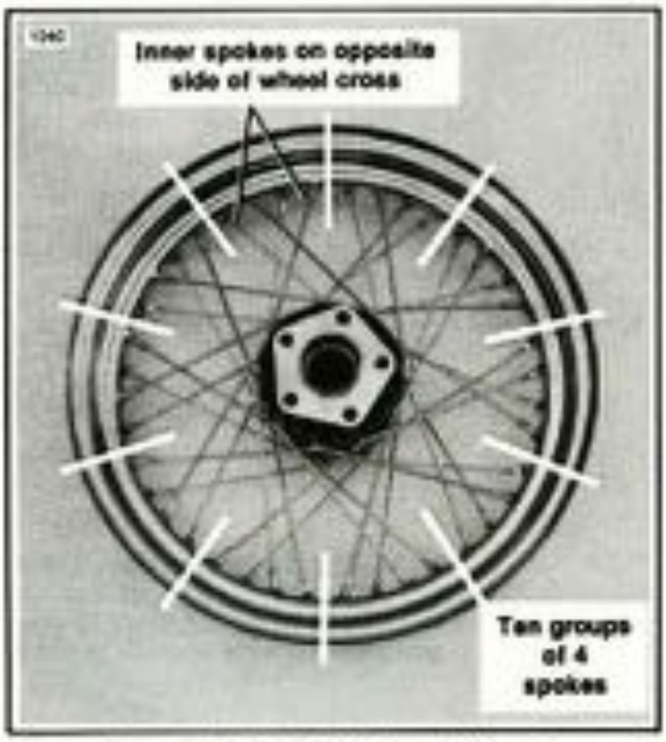


Figure 2-17. Late Style Laced Wheel

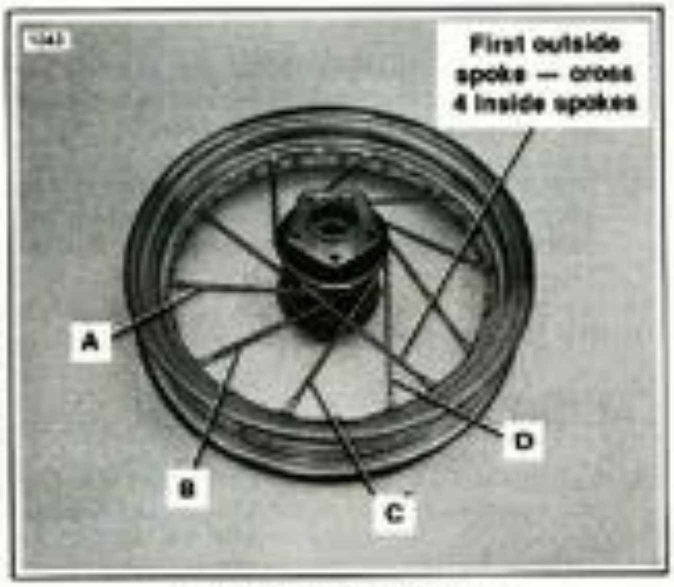


Figure 2-18. Cross-4 Pattern

clockwise. Swing the inner spokes (long-head) counterclockwise, crossing over the outer spokes. Angle all spokes as far as they will go without overlapping the next LIKE spoke. For instance, swing an outer spoke (short-head) clockwise as far as it will go before crossing another outer spoke.

6. Center the rim over the hub assembly. Undo each top bundle and fan the spokes out around the top rim edge.

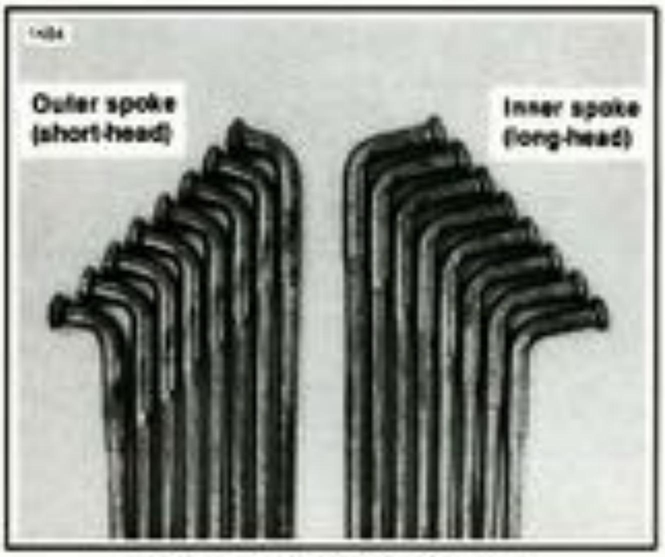


Figure 2-19. Spoke Identification

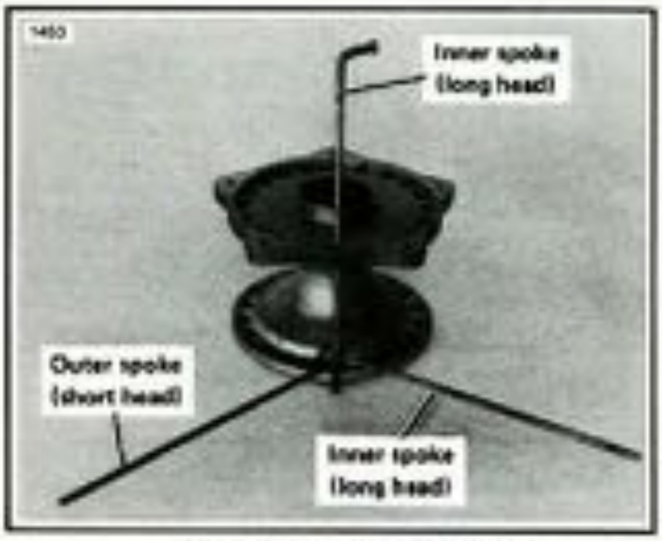


Figure 2-20. Lacing 19" Wheel

7. See Figure 2-21. The rim is divided into ten groups of spoke holes, 4 holes to a group. Each group has two holes on the left and two holes on the right, angled inward towards each other. Only one hole in each group will be angled toward the bottom flange inner spoke (long-head). Lace all bottom flange inner spokes into these holes. Secure each spoke with a nipple screwed on the end about 3 turns.

NOTE

Hub and spoke assembly may have to be spun slightly within the rim to allow proper spoke-to-rim alignment. Keep the bottom flange spokes crossed in correct position when spinning the hub. Also, keep the top flange spokes fanned around the rim. If they fall off the rim and become tangled in the bottom flange spokes, the hub

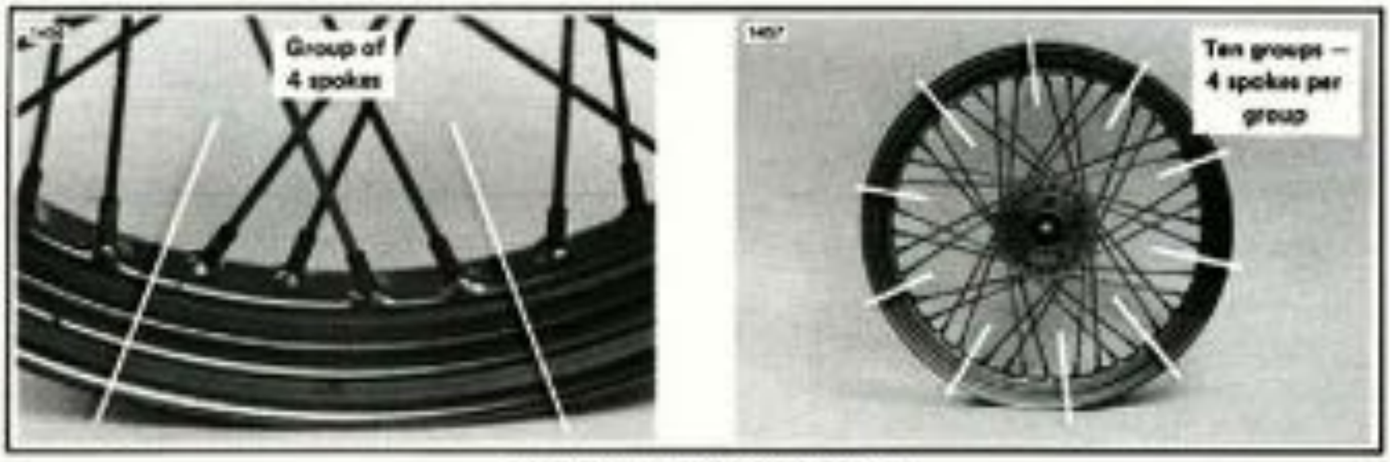


Figure 2-21. Grouping the Spokes

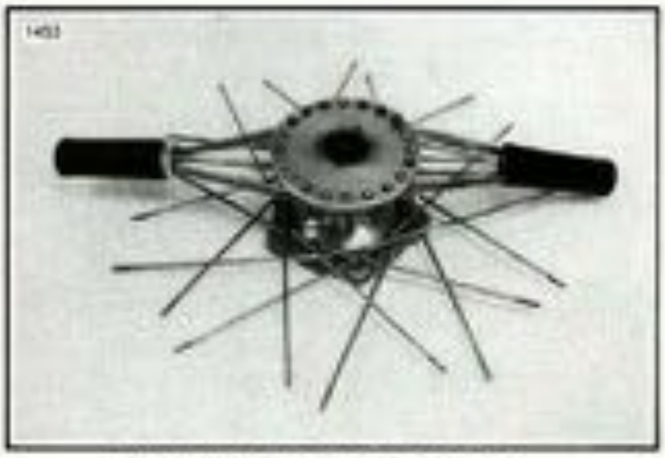


Figure 2-22. Bundling Top Spokes

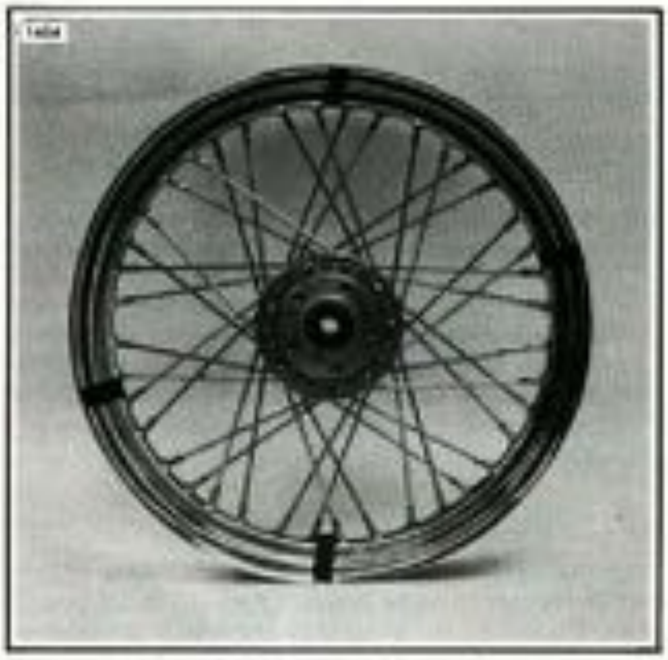


Figure 2-23. Marking Spoke Groups

will not rotate and it might be necessary to unlace the wheel to untangle them.

8. Next lace the 10 bottom flange outer spokes (short-head). Only one hole in each group of rim spoke holes will be angled toward these spokes. Secure each spoke with a nipple screwed on about 3 turns.

NOTE

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

9. Lace all the top flange inner spokes, one at a time leaving the outer spokes resting on the rim. Swing the top flange inner spokes clockwise.

10. Now lace the top flange outer spokes. Swing them counterclockwise and make sure each one crosses 4 inner spokes before securing it to the rim.

11. See TRUING WHEELS.

LACING WHEEL — 21 INCH

1. See Figure 2-24. To identify a late style hub, 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.

2. Place hub on bench with either flange up.

NOTE

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

3. See Figure 2-24. Insert 10 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 2-25. 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

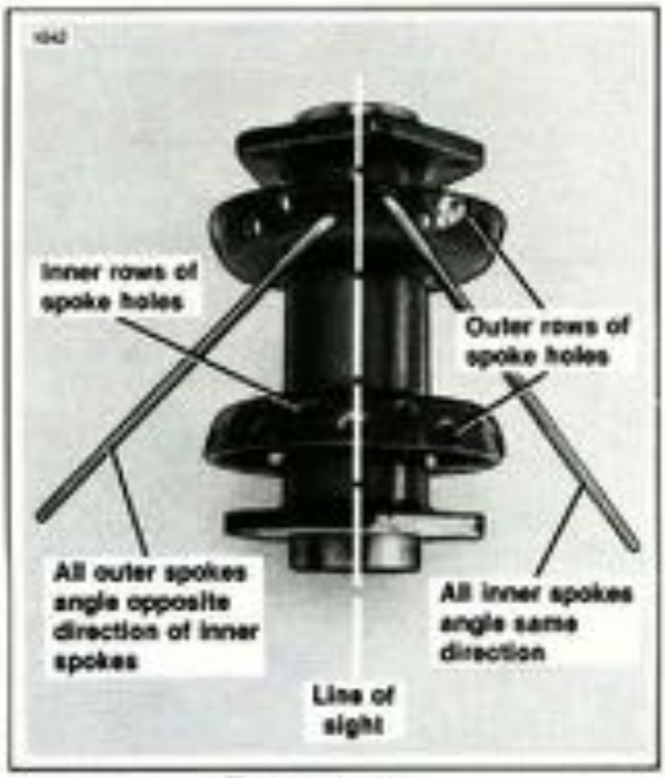


Figure 2-24. Hub

spoke. Insert the spokes into thes holes. Secure each spoke with a nipple screwed on the end about three turns, just enough to hold it in place.

5. When all 10 inner spokes are installed, insert a spoke into an outside spoke hole on the same flange side.

6. See Figure 2-26. 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 2-25. Laced Wheel

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. See TRUING LACED WHEELS.

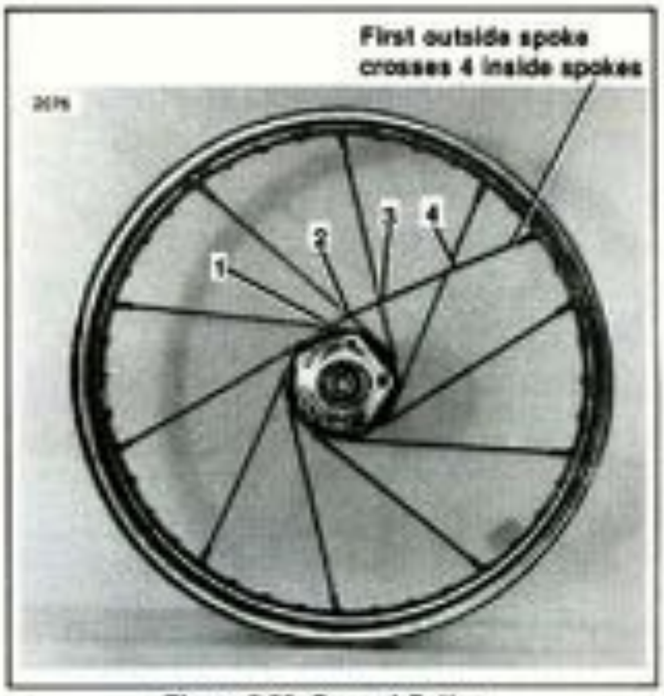


Figure 2-26. Cross-4 Pattern

TRUING LACED WHEEL

1. See Figure 2-23. Divide the wheel spokes into 4 groups of 4 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. See Figure 2-27 and 2-28. The hub must be centered sideways with the rim. 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. If this dimension is not equal on both sides of the wheel, loosen and tighten the 4 spokes accordingly. Use Spoke Wrench, Part No. HD-94681-80.

   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 4 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.

Figure 2-27. Centering 16 in. and 21 in. Hub

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

5. See Figure 2-29. After rim has been centered sideways it must be checked and trued radially. Adjust truing stand gauge to the rims tire bead seat as shown. The rim should be trued within 1/32 in.

6. 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.

   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.

7. 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.

8. Seat each spoke head in the hub flange using a flat nose punch and hammer. Then check wheel trueness again and tighten the nipples accordingly.

Figure 2-28. Centering 19 in. Hub

CAUTION

Do not tighten spokes too tight or nipples may be drawn through rim, or hub flanges may be distorted. But if spokes are left too loose, they will continue to loosen when wheel is put into service.

9. File or grind off ends of spokes protruding through nipples to prevent puncturing tube when tire is mounted.

CHECKING CAST RIM RUNOUT

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

1. See Figure 2-30. 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 3/64 in., replace the wheel.

2. See Figure 2-31. Check for radial runout as shown here. Replace the wheel if runout exceeds 1/32 in.

TIRES

General

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

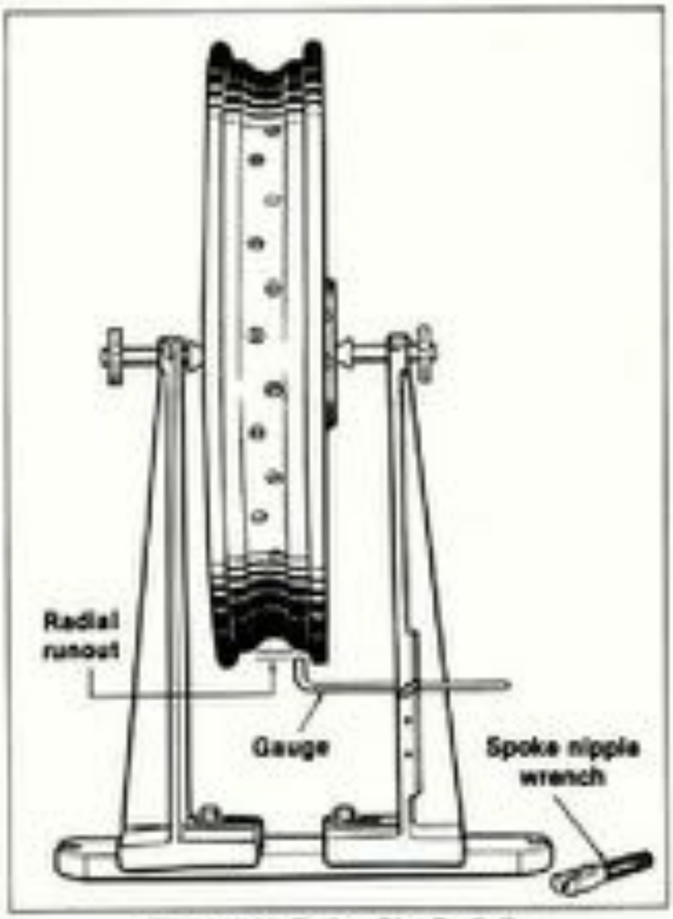


Figure 2-29. Truing Rim Radially

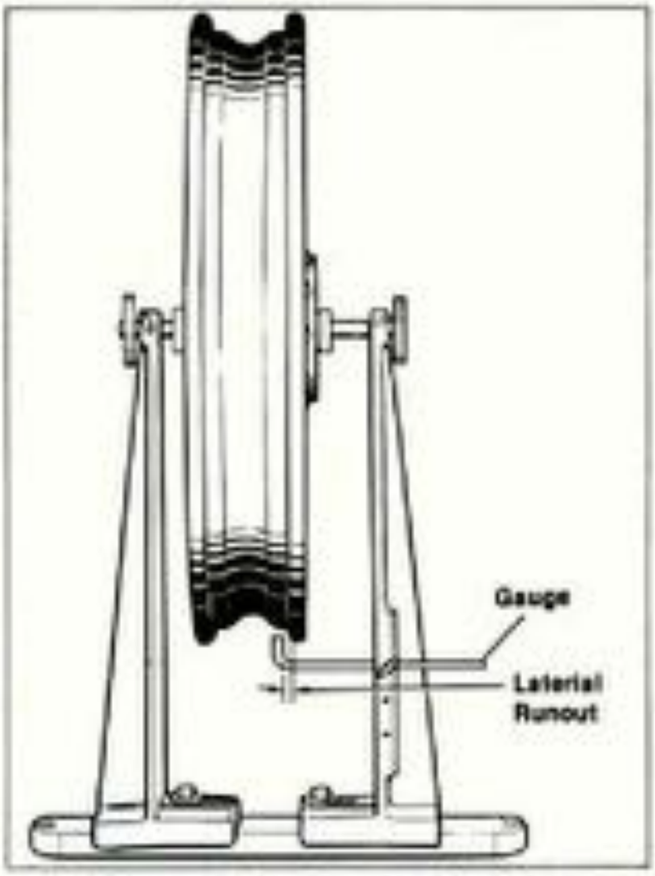


Figure 2-30. Checking Cast Rim Lateral Runout

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 tube as soon as possible.

Inner tubes must be used on all Harley-Davidson laced wheels. Rim bands must also be used on all laced wheels.

Some tires have arrows molded into the tire sidewall. These tires should be mounted on the rim with the arrow pointing in the direction of forward rotation.

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.

Removal

1. Remove wheel from motorcycle. See WHEELS.
2. Let the air out of the tube or tire.
3. See Figure 2-32. Loosen both beads from rim flange by stepping on sides of tire or by using a tire tool. Stand or kneel on tire opposite valve and push bead into rim well. Repeat for other side.

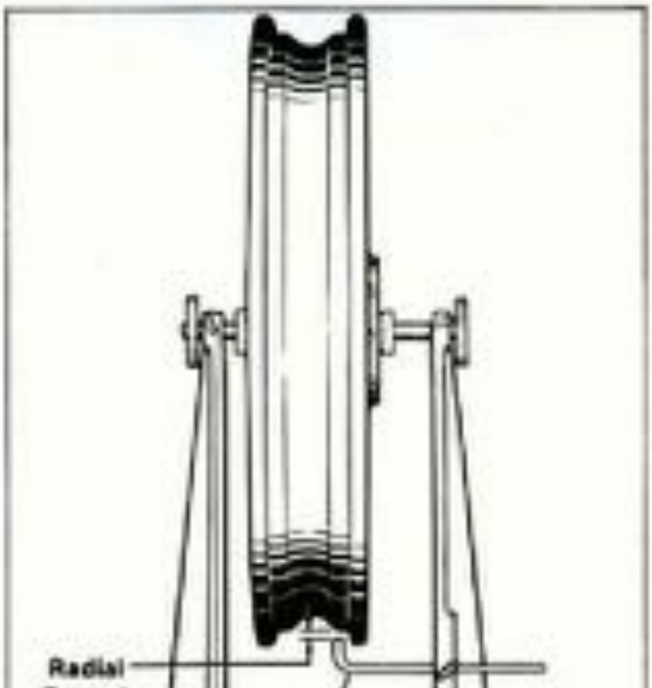


Figure 2-31. Checking Cast Rim Radial Runout

Figure 2-32. Loosening Tire Beads

Figure 2-33. Starting Tire Off Rim

NOTE

In most cases a bead breaker machine will be required to break the bead on 16 in. wheels.

4. See Figure 2-33. Using tire tools (not sharp instruments), 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 the tube.

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.

Figure 2-34. Installing Rim Strip

Figure 2-35. Starting Bead on Rim

NOTE

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

CAUTION

If tire tools are used, take care not to damage the tire and rim sealing surfaces.

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

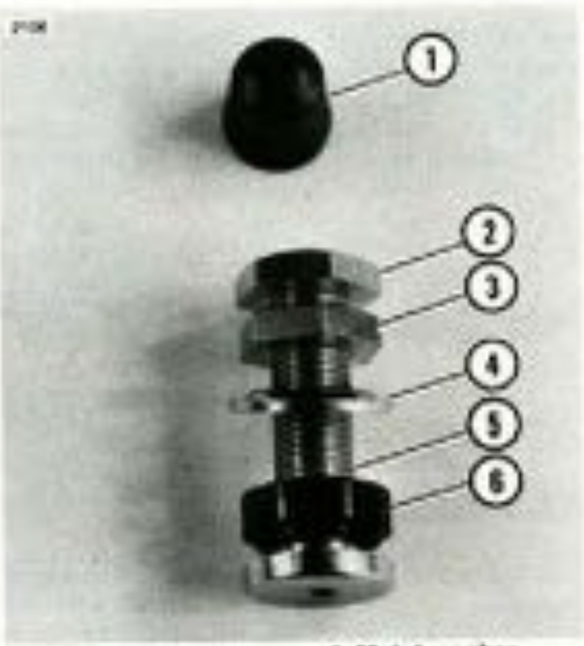
1. Clean the inside of tire, rim and tube (if applicable).
2. If rim is dirty or rusty, clean with a stiff wire brush.
3. Inspect the tire and tube for wear.

Installation

WARNING

Use the correct inner tube and tire as specified. See TIRE DATA in SPECIFICATIONS.

1. See Figure 2-36. On tubeless wheels, damaged or leaking stems must be replaced. Place rubber grommet on valve stem with shoulder in recess of the valve stem head.



1. Cap
2. Second nut
3. First nut
4. Metal washer
5. Stem
6. Rubber grommet

Figure 2-36. Tubeless Tire Valve Stem

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.
4. See Figure 2-34. On laced wheels, install a rim strip into the rim well. Make sure no spokes protrude through nipples and be sure to align the valve stem hole in rim strip with hole in rim.

Figure 2-37. Starting Second Bead on Rim

5. Thoroughly lubricate the rim flanges and both beads of the tire with tire lubricant.

CAUTION

When mounting tire and tube on the rim, use extreme care so the inner tube is not pinched.

6. See Figure 2-35. Starting at the valve stem, start the first bead into the rim well. Work the bead on as far as possible by hand. Be careful not to pinch the tube. Use the tire tool to pry the remaining bead over the rim flange.
7. Inflate tube just enough to round it out. Lubricate thoroughly 360° around the tube base. Insert tube in tire with valve stem in hole.
8. See Figure 2-37. 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 rim hole before prying the remaining bead over the rim flange. The colored dot on the sidewall is a balance mark and should be located next to the valve stem hole.

   Make sure valve stem moves in and out freely on tube type tires, then inflate the tire to recommended pressure to seat the bead. See SPECIFI-

CATIONS. Then deflate tire to allow inner tube to smooth out. Again inflate to recommended pressure to seat the bead.

WARNING

Do not inflate over 40 psi to seat the beads. Inflating the tire beyond 40 psi 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 40 psi, deflate and relubricate the bead and rim and reinflate to seat the beads but do not exceed 40 psi.

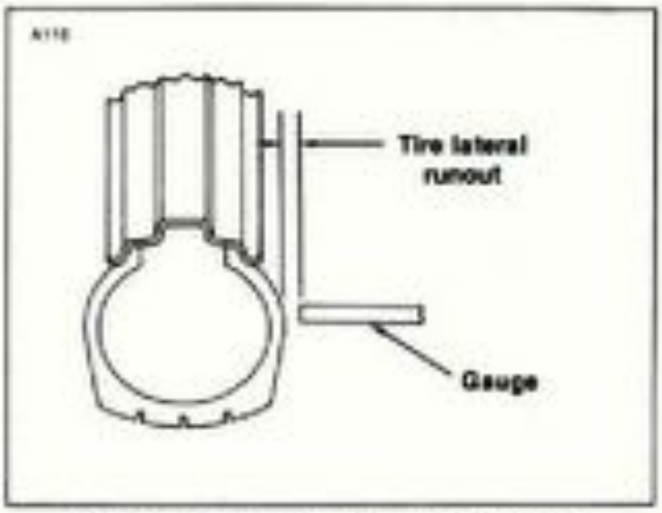


Figure 2-38. Checking Tire Lateral Runout

Checking Tire Lateral Runout

1. Check runout by turning wheel on axle, measuring amount of sideways displacement from a fixed point near the tire (see Figure 2-38).

2. Tire tread runout should be no more than 3/64 in. If tire tread runout is more than 3/64 in., remove tire from rim and check rim bead side runout to see if rim is at fault.

3. If rim side runout is less than 1/32 in., tire is at fault and should be replaced. If rim side runout is more than 1/32 in., correct by tightening selected spoke nipples on laced wheels or replacing the cast rim. Reinstall old tire and recheck tire tread lateral runout.

Checking Tire Radial Runout

1. Check runout by turning wheel on axle, measuring tread runout (see Figure 2-39).

2. Tire tread runout should be no more than 3/32 in. If tire tread runout is more than 3/32 in., remove tire from rim and check rim bead runout to see if rim is at fault.

3. If rim bead runout is less than 1/32 in., tire is at fault and should be replaced. If rim bead runout is more than 1/32 in., correct by tightening selected spoke nipples on laced wheels or replacing the cast rim. Reinstall tire and recheck tire tread runout.

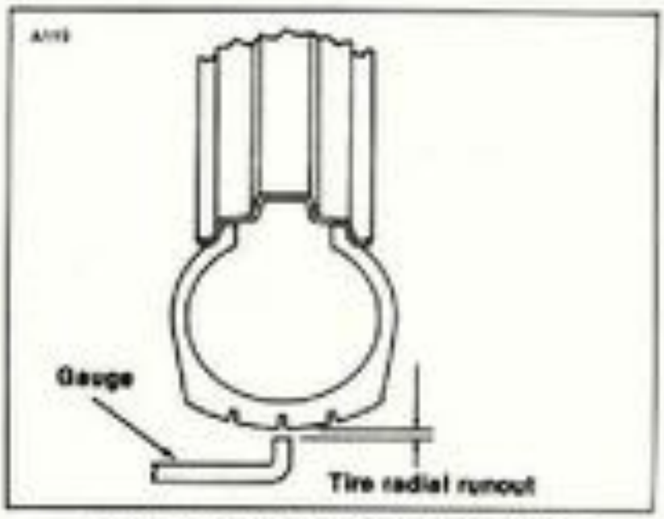


Figure 2-39. Checking Tire Radial Runout

Wheel Alignment

NOTE

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

1. See Figure 2-40. Place a straightedge against the front and rear tire sidewalls as far up towards the brake discs as possible.

2. With the front wheel pointing straight ahead, both front and rear wheels should be in perfect alignment on FX models. On FL models the front wheel will be offset 3/16 in. to the right of the rear tire.

3. Adjust the rear wheel as necessary to correct any misalignment.

Wheel Balancing

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

Cast aluminum wheels require the special self-adhesive weights listed below.

Aluminum color	1 oz. weight, Part No. 95588-75
	1/2 oz. weight, Part No. 95587-75

Black   1 oz. weight, Part No. 95591-77
         1/2 oz. weight, Part No. 95590-77

1. 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.

2. Remove paper backing from weight and press firmly in place. If 1 oz. or more of weight must be added at one location, split the amount so that half is applied to each side of the rim.

3. Wheel should not be used for 48 hours to allow adhesive to cure completely.

4. In most cases, static balancing using WHEEL TRUING STAND, Part No. HD-95500-80 will produce satisfactory results. However, dynamic balancing, utilizing a wheel spinner, can 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 to the rim. Wheels should be balanced to within 1/2 oz. at 60 mph.

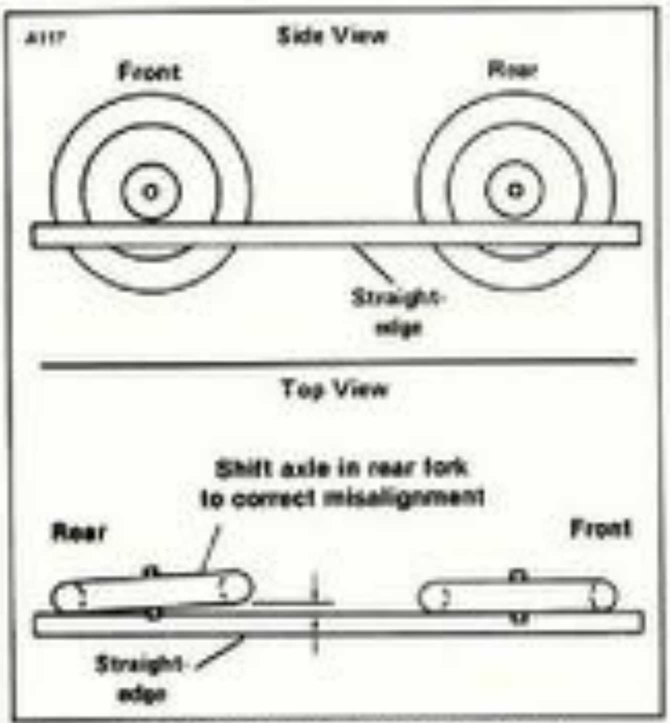


Figure 2-40. Wheel Alignment Diagram

GENERAL

The front and rear brakes are fully hydraulic disc brakes and require little maintenance. Every 1250 miles, check master cylinders for proper fluid levels and check brake pads and discs for wear. If brake pads are worn to 1/16 in. or less they should be replaced. Minimum brake disc thickness is stamped on the side of the disc. When filling master cylinders, use only D.O.T. 5 Hydraulic Brake Fluid which is approved for use in hydraulic brake systems. When removing master cylinder filler plug or cover, make sure that all dirt is removed from the area to prevent entrance into reservoir. 1978 to early 1979 rear brake master cylinders should be filled to 1/4 in. from the top. Late 1979 and later rear brake master cylinders should be filled to 1/8 inch from 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 mechanic.

Whenever the brake system is serviced, it should be tested on dry, clean pavement at slow speeds before putting the motorcycle in regular service.

ADJUSTMENTS

Rear Brake Pedal — FL Models

The rear brake pedal master cylinder plunger should have 1/16 in. free play.

1. Work brake pedal up or down by hand to determine free play before plunger contacts piston in master cylinder.

2. **1978½-Early 1979** — See Figure 2-41. Loosen the master cylinder rear bolt (4) and brake pedal stop plate bolt (2). Move front end of plate (3) down to decrease free play or up to increase free play.

3. **Late 1979 and Later** — See Figure 2-42. Loosen locknut (1) and turn stop bolt (2) clockwise to decrease free play or counterclockwise to increase free play. Tighten locknut to 10 ft-lbs torque.

1. Rear brake pedal
2. Pedal stop plate bolt
3. Pedal stop plate
4. Master cylinder rear bolt
5. Master cylinder fill plug

Figure 2-41. Adjusting Rear Brake Pedal — FL 1978 and Early 1979

1. Jam nut
2. Stop bolt

Figure 2-42. Adjusting Brake Pedal — FL Late 1979 and Later

Rear Brake Pedal — FX Models

The rear brake pedal master cylinder plunger should have 1/16 in. free play.

1. **FXWG 1983 AND EARLIER Only** — See Figure 2-43. Loosen the locknut (2) and turn stop bolt (3) clockwise to decrease free play or counterclockwise to increase free play. Hold the stop bolt in position and tighten the locknut to 10 ft-lbs torque.

Figure 2-43. Rear Brake Pedal Adjustment 1983 & Earlier FXWG Only

Figure 2-44. Rear Brake Pedal Adjustment FX Models (Except FXDG And 1984 FXST/FXWG)

2. **FX Models (except FXDG and 1984 FXST/FXWG)** — See Figure 2-44. Loosen the locknut (2) and turn the plunger (3) on clevis threads (4) forward to increase free play or rearward to decrease free play. Adjustment should be made with the linkage very loose, then turning plunger rearward until proper free play is obtained.

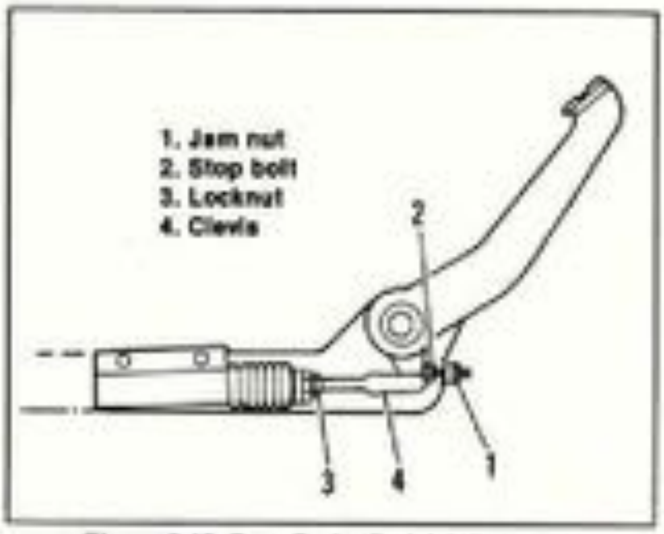


Figure 2-45. Rear Brake Pedal Adjustment FXDG And 1984 FXST/FXWG

3. **FXDG and 1984 FXST/FXWG (Figure 2-45)** Loosen jam nut (1) and adjust stop (2) to obtain specified pedal to footpeg relationship.

   Loosen locknut (3) and turn plunger (4) on clevis threads (5) forward to increase free play or rearward to decrease free play.

FRONT BRAKE MASTER CYLINDER (Figure 2-46)

Disassembly

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(s) and drain the brake fluid by pumping the handlever.
2. Remove the master cylinder screws (4), cover (2) and gasket (3).
3. Disconnect the hydraulic line (5) from the master cylinder.
4. Remove the handlebar switch assembly and disconnect the stop lamp wires.
5. Remove the retaining ring (6), pivot pin (7) and lever (8). Pull out the pin (9), plunger (10), spring (11), washers (12) and dust wiper (13). Remove the retaining ring (14) using Harley-Davidson RETAINING RING PLIERS, Part No. HD-96215-49. Pull out the piston (15) and O-ring (16) assembly, piston cup (17), spring cup (18) and spring (19).

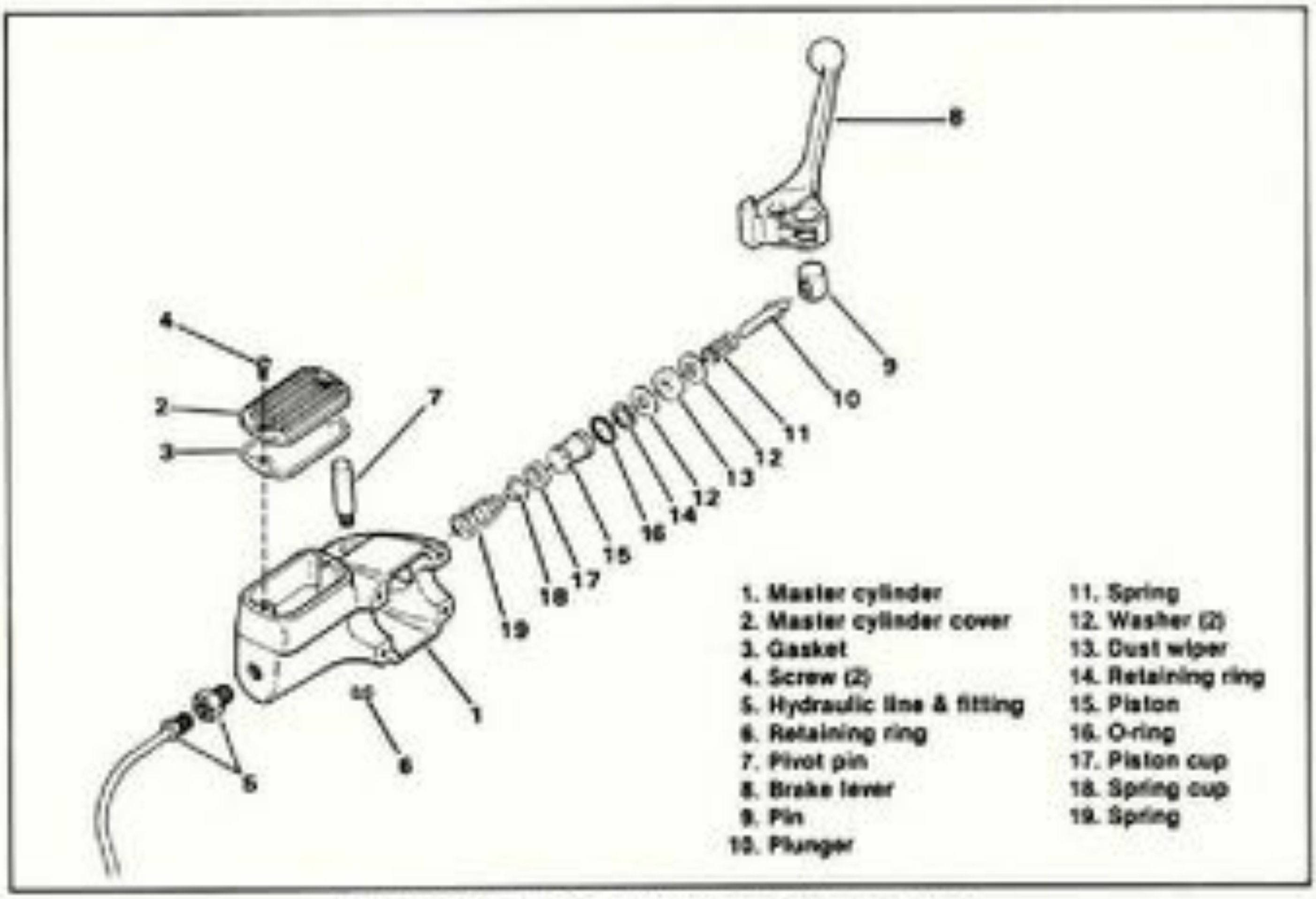


Figure 2-46. Front Master Cylinder — 1981 and Earlier

Cleaning, Inspection And Repair

1. Inspect the piston cup (17) and O-ring (16) for wear, softening and enlarging. Replace if necessary.

2. Examine the cylinder walls for scratches and grooves.

3. Make sure the vent hole in the master cylinder is open.

4. The gasket (3) should be replaced if torn or punctured.

Assembly

1. Dip all internal parts in D.O.T. 5 Hydraulic Brake Fluid.

2. Install the spring (19), spring cup (18), piston cup (17), piston (15) and O-ring (16) assembly into the master cylinder.

3. Install the retaining ring (14). Insert the dust wiper (13), washer (12), spring (11), plunger (10) and pin (9). Install the lever (8) and secure it with the pin (7) and retaining ring (6).

4. Install the master cylinder and switch assembly on the handlebar and connect the stop lamp wires.

5. Connect the brake line to the master cylinder. Fill the master cylinder with D.O.T. 5 Hydraulic Brake Fluid. Bleed the brake system using the procedures outlined in BLEEDING THE HYDRAULIC BRAKE SYSTEM.

NOTE

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

6. Test ride the motorcycle. If brakes feel spongy, repeat the bleeding procedure.

FRONT BRAKE MASTER CYLINDER (1982 AND LATER) (Figure 2-47)

Disassembly

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(s) and drain the brake fluid by pumping the hand lever.

2. Disconnect the hydraulic brake line (7) from the

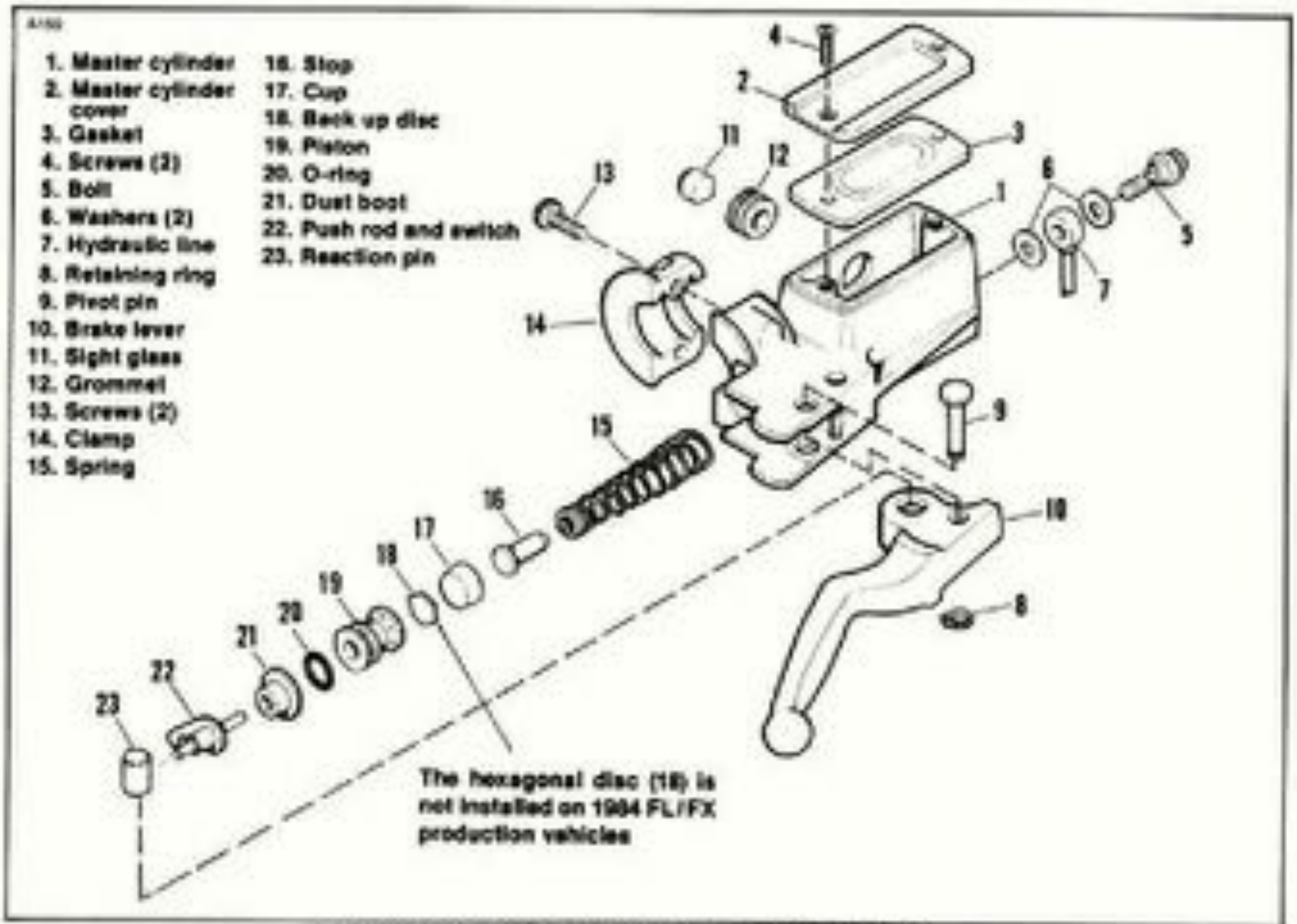


Figure 2-47. Front Master Cylinder — 1982 and Later

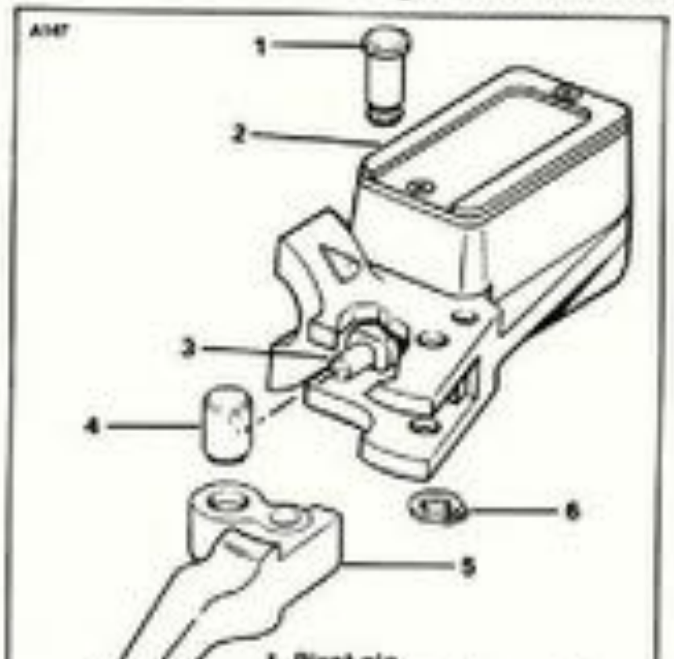


Figure 2-48. Front Brake Hand Lever

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 (23).

5. Remove master cylinder from handlebar by removing screws (13) and clamp (14).

6. Pull out the push rod and switch actuator (22), dust boot (21), plstion and O-ring (19 and 20), back up disc (18), cup (17), stop (16) and spring (15).

NOTE

On 1984 vehicles the front hydraulic master cylinder no longer has the flapper valve (18) which was installed on earlier vehicles. The hexagonal nylon flapper valve is no longer needed as a piston modification accomplishes the same purpose.

WARNING

Installation of a flapper valve disc or master cylinders where it is not required may cause brake drag of lockup.

7. Remove grommet (12) and sight glass (11).

Cleaning Inspection And Repair

1. Inspect cup (17), O-ring (20), dust boot (21) and grommet (12) for wear, softening and enlarging. Replace if necessary.

2. Examine the cylinder walls for scratches and grooves.

3. Make sure vent holes in the master cylinder are open.

4. The gasket (3) should be replaced if torn, punctured or deformed.

Assembly

1. Dip all internal parts in D.O.T. 5 Hydraulic Brake Fluid.

2. Install grommet (12) coated with D.O.T. 5 Hydraulic Brake Fluid and sight glass (11).

3. Install spring (15), stop (16), cup (17) and flapper disc (18) on specified vehicles only. Refer to the following NOTE and WARNING. Assemble piston (19) with O-ring (20), dust boot (21) and push rod and switch activator (22).

NOTE

On 1984 FL/FX vehicles the front hydraulic master cylinder no longer has the flapper valve (18) which was installed on earlier vehicles. The hexagonal nylon flapper valve is no longer needed as a piston modification accomplishes the same purpose.

WARNING

Installation of a flapper valve disc on master cylinders where it is not required may cause brake drag or lockup.

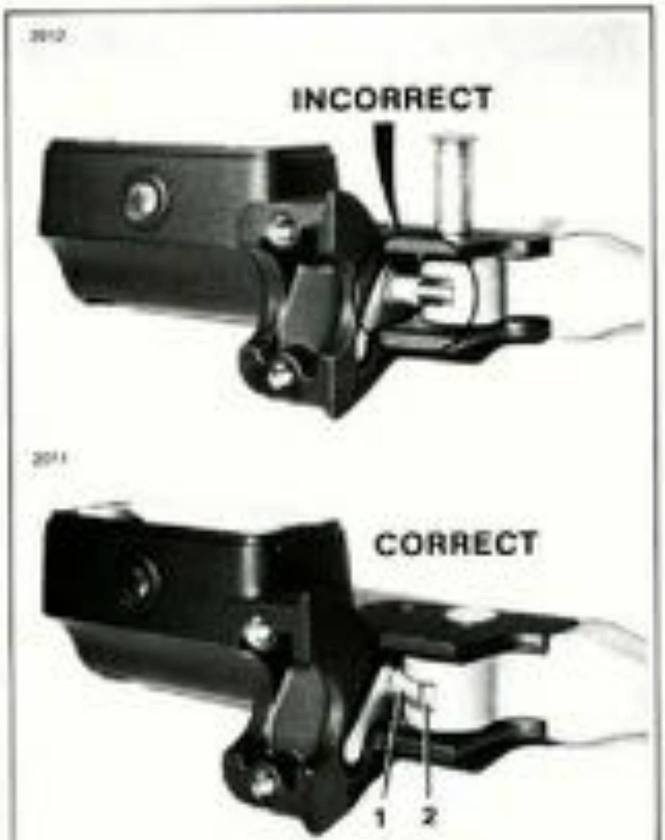
4. See Figure 2-48. Lightly coat reaction pin (4) with Loctite ANTI-SEIZE and insert it into the large hole in the brake lever (5). Assemble the brake lever (5) to the master cylinder assembly (2) using pivot pin (1) and retaining ring (6). Make sure the push rod (3) fits into hole in reaction pin (4). Check front brake lever for proper operation.

CAUTION

See Figure 2-49. Ensure that push rod and switch actuator (1) is 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 is 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.



1. Push rod
2. Reaction pin

Figure 2-49. Hand Lever Assembly

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

6. See Figure 2-47. Install washer (6), bolt (5) and hydraulic brake line (7) into master cylinder. Tighten bolt to 20-25 ft-lbs torque.

CAUTION

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

NOTE

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

7. Fill the master cylinder with D.O.T. 5 Hydraulic Brake Fluid. Bleed the brake system using the procedures outlined in BLEEDING THE HYDRAULIC BRAKE SYSTEM.

WARNING

Make sure the relief port in the cylinder is operating properly. Always after servicing the master cylinder actuate the brake lever with the reservoir cover removed.

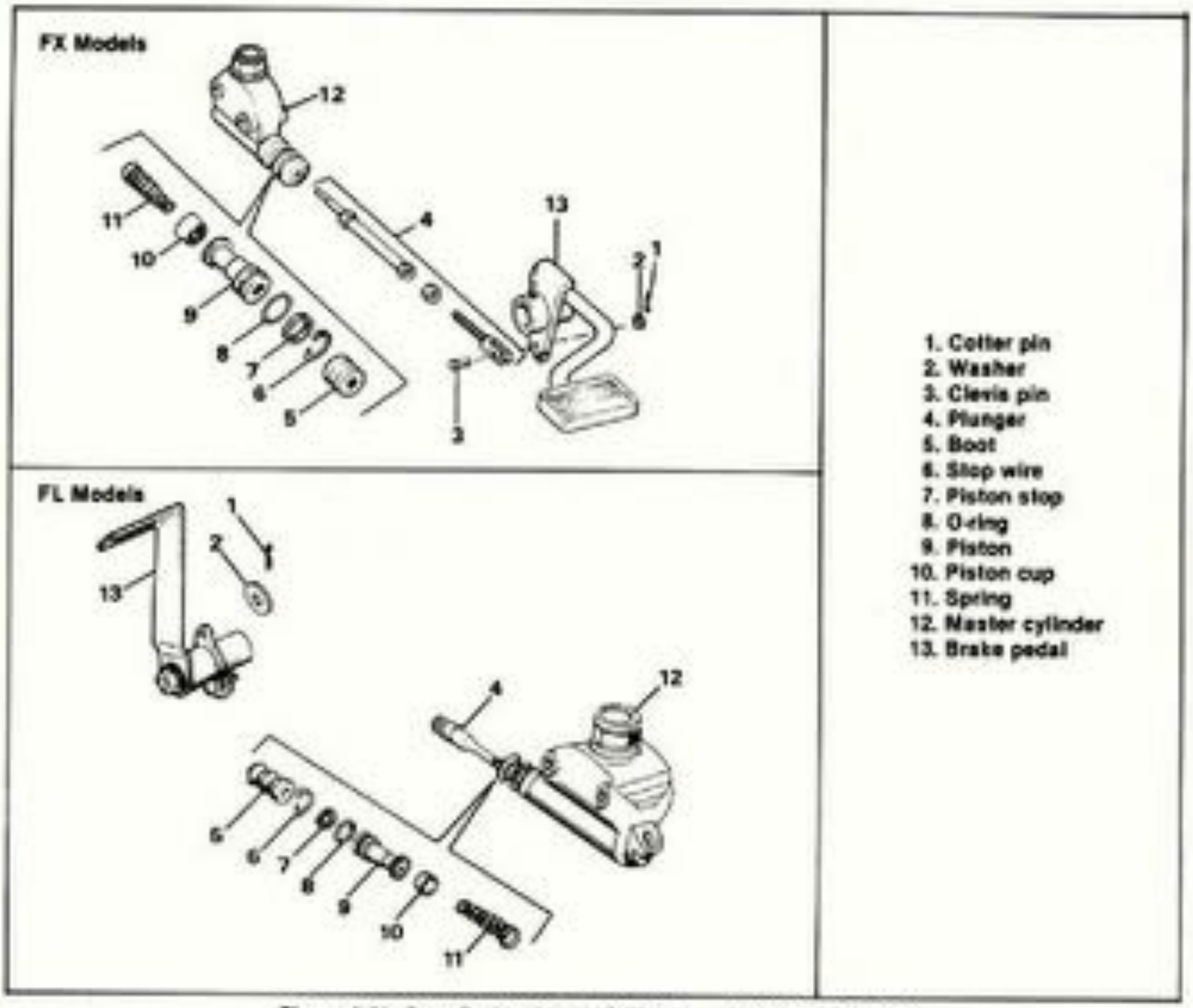


Figure 2-50. Rear Brake Master Cylinder — 1978½-Early 1979

While actuating the brake lever a small spurt of fluid will break through the fluid surface if all internal components are working satisfactorily.

8. Install gasket (3), cover (2) and screws (4). Tighten screws 10-15 in-lbs torque.

9. Test ride motorcycle. If brakes feel spongy, repeat the bleeding procedure.

NOTE

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

10. This master cylinder assembly is 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 lighten up telling the rider the brake fluid level is low.

REAR BRAKE MASTER CYLINDER 1978½-EARLY 1979 (Figure 2-50)

Dissassembly

NOTE

It is not necessary to remove the master cylinder from the motorcycle to remove the piston assembly.

1. Remove the cotter pin (1), washer (2) and clevis (3). Pull out plunger (4).

2. Remove the boot (5).

3. Remove the stop wire (6), piston and O-ring (7 and 8), piston stop (9), piston cup (10) and spring (11).

Cleaning, Inspection and Repair

1. Inspect the piston cup (10) and rubber parts for wear, softening and enlarging. Replace if necessary.

2. Examine the cylinder walls for scratches and grooves. Replace if necessary.

Assembly

1. Dip all internal parts in D.O.T. 5 Hydraulic Brake Fluid.

2. Install the spring (11), piston cup (10) and piston stop (9).

3. Assemble the piston (8) and O-ring (7). Install the assembly into the master cylinder.

4. Install the stop wire (6) and boot (5).

5. Insert the plunger (4) and connect it to the brake pedal using the clevis pin (3), washer (2) and cotter pin (1).

6. Fill the master cylinder with D.O.T. 5 Hydraulic Brake Fluid and bleed the brake system according to the procedures outlined in BLEEDING THE HYDRAULIC BRAKE SYSTEM.

7. Adjust the plunger free play as described in ADJUSTMENTS.

REAR BRAKE MASTER CYLINDER LATE 1979 - 1983 FL/FXE AND LATE 1979 - 1982 FX (Figure 2-51)

Disassembly

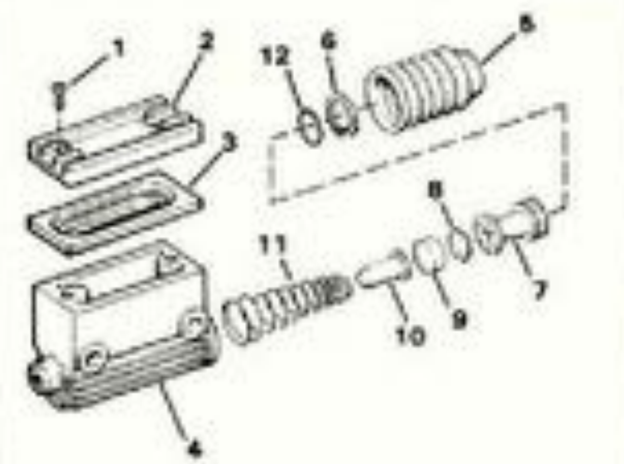
1. Disconnect the brake line at the master cylinder and remove the master cylinder from the motorcycle.

2. Remove the cover screws (1), cover (2) and gasket (3). Drain the fluid from the master cylinder.

3. Pull off the boot (5). Remove the retaining ring (6), piston assembly (7), wafer (8), piston cup (9), spring seat (10) and spring (11). Remove the O-ring (12) from the piston (7).

Cleaning, Inspection And Repair

1. Inspect the piston cup (9) and rubber parts for wear, softening and enlarging. Replace if necessary.



1. Cover screw (2)	7. Piston
2. Cover	8. Wafer
3. Gasket	9. Piston cup
4. Master cylinder	10. Spring seat
5. Boot	11. Spring
6. Retaining ring	12. O-ring

Figure 2-51. Rear Brake Master Cylinder — Late 1979 to 1983 FL/FXE Late 1979 to 1982 FX and 1984 FL

2. Examine the cylinder walls for scratches and grooves. Replace if necessary.

3. Make sure vent hole in cover is not plugged.

Assembly

1. Dip all internal parts in D.O.T. 5 Hydraulic Brake Fluid.

2. Install the Spring (11), spring seat (10), piston cup (9) and wafer (8). Refer to the following NOTE.

NOTE

On 1984 FL vehicles the rear hydraulic master cylinder no longer has the flapper valve (8) which was installed on earlier vehicles. The hexagonal nylon flapper valve is no longer needed as a piston modification accomplishes the same purpose. Piston repair kits obtained for earlier vehicles will have the new modified piston and no flapper valve.

WARNING

Installation of a flapper valve disc on master cylinders where it is not required may cause brake drag or lockup.

3. Install O-ring on piston (7) and insert piston assembly into master cylinder.

4. Install the retaining ring (6) and boot (5).

5. Install the master cylinder on motorcycle and seat plunger inside.

6. Fill the master cylinder with D.O.T. 5 Hydraulic Brake Fluid and follow the procedures in BLEEDING THE HYDRAULIC BRAKE SYSTEM.

7. Install the gasket (3), cover (2) and screws (1).

8. Adjust the plunger free play as described under ADJUSTMENTS.

REAR MASTER CYLINDER — 1983 MODELS (EXCEPT FL/1979 - 1983 FXE) (Figure 2-52, 2-53)

Disassembly

1. Remove screws (1), cover (2) and gasket (3) from reservoir (4). Disconnect hose (5) from fitting (6) on top of master cylinder (7) and drain fluid from reservoir.

2. Remove brake line (20). Remove mounting bolts (8). Master cylinder may now be removed and disassembled on a clean work bench.

3. Remove retaining ring (14) piston with seal (12 and 13), washer (19), piston cup (11), spring retainer (10) and spring (9). Remove seal (13) from piston (12).

Cleaning, Inspection And Repair

1. Inspect piston cup (11) and seal (13) for softening, enlarging and wear. Replace if necessary.

2. Inspect cylinder bore for scratches and grooves and replace if necessary.

3. Inspect reservoir cover gasket (3) and replace if punctured or torn.

4. Make sure push rod (16) and pedal assembly (18) are not bent. Bent parts should be replaced.

Assembly

1. Dip all master cylinder internal parts in D.O.T. 5 HYDRAULIC BRAKE FLUID.

2. Install seal (13) on piston (12). Install spring (9), spring retainer (10), piston cup (11) and washer (19) on piston (12) and insert into master cylinder bore. Install retaining ring (14).

3. On FSXT/FXWG vehicles install brake return spring (15-A), brake spring washer (15-B), over small diameter end of push rod prior to installing boot (15). Install boot assembly (15) on push rod (16). Insert end of push rod into end of master cylinder piston and install master cylinder on motorcycle using bolts (8).

4. Install brake line (20), tighten fitting to 70-80 in-lbs torque. Install hose and clamp (5) on fitting (6).

5. Fill reservoir (4) with D.O.T. 5 HYDRAULIC BRAKE FLUID and bleed system following the procedures outlined under BLEEDING THE HYDRAULIC BRAKE SYSTEM.

6. Replace gasket (3), cover (2) and screws (1).

7. Check and adjust brake pedal height and push rod free play as described under ADJUSTMENTS given earlier.

FRONT CALIPER — FL/FLHS

General

All late 1980 and later FL motorcycles above VIN 20625-J0 have quad (4 sided) seal calipers installed on the front wheel. Instead of the spring retractor system used on 1978½ — early 1980 models, the caliper features a square cross section seal.

All front calipers are stamped FM on top of the right caliper half. The square seal calipers are distinguishable by the additional F stamped on the left caliper half as well. See Figure 2-50.

WARNING

Front and rear calipers are not interchangeable because of a difference in piston retraction. Braking can be effected if calipers are not installed as marked.

Removal (Figure 2-55)

1. Remove the screws (1), washers (2). Pull the caliper halves (3 and 4) from the fork leg and remove the mounting pin (5).

2. Remove the brake pads (6), brake pad pins (7), plate (8) and insulator (9).

NOTE

Do not remove piston assembly from outer caliper half unless there are signs of hydraulic fluid leakage or if the piston is not operating properly. Perform step 3 to remove piston.

3. Pump brake hand lever until piston will move no farther. Remove the hydraulic line and dust boot (10). Pull piston from caliper and remove the O-ring (12) or seal (14).

or

Place the caliper on workbench with piston facing down. Place a shop towel under 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. Remove O-ring (12) or seal (14).

WARNING

Piston may develop considerable force from pressure build-up and care should be taken to keep hands out from under piston to prevent personal injury.

Cleaning, Inspection And Repair

1. If brake pads are worn to 1/16 in. or less, replace them as a set.

WARNING

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

2. Clean all metal parts in a nonflammable cleaning solvent and blow dry with compressed air.

WARNING

Use a non-flammable cleaning solvent for cleaning metal parts. DO NOT use gasoline or other flammable substances.

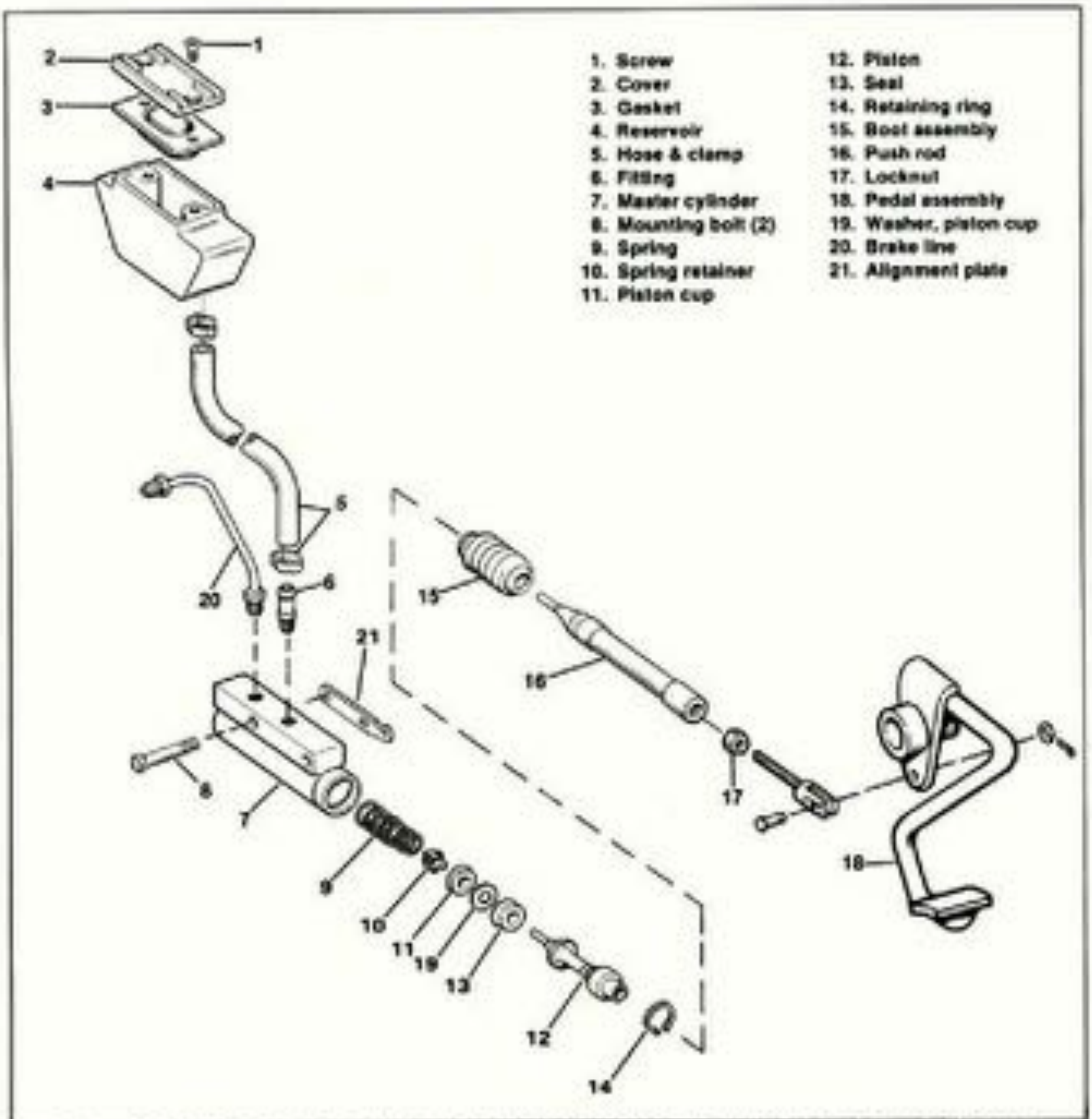


Figure 2-52. FX Models Rear Brake Control - Late 1983 And 1984 FXE — 1983 FXDG — 1983 - 1984 FSXB

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

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 and would continue to deteriorate after assembly which could result in component failure.

4. Clean and inspect bushings (17) and pin (5) in fork slider or caliper mounting bracket. Install new bushings and pins if worn or damaged.

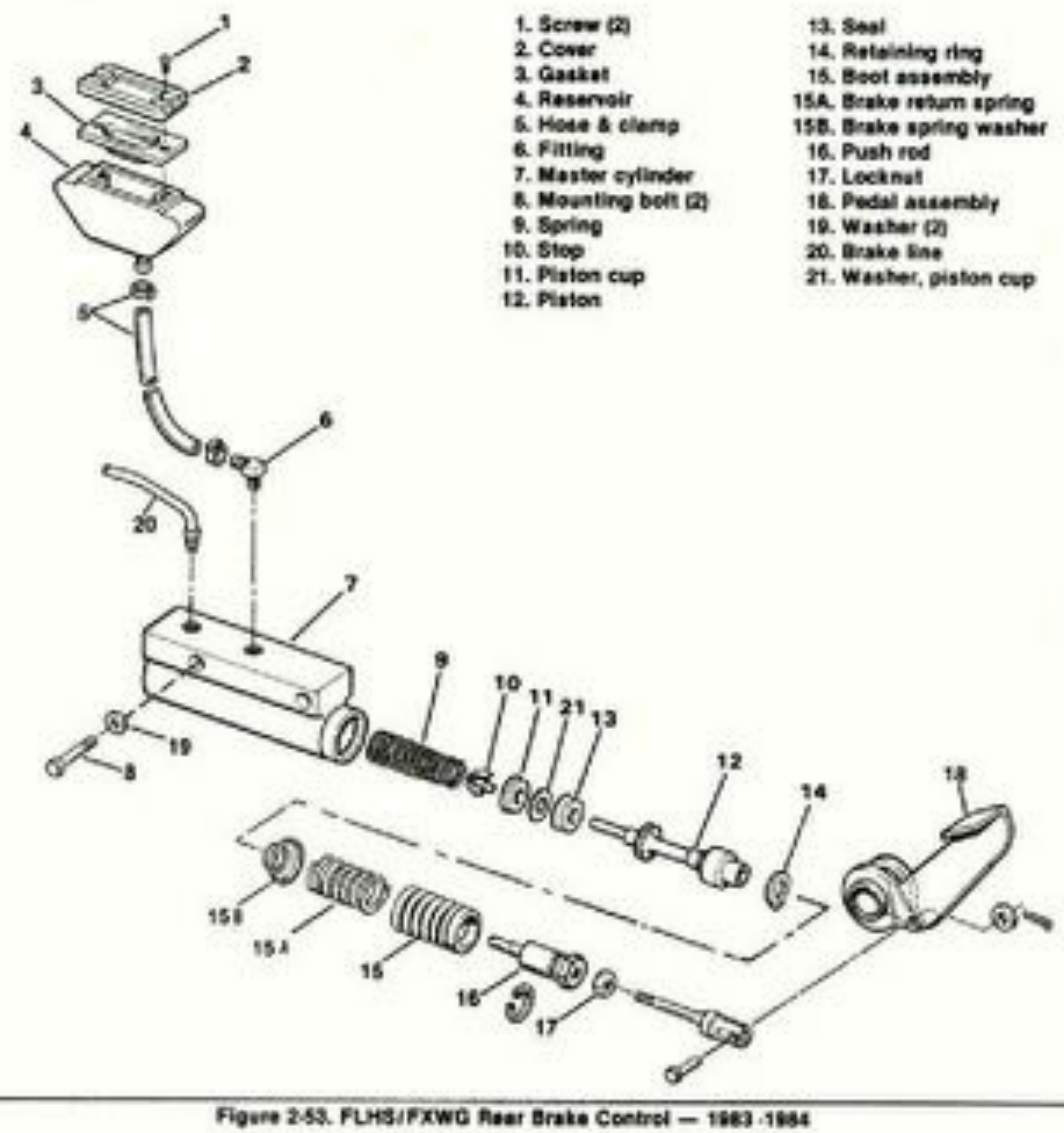
Assembly

1. If the piston was removed from the caliper install the O-ring (12) or seal (14) and install the piston all the way into the caliper. Install the dust boot (10).

CAUTION

Make sure O-ring or seal remains in piston groove when installing the piston.

2. Install the insulator (9). Install the brake pad pins (7) plate (8) and brake pads (6) to the outer caliper half (5).



1. Screw (2)
2. Cover
3. Gasket
4. Reservoir
5. Hose & clamp
6. Fitting
7. Master cylinder
8. Mounting bolt (2)
9. Spring
10. Stop
11. Piston cup
12. Piston
13. Seal
14. Retaining ring
15. Boot assembly
15A. Brake return spring
15B. Brake spring washer
16. Push rod
17. Locknut
18. Pedal assembly
19. Washer (2)
20. Brake line
21. Washer, piston cup

Figure 2-53. FLHS/FXWG Rear Brake Control — 1983-1984

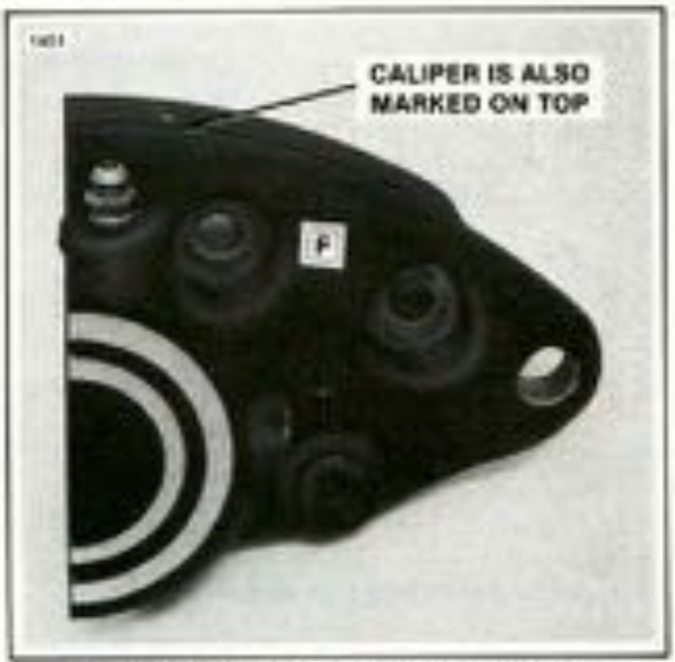


Figure 2-54. Quad Seal Caliper Identification

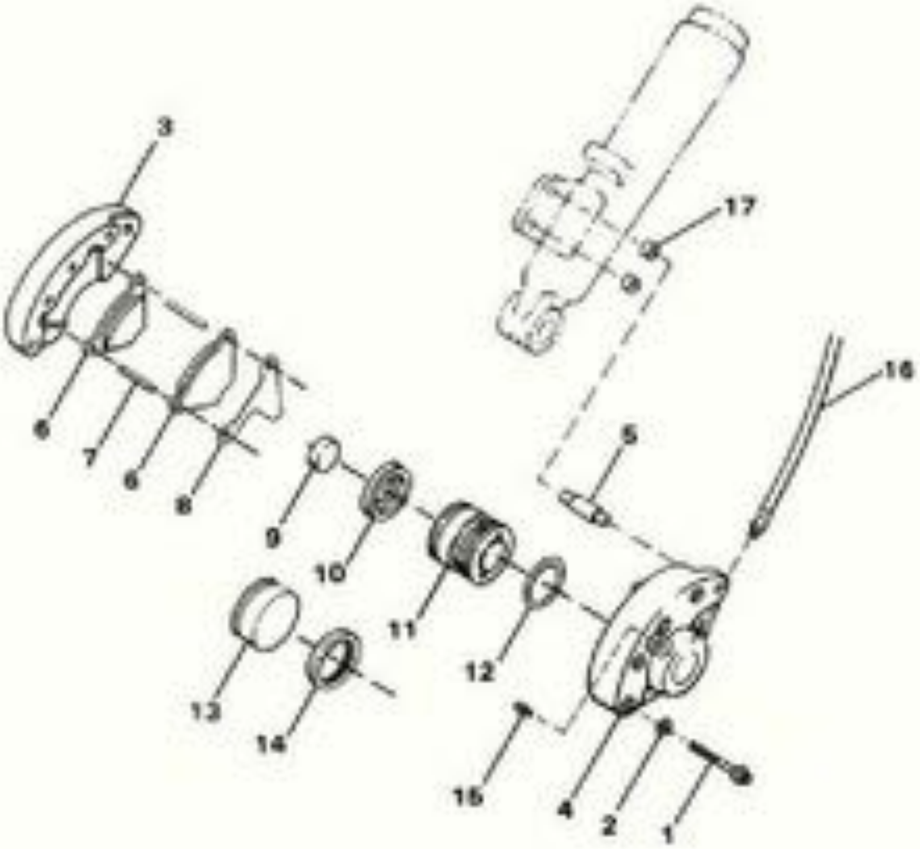
NOTE

When replacing brake pads, place new pads on a flat surface and sand the pad material with 60 or 80 grit emery cloth to break up any surface glaze. Also, use the emery cloth to slightly round off the leading edge of the brake pads. Make sure the outer plate (8) is positioned between the piston and outer brake pad so that the wheel rotates into the notch.

3. Coat the bushings (17) with Loctite ANTI-SEIZE. Install the caliper mounting pin (5) and left caliper half to the fork side. Install the right caliper half (3). Coat the screws (1) with Loctite ANTI-SEIZE and secure the caliper halves to each other with the four screws and lockwashers (2). Tighten the screws to 30–35 ft-lbs torque.

4. Install the bleed fitting (15) and brake hose (16) to the caliper.

5. Turn handlebar until top of master cylinder is nearly level. Slowly fill reservoir with D.O.T. 5 brake



1. Screw (4)
2. Washer (4)
3. Inner caliper
4. Outer caliper
5. Caliper mounting pin
6. Brake pad (2)
7. Brake pad pin (2)
8. Plate
9. Insulator
10. Dust boot
11. Piston (1978½-early 1980)
12. O-ring (1978½-early 1980)
13. Piston (late 1980-1982)
14. Seal (late 1980-1982)
15. Bleeder nipple
16. Brake hose
17. Bushings (2)

Figure 2-55. Front Brake Caliper — FL/FLHS fluid to gasket level. Follow the procedures outlined in BLEEDING THE HYDRAULIC SYSTEM.

CAUTION

Check for leaks at fittings. If leaks exist, coat the fitting threads with Loctite PIPE SEALANT WITH TEFLON. Use only this sealant to avoid contamination of the brake system. Bleed the brakes to purge the system of air.

7. Check for adequate hand lever action. Brake hand lever must not bottom on handlebar with 60 lb pull on lever. If the lever does bottom, replace or rebuild the master cylinder.

FRONT BRAKE CALIPER - FX 1983 AND EARLIER (Figure 2-56, 2-57)

General

A special foam tape is now available for 1982 and 1983 FX front brake calipers. When applied to the front of the caliper outer half, this tape will help prevent caliper rattle.

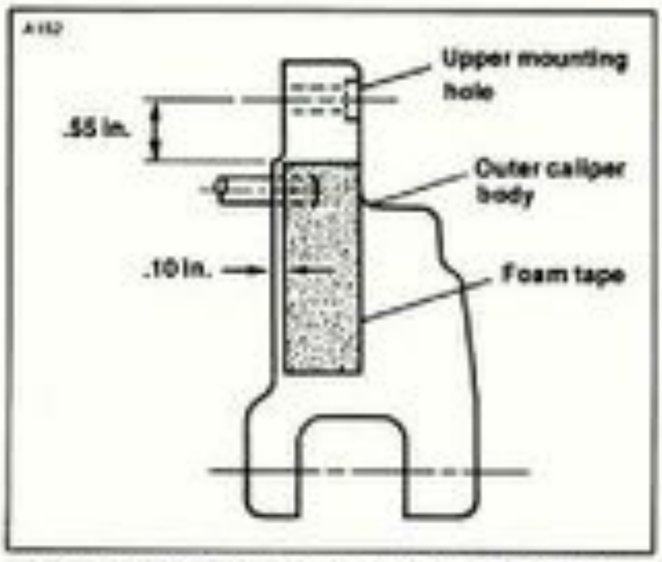


Figure 2-56. Foam Tape Installation — FX Models

Procedure — 1983 And Earlier

1. Remove the upper caliper mounting screw and rotate the caliper away from the slider. Clean the caliper body with Loctite CLEANING SOLVENT and allow to dry.

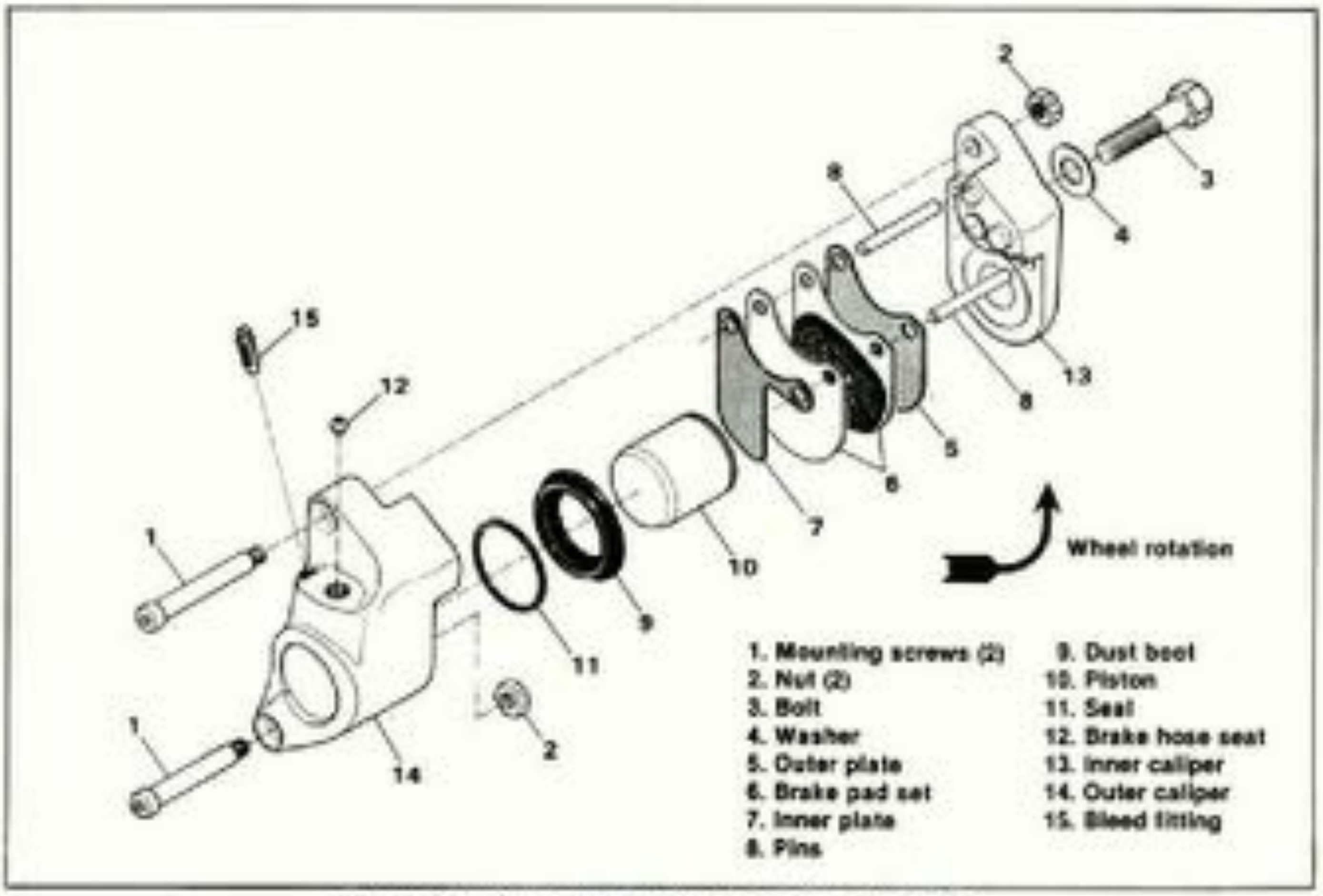


Figure 2-57. Front Brake Caliper — FX 1983 and Earlier

2. See figure 2-56. Remove the paper backing from the foam and apply to the front of the outer caliper body. Do not remove the protective Mylar from the foam. Apply a thin coating of Loctite ANTI-SEIZE to the mounting screw and reinstall the caliper using a new locknut. Tighten the screw to 80 to 90 in-lbs torque.

This FOAM TAPE is available under Part No. 44125-82 for FX models. Order one (1) for each caliper (2 per vehicle).

Disassembly

1. Remove the mounting screws (1) and nuts (2). Remove the caliper from the fork leg.

2. Remove the bolt (3) and washer (4). Pull the caliper halves apart.

3. Remove the outer plate (5), brake pads (6) inner plate (7) and pins (8).

WARNING

Piston may develop considerable force from pressure build-up and care should be taken to keep hands out from under piston to prevent personal injury.

4. Remove the dust boot (9). Pump the brake hand lever until piston (10) reaches its full travel. Disconnect the brake hose from the caliper and remove the brake hose seat (12). Remove the piston from the caliper. If the piston will not come loose, use the following method:

   Disconnect the brake hose at the caliper and remove the brake hose seat (12). Place the caliper on a workbench with the piston facing down. Place a 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.

5. Remove the seal (11) from the piston (10).

Cleaning, Inspection And Repair

1. If brake pads are worn to 1/16 in. or less, replace them as a set.

WARNING

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

2. Replace any parts that appear worn or damaged.

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

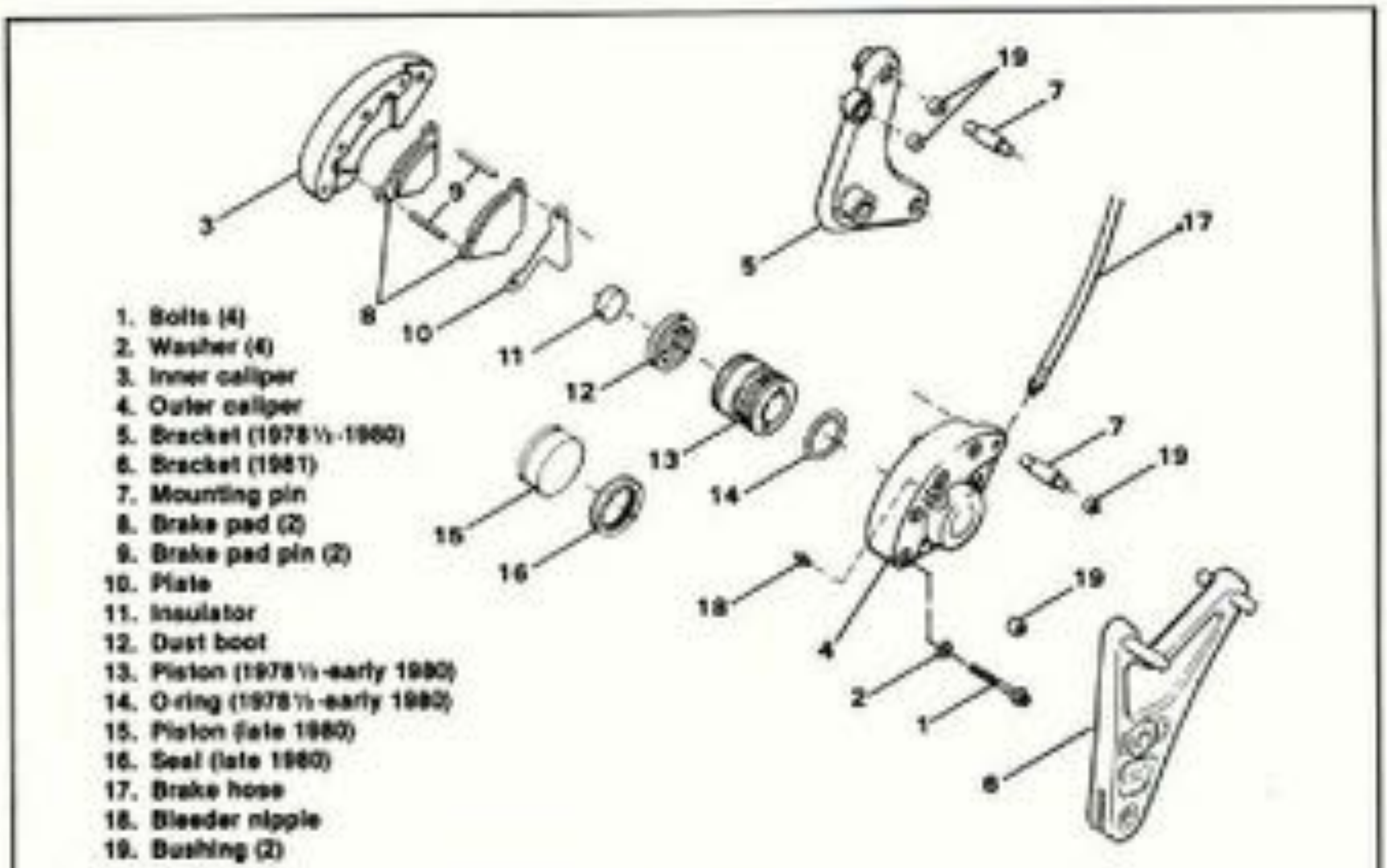


Figure 2-58. Rear Brake Caliper — 1978½-1980 FL/FX Models

WARNING

Always use a non-flammable cleaning solvent for cleaning metal parts. DO NOT use gasoline or other flammable substances.

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

WARNING

Always clean brake system rubber parts by washing in denatured alcohol or D.O.T. 5 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 during and after assembly which could result in component failure.

Assembly

1. Install the seal (11) on piston (10). Install boot (9) and piston to caliper. Press piston all the way into the outer caliper bore. Install the dust boot (9).

2. Coat pins (8) with Loctite ANTI-SEIZE. Install the brake pad pins (8), inner plate (7), brake pads (6) and outer plate to the outer caliper half.

NOTE

When replacing brake pads, place new pads on a flat surface and sand the pad material with 60 or 80 grit emery cloth to break up any surface glaze. Also, use the emery cloth to slightly round off the leading edge of the brake pads. Make sure that outer plate (5) is positioned between the piston and outer brake pad so that the wheel rotates into the notch.

3. Secure the inner caliper half to the outer caliper half with bolt (3) and washer (4). Tighten the bolt to 45–50 ft-lbs torque.

4. Install the caliper to the fork leg using screws (1) and new nuts (2). Tighten the screws to 115–120 in-lbs torque.

5. Follow the procedures in BLEEDING THE HYDRAULIC BRAKE SYSTEM.

WARNING

Always use new nuts (2) when reinstalling the caliper as this type of nut loses its holding power when reused. If new locknuts are not available, coat the screw threads with Loctite LOCK 'N SEAL.

FRONT BRAKE CALIPER 1984 FX MODELS (Figure 2-59 and Figure 2-60)

Disassembly

To disassemble the front brake caliper for servicing do the following:

1. Remove the upper mounting bolt (1) and the lower mounting pin (2) to release the caliper assembly from the vehicle.

2. Disconnect the brake line at the caliper fitting.

3. Move the caliper assembly to a clean bench area and remvoe the retainer screw (15) pad retainer (14) and inside pad (9).

4. The outer pad (9), pad holder (7) and spring clip (8) are then removed as an assembly. Remove pad (9) from pad holder (7) by pushing the pad free of the pad hold down spring clip (8).

5. Pry out the retaining wire (13) by inserting a small screwdriver into the notched groove at the bottom of the piston bore.

6. Remove the piston dust boot (12). Then remove the piston by applying air pressure to the hydraulic brake line inlet.

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 care should be taken to keep hands out from under piston to prevent personal injury.

7. Pull threaded bushing (4) out of bushing bore, then remove pin boot (5) from groove in caliper.

8. Seal (10) and the three O-rings (6) can be removed by prying them out of their respective grooves.

Cleaning, Inspection and Repair

If brake pads are 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.

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 pairs.

Inspect all components carefully for excessive wear or damage.

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

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 and would continue to deteriorate after assembly which could result in component failure.

2. See figure 2-56. Remove the paper backing from the foam and apply to the front of the outer caliper body. Do not remove the protective Mylar from the foam. Apply a thin coating of Loctite ANTI-SEIZE to the mounting screw and reinstall the caliper using a new locknut. Tighten the screw to 80 to 90 in-lbs torque.

This FOAM TAPE is available under Part No. 44125-82 for FX models. Order one (1) for each caliper (2 per vehicle).

Disassembly

1. Remove the mounting screws (1) and nuts (2). Remove the caliper from the fork leg.

2. Remove the bolt (3) and washer (4). Pull the caliper halves apart.

3. Remove the outer plate (5), brake pads (6) inner plate (7) and pins (8).

WARNING

Piston may develop considerable force from pressure build-up and care should be taken to keep hands out from under piston to prevent personal injury.

4. Remove the dust boot (9). Pump the brake hand lever until piston (10) reaches its full travel. Disconnect the brake hose from the caliper and remove the brake hose seat (12). Remove the piston from the caliper. If the piston will not come loose, use the following method:

   Disconnect the brake hose at the caliper and remove the brake hose seat (12). Place the caliper on a workbench with the piston facing down. Place a 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.

5. Remove the seal (11) from the piston (10).

Cleaning, Inspection And Repair

1. If brake pads are worn to 1/16 in. or less, replace them as a set.

WARNING

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

2. Replace any parts that appear worn or damaged.

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

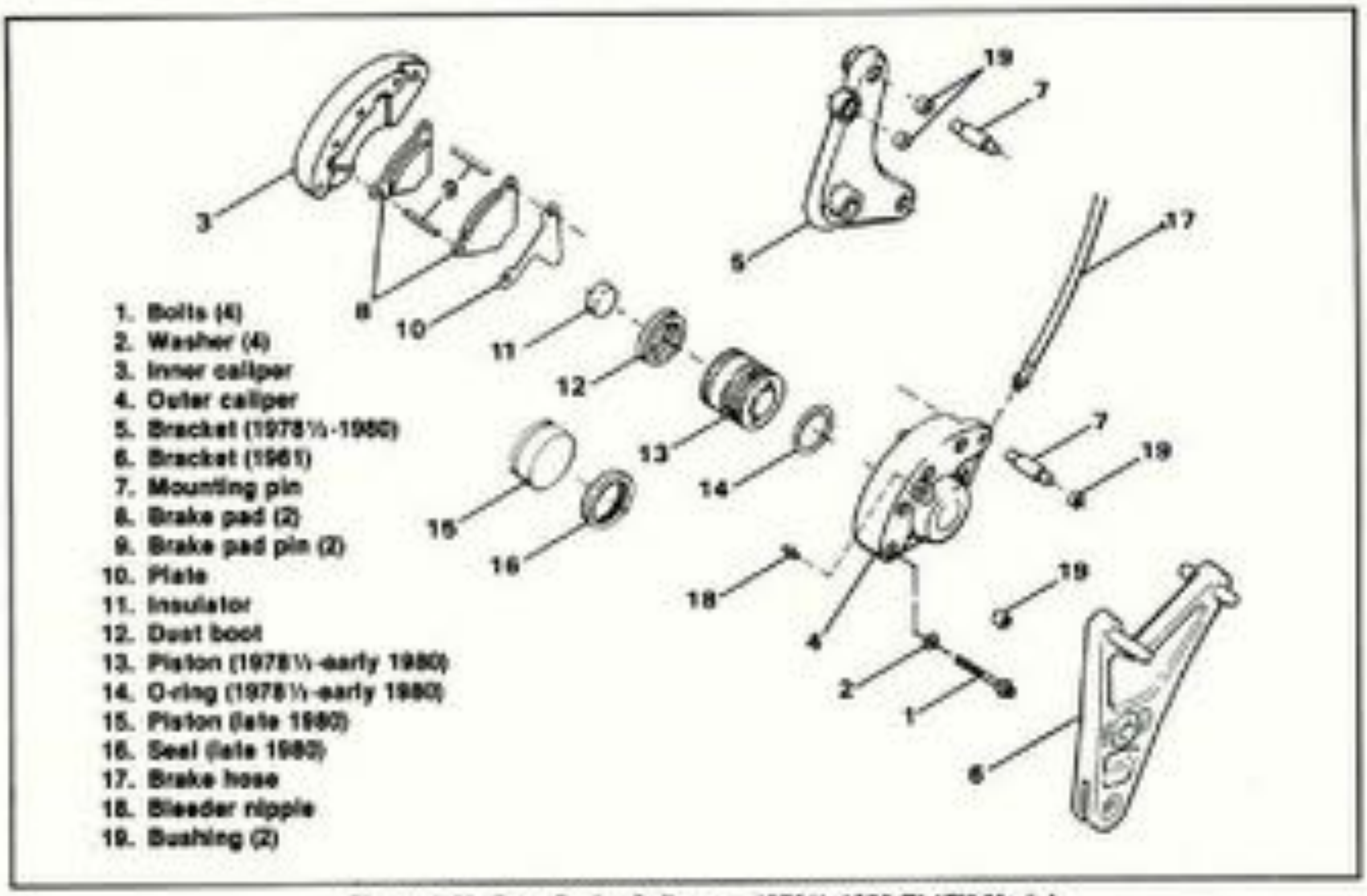


Figure 2-58. Rear Brake Caliper — 1978½-1980 FL/FX Models

WARNING

Always use a non-flammable cleaning solvent for cleaning metal parts. DO NOT use gasoline or other flammable substances.

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

WARNING

Always clean brake system rubber parts by washing in denatured alcohol or D.O.T. 5 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 during and after assembly which could result in component failure.

Assembly

1. Install the seal (11) on piston (10). Install boot (9) and piston to caliper. Press piston all the way into the outer caliper bore. Install the dust boot (9).

2. Coat pins (8) with Loctite ANTI-SEIZE. Install the brake pad pins (8), inner plate (7), brake pads (6) and outer plate to the outer caliper half.

NOTE

When replacing brake pads, place new pads on a flat surface and sand the pad material with 60 or 80 grit emery cloth to break up any surface glaze. Also, use the emery cloth to slightly round off the leading edge of the brake pads. Make sure that outer plate (5) is positioned between the piston and outer brake pad so that the wheel rotates into the notch.

3. Secure the inner caliper half to the outer caliper half with bolt (3) and washer (4). Tighten the bolt to 45–50 ft-lbs torque.

4. Install the caliper to the fork leg using screws (1) and new nuts (2). Tighten the screws to 115–120 in-lbs torque.

5. Follow the procedures in BLEEDING THE HYDRAULIC BRAKE SYSTEM.

WARNING

Always use new nuts (2) when reinstalling the caliper as this type of nut loses its holding power when reused. If new locknuts are not available, coat the screw threads with Loctite LOCK 'N SEAL.

FRONT BRAKE CALIPER 1984 FX MODELS (Figure 2-59 and Figure 2-60)

Disassembly

To disassemble the front brake caliper for servicing do the following:

1. Remove the upper mounting bolt (1) and the lower mounting pin (2) to release the caliper assembly from the vehicle.

2. Disconnect the brake line at the caliper fitting.

3. Move the caliper assembly to a clean bench area and remvoe the retainer screw (15) pad retainer (14) and inside pad (9).

4. The outer pad (9), pad holder (7) and spring clip (8) are then removed as an assembly. Remove pad (9) from pad holder (7) by pushing the pad free of the pad hold down spring clip (8).

5. Pry out the retaining wire (13) by inserting a small screwdriver into the notched groove at the bottom of the piston bore.

6. Remove the piston dust boot (12). Then remove the piston by applying air pressure to the hydraulic brake line inlet.

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 care should be taken to keep hands out from under piston to prevent personal injury.

7. Pull threaded bushing (4) out of bushing bore, then remove pin boot (5) from groove in caliper.

8. Seal (10) and the three O-rings (6) can be removed by prying them out of their respective grooves.

Cleaning, Inspection and Repair

If brake pads are 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.

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 pairs.

Inspect all components carefully for excessive wear or damage.

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

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 and would continue to deteriorate after assembly which could result in component failure.

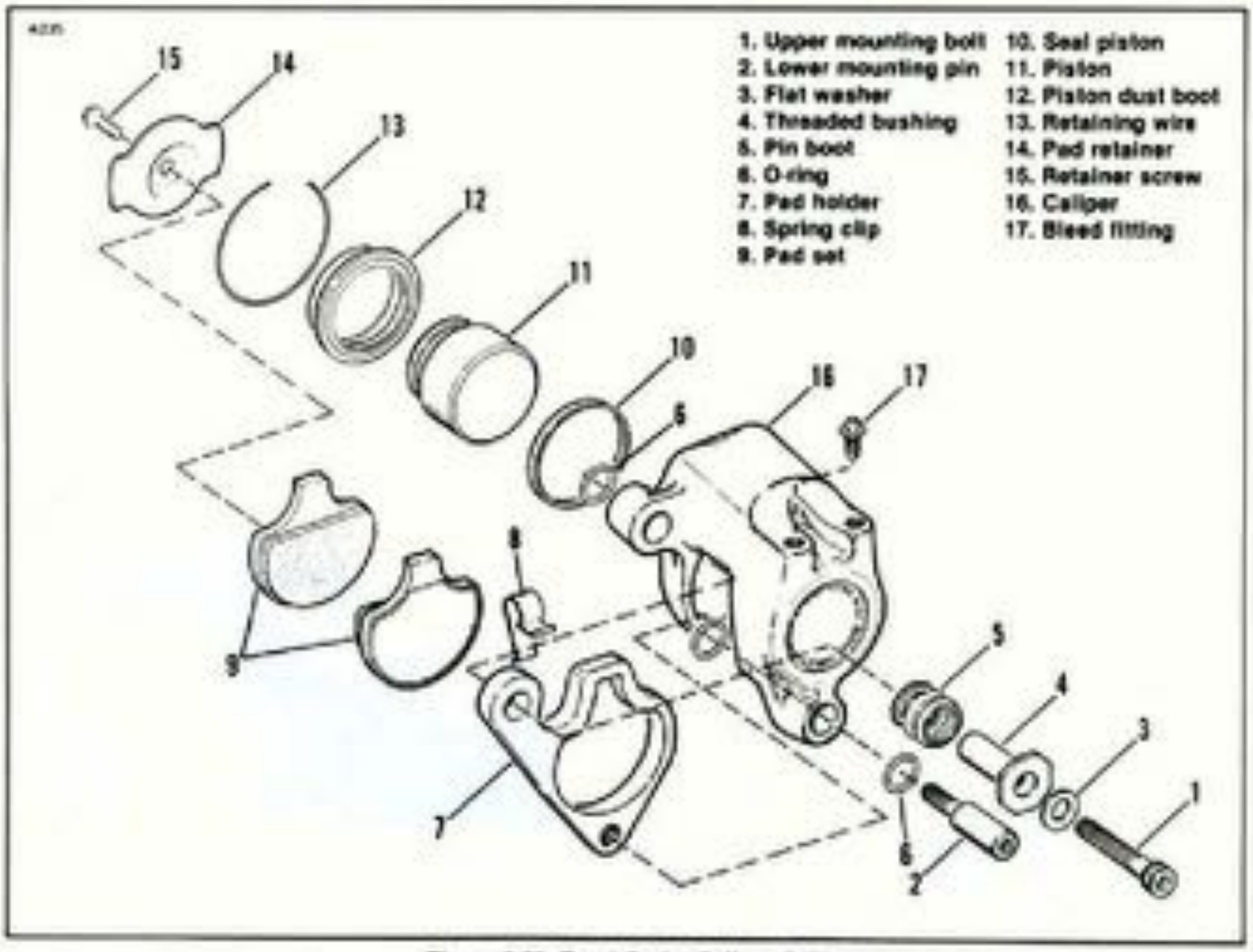


Figure 2-59. Front Brake Caliper (left)

Reassembly

After the parts have been inspected and any worn or damaged parts replaced, the caliper is reassembled 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 respective 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 with dust boot into the piston bore. If necessary, press the piston in with a "C" clamp.

NOTE

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

4. Position the gap of the retainer wire at the top of the caliper and compress the retainer wire (13) into the piston bore. Push the retainer 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 into the pin boot 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 pad holder (7) down on a firm flat surface. The upper mounting bolt hole must be positioned at the upper right.

8. Install the spring clip (8) at the top of pad holder (7) as shown in Figure 2-60.

9. Take pad (9), the pad 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

pad holder. With the pad centered within the pad holder 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), pad holder (7) 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 pad holder reversed and the parts reassembled.

11. Place the inner pad (9) (without insulator) 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 55-70 in-lbs.

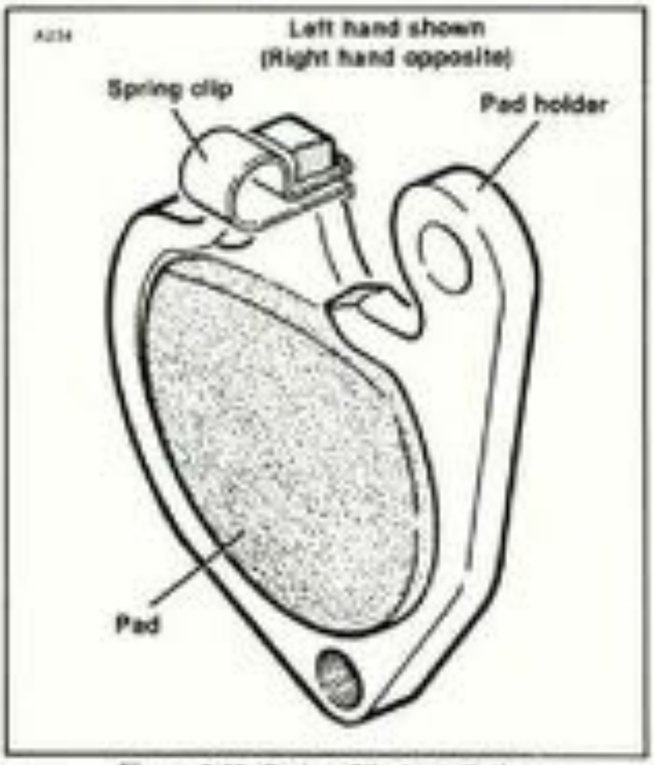


Figure 2-60. Spring Clip Installation

Installation (Figure 2-59)

Mount the caliper on the vehicle as follows:

1. Coat the outside diameter of mounting pin (2) with Dow Corning Moly 44 grease.

2. Position the caliper with the disc between the friction pads and the two mounting holes in the caliper aligned with the mounting lugs on the fork. See Figure 2-61.

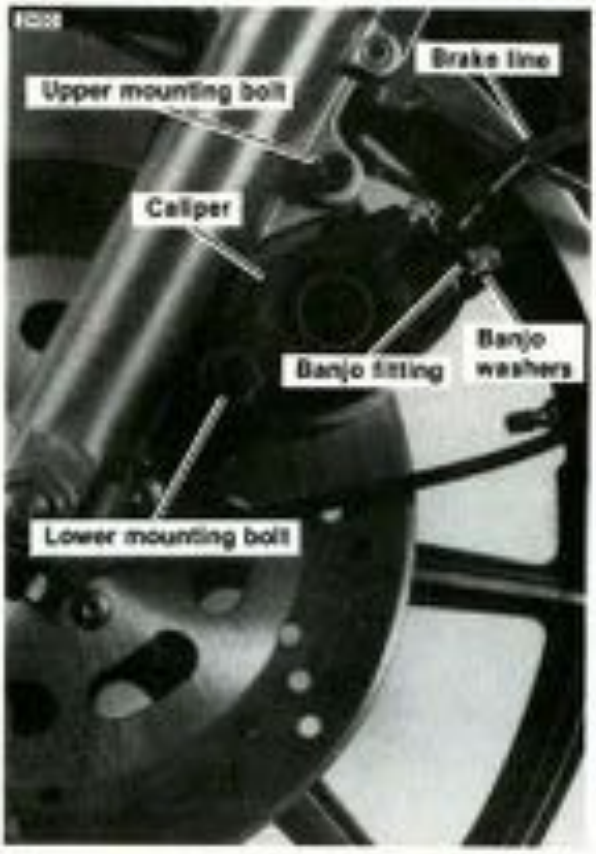


Figure 2-61. Front Brake Caliper Mounting

3. Place a flat washer on bolt (1), then insert the upper mounting bolt through the fork lug, through the pad holder (7), then thread the bolt into the threaded bushing (4).

4. Insert the lower mounting pin (2) through the caliper, the fork lug and then thread into the tapped hole at the lower end of pad holder (7). 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 screw was removed, it should be installed and tightened to 32-40 in-lbs.

7. Using new banjo washers, connect the brake line to the caliper. Torque banjo bolt to 30-35 ft-lbs torque. See Figure 2-61.

8. With master cylinder nearly level, fill reservoir with D.O.T. 5 HYDRAULIC BRAKE FLUID to 1/8" below top. Reservoir may be filled with bladder type pressurized equipment. See BLEEDING HYDRAULIC SYSTEM.

9. Actuate the brake lever. Check to be sure there is a small spurt of fluid breaking the fluid surface when actuating the brake lever.

10. Reinstall the master cylinder cover. Be sure the longer screw is installed at the end of the cover with the thicker section. Actuate the master cylinder and check for leaks.

REAR BRAKE CALIPER — 1978½–1980 FL/FX MODELS, (Figure 2-58)

General

All late 1980 FL/FX model motorcycles above VIN 28625-J0 have a square (4 sided) seal caliper installed in the rear wheel. Instead of the spring retractor system used on 1978½-early 1980 models, the caliper features a square cross-section seal.

All rear calipers have an R stamped on top. The quad seal calipers are distinguished by an additional R stamped on the side of the left caliper half as well.

WARNING

Front and rear calipers are not interchangeable because of a difference in piston retraction. Braking can be affected if calipers are not installed as marked.

Removal

1. Remove the bolts (1) and washers (2). Pull the caliper halves (3 and 4) from the mounting bracket (5 and 6). Remove the mounting pin (7).

2. Remove the brake pads (8), brake pad pins (9), plate (10), and insulator (11).

NOTE

Do not remove piston from outer caliper half unless there are signs of hydraulic fluid leakage or if the piston is not operating properly. If the piston must be removed proceed to the following steps.

3. Pump the brake lever until piston (12) reaches its full travel. Disconnect the brake hose (17) and remove the piston (13) and boot (12) from the caliper. If the piston will not come loose, use the following method:

   Disconnect the brake hose (17) at the caliper. Place the caliper on a workbench with the piston facing down. Place 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.

WARNING

Piston may develop considerable force from pressure build-up and care should be taken to keep hands out from under piston to prevent personal injury.

4. Remove the O-ring (14) or seal (16) from the piston (13 or 15).

Cleaning, Inspection And Repair

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

WARNING

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

2. Replace any parts that appear worn or damaged.

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

WARNING

Always use a non-flammable solvent for cleaning metal parts. DO NOT use gasoline or other flammable substances.

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

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 such as gasoline or paint thinner. Use of mineral base solvents will cause deterioration of the parts during and after assembly which could result in component failure.

Assembly

1. If piston was removed, install the O-ring (14) or seal (16) on the piston (13 or 15). Push the piston all the way into the caliper bore. Install the dust boot (12).

2. Coat pins (9) with Loctite ANTI-SEIZE. Install the insulator (11), brake pad pins (9), plate (10) and brake pads (8) on the outer caliper half.

NOTE

When replacing brake pads, place new pads on a flat surface and sand the pad material with 60 or 80 grit emery cloth to break up any surface glaze. Also, use the emery cloth to slightly round off the leading edge of the brake pads. Make sure the plate (10) is positioned between the piston and outer brake pad so that the wheel rotates into the notch.

3. Secure the inner and outer caliper halves to the brake bracket (5 or 6) using screws (1) and washers (2). Coat the screws with Loctite ANTI-SEIZE and tighten to 30–35 ft-lbs torque.

4. Reconnect the brake hose if it was removed.

5. Follow the procedures in BLEEDING THE HYDRAULIC BRAKE SYSTEM.

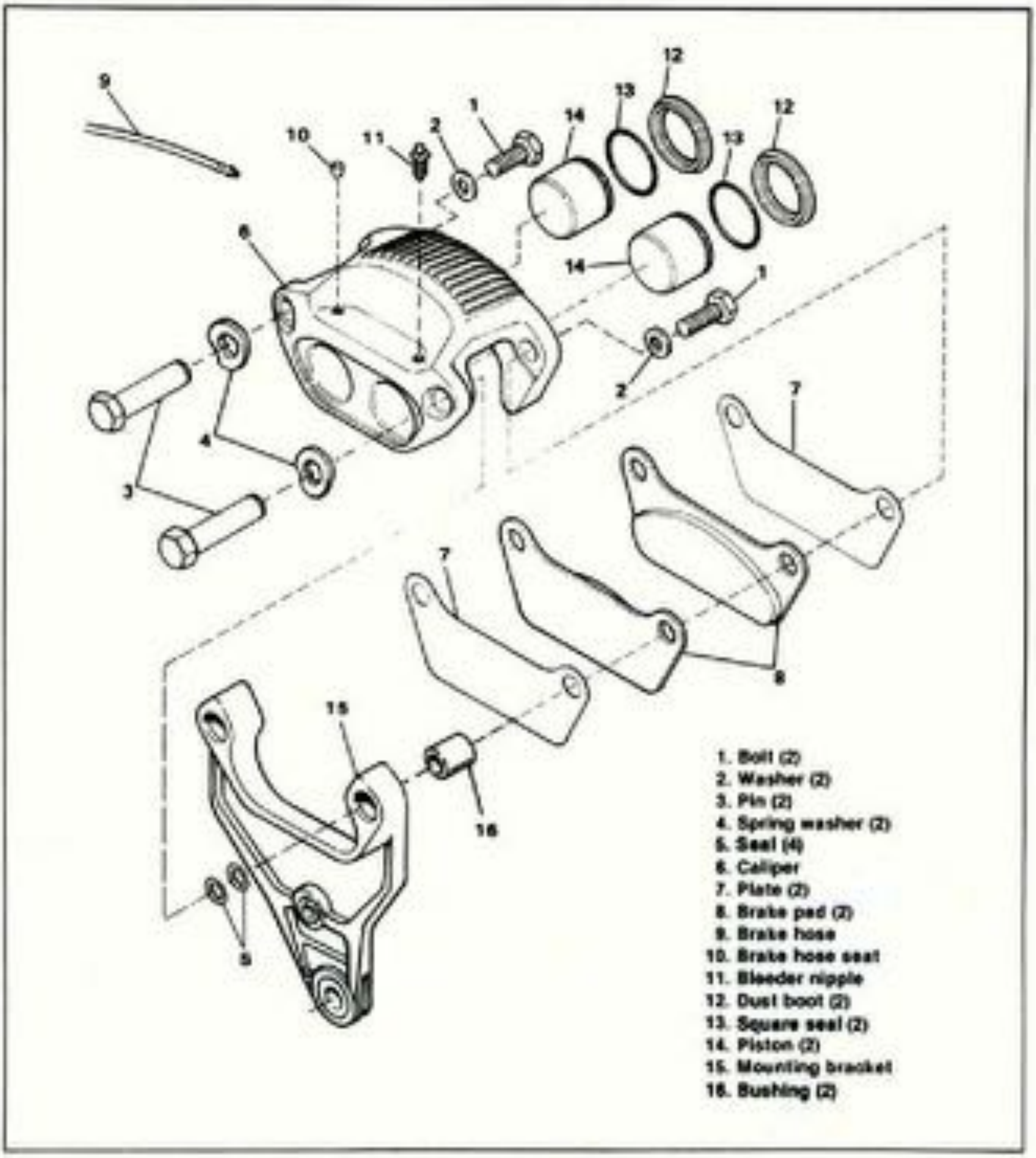


Figure 2-62. Rear Brake Caliper — 1981 and Later FL/FLH

REAR BRAKE CALIPER — 1981-1984 FL/FLH (Figure 2-62)

Removal

1. Remove the bolts (1), washers (2), pins (3), spring washers (4) and seals (5).
2. Remove the caliper (6), plates (7) and brake pads (8).

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 to the following steps.

3. Pump the brake lever until pistons reach their full travel. Disconnect the brake hose (9). Be careful not to lose the brake hose seat (10). Remove the pistons (12), dust boots (13) and seals (14). If the pistons will not come loose, use the following method:

Disconnect the brake hose (9) at the caliper. Place the caliper on a workbench with the pistons facing downward. Place a shop towel under the pistons 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.

WARNING

Piston may develop considerable force from pressure build-up and care should be taken to keep hands out from under piston to prevent personal injury.

Cleaning, Inspection And Repair

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

WARNING

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

2. Replace any parts that appear worn or damaged.

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

WARNING

Always use a non-flammable solvent for cleaning metal parts. DO NOT use gasoline or other flammable substances.

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

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 such as gasoline or paint thinner. Use of mineral base solvents will cause deterioration of parts during and after assembly which could result in component failure.

Assembly

1. If the pistons were removed, install the seals (13) on the pistons (14). Push the pistons all the way into the caliper bores. Install the dust boots (12).

2. Install the caliper (6), plates (7) and brake pads (8) onto the brake bracket. Make sure brake disc is between pads.

3. Install the seals (5). Coat the pins (3) with Loctite ANTI-SEIZE. Install the pins, spring washers (4), washers (2) and bolts (1). Tighten bolts to 12-15 ft-lbs torque.

4. Re-install the brake hose seat (10) and brake hose (9) if removed.

5. Follow the procedures in BLEEDING THE HYDRAULIC BRAKE SYSTEM.

REAR CALIPER — 1981-1982 FX, 1983 FXE (Figure 2-63)

Removal

1. Remove the screws (1), washers (2). Pull the caliper halves (3 and 4) from the mounting bracket (5) and remove the damper and sleeve (15).

2. Remove the spring (16), brake pads (6), brake pad pins (7), plate (8) and insulator (9).

NOTE

Do not remove piston assembly from outer caliper half unless there are signs of hydraulic fluid leakage or if the piston is not operating properly. Perform step 3 to remove piston.

3. Pump brake foot lever until piston will move no farther. Remove the hydraulic line and dust boot (10). Pull piston (11) from caliper and remove the square seal (12).

or

Place the caliper on workbench with piston facing down. Place a shop towel under 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. Remove square seal (12).

WARNING

Piston may develop considerable force from pressure build-up and care should be taken to keep hands out from under piston to prevent personal injury.

Cleaning, Inspection And Repair

1. If brake pads are worn to 1/16 in. or less, replace them as a set.

WARNING

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

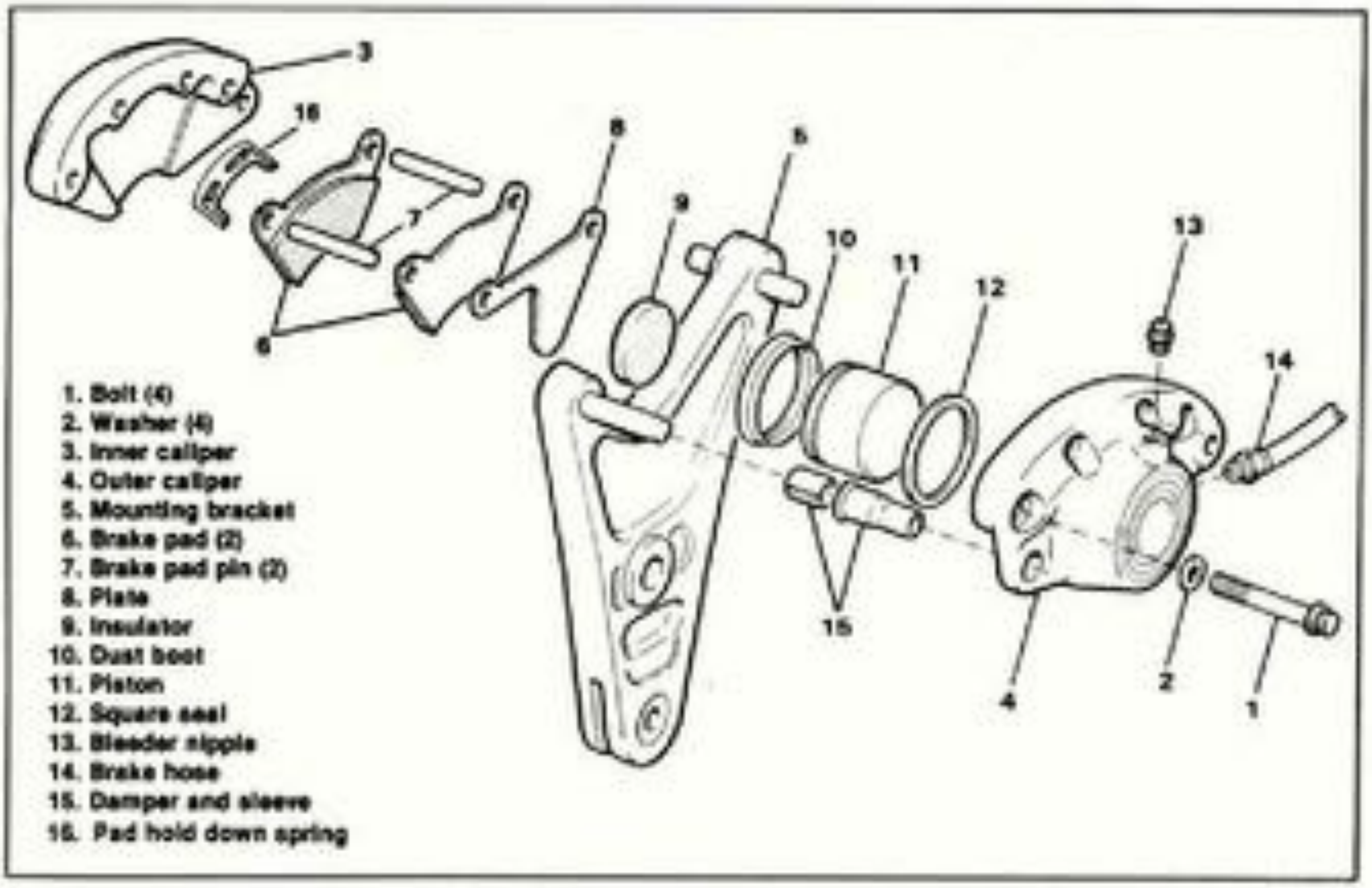


Figure 2-63. Rear Brake Caliper — 1981-1982 FX Models, Early 1983 FXE

2. Clean all metal parts in a nonflammable cleaning solvent and blow dry with compressed air.

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

4. Clean and inspect bushings (17) and (5) in fork slider or caliper mounting bracket. Install new bushings and pins if worn or damaged.

WARNING

Always clean brake system rubber parts by washing in denatured alcohol or D.O.T. 5 brake fluid. DO NOT use mineral base cleaning solvents such as gasoline or paint thinner. Use of mineral base solvents will cause deterioration of parts during and after assembly which could result in component failure.

Assembly

1. If the piston was removed from the caliper install the square seal (12) and install the piston (11) all the way into the caliper. Install the dust boot (10).

CAUTION

Make sure square seal remains in piston groove when installing the piston.

2. Install the insulator (9). Install the brake pad pins (7) plate (8) and brake pads (6) to the outer caliper half (4).

3. Insert spring (16) on top of pads (6). Insert the spring (16) with the arc toward the top and the prongs toward the right side of caliper.

NOTE

When replacing brake pads, place new pads on a flat surface and sand the pad material with 60 or 80 grit emery cloth to break up any surface glaze. Also, use the emery cloth to slightly round off the leading edge of the brake pads. Make sure the outer plate (8) is positioned between the piston and outer brake pad so that the wheel rotates into the notch.

4. Install the damper and sleeve (15) and left caliper half to the mounting bracket. Install the right caliper half (3). Coat the screws (1) with Loctite ANTI-SEIZE and secure the caliper halves to each other with the four screws and lockwashers (2). Tighten the screws to 30-35 ft-lbs torque.

5. Install the bleed fitting (13) and brake hose (14 to the caliper.

6. Follow the procedures in BLEEDING THE HYDRAULIC BRAKE SYSTEM.

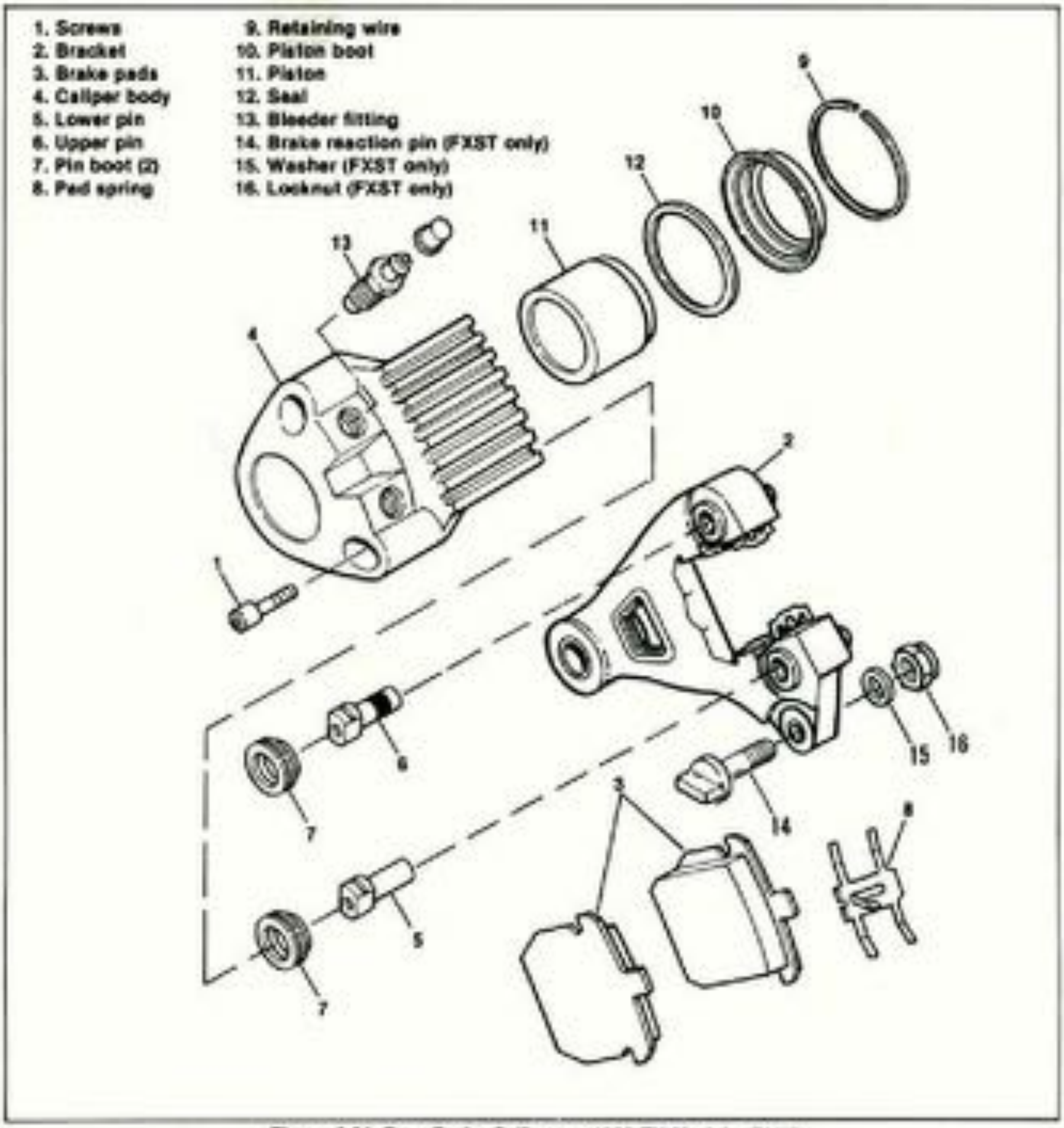


Figure 2-64. Rear Brake Caliper — 1983 FX Models, FLHS

REAR BRAKE CALIPER — 1983 FX/FLHS (Except FXE) (Figure 2-64)

Removal

1. Remove screws (1) and lift caliper body (4) off bracket (2). Remove brake pads (3).

NOTE

Brake pads may now be replaced without further disassembly.

2. Remove pins (5 and 6) and boots (7). Remove pad spring (8) from caliper body.

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 to the following steps.

3. Remove retaining wire (9) and piston boot (10). Remove piston (11) and seal (12). If piston cannot be easily removed, use the following method:

Pump brake lever until piston reaches its full travel. Remove brake line. Place the caliper on a workbench with the pistons facing downward. Place a shop towel under the pistons 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.

WARNING

Piston may develop considerable force from pressure build-up and care should be taken to keep hands out from under piston to prevent personal injury.

Cleaning, Inspection And Repair

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

WARNING

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

2. Replace any parts that appear worn or damaged. Always replace seal (12) if piston is removed.
3. Clean all metal parts in a non-flammable cleaning solvent and blow dry with compressed air.

WARNING

Always use a non-flammable solvent for cleaning metal parts. DO NOT use gasoline or other flammable substances.

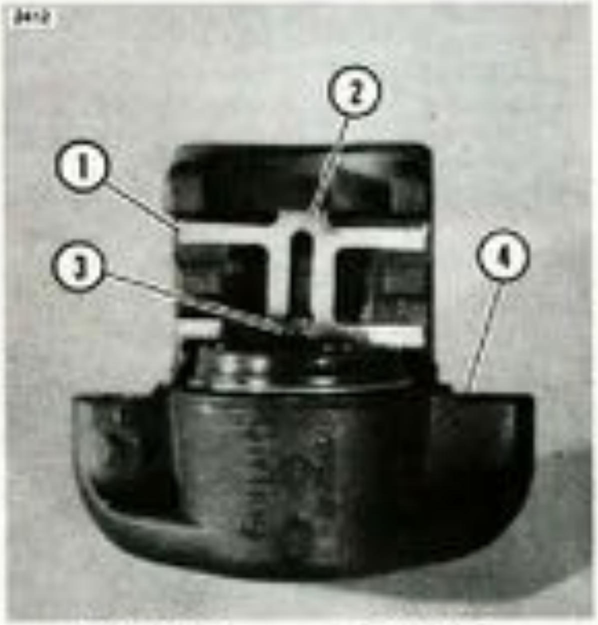
4. Clean all rubber parts in denatured alcohol or brake fluid.

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 such as gasoline or paint thinner. Use of mineral base solvents will cause deterioration of parts during and after assembly which could result in component failure.

Assembly

1. If piston was removed install new seal (12) into caliper bore. Install piston (11) all the way into caliper bore and install boot (10) and retaining wire (9).
2. Place pad spring (8) into top of caliper with long tab extending above piston. Hook short tab opposite piston above ridge on caliper casting to hold spring in place. Refer to Figure 2-65.
3. Install pin boots (7) on pins (5 and 6) and coat pins and pin bores with silicone grease. Insert pins into pin bores (pin with nylon sleeve goes into top hole) making sure boots are properly seated on boss around holes. Turn pin so flats are parallel with opening in bracket as shown in Figure 2-64.



1. Pad spring
2. Short tab
3. Long tab
4. Caliper body

Figure 2-65. Pad Spring Installation

4. If either of the two abutment shims are lost or damaged, they must be replaced. See Figure 2-66. If the shims are not to be replaced, proceed to Step 7. Remove all the existing adhesive from the mounting bracket surface where the abutment shim is located. The surface should be scraped with a knife and if required, lightly sanded with fine emery cloth.
5. Clean the scraped and sanded surface with denatured alcohol.
6. Apply a silicone sealant to the bracket surface and install the abutment shim. To hold the shims in position, install the brake pads in the bracket. Allow the silicone sealant to dry. Check that the brake pads have free lateral movement in the bracket.
7. Install pads (3) on bracket and place caliper body (4) on bracket making sure pins (5 and 6) do not turn.
8. Install screws (1) and tighten to 12-15 ft-lbs torque. Pins (5 and 6) should still be in same position as described in Step 3.
9. Bleed brake system as described under BLEEDING HYDRAULIC BRAKE SYSTEM.

Figure 2-66. Location of Abutment Shims

CAUTION

If the reaction pin (14), washer (15) and nut (16) are removed on FXST vehicles, it is important that the nut is tightened to 20 ft-lbs torque upon reassembly.

BRAKE DISCS

Removal And Installation

To remove the front and rear brake discs, follow the disassembly procedure for the front and rear wheels.

Inspection

The brake discs have a minimum thickness stamped on their sides. Replace any brake disc that is worn beyond this limit. See specifications.

BLEEDING THE HYDRAULIC BRAKE SYSTEM (Figure 2-67)

NOTE

Hydraulic brake fluid bladder type pressure equipment can be used to fill brake master cylinder through the bleeder fitting providing 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.

1. 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.

Figure 2-67. Bleeding The Brakes

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

3. With 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.

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

Anytime a hydraulic brake line or fitting is opened the fitting should be flushed with brake fluid and the brake system must be bled. This is in order 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.

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 burnt out. If the bulb is good, disassemble the switch assembly and replace the stoplight switch.

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 okay, replace the stoplight switch.

CAUTION

Do not contaminate switches with brake fluid or switch failure could occur.

FRONT FORKS — FL MODELS

GENERAL

The 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.

ADJUSTMENTS

The adjustable front fork is for use on a motorcycle operated with a sidecar. It has a two-position adjustable bracket and a steering damper.

Adjusting Front Fork Trail

The forks can be adjusted forward for less trail (use with sidecar) or rearward for more trail (solo service). The fork must be adjusted for sidecar service as follows:

1. Raise front end of motorcycle so front wheel turns freely and support motorcycle with suitable blocking.

2. See Figure 2-68. Underneath fork head lower bracket is a large bolt secured with a castellated nut and cotter pin. Remove cotter pin, loosen nut and disengage lockplates (located under bolt head and nut) from slots in fork bracket.

3. Grasp front wheel and pull fork sides as far forward as elongated holes in fork sides permit.

4. Re-engage lockplates in elongated holes with plates engaging to the front. Securely tighten nut and re-insert cotter pin.

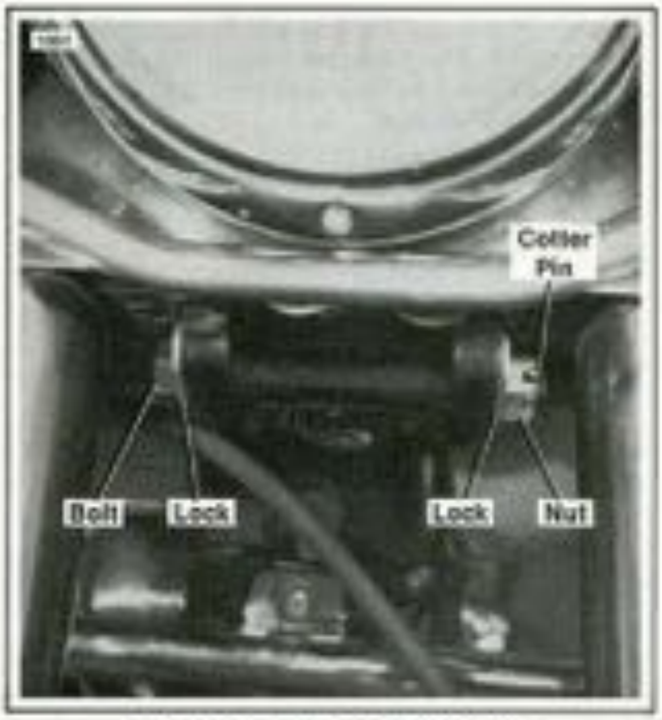


Figure 2-68. Adjusting Fork Trail

Adjusting The Steering Damper

The steering damper is located on top of the steering head. Turn steering damper clockwise to apply damping action and counterclockwise to reduce damping action. It is best to keep the damper set a little snug when operating with a sidecar.

CHANGING THE FORK OIL

1. Remove the fork tube cap from one fork side. On FL models with adjustable front forks, remove the filler plug from the fork tube plug.

2. Remove the fairing and headlight housing to get at the fork tube caps. See FIBERGLASS and ELECTRICAL sections.

3. See Figure 2-69. Remove the drain plug from the bottom of the fork.

4. Drain the oil by flexing the fork, then replace the drain plug.

5. Fill the fork with 7-3/4 oz. of Harley-Davidson TYPE B FORK OIL.

Figure 2-69. Fork Drain Plug

NOTE

When the fork has been disassembled, cleaned and reassembled, it is considered a dry fork and should be filled with 8-1/2 oz. of TYPE B FORK OIL. The difference in the amount of oil required between a WET and a DRY fork is due to oil cling.

6. Install the fork tube cap or fork tube filler plug and repeat steps 2-5 for the other fork side.

7. Re-install the headlight housing and fairing.

FRONT FORK

Removal (Figures 2-71, 2-72)

NOTE

It is not necessary to remove the front fork to change the fork seals. See steps 1 and 2 in the DISASSEMBLY procedure.

1. Remove the fairing, windshield, headlight and headlight housing. See FIBERGLASS and ELECTRICAL sections.

2. Remove the front wheel and brake as described in the previous sections.

3. Remove the front fender.

4. **Non-Adjustable Forks.** See Figure 2-71. Remove the fork tube caps (1) and oil seals (2). Loosen the lower bracket pinch bolts (6) and pull the fork sides from the brackets.

   Adjustable Forks. See Figure 2-72. Remove the upper bracket bolts (1) and washers (2). Loosen the lower bracket pinch bolts (22) and pull the fork sides from the brackets.

NOTE

If it is necessary to disassemble the fork stem and brackets at this time, proceed to the following sections, NON-ADJUSTABLE FORK STEM AND BRACKET or ADJUSTABLE FORK STEM AND BRACKET.

Disassembly (Figure 2-70)

1. Drain the oil from the fork side.

2. Remove the bolt (1) and washer (2) from the bottom of the fork. Pull the fork tube (3) from the slider. If the seals (7) have to be replaced, remove the retaining ring (6) and pry the seal out. Install a new seal and secure it with the retaining ring.

3. Remove the fork tube plug (10, 10A), O-ring (11), spring (12) and damper tube (13). Remove the wear rings (14) from the damper tube. Remove the small spring (15).

4. Repeat steps 1-3 for the other fork side.

Cleaning, Inspection And Repair

1. Replace the springs if they are worn, stretched or broken.

2. Check the hole in the fork tube bottom groove to make sure it is not blocked.

3. Replace any parts that appear worn or damaged.

Assembly (Figure 2-70)

1. Install fork tube (3) into the fork side and secure it with the bolt (1) and washer (2). Make sure one flat on each fork tube cap (10, 10A) faces toward the inside of the fork.

2. Install the wear rings (14) on the damper tube (13). Install the small spring (15), damper tube (13), large spring (12), O-ring (11) and fork tube plug (10, 10A) into the fork tube (3).

3. Fill the fork with fork oil as specified in CHANGING THE FORK OIL.

4. Repeat Steps 1-3 for the other fork side.

Installation (Figures 2-71, 2-72)

1. Place the fork assemblies into the upper and lower brackets with the brake caliper mounting bosses to the inside. Tighten the lower bracket pinch bolts to 30-35 ft-lbs torque.

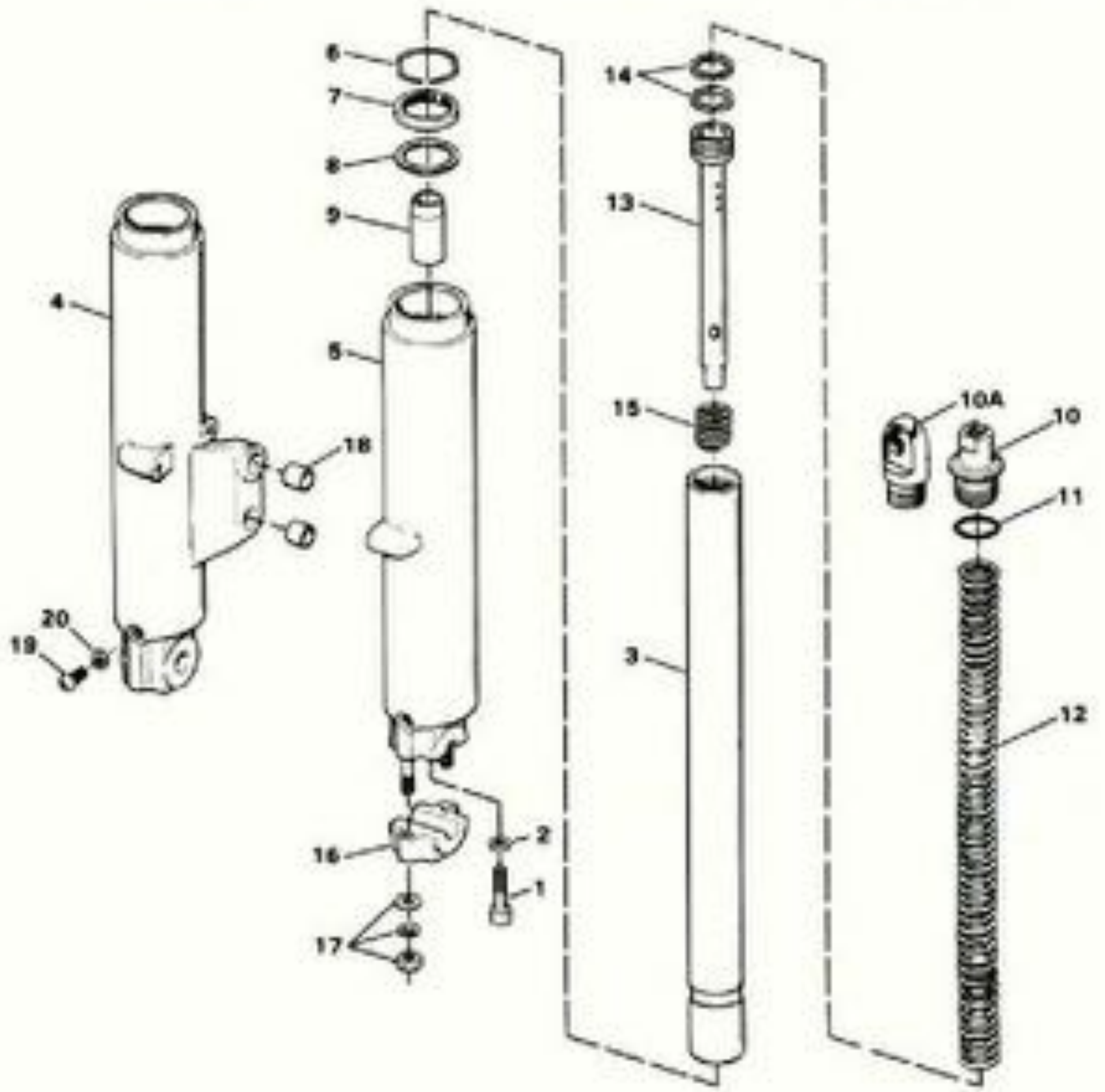
2. **Non-Adjustable Forks.** See Figure 2-71. Install the fork tube caps (1) and oil seals (2).

   Adjustable Forks. See Figure 2-72. Install the upper bracket bolts (1) and washers (2). Tighten the bolts to 22-26 ft-lbs torque.

3. Install the front fender. Tighten the fender mounting bolts to 16-20 ft-lbs torque. Bend the locking tabs over the nut flats.

4. Install the front wheel and brake as described in the previous section.

5. Install the headlamp housing, headlamp, fairing and windshield. See the ELECTRICAL and FIBERGLASS sections.



1.	Bolt	11.	O-ring
2.	Washer	12.	Large spring
3.	Fork tube	13.	Damper tube
4.	Right fork leg	14.	Wear ring (2)
5.	Left fork leg	15.	Small spring
6.	Retaining ring	16.	Axle cap
7.	Oil seal	17.	Axle cap hardware
8.	Washer	18.	Bushing
9.	Sleeve	19.	Drain plug
10.	Fork cap (non-adjustable fork)	20.	Washer
10A.	Fork cap (adjustable fork)		

Figure 2-70. Front Fork — FL Models

NON-ADJUSTABLE FORK STEM AND BRACKET (Figure 2-71)

Disassembly

1. Remove the front forks as described previously.
2. Bend the lockwasher tab (4) away from the fork stem nut (3). Remove the nut (3), lockwasher (4) and upper bracket (5).
3. Remove the bearing seal (6) using Harley-

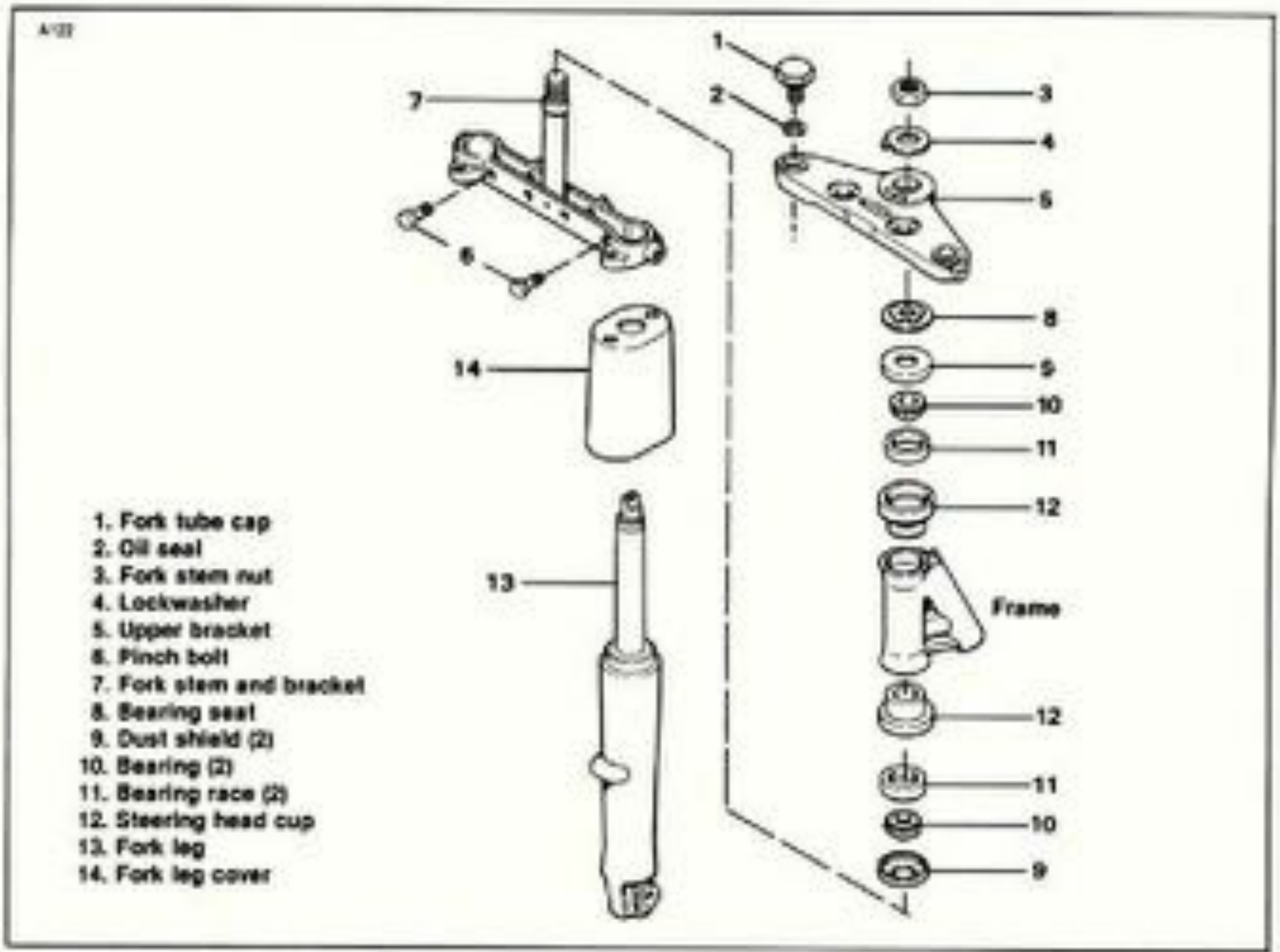


Figure 2-71. Non-adjustable Fork and Bracket

Davidson's LOCKNUT WRENCH, Part No. HD-96219-50.

4. Remove the fork stem and bracket (7), dust shields (9) and bearings (10).

Cleaning, Inspection And Repair

1. Check bearings (10) and races (11) for pitting or wear. Check for roughness by rolling the bearings on the bearing races. Replace them in sets if worn.

2. To replace a bearing race, knock the head cup (12) from the steering head using a suitable drift. Discard the cup. Press a new bearing race into a new steering head cup. Press the cup into the frame steering head.

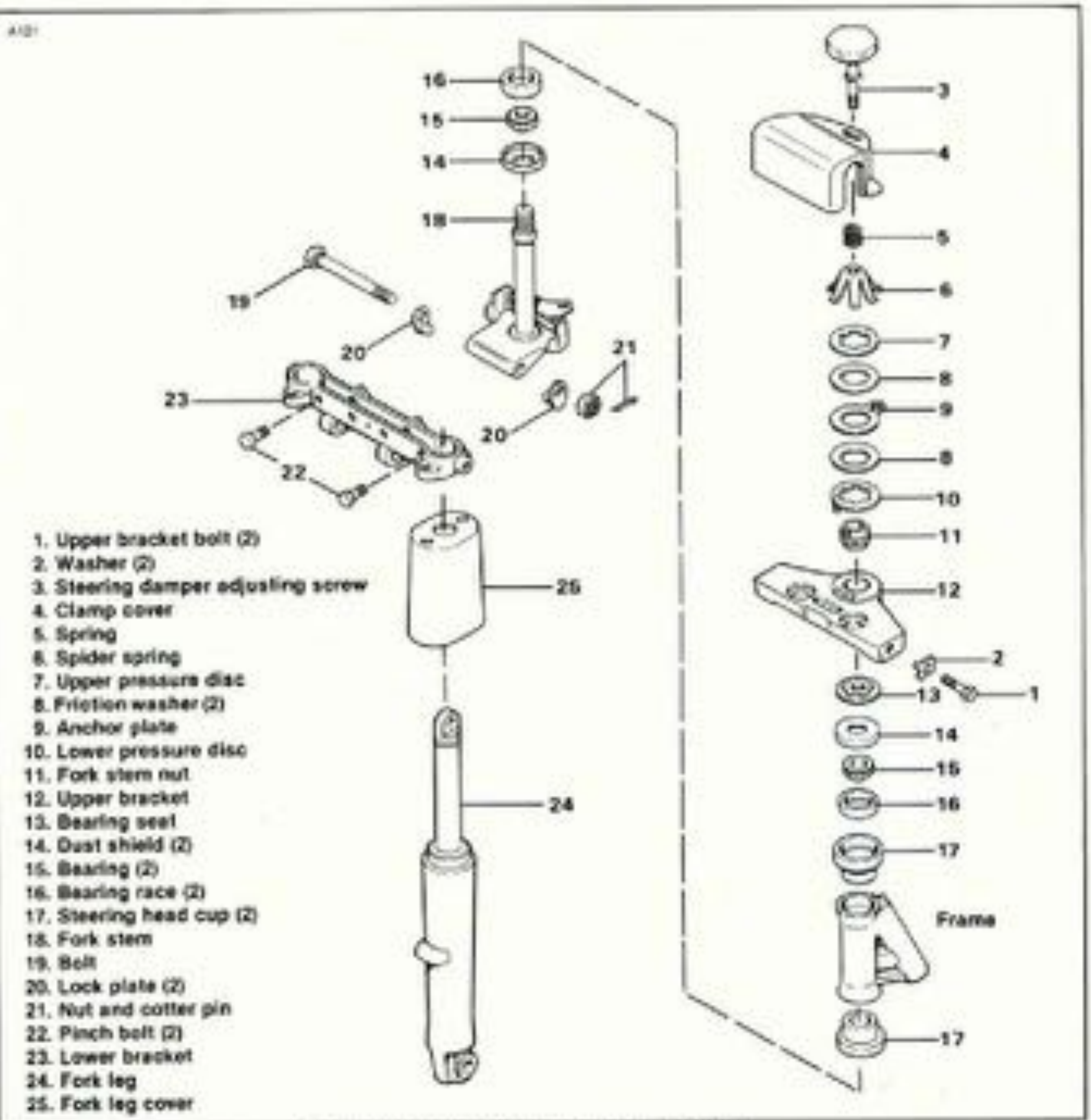
3. If the fork stem and brackets are bent or twisted, replace them.

Assembly

1. Coat the bearings with bearing grease and install the lower dust shield (9) and one bearing (10) onto the lower bracket fork stem (7).

2. Insert the fork stem up through the frame steering head and install the other bearing, dust shield (9) and bearing seat (8). Tighten the bearing seat until the bearings have no noticeable shake and the fork stem turns freely from side to side.

3. Install the upper bracket (5), lockwasher (4) and nut (3). Tighten nut securely and bend the lockwasher tab against the nut flat.



1. Upper bracket bolt (2)
2. Washer (2)
3. Steering damper adjusting screw
4. Clamp cover
5. Spring
6. Spider spring
7. Upper pressure disc
8. Friction washer (2)
9. Anchor plate
10. Lower pressure disc
11. Fork stem nut
12. Upper bracket
13. Bearing seat
14. Dust shield (2)
15. Bearing (2)
16. Bearing race (2)
17. Steering head cup (2)
18. Fork stem
19. Bolt
20. Lock plate (2)
21. Nut and cotter pin
22. Pinch bolt (2)
23. Lower bracket
24. Fork leg
25. Fork leg cover

Figure 2-72. Adjustable Fork Stem and Bracket

ADJUSTABLE FORK STEM AND BRACKET (Figure 2-72)

Disassembly

1. Remove the front forks as described previously.
2. Remove the steering damper adjusting screw (3).
3. Remove the clamp cover (4), spring (5), spider spring (6), upper pressure disc (7), friction washers (8), anchor plate (9) and lower pressure disc (10).
4. Remove the fork stem nut (11) and upper bracket (12).
5. Remove the bearing seat (13), dust shield (14) and bearing (15). Remove the bottom bracket (22) and fork stem (18). Lift the bottom bearing and dust shield off the fork stem.

Cleaning, Inspection And Repair

1. Check the bearings (15) and races (16) for pitting or wear. Check for roughness by rolling the bearings on the bearing races. Replace them in sets if necessary.

2. To replace a bearing race, knock the head cup (17) from the steering head using a suitable drift. Discard the cup. Press a new bearing race into a new steering head cup. Press the cup into the frame steering head.

3. If the fork stem and brackets are bent or twisted, replace them.

Assembly

1. Coat the bearings with bearing grease and install one dust shield (14) and bearing (15) onto the fork stem (18).

2. Insert the fork stem and lower bracket assembly up through the frame steering head and install the other bearing (15), dust shield (14) and bearing seat (13).

   Tighten the bearing seat until the bearings have no noticeable shake and the fork stem turns freely from side to side.

3. Install the upper bracket (11) and fork stem nut (10). Tighten nut securely.

4. Install the lower pressure disc (10) so the pin registers in one of the three holes in the upper bracket (12).

5. Install one friction washer (8) and the anchor plate (9). Make sure hole in anchor plate tab registers with roll pin on frame.

6. Install the other friction washer (8), upper pressure disc (7), spring (6), spring (5), handlebar clamp cover (4), and damper screw (3).

7. Install the front forks as described in the preceding section.

FRONT FORKS — FX MODELS

GENERAL

The 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.

CHANGING THE FORK OIL

1. Remove the fork tube cap from the top of one fork side.
2. See Figure 2-69. Remove the drain plug from the bottom of the fork.
3. Drain the oil by flexing the fork then replace the drain plug.
4. Fill the fork with Harley-Davidson's TYPE E or B FORK OIL with the specified amounts listed below:

FX Models (Except FXWG)	Wet 5 oz. Dry 6 oz.
FXWG Only	Wet 9-1/4 oz. Dry 10 oz.

NOTE

The difference in the amount of oil required between a WET or DRY fork is due to oil cling.

5. Install the fork tube cap and repeat Steps 1-4 for the other fork side.

FRONT FORK — FX MODELS (EXCEPT FXWG AND FXST)

Removal (Figure 2-75)

1. Remove the front wheel and brake calipers as described in the previous sections.
2. Remove the front fender.

NOTE

It is not necessary to remove the front fork to change the fork seals. See Steps 1 and 2 in the DISASSEMBLY procedure.

3. Remove the cover screws (1) and lift the cover (2) up to expose the fork stem and bracket (15).
4. Loosen the pinch bolts (3) and upper bracket screws (4). Pull the fork side (6) from the brackets.
5. Repeat Steps 1-4 for the other fork side.

NOTE

If it is necessary to disassemble the fork stem and brackets at this time, proceed to the disassembly procedure under FORK STEM AND BRACKET — FX MODELS (EXCEPT FXWG).

Disassembly 1983 And Earlier Vehicles (Figure 2-73)

1. Remove the fork tube cap (1), washer (2) and O-ring (3). Remove the drain screw (13) and washer (14). Drain the fork oil from the fork side.
2. Remove the screw (15) and washer (16) from the bottom of the fork side. Pull the fork tube (7) and dust boot (8) from the slider (12). If the seal (10) has to be replaced, remove the retaining ring (9) and pry the seal out. Install a new seal and secure it with the retaining ring.
3. Remove the spring (4) and damper tube (6). Remove the wear rings (5) from the tube.

Cleaning, Inspection And Repair 1983 And Earlier Vehicles

1. Replace the spring if it appears worn, stretched or broken.
2. If the fork tube appears bent, replace it.
3. Check the hole in fork tube bottom groove. It should not be obstructed.

Assembly 1983 And Earlier Vehicles (Figure 2-73)

1. Install the wear rings (5) on the damper tube (6). Install the damper tube and spring (4) into the fork tube.
2. Install the fork tube (7) and dust boot (8) to the fork slider (12). Install the screw (15) and washer (16).
3. Install the drain screw (13) and washer (14). Fill the fork with fork oil as specified in CHANGING THE FORK OIL. Repeat this assembly procedure for the other fork side.
4. Install the O-ring (3, washer (2) and fork tube cap (1).

Installation 1983 And Earlier Vehicles (Figure 2-75)

1. Insert both fork assemblies up through the fork

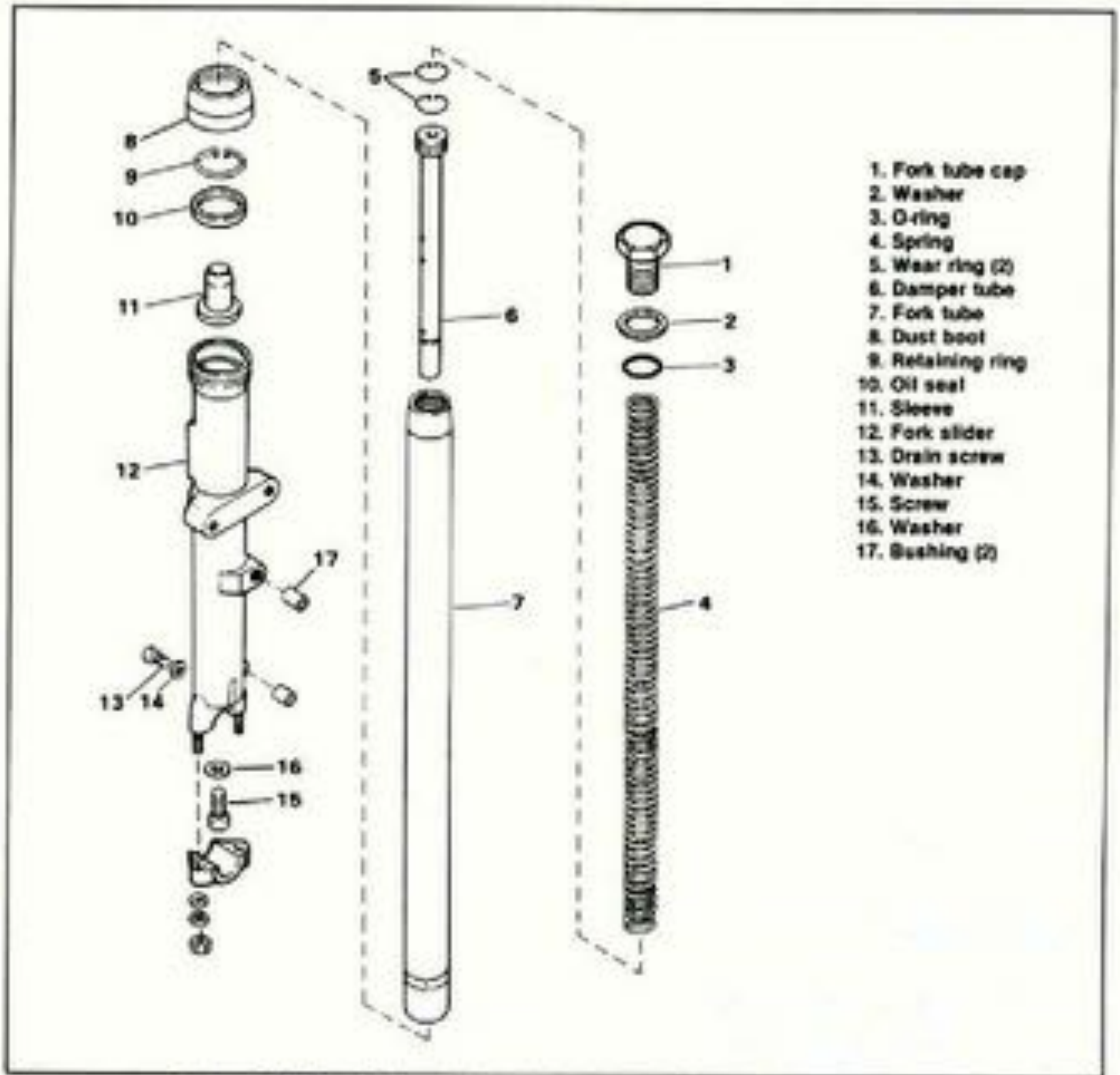


Figure 2-73. Front Fork — 1983 And Earlier FX Models (Except FXWG/FXDG)

stem bracket (15), cover (2) and upper bracket (7). The top of fork tube should be flush with top of upper bracket. Also, fender mounting holes should face to the inside.

2. Tighten the lower bracket pinch bolts (3) and upper bracket screws (4) to 30-35 ft-lbs torque. Fasten the cover (2) to the lower bracket using the two screws (1).

3. Install the fender.

4. Install the front wheel and brakes as described in the previous sections.

Disassembly 1984 FX Models (Except FXWG/FXDG And FXST) (Figure 2-74)

1. Remove O-ring (3) from the groove in the tube cap and slide off washer (2). Pull spring (10) out of fork tube (8).

2. Remove dust seal (11). Then compress internal circle clip (12) and remove the clip from the internal groove at the top of slider (16).

3. Using an allen wrench, remove socket bolt (17) along with washer (18) from the bottom end of fork

slider (16). This will free shock absorber tube (6) and slider (16) so that they can be removed from fork tube (8).

NOTE

Since there is little resistance to rotation when removing socket bolt (17), the job is best done with an air impact wrench.

4. The upper bushing (15) is a slight interference fit in slider (16). The upper bushing (15) together with spacer seal (14) and oil seal (13) are removed by lightly hitting the upper bushing with the lower bushing as the fork tube is pulled free of the slider (16) in a quick continuous stroke. Continue this slide hammer type action until the components are freed.

5. Remove shock absorber tube (6) by pushing the tube and spring assembly free of fork tube (8) by inserting a small diameter rod through the opening in the bottom of tube (8).

6. Remove sleeve (10) from the lower end of shock absorber tube (16) and slide off rebound spring (7).

7. Piston rings (5) can now be removed from the grooves at the top end of shock absorber tube (16). Lower bushing (9) should not be removed unless it is to be replaced. When replacing lower bushing (9), expand the new split bushing diameter only enough to fit over tube (8) and slide bushing into the bushing groove.

Cleaning, Inspection and Repair 1984 FX Models (Except FXWG/FXDG and FSXT)

Thoroughly clean and inspect each part. If inspection shows that any parts are bent, broken or damaged, those parts should either be repaired or replaced. (See Figure 2-74).

Inspect seal (13) for wear. If seal was removed, a new one must be installed. Inspect both piston rings (5) on shock absorber tube (6) and replace if worn excessively or damaged.

Check dust seal (11) 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.

Replace either of the springs (4) or (7) if broken.

Inspect small hole in lower end of fork tube (8) and see that it is not obstructed.

Make sure O-ring (3) is in good condition, without irregularities, and that it provides proper sealing when in place.

Check both washers (18) and (19) to see that they provide a good seal when used with their respective screws (17) and (20) to prevent oil leakage.

Replace bent of damaged fork tube (8).

Reassembly 1984 FX Models (Except FXDG And FXST) (Figure 2-74)

Reassembly is similar to the reverse order of disassembly however, some important factors which effect proper assembly must be pointed out. The general reassembly procedure is as follows:

1. Place rebound spring (7) on shock absorber tube (6). Insert shock absorber tube (6) into fork tube (8).

2. Insert spring (4) into fork tube (8) taper side toward piston, and push the shock absorber tube through the opening at the bottom end of the fork tube.

3. Position fork tube (8) and damper tube (6) into slider (16). Hold the assembly in place by exerting pressure on the spring and install socket bolt (17) with washer (18).

4. Place upper bushing (15), seal spacer (14) and seal (13) (in that order) over fork tube (16). Be sure that the flanged surface of the seal spacer is up and lettered side of the seal is facing upward. Installation tool HD-34190 is then placed over fork tube (16). Bushing (15), spacer (14) and seal (13) are then seated into the slider bore by lightly tapping the components into place with the installation tool.

5. Fill fork sides with exactly 5.4 ozs. wet or 6.4 ozs. dry of Harley Davidson, type E, fork oil.

Installation 1984 FX Models (Except FXWG/FXDG And FXST) (Figure 2-75)

1. Insert both fork assemblies up through the fork stem bracket (15), cover (2) and upper bracket (7). The top of fork tube should be flush with top of upper bracket. Also, fender mounting holes should face to the inside.

2. Tighten the lower bracket pinch bolts (3) and upper bracket screws (4) to 30-35 ft-lbs torque. Fasten the cover (2) to the lower bracket using the two screws (1).

3. Install the fender.

4. Install the front wheel and brakes as described in the previous sections.

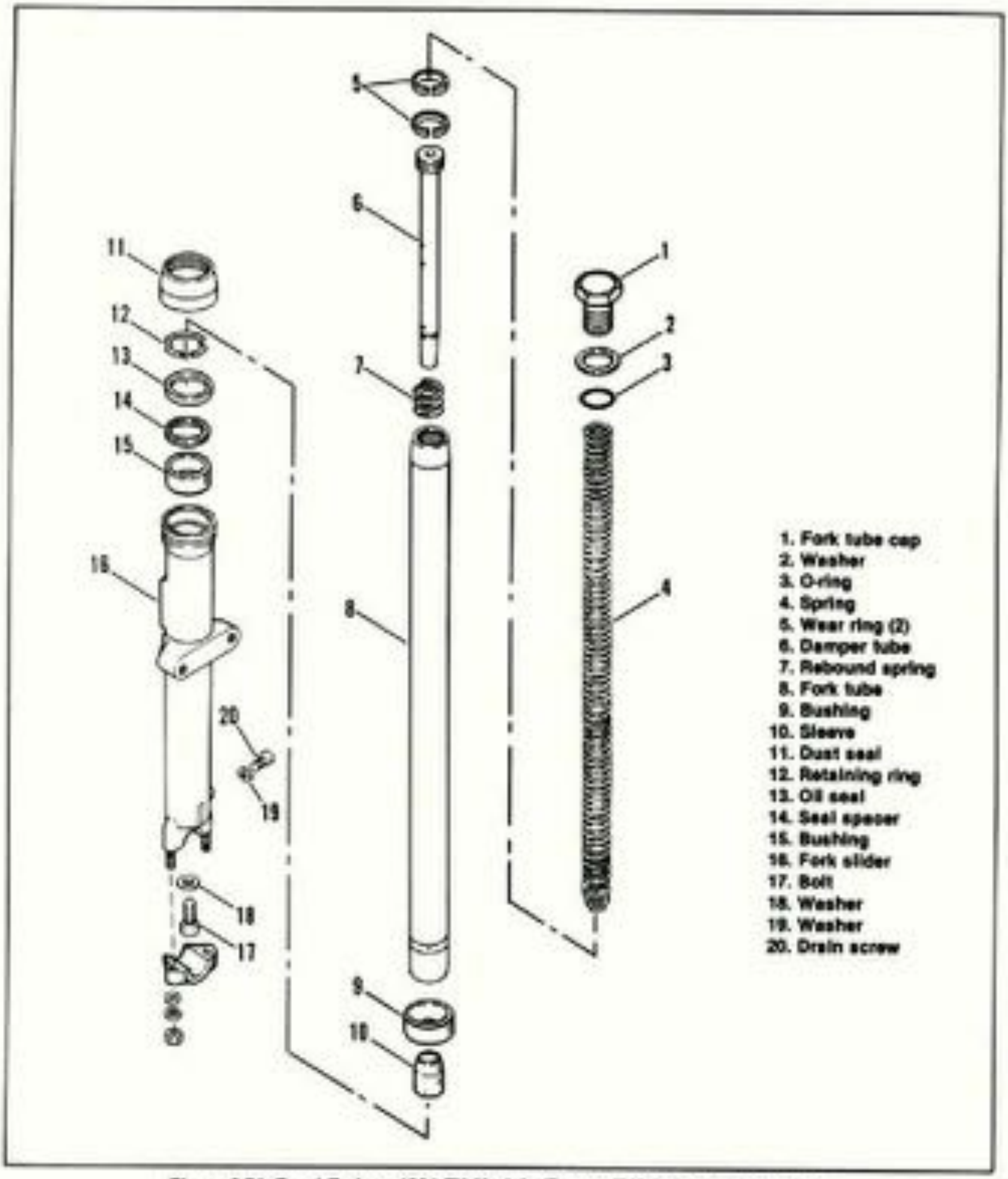


Figure 2-74. Front Fork — 1984 FX Models (Except FXDG/FXWG and FXST)

FORK STEM AND BRACKET ASSEMBLY FX MODELS (EXCEPT FXWG/FSXT AND FXDG) (Figure 2-75)

Disassembly

1. Remove the forks as described previously.

2. Remove brake hose clamp from bottom bracket. Remove the fork stem nut (8).

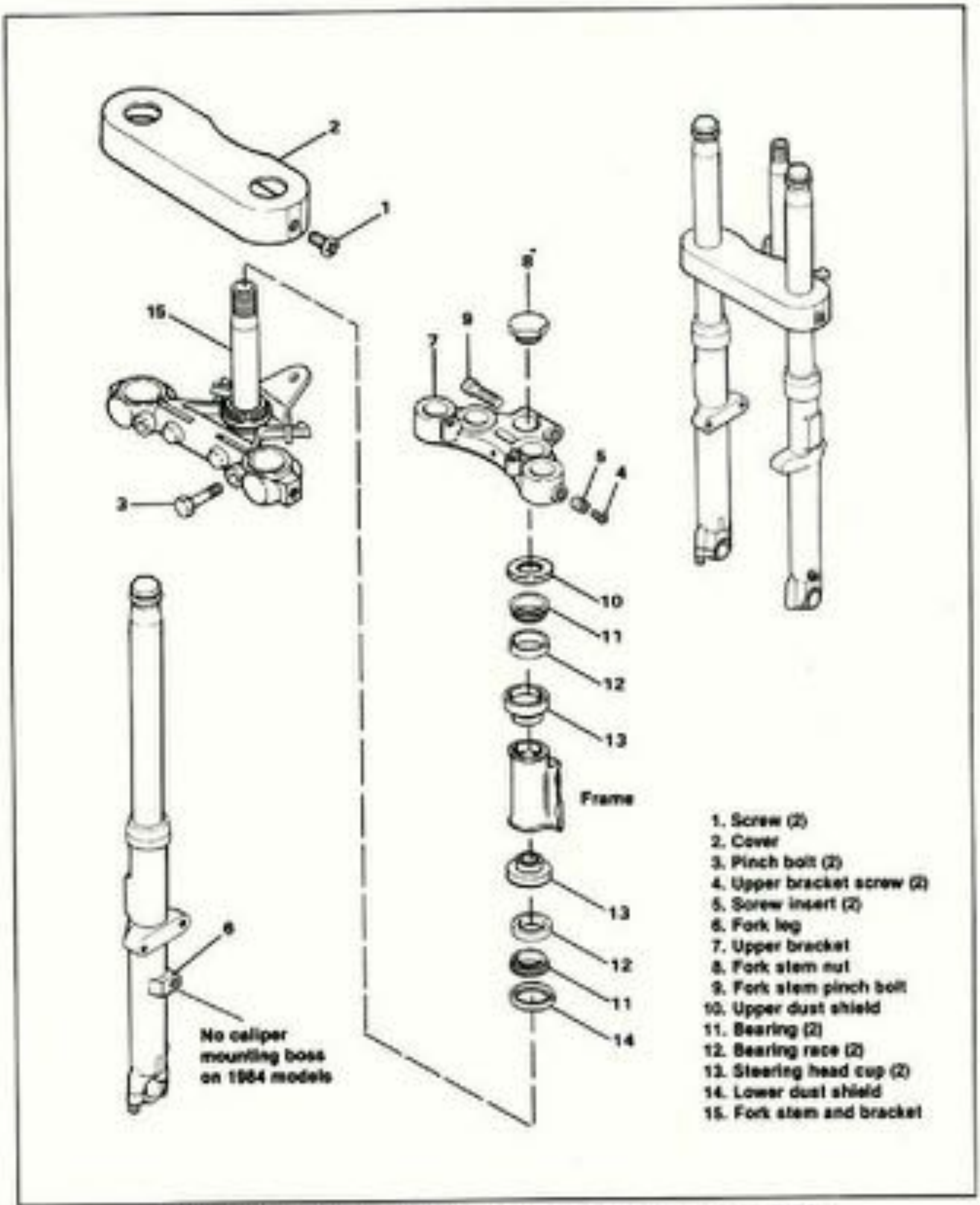


Figure 2-75. Fork Stem and Bracket — FX Models (Except FXWG/FXST/FXDG)

3. Loosen the upper bracket pinch bolt (9) and remove the fork stem bracket (15), dust shields (10, 14) and bearings (11).

Cleaning, Inspection And Repair

1. Check bearings (11) and races (12) for pitting or wear. Check for roughness by rolling the bearings on the races. Replace them in sets if worn.

2. To replace a bearing race, knock the head cup (13) from the steering head using a suitable drift. Dis-

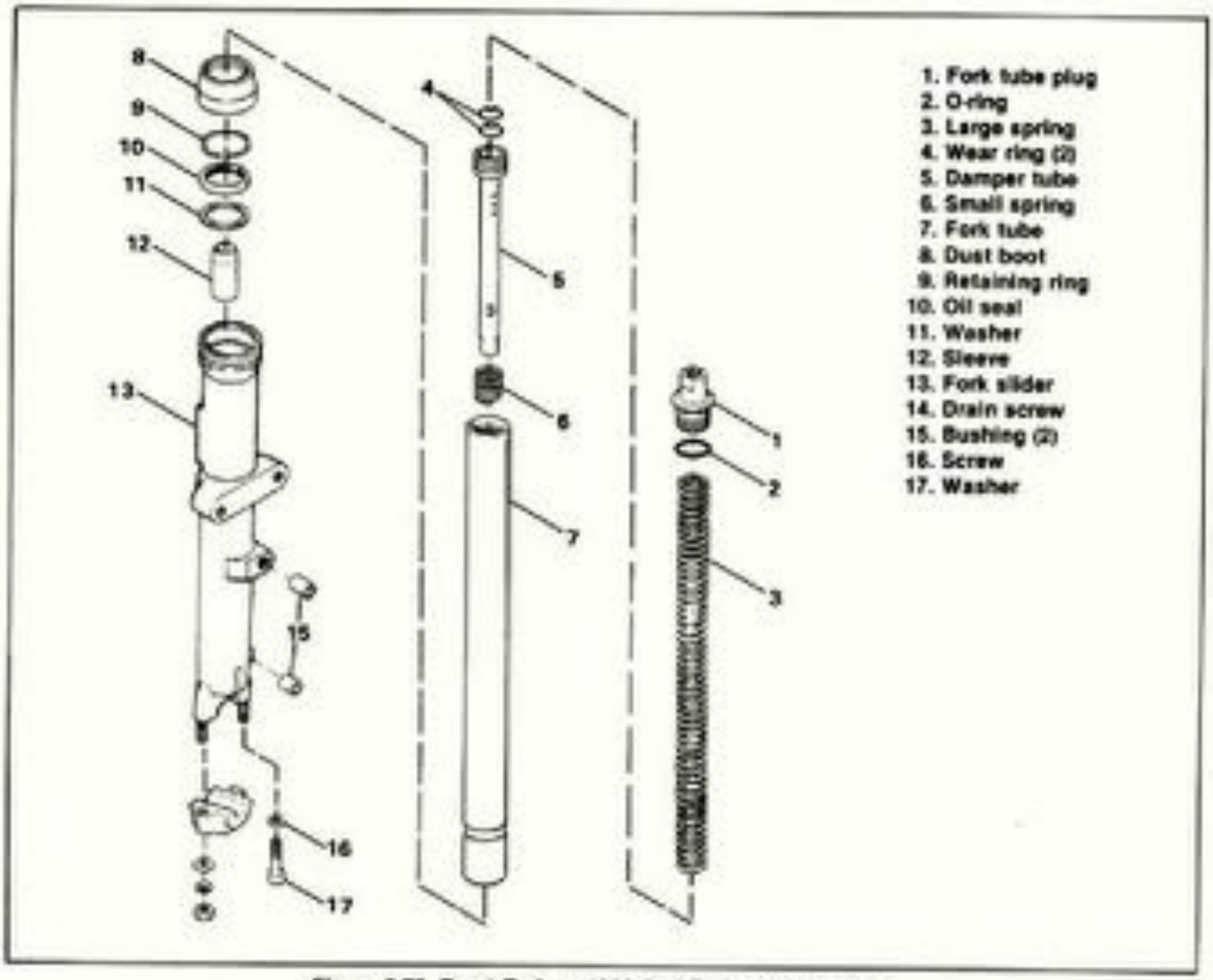


Figure 2-76. Front Fork — 1983 And Earlier FXWG/FXDG

card the cup. Press a new bearing race into a new steering head cup. Press the cup into the frame steering head.

3. If the fork stem or brackets are bent or twisted, replace them.

Assembly

1. Coat the bearings with bearing grease and install the lower dust shield (14) and bearing (11) onto the fork stem (15).

2. Insert the fork stem up through the frame steering head and install the stem bearing and upper dust shield (10). Install the fork stem nut (8) and tighten until bearings have no noticeable shake. Also, the fork stem must turn freely from side to side.

3. Tighten the pinch bolt (9) to 20-25 ft-lbs torque.

4. Fasten the brake hose bracket to bottom bracket using original hardware. Tighten bolt to 11 ft-lbs torque.

5. Install the front forks as described previously.

FRONT FORK — FXWG AND FXST

Removal (Figure 2-77)

1. Remove the front wheel and brake calipers as described in the previous sections.

2. Remove the front fender.

NOTE

It is not necessary to remove the front fork to change the fork seals. See Steps 1 and 2 in the DISASSEMBLY procedure.

3. Remove the fork tube cap (3), washer (4) and oil seal (5) from the top of one fork side.

4. Loosen the pinch bolt (1) and pull the fork side from the brackets.

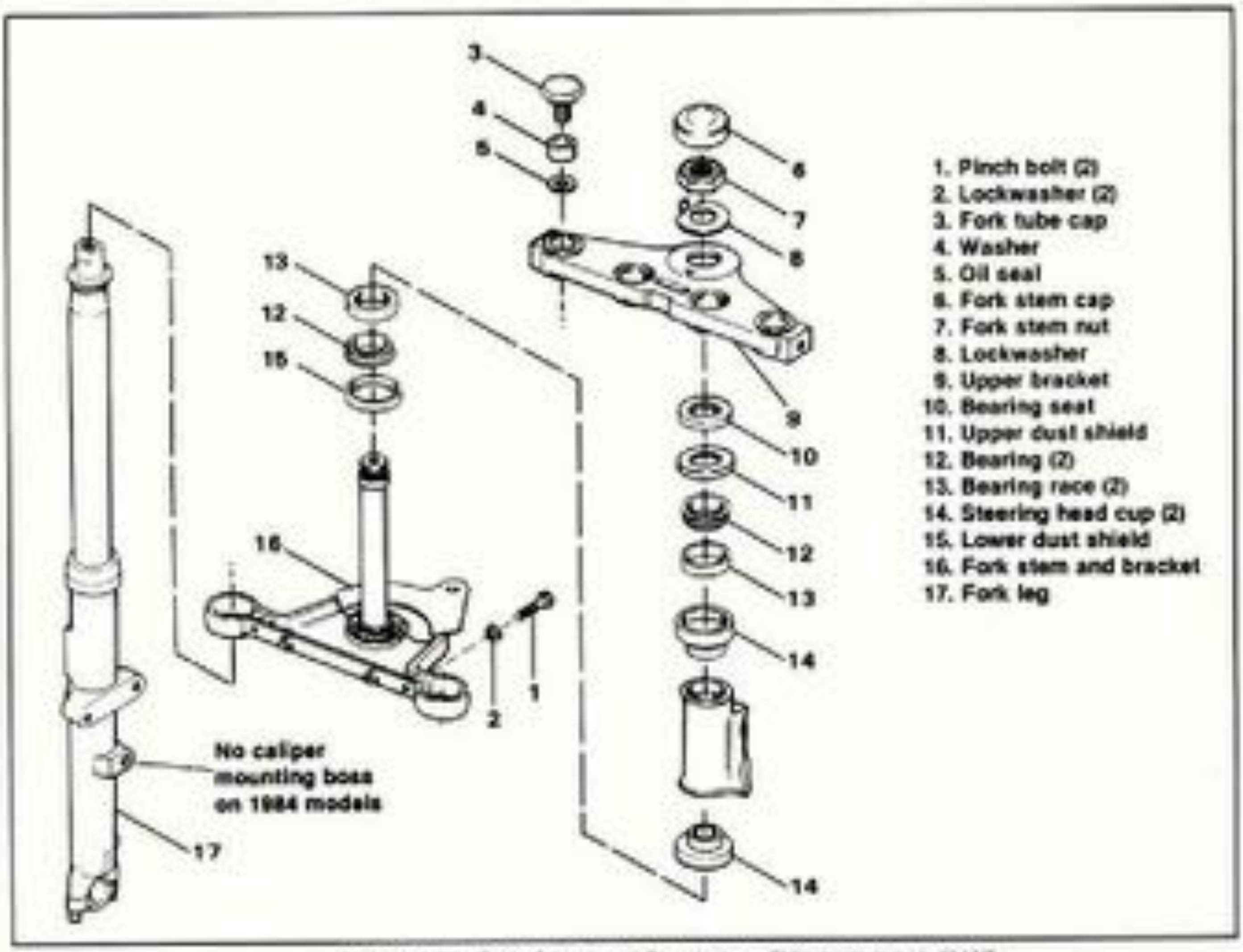


Figure 2-77. Fork Stem and Bracket — FXWG/FXDG & FXST

5. Repeat Steps 1-4 for the other fork side.

NOTE

If it is necessary to disassemble the fork stem and brackets at this time, proceed to the disassembly procedure under FORK STEM AND BRACKET — FXWG.

Disassembly 1983 and Earlier FXWG and FXDG (Figure 2-76)

1. Remove the fork tube plug (1) and O-ring (2). Remove the drain screw (14) and drain the fork oil.
2. Remove the screw (16) and washer (17) from the bottom of the fork side. Pull the fork tube (7) and dust boot (8) from the slider (13). If the seal (10) has to be replaced, remove the retaining ring (9) and pry the seal out. Install a new seal and secure it with the retaining ring.
3. Remove the large spring (3), damper tube (5) and small spring (6). Remove the wear rings (4) from the damper tube.

Cleaning, Inspection And Repair 1983 and Earlier FXWG and FXDG

1. Replace the springs if they appear worn, stretched or broken.
2. If the fork tube appears bent, replace it.
3. Replace any parts that appear worn or damaged.

Assembly 1983 and Earlier FXWG and FXDG (Figure 2-76)

1. Install the wear rings (4) on the damper tube (5). Install the small spring (6) and damper tube. Install the large spring (3) O-ring (2) and fork tube cap (1).
2. Install the fork tube (7) and dust boot (8) to the fork slider (13). Fasten them together using the washer (17) and screw (16).
3. Install the drain screw (14) and fill the fork side with fork oil as specified in CHANGING THE FORK OIL.

4. Repeat Steps 1-3 for the other fork side.

Installation (Figure 2-77)

1. Insert both fork assemblies up through the fork stem bracket (16) and upper bracket (9). The top of the fork tube plug should be flush with the top of upper bracket. Also, fender mounting holes should face to the inside.

   Make sure one flat on each fork tube cap (1, Figure 2-66) faces toward the inside of the fork.

2. Install the oil seal (5), washer (4) and fork tube cap (3). Tighten securely.

3. Tighten the fork stem bracket pinch bolts (1) to 30-35 ft-lbs torque.

Disassembly 1984 FXWG And FXST (Figure 2-78)

1. Remove the fork tube plug (1) and O-ring (2). Remove the drain screw (18) and drain the fork. Pull spring (3) out of fork tube (7).

2. Remove dust seal (10). Then compress internal circle clip (11) and remove the clip from the internal groove at the top of slider (15).

3. Using an allen wrench, remove socket bolt (16) along with washer (17) from the bottom end of fork slider (15). This will free shock absorber tube (5) and fork tube (7) so that they can be removed from slider (15).

NOTE

Since there is little resistance to rotation when removing socket bolt (16), the job is best done with an air impact wrench.

4. The upper bushing (14) is a slight interference fit in slider (15). The upper bushing (15) together with spacer seal (13) and oil seal (12) are removed by lightly hitting the upper bushing with the lower bushing as the fork tube is pulled free of the slider (15) in a quick continuous stroke. Continue this slide hammer type action until the components are freed.

5. Remove shock absorber tube (5) by pushing the tube and spring assembly free of fork tube (7) by inserting a small diameter rod through the opening in the bottom of tube (7).

6. Remove sleeve (9) from the lower end of shock absorber tube (5) and slide off rebound spring (6).

7. Piston rings (4) can now be removed from the grooves at the top end of shock absorber tube (5). Lower bushing (8) should not be removed unless it is to be replaced. When replacing lower bushing (8), expand the new split bushing diameter only enough to fit over tube (7) and slide bushing into the bushing groove.

Inspection 1984 FXWG and FXST (Figure 2-78)

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

Inspect seal (12) for wear. If seal was removed, a new one must be installed. Inspect both piston rings (4) on shock absorber tube (5) and replace if worn excessively or damaged.

Check dust seal (10) where it rubs on fork tube (7). 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.

Replace either of the springs (3) or (6) if broken.

Inspect small hole in lower end of fork tube (7) and see that it is not obstructed.

Make sure O-ring (2) is in good condition, without irregularities, and that it provides proper sealing when in place.

Check both washers (17) and (19) to see that they provide a good seal when used with their respective screws (16) and (18) to prevent oil leakage.

Replace bent of damaged fork tube (7).

Reassembly 1984 FXWG and FXST (Figure 2-78)

Reassembly is similar to the reverse order of disassembly however, some important factors which effect proper assembly must be pointed out. The general reassembly procedure is as follows:

1. Place rebound spring (6) on shock absorber tube (5). Insert shock absorber tube (5) into fork tube (7).

2. Insert spring (3) into fork tube (7) taper side toward piston, and push the shock absorber tube through the opening at the bottom end of the fork tube.

3. Position fork tube (7) and damper tube (5) into slider (15). Hold the assembly in place by exerting pressure on the spring and install socket bolt (16) with washer (17).

4. Place upper bushing (14), seal spacer (13) and seal (12) (in that order) over fork tube (15). Be sure that the flanged surface of the seal spacer is up and let-

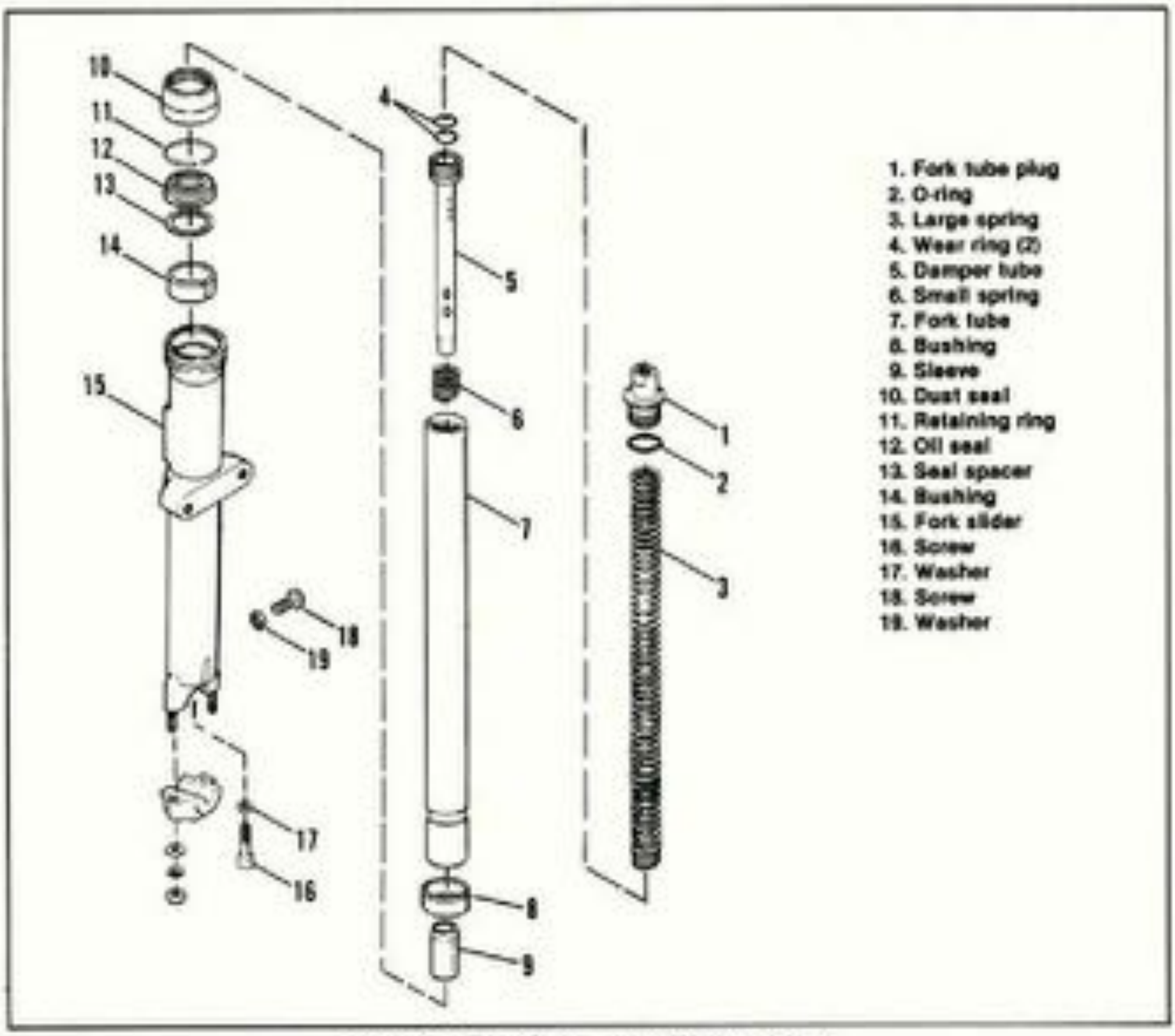


Figure 2-78. Front Fork — 1984 FXWG and FXST

tered side of the seal is facing upward. Installation tool HD-34634 is then placed over fork tube (15). Bushing (14), spacer (13) and seal (12) are then seated into the slider bore by lightly tapping the components into place with the installation tool.

5. Fill fork sides with exactly 5.4 ozs. wet or 6.4 ozs. dry of Harley Davidson, type E, fork oil.

Installation 1984 FXWG and FXST) (Figure 2-77)

1. Insert both fork assemblies up through the fork stem bracket (16) and upper bracket (9). The top of fork tube plug should be flush with top of upper bracket. Also, fender mounting holes should face to the inside.

   Make sure one flat on each fork tube cap (1, Figure 2-76) faces toward the inside of the fork.

2. Install the oil seal (5), washer (4) and fork tube cap (3). Tighten securely.

3. Tighten the fork stem bracket pinch bolts (1) to 30-35 ft-lbs torque.

FORK STEM AND BRACKET ASSEMBLY — FXWG/FXST (Figure 2-77)

Disassembly

1. Remove the forks as described previously.

2. Remove the headlight and headlight bracket. See the ELECTRICAL section.

3. Remove the brake hose bracket from the bottom of the fork stem bracket (16).

4. Remove the fork stem nut cap (6). Bend the lockwasher tab (8) away from the nut (7) and remove them along with the handlebar and upper bracket (9).

5. Remove the bearing seat (10) and pull the fork stem bracket (16) out of the steering head. Remove the dust shields (11, 15) and bearings (12).

Cleaning, Inspection And Repair

1. Check bearings (12) and races (13) for pitting or wear. Check for roughness by rolling the bearings on the races. Replace them in sets if worn.

2. To replace a bearing race, knock the head cup (14) from the steering head using a suitable drift. Discard the old cup. Press a new bearing race into a new steering head cup. Press the cup into the frame steering head.

3. If the fork stem or brackets are bent or twisted, replace them.

Assembly

1. Coat the bearings with bearing grease and install the lower dust shield (15) and a bearing (12) onto the fork stem (16).

2. Insert the fork stem up through the frame steering head and install the other bearing and upper dust shield (11) and secure with the bearing seat (10). Tighten the bearing seat until the bearings have no noticeable shake. Also, fork stem must turn freely from side to side.

3. Install the upper bracket (9), lockwasher (8) and nut (7). Make sure pin on lockwasher registers in upper bracket hole. Tighten the nut securely and bend the lockwasher tab against the nut flat.

4. Install the cap (6).

5. Fasten the brake hose bracket to bottom bracket using original hardware. Tighten bolt to 11 ft-lbs torque.

6. Install the headlight assembly. See the ELECTRICAL section.

7. Install the front forks as described previously.

FRAME AND REAR SWING ARM

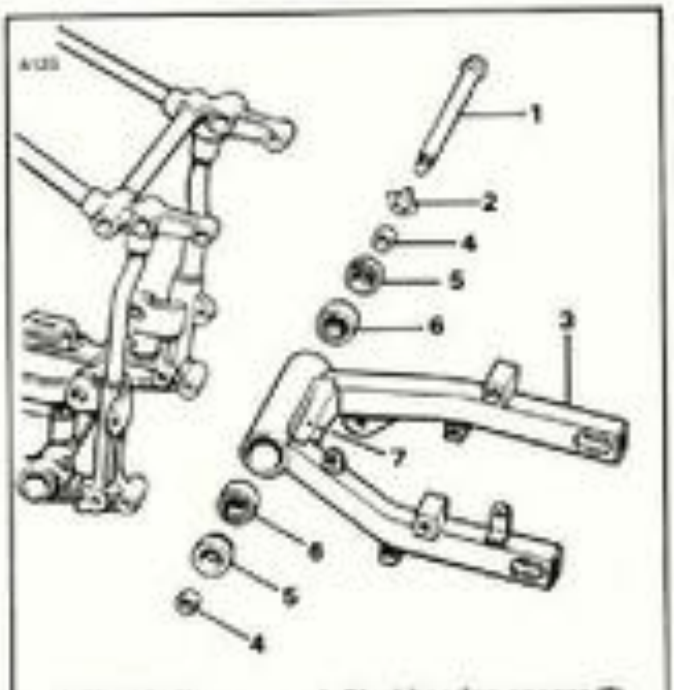
REAR SWING ARM — FX/FL (EXCEPT FSXT)

Disassembly

1. Remove the rear wheel as described in the WHEELS sections.
2. Remove the rear brake caliper and mounting bracket as described in the BRAKE section.
3. Remove the shock absorbers. See the REAR SHOCK ABSORBER section.
4. Turn back the locking ear on the lockwasher (2) and remove the pivot bolt (1). Remove the fork from the frame.

Cleaning, Inspection And Repair

1. If the oil seals leak, remove the spacers (4) and oil seals (5) using a suitable drift pin. Replace the seals.
2. Roll the bearings (6) inside the fork. If they appear rough, replace them. Pack new bearings with bearing grease.



1. Pivot bolt	4. Pivot bearing spacer (2)
2. Pivot bolt lock washer	5. Bearing seal (2)
3. Rear fork	6. Bearing (2)
	7. Grease fitting

Figure 2-79. Rear Swing Arm

3. Rough check the swing arm for correct alignment. A bent swing arm must be replaced.

Assembly

1. Place the swing arm in the frame. Install the pivot bolt (1) and lockwasher (2) from the right side. Attach a spring scale to the end of the swing arm and tighten the pivot bolt to pre-load bearings to 1-2 lbs. Bend the lockwasher tab against the bolt head flat.

NOTE

After the pivot shaft is assembled, apply a quantity of grease to the fitting (7) with a hand grease gun to fill the area between bearings. Grease the swing arm at 2,500 mile intervals.

2. Install the shock absorbers, rear brake caliper and rear wheel as described in each respective section.

REAR SWING ARM — FXST (Figure 2-80)

Disassembly

1. Remove the rear wheel as described under WHEELS earlier in this Section.
2. Remove the rear brake caliper and mounting bracket as described under BRAKES earlier in this Section.
3. Remove the shock absorbers. See the instructions under REAR SHOCK ABSORBERS later in this Section.
4. Remove the bolts (7) that are threaded into each end of the swing axis tube (15). Removing the bolts will free lockwasher (8), spacer (5) and swing axis tube (15). The swing arm (2) can now be pulled free of frame (1).

Cleaning, Inspection and Repair

The spherical bearings (9) 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 rag, removing any dirt or grit adhering to the bearing surface.

Rough check the swing arm for correct alignment. A bent swing arm must be replaced.

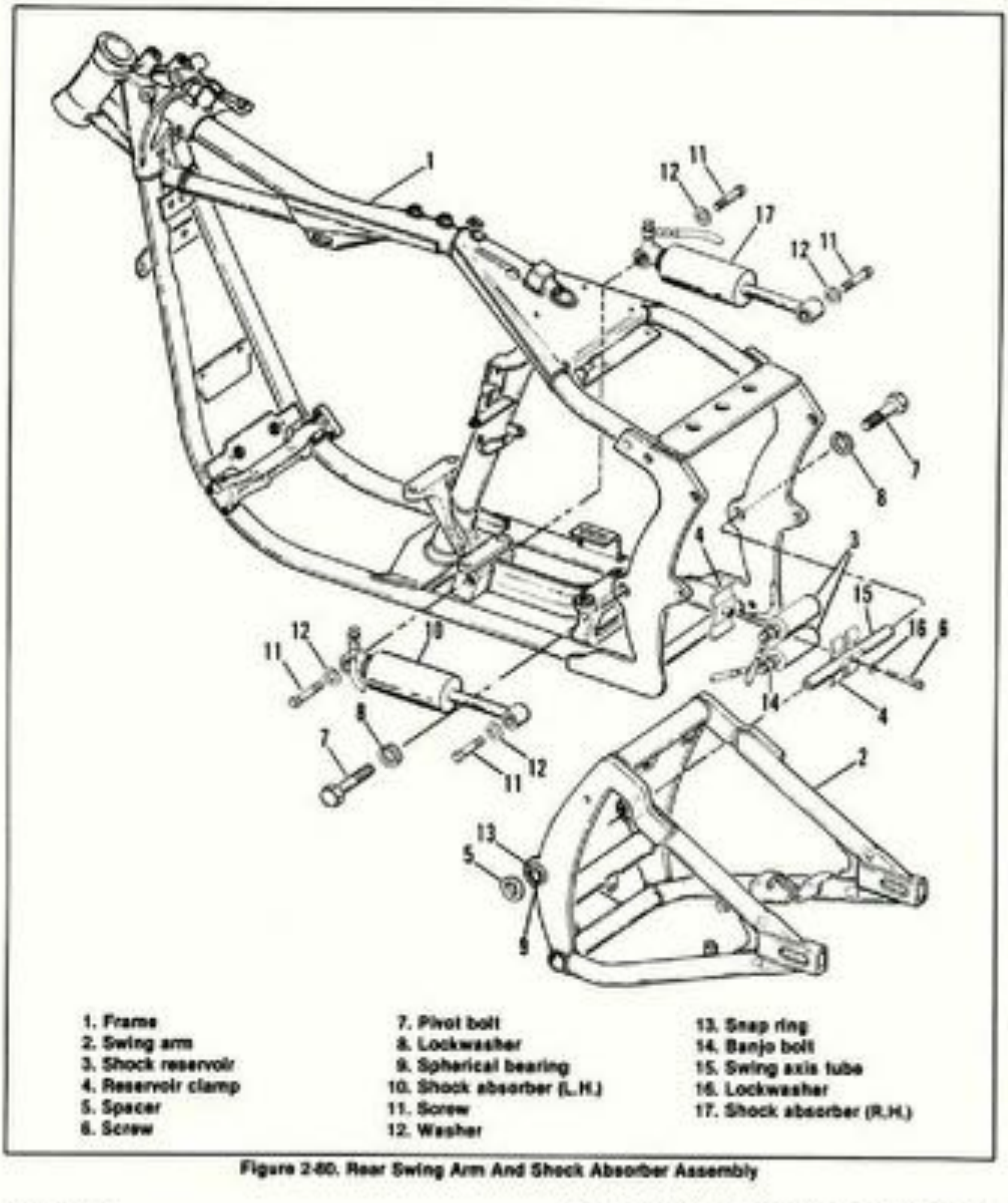


Figure 2-80. Rear Swing Arm And Shock Absorber Assembly

Assembly

1. Place swing arm (2) in the frame so that the bores in the frame align with the bores in the swing arm and spacers (5) are positioned between the swing arm and the frame.

2. Hold swing axis tube (15) in position between the swing arm bores. Place lockwashers (8) onto bolts (7). Insert bolts (7) through the frame bore, through spacer (5), through spherical bearings (9) and thread into each tapped end of swing axis tube (15). Hold the swing axis tube with a wrench at the 2 flats provided and tighten bolts (7) evenly to 120-150 ft-lbs torque.

3. Check for freedom of rotation of the swing arm

around the bearings and that the swing arm and frame side members have not been distorted when the pivot bolts were tightened.

WARNING

Proper tightening of the pivot bolts is important to maintaining swing arm alignment.

REAR SHOCK ABSORBER

Adjustment (Figure 2-81)

The rear shock absorber can be adjusted to three positions for various loads. The springs should be compressed for heavy loads and extended for lighter loads. Use the following procedure to adjust the shocks:

1. Remove the saddlebags on FL models.

2. Turn the shock absorber cam to the described position using SPANNER WRENCH, Part No. HD-94700-52B.

NOTE

Always back off on the cam when releasing the spring tension for lighter adjustments.

Figure 2-81. Adjusting Rear Shock Absorber

FXST SWING ARM SHOCK DAMPENING

The rear shock absorber reservoirs, on the FSXT models, supply make-up fluid and store excess fluid as the shock absorber piston rod extends and retracts. In order to insure a positive head of fluid and avoid cavitation due to the horizontal position of these shock absorbers, approximately 15 psi of nitrogen is sealed into the reservoirs.

CAUTION

No provision is made to check or vary the reservoir pressure nor are reservoirs intended to vary shock absorber preload for various vehicle loading conditions. Instead, these shock absorbers are equipped with variable rate springs that automatically compensate for varying load conditions without any external adjustment.

Removal - FL/FX (Except FXST)

When removing shocks for repair or replacement, remove and install one shock first, then the other. This will eliminate the need for raising the rear end of the motorcycle. If it is necessary to remove both shocks at once, place the motorcycle on a center stand with the rear wheel raised off the ground.

1. Remove the saddlebags on FL models.

2. Remove the upper mounting nut, washer and cover.

3. Remove the bottom mounting bolt and washer. Remove the shock absorber.

Disassembly - FL/FX (Except FXST)

1. See Figure 2-82. Place the shock, cam side down, in SHOCK COMPRESSOR, Part No. HD-97010-52A. Place an extra pressing block in the compressor to help compress the shock.

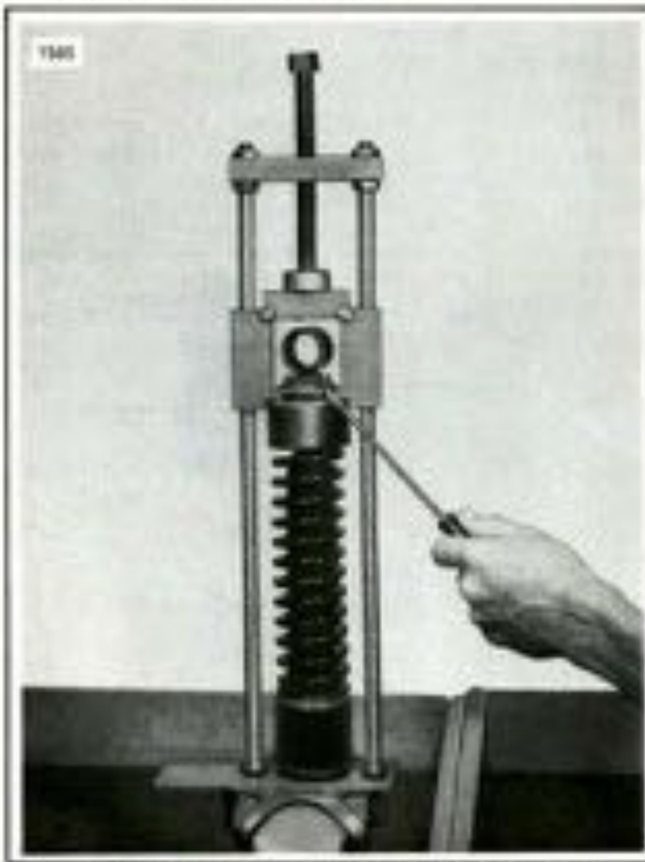


Figure 2-82. Disassembling Shock Absorber

2. Compress the shock and remove the spring retainers (1, Figure 2-83).

3. See Figure 2-83. Remove the shock from the compressor and disassemble the upper washer (2), spring (3) and lower washer (4).

NOTE

On FL models, remove the seal (5) and washer (6).

4. Remove the sleeve (7), cam (8) and cam support (9).

Cleaning, Inspection and Repair

1. Examine the shock (10) for leaks. The unit should not leak and should compress slightly easier than it extends. Compare the action of the shock with a new one to see if it is worn. The shock is a non-repairable item and must be replaced if worn.

2. Clean and examine all other parts and replace any that appear worn or damaged.

Assembly – FL/FX (Except FXST)

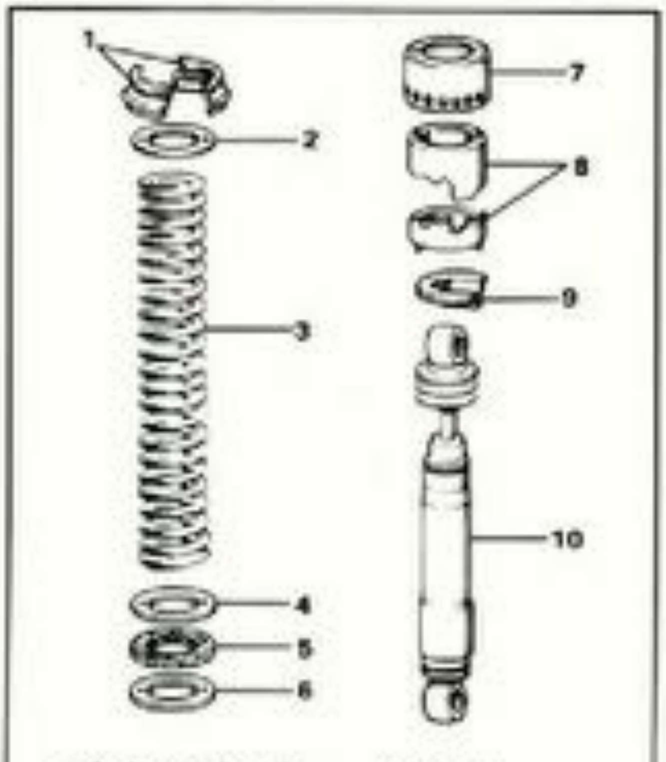
1. See Figure 2-83. Install the cam support (9), cam (8) and sleeve (7). Coat these parts with an all-purpose grease before assembly.

NOTE

On FL models install the washer (6) and seal (5).

2. Install the lower washer (4), spring (3) and upper washer (2).

3. See Figure 2-83. Place the shock, cam side down, in the SHOCK COMPRESSOR. Compress the shock and install the spring retainers (1).



1. Spring retainer (2)
2. Washer
3. Spring
4. Washer
5. Seal (FL only)
6. Washer (FL only)
7. Sleeve
8. Cam
9. Cam support
10. Shock absorber

Figure 2-83. Rear Shock Absorber

Installation – FL/FX (Except FXST)

1. Install the shock and cover on the top mounting bolt and secure with the original lockwasher and nut.

2. Secure the shock to the bottom mounting hole using the original lockwasher and bolt.

3. On FL models, install the saddlebag.

Removal - FXST (Figure 2-80)

The system of shock absorption at the rear wheel on FXT vehicles is not repairable. If the system, shock absorber or reservoir becomes faulty, the two parts must be replaced assembled as a unit. To remove the right or left hand shock absorber system for replacement do the following:

1. Remove the two screws (6) at the swing axis tube. Do not disconnect the hose fittings at either the shock absorber or reservoir. See the following Caution.

CAUTION

The contents of the shock absorber and the reservoir are under pressure. Do not loosen or disconnect hose fittings.

2. Separate the two halves of the connector bracket and remove the two cannisters without detaching hose.

3. Remove screws (11), with washers (12), from each end of shock absorber (10). The shock absorber, reservoir and interconnecting hose are now free to be removed as an assembly. Remove the second shock absorber assembly in the same manner if necessary.

Disassembly

CAUTION

The shock absorber and reservoir are not repairable on FXST vehicles. Do not attempt to disassemble the shock absorber from the reservoir as the contents are under low pressure and replenishment of fluid or pressure can only be accomplished at the factory.

Installation

1. Place the reservoir (3) in clamp (4). Position clamp (4) with reservoirs (3) against the swing axis tube with the holes aligned. Be sure the clamp half with the threaded holes is positioned at the outboard side from the swing axis tube (15). Route the hoses as shown in Figure 2-84.

2. Insert bolts (6) through swing axis tube (15) and thread into the tapped holes in the outer bracket. Tighten bolts (6) thoroughly.

3. Place shock absorber (10) with the dead end in alignment with the bracket at the center of the frame.

4. Coat the thread surface of screw (11) with Loctite LOCK 'N SEAL Adhesive. Place washer (12) on screw (11). Insert screw (11) through the shock absorber dead end and thread into the bracket. Tighten screw (11) to 115-130 ft-lbs torque.

5. Pivot the swing arm in position so that the rod end of shock absorber (10) is in alignment with the threaded bar at the lower front end of the swing arm.

6. Coat the thread surface of screw (11) with Loctite LOCK 'N SEAL Adhesive. Place washer (12) on screw (11). Insert screw (11) through the shock absorber rod end and thread into the tapped end of the threaded bar. Tighten screw (11) to 115-130 ft-lbs torque.

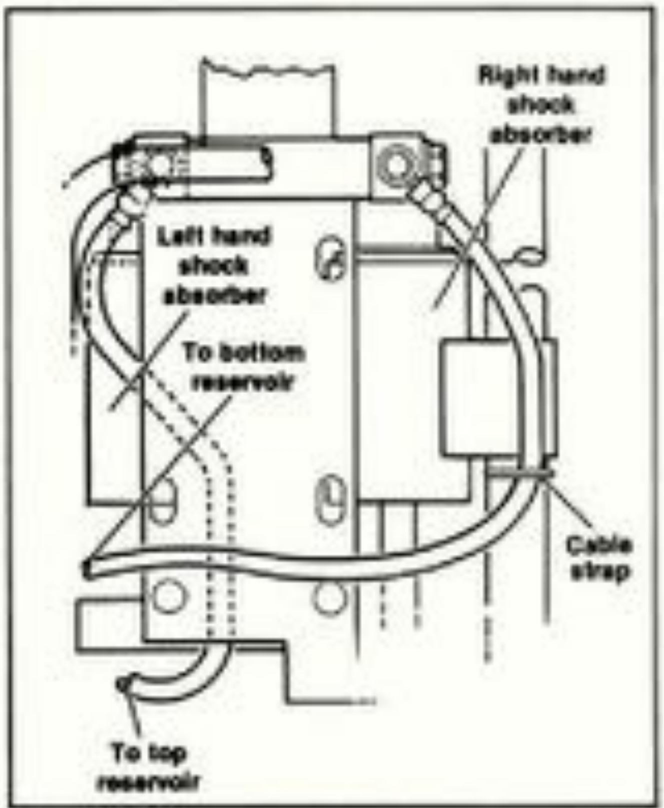


Figure 2-84. Hose Routing Shock Absorber & Reservoir

HANDLEBAR CONTROLS AND INSTRUMENTS

THROTTLE CONTROL (1978½ - 1980) (Figure 2-85)

General

The throttle control must operate freely without binding. With the friction adjusting screw (10) backed off, the carburetor throttle must return to the closed (idle) position.

Disassembly

1. Remove the two screws (1) and separate the upper clamp (2) from the lower clamp (3).

2. Unhook the ferrule (4) and cable (5) from the throttle grip (6) and clamp (3). Disconnect the other end of the cable from the carburetor.

3. Remove the friction spring (7), set screw (8), spring (9) and adjusting screw (10) from the lower clamp (3).

Cleaning, Inspection And Repair

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

2. Replace the cable assembly (5) if it is frayed, kinked or bent.

Assembly

1. Apply a light coating of graphite to the handlebar and inside surface of the clamps (2 and 3).

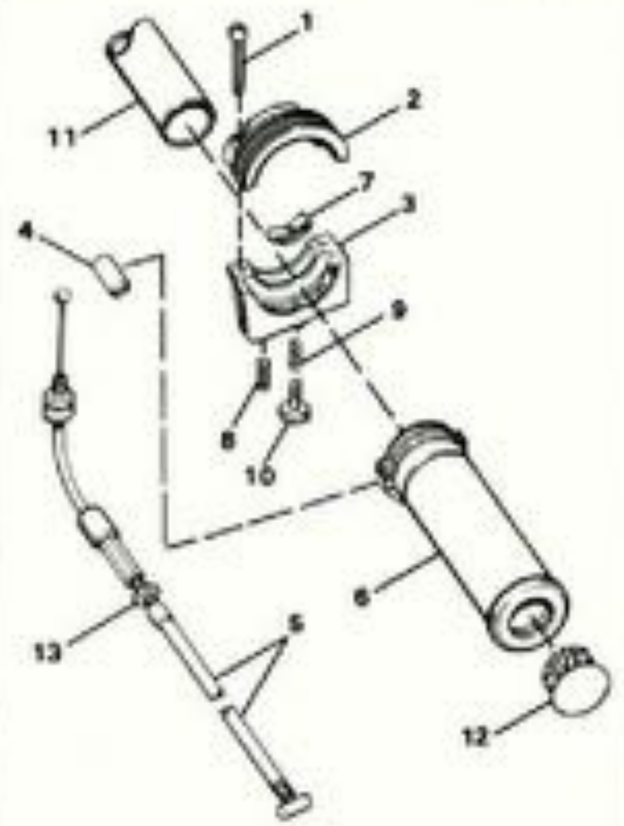
2. Attach the cable assembly (5) to the lower clamp (3). Install the set screw (8), adjusting screw (10), spring (9) and friction spring in the lower clamp. Be sure the hole in the spring (7) engages the set screw.

3. Position the throttle (6) on the handlebar. Place the lower clamp (3) on the throttle. Position the ferrule (4) over the cable ball and seat them in the throttle notch.

4. Fasten the upper clamp (2) to the lower clamp (3) using the screws (1). Tighten the screws to 12-16 ft-lbs torque.

5. **FL Models** — The throttle cable should be routed under the gas tank next to the frame right side and should hang free from the throttle control.

   FX Models — The throttle cable should be routed



1. Screw (2)
2. Upper throttle clamp
3. Lower throttle clamp
4. Ferrule
5. Control cable assembly
6. Throttle grip
7. Friction spring
8. Set screw
9. Spring
10. Adjusting screw
11. Handlebar
12. Grip plug
13. Adjusting nut

Figure 2-85. Handlebar Throttle Control 1978½ - 1980

between the brake hose and handlebar upper clamp, then under the gas tank next to the frame right side.

6. Fasten the cable to the carburetor.

Adjustment

1. When turned by hand and then released, the throttle lever must return throttle grip (6) to the closed or idle position. If throttle grip (6) does not return to idle position freely, back off of adjusting screw (10) until this is accomplished. If the throttle grip turns stiffly, it should be disassembled, cleaned and inspected thoroughly.

WARNING

Do not overtighten the friction screw. Operation with the

friction screw overtightened is not recommended because of the possible hazard involved when the engine will not return to idle position automatically in an emergency.

2. Adjust throttle cable free play by turning adjusting nut (13) to desired position. The cable should not put pressure on the carburetor lever when handlebars are turned to left and right stops.

3. With handlebars in straight ahead position, adjust grip travel limit. To adjust for grip travel limit, turn throttle to open position and adjust set screw (8) with a 2mm (Allen) wrench. The throttle grip should be in fully open position as the carburetor lever reaches fully open position.

CAUTION

This adjustment is necessary to prevent excess stress and potential failure of the throttle cable.

THROTTLE CONTROL (1981 - 1984) (Figure 2-86)

General

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.

NOTE

On 1982 and later models the throttle clamp components (2 and 3) are integrated into the push button switch assembly. All adjustment procedures remain unchanged.

Disassembly

1. Remove the two screws (1) and separate the upper clamp (2) from the lower clamp (3).

2. Unhook the ferrules (4) and cables (5) from the throttle grip (6) and clamp (3). Disconnect the other end of the cables from the carburetor.

3. Remove the friction spring (7), spring (8) and adjusting screw (9) from the lower clamp (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 (5) if frayed, kinked or bent.

Assembly

1. Apply a light coating of graphite to the handlebar and inside surface of the clamps (2 and 3).

2. Attach the cable assemblies (5) to the lower clamp (3). The throttle cable has a 5/16"-18 threaded adjuster and should be assembled to the right side of the throttle grip. The idle cable has a 1/4"-20 threaded adjuster 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 (6) on the handlebar. Place the lower clamp (3) on the throttle. Position the ferrules (4) over the cable balls and seat them in the throttle notches.

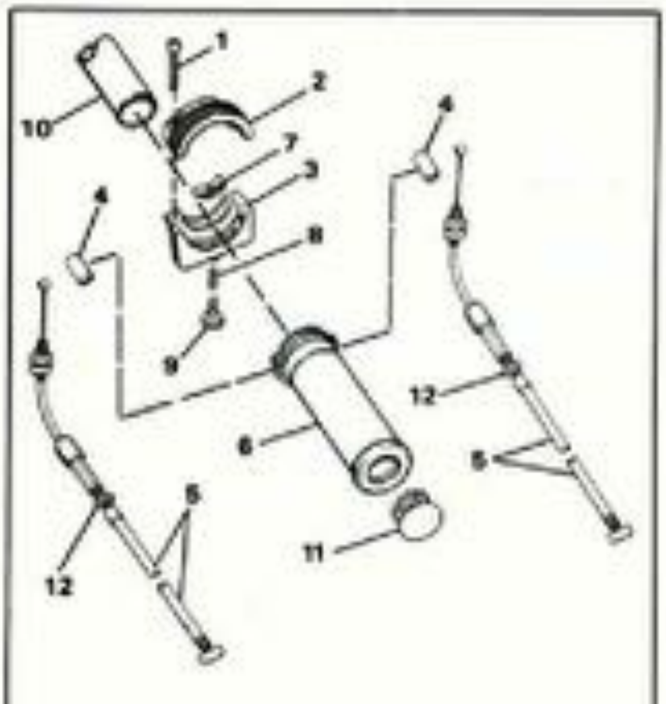
4. Fasten the upper clamp (2) to the lower clamp (3) using the screws (1). Tighten the screws to 12-16 ft-lbs torque.

5. See Figure 2-87. (1981 Models).

FL Models — Route the throttle cables through the clip fastened to the handlebar clamp cover, then under the gas tank next to the frame right side.

FXB Model — Route the throttle cables under the gas tank next to the frame right side.

FXE Model — Route the throttle cables between the speedometer cable and the frame steering



1. Screw (2)
2. Upper throttle clamp
3. Lower throttle clamp
4. Ferrule (2)
5. Control cable assembly (2)
6. Throttle grip
7. Friction spring
8. Spring
9. Adjusting screw
10. Handlebar
11. Grip plug (2)
12. Adjusting nut (2)

Figure 2-86. Handlebar Throttle Control 1981 and Later

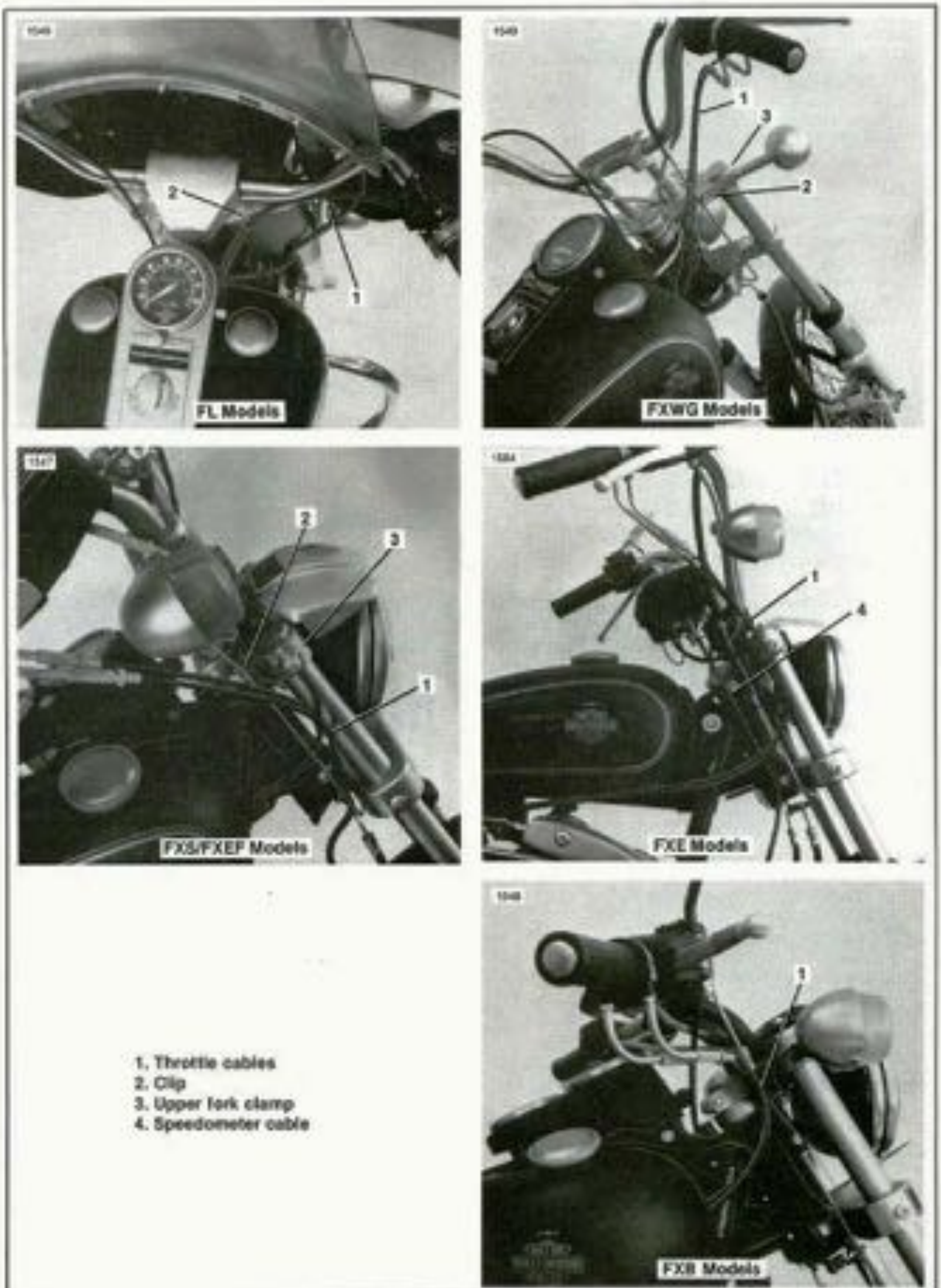


Figure 2-67. Throttle Cable Routing — 1981

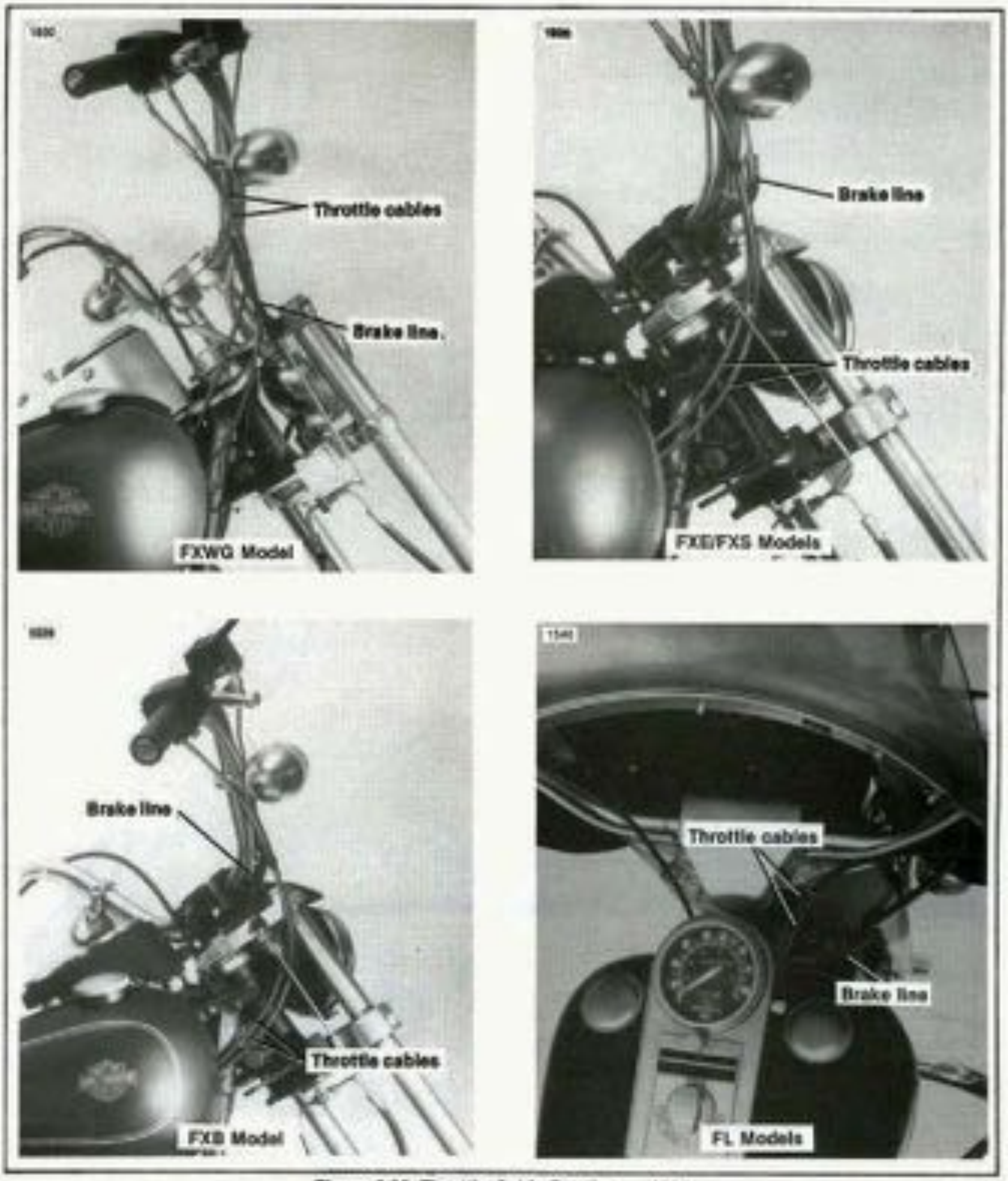


Figure 2-88. Throttle Cable Routing — 1982

head, then underneath the gas tank next to the frame right side.

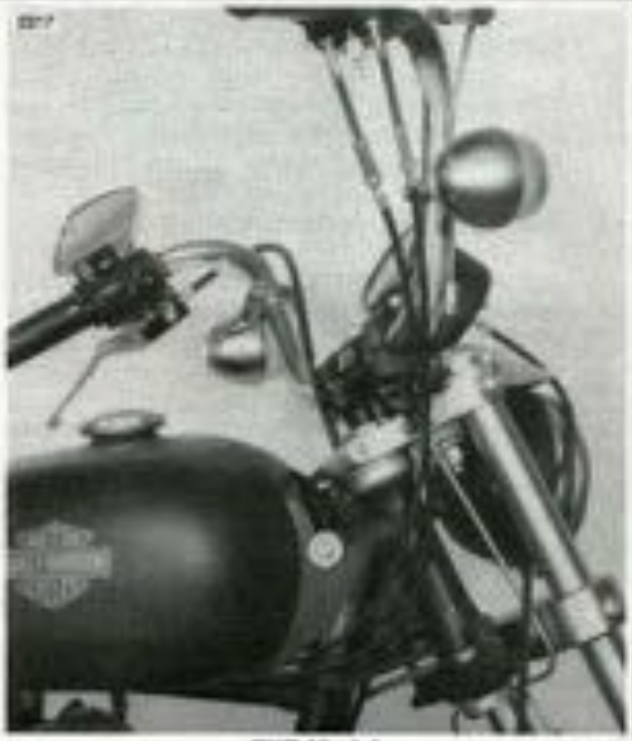
FXS/FXEF Models — Route the throttle cables below the upper fork clamp, between the brake hose and frame steering head, then under the gas tank next to the frame right side.

FXWG Model — Route the throttle cables above upper fork bracket, between the brake hose and frame steering head, then under the gas tank next to the frame right side.

6. See Figure 2-88. (1982 Models).

   FL Models — Secure the clip preassembled to the throttle cables to the right hand handlebar clamp cover mounting screw. Route cables under the gas tank next to the frame right side.

FL Model



FXE Model

FXSB Model

FXWG Model

Figure 2-89. Throttle Cable Routing — 1983

FXE/FXS Models — Route cables behind handlebars and under right side of tank.

FXWG Model — Route cables between brake line and right fork leg, above the upper fork bracket.

FXB Model — Route cables between brake line and right fork leg, and under the right side of the gas tank.

7. See Figure 2-89. 1983 Models

FL Models — Throttle cables must be routed through the cable clamp fastened to the handlebar clamp cover, under the fuel tank next to the frame right side.

FXE Models — Throttle cables must be routed behind the handlebars, and down under right side of fuel tank.

FXSB Models — Throttle cables must be routed between the brake line and right fork leg.

FXWG Model — Throttle cables must be routed between the brake line and steering head below the brake line clamp on the upper fork bracket.

8. See Figure 2-90. (1984 Models).

FL Models — Throttle cables must be routed through the cable clamp fastened to the handlebar clamp cover, under the fuel tank next to the frame right side.

FXE Models — Throttle cables must be routed between the brake line and steering head just below brake line clamp. Direct the cable under the right side of fuel tank to the carburetor.

FXSB Models — Throttle cables must be routed between the brake line and steering head, then between the gas tank and frame to the carburetor.

FXWG/FXST Models — Throttle cables are routed between brake line and steering head, then between the gas tank and frame to the carburetor.

9. See Figure 2-91. 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 threaded adjuster at the throttle end.

Install the throttle cable (2) into the other support sleeve on the carburetor. The throttle cable has a 5/16"-18 threaded adjuster at the throttle end.

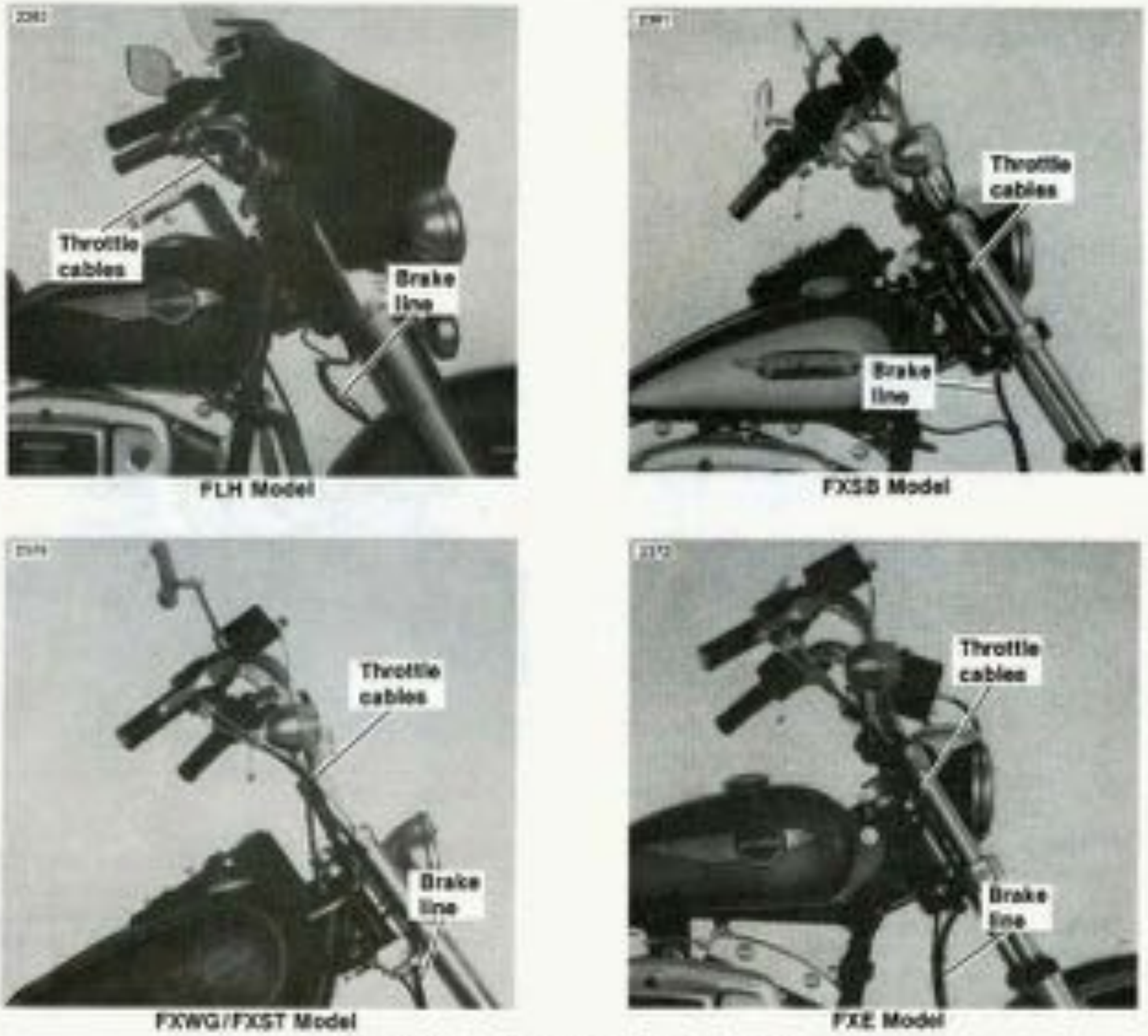
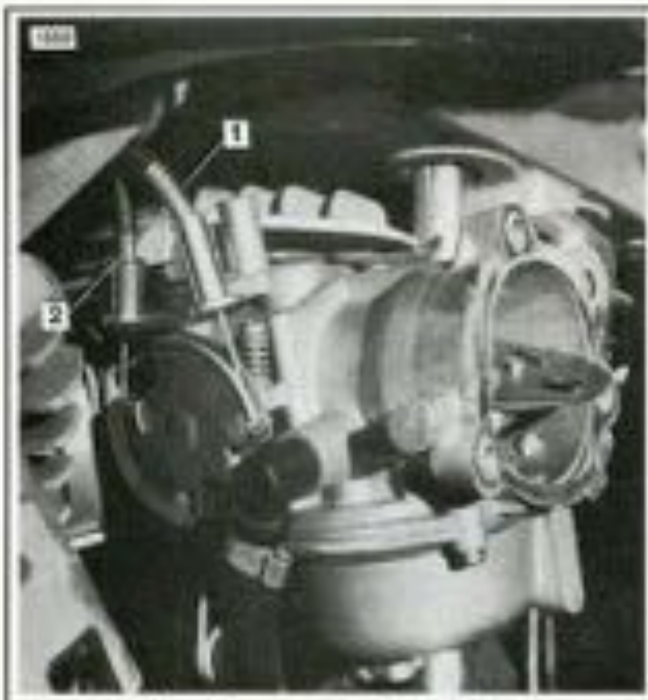


Figure 2-90. Throttle Cable Routing — 1984

Adjustment (Figure 2-92)

CAUTION

This adjustment is necessary to prevent excess stress and potential failure to the throttle cables.



1. Idle cable 2. Throttle cable

Figure 2-91. Cable Installation

NOTE

The throttle cable has a 5/16"-18 threaded adjuster and is assembled to the right hand anchor slot at the top of the throttle grip. The idle cable has a 1/4"-20 threaded adjuster and is assembled to the left hand anchor slot at the top of the throttle grip.

1. Turn the cable adjusters and locknuts clockwise as far as they will go. Both cables should have zero adjustment to start this procedure.

2. Point the front wheel straight ahead. Turn the throttle grip so the throttle is wide open (fully counterclockwise) and hold it there. Now turn the throttle cable adjuster (1) counterclockwise until the throttle cam stop (3) just touches the stop boss on the carburetor. Tighten the locknut (2) against the throttle cable adjuster and release the throttle.

3. Turn the front wheel full right. Turn the idle cable adjuster (4) counterclockwise until the cable housing (6) just touches the spring (7) in the cable support sleeve. Work the throttle grip to make sure throttle cable returns to idle position when released. If the cable does not return to idle, turn adjuster (4) clockwise to achieve the correct adjustment. Tighten the locknut (5) against the idle cable adjuster.

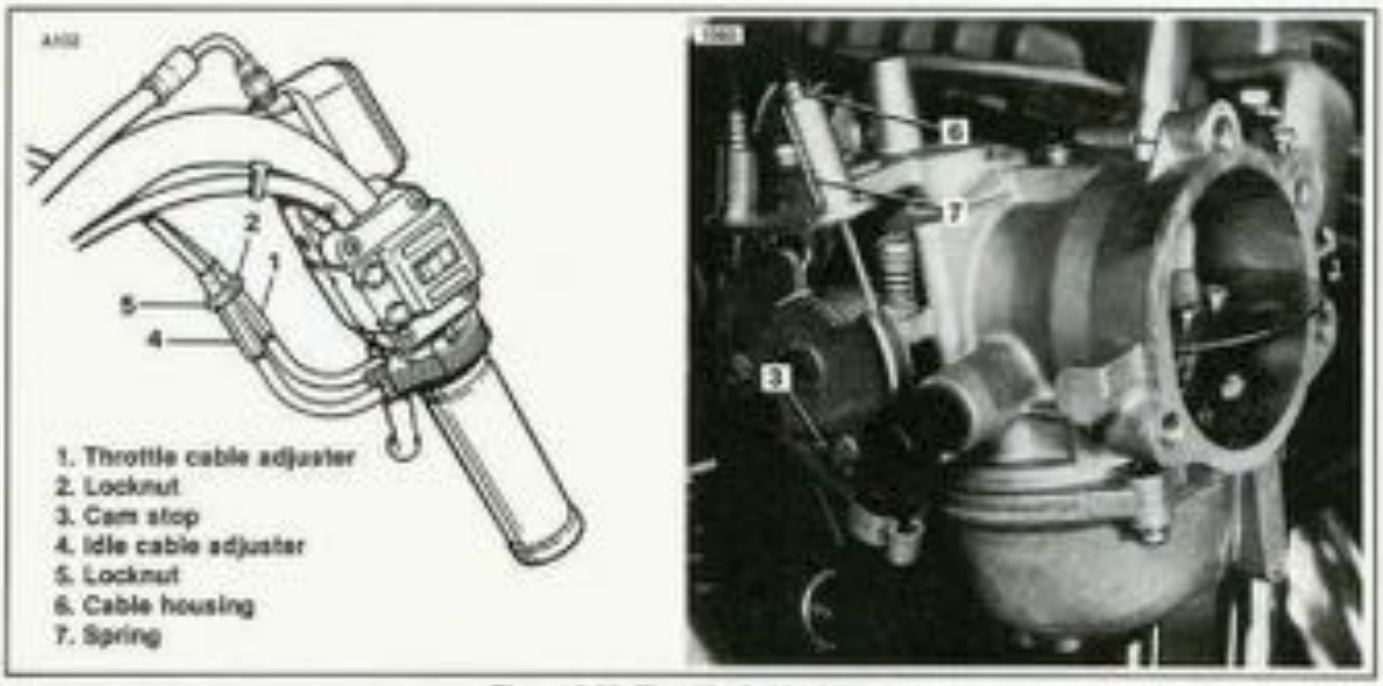


Figure 2-92. Throttle Cable Adjustment

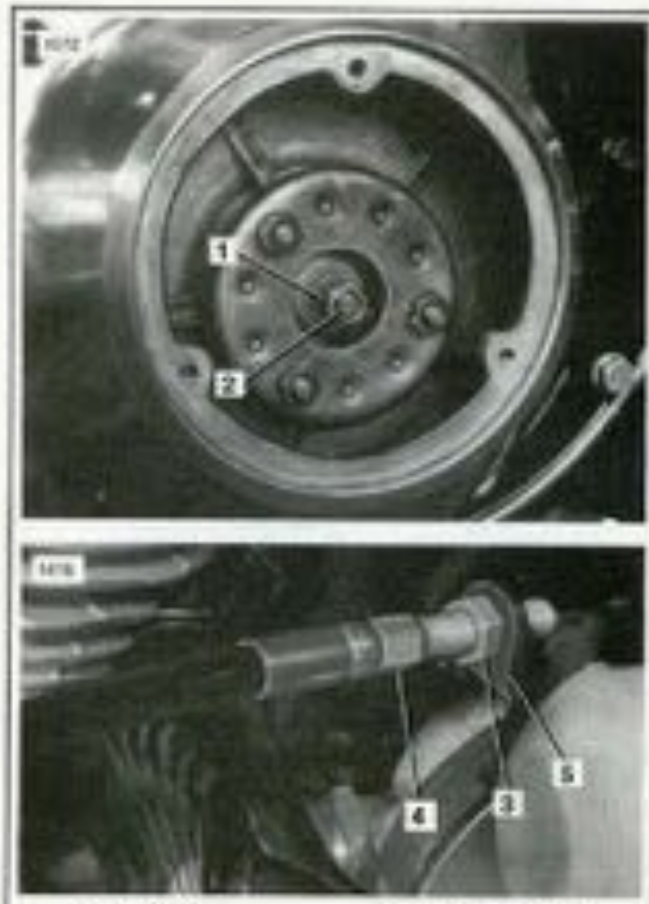
CLUTCH HAND CONTROL

Removal

1. Remove the battery and battery carrier.
2. See Figure 2-93. Remove the clutch cover and loosen the locknut (1). Turn the adjusting screw (2) outward until the clutch cable is slack.
3. Loosen the locknut (3) and turn the cable housing adjuster (4) out of the bracket (5). Remove the cable from the clutch release lever.
4. See Figure 2-94. Remove the clutch cable and anchor pin from the hand lever.

Installation

1. See Figure 2-94. Install the clutch cable and anchor pin to the clutch hand lever. The slot in the pin must face in towards the hand lever.
2. See Figure 2-95. Route the cable along the left side down tube and through the clip as shown. On FL models, cable is also routed through clip on handlebar clamp cover.
3. See Figure 2-93. Turn the cable housing adjuster (4) into the bracket and fasten the cable ferrule into the clutch release lever.



1. Locknut
2. Adjusting screw
3. Locknut
4. Cable housing adjuster
5. Bracket

Figure 2-93. Clutch Cable Replacement

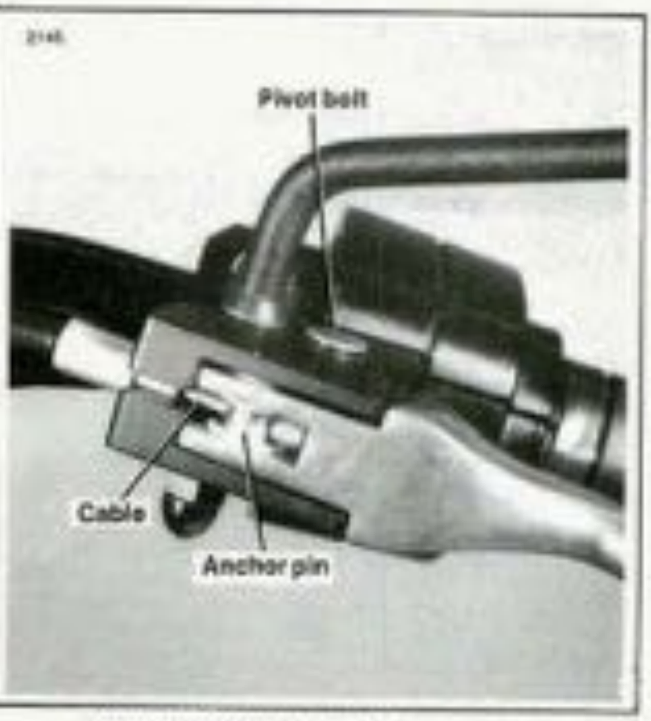


Figure 2-94. Clutch Cable Installation

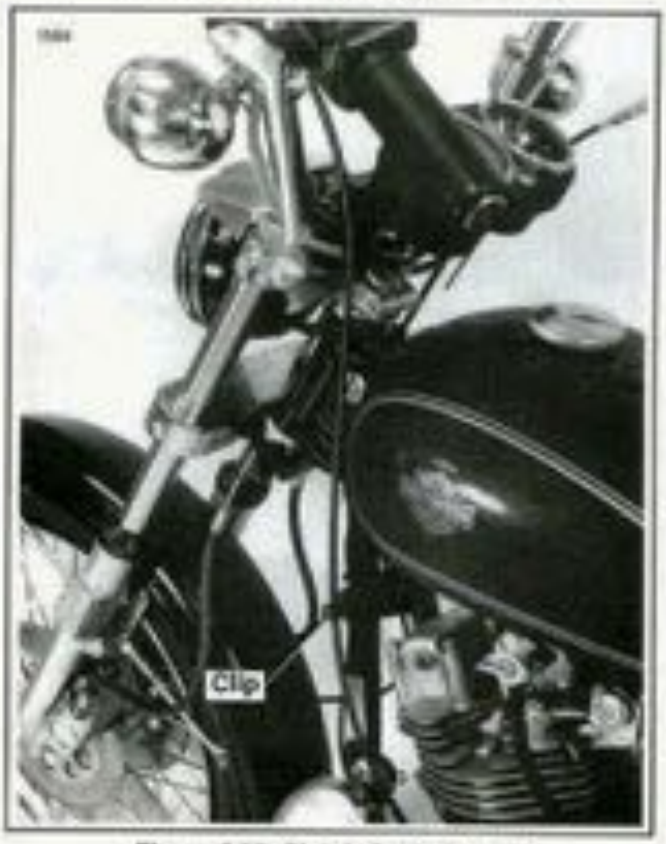


Figure 2-95. Clutch Cable Routing

1. Odometer knob and screw
2. Choke knob and locknut
3. Nut

Figure 2-96. Speedometer — FL/FXWG/FXDG/FXST

1. Mounting screws

Figure 2-97. Instrument Mounting — FXB/FXSB/FXS/FXEF

4. Adjust the clutch and cable as described in Section 6 under CLUTCH.

5. Install the battery carrier and battery.

6. Turn the handlebars full left and right to make sure the clutch cable does not bind or cause steering interference.

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.

1. Screw
2. Switch housing cover
3. Screw
4. Rocker switch (Hi-Lo)
5. Rocker switch (Run-Off)
6. Screw
7. Retainer
8. Pushbutton switch
9. Rubber cap
10. Stop light switch
11. Washer
12. Button cap

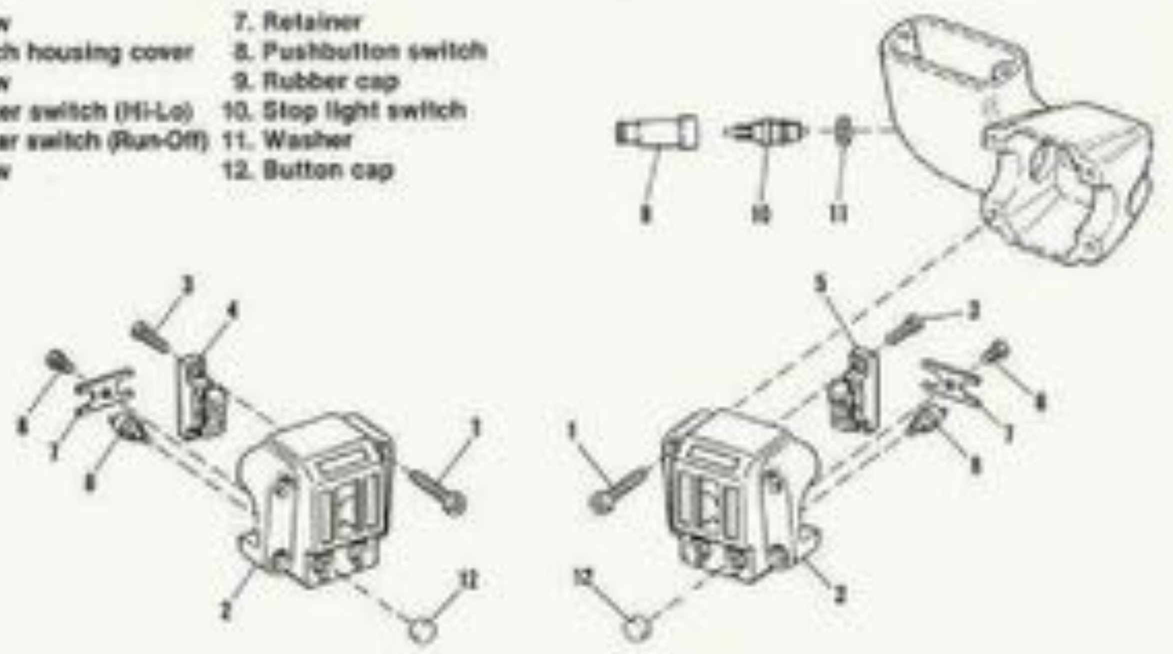


Figure 2-98. Handlebar Switch Assemblies — 1981 and Earlier

Lubricate the cables with graphite grease every 1,000 miles.

Replacement

Use the following procedures to replace an instrument or instrument bulb .

FL/FXWG/FLHS/FXDG

1. See Figure 2-96. Remove the odometer knob and screw (1).
2. Unscrew the choke knob and locknut (2). Remove the housing nut (3) and pull the housing straight up to remove.
3. Replace any burnt out bulb by pulling the bulb housing from the instrument.
4. Replace the instrument by disconnecting the cable and mounting hardware.

FXB/FXSB/FXEF/FXS

1. See Figure 2-97. Remove the three mounting screws (1) and lift the instrument housing straight up.
2. Replace any burnt out bulb by pulling the bulb housing from the instrument.
3. Replace the instrument by disconnecting the cable and mounting hardware.

FXE

The instrument (s) are mounted on the handlebars. Replacing bulbs or instruments is the same as Steps 2-3 under FXB/FXSB/FXEF/FXS.

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.

Replacing Switches (1981 and Earlier) (Figure 2-98)

1. Remove the four screws (1) from the switch assembly and remove the cover (2).
2. To replace the rocker switches (4 and 5), remove the screws (3).
3. To replace the pushbutton switches (8) remove the screws (6) and retainer (7).
4. Replace the switches and install the screws (6), retainer (7), screws (3), cover (2) and screws (1).

Replacing Switches - 1982 and later (Figure 2-99)

1. Remove screw (1) from switch housing (2).
2. To replace switch (3) remove screw (4).
3. Replace switch (3), screw (4) and screws (1).
4. Tighten screws (1) to 18-24 in-lbs torque.

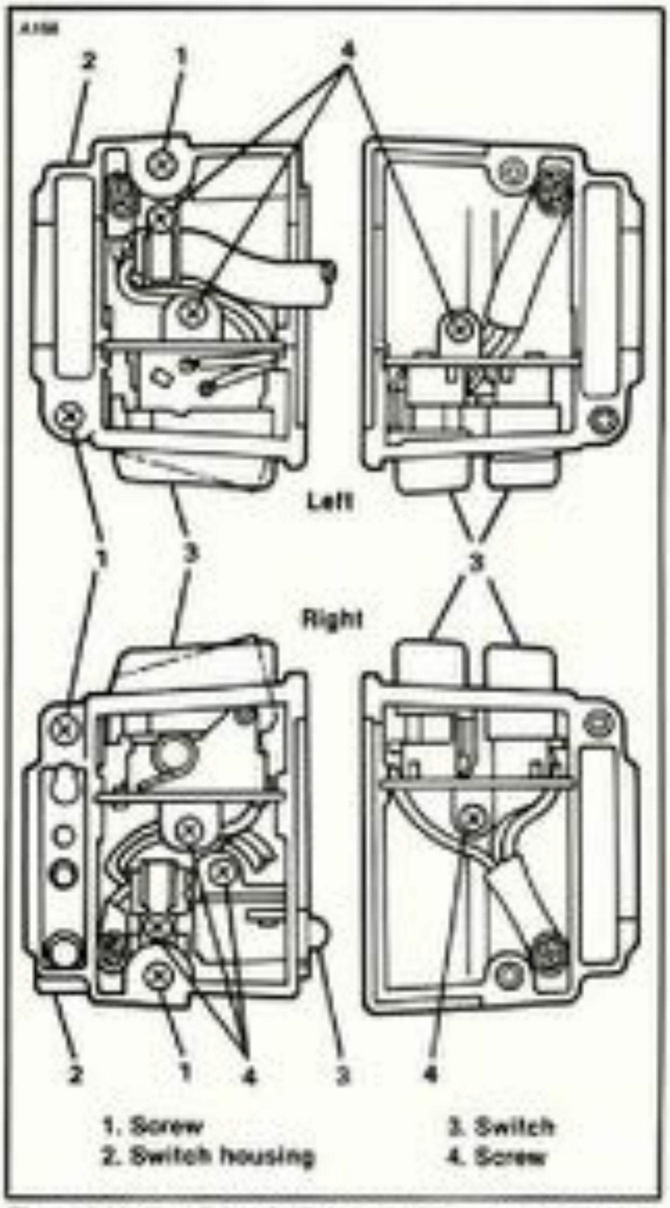


Figure 2-99. Handlebar Switch Assembly — 1982 and Later

SEATS

SOLO SADDLE (Figure 2-100)

General

Two seat post spring arrangements are available. The standard spring set is suitable for a rider weight up to 220 lbs. A heavy spring set for weights above 220 lbs. includes heavier springs and guide collars. The heavy set is identified by a D stamped on the upper end of the seat post plunger.

Disassembly

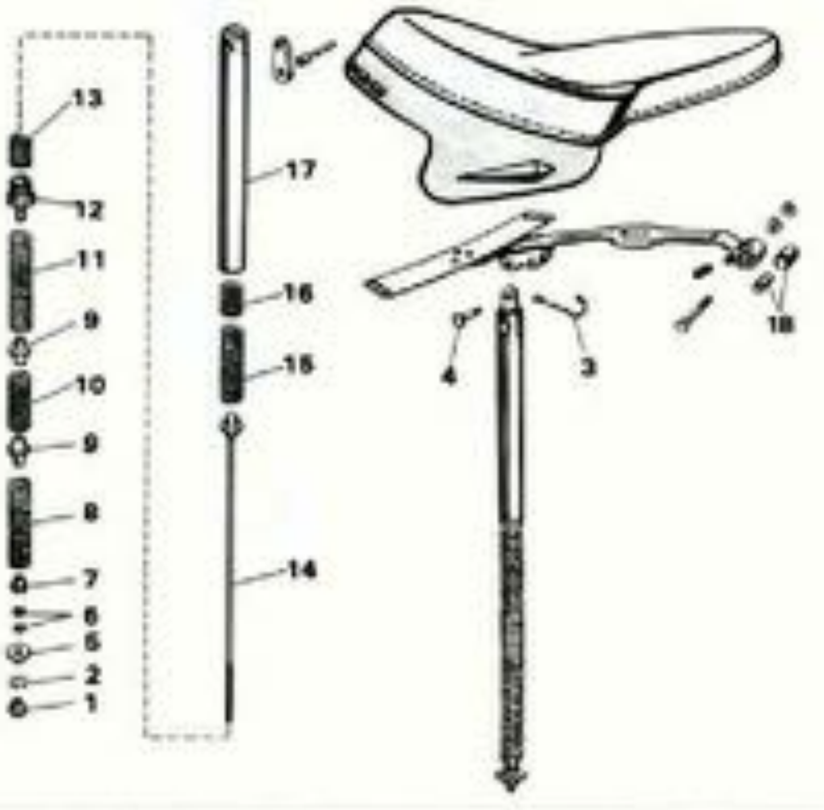
1. Remove the locknut (1) and washer (2) from the frame seat tube bottom.
2. Pull up sharply on the rear of the seat to break the rod nut (5) loose.
3. Unsnap the clevis pin spring (3) and remove the clevis pin (4).
4. Tip the seat forward and lift out the seat post assembly.

Cleaning, Inspection And Repair

1. Replace any broken parts.
2. Check the spring lengths against the measurements given in Figure 2-100. Replace any springs that are worn or stretched.
3. Replace the seat bushings (18) if worn.

Assembly

1. Coat all the parts with a multi-purpose grease.
2. If the seat post was dissassembled, insert the two springs (16, 15) and rod (14) into the seat post (17).
3. Install the springs (13), plunger (12), springs (11, 10, 8) and guides (9).
4. Install the adjusting nut (7). Tighten the nut so the visible spring length equals 11 in. for standard springs or 10-1/2 in. for D heavy springs. Turn one locknut (6) against the adjusting nut and tighten securely. Now install the second locknut, but do not tighten it.
5. Position the rod nut (5) so bottom end of rod extends through the nut exactly 3/4 in. Tighten the second locknut against the rod nut.
6. Place the assembly into the frame seat post. Secure it at the bottom with the washer (2) and locknut (1).



1. Rod locknut
2. Rod locknut washer
3. Clevis pin spring
4. Clevis pin
5. Seat post rod nut
6. Locknut (2)
7. Spring adjusting nut
8. Cushion spring (5-1/8 in.)
9. Guide collar (2)
10. Cushion spring (2-13/16 in.)
11. Cushion spring (5-1/8 in.)
12. Plunger locknut
13. Auxiliary spring (2-3/4 in.)
14. Seat post rod
15. Auxiliary spring (2-3/4 in.)
16. Auxiliary spring (2-3/4 in.)
17. Seat post plunger
18. Seat bar bushings

Figure 2-100. Seat Post

7. Install the clevis pin (4) and spring clip (3).

COMFORT FLEX SEAT

General

The Comfort Flex seat is adjustable for seat spring firmness and seat spring damping. In addition, the seat can be raised for access to the oil tank and battery located under the seat.

Adjustments

1. On 1978½-1980 models see Figure 2-101. Remove the seat post pin (4). Lift the seat up towards the

CAUTION

Do not leave lower shaft (9) in the rear position shown when riding or friction damper (8) will contact the suspension structure. Always place shaft (9) in forward position of slot (10) when lowering seat for riding.

1. Spring adjusting cross rod
2. Spring adjusting slots
3. Seat springs
4. Seat post pin (1980 and earlier)
5. Friction washer
6. Locking ring
7. Castellated nut
8. Friction damper
9. Cross shaft
10. Slot

Figure 2-101. Seat Adjustments

1. Release lever
2. Cross shaft
3. Slot
4. Adjusting rod
5. Bracket

Figure 2-102. Raising the Seat — 1981 and Later

rear and place the cross shaft (9) into the rear of slot (10). The adjusting rod should be in the second slot as shown.

On 1981 and later models see Figure 2-102. Pull the release lever (1) back and lift the seat up and to the rear. Place the cross shaft (2) into the rear of the slot (3). The adjusting rod (4) should be in the second notch as shown.

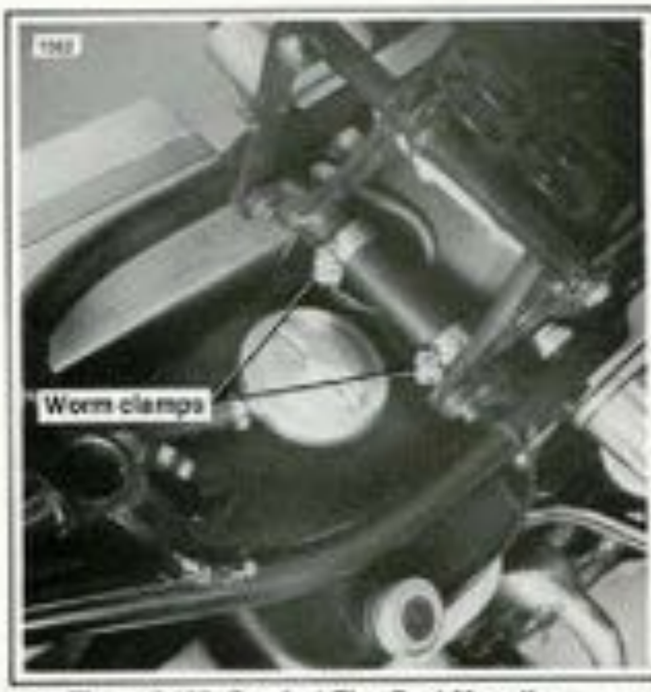


Figure 2-103. Comfort Flex Seat Mounting — 1978½ to 1980

2. All models, see Figure 2-101. The seat may be adjusted to five spring positions to accommodate various rider weight. Move the adjusting rod (1) into the forward adjusting slots for a firmer ride — suitable for heavier rider/passenger combinations. Move the adjusting rod (1) rearward for a softer ride suitable for lighter rider/passenger combinations. The most rearward slot allows the seat to be used in the lowest position without any spring action.

3. To adjust the damper, remove the lock ring (8). Turn the nut (7) clockwise to increase the damping effect, counterclockwise to decrease the damping effect. Replace the lock ring.

NOTE

Nut (7) should be set finger tight initially and tightened as necessary to prevent any objectionable spring rebounding.

4. See Figure 2-101. After the seat is adjusted, place the cross shaft (9) into the forward position of the slot (10) and lower the seat.

   On 1978½-1980 models, insert the pin (4, figure 2-101) into the seat post hole.

   See Figure 2-102. On 1981 models, make sure the release mechanism engages on the bracket (5).

Removal

1. Raise the seat and remove the four nuts that secure the seat to the suspension assembly. Remove the spacer from each seat stud.

2. 1978½-1980 models see Figure 2-103. Remove the two worm clamps that secure the suspension assembly to the frame cross tube.

Figure 2-104. Comfort Flex Seat Mounting — 1981 and Later

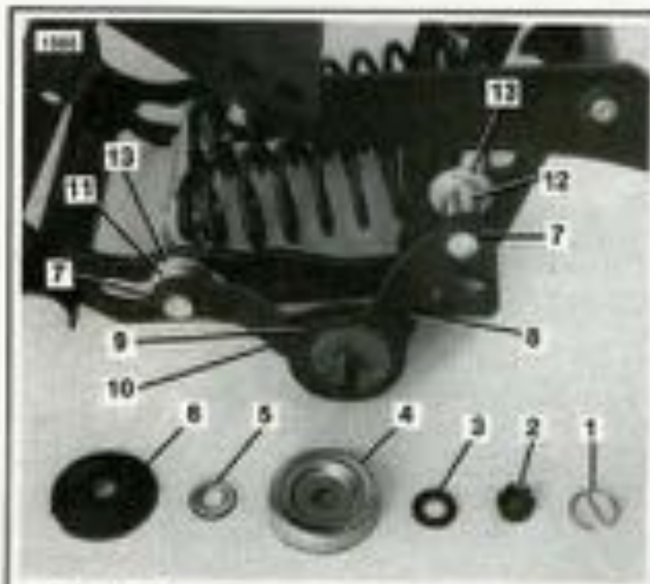
1981 and later models see Figure 2-104. Remove the two bolts and mounting clamp that secure the suspension assembly to the frame cross member.

3. See Figure 2-105. Remove the two socket head screws and washers from the suspension and rear fender. Remove the suspension assembly.

Disassembly — 1978½ to 1980

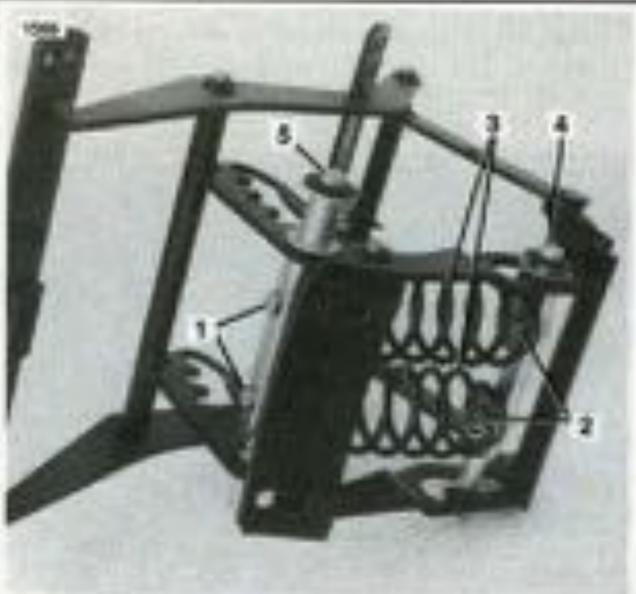
1. See Figure 2-106. Remove the lock ring (1), nut (2), washer (3), cup (4), fiber washer (5) and friction disc (6).
2. Pry off the two speed nuts (7), outer damper arm (8) and large fiber washer (9). Remove the inner damper arm (10), small spacer (11), large spacer (12) and washers (13).
3. See Figure 2-107. Remove the bolts (1) and retainers (2) from each spring end.
4. Remove the cross shaft (4) and adjusting rod (5).
5. See Figure 2-108. Remove the speed nuts (1), washers (2) and spacer (3) from the cross shaft and adjusting rod only if they are damaged and have to be replaced. Reassemble as shown.
6. See Figure 2-109. The frame should only be disassembled if it is badly bent or cracked. Remove the speed nuts and pull the shafts from the frame.

Figure 2-105. Comfort Flex Seat Rear Mounting Screws



1. Lock ring
2. Nut
3. Washer
4. Cup
5. Small fiber washer
6. Friction disc
7. Speed nut
8. Outer damper arm
9. Large fiber washer
10. Inner damper arm
11. Small spacer
12. Large spacer
13. Washer

Figure 2-106. Friction Damper — 1978½ - 1980



1. Bolt
2. Retainer
3. Spring
4. Cross shaft
5. Adjusting rod

Figure 2-107. Spring Assembly

Assembly — 1978½ to 1980

CAUTION

When reassembling the suspension assembly, use new speed nuts. Speed nuts lose some of their retention power when removed.

1. See Figure 2-108. Reassemble the frame members as shown if disassembled.
2. See Figure 2-110. Insert the adjusting rod through the right side of the five-slot brackets. Position the

rod so the step faces towards the front of the suspension assembly as shown.

Fasten the two springs to the rod using two retainers and bolts. Tighten bolts securely.

3. See Figure 2-107. Insert the cross shaft through the right side of front slots with the step facing towards the springs. Fasten the shaft to the springs using the other two retainers and bolts. Tighten bolts securely.

4. See Figure 2-108. Place a washer (13) on the cross shaft and on the adjusting rod. Insert the small spacer (11) on the cross shaft and the large spacer (12) on the adjusting rod.

   Place the inner damper arm (10) on the cross shaft. Secure it with a new speed nut. Install the large fiber washer (4) on the inner damper arm (12).

5. Place the outer damper arm (8) on the adjusting shaft and secure it with a new speed nut.

6. Install the friction disc (6), small fiber washer (5), cup (4), washer (3), nut (2) and lock ring (1).

Disassembly — 1981 and Later

1. See Figure 2-111. Remove the lock ring (1), nut (2), washer (3), cup (4), small fiber washer (5) and friction disc.

2. Pry off the speed nut (7), outer damper arm (8) and large fiber washer (9). Remove the spacer (10) and washer (11) from the adjusting rod. Remove the inner damper arm (12) and two washers (11) from the cross shaft.

3. See Figure 2-112. Remove the speed nuts (1) from the adjusting rod and cross shaft. Remove the sliding brace (2), long spacer (3), short spacer (4) and washer (5).

4. Move the adjusting rod and cross shaft away from each other and remove the springs.

5. See Figure 2-112. The frame should only be disassembled if it is badly bent or cracked. Remove the speed nuts and pull the shafts from the frame.

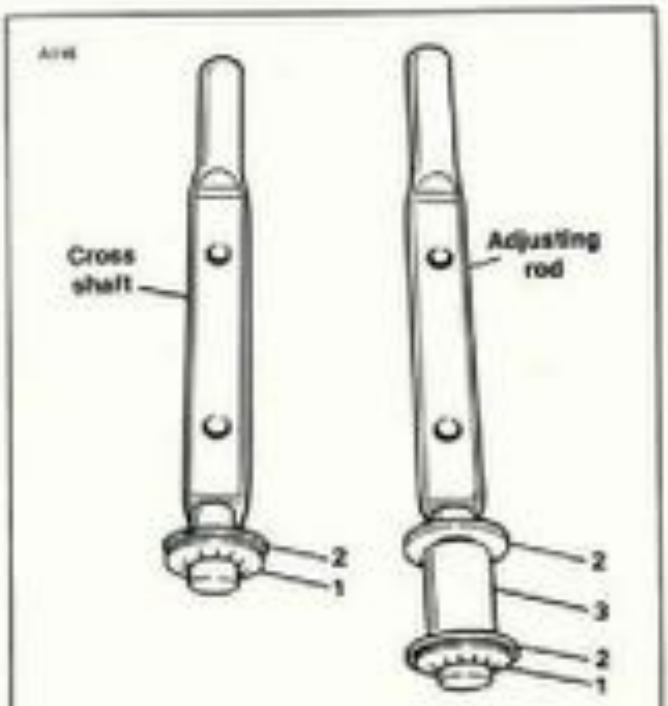


Figure 2-108. Cross Shaft and Adjusting Rod

Figure 2-109. Suspension Frame — 1978½ to 1980.

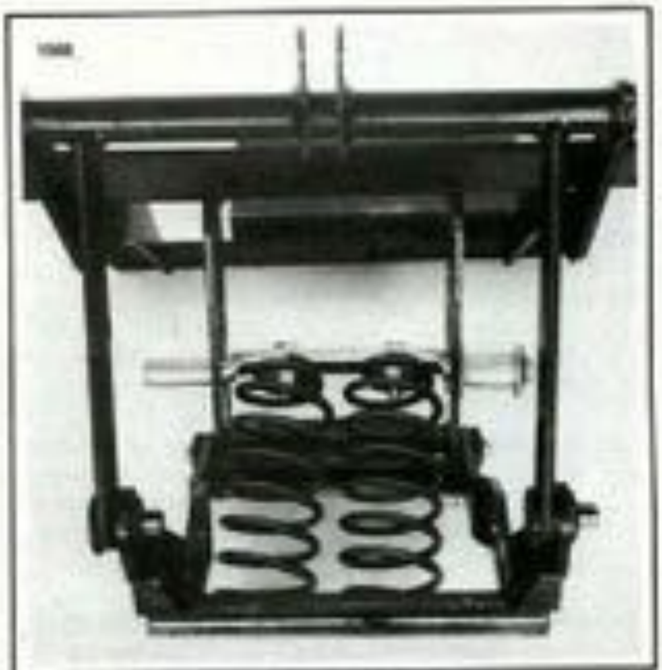


Figure 2-110. Installing Adjusting Rod and Springs 1978½ to 1980

Assembly — 1981 and Later

CAUTION

When reassembling the suspension assembly, use new speed nuts. Speed nuts lose some of their retention power when removed.

1. See Figure 2-113. Reassemble the frame members as shown if disassembled.

2. See Figure 2-112. Place the springs into the retainers. Place the washer (5) and short spacer (4) on the adjusting rod. Place the long spacer (3) on the cross shaft. Install the sliding brace (2) tight against the end of flat on cross shaft and secure it with two speed nuts at each end.

3. See Figure 2-111. Install two of the large washers (11) and inner damper arm (12) on the cross shaft and secure them with a speed nut. Tighten speed nut until there is .020-.050 in. between speed nut and inner damper (12).

4. Install the large fiber washer (9) onto the inner damper arm. Install the other large washer (11), spacer (10) and outer damper arm (8) on the adjusting rod and secure them with a speed nut. Tighten speed nut until there is .050-.070 in. between speed nut and outer damper arm.

NOTE

Speed nuts on adjusting rod and cross shaft must be butted against a secure surface to keep them positioned properly while installing speed nuts onto the opposite end.

5. Install the friction disc (6), small fiber washer (5), cup (4), washer (3), nut (2) and lock ring (1).

Installation

1978½-1980

Before installing the seat and suspension, check and adjust the seat post. Seat post height must be 3 ± 1/16 in. from seat post frame to centerline of post pin hole. See Figure 2-114. Adjust as follows.

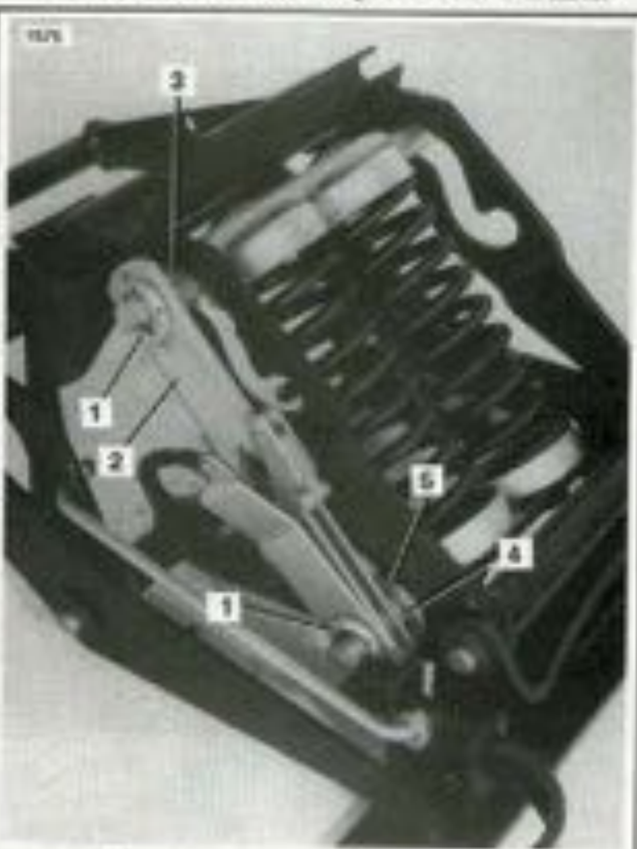
1. Remove the nut and washer (1) from the seat post bottom. Remove the seat post from the frame.

2. Adjust the rod nut (2) to obtain the 1/2 in. dimension shown and tighten the locknut (3) against the rod nut. With the rod nut 1/2 in. from seat post end, the seat post height described above should be obtained.

3. Loosen the locknut (4) and adjusting nut (5) until they bottom on the locknut (3) or until the 1-5/16 in. dimension shown is obtained. This is the correct adjustment for average weight rider combinations.

1. Locking ring
2. Nut
3. Washer
4. Cup
5. Small fiber washer
6. Friction discs
7. Speed nut
8. Outer damper arm
9. Large fiber washer
10. Spacer
11. Washer
12. Inner damper arm

Figure 2-111. Friction Damper — 1981 and Later



1. Speed nut
2. Sliding brace
3. Long spacer
4. Short spacer
5. Washer

Figure 2-112. Suspension Assembly

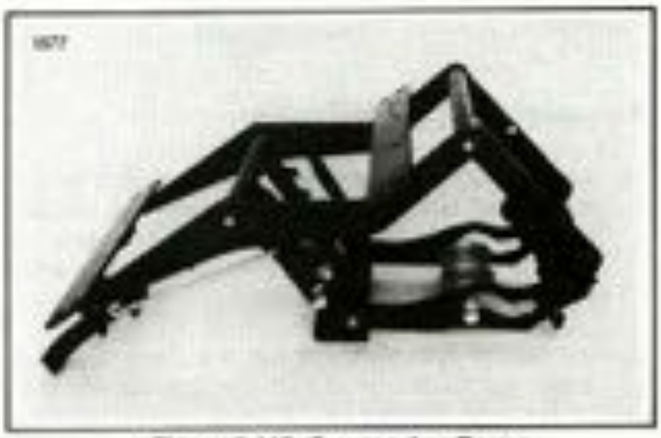


Figure 2-113. Suspension Frame

For heavier rider combinations, adjust the adjusting nut (5) to achieve the 2-1/16 in. dimension shown.

4. Coat the seat post with a multi-purpose grease. Install the seat post, washer and clamp nut (1).

ALL MODELS

1. See Figure 2-105. Place the suspension assembly on the motorcycle. Fasten it to the rear fender using the original socket head screws.

2. 1978½-1980 models see Figure 2-103. Fasten the suspension assembly to the frame cross tube using two worm clamps.

WARNING

Position the clamps so screws face to the front and upwards as shown in Figure 2-90. Improper positioning could cause the clamps to contact the support brackets and break.

1981 and later models see Figure 2-104. Fasten the suspension assembly to the frame cross tube using the original mounting bracket and bolts.

3. See Figure 2-115. Install the seat on the suspension assembly with the studs positioned in the rear set of mounting holes. Install the spacers between the seat and suspension assembly. Install the short spacers at the rear of the seat and the long spacers at the front.

4. Adjust the seat springs and damper as described under ADJUSTMENTS.

NOTE

Seat should have adequate clearance with gas tank (5/16 in. min), fender, saddlebags and Tour Pak. Additional clearance can be obtained by adding washers between the seat and suspension assembly or at the fender/suspension mounting location. A heavy duty spring kit is available — Part No. 51771-29.

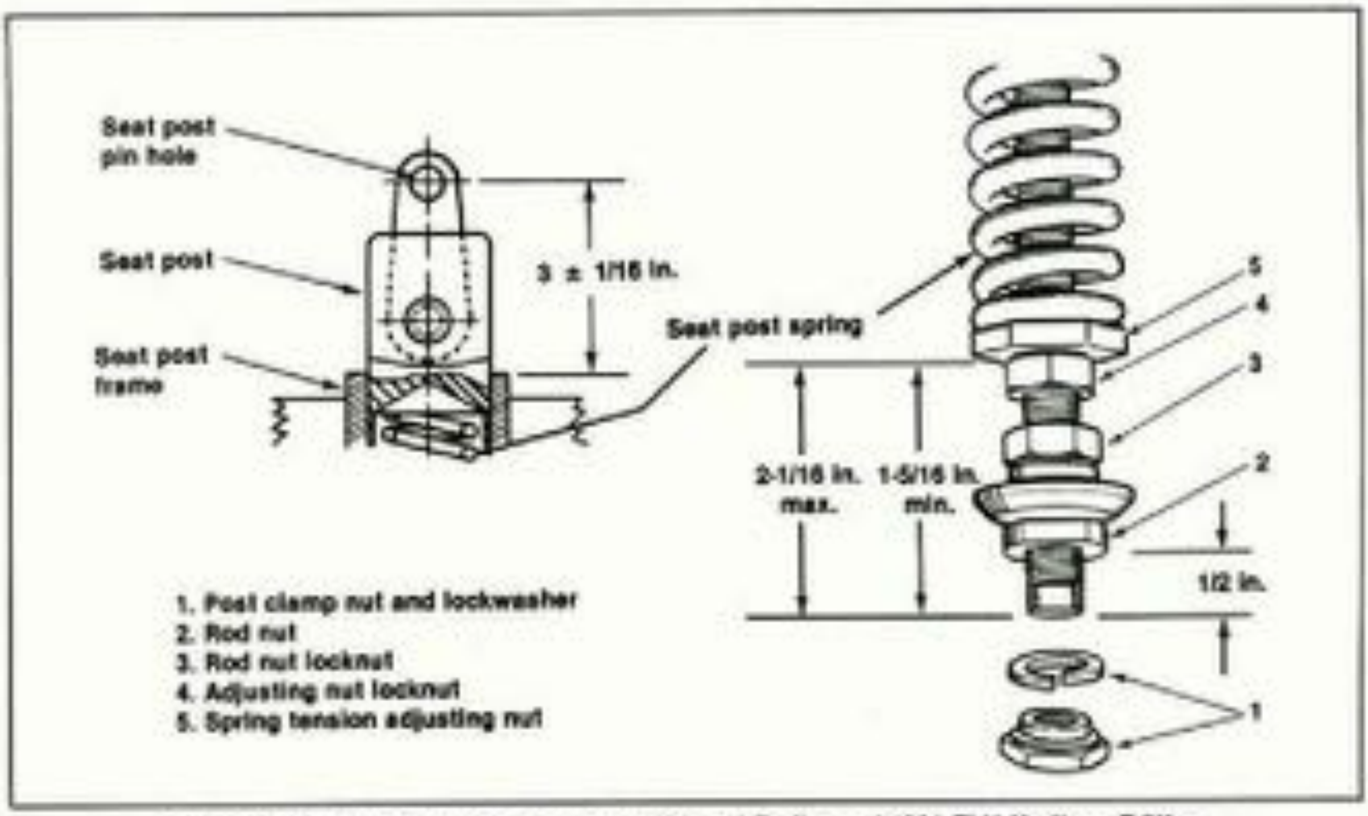


Figure 2-114. Seat Post Adjustment — 1980 and Earlier and 1981 FLH Heritage Edition

Figure 2-115. Seat Mounting Holes

FRAME MOUNTED SEAT

Removal And Installation

1. On FL models, the frame mounted seat is held in place by two bolts and lockwashers located underneath the rear of the seat. On FX models, the seat is held in place by a screw and lockwasher located at the rear of the seat.

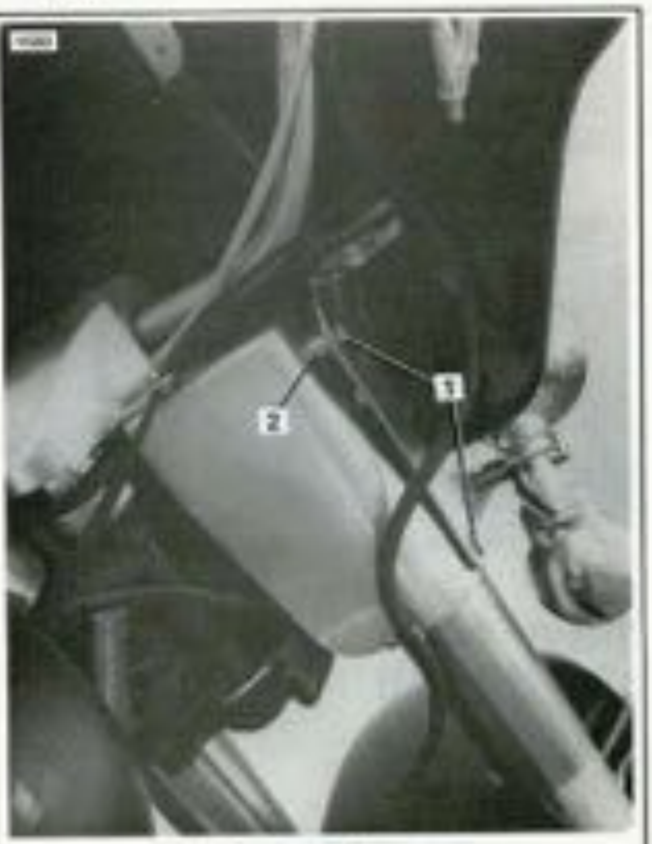
2. To remove the seat, remove the mounting hardware. Pull back and up to disengage the two clips at the front of the seat.

3. When reinstalling the seat, make sure the two front clips engage underneath the frame cross bar before installing the rear mounting hardware.

FAIRING AND WINDSHIELD — FL MODELS

Disassembly

1. See Figure 2-116. Remove the two bolts (1) and spacer (2) from each fork side. Remove the fairing and windshield assembly. Let the spotlamps hang loose.



1. Bolt 2. Spacer

Figure 2-116. Fairing Bracket

2. See Figure 2-117. Remove the four locknuts (1) and washers (2). Remove the fairing from the brackets.

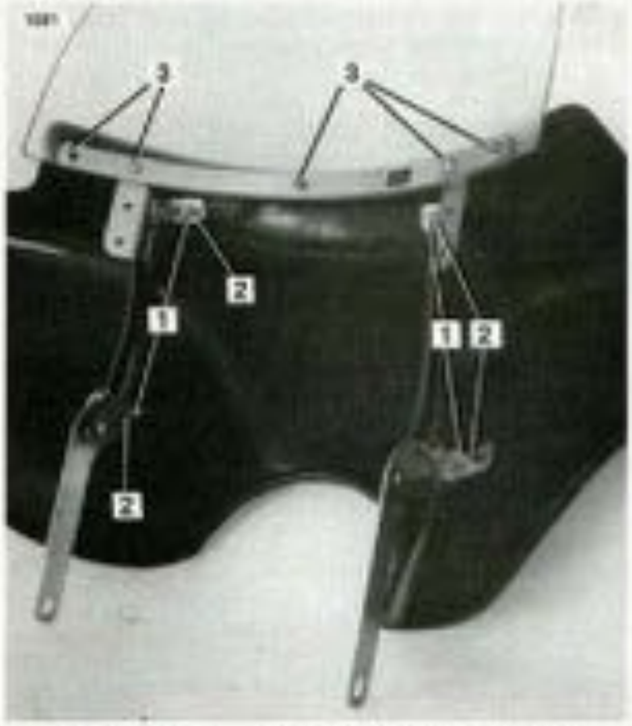
3. See Figure 2-117. Remove the windshield mounting hardware (3) and windshield.

Assembly

1. Before installing a new windshield, place one piece of foam tape (supplied with windshield) on each side of the windshield bottom edge.

2. See Figure 2-117. Install the windshield using the original mounting hardware.

3. See Figure 2-117. Mount the fairing to the braces using the original washers (2) and nuts (1).



1. Locknut 3. Windshield hardware
2. Washer

Figure 2-117. Windshield and Fairing

4. See Figure 2-118. Place the windshield and fairing assembly on the motorcycle with the spotlamp brackets between the fork legs and the fairing brackets.

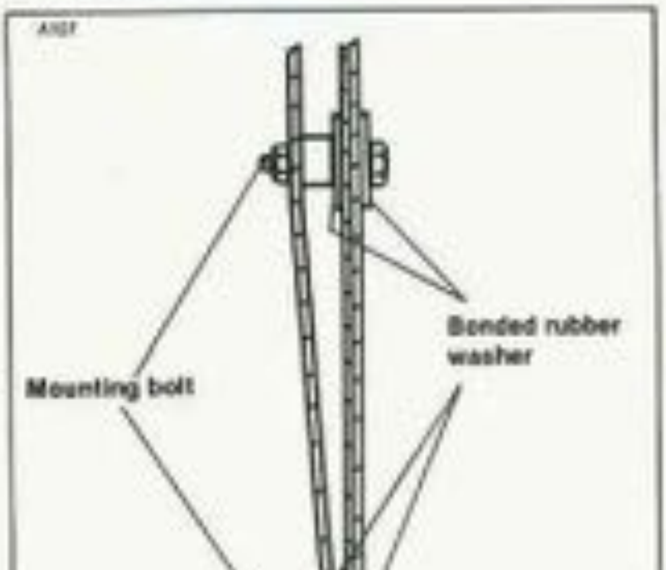


Figure 2-118. Fairing Rubber Washers

5. See Figure 2-105. Install the 8 rubber washers as shown.

6. Position the spacer on each side as shown and secure with the original bolts.

SADDLEBAGS — FL MODELS

General

The saddlebags should be removed from the motorcycle when performing operations such as shock absorber adjustment, rear chain adjustment or rear brake work.

CAUTION

1981 and later right side saddlebags have a recess for brake caliper clearance. DO NOT use 1980 and earlier saddlebags on the right side of 1981 and later models.

Removal And Installation (Figure 2-119)

1. Unlock and remove the saddlebag cover.

2. Pull up on the locking clips to release bag from support.

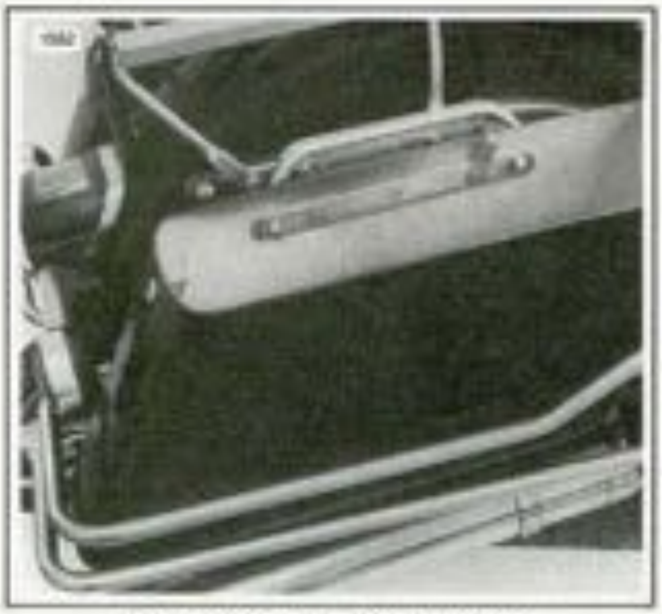


Figure 2-119. Saddlebag Mounting

3. Lift bag up and out of support.

4. When installing bag, make sure clips lock securely on support.

TOUR PAK FL MODELS (Early) (Figure 2-120)

Removal

1. Insert the key in the Tour-Pak lock. Turn the key slightly to the left, then to the right as far as it will go.

2. From the rear of the motorcycle, push forward and down on the back of the Tour Pak to disengage it from the luggage rack.

Installation

1. Hook the back of the Tour-Pak on the luggage rack.

2. Push forward until Tour-Pak snaps in place.

Figure 2-120. Tour-Pak Mounting

TOUR - PAK — FL MODELS (Late) (Figure 2-121)

Removal

1. Unlock the Tour-Pak cover by turning the key to the unlocked (horizontal) position. Press down firmly on the Tour-Pak cover above the lock and while maintaining downward pressure, push inward on the lock button. Open cover.

2. Remove Tour-pak mat.

3. Push down and turn each fastener, located in the bottom of the Tour-Pak, 1/4 turn counterclockwise. See Figure 2-121. Lift the Tour-Pak free of the luggage lock.

Installation

1. Open Tour-Pak cover and remove mat.

2. Center the Tour-Pak on the luggage carrier with the lock side of the Tour-Pak to the right (as viewed from rear of the motorcycle).

3. See Figure 2-121. Turn each fastener located in the

bottom of the Tour-Pak 1/4 turn clockwise while pressing downward.

4. Place Tour-Pak mat in the bottom of the Tour-Pak. Close the Tour-Pak cover.

Figure 2-121. Tour-Pak Installation

FRONT FENDER REPLACEMENT — FL MODELS

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. Bolt 2. Lockplate

Figure 2-122. Front Fender Replacement FL Models

1. Remove the front wheel. See WHEELS. Remove the speedometer cable from the speedometer drive and from the guide on the fender.

2. Remove the Phillips head screw and clip securing the brake hose clamp to the fender.

3. See Figure 2-122. Remove the bolts and lockplates securing the original fender. Discard the lockplates.

4. Remove the 1/4"-20 locknut and washer securing the bumper assembly and transfer the bumper to the new fender. Tighten the locknut to 6 ft-lbs torque.

5. Remove the four nuts securing the side trim strips and transfer the strips to the new fender. Securely tighten the nuts.

6. Remove the two #8-32 self-tapping screws securing the fender tip and transfer it to the new fender. Securely tighten the screws.

7. Remove the four #4-40 Phillips head screws securing the FLH trim plate and transfer it to the new fender. Securely tighten the screws.

8. Carefully mount the new fender using the bolts removed in Step 2 and new lockplates. Tighten the bolts to 20 ft-lbs torque and bend the edge of the lockplate against the bolt head flats as shown in Figure 2-122.

9. Install the brake hose clamp using the hardware removed in Step 2.

10. Route the speedometer cable through the cable guide and reattach it to the speedometer drive. Reinstall the front wheel.

FRONT FENDER REPLACEMENT — FX MODELS (1983 and Earlier)

1. Remove the front wheel as described under WHEELS. Remove the speedometer cable from the speedometer drive and fender.

2. See Figure 2-123. Remove the four bolts lockwashers securing the fender to the fork sides.

3. Install the new fender using the same four bolts and lockwashers.

4. Route the speedometer cable through the guide on the fender. Install the speedometer drive on the cable.

5. Re-install the front wheel.

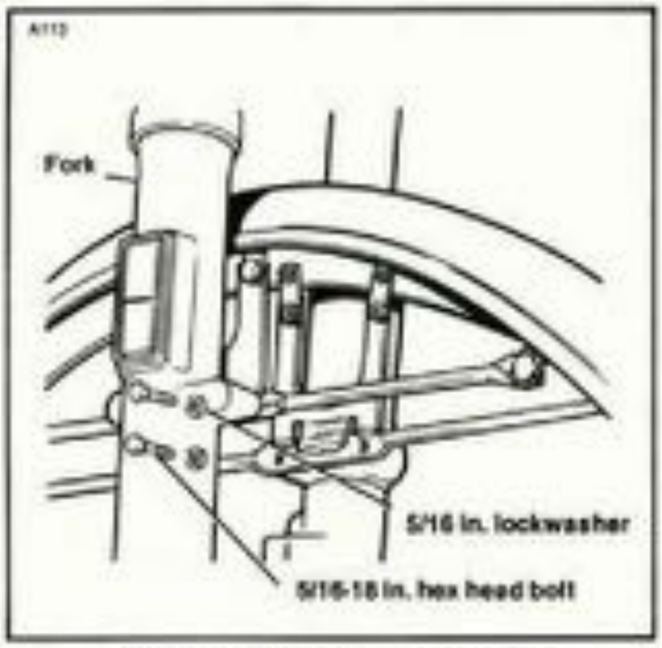


Figure 2-123. Front Fender Removal
FX Models

FRONT FENDER REPLACEMENT — FX 1984 MODELS

1. Remove the front wheel as described under WHEELS. Remove the speedometer cable from the speedometer drive.

2. See Figure 2-124. Remove the four flanged locknuts at the inboard side of the fender brace. Remove the four socket head capscrews.

3. Position new fender between fork sides. Insert the four socket head capscrews through the fork sides and through the fender brace. Thread a flanged locknut onto each screw and tighten to 33 ft-lbs torque.

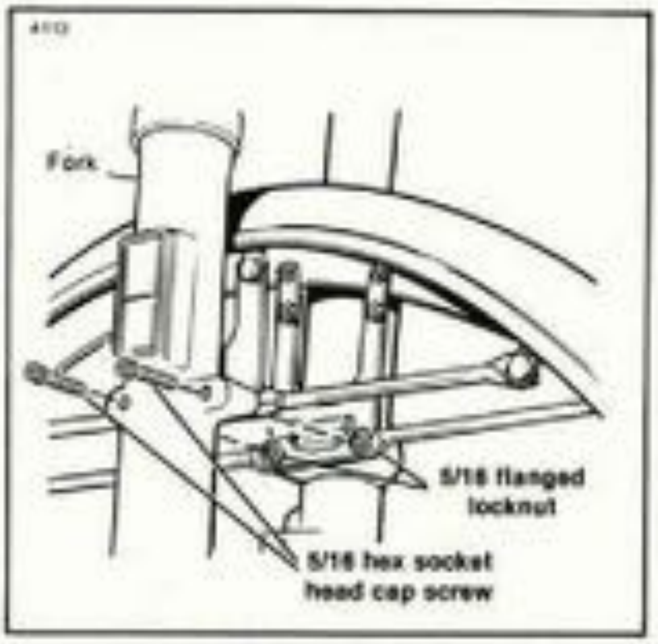


Figure 2-124. Front Fender Removal
FX 1984 Models

4. Connect the speedometer cable to the speedometer drive.

5. Re-install the front wheel.

REAR FENDER REPLACEMENT — FL MODELS

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.

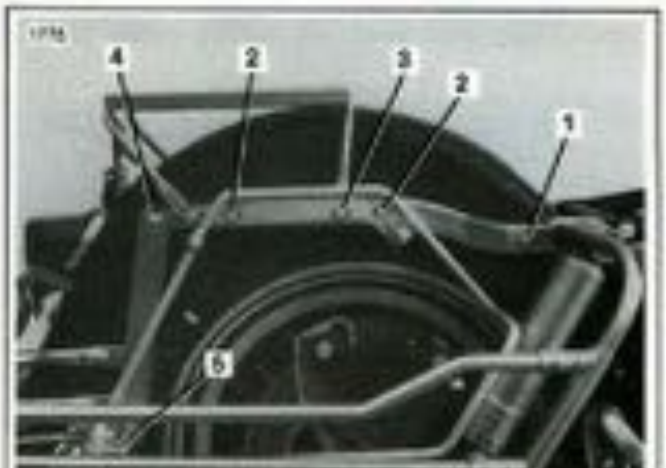
2. Remove the saddlebags.

3. See Figure 2-125. Remove the hex head bolts (2) and (3) pull luggage carrier from the assembly.

NOTE

Spacers are located between the saddlebag carriers and the fender supports, in conjunction with hex head bolts (2).

4. Remove hex head bolts (5) and saddlebag supports.



Fender Mounting Bolts
1. 3/8-24 x 2 in.
2. 5/16-24 x 1-5/8 in.
3. 5/16-24 x 3/4 in. with external tooth lockwasher
4. 5/16-24 x 1-3/8 in. with external tooth lockwasher
5. 1/4-28 x 1-1/4 in. with two plain washers and one lockwasher

Figure 2-125. Rear Fender Removal — FL Models

5. See Figure 2-126. Unplug the signal/taillight wiring harness. Use a PIN TERMINAL TOOL, Part No. HD-97362-71 to remove the pins from the terminal housing.

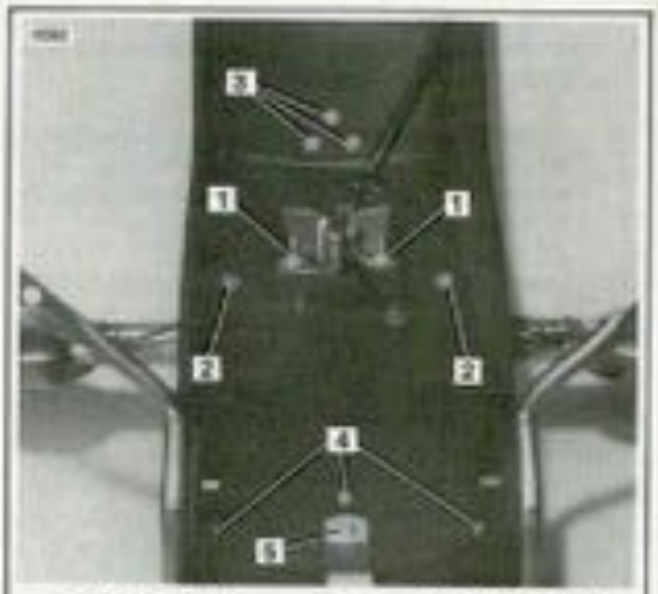
6. See Figure 2-125. Carefully remove hex head bolts (1) and (4). Lift off the fender.

7. Pull the wiring harness through the hole in the side of the fender and remove it from under the wire clips.

8. See Figure 2-127. Remove and discard the two 1/4 in. speed nuts (1) securing the taillight. Remove the two bolts and lockwashers (2) securing the turn signal assembly.

9. Unfasten the two wire connectors joining the turn signal wires to the wiring harness.

10. Transfer the taillight assembly to the new fender and install it using new 1/4 in. speed nuts. Secure the signal light wire clamp under one of the speed nuts. Route the wiring harness to the front of the fender securing it under the wire clips.



1. Speed nut (2)
2. Bolt and lockwasher (2)
3. Nut (3)
4. Self-tapping screw (3)
5. Nut

Figure 2-127. Turn Signal and Taillight Removal FL Models

Figure 2-126. Tail/Signal Light Terminal FL Models

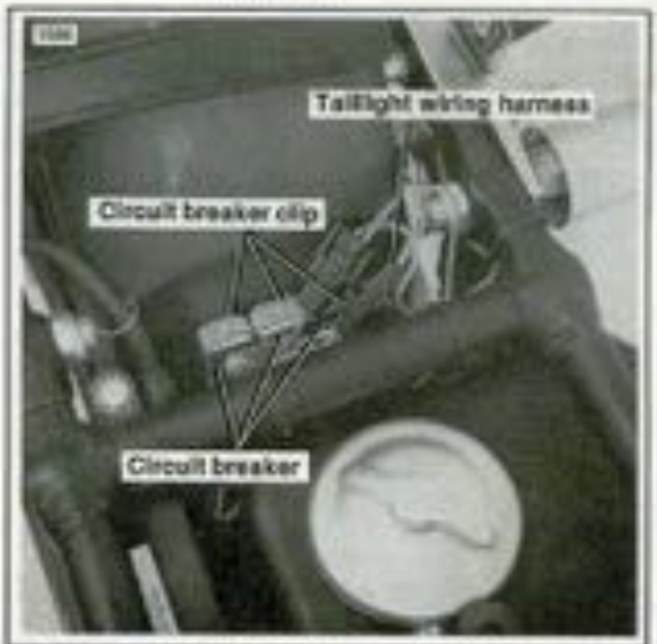


Figure 2-128. Taillight Wiring and Circuit Breakers FX Models

11. Install the signal light assembly on the new fender using the hardware removed in Step 8. Tighten to 10 ft-lbs torque.

12. Use new wire connectors to rejoin the signal light wires to wiring harness. Attach the brown wire from the wiring harness to the right signal light and the purple to the left.

13. See Figure 127. Remove the three nuts (3) securing the license plate bracket and transfer the assembly to the new fender. Tighten the nuts to 6 ft-lbs torque.

14. Remove the three self-tapping screws (4) securing the fender tip.

15. Remove the nut (5) securing the bumper assembly and transfer the bumper to the new fender. Tighten to 10 ft-lbs torque.

16. Mount the fender tip on the new fender securing with the hardware removed in Step 14 and tighten securely.

17. Route the wiring harness through the hole in the

front of the fender and reinstall the pins into the terminal housing. Use the mating terminal as a guide for wire placement.

18. Carefully place the new fender into position and secure it with the hardware as removed in Step 6. Tighten bolts (1) to 33 ft-lbs torque and bolts (4) to 19 ft-lbs torque.

19. Loosely install the saddlebag carriers with hex head bolts (2). Install the spacers between the carriers and the fender supports.

20. Reinstall hex head bolts (5). Assemble in this order: bolt, plain washer, saddlebag carrier, support stud, bumper brace, plain washer, lockwasher and hex head nut. Tighten the bolts to 10 ft-lbs torque.

21. Tighten the bolts (2) to 19 ft-lbs torque.

23. Reinstall the saddlebags and seat.

24. Reconnect the battery cables, positive cable first.

WARNING

Check the operation of the turn signals and taillight before operating the vehicle.

REAR FENDER REPLACEMENT — FX MODELS

WARNING

To avoid accidental start-up of vaehicle and possible personal injury, disconnect the battery cables (negative cable first) before performing any of the following procedures.

1. See Figure 2-128. Unplug the tailight assembly and pull the circuit breakers out of the retaining clips.

2. See Figure 2-129. Remove the two 3/8"-24 hex head bolts and hardware securing the rear fender and passenger strap.

3. Remove the center two 3/8"-16 acorn nuts and hardware securing the rear fender.

NOTE

Make special notation as to the location of the spacers and hardware to facilitate proper reinstallation. A single washer is located between the fender and the fender support in all locations, except the front, where the passenger strap mounts. In this location two washers and a spacer are located on each side.

4. Carefully remove the rear fender.

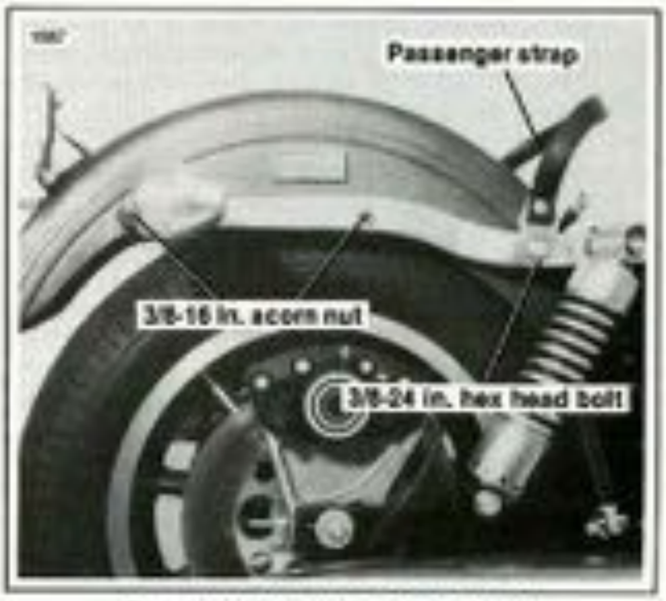


Figure 2-129. Rear Fender Removal FX Models

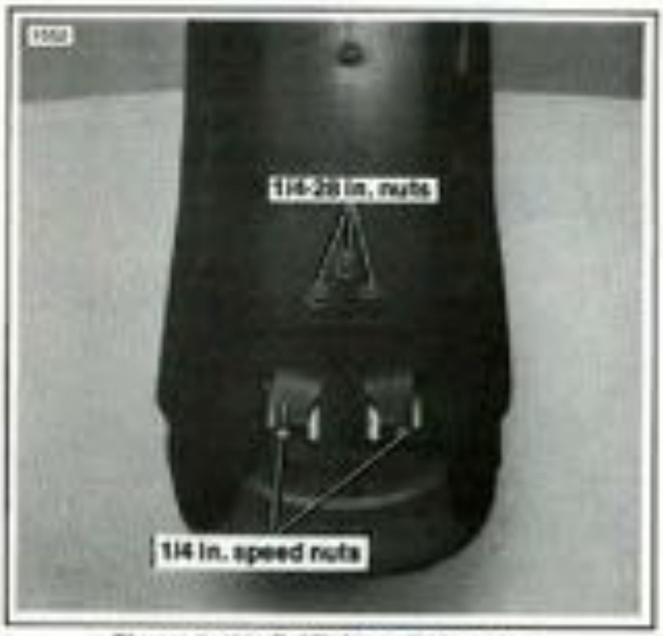


Figure 2-130. Taillight and License Plate Bracket Removal FX Models

5. Cut both taillight wires at the connector, and pull the wiring harness through the fender.

6. See Figure 2-130. Remove and discard the two 1/4 in. speed nuts securing the taillight assembly, transfer the assembly to the new fender and install it using new 1/4 in. speed nuts. Route the wiring harness to the front of the fender, securing it under the wire clips.

7. Pull the wiring harness through the side of the fender. Strip approximately 3/32 in. insulation from the end of the taillight wires and crimp on the new

pins. Install the pins into the new connector using the old connector as a guide for wire replacement. Take note as to the location of the key slot, with respect to the wire colors.

8. See Figure 2-130. Remove the three 1/4"-28 nuts securing the license plate bracket and transfer the assembly to the new fender. Tighten the screws to 6 ft-lbs torque.

9. Carefully drill out the pop rivets securing the three circuit breaker clips using a 1/4 in. diameter drill. Rivet the clips to the new fender in the same location.

10. Carefully place the new fender into position and secure it with the hardware removed in Step 3. Tighten all bolts to 33 ft-lbs torque.

11. Snap the circuit breakers back into their clips and plug in the taillight.

12. Reinstall the seat.

13. Re-connect the battery cables, positive cable first.

WARNING

Check the operation of the turn signals and taillight before operating the vehicle.

ENGINE

SUBJECT | **PAGE NO.**

FL/FX (Except FXST)

1. Specifications 3-1
2. General 3-5
3. Cylinder Head 3-15
4. Cylinder and Piston 3-23
5. Gearcase 3-29
6. Crankcase 3-39

FXST

1. Specifications V3-1
2. General Information V3-3
3. Cylinder Head V3-13
4. Cylinder and Piston V3-23
5. Gearcase V3-27
6. Crankcase V3-35

Design Patents Pending on V²™ Evolution Engine cylinder heads and rocker arm covers.

ENGINE

SPECIFICATIONS

GENERAL

Number of Cylinders	2
Type	4-cycle, 45 Degree V
Horsepower	
1200cc	60 hp @ 5200 rpm
1340cc (1980 and earlier)	60 hp @ 4800 rpm
1340cc (1981 and later)	65 hp @ 5400 rpm
1340cc (1984 FXST)	69 hp @ 5000 rpm
Bore	
1200cc	3.438 in. (87.3 mm)
1340cc	3.498 in. (88.8 mm)
Stroke	
1200cc	3.968 in. (100.8 mm)
1340cc	4.250 in. (108.0 mm)
Piston Displacement	
1200cc	73.66 cu in.
1340cc	81.6 cu in.
Torque	
1200cc	70 ft-lbs @ 4000 rpm
1340cc (1980 and earlier)	67 ft-lbs @ 3600 rpm
1340cc (1981 and later)	71.5 ft-lbs @ 3800 rpm
1340cc (1984 FXST)	82 ft-lbs @ 3600 rpm
Compression Ratio	
1200cc	8-1
1340cc (1980 and earlier)	8-1
1340cc (1981 and later except FXST)	7.4-1
1340cc (FXST)	8.5-1

VALVES

Exhaust valve fit in guide	
1978½ and early 1981 (without seals)	.0035-.0055 in.
Late 1981 and Later (with seals)	.0014-.0031 in.
Intake valve fit in guide	
1979 and earlier	.0018-.0038 in.
1980 and early 1981 (without seals)	.0021-.0040 in.
Late 1981 and later (with seals)	.0009-.0026 in.
Seat width	.050-.090 in.
Stem protrusion from cylinder head boss	1.600-1.645 in.
Outer spring - early 1982 and earlier (aluminum or white)	
Open	179-195 lbs @ 15/16 in.
Closed	104-120 lbs @ 1-3/8 in.
Free length	1.900-1.960 in.
Outer spring - late 1982 and later (orange or red)	
Open	182-204 lbs @ 15/16 in.
Closed	76-94 lbs @ 1-3/8 in.
Free length	1.720-1.78 in.
Inner spring - early 1982 and earlier (aluminum or white)	
Open	69-81 lbs @ 51/64 in.
Closed	20-26 lbs @ 1-3/16 in.
Free length	1-23/64 in.
Inner spring - late 1982 and later (orange or red)	
Open	77-87 lbs @ 3/4 in.
Closed	32-40 lbs @ 13/16 in.
Free length	1.50-1.56 in.

ROCKER ARM

Fit in bushing (loose)	.005-.002 in.
End clearance	.004-.025 in.

PISTON

Fit in cylinder (loose)	.0020-.0025 in.
Compression ring gap	
Early 1983 and earlier	.010-.020 in.
Late 1983 and later	.008-.015 in.
Ring gap-oil control	.010-.045 in.
Compression ring side clearance	.004-.005 in.
Oil ring side clearance	.000-.005 in.
Piston pin fit (loose)	
Early 1983 and earlier	.0008-.001 in.
Late 1983 and later	.00015-.00065 in.
Piston pin end play (Early 1983 & earlier)	.009-.030 in.

CYLINDER HEAD

Valve guide in head (tight)	.004-.002 in.
Valve seat in head (tight)	.006-.004 in.

CONNECTING ROD

Piston pin fit (loose)	
Early 1983 and earlier	.0008-.00012 in.
Late 1983 and later	.00025-.00085 in.
Side play betwen flywheels	.005-.025 in.
Fit on crankpin (loose)	.001-.0015 in.

OIL PUMP PRESSURE

At normal operating temperature and engine speed of 2000 rpm, oil pressure should be 12-35 psi.

TAPPETS

Guide fit	.0025 in.
Fit in guide (loose)	.001-.002 in.
Roller fit	.0005-.001 in.
Roller end clearance	.008-.010 in.

GEARCASE

Breather gear end play	.001-.016 in.
Cam gear shaft in bushing	.0008-.0018 in.
Cam gear shaft in bearing	.0005-.003 in.
Cam gear end play	.001-.016 in.
Oil pump drive shaft (crankcase bushing)	.0008-.0012 in.

FLYWHEELS

Runout (flywheels at rim) .... .006 in. maximum
Runout (shaft at flywheel) .... .002 in. maximum
End play (1980-1981) .... .001-.006 in.
(1982 and later) .... .001-.004 in.

SPROCKET SHAFT BEARING

Cup fit in crankcase (tight) .... .0032-.0012 in.
Cone fit on shaft (tight) .... .0015-.0002 in.

PINION SHAFT BEARING

Roller bearing fit (loose) .... .0004-.0008 in.
Cover bushing fit (loose) .... .0005-.0012 in.

IGNITION TIMING

Timer air gap
1979 and earlier .... .004-.006 in.
1980 and later .... not adjustable
Ignition timing
fully retarded .... 3° BTC (1/64 in. BTC)
automatic advance .... 35° BTC (7/16 in. BTC)
Spark plug gap .... .038-.043 in.

TORQUES

Sprocket shaft nut (1980 and early 1981) .. 300-440 ft-lbs
Crank pin nut (1980 and early 1981) .... 150-250 ft-lbs
Pinion shaft nut (1980 and early 1981) .... 120-160 ft-lbs
Sprocket shaft nut (late 1981 and later) .. 290-320 ft-lbs
Crankpin nut (late 1981 and later) .... 180-210 ft-lbs
Pinion shaft nut (late 1981 and later) .... 140-170 ft-lbs
Pinion gear nut .... 35-45 ft-lbs
Oil pump cover bolt or nut
with plastic gasket .... 45-50 in-lbs
with white paper gasket .... 50-60 in-lbs
with black paper gasket .... 90-120 in-lbs
Tappet guide bolts .... 65-105 in-lbs
Rocker cover nuts .... 12-15 ft-lbs
Cylinder head bolts .... 55-75 ft-lbs
Cylinder base nuts .... 32-40 ft-lbs
Upper engine mounting bracket nut .... 35-40 ft-lbs
Crankcase stud nut .... 12-15 ft-lbs
Crankcase bolt .... 22-26 ft-lbs
Tappet adjusting locknut .... 6-11 ft-lbs
Gear case cover screws .... 90-120 in-lbs
Rocker arm shaft screw (1981 and earlier) .... 8-12 ft-lbs
Rocker arm shaft locknut .... 12-18 ft-lbs
Timer screws (inner cover and sensor plate) 15-30 in-lbs.
Trigger rotor screw .... 43-48 in-lbs
Tappet screen plug .... 90-160 in-lbs
Spark plug .... 18-28 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.

Valves

Exhaust valve fit in guide
1978½ and early 1981 (without seals) .. .0035-.0075 in.
Late 1981 and Later (with seals) .... .0014-.004 in.
Intake valve fit in guide
1979 and earlier .... .0018-.0038 in.
1980 and early 1981 (without seals) .... .0020-.0060 in.
Late 1981 and later (with seals) .... .0009-.0035 in.
Stem taper .... .0000-.0015 in.
Stem-face eccentricity .... .000-.002 in.
Head margin .... .000-.030 in.
Seat width .... .050-.090 in.
Stem protrusion from
cylinder head boss .... 1.600-1.645 in.

Rocker Arm

Fit in bushing (loose) .... .005-.0035 in.
End clearance .... .004-.025 in.

Piston

Fit in cylinder (loose) .... .002-.005 in.
Compression ring gap
Early 1983 and earlier .... .010-.031 in.
Late 1983 and earlier .... .008-.015 in.
Ring gap-oil control .... .010-.045 in.
Compression ring side clearance .... .004-.006 in.
Oil ring side clearance .... .003-.006 in.
Piston pin fit (loose)
Early 1983 and earlier .... .0008-.001 in.
Late 1983 and later .... .00015-.00065 in.
Piston pin end play
Early 1983 and earlier .... .009-.030 in.

Cylinder Head

Valve guide in head (tight) .... .004-.002 in.
Valve seat in head (tight) .... .006-.004 in.
Head warpage .... .000-.005 in.

Cylinder

Taper .... .000-.002 in.
Out of round .... .000-.001 in.
Warpage (gasket surfaces) .... .000-.003 in.

Connecting Rod

Piston pin fit (loose)
- Early 1983 and earlier .... .0006-.002 in.
- Late 1983 and later .... .00025-.00085 in.

Side play between flywheels .... .005-.030 in.
Fit on crankpin (loose) .... .001-.0017 in.

Tappets

Guide fit .... .0025 in.
Fit in guide (loose) .... .001-.003 in.
Roller fit .... .0005-.0012 in.
Roller end clearance .... .008-.015 in.

Gearcase

Breather gear end play .... .001-.016 in.
Cam gear shaft in bushing .... .0008-.003 in.
Cam gear shaft in bearing .... .0005-.003 in.
Cam gear end play .... .001-.016 in.
Oil pump drive shaft
(crankcase bushing) .... .0008-.0025 in.

Flywheels

Runout (flywheels at rim) .... .006 in. maximum
Runout (shaft at flywheel) .... .002 in. maximum
End play (1980-1981) .... .001-.006 in.
(1982 and later) .... .001-.004 in.

Pinion Shaft Bearing

Roller bearing fit (loose) .... .002-.0008 in.
Cover bushing fit (loose) .... .0005-.0025 in.

GENERAL INFORMATION

DESCRIPTION

The engine is the traditional Harley-Davidson two-cylinder, four-cycle, air cooled, overhead-valve V-type. It has three major component assemblies: **cylinders, gear-case** and **crankcase.**

Cylinder assemblies include cylinder head, valves, rocker arms and piston. Cylinders mount on the crank-case 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 5-piece 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 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 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 and a magnetic sensing unit. Both spark plugs fire each crankshaft revolution. However, the spark in one cylinder alternately occurs ineffectively during its exhaust stroke.

GASOLINE

Use a good quality leaded or unleaded gasoline. For 1980 and earlier models, use premium grade (94 pump octane or higher). For 1981 and later models use any grade gasoline (89 pump octane or higher).

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, solo or sidecar, fast or moderate driving, how well the engine is kept tuned and chain oiler adjustment.

Remove tank cap and check oil supply as part of every preride inspection. If level is down near REFILL mark on gauge rod, add oil. When level is down to REFILL mark, add two quarts. Engine will run cooler and usage will be less with oil level well up in tank.

The oil tank capacity is 4 quarts except on FXST vehicles which is 3 quarts. The tank is full when the oil level is about one inch from the top with motorcycle in an upright position off the jiffy stand. Do not fill above this level because the tank needs some air space. Tighten 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

Change oil in a new engine after first 500 miles, and at about 2500 mile intervals thereafter. Completely drain oil tank of used oil and refill with fresh oil. If service is extremely hard, hot, on dusty roads or in competition, drain and refill at shorter intervals. Draining should be done while oil is hot. It is not necessary to drain the crankcase for it does not accumulate more than about 5 oz. of oil at any time. At the time of the first oil change, and along with at least every second oil change thereafter, thoroughly flush and clean out tank with kerosene to remove any sediment and sludge that may have accumulated. Use the following procedure:

1. Run engine until normal operating temperature is reached.
2. Remove oil tank drain plug 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 chaincase drain plug (except 1983 and earlier FXB/FXSB/FXDG) located under the clutch cover on the bottom of the chaincase. Clean and replace.
5. Replace the oil filter as described in the following sections.
6. Replace the oil tank drain plug and pour one quart of kerosene into oil tank and agitate by rocking motorcycle from side to side. Remove plug and allow tank to drain completely before replacing plug. Tighten drain plug to 10 ft-lbs torque.
7. With drain plug tightened, install four (4) quarts (3 quarts FXST) of recommended grade oil determined from chart, Figure 3-6.
8. Start engine and carefully check for oil leaks around drain plug.
9. Check oil level in tank and if necessary add oil to bring level to one inch from top of tank. Do not fill tank above this level. Tank needs some air space.

Air Temperature (Cold Engine Starting Conditions)	Use Harley-Davidson Oil Grade
10° to 100°F. - Normal and severe operating conditions	Power Blend* Super Premium
Above 80°F.	Premium II™ Extra Heavy Grade 60
Above 60°F.	Regular Heavy
Above 40°F.	Medium Heavy
—20° to 40°F.	Special Light

10. Check oil level as a part of every preriding inspection.

Oil Filter — 1982 and Earlier (Figure 3-1)

The oil tank is equipped with an oil filter attached to the oil tank cap. The oil filter element (3) should be replaced at every oil change as follows:

1. Remove the cap from the oil tank.

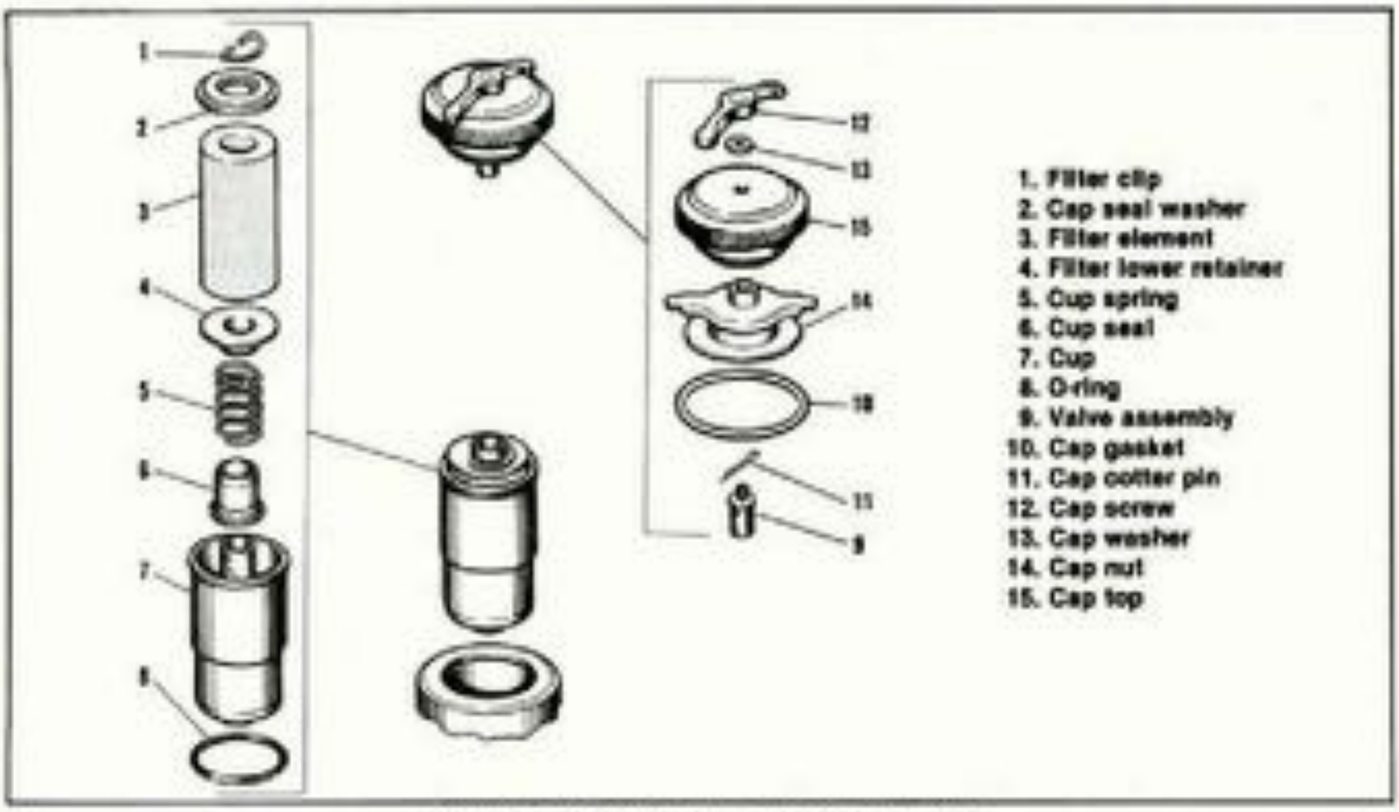


Figure 3-1. Oil Tank Filter — 1982 and Earlier

Figure 3-2. Oil Filter — 1983-1984 (except FXST)

2. Remove the clip (1) and washer (2). Remove the filter (3).

3. Insert a new oil filter. Install the washer (2) and clip (1).

NOTE

Make sure O-ring (6) is positioned against the filter cup flange (7) when filter is installed in the tank.

Oil Filter — 1983-1984 (except FXST) (Figure 3-2)

The oil filter is located under the motorcycle behind the transmission in front of the rear tire.

FXST vehicles have the oil filter installed above the voltage regulator.

1. Remove oil filter.

2. Lube rubber seal 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.

Oil Cooler (FXB/FXS Only) (1981 and Earlier)

The FXB/FXS model is equipped with an oil cooler as standard equipment. Oil cooler does not require periodic maintenance. When operating the motorcycle in temperatures below 50°F (10°C), it is recommended that the oil cooler cover, provided with your motorcycle, be installed; otherwise engine will not warm up to proper operating temperature.

Oil Pressure Signal Light

If the oil signal light fails to go off at speeds above idling, it is usually due to low or diluted oil supply. In freezing weather 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 may be checked as follows:

Fill oil tank to proper level. Disconnect oil pressure switch wire at top of switch and remove switch. Install OIL PRESSURE GAUGE, Part No. HD-96921-52. Attach gauge to motorcycle and road run or simulate road running until engine is completely warmed. A full operating temperature is essential for accurate gauging. Oil pressure should be 12-35 psi at 2000 rpm with oil at normal operating temperature.

An acceptable alternate method of checking oil pressure is to connect the gauge, by means of an adapter, Part No. HD-96921-107, at the tappet oil screen.

Engine Lubrication System (Figure 3-3)

1. Gravity feed from oil tank to feed pump.

2. Feed (pressure) section of pump.

3. Check valve prevents gravity oil drainage from tank to engine.

4. Oil is screened through an oil screen and forced through passages or external oil lines to lubricate rocker arm bushings, shafts, valve stems, valve springs and push rod sockets. A branch passage supplies oil to the hydraulic lifters.

5. Pressure regulating valve maintains correct pressure in system. Oil form top of regulating valve is drawn, back to tank 1980 and earlier and into gear case 1981 and later. When oil reaches rocker arms and lifters, regulating valve lifts and allows pressurized oil to flow to pinion gear shaft.

6. Oil is forced through pinion gear shaft to lubricate lower connecting rod bearings from which oil splashes to cylinder walls, piston, piston pin and main bearings. Refer to Figure 3-3 (Part II). During cold engine start-up, pressure regulating valve (5) lifts further to allow excess oil to return directly to return line (1980 - early 1982) or feed line (late 1982 and later).

7. Oil drains from cylinder rocker housing through passage in each cylinder, then flows through hole in the base of each cylinder, lubricating cylinder walls, piston, piston rings and main bearings.

8. Some oil drains from the rocker housing through

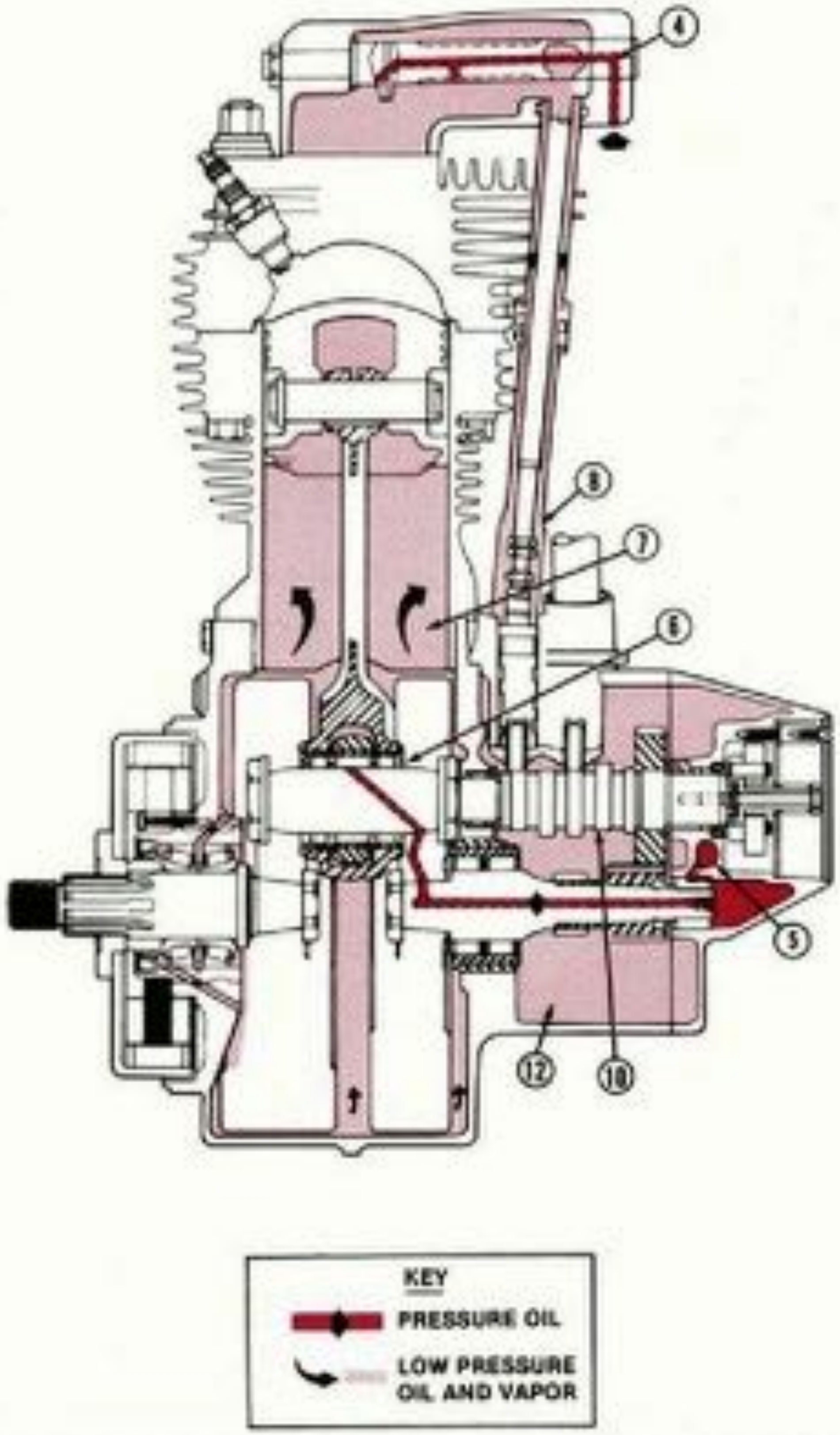


Figure 3-3. Lubrication System — Part I

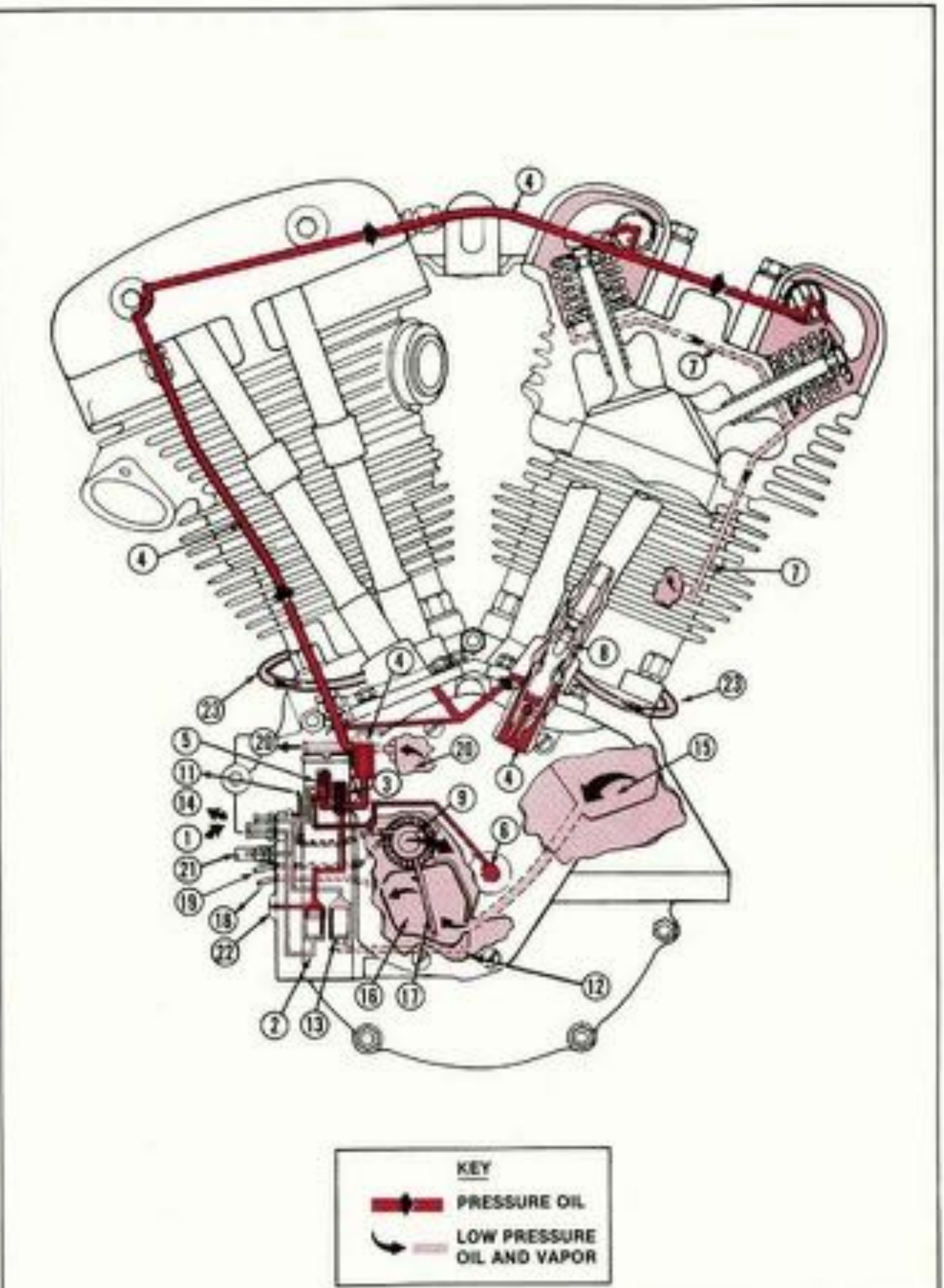


Figure 3-3. Lubrication System — Part II

push rod covers into the gearcase compartment, lubricating push rods and tappets. On late 1981 & early 1982 models, some oil is scavenged into crankcase (23).

9. Rotary breather valve is timed to open on the downstroke of pistons, allowing crankcase exhaust air pressure to expel scavenge oil from the flywheel compartment through the breather valve into gearcase. Breather valve closes on upward stroke of pistons, creating a vacuum in the flywheel compartment.

   During piston upstroke, the small port in breather valve lines up with passage in crankcase and vacuum draws oil from the crankcase breather oil trap.

10. Oil blown and drained into timing gearcase (steps 8 and 9), lubricates timing gears and gear shaft bearings.

11. Front chain oil (except 1983 and earlier FXB/FXSB/FXDG). Oil is blown into chain case housing when breather valve is open.

12. Gearcase oil settling in gearcase sump flows to scavenge section of pump.

13. Scavenge (return) section of pump.

14. Engine oil return to tank.

15. Crankcase exhaust air baffle and gearcase cover transfer passage. Air and oil mist is forced into crankcase breather trap.

16. Breather oil trap.

17. Oil transfer to breather valve. On piston upstroke, crankcase vacuum draws trapped oil into breather.

18. Crankcase exhaust air escapes from gearcase and is fed into the rear of the air cleaner housing.

19. Return line from chain housing (except 1983 and earlier FXB/FXSB/FXDG). On piston upstroke, crankcase vacuum draws oil from chain housing to breather valve. On piston downstroke, oil on breather valve is forced into gearcase.

20. Vent line to oil tank and chain housing (except 1983 and earlier FXB/FXSB/FXDG).

21. Rear chain oiler 1982 and earlier (if applicable).

22. Pressure switch fitting.

23. Tappet guide scavenge lines (late 1981 & early 1982). When the pistons are on their upstroke, the piston skirt opens a hole in the cylinder flange allowing crankcase vacuum to scavenge excess oil from the tappet guides into the crankcase.

REPAIR AND DIAGNOSTIC PROCEDURES

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, only gearcase; or whether engine must be completely disassembled for crankcase section 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 9.

After disassembling cylinder head and cylinder it may be found that lower end repair is necessary. This requires removal of engine crankcase from frame as described in steps 10 through 16 in STRIPPING MOTORCYCLE FOR ENGINE REPAIR.

When it has been definitely determined beforehand that the lower portion of engine (crankcase) is in need of repair, remove complete engine from chassis before starting disassembly as described in Steps 1 through 16 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.

A noisy engine is usually caused by loose bearings. Main bearings are generally more durable than rod bearings or bushings so the latter should be suspected first. 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 slap from front to rear of 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 3000 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. With engine running, raise push rod cover at the noisy lifter and check to see that oil is reaching the tappet. If oil is not reaching the tappet, inspect the passages in the tappet, tappet block and right crankcase for restrictions or blockage.

   If oil is reaching the tappet, remove the hydraulic unit and inspect per procedure listed under VALVE TAPPETS AND GUIDES. Clean tappet bore of all foreign material.

   Replace hydraulic unit if necessary.

3. Examine push rod, hydraulic unit, tappet and tappet block for proper fits 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.

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 a compression tester such as the Sun MODEL UTC-48 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 until 5 to 7 full compression strokes are completed.

CAUTION

Before starting engine, after the test, make sure that throttle plate is in the closed position.

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 100 psi or more and if the final readings do not indicate more than a 10 psi variance between cylinders, compression is considered normal. If compression does not meet specifications, see diagnostic chart below.

7. Inject approximately 1/2 oz. of SAE 30 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.

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 tappet adjustment.
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 fourth 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, tailpipe, 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. Listen around head gasket area to check for leaking gasket.

NOTE

If air is escaping through valves, check valve train adjustment.

9. Repeat procedure on rear cylinder.

CAUTION

Make 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 proceed as follows:

NOTE

Steps 1 - 5 do not apply to the 1982 and earlier FXB/FXSB/FXDG models

1. Remove one clutch cover screw and install VACUUM GAUGE, Part No. HD-96950-68.

2. Start engine and let idle, gauge should read 9 inches of water minimum.

3. Pinch primary housing vent line (3/8 in. hose running from primary housing to tee). Gauge reading should be 25 inches of water vacuum minimum at 2000 rpm.

4. If primary housing vacuum is low, check for leaks by pressurizing the housing with compressed air.

CAUTION

Use 10 psi pressure maximum for leak test. Before applying air pressure through the clutch cover screw hole pinch all oil lines running to primary housing near housing.

5. With primary housing pressurized, listen for leaks at following locations:
   - All gasket surfaces
   - O-ring surfaces
   - Hose fittings
   - Oil seals (between engine and primary housing and transmission and primary housing)
   - Solenoid mounting
   - Starter drive mounting
   - Clutch cover seal
   - Chain inspection cover seal

If primary housing vacuum is within specifications and the COMPRESSION and CYLINDER LEAKAGE TESTS show no problems, the oil supply to the heads can be blocked to determine if the oil consumption/smoking is due to a problem in the cylinder head area. Continue with Steps 6-8.

CAUTION

The oil supply to the cylinder heads should not be blocked for an excessive amount of time (2 minutes maximum) or damage will result. Do not run the engine above idle speed while oil supply is blocked.

6. With engine at normal operating temperature, block off the overhead oil supply line to the cylinder heads.

7. Start engine and let idle for no more than 2 minutes. If the smoking stops during this period, the problem is in the cylinder head area.

8. Remove suspect head(s) and inspect the following:
   - Gasket surface of both head and cylinder.
   - Oil return passages for clogging.
   - Cylinder head casting porosity allowing oil to drain into combustion chamber.
   - Valve guide to valve stem clearance.
   - Check that lip on top of cylinder does not contact combustion chamber. To check, this, place head on cylinder without gasket. The head gasket surface must contact the cylinder gasket surface all the way around.
   - Valve guide seals (late 1981 and later).

STRIPPING MOTORCYCLE FOR ENGINE REPAIR

Removing the Engine

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 start-up of vehicle and possible personal injury.

1. Remove seat.

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.

2. Drain gas tank. Disconnect fuel line and remove gas tank.

3. Remove instrument cover. See HANDLEBAR CONTROLS AND INSTRUMENTS.

4. Remove upper cylinder head bracket. Note washer(s) between bracket and frame lug, use same washer(s) when bracket is assembled.

5. Remove spark plugs to avoid damaging.

6. Remove air cleaner cover, filter element, air cleaner back plate and air cleaner back plate support bracket from carburetor body.

7. Disconnect throttle and choke controls from carburetor. Remove carburetor.

8. Remove carburetor intake manifold clamps.

9. Remove exhaust pipes.

At this stage, the cylinder heads and cylinders may be removed.

To remove engine crankcase or complete engine, continue stripping motorcycle as follows:

10. Remove pilot bolt from left footboard on FL models and swing rear end of footboard down away from primary cover. Remove primary cover. Remove compensating sprocket shaft nut.

    Remove clutch and sprocket assemblies as described in CLUTCH, Section 6.

11. Remove four bolts, attaching inner primary housing to engine.

    Loosen the two nuts and two bolts attaching the primary to the transmission on 1980 and later vehicles or the (4) nuts on 1979 and earlier vehicles.

    Remove chain oiler hose at oil pump (if applicable). Remove other hoses from connections at back of inner primary housing.

    Remove starter, starter housing and primary housing.

    Remove alternator rotor using ROTOR PULLER TOOL, Part No. HD-95960-52A. See ALTERNATOR, Section 8.

12. Disconnect timer wires at coil or connector. Disconnect alternator plug from crankcase and remove rectifier/regulator.

13. On FL models, remove right footboard rear stud nut from inside of frame member and front footboard mounting stud bolts from brake master cylinder by removing nut and lockwasher on back side. remove brake master cylinder attaching stud bolt which passes through master cylinder and frame with a lockwasher and nut on back side of frame member. Remove brake master cylinder sideplate bolt located behind master cylinder plunger boot. Swing master cylinder and sideplate assembly down away from engine crankcase.

    For FX models, remove right footrest and brake pedal assembly.

14. Remove exhaust system.

15. Disconnect wire from oil pressure switch. Drain oil tank and remove oil lines from oil pump. Remove crankcase breather pipe.

16. Remove two front and two rear engine mounting bolts. Engine is now completely stripped and may be removed from right side of motorcycle.

Installing the Engine

1. Install engine in chassis. Tighten mounting bolts to 35-40 ft-lbs torque.

2. Loosen transmission mounting bolts.

3. Install new O-ring on crankcase.

4. Check primary housing bearing. Replace if necessary. Install new seal.

5. Connect primary housing hose (except 1983 and earlier FXB/FXSB) and install primary housing on transmission mainshaft.

6. Loosely assemble primary housing mounting bolts (finger tight) to crankcase.

7. On 1978½ to 1979 models, install primary housing four nuts on transmission studs and tighten to 30-35 ft-lbs torque. On 1980 and later models, coat the two bolts with Loctite, then install the two nuts and two bolts.

8. Tighten inner primary housing to engine mounting bolts to 18-22 ft-lbs torque. Install new safety wire on two rear mounting bolts.

9. Tighten transmission mounting nuts to 18-22 ft-lbs torque. Make sure transmission mainshaft turns freely.

10. Tighten the primary housing-to-transmission mounting bolts to 18-22 ft-lbs torque.

11. Install starter motor and housing.

12. Install clutch, compensating sprocket, primary chain and chain adjuster or belt as described in the DRIVE section.

13. Install primary cover and a new gasket.

14. Install the exhaust pipes and footboards.

15. Install the carburetor and air cleaner as described in the FUEL section.

16. Install the throttle cables as described in HANDLEBAR CONTROLS AND INSTRUMENTS.

17. Install the gas tank, instruments and seat.

NOTE

On chain drive models, primary housing must be air-tight. Check using VACUUM GAUGE, Part No. HD-96950-68. Remove one of the three screws securing the clutch inspection cover and in its place screw in the threaded fitting of the gauge. Perform check with vent hose pinched closed with a pliers between primary housing and tee fitting. The reading should now be 25 inches of water vacuum at 2000 rpm. A lower reading indicates an air leak into primary housing.

CYLINDER HEAD

REMOVING (Figure 3-6)

Before removing cylinder head assembly, strip motorcycle as described in STRIPPING MOTORCYCLE FOR ENGINE REPAIR.

1. Disconnect overhead oil feed line (1) and cylinder interconnecting oil line (4) at fittings.
2. Remove spring cap retainers (8) on push rod covers by prying down on cover spring cap with screwdriver wedged between cylinder cooling fins and pulling spring cap retainers out. Crank engine until valves are closed.
3. Remove five head bolts (5) from each head. Lift cylinder head enough to slip out push rods (6) and push rod covers (7). Mark push rods so that they will be reassembled in same position.
4. Remove cylinder head (9) and cylinder head gasket (10).

DISASSEMBLING (Figure 3-6)

1. Free the rocker arm cover (13) and gasket (14) from cylinder head by removing stud nuts and washers (11). Before further disassembly, carefully check the rocker arm pads and ball sockets for pitting and excessive wear. Also, check the rocker arm shaft (17) for proper end play. See SPECIFICATIONS.
2. Remove rocker arm shaft screw and O-ring (18), spacer washer (34), acorn nut and washer (15). Discard shaft screw O-ring.
3. Tap rocker arm shaft (17) from cover and remove rocker arm (20) and spacer (16). Mark rocker arm shaft and arm in some manner so all parts may be returned to respective locations during assembly.
4. Valves must be reassembled in same cylinder head from which they were removed, therefore, before removing, mark them in some manner to identify them with front and rear cylinder head. Compress valve spring using VALVE SPRING COMPRESSOR, Part No. HD-96600-36, and remove valve keys (23) from ends of valve stems as shown in Figure 3-4. Mark keys to identify them with their respective valves. Remove valve spring collars (24 and 27), springs (25 and 26), valve stem seals (33) and valves (28). Discard valve stem seals.

CLEANING AND INSPECTION

1. Bead blast or 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.
2. 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. Check valve stem for excessive wear.

Figure 3-4. Compressing Valve Spring

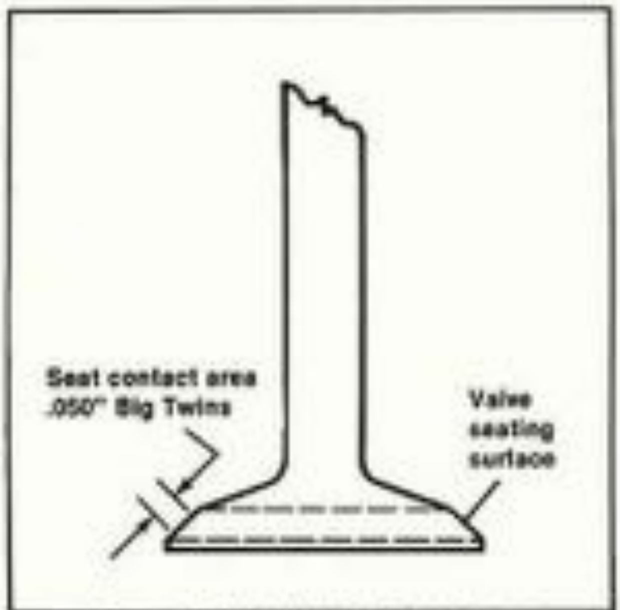
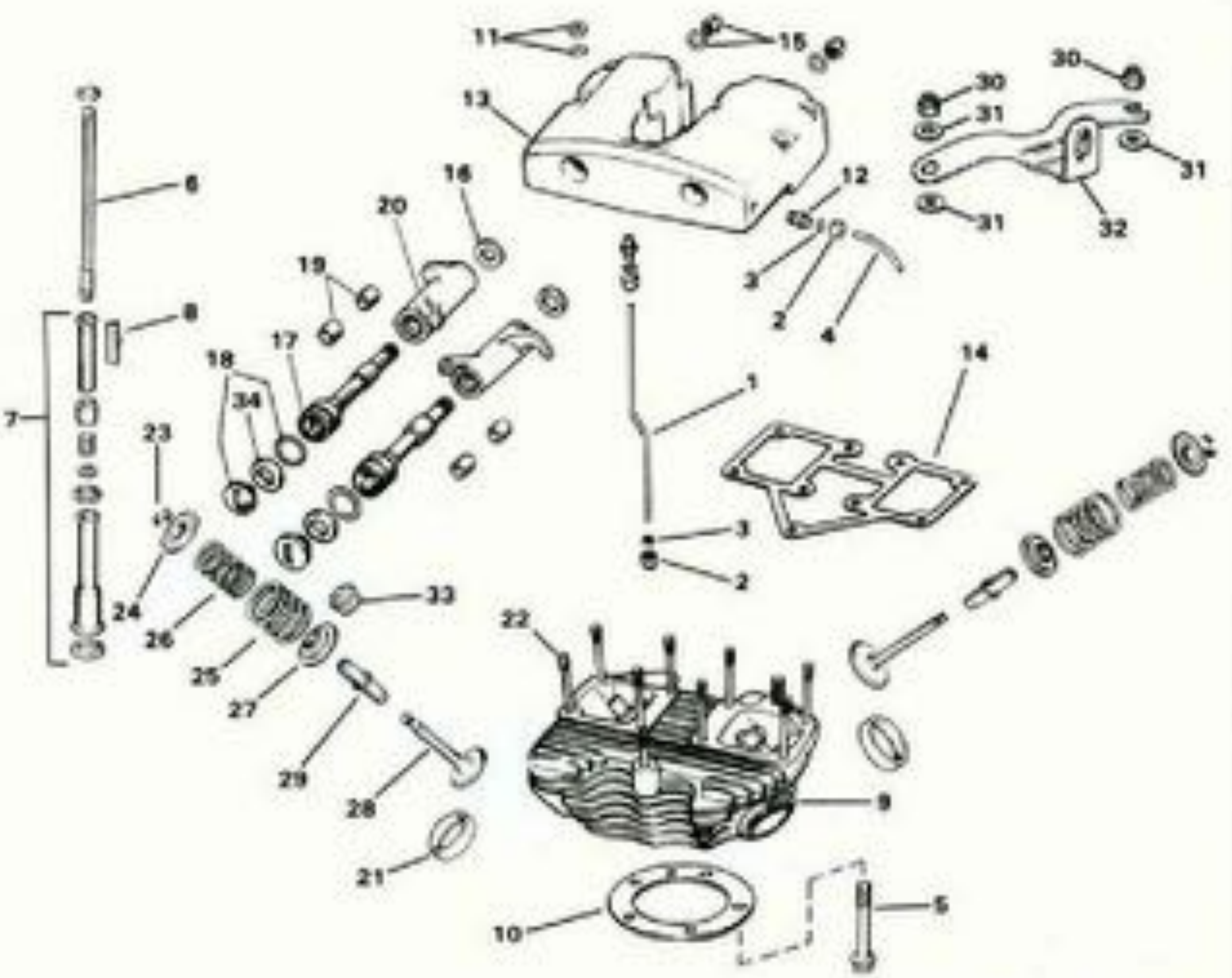


Figure 3-5. Valve Head Contact Area

3. Valve head must have a contact area .050 in. wide and should be located two-thirds the way towards the outside edge of the valve sealing surface. See Figure 3-5. This will leave twice as much remaining



1. Overhead oil feed line
2. Feed line nut (3)
3. Feed line rubber sleeve (3)
4. Cylinder interconnecting oil line
5. Head bolt and washer (5)
6. Push rod (2)
7. Push rod cover (2)
8. Spring cap retainer (2)
9. Cylinder head
10. Cylinder head gasket
11. Rocker housing nut and washer (5)
12. Oil feed line nipple
13. Rocker arm housing
14. Rocker housing gasket
15. Rocker arm shaft acorn nut and washer
16. Rocker arm spacer (2)
17. Rocker arm shaft (2)
18. Rocker arm shaft screw and O-ring (2 each)
19. Rocker arm bushing (4)
20. Rocker arm (2)
21. Valve seat insert (one exhaust, one intake)
22. Rocker housing stud (8)
23. Valve key (2)
24. Upper valve spring collar (2)
25. Outer valve spring (2)
26. Inner valve spring (2)
27. Lower spring collar (2)
28. Valve (one exhaust, one intake)
29. Valve guide, shouldered (2)

29A. Valve guide and snap ring (2) (1980 and later)

30. Nut
31. Washer
32. Upper engine mount bracket
33. Valve stem seal (2) (late 1981 and later)
34. Spacer washer (2) (1981 and later)

Figure 3-6. Cylinder Head — Exploded View seating surface at the inboard side of the contact area as will be at the outboard side of the contact area. The seating surface 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 idicates excessive heat and burning.

4. Valve seats are also subject to wear, pitting and burning. They should be resurfaced whenever valves are refinished.
5. Clean valve guides with an appropriate expansion reamer. Check for valve wear and valve stem clearance.
6. 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.
7. Inspect valve springs for broken or discolored coils. Check free length tension of each spring. If a spring is shorter than service limit, or tension shows spring to be below low service limit, replace it with a new spring. Check valve spring compression against tolerances shown in engine SPECIFICATIONS.
8. Examine push rods, particularly the ball ends. Replace any rods that are bent, worn, discolored or broken. Check cup at end of rocker arm to make certain there are no chipped areas.
9. Blow out oil passages in rocker arms, rocker arm bushings and rocker arm covers.
10. If the rocker arm pads show uneven wear or pitting, replace.
11. Carefully check the rocker arm and shaft for wear. Replace rocker arm bushings if shaft is over .0035 in. loose in bushings, as described in REPAIRING ROCKER ARMS AND BUSHINGS.

REPAIRING ROCKER ARMS AND BUSHINGS (Figure 3-6)

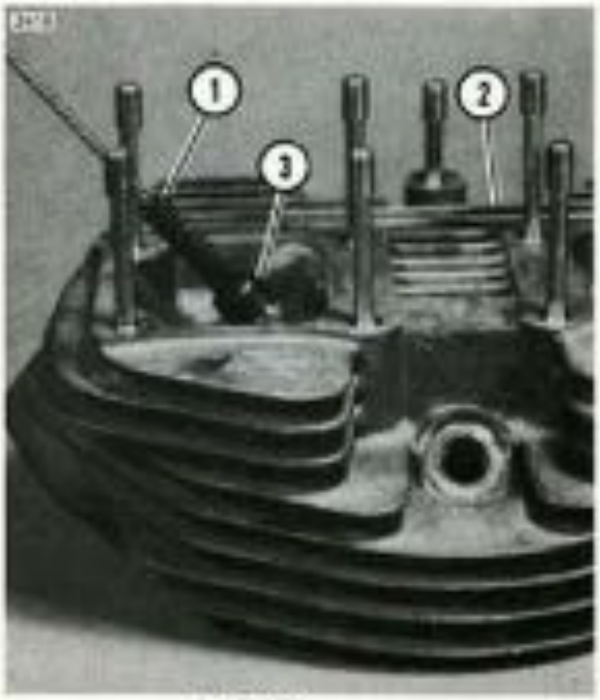
To replace worn bushings (19), press or drive them from the rocker arm. If bushing is difficult to remove, insert a 9/16-18 tap into bushing. From opposite side of rocker arm, drive out bushing and tap. Press replacement bushings into rocker arm, flush with arm end, oil hole correctly aligned and split portion of bushing towards top of arm. Using remaining old bushing as a pilot, line ream new bushing with Harley-Davidson ROCKER ARM BUSHING REAMER, Part No. HD-94804-57. Repeat for other end of rocker arm. When reassembling rocker arm housing, install new O-rings (18).

REPLACING VALVE GUIDES

Replacing valve guide if necessary, must be done before valve seat and face are ground since the valve stem hole in valve guide is the basis from which all face and seat grinding is done. Valve stem - valve guide clearances with oil seals are exhaust .002 in. - .0025 in. and intake .001 in. - .0015 in. If valve stems and/or guides are worn beyond service limits, new parts must be installed.

Tap out valve guides with shouldered drift pin (from chamber side) and insert replacement guide on arbor press. Be particularly careful to press replacement guide squarely into hole.

New valve guides are reamed to correct size. However, when guides are pressed into cylinder heads they must close up slightly; also the ends may be burred. Therefore, after new guides are in place, they are reamed to within .001 in. - .0005 in. of the correct diameter. The guides are then honed to final size with Harley-Davidson VALVE GUIDE HONE HD-34724 while applying liberal amounts of honing oil. See Figure 3-7.



1. Hone
2. Cylinder head
3. Valve guide

Figure 3-7. Honing Valve Guide

It is a prime importance that valve guides fit tightly in cylinder heads or valves may not seat properly. If original guide or new standard guide is not a tight press fit, an oversize guide must be installed.

Cast iron guides are available in the following oversizes: Intake and exhaust — .001, .002, .003, .004, .006, and .008.

RECONDITIONING OR REPLACING VALVE SEATS

After installing valve guides, valve seats must be refaced to true them with guides.

If valves have been reseated several times, valve seats may have become too wide and/or may be seating too deeply in head. When valve seat becomes wider than .090 in. (see Figures 3-8, 3-10) valve seat relief must be counterbored or ground to reduce seat to .050 in. Counterbore dimensions are shown. Tools for this purpose are available commercially. To determine if valve is seating itself too deeply in head, meaure distance from shoulder of valve guide to end of valve stem. See dimensions in Figure 3-8 and 3-9. When valve stem extends through guide in excess of maximum shown, valve seat inserts must be replaced.

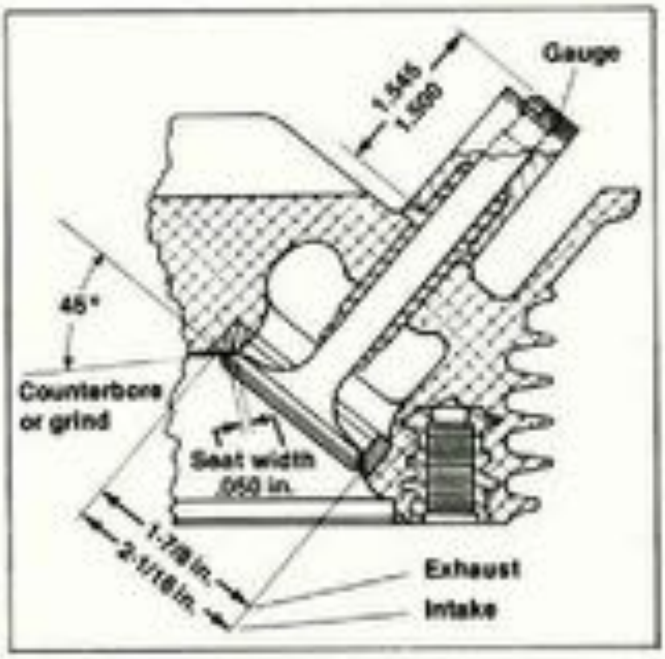


Figure 3-8. Valve Seat — 1979 and Earlier

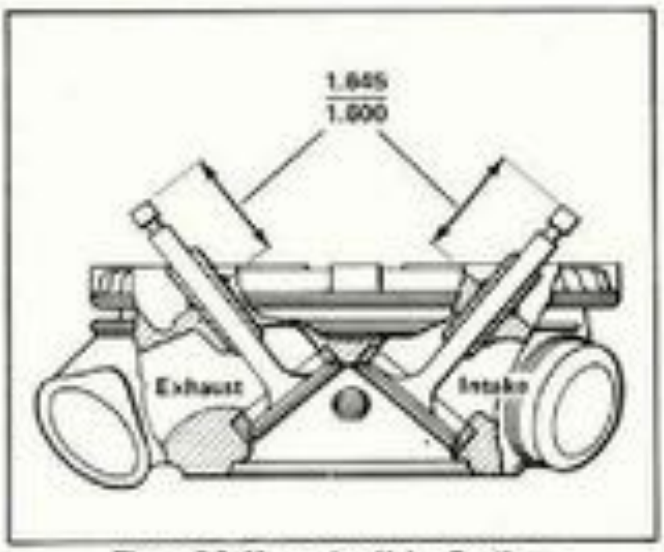


Figure 3-9. Measuring Valve Depth — 1980 and Later

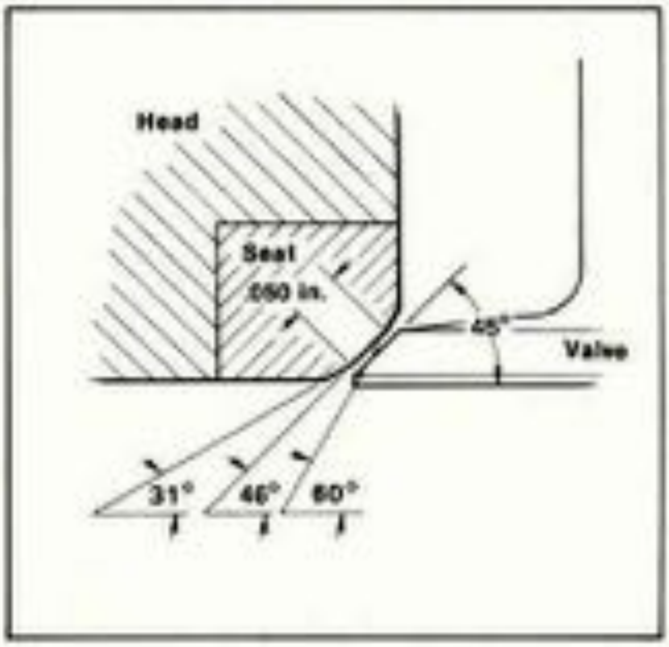


Figure 3-10. Valve Seat Angles

For 1979 and earlier models, a special VALVE SEAT GAUGE TOOL is available under Part No. HD-96490-58A, which is used to measure this dimension. The tool consists of gauge valves and gauge which is placed over the valve stem as shown. If top end of gauge valve stem is between steps on gauge, the valve seat location is satisfactory.

Replacement inserts are available from the factory. Installation requires accurate boring equipment to machine correct counterbore in head for installation with .004 to .006 in. interference fit.

GRINDING VALVE FACES AND SEATS

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 very thin or sharp, 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, true end of stem on a valve refacing grinder equipped with suitable attachment.

Valve seat tools and fixtures are available commercially. Seat each valve in same port from which it was disassembled. Correct valve seat angles are shown in Figures 3-8 and 3-10.

Late 1980 and later models use a 3-angle valve seat on both the intake and exhaust. Use a NEWAY VALVE SEAT CUTTER to cut the seats. Always grind valves before cutting the seats. See Figure 3-10.

1. Cut the 46° valve seat angle first. Cut only enough to clean up the seat.

2. Apply blueing to valve and install valve in head. Rotate valve against seat. Remove valve and check contact pattern. Valve seat should be .050 in. wide and the contact area on the valve should be two-thirds the way towards the outside of the valve seating surface. See Figure 3-5.

3. If valve seat pattern is too close to stem side of valve face, cut 60° angle to raise seat. If pattern is too close to the edge of the valve face, cut the small inboard angle 31°.

4. After cutting either or both the small degree or large degree angle to position seat, make a final cut on the 46° seat angle to obtain the proper .050 in. width.

5. Recheck valve seat width and location with blueing as described in Step 2.

Lapping Valve Faces and Seats (Figure 3-12)

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-96550-36.

2. Lift valve and rotate it about 1/3 of a turn.

Figure 3-12. Lapping Valve and Seat

3. Repeat lapping procedure as shown in Figure 3-12.

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.

6. After valve seat refacing, the clearance between the valve head (1) and the end of the exhaust valve guide (2) must be correctly gauged to prevent contact. See Figure 3-13. Check valve guide to valve head clearance using VALVE GUIDE GAUGE/CUTTING TOOL, Part No. HD-34107.

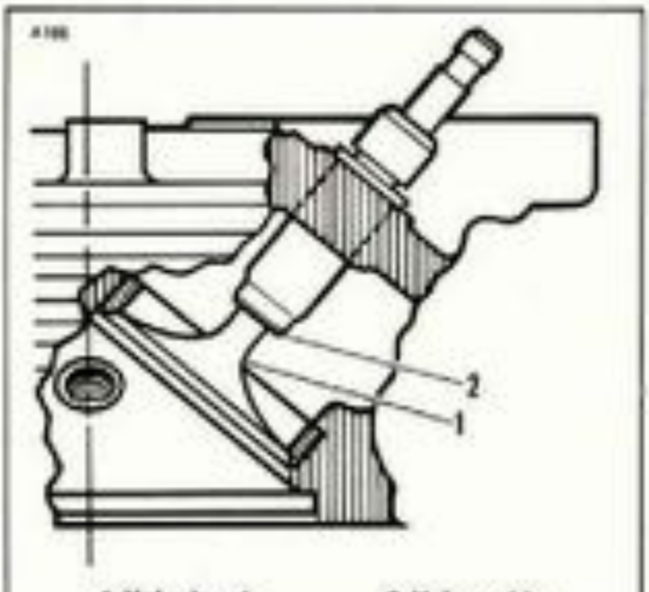


Figure 3-13. Valve Guide to Valve Head Clearance

ASSEMBLING CYLINDER HEAD (Figure 3-6)

NOTE

Steps 1 through 4 are for late 1981 & later models only. Do not install valve stem seals on engines with steel valve guides. Engines with valve stem seals require special stem to guide clearances as given previously.

1. See Figure 3-4. Apply a liberal amount of Harley-Davidson motor oil to the valve stem, then install valve into a valve guide that was previously reamed to allow for the correct clearance.

NOTE

Whenever a valve is removed from a head the valve guide seal must be replaced. Also, whenever a valve guide is replaced the valve seat must be re-ground.

2. Install and position a PROTECTIVE SLEEVE, K-Line Part No. 1403F, over the valve stem so that it completely covers the keeper area of valve stem.

3. Slide a new valve guide seal down the valve stem and position it squarely against valve guide. Remove the protective sleeve.

4. Using VALVE GUIDE INSTALLATION TOOL, Part No. HD-34643 and DRIVER HANDLE, Part No. HD-34643, carefully tap seal down on the guide until the tool bottoms on the head.

NOTE

Valve guide seal must be installed squarely and firmly onto guide or it will not stay on during engine operation. Do not remove the valve after seal has been installed. Doing so will destroy the seal.

5. See Figure 3-4. Replace valve and valve spring assemblies using VALVE SPRING COMPRESSOR, Part No. HD-96600-36. Position valve keys so spaces between key halves are equal.

6. See Figure 3-6. Replace rocker arm assemblies in cover. Tighten rocker arm shaft locknut (15) to 12-18 ft-lbs torque. Make sure rocker arm rotates freely on shaft for proper hydraulic lifte operation.

7. Install new O-ring (18), spacer washer (37) (1980 & 1981) and cap screw (16). Tighten screw to 8-12 ft-lbs torque.

8. Place rocker arm cover assembly on a bench. Using new cover gasket (14), install head over cover. Tighten cover nuts (11) evenly to 9-13 ft-lbs torque.

CAUTION

Be sure to see that rocker arm ends do not jam against valve stems as rocker box is installed on head studs.

9. Install each cylinder head with a new cylinder gasket and position rear head. Coat the bolts with Loctite ANTI-SEIZE and start bolts into head. First turn bolts snug, then using a torque wrench tighten each alternately 1/4 turn at a time until all are drawn to 55–75 ft-lbs.

NOTE

A torque wrench extension (dog bone) may be used to tighten the head bolts. However, an adjustment must be made to the torque readings on the torque wrench. Slide charts for calculating these adjustments are also available commercially.

10. Install push rods as described in the next procedure.

INSTALLING AND ADJUSTING PUSH RODS

1. Before installing or adjusting push rods, remove and clean all hydraulic tappets. Make sure each tappet is clean and free from oil before installing in the guide. See VALVE TAPPETS AND GUIDES.

2. See Figure 3-15. Remove the spark plugs and turn the engine until the front piston is at the top of its compression stroke. With front piston in this position the advance timing mark (3) will align with the timing inspection hole.

3. Install front cylinder push rods and covers (6, 7 Figure 3-6). Always use new push rod cover O-rings, or quad seals when reassembling. Clean sealing surfaces with greaseless solvent.

Greasy joint surfaces will make it difficult to remove O-rings, or quad seals during next disassembly.

4. See Figure 3-14. Turn one front cylinder push rod adjusting screw (2) downward until the ball end of rod is seated in hydraulic lifter and has just no noticeable shake. Hold the push rod flats (3) with one wrench to keep rod from turning and with a second wrench turn the adjusting screw down slowly until hydraulic lifter is completely compressed. Then turn it up exactly 1-1/2 turns. Lock the adjustment by turning locknut (1) against push rod and tightening the locknut to 6-11 ft-lbs torque. Repeat for the other front cylinder push rod.

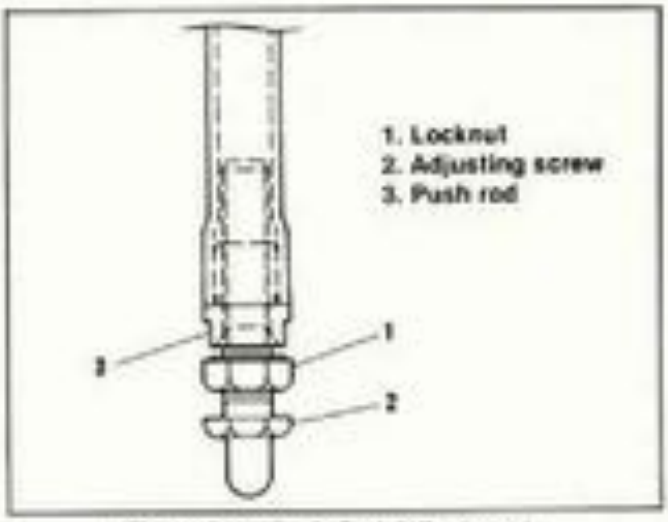


Figure 3-14. Push Rod Adjustment

5. See Figure 3-15. Now turn the engine over until the rear piston is at the top of its compression stroke. With the rear cylinder in this position the rear cylinder advance mark (4) will align with the timing inspection hole.

6. Repeat the procedure for the rear cylinder push rods.

7. Re-install the spark plugs and tighten to 18-22 ft-lbs torque.

CHECKING PUSH ROD ADJUSTMENT

Push rod adjustment may be checked using the PUSH ROD ADJUSTMENT GAUGE, Part No. HD-94438-79.

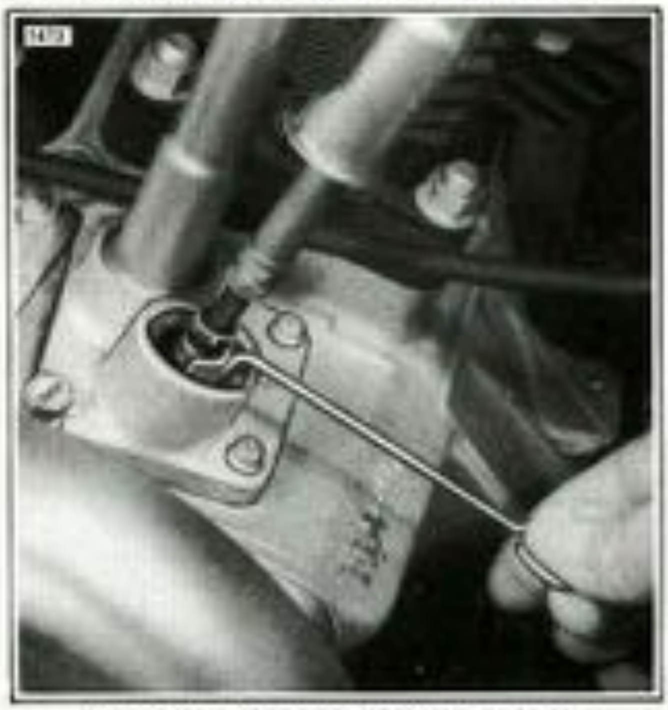


Figure 3-16. Checking Push Rod Adjustment

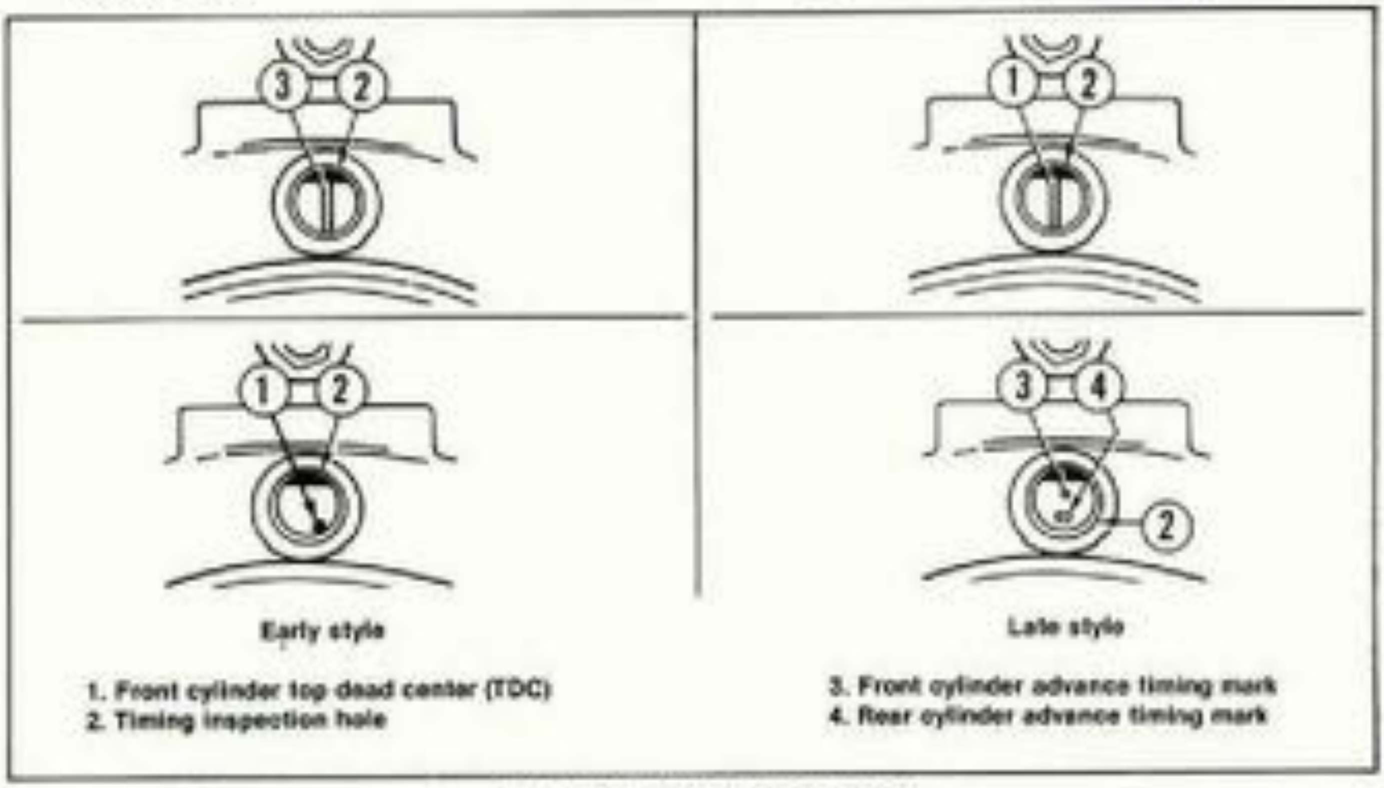


Figure 3-15. Ignition Timing Mark

1. With appropriate piston at the top of the compression stroke (see INSTALLING AND ADJUSTING PUSH RODS), raise the push rod cover to expose the hydraulic lifter.

2. See Figure 3-16. Place the gauge on the lifter as shown. The top of the lifter should be even with the top of the gauge.

3. If gauge and lifter do not line up, follow the procedure for INSTALLING AND ADJUSTING PUSH RODS.

CYLINDER AND PISTON

DISASSEMBLING CYLINDER AND PISTON (Figure 3-17)

1. Strip motorcycle as described in STRIPPING MOTORCYCLE FOR ENGINE REPAIR.

2. Remove cylinder head as described in DISASSEMBLING CYLINDER HEAD.

3. Remove all cylinder base stud nuts and spacers (1) except one on rear cylinder, using CYLINDER BASE NUT WRENCH, Part No. HD-94589-29A.

4. On late 1981 - early 1982 models remove clamp and oil hose (13) from fitting (12) on both cylinders.

5. Raise front cylinder over piston enough to permit placing a cloth over crankcase opening. This will prevent dirt or pieces of broken ring from falling into crankcase.

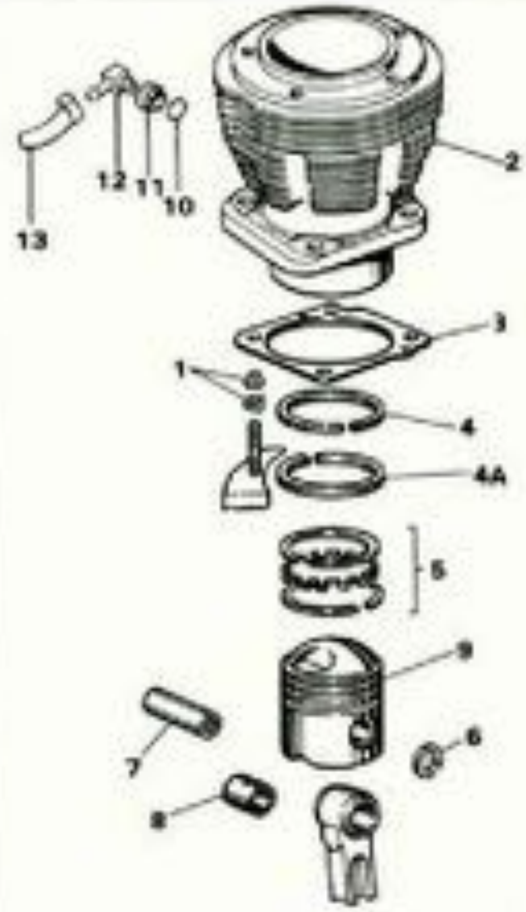
6. With piston at bottom of stroke, remove cylinder (2). Place rubber sleeves over studs to prevent scratching piston.

7. Remove remaining stud nut from rear cylinder. Remove rear cylinder in same manner. Discard cylinder to crankcase gasket (3). Place rubber sleeves over studs.

8. Spring piston rings (4, 4A, 5) outward until they clear ring grooves in piston and lift off. Use a commercial ring expander if necessary.

9. On vehicles 1983 and earlier remove piston pin lock rings (6) using INTERNAL LOCK RING PLIERS, Part No. HD-96215-49. On vehicles 1983 and later pry lock ring from piston.

10. Support piston and tap out piston pin (7) with a suitable drift. Mark pistons so they will be returned to their original position.



1. Cylinder base nut and spacer (4)	6. Piston pin lock ring (2)
2. Cylinder	7. Piston pin
3. Cylinder base gasket	8. Piston pin bushing
4. Compression ring (1st groove)	9. Piston
4A. Compression ring (2nd groove)	10. O-ring*
5. Oil ring	11. Spacer*
	12. Oil fitting*
	13. Oil hose with clamp*

*Late 1981 to early 1982 only

Figure 3-17. Cylinder — Exploded View

CLEANING, AND INSPECTION

1. Place cylinders and piston in GUNK HYDRO-SEAL or other carbon and gum dissolving agent until deposits are soft.

2. Scrub piston dome and outside of cylinder to remove deposits.

3. Where carbon deposit is thick and hard, it is advisable to scrape carbon before cleaning. Use a putty knife or ground tip on an old file. Use care to keep from scraping into aluminum of piston.

4. Wash all parts in solvent and blow dry with compressed air. Force air through feed and return oil passages in cylinder.

5. 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. Check clearances listed in Service Limit Specifications.

8. Make sure piston pin lock ring grooves are clean.

9. Examine piston and cylinder for cracks, burned spots, grooves and gouges.

10. Check rods for up and down play in lower bearings. When up and down play is detected, lower bearing should be refitted. This requires removing and disassembling engine crankcase.

REFINISHING CYLINDER

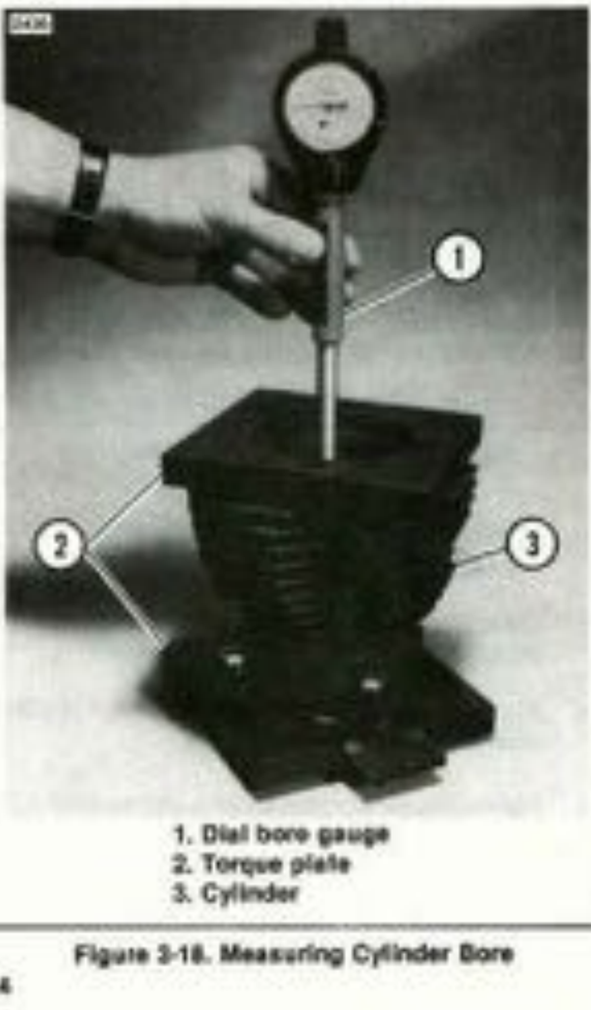
Measure pistons and cylinder to determine if they are worn to the point where cylinders must be rebored and oversize pistons installed.

NOTE

Inside and outside micrometers used for piston to cylinder fitting should be checked together to be sure they are adjusted to read exactly the same.

Measuring Cylinder Bore (Figure 3-18)

1. Take cylinder bore measurements with the cylinder under clamp load, using Harley-Davidson CYLINDER TORQUE PLATE, Part No. HD-33446. Check the cylinder, gasket surfacees, top and bottom to be sure they are free of any surface disruptions. Position a head and base gasket in place on the cylinder and clamp the cylinder in the fixture tightening the head bolts to 65 ft-lbs torque and base bolts to 35 ft-lbs torque. See Figure 3-18.



1. Dial bore gauge
2. Torque plate
3. Cylinder

Figure 3-18. Measuring Cylinder Bore

2. Take cylinder bore measurement in the ring path, starting about 1/2 in. from the top of the cylinder measuring from front to rear and then side to side. Record readings.

3. 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.

4. If cylinders are not scuffed, scored and are not worn beyond service limits, it is not necessary to rebore oversize at time.

5. 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.

Figure 3-19. Measuring Piston (Early 1983 & Earlier)

Measuring Piston (Early 1983 & Earlier) (Figure 3-19)

Pistons are measured front-to-rear at base of piston skirt as shown in figure 3-19. Pistons are cam ground to an egged or oval shape so only front and rear surfaces are touching cylinder wall.

Late 1983 and Later Pistons

The late 1983 and later pistons are difficult to measure due to their barrel shape. This is of no concern since it is the amount of cylinder bore wear which will determine when replacement pistons are needed and the diameter of oversize piston required. The following chart cross references the cylinder bore with the oversize piston required.

PISTON FITMENT	
Cylinder Bore	Piston
3.4980 in. ± .0002 in.	Standard
3.5030 in. ± .0002 in.	.005 in. O.S.
3.5080 in. ± .0002 in.	.010 in. O.S.
3.5180 in. ± .0002 in.	.020 in. O.S.
3.5280 in. ± .0002 in.	.030 in. O.S.

Service Wear Limits would exceed above cylinder bore specifications by .004 in.

Fitting Cylinder to Piston

If cylinders are not scuffed or scored and piston clearance is within service limit, it is not necessary to rebore oversize. If desired, a new piston may be installed to reduce clearance for more quiet operation.

If piston clearance is more than service limit, cylinders should be rebored and/or honed to next standard oversize and refitted with corresponding pistons and rings.

Cylinders can be refinished oversize with a hone only, or with a boring bar followed by a finishing hone. In general, only cylinders not scored and not badly worn are refinished entirely with a hone. The cylinders are bored and honed under clamp load using Harley-Davidson CYLINDER TORQUE PLATE HD-33446. Check the cylinder gasket surfaces, top and bottom, to be sure they are free of any surface disruptions. Position a head and base gasket in place on the cylinder and clamp the cylinder in the fixture tightening the head bolts to 65 ft-lbs torque and base bolts to 35 ft-lbs torque. See Figure 3-18. Cylinders badly worn are first rebored to nearly the required oversize diameter. All honing must be done from the crankcase side of the cylinder. Honing may be started, if necessary, with a medium finishing stone set of 220 grit. Final finish hone to exact size using a polishing set of 280 grit. Do not polish to a surface finish using a finer grit than 280. Exact final size of the cylinder bore is determined by size of the piston to be used in that cylinder. On early 1983 and earlier vehicles, measure piston diameter accurately as described previously, then add desired piston clearance in cylinder. This will equal the exact final size to which cylinder bore should be refinished, example: a .010 in. oversize piston to be used measures 3.5185 in., adding .002 in. (desired clearance equals 3.5205 in. (finish-honed size). When cylinders require reboring to beyond .030 in. (1340cc) .070 in. (1200cc) oversize to clean up, their oversize limit has been exceeded and the cylinders must be replaced.

When cylinders are worn less than service limit, reboring is unnecessary. Unless they are scuffed or grooved, the same pistons may be used with the replacement of rings and the roughing of cylinder walls to facilitate ring seating. Use a 240 S.C. (Silicon Carbide) Flex Hone.

Fitting Piston Rings

Piston rings are two types — compression (plain face) and oil control ring. The two compression rings are positioned in the two upper piston ring grooves. The outer edge of the oil control ring is slightly tapered and the ring must be installed in the ring groove with the dot mark on the top side for the ring to work properly. The bevel edge at the inner diameter of the second ring will face downward when installed properly. Rings are regularly supplied to fit standard oversize pistons.

1. Compression rings must have proper side clearance in grooves. Check with thickness gauge as shown in Figure 3-20.

2. See Figure 3-21. Taper face type compression rings are being used in the 2nd from top ring groove of 1340cc engines beginning with crankcase no. 1479-345-165, and in 1200cc engines beginning with crankcase no. 179-023-001.

   The new ring replaces the chrome ring formerly used in the 2nd ring groove, and is identifiable by the black color instead of chrome on the outer edge. When installed in the ring groove, the lower

Figure 3-20. Measuring Ring Side Clearance

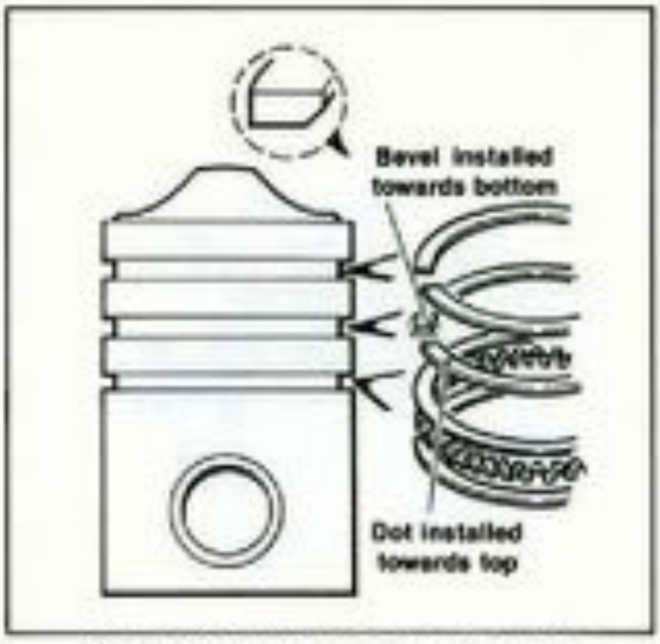


Figure 3-21. Late Style Compression Ring

edge of the ring seals against the cylinder wall to improve compression and oil control.

3. The bottom oil ring is a three piece oil control ring using a spring expander.

4. Ring gap (space between ends) must also be as specified, see SPECIFICATIONS, at the beginning of this section.

   To check ring gap, place a piston in cylinder with top end of piston about 1/2 in. from top of cylinder. Place ring in cylinder bore squarely against piston and check gap with thickness gauge (see Figure 3-22).

   Use only standard size rings and piston in standard bore, and only matching oversize rings and piston in the same oversize bore.

   If gap is less than specified, ring ends may butt under expansion and be scored or broken. Compression ring gap may be increased by filing with fine-cut file.

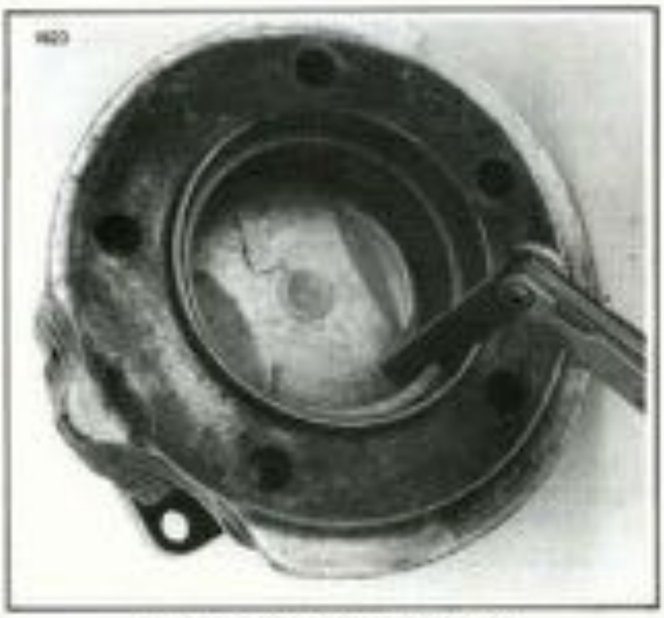


Figure 3-22. Checking Ring Gap

Figure 3-23. Assembling Rings

5. See Figure 3-23. Slip rings over the piston into their respective grooves without over expanding or twisting rings which could damage finely finished piston surface.

6. See Figure 3-24. Ring gaps should be staggered on either side of the piston pin. Do not place ring gaps at thrust surfaces of piston. Also, gaps on the oil control ring top and bottom rails should be spaced 1 in. either side of the oil control expander ring gap.

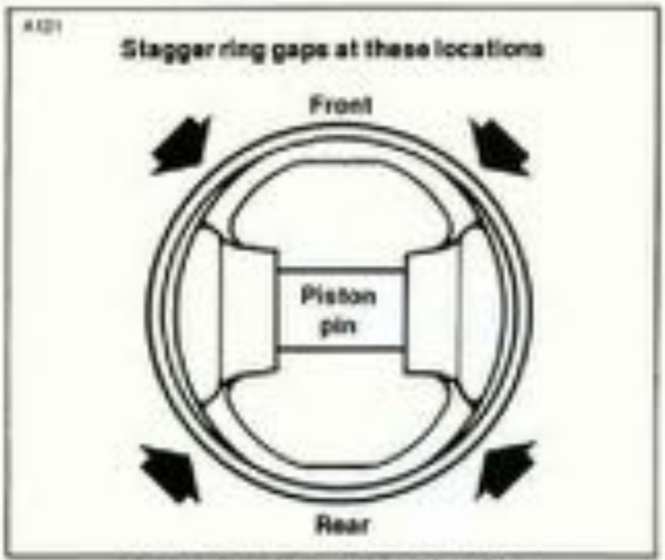


Figure 3-24. Positioning Ring Gaps

CONNECTING ROD BUSHING

General

On early 1983 and earlier vehicles, when connecting rod bushing is tight in rod but is worn to excessive pin clearance (0.002 in. or more) it is possible to service by reaming oversize and fitting an oversize pin. However, it is recommended that a new bushing be installed and reamed to fit a standard pin. The objection to fitting the upper end oversize is that considerably more time is required for the job, because pistons, standard or oversize, obtained from the factory are supplied correctly fitted with standard pin, and may be installed in a short time if the rod bushing is standard size. If bushing has been reamed oversize, the piston must be reamed oversize to fit an oversize pin, which involves extra time.

Replacing Rod Bushings (Figure 3-25)

When replacing bushings in connection with only a top overhaul, use Harley-Davidson PISTON PIN BUSHING TOOL, Part No. HD-95970-32A and CONNECTING ROD CLAMPING FIXTURE, Part No. HD-95952-33. Be careful to start new bushing with oil slot in bushing aligned with oil slot in rod.

Ream new bushing to size with EXPANSION REAMER, Part No. HD-94800-26. Refer to SPECIFICATION section for correct clearances.

Figure 3-25. Replacing Rod Bushing

TWISTED CONNECTING RODS

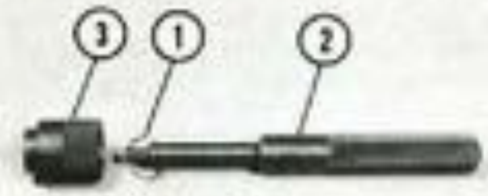
If there is reason to believe the connecting rod is twisted, the connecting rod must be replaced. The crankpin bushing and the piston pin bushing must be axially parallel or accelerated wear and excessive noise will result. To replace a connecting rod, refer to the procedures given under FLYWHEELS later in this section.

ASSEMBLING CYLINDER AND PISTON

1. Attach piston to connecting rod with a piston pin.

2. After installing piston pin to connecting rod, install new piston pin lock rings using INTERNAL LOCK RING PLIERS, Part No. HD-96215-49 on vehicles early 1983 and earlier. On late 1983 and later pistons install the retaining ring using Harley-Davidson RETAINING RING INSTALLER, Part No. HD-34623. See Figure 26. Place a retaining ring (1) in the grooved end of driver (2). Push the retaining ring, any distance, into the bore of collar (3) from the chamfered end. Insert driver (2) through collar (3) and retaining ring (1). Position the pilot end of driver (2) into the hole in the piston pin.

   Rotate collar so that retaining ring gap will be away from the bottom. Hold collar (3) tightly against the flat at the side of the piston wall. Push against driver (2) with considerable force until the retaining ring is heard snapping in place.



1. Retaining ring
2. Driver
3. Collar

Figure 3-26. Retaining Ring Installer

CAUTION

Make sure lock ring groove is clean and that ring seats firmly in groove. If it doesn't, discard the ring and install a new one. A lock ring loosely installed will loosen further in service and finally will come out of piston groove, resulting in both piston and cylinder soon being damaged beyond repair. Never install a used lock ring or a new one if it has been installed and then removed for any reason. Always use a new lock ring. On early 1983 and earlier vehicles always install lock ring with sharp edge out. On 1983 and later vehicles istall retaining ring with gap away from the bottom or 6 o'clock position.

3. Lubricate cylinder walls, pistons, pins and rod bushings with engine oil.

4. Turn engine until crank pin is at top center.

5. Install new cylinder base gasket.

6. Support the piston with PISTON SQUARING PLATE, Part No. HD-33030. This will support the piston squarely, prevent rotation and leave both hands free for installing the cylinder.

7. Position PISTON RING COMPRESSOR, Part No.

HD-96333-51A, on rear piston and slip rear cylinder down over piston as shown in Figure 3-27.

8. Install cylinder mounting spacers with the stamped side "UP" facing upward. Thread on the nuts and tighten them evenly. Torque nuts to 32-40 ft-lbs. Repeat process to assemble other cylinder.

9. See Figure 3-17. On late 1981 and early 1982 models, connect oil hoses (13) to fittings (12) using new clamps. If fitting was removed, a new O-ring must be installed. Tighten fitting to 70-80 in-lbs torque. Then continue to tighten so fitting is facing in proper direction.

10. Assemble cylinder heads as indicated in ASSEMBLING CYLINDER HEADS.

Figure 3-27. Slipping Cylinder Over Piston

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 reroutes surplus oil (above the amount needed to lubricate the engine) directly to the oil tank. A check valve is located ahead of the pressure regulating valve to prevent oil drainage from tank.

Under normal operating conditions, the pump is a comparatively trouble free unit. The most common trouble with pump operation is the introduction into the pump of a metal or hard carbon chip. 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 shearing of the 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.

Disassembling (Figure 3-28)

The oil pump may be disassembled, piece-by-piece without removing gearcase cover, with engine in chassis as follows:

NOTE

Gears and keys must be replaced in the same position as removed.

1. Disconnect oil lines and oil pressure switch (1) from pump.
2. Remove bolts and lockwashers (2) that hold oil pump cover in place.
3. Remove oil pump cover (3) and gasket (4).
4. Remove lock ring (5), drive gear (6), gear key (7) and idler gear (8).

CAUTION

Do not allow drive shaft (11) to be pushed into gearcase because key could fall out of shaft into gearcase.

5. Remove the oil pump body mounting hardware (9 or 9A) and slip pump body (10) off drive gear shaft (11).
6. Remove drive gear (12), key (13) and idler gear (14).
7. Remove relief valve plug (15) from pump body and remove relief valve spring (16), dowel (27) and valve (17).
8. Remove check valve spring cover screw and O-ring (18), valve spring (19) and ball (20).
9. Remove the chain oiler adjusting screw (21) on 1982 and earlier models except FXB.
10. Oil pump elbows (22) may be turned out of pump cover to facilitate cleaning.

Cleaning, Inspection And Repair (Figure 3-28)

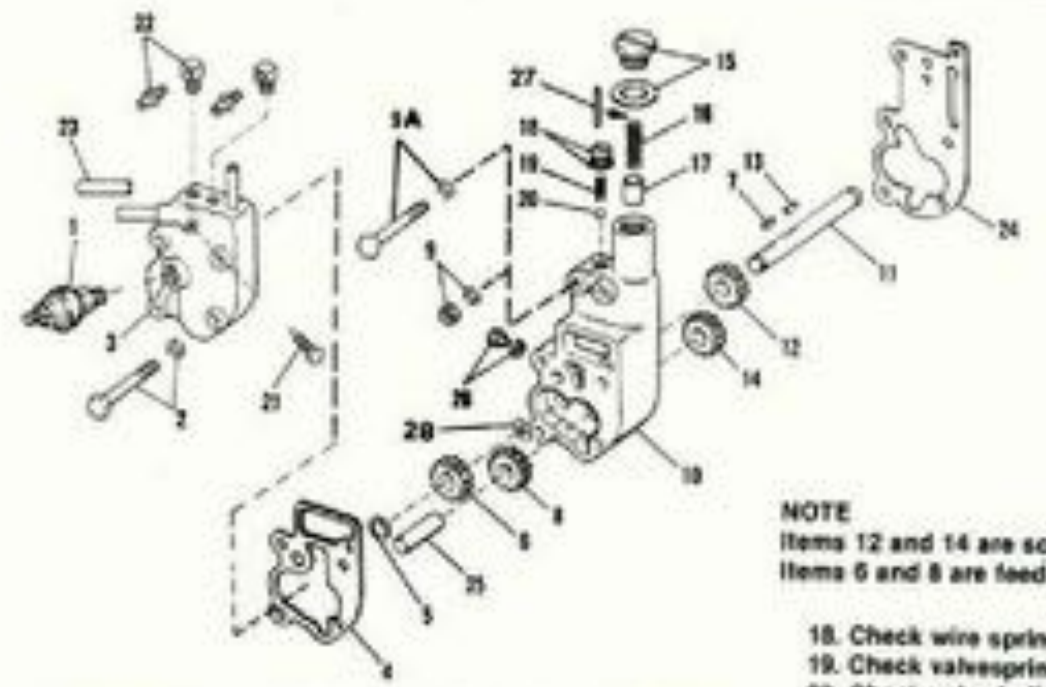
Thoroughly clean all parts in cleaning solvent and blow pump body passages clear with compressed air. Inspect valves and valve seats for pitting and wear. Replace pump having worn or damaged valve seat. Inspect keys and keyways. Inspect scavenger and feed pump gear teeth for gouging or cracking caused by foreign materials going through pump. Replace seal (28) with lip facing feed gear. Pump shafts and bushings normally last for the lifetime of the engine.

Assembling (Figure 3-28)

NOTE

Do not mix gears and keys, replace in original location. Oil pump gaskets should not be reused. Use only FACTORY MADE gaskets. 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 (22).
2. On 1982 and earlier models except FXB, install the adjusting screw (21). Bottom the screw then turn it out 1/4 turn.
3. Install check valve ball (20), valve spring (19) and cover screw (18).
4. Install relief valve plunger (17), spring (16) and plug and gasket (15). Tighten plug to 80-110 in-lbs torque.
5. Install key (13) and drive gear (12) on drive shaft (11).
6. Install idler gear (14) on idler gear shaft from back side of oil pump body (10).
7. Place new gasket (21) on gearcase and install pump body (10) and snug mounting hardware (9 or 9A).
8. Install key (7) and drive gear (6). Secure drive gear (6) with new lock ring (5).
9. Install idler gear (8).



NOTE
Items 12 and 14 are scavenger gears.
Items 6 and 8 are feed gears.

1. Oil pressure switch
2. Cover bolt and washer
3. Oil pump cover
4. Cover gasket
5. Lock ring
6. Drive gear
7. Gear key
8. Idler gear
9. Stud nuts and washers (2) (1978 ½)
9A. Bolt and lockwasher (1979 and later)
10. Oil pump body
11. Oil pump gear drive shaft
12. Drive gear
13. Gear key
14. Idler gear
15. Relief valve plug and washer
16. Relief valve spring
17. Relief valve spring plunger
18. Check wire spring cover screw
19. Check valvespring
20. Check valve ball
21. Chain oiler adjusting screw (1982 & earlier except FXB)
22. Oil line elbow and nipple (2)
23. Chain oiler pipe (1982 & earlier except FXB)
24. Body gasket
25. Idler gear shaft
26. Plug and gasket
27. Dowel*
28. Seal

* 1981 & early 1982

Figure 3-28. Oil Pump — Exploded View

10. Install a new cover gasket (4) and oil pump cover (3) with bolts and lockwashers (2). Tighten hardware (2 and 9) evenly to 45-50 in-lbs torque if plastic gaskets are used. Tighten hardware (2 and 9) to 50-60 in-lbs torque if white paper gaskets are used. Tighten hardware (2 and 9) to 90-120 in-lbs torque if black paper gaskets are used.

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.

11. Install oil pressure switch (1).

12. Connect oil lines to pump. (Figure 3-29, 3-30). 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.

VALVE TAPPETS AND GUIDES

General

The tappet assembly consists of tappet, roller and hydraulic unit. The tappet and roller, under compression force from valve spring, follow the surface of the revolving cam. The up-and-down motion produced is transmitted to the valve by the hydraulic unit, push rod and rocker arm. The hydraulic unit contains a piston or plunger and cylinder plus a check valve ball which allow the unit to pump itself full of engine oil to take up all play in the entire valve train.

When hydraulic units are functioning properly the assembly operates with no 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 for some time. Hydraulic units have a definite LEAK DOWN rate which permits the oil in the hydraulic unit cylinder to escape. This is necessary to allow units to compensate for various expansion conditions of parts and still maintain non-clearance operation. Hydraulic units are functioning properly if they become quiet after a few minutes of engine operation.

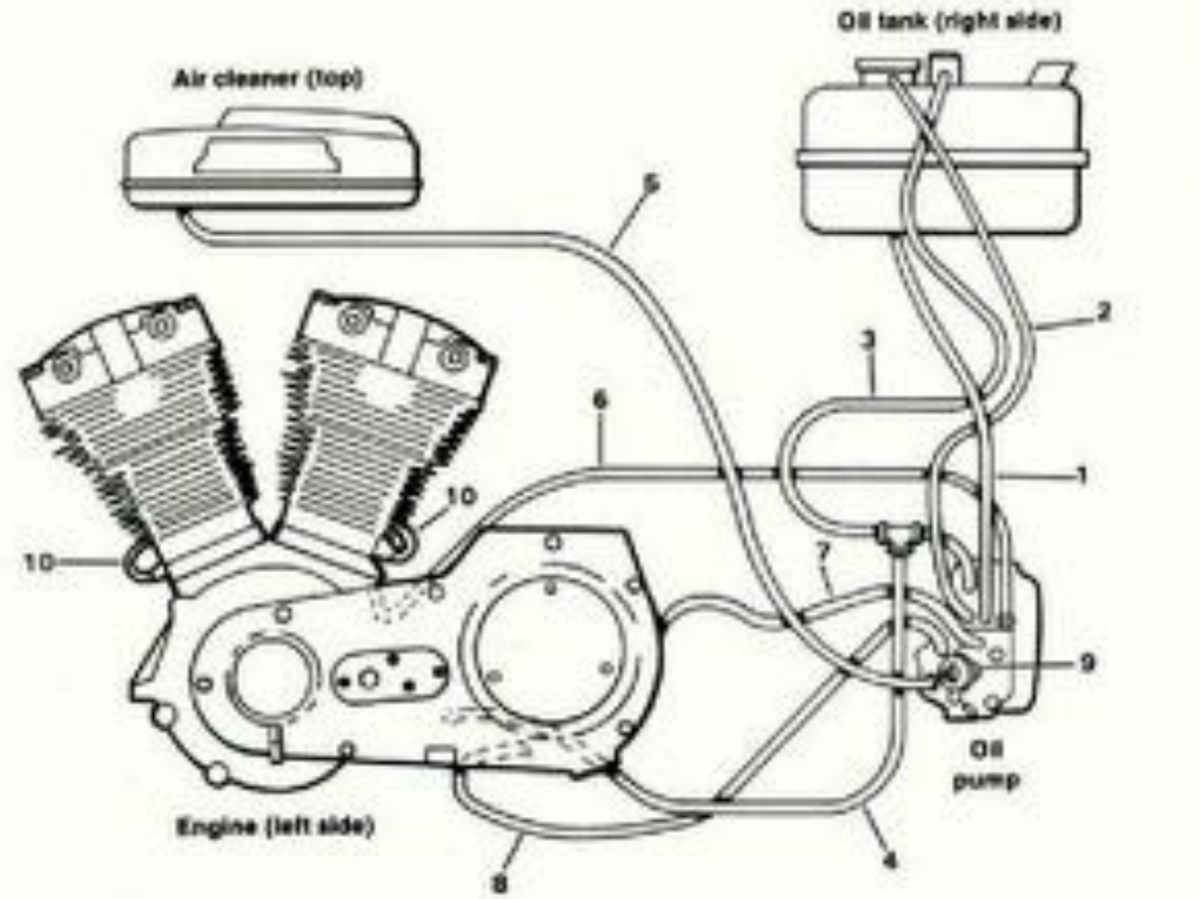


Figure 3-29. Oil Hose Routing — 1981 And Earlier

Disassembling Tappets (Figure 3-31)

1. If engine cylinder head is not disassembled, rotate engine until both valves are closed.

2. Remove push rod cover spring cap retainer. Lift push rod covers and retract push rod adjusting screw until push rod may be lifted out of ball sockets.

3. Remove oil hose (late 1981 and early 1982) and clamp from fitting (7). Scribe lines from the tappet guide to the crankcase on two sides to assure proper realignment during reassembly. Remove tappet guide screws (1).

4. Lift out hydraulic units (2). If units are loctited, remove hydraulic lifter from lifter body. Insert Harley-Davidson VALVE LIFTER REMOVER, Part No. HD-97102-61 into the internal bore of the lifter body for removal.

5. Loosen tappet guides by tapping gently with rawhide or soft metal mallet.

6. Insert thumb and forefinger into push rod opening in tappet guide and press tops of tappets against side of guides.

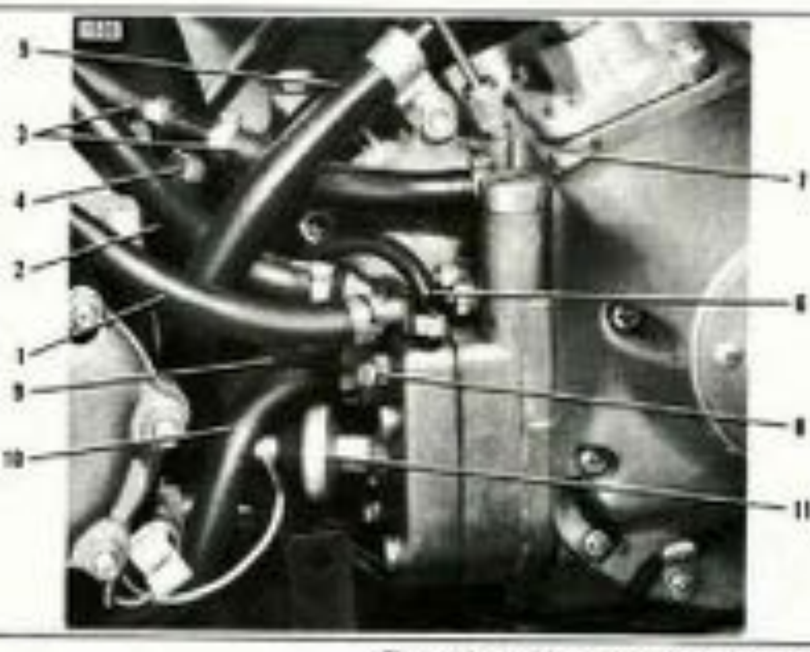
7. Remove tappet and guide assembly. Be careful to avoid dropping a tappet through guide mounting hole and into gearcase.

8. Slip push rod cover seals (3, 3A or 3B) out top of tappet guide (4).

9. Pull tappet and roller (5) out bottom of tappet guide and remove tappet guide gasket (6).

Cleaning And Inspecting

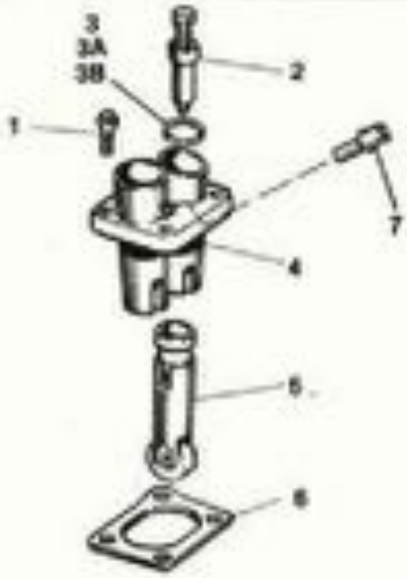
1. Wash all parts except hydraulic units, tappet and roller and gaskets in grease solvent. Hydraulic unit



1. Oil supply line from tank
2. Oil return line to tank
3. Vent line to oil tank
4. Vent line to primary housing (chain drive)
5. Crankcase breather hose
6. Front chain oiler line to primary housing (chain drive)
7. Tappet oil screen plug
8. Rear chain oiler adjusting screw (chain drive 1982 and earlier)
9. Rear chain oiler line (chain drive)
10. Primary housing return line (chain drive)
11. Oil pressure switch (Except FXST)

Figure 3-30. Oil Pump and Connecting Lines

parts are selectively fitted and may not be interchanged as they must be individually and separately washed. Twist and pull hydraulic piston and spring from cylinder and work parts. Tappet and roller should be soaked in clean engine oil for two hours. Remove and allow to drain in a clean covered container until ready for reassembly into engine.



1. Tappet guide screw (4)
2. Hydraulic unit (2)
3. Cork washer (2) (1978 to early 1979)
3A. O-ring (2) (late 1979 and later)
3B. Quad seal (late 1981 and later)
4. Tappet guide
5. Tappet and roller assembly (2)
6. Tappet guide gasket
7. Fitting (late 1981 and early 1982)

Figure 3-31. Tappet Assembly — Exploded View

2. Blow out oil passages in tappet guides and hydraulic units with compressed air. Insert a length of wire into oil channel openings in tappet guide to make sure passages are open. Air dry all parts.

3. Examine cam lobes through tappet guide holes in gearcase for nicked, grooved or chipped condition. Examine tappet guide matching surfaces for scuffing or grooving.

4. When tappet fit in guide exceeds service limit shown in engine SPECIFICATIONS, replace worn parts. If roller radial clearance is found to be not more than .0012 in., force out pin on arbor press, insert new parts and peen on stake pin ends.

5. Check roller end clearance. Replace all units exceeding service limits listed in specifications.

Assembling Tappets (Figure 3-31)

1. See Figure 3-31, 3-32. Slip tappets (5) into guide (4) so flat surfaces on tappets are toward center of guide as shown. If flat surfaces with holes are not toward center of guide, engine oil will not feed across and exhaust hydraulic unit cannot fill with oil.

2. Assemble tappet guide gasket dry and insert tappet guide assembly in place on gearcase with scribed lines matching to ± .0005 in. Hold tappets in place with thumb and forefinger as when unit was removed.

3. Assemble push rod cover O-ring or quad ring, push rod hydraulic units and tappet guide screw. Tighten tappet guide screw to 90-120 in-lbs torque.

4. Install oil hose on tappet guide fitting using new clamp.

5. Assemble remainder of push rod assembly.

6. Adjust tappet clearance as described in CYLINDER HEAD.

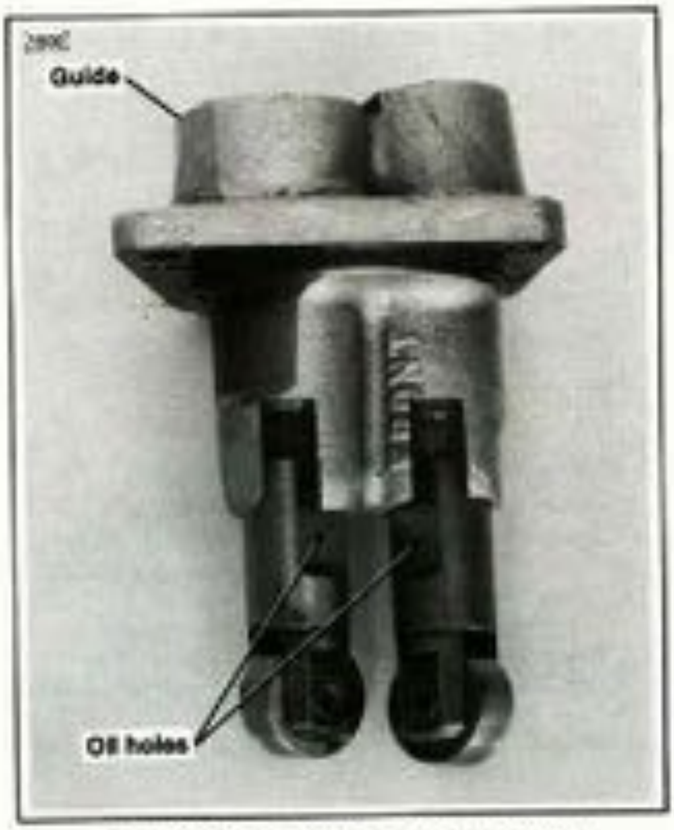


Figure 3-32. Inserting Tappets on Guide

GEARCASE COVER AND TIMING GEARS

General

The gearcase, located on the right side of the engine crankcase, contains a train 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 engine crankcase.

Shafts run in bushings except the crankcase side of the cam shaft which operates in a needle roller bearing.

Disassembling Gearcase (Figure 3-34)

Before disassembling gearcase, it is advisable to remove push rods, tappets, push rod hydraulic units and tappet guides as described in DISASSEMBLING TAPPETS.

1. Remove tappet oil screen cap (1), O-ring (2), screen spring (3) and screen (4). Drill out two cover rivets (5) and remove cover.

Figure 3-33. Pulling Pinion Gear

2. Remove two ignition sensor cover screws (6), cover (7) and gasket (8).

3. Remove sensor plate screws and lockwashers (9).

4. Disconnect sensor plate wires at connection so that sensor plate may be moved out of the way.

5. Remove bolt (11) and rotor (12).

6. Remove gearcase cover screws (13, 14 and 15).

7. Tap gearcase cover with wood or rawhide mallet to loosen and remove gear cover (16) and gearcase cover gasket (17).

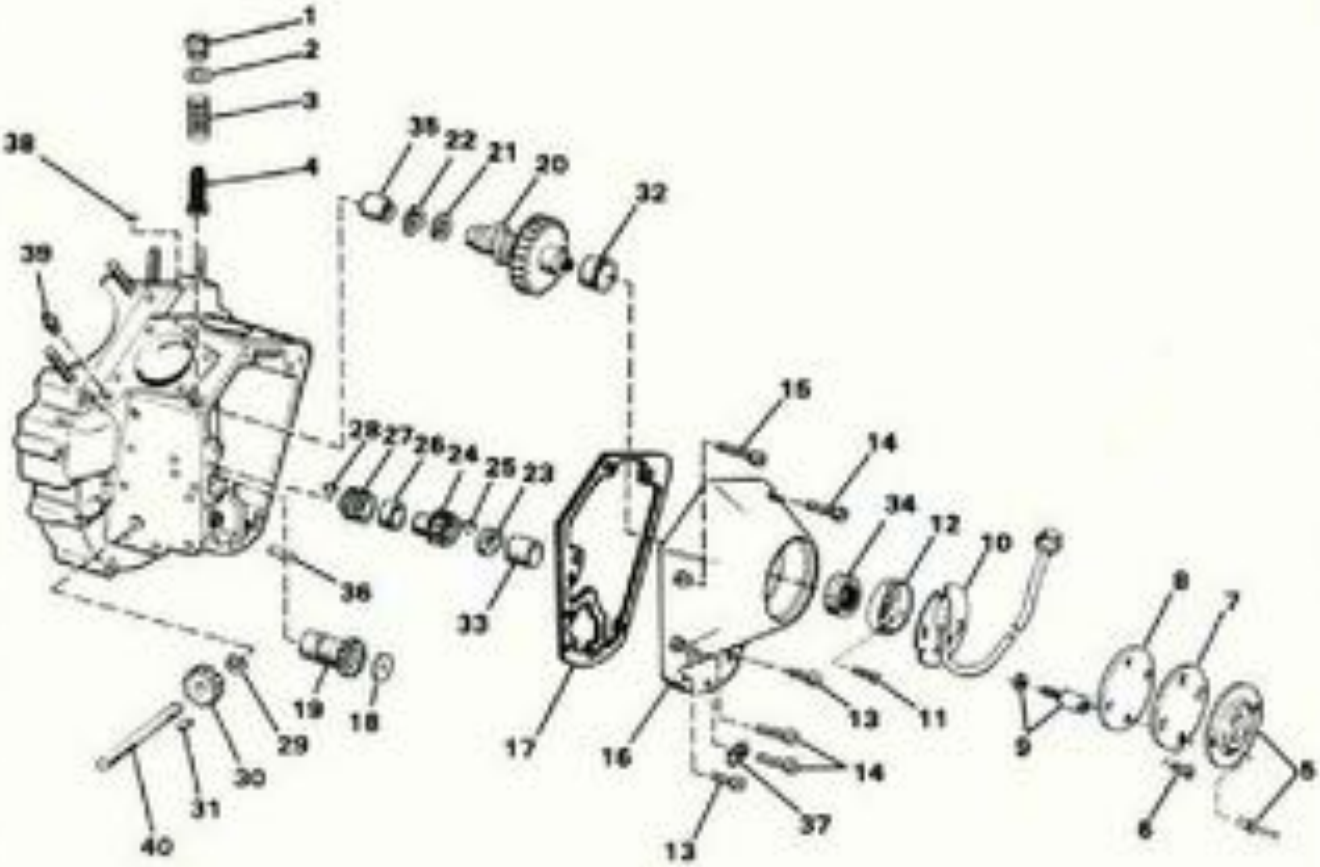
8. Remove breather valve spacing washer (18) and breather gear (19).

9. Remove cam gear (20), spacing washer (21) and thrust washer (22).

10. Remove pinion gear shaft nut (23) which has a left hand thread. Use PINION SHAFT NUT SOCKET, Part No. HD-94555-55A. Pull pinion gear (24) using PINION GEAR PULLER AND INSTALLER, Part No. HD-96830-51 as shown in Figure 3-33. Tool has left-hand threads.

11. Remove key (25), gear shaft pinion spacer (26), oil pump pinion shaft gear (27) and key (28).

12. Use a lock ring pliers such as Snap-On No. PR129A and remove oil pump drive gear shaft lock ring (29), drive gear (30) and drive gear key (31).



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 bolt
12. Rotor
13. Gear cover screw, 1 in. (2)
14. Gear cover screw, 1-1/4 in. (3)
15. Gear cover screw, 1-3/4 in. (1)
16. Gear cover
17. Gear cover gasket
18. Breather gear washer
19. Breather gear
20. Cam gear
21. Cam gear spacing washer
22. Cam gear thrust washer
23. Gear shaft nut
24. Pinion gear
25. Pinion gear key
26. Pinion gear spacer
27. Oil pump pinion shaft gear
28. Oil pump pinion shaft gear key
29. Oil pump drive gear lock ring
30. Oil pump drive gear
31. Oil pump drive gear key
32. Gear cover camshaft bushing
33. Gear cover pinion shaft bushing
34. Camshaft oil seal
35. Camshaft needle bearing
36. Cover dowel pin (2)
37. Wire clip
38. Welch plug
39. Oil line fitting
40. Oil pump shaft

NOTE: 1980 and later ignition system components are shown in this illustration.

Figure 3-34. Gearcase

13. If necessary, remove oil pump bolts and washers and remove oil pump from gearcase. See DISASSEMBLING OIL PUMP.

Cleaning And Inspecting (Figure 3-34)

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 no grease or solvent into crankcase when washing gearcase.

2. Inspect oil screen (4) carefully to make 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 (32 and 33) in gearcase cover for pitting, scuffing and grooving. Determine amount of pinion and cam shaft wear in cover bushing. If it exceeds service limit shown in engine SPECIFICATIONS, install new bushings.

4. Inspect cam gear oil seal (34) in cover to see that lip is in good condition.

5. Attach dial indicator to gearcase cover mounting screw hole and determine amount of pinion shaft play in right main roller bearing. When service limit in engine SPECIFICATIONS is exceeded, bearings and/or cam shaft should be replaced.

6. Inspect needle bearing (35) for wear, 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.

7. Needle bearing can be removed and installed in crankcase without disassembling crankcase using PULLER TOOL, Part No. HD-95760-69, as shown in Figure 3-38. Press needle roller bearing into crankcase with NEEDLE BEARING TOOL, Part No. HD-97272-60, as shown in Figure 3-38. Press from heavier end having the manufacturer's name only. 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 DISASSEMBLING CRANKCASE.

8. 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 considered ideal when no play between gears can be felt and cam gear can be moved back and forth along shaft axis with slight drag.

Replacing Gearcase Cover Bushings (Figure 3-34)

Remove pinion shaft cover bushing using PULLER TOOL, Part No. HD-95760-69, as shown in Figure 3-35.

Figure 3-35. Removing Pinion Shaft Cover Bushing

Figure 3-36. Line Reaming Cover Bushing

Install new pinion gear shaft bushing (33) in hole in cover as follows:

1. Position bushing in cover so flat on bushing is in line with oil hole in cover. Press in bushing on arbor press until top of bushing is flush with case bushing boss on cover. Locate and center punch new dowel pin location 1/8 in. or more from original location. Drill No. 31 hole 3/16 in. deep. Press in bushing until it bottoms on shoulder in cover boss hole. Continue drilling dowel pin hole to depth of

9/32 in. from top of bushing. Drive in new dowel pin and carefully peen edges of hole to lock pin in place.

1982 and later production vehicles do not have the pinion gear shaft bushing (33) or the cam shaft cover bushing (32) pinned at assembly. Replacement bushings will require that the bushing is pinned to the cover to prevent possible bushing rotation.

2. To replace cam shaft cover bushing (32), proceed as follows:

Use PULLER TOOL, Part No. HD-95760-69, to extract old bushing. Make a mark on outside of bushing boss to locate original dowel pin hole. Press in new bushing with arbor press until shoulder is against cover boss. Locate new dowel pin hole at least 1/8 in. from original hole, center-punch and drill No. 31 hole exactly 9/32 in. deep. Drive in new dowel pin and peen bushing edges over dowel to secure it.

3. Drill lubrication oil hole through wall of bushing with 5/32 in. drill using oil hole in bushing boss as a drill guide.

Pinion shaft and cam shaft 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.

4. To ream pinion shaft bushing, insert reamer pilot in right crankcase roller race as shown in Figure 3-38. Insert 9/16 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.

To ream cam gear cover bushing, use a 1 in. expansion reamer and ream to 1.003/1.002 in. diameter.

Assembling

1. Before assembling gear train, determine amount of end play in breather gear as follows: Assemble breather gear and dry cover gasket to gearcase. Select spacer washer (use washer disassembled unless it is known to give incorrect spacing) and position on end of breather gear. Place a steel straightedge across gearcase at spacer. 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. An end play tolerance of 0.001 to 0.016 in. is correct. If end play exceeds maximum, insert thicker spacer. Breather valve and gear spacer washers are available 0.110, 0.115, 0.120 and 0.125 in. thick.

2. Establish proper cam gear end play as follows: Install thrust washer, spacing washer and cam gear. Position cover gasket and secure cover with at least four screws. Measure cam shaft end play between cam gear shaft and thrust washer with thickness gauge through tappet guide hole in gearcase. End play should be from 0.001 to 0.016 in. If measurement is under or over tolerance, remove cover and replace spacing washer with one to give suitable clearance. Cam gear spacing washers are available in .005 increments from 0.050 to 0.095 in. thick.

3. See Figure 3-34. Make sure that chamfer on oil pump pinion shaft gear (27) faces toward the inside. Tighten pinion gear shaft nut (23) to 35–45 ft-lbs. Make sure that gear shaft pinion spacer (26) has noticeable end play. Breather, cam and pinion gears contain timing marks which must be aligned or matched as shown in Figure 3-38. Rotate gear train and note if it revolves freely. A bind indicates gears are meshed too tightly.

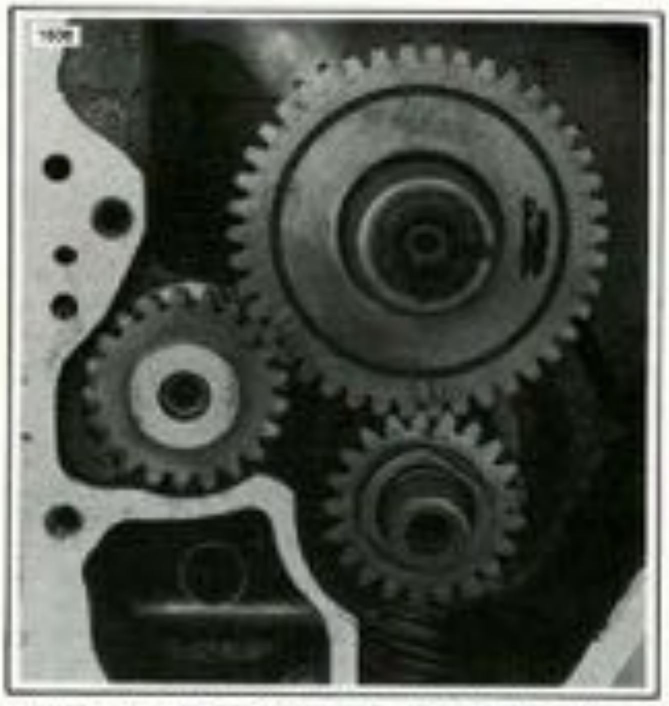


Figure 3-37. Timing Gears with Timing Marks Aligned

NOTE

Pinion gears and cam gears are color coded according to their pitch diameters. When replacing only one of these gears, it is advisable to replace it with a gear having the same color code. If gears are not matched according to their color, lifter noise or gear whine may result. Refer to your Parts Catalog for proper color code matching. 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.

CAUTION

Due to a change in cam profile the camshafts are stamped with an identifying letter on the rear cylinder intake lobe of the camshaft. Early 1983 and earlier camshafts are identified with the letter "H". Late 1983 and later camshafts are identified with the letter "S". The two camshafts are not interchangeable.

4. Apply a coat of non-hardening gasket sealer to crankcase and cover gasket surface. Position new cover gasket and secure cover with all cover screws. Tighten screws to 9-120 in-lbs torque. After securing cover, pour about 1/4 pint of engine oil through tappet guide hole over gears to provide initial lubrication.

5. Assemble remainder of gearcase and ignition timer. See IGNITION SYSTEM, Section 8.

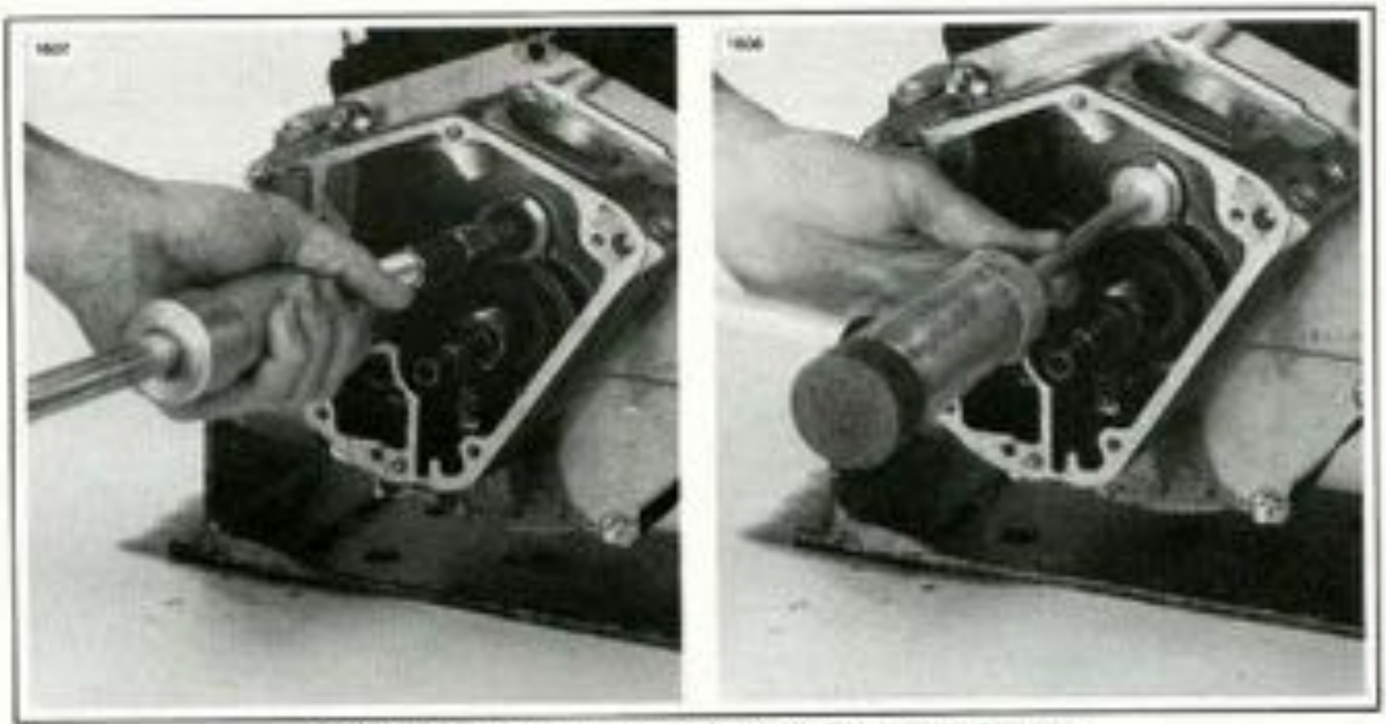


Figure 3-38. Removing and Installing Cam Gear Needle Bearing

GENERAL

When rod bearings, pinion shaft bearings or sprocket shaft bearings are in need of repair, the engine must be removed from the motorcycle as described in STRIPPING THE MOTORCYCLE FOR ENGINE REPAIR. It is recommended procedure to check and make repairs to cylinder heads, cylinders and gearcase at the same time, or in other words, perform an entire engine overhaul.

Flywheel End Play Check (Figure 3-39)

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.
3. Install BEARING INSTALLATION TOOL, Part No. HD-97225-55, to 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 between .001 and .004 in., the bearing inner spacer must be replaced. Choose spacer from the chart. A thinner spacer will result in less end play.

PART NO.	SIZE
9120	.0925/.0915
9121	.0945/.0935
9122	.0965/.0955
9123	.0985/.0975
9124	.1005/.0995
9125	.1025/.1015
9126	.1045/.1035
9127	.1065/.1055
9128	.1085/.1075
9129	.1105/.1095
9130	.1125/.1115
9131	.1145/.1135
9132	.1165/.1155
9133	.1185/.1175
9134	.1205/.1195

Bearing Inner Spacers

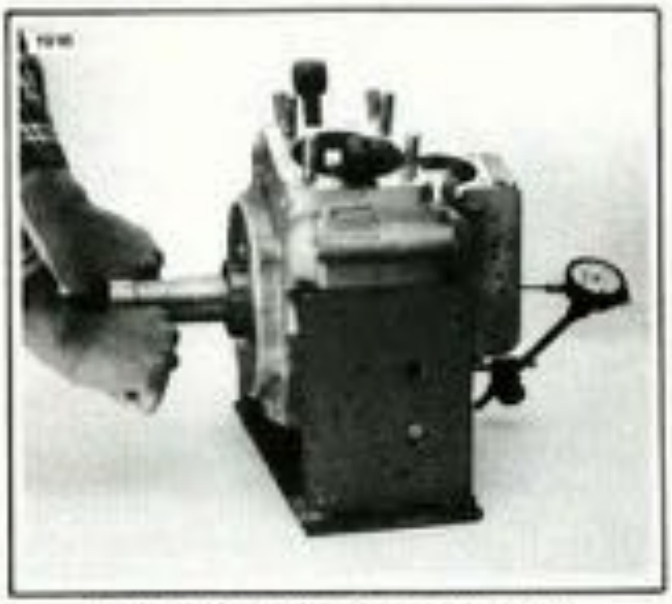
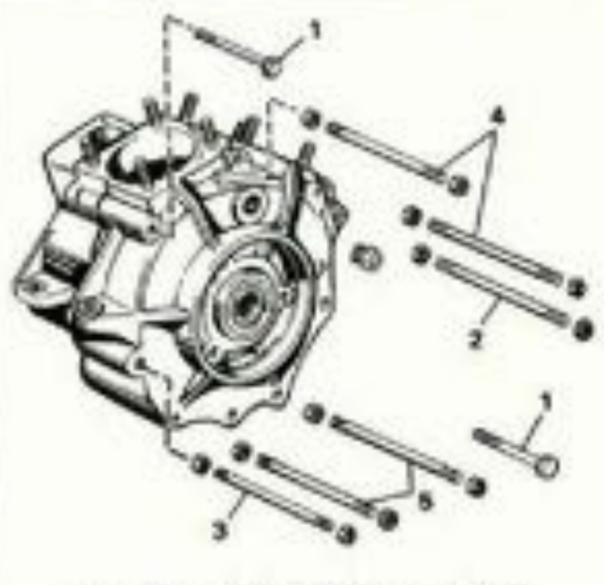


Figure 3-39. Checking Flywheel End Play

DISASSEMBLING CRANKCASE

1. Remove cylinder heads as described in DISASSEMBLING CYLINDER HEAD.
2. Remove cylinders as described in DISASSEMBLING CYLINDER AND PISTON.



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 3-40. Crankcase Studs — Exploded View

3. Remove gearcase parts as described is DISASSEMBLING GEARCASE. Check flywheel end play as described previously.

4. See Figure 3-40. Remove crankcase bolts and studs (1, 2, 3, 4, 5). It is necessary to remove only one stud nut and slip stud and other nut out opposite side of crankcase.

NOTE

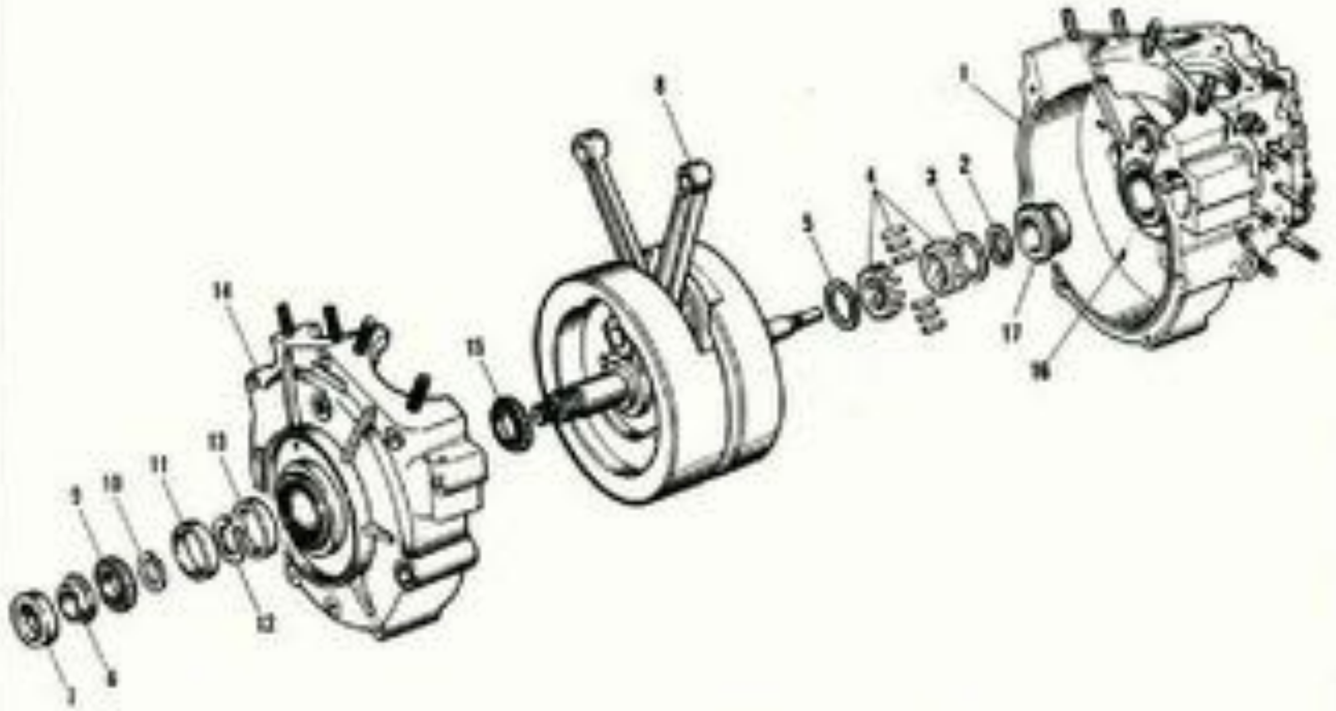
The top center stud (4) and left and right bottom stud (5) are fitted to the crankcase holes for proper crankcase alignment. Mark these studs so they can be reinstalled in their original location.

5. See Figure 3-41. Position crankcase with gearcase (right side) up. Tap crankcase with rawhide or soft metal mallet to loosen right half. Lift right crankcase half (1) off pinion shaft main bearings. Remove spiral lock ring (2) from pinion shaft with tip of screwdriver. Lift bearing washers (3 and 5) with bearings and bearing retainers (4) off pinion shaft.

6. Mount flywheel and left case assembly on press table supporting case on parallel bars (Figure 3-46) and 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).

7. If left main bearing is to be replaced, press out bearing races (11 and 13) from opposite sides of crankcase hole, using CRANKSHAFT BEARING REMOVAL & INSTALLATION TOOL, Part No. HD-94547-80. If bearing set is being replaced, remove lock ring (12) using a pin punch or similar tool. Rotate lock ring in groove so that one edge covers oil hole. Insert tool into oil hole with tapered end underneath lock ring. Tap on tool to force one end out of groove as shown in Figure 3-47. Starting at this free end, push ring out of bearing bore.

8. If flywheels are to be disassembled, place a flywheel holding fixture such as Rowe number HD 09-1194 in a vise. Insert pinion shaft into fixture and install BEARING PULLER, Part No. HD-96015-56A over sprocket shaft bearing as shown in Figure 3-48. Turn forcing screw to remove bearing. Keep bearings in a set with proper bearing outer races.



1. Right crankcase half
2. Spiral lock ring
3. Bearing washer (2)
4. Bearings and retainer
5. Bearing washer (see item 3)
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 snap ring
13. Bearing outer race
14. Left crankcase half
15. Sprocket bearing half
16. Pinion shaft bearing race lock screw (2)
17. Pinion shaft bearing race

NOTE: Keep parts 9, 10, 11, 12, 13 and 15 as a set. Do not transpose or interchange parts.

Figure 3-41. Crankcase

FLYWHEELS

General

A commonized flywheel taper design was a running change in 1981 production. All tapers have been commonized at 6 degrees, and all keys have been standardized.

Except for torque values, all assembly and disassembly procedures remain unchanged for the late style commonized flywheel assemblies. Late and early style components must not be intermixed.

CAUTION

Intermixing late and early style components can cause permanent damage to flywheel assembly.

The following figures and chart include information to identify late and early style components.

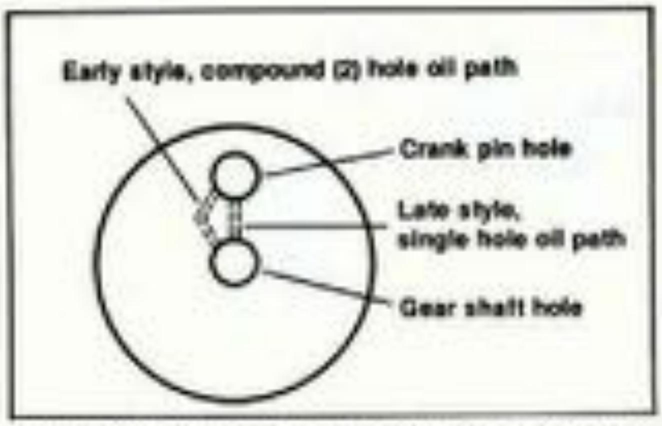


Figure 3-42. Flywheel Gear Side Oiling Hole (1340cc)

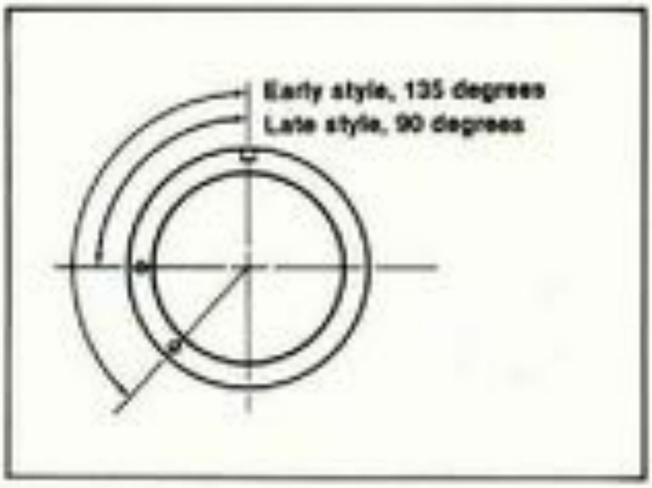


Figure 3-43. Crank Pin and Gear Shaft Oil Holes (1200cc/1340cc)

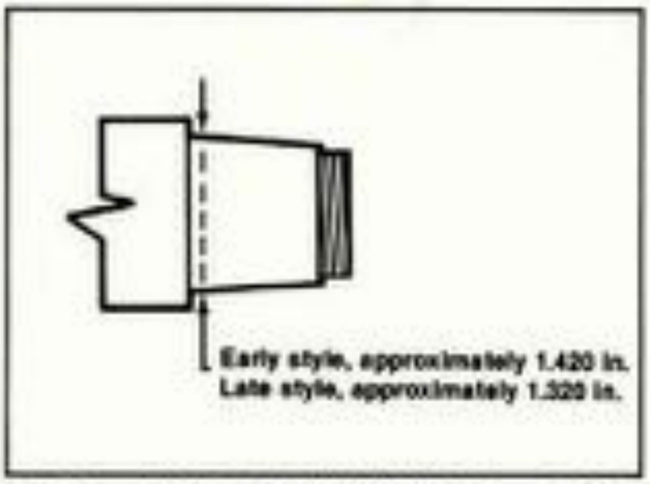


Figure 3-44. Sprocket Shaft (1340cc) Taper End

1200cc/1340cc

PART	LATE STYLE NOTABLE MARKING	EARLY STYLE NOTABLE MARKING
Flywheel Sprocket Side	Rear cylinder timing mark (∞)	None
Flywheel Gear Side	Single hole oil path (See Figure 3-39)	Compound (2) hole oil path (See Figure 3-39)
Crank Pin	Oil hole 90° to key (See Figure 3-40)	Oil hole 135° to key (See Figure 3-40)
Crank Pin Nut	1-20 in. thread	1-18 in. thread
Sprocket Shaft	Approximate diameter at large end of taper, 1.320 in. (See Figure 3-41)	Approximate diameter at large end of taper, 1.420 in. (See Figure 3-41)
Gear Shaft	Oil hole 90° to key (See Figure 3-40)	Oil hole 135° to key (See Figure 3-40)
Sprocket Shaft Nut	1-1/8-16 in. thread fit of thread changed	1-1/8-16 in. thread
Gear Shaft Nut	3/4-20 in. thread	3/4-18 in. thread
Gear Shaft Key	Small woodruff key, 1/8 in. wide x 3/8 in. long	Large woodruff key, 1/8 in. wide x 1/2 in. long
Crank Key	Small woodruff key, 1/8 in. wide x 3/8 in. long	Large woodruff key, 3/16 in. wide x 1/2 in. long

Disassembling Flywheels (Figure 3-46)

1. Place flywheels in flywheel holding fixture and remove crank pin nut using FLYWHEEL NUT WRENCH, Part No. HD-94546-41, as shown in Figure 3-45. To loosen flywheel, strike right flywheel rim with soft metal mallet at 90 degrees to crankpin. Remove right flywheel and gear shaft assembly. Remove crank pin key (11, Figure 3-45).

2. 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 crank pin.

3. Refer to Figure 3-47. Using 1-5/8 in. socket, Snap-On Part No. S6202, remove sprocket shaft nut (12). Press sprocket shaft (13) out of flywheel.

4. Turn flywheel over in fixture and remove crank pin nut (1). Press crank pin out of flywheel.

5. Place pinion shaft and flywheel in fixture and remove pinion shaft nut (5). Press pinion shaft (7) out of flywheel and remove key (8) from shaft.

Cleaning And Inspecting Flywheels (Figure 3-49)

1. Wash all parts in grease solvent and blow dry with compressed air. Examine crank pin for wear, grooving and pitting. If the surface is at all worn, replace with new pin. Examine flywheel washers (14 and 15). 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 bearing rollers installed. If they appear badly worn, grooved or pitted, new rods should be installed, preferably as an assembly with new bearings and crankpin.

3. Examine pinion shaft and right crankcase bearing race (17, Figure 3-41) for pitting, grooving and gouging at point where right main roller bearings ride. A shaft that is worn must be replaced. If bushing is worn beyond repair, replace as described in TRUING AND SIZING SHAFT MAIN BEARING.

4. Examine sprocket shaft outer races for wear, 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. If a new bearing set is installed, check flywheel end play as described earlier in this section.

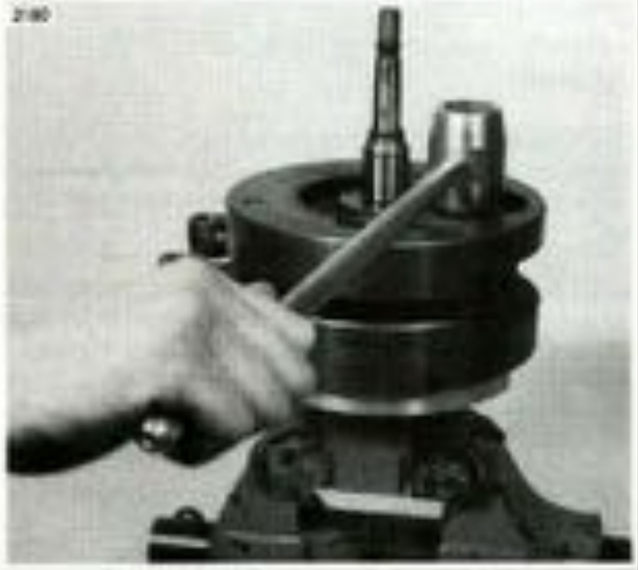


Figure 3-45. Removing Crank Pin Nut

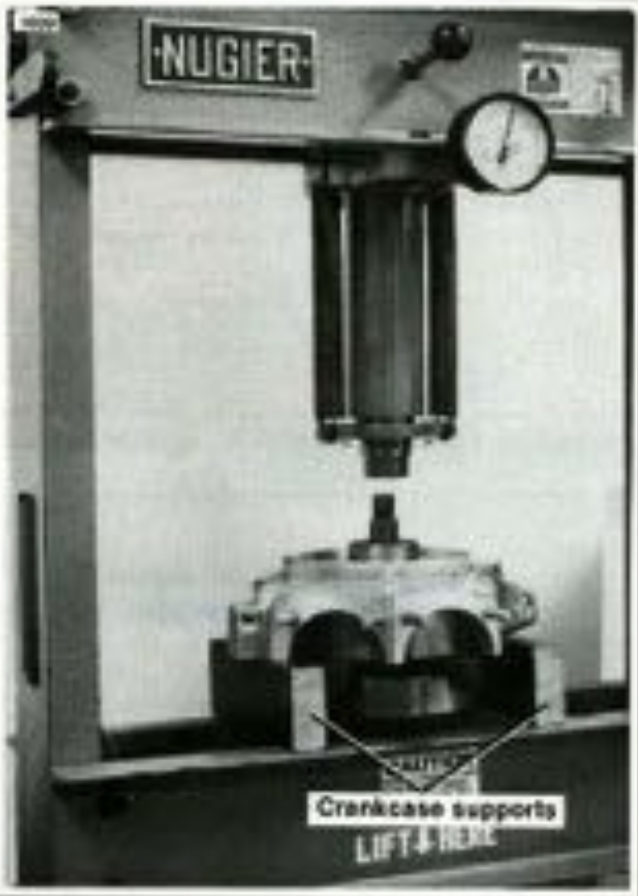


Figure 3-46. Pressing Flywheels Out of Crankcase

Replacing 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 (1/8 in. or

Figure 3-47. Removing Lock Ring

smaller) at the outer edge of the washer to permit getting pointed tool underneath to pry it out. The hole is drilled only slightly deeper than the thickness of the washer to avoid removing more metal than necessary.

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 is not likely to have necessary clearance for side play.

Lapping Connecting Rod Races

1. See Figure 3-50. 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.

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.

Fitting Rod Bearings

Oversize rollers are available in 0.0002, 0.0004, 0.0006, 0.0008 and 0.0010 in. oversize.

There are two ways to determine oversize rollers to use.

Figure 3-48. Pulling Bearing from Sprocket Shaft

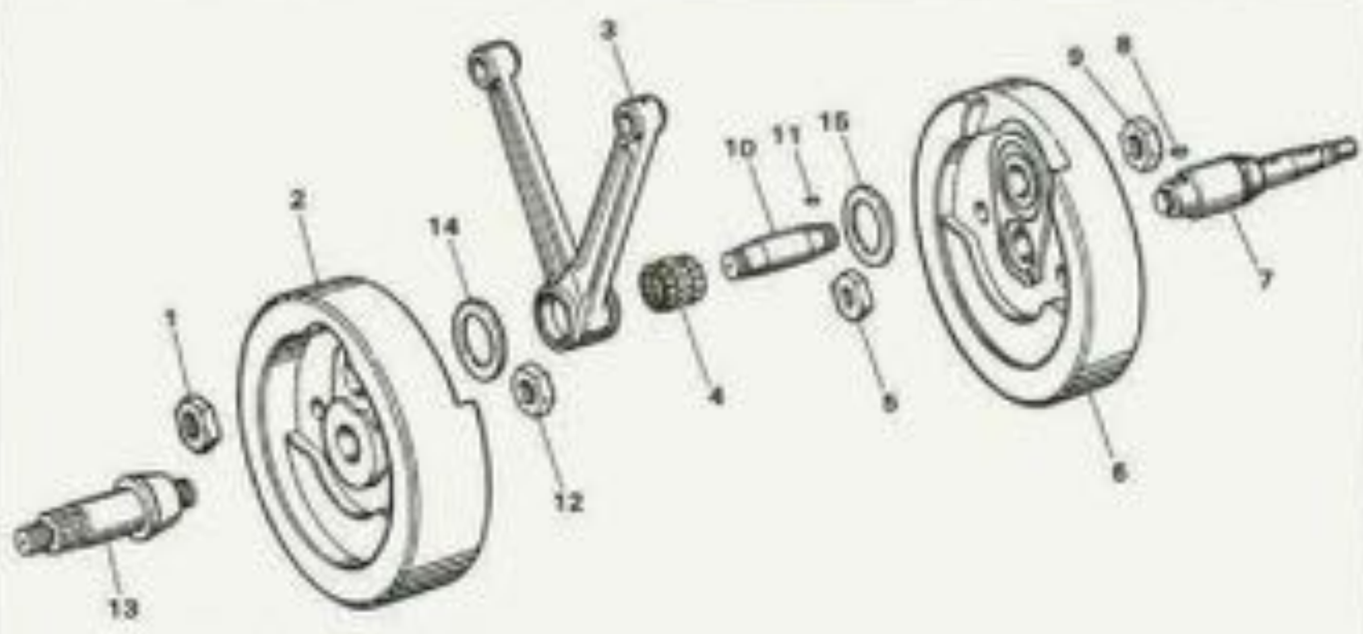
Both methods will result in properly fitted bearings if applied correctly.

All fitting and checking must be made with bearings, rods and crank pin clean and free of oil.

1. Use a micrometer to measure the outside diameter of the crank pin at its center. Use an inside micrometer or telescoping hole gauge to measure the inside diameter of the rod races. Subtract the diameter of the crank pin from the inside diameter of the bearing race. Subtract from this figure the standard allowance for bearing running fit size. This answer, divided by two will give proper roller size. To find oversize amount of bearing, subtract from this figure the diameter of a standard roller.

EXAMPLE:

The rod bearing race measures 1.6263 in. after lapping and truing. The crank pin is slightly worn and measures 1.2485 in. Subtract 1.2485 in. from 1.6263 in. The answer, 0.3778 in., represents the diameters of both rollers (one on each side) plus clearance for running fit. Subtract minimum clearance for running fit (0.001 in.). The answer, 0.3768 in., is then divided by two to get the



1. Crank pin nut
2. Left flywheel
3. Connecting rods (one forked, one single end)
4. Bearing rollers and retainers
5. Pinion shaft nut
6. Right flywheel
7. Pinion shaft
8. Pinion shaft key
9. Crank pin nut
10. Crank pin
11. Crank pin key
12. Sprocket shaft nut
13. Sprocket shaft
14. Flywheel washer
15. Flywheel washer

Figure 3-49. Flywheel Assembly

diameter of each oversize roller. In this case it would be 0.1884 in. To find how much oversize each roller must be, subtract from this figure the diameter of a standard roller, or 0.1875 in. Rollers must be 0.0008 in. oversize.

2. Install any new set of oversize rollers to bearing races and position on crank pin. Slip rods over bearings. If they will not fit, it is obvious rollers are too large and a smaller size must be tried. If they fit and spin freely, install a larger set of rollers. Try various roller sizes until the rods will turn with a very slight drag. This is a plug fit. Determining running fit is merely a matter of subtracting one half the desired running fit clearance (0.0005 in.) from the roller size to find the running fit roller size.

It may be easier to gauge a plug fit as follows:

Fit any size rollers into races. Position bearings in rods. Support rods and bearings with left hand. Drop crank pin (not attached to flywheel) through crank pin hole. Plug fit has been achieved when crank pin will slide slowly through hole from its own weight. Running fit is then determined by subtracting one half running clearance from oversize of rollers used to make plug fit.

All fitting and checking must be made with bearings, rods and crank pin clean and free of oil.

Figure 3-50. Lapping Connecting Rod Bearing Races

CAUTION

Fitting bearings tighter than described may result in seizing and bearing damage when heat expands parts.

Check overall width of roller retainer assembly. It must be less than width of female rod end.

Figure 3-51. Squaring Flywheel Faces

Assembling Flywheels (Figure 3-48)

After correct connecting rod bearing fit has been attained. Clean and assemble parts as follows:

1. Wipe all tapers perfectly clean and free of oil. Install shaft (13) to left flywheel (2).

NOTE

Prior to assembly apply one drop of Loctite RC/620 on the threads and one drop on the bearing surface at two points 180 degrees apart on the flywheel assembly nuts (9), (5), (12) and (1). See Figure 3-52.

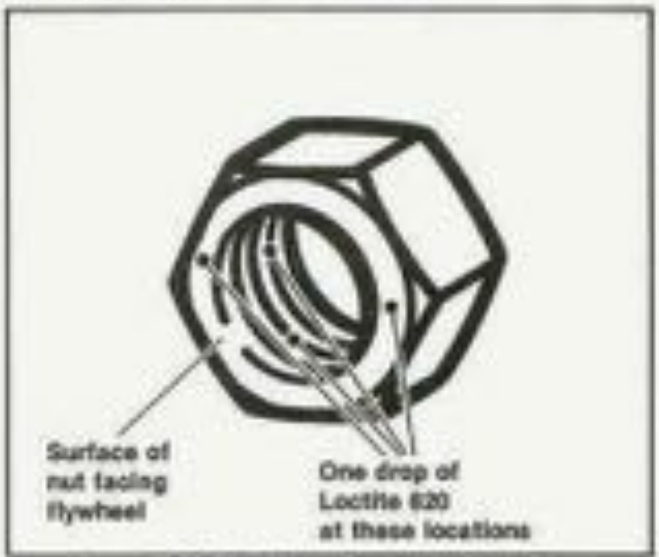


Figure 3-52. Retaining Compound Locations

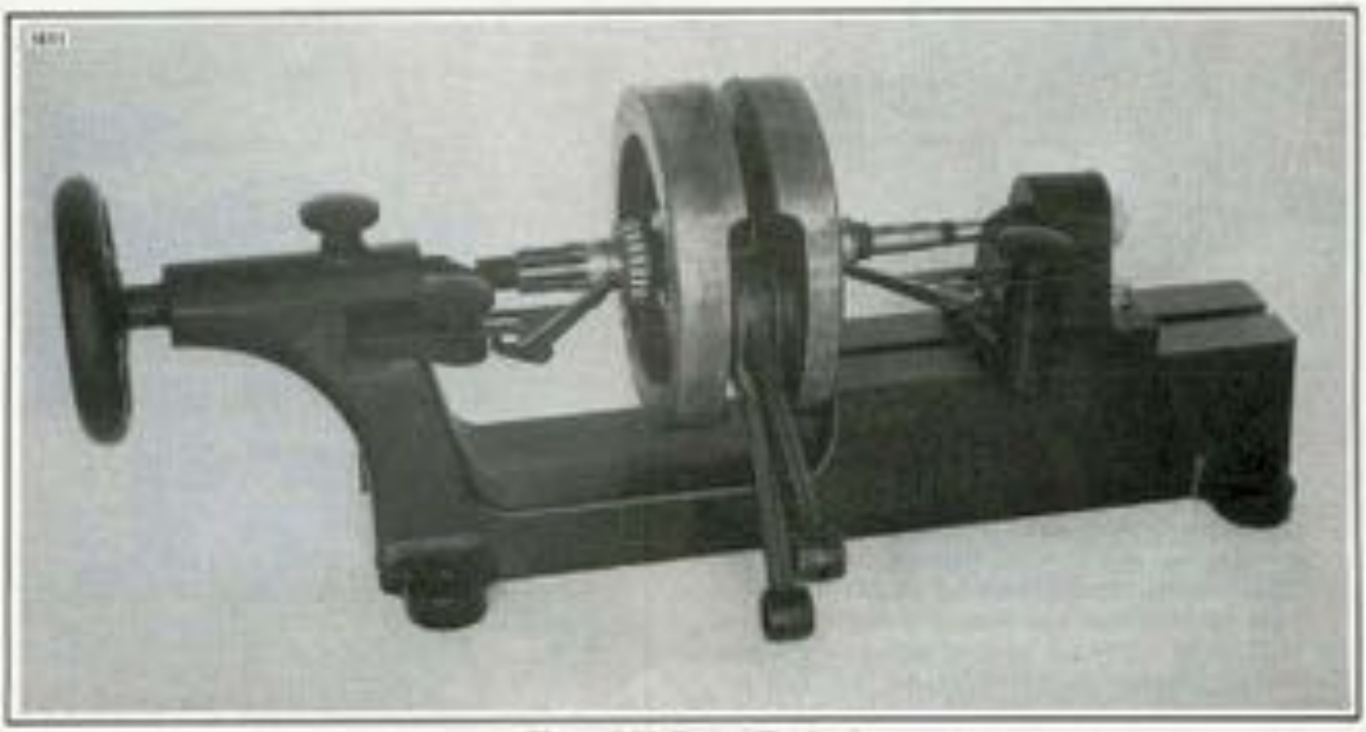


Figure 3-53. Truing Flywheel

See engine SPECIFICATIONS for proper torque. Assemble pinion shaft (7) and crank pin (10) to right flywheel (8) making sure that keys (6, 11) are in proper position.

Check to make sure oil passages through pinion shaft, right flywheel and crank pin are clear by blowing compressed air into hole in end of pinion shaft.

2. Position right flywheel assembly in flywheel fixture, crank pin up. Wipe crank pin taper clean. Slip bearings and connecting rods over crank pin with forked rod to rear cylinder. On late 1983 and later connecting rods, the area of the male rod where it joins the crankpin bearing is slightly offset from the rod center. The heavy portion of the offset must face away from the forked female rod to be installed correctly. See Figure 3-53. Late 1983 and later connecting rods will not function in early 1983 and earlier flywheel halves. Wipe crank pin hole in left flywheel clean and dry. Install left flywheel and tighten nut lightly. Hold steel straightedge along outer face of wheel rims at 90 degrees from crank pin as shown in Figure 3-51. Tap outer rim of top wheel until wheels are concentric. Tighten nut, recheck with straightedge at frequent intervals. Use soft metal hammer to realign wheels.

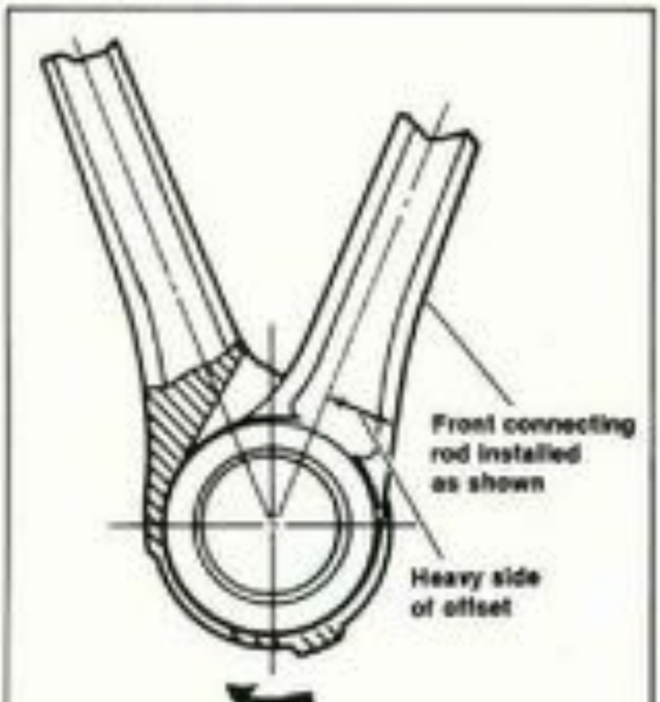


Figure 3-54. Connecting Rod Installation (Late 1983 & Later)

3. See Figure 3-53. When nut is fairly tight, install flywheel assembly in FLYWHEEL TRUING DEVICE, Part No. HD-96650-80. Adjust so centers are snug. 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.

4. 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. Remove flywheel from truing stand and make corrections as stated in step 5.

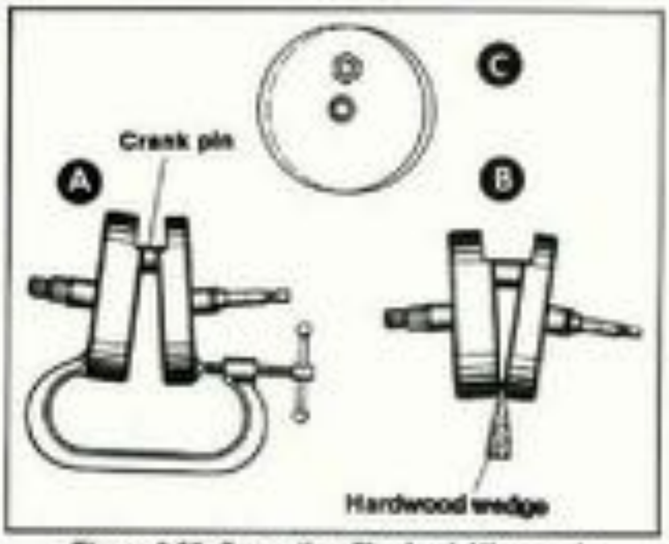


Figure 3-55. Correcting Flywheel Alignment

5. Flywheel may be out of true three ways, A, B and C, Figure 3-55 or a combination of two of the three ways.

When wheels are both out of true as indicated in "A", tighten C-clamp on rims or wheels opposite crank pin and lightly tap the rim at the crank pin with lead or copper mallet.

When wheels are both out of true as indicated in "B" drive a hardwood wedge between the wheels opposite the crank pin and lightly tap the rims near the crank pins with a mallet.

Figure 3-56. Checking Connecting Rod Side Play

When wheels are out of true as indicated in "C," strike the rim of the wheel a firm blow at about 90 degrees from crank pin on high side.

When wheels are out of true in a combination of any of conditions shown, correct A or B first, tapping rim of offending wheel only, and then correct condition C.

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. Remember that centers must be loosened slightly before striking flywheels. Making them too loose may result in damaged centers. Never strike wheels a hard blow near crank pin. This could result in a broken crank pin.

6. 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.).

7. If it is impossible to true wheels, check for a cracked flywheel, damaged or enlarged tapered hole, or a sprocket or pinion shaft worn out of round at surface where indicator reading is being taken. When wheels are true, position in vise and draw crank pin nuts very tight using CRANK PIN and FLYWHEEL NUT WRENCH, Part No. HD-94546-41. Use torque wrench to finish tightening as specified in SPECIFICATIONS. Check connecting rod side play with thickness gauge as shown in Figure 3-56. If side play is greater than tolerance shown in engine SPECIFICATIONS, draw up crank pin nuts until within tolerance. Insufficient play between rods and flywheel face is caused by one of the following conditions:

   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 crank pin. As last resort, grind down width of forked rod.

   c. Tapered holes enlarged as a result of having been taken apart several times. Replace wheel seating deepest.

   d. Cracked flywheel at tapered hole. Replace flywheel.

If sides of forked rod are ground to get desired clearance, backs of bearing retainers must be ground down to remain narrower than width of female rod.

After rod side play is checked and adjusted crank pin nut tightened to specified torque, again recheck wheel trueness on truing stand. Correct any runout as above.

Truing and Sizing Pinion Shaft Main Bearing

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.

A race that is worn beyond limits of oversize bearings must be replaced. To remove bearing race, remove two bearing race lock screws (16, Figure 3-41) from inside of case. Bearing lock screws (16) are not installed on later production vehicles. Heat case to 275-300 degrees F. Heating expands case and makes it possible to remove bearing race using less force. Press worn race (17, Figure 3-41) 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 Bearings (Figure 3-57)

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 5/32 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 fine 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 3-57. Lapping Pinion Shaft Main Bearing Race

Fitting Pinion Shaft Bearing

The fitting of pinion shaft bearing is done in much the same way as fitting lower rod bearings (see FITTING ROD BEARINGS.)

All fitting must be done with bearings that are clean and dry. Oiled surfaces will take up some clearance and give a false reading.

1. A plug fit is first determined using the pinion shaft that will be used on engine being overhauled, or spare shaft of exactly same size. When a plug fit has been found, pinion shaft will enter bearing slowly under its own weight, will turn with only a very light drag and will have no perceptible shake.

2. A running fit is determined from a plug fit by subtracting one half the desired running fit clearance from the size of the plug fit rollers.

EXAMPLE:

Running fit clearance is 0.0008 to 0.002 in. loose. See engine SPECIFICATIONS. If a plug fit was achieved with 0.0008 in. oversize rollers, subtract one half running fit clearance from plug fit roller oversize. Use figure representing middle or average of tolerance span, .014 in. One half the average of tolerance (.0007 in.), subtracted from roller oversize (0.0008 in.), indicates that 0.0001 in. oversize rollers should be used to produce a suitable running fit.

3. Oversize rollers are available in 0.0001, 0.0002, 0.0003, 0.0004, 0.0005, 0.0006, 0.0008, and 0.0010 in. sizes. All calculations should therefore be made to nearest available size.

Fitting Sprocket Bearing

If flywheel end play is within tolerance and if Timken tapered roller bearings and races pass visual check and have no apparent wear, the same set may be reinstalled. Make certain all parts of bearing are installed in exactly the same order they were removed. If any part of bearing assembly is worn, entire assembly should be replaced.

ASSEMBLING CRANKCASE (Figure 3-41)

1. Install flywheel side outer race lock ring (12) in case. 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. Position flywheel assembly, sprocket shaft up, in flywheel fixture. Press bearing (15) on sprocket shaft using BEARING INSTALLATION TOOL, Part No. HD-97225-55. SPROCKET SHAFT SPACER HD-24036-70 may be needed with BEARING INSTALLATION TOOL as shown in Figure 3-58. 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. Install the bearing inner spacer (10) and tool sleeve and press bearing against flange on flywheel using the tool as shown in Figure 3-58.

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 pressing bearings tightly together as shown in Figure 3-59. Bearings must be tight against the bearing inner spacer to provide correct bearing clearance.

6. Remove assembly from flywheel fixture and install bearing washer (5), bearings (4) and bearing washer (3) on pinion shaft. Install new spiral lock (2) on groove in pinion shaft. Slip right case half over bearing and against left case half after applying a coat of Harley-Davidson CRANKCASE SEALANT, 99650-81 to parting surfaces.

7. See Figure 3-40. Align case halves and tap crankcase studs (4 and 5) into holes. These four 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 nuts on studs to 15-19 ft-lbs torque. Tighten nuts on bolts to 15-19 ft-lbs torque.

8. Check exact amount of flywheel end play with dial indicator as directed at the beginning of this section to determine if within specified limits. See Figure 3-39.

9. See Figure 3-41. Install spacer (6). Press seal (7) into crankcase with lip toward flywheels.

10. Install compensating sprocket shaft extension. See PRIMARY CHAIN AND SPROCKETS, Section 6.

Figure 3-58. Pressing Bearing on Sprocket Shaft

Figure 3-59. Pressing Flywheel into Crankcase

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 or PRIMARY BELT AND SPROCKETS.

SPECIFICATIONS

GENERAL

Number of Cylinders	2
Type	4-cycle, 45 °V
Horsepower	69 hp @ 5000 rpm
Bore	3.498 in. (88.8 mm)
Stroke	4.250 in. (108.0 mm)
Piston Displacement - 1340 cc	81.6 cu. in.
Torque	82 ft-lbs @ 3600 rpm
Compression Ratio	8.5-1

VALVES

Fit in guide - with seal -	
Exhaust	.0015-.0033 in.
Intake	.0008-.0026 in.
Seat width	.040-.062 in.
Stem protrusion from cylinder head boss	1.980-2.014 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)	.0005-.002 in.
End clearance	.010-.025 in.
Bushing fit in rocker arm (tight)	.004-.002 in.

ROCKER ARM SHAFT

Shaft fit in rocker cover (loose)	.0007-.0022 in.

PISTON

Fit in cylinder (loose)	.0006-.0023 in.
Compression ring gap	.008-.015 in.
Oil control ring rail gap	.015-.055 in.
Compression ring side clearance -	
Top	.002-.0047 in.
2nd	.0016-.0043 in.
Oil control ring side clearance	.001-.006 in.
Piston pin fit (loose)	.0002-.0007 in.

CYLINDER HEAD

Valve guide in head (tight)	.0033-.002 in.
Valve seat in head (tight)	.0045-.0020 in.
Head gasket surface (flatness)	.006 in. total

CONNECTING ROD

Piston pin fit (loose)	.0003-.0009 in.
Side play between flywheels	.005 in.
Fit on crankpin (loose)	.0007 in.

TAPPETS

Guide fit in crankcase	.0025 in.
Fit in guide	.0008-.002 in.
Roller fit	.0006-.001 in.
Roller end clearance	.010-.014 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	.001 in.
Cam gear shaft in bushing	.0008 in.
Cam gear shaft in bearing	.0005 in.
Cam gear end play	.001 in.
Oil pump drive shaft (crankcase bushing)	.0008 in.

FLYWHEELS

Runout (flywheels at rim)	.000-.006 in.
Runout (shaft at flywheels)	.000-.001 in.
End play	.001 in.

SPROCKET SHAFT BEARING

Cup fit in crankcase (tight)	.0032-.0012 in.
Cone fit on shaft (tight)	.0015-.0002 in.

PINION SHAFT BEARINGS

Roller bearing fit (loose)	.0008 in.
Cover bushing fit (loose)	.0005 in.

IGNITION TIMING

Timer air gap	not adjustable
Ignition timing	
fully retarded	5 °BTDC (1/64 in. BTDC)
automatic advance	35 °BTDC (7/16 in. BTDC)
Spark plug gap	.038-.043 in.

TORQUES

Shaft/pin installed without hydraulic press

Sprocket shaft nut	290-320 ft-lbs
Crankpin nut	180-210 ft-lbs
Pinion shaft nut	140-170 ft-lbs
Pinion gear nut	35-45 ft-lbs
Oil pump cover bolt or nut	90-120 in-lbs
Tappet guide bolts	90-120 in-lbs
Rocker cover -	
5/16 in. bolts	22-25 ft-lbs
1/4 in. bolts	11-12 ft-lbs.
Cylinder head bolts	24-25 ft-lbs
Upper engine mounting bracket nut	22-28 ft-lbs
Crankcase stud nut	12-15 ft-lbs
Crankcase bolt	22-26 ft-lbs
Gearcase cover screws	90-120 in-lbs
Timer screws (inner cover & sensor plate)	15-30 in-lbs
Tappet screen plug	90-160 in-lbs
Spark plug	18-28 ft-lbs
Rotor bolt	43-48 in-lbs

SERVICE WEAR LIMITS

Service 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 above.

Valves

Fit in guide - with seal
Exhaust .... .0033-.0040
Intake .... .0008-.0035
Stem taper .... .0000-.0015 in.
Stem face eccentricity .... .000-.002 in.
Head margin .... .031 in.
Seat width .... .040-.062
Stem protrusion from cylinder
head boss .... 1.980-2.034 in.

Rocker Arm

Shaft fit in bushing (loose) .... .0005-.0035 in.
End clearance .... .010-.035

Rocker Arm Shaft

Shaft fit in rocker cover (loose) .... .002-.0035 in.

Piston

Fit in cylinder (loose) .... .0008-.0053 in.
Compression ring gap .... .008-.030 in.
Oil control ring gap .... .015-.065
Compression ring side clearance
Top ring .... .002-.006 in.
2nd ring .... .0016-.006 in.
Oil control ring side clearance .... .0011-.008 in.
Piston pin fit (loose) .... .0002-.001 in.

Cylinder Head

Valve guide in head (tight) .... .0033-.0020 in.
Valve seat in head (tight) .... .0045-.0020 in.
Head Warpage .... .000-.006 in.

Cylinder

Taper .... .000-.002 in.
Out of round .... .001-.003 in.
Warpage (gasket surfaces)
Top .... .006 in.
Base .... .008 in.
Bore:
Standard .... 3.501 in.
.005 Oversize (O.S.) .... 3.506 in.
.010 O.S. Bore .... 3.511 in.
.020 O.S. Bore .... 3.521 in.
.030 O.S. Bore .... 3.531 in.

Connecting Rod

Piston pin fit (loose) .... .0003-.001
Side play between flywheels .... .005-.030 in.
Fit on crankpin (loose) .... .0007-.002 in.

Tappets

Fit in guide .... .0008-.003 in.
Roller fit .... .0006-.0015 in.
Roller end clearance .... .010-.015 in.

Gearcase

Breather gear end play .... .001-.016 in.
Cam gear shaft in bushing .... .0008-.0030 in.
Cam gear shaft in bearing .... .0005-.0050 in.
Cam gear end play .... .001-.016 in.
Oil pump drive shaft
(crankcase bushing) .... .0008-.0025 in.

Flywheels

Runout (flywheels at rim) .... .000-.006 in.
Runout (shaft at flywheels) .... .000-.001 in.
End play .... .001-.004 in.

Pinion Shaft Bearing

Roller bearing fit (loose) .... .0008-.0020 in.
Cover bushing fit (loose) .... .0005-.0025 in.

GENERAL INFORMATION

DESCRIPTION

The engine is the V^2 Evolution Engine. It is a two-cylinder, four-cycle, air cooled, overhead-valve V-type. It has three major component assemblies: **cylinders, gearcase** and **crankcase.**

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 5-piece 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 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 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 drive 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 microprocessor, 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 its exhaust stroke.

GASOLINE

Use a good quality leaded or unleaded gasoline (89 pump octane or higher).

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 gauge rod, add oil. When level is down to REFILL mark, add two quarts. Engine will run cooler and usage will be less with full oil tank.

The oil tank capacity with filter is 4 quarts on FLT models and 3 quarts on FXR models. The tank is full when the oil level is at the upper mark on the dipstick with the motorcycle in an upright position off the jiffy stand. 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 Oil And Filter

Change oil and oil filter in a new engine after first 500 miles, and at 2500 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. The oil tank should be flushed with kerosene at the first oil change and at least every second oil change thereafter.

1. Run engine until normal operating temperature is reached.

2. Remove oil tank drain plug 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 primary chaincase magnetic drain plug located under the clutch cover on the bottom of the chaincase. Clean plug and replace.

5. Replace drain plug and pour one quart of kerosene into oil tank and agitate by rocking motorcycle from side-to-side. Remove plug and allow tank to drain completely before replacing plug. Tighten drain plug to 10 ft-lbs torque.

6. Remove oil filter.

7. Lube rubber seal 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.

8. With drain plug and filter tightened, install three (3) or four (4) quarts of recommended grade oil determined from chart below.

Air Temperature (Cold Engine Starting Conditions)	Use Harley-Davidson Oil Grade
10° to 100°F. - Normal and severe operating conditions	Power Blend® Super Premium
	Premium II™
Above 80°F.	Extra Heavy Grade 60
Above 60°F.	Regular Heavy
Above 40°F.	Medium Heavy
-20° to 40°F.	Special Light

9. Start engine and carefully check for oil leaks around drain plug and oil filter.

10. Check oil level in tank and if necessary add oil to bring level to one inch from top of tank. Do not fill tank above this level. Tank needs some air space.

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

Oil Hose Routing

Refer to Figure 3-1 for correct location of oil hoses.

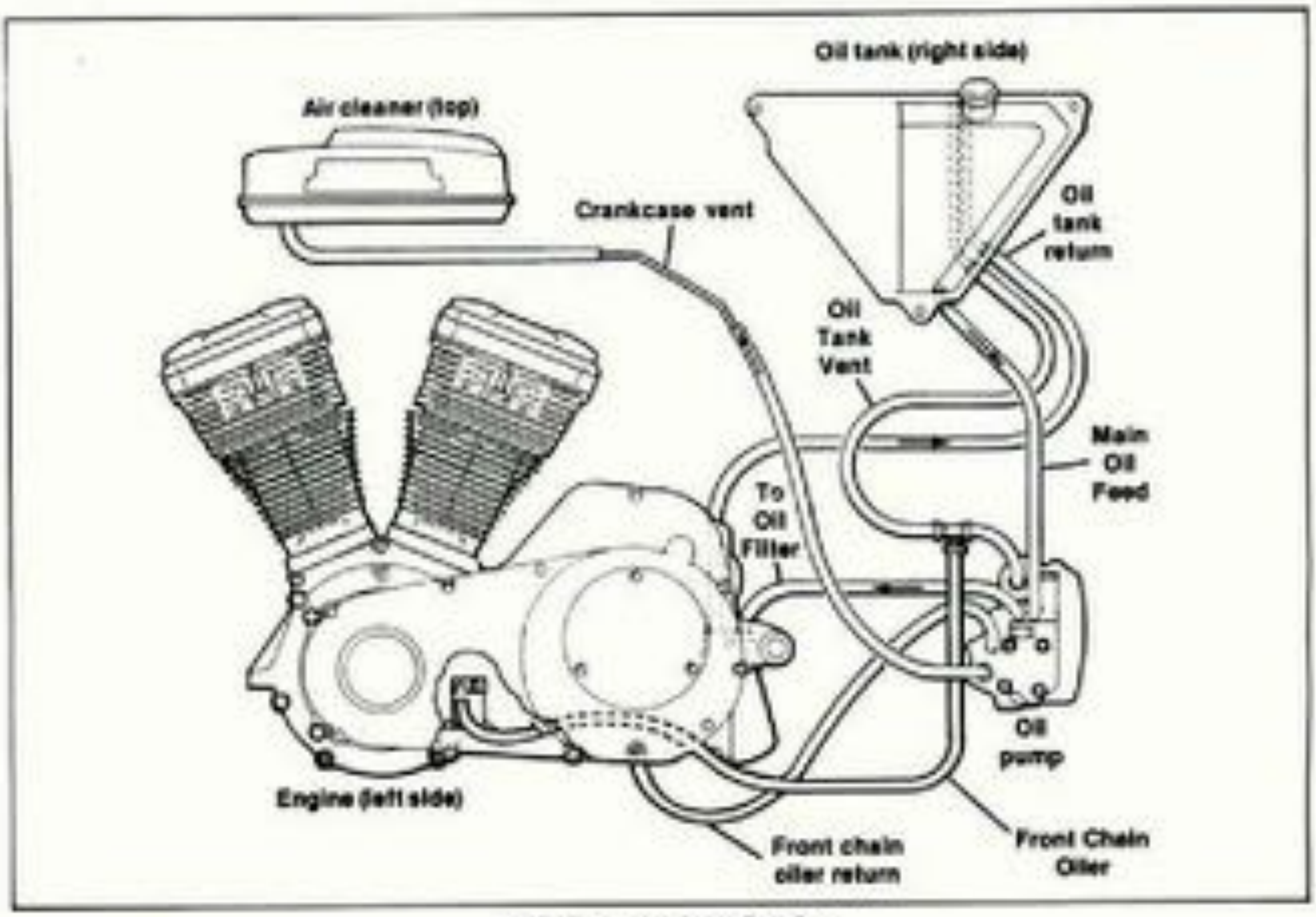


Figure 3-1. Oil Hose Routing

Oil Pressure Signal Light

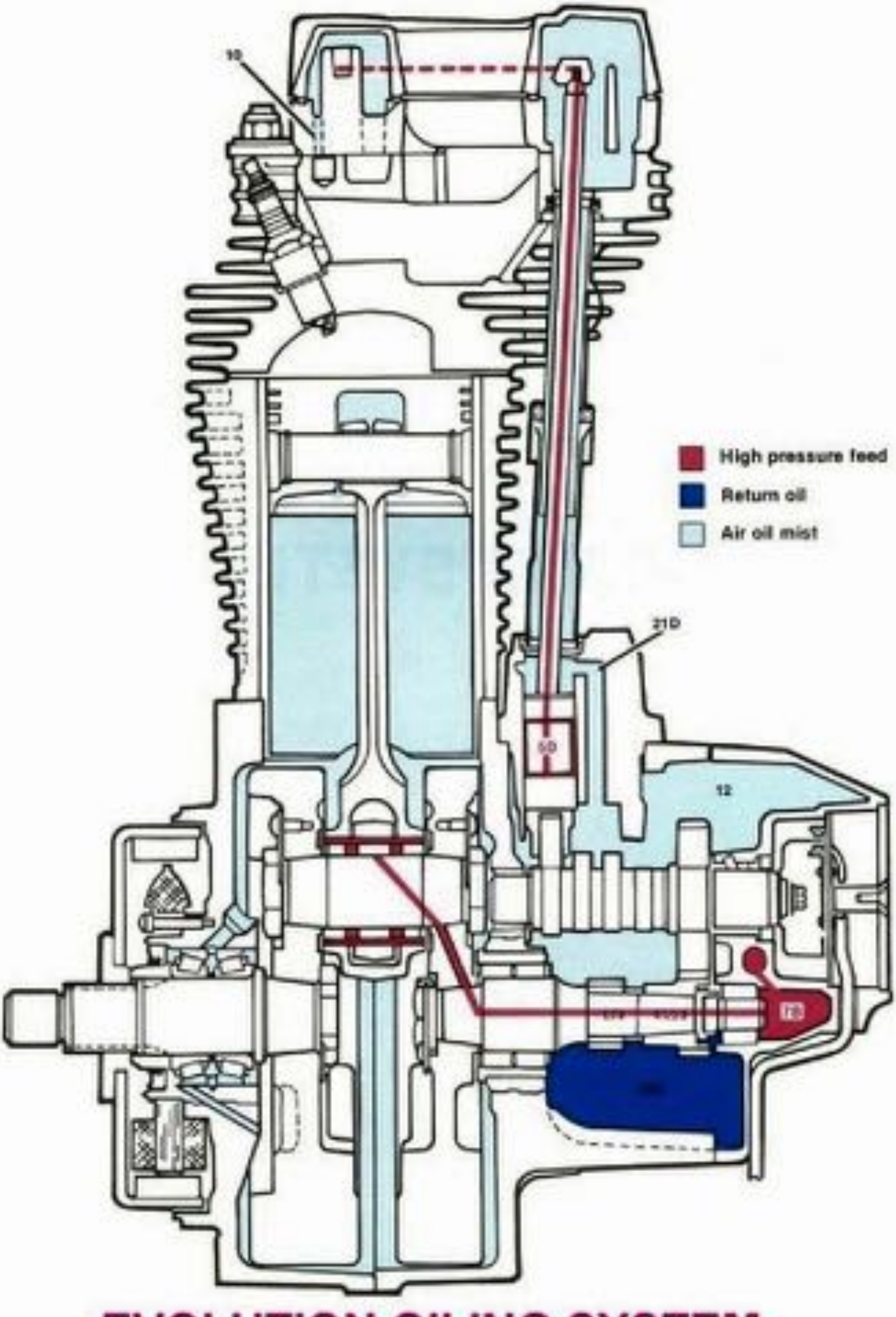
If the oil signal light fails to go off at speeds above idling, it is usually due to low or diluted oil supply. In freezing weather oil feed pipe may clog with ice and sludge, preventing circulation of oil A grounded oil signal switch wire, faulty signal switch or trouble with oil pump will also cause the light to stay on. If the oil signal lights 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 may be checked as follows:

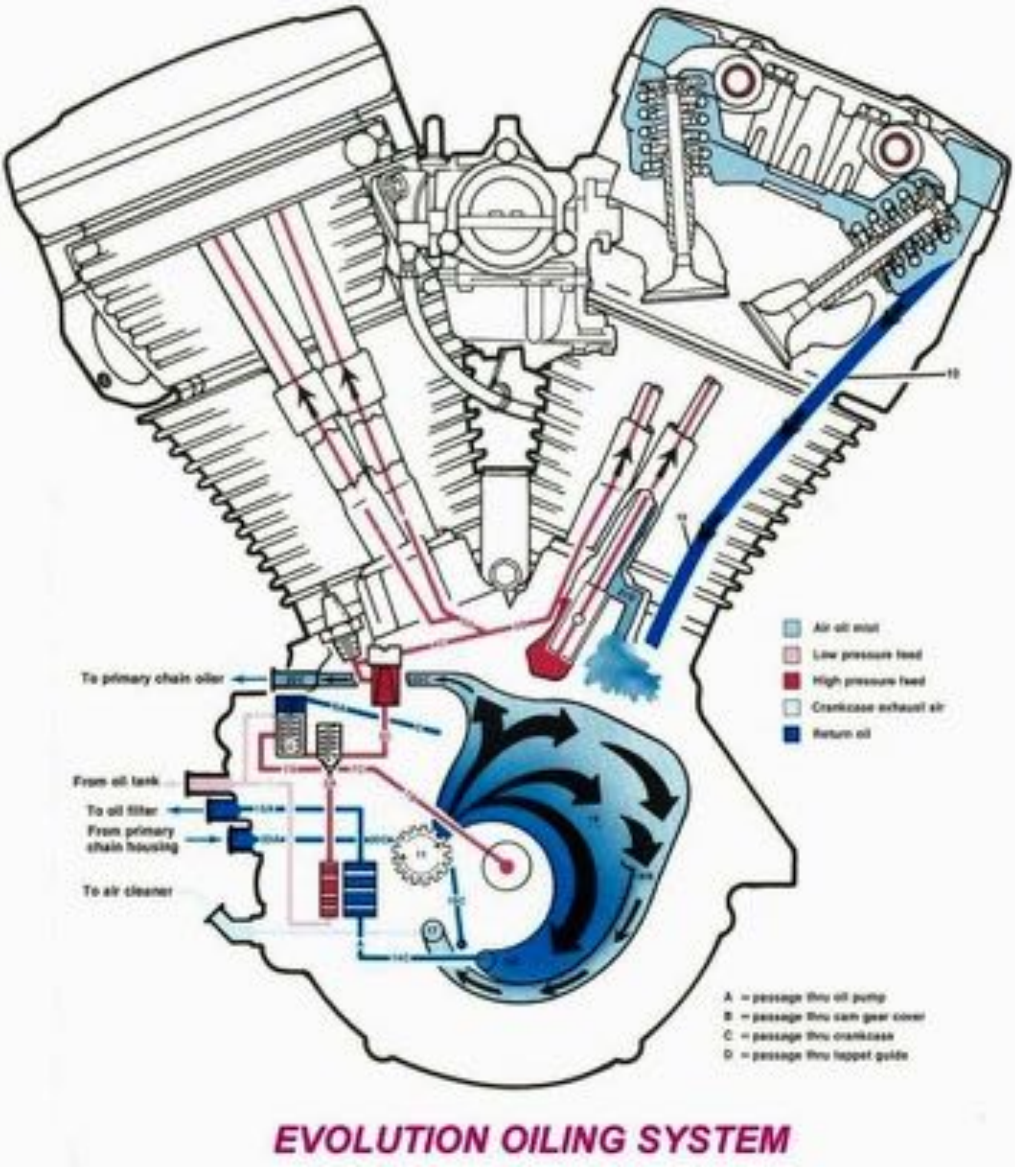
Fill oil tank to proper level. Disconnect oil pressure switch wire at top of switch and remove switch. Install OIL PRESSURE GAUGE, Part No. HD-969212-52. Attach gauge to motorcycle and road run or simulate road running until engine is completely warned. A full operating temperature is essential for accurate gauging. Oil pressure should be 12-35 psi at 2000 rpm with oil at normal operating temperature.

An acceptable alternate method of checking oil pressure is to connect the gauge, by means of the OIL PRESSURE GAUGE ADAPTER, Part No. HD-96921-107 at the tappet screen plug.

EVOLUTION OILING SYSTEM



EVOLUTION OILING SYSTEM



EVOLUTION OILING SYSTEM

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 guides (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 over 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. A series of additional baffles, one in the cam cover and one in the crankcase (17), 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 baffle compartment (19C) and on piston upstroke, vacuum pulls oil thru a timed opening in the breather valve.

Also on the the piston upstroke a timed opening in the breather valve draws oil from the primary chain housing (20A & 20C).

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) carries an air/oil mist to the primary chain oiler and also vents to the oil tank.

DIAGNOSTIC AND REPAIR PROCEDURES

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, only 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 14.

After disassembling cylinder head and cylinder it may be found that lower end repair is necessary. This requires removal of engine crankcase from frame as described in Steps 15 through 29 in STRIPPING MOTORCYCLE FOR ENGINE REPAIR.

When it has been definitely determined beforehand that the lower portion of engine (crankcase) is in need of repair, remove complete engine from chassis before starting disassembly as described in Steps 1 through 29 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.

A noisy engine is usually caused by loose bearings. Main bearings are generally more durable than rod bearings or bushings so that the latter should be suspected first. 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 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 3000 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 the 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 fits 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.

Compression Test 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 a compression tester such as the Sun MODEL UTC-48 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 continuously through 5 to 7 full compression strokes.

4. Note gauge readings at the end of the first and last compression strokes. Record test results.

5. Repeat Steps 2 through 4 on rear cylinder.

6. If the final readings are 90 psi or more and if the final readings do not indicate more than 10%

variance between cylinders, compression is considered normal. If compression does not meet specifications, see diagnostic chart below.

7. Inject approximately 1/2 oz. SAE 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, make 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 leakage.

8. Listen for air leaks at carburetor intake, tailpipe, 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, make 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 proceed as follows:

1. Remove one clutch cover screw and install VACUUM GAUGE, Part No. 96950-68.

2. Start engine and let idle, gauge should read 9 inches of water minimum.

3. Pinch primary housing vent line (3/8 in. hose running between chaincase and tee; gauge reading should be 25 inches of water minimum at 1500 rpm.

4. If primary housing vacuum is low, check for leaks by pressurizing the housing with compressed air.

CAUTION

Use 10 psi pressure maximum for leak test. Before applying air pressure through the clutch cover screw hole, pinch all oil lines running to primary housing near housing.

5. With primary housing pressurized, listen for leaks at following locations:
   - All gasket surfaces
   - O-ring surfaces
   - Hose fittings
   - Oil seals (between engine and primary housing and transmission and primary housing)
   - Solenoid mounting
   - Starter drive mounting

— Clutch cover seal
— Chain inspection cover seal
— Timing inspection hole
— Transmission filler hole

6. Remove suspect head(s) and inspect the following:

— Gasket surface of both head and cylinder
— Oil return passages for clogging
— Cylinder head casting porosity allowing oil to drain into combustion chamber
— Valve guide to valve stem clearance

STRIPPING MOTORCYCLE FOR ENGINE REPAIR

Removing the Engine

Use the following procedure to strip the motorcycle for either cylidner 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 start-up of vehicle and possible personal injury.

1. **Remove seat.**

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.

2. Drain gas tank. Disconnect fuel line and remove gas tank.

3. Remove instrument cover. See HANDLEBAR CONTROLS AND INSTRUMENTS.

4. Remove upper cylinder head bracket. Note washer(s) between bracket and frame lug, use same washer(s) when bracket is assembled.

5. Remove spark plugs to avoid damaging.

6. Remove air cleaner cover, filter element, air cleaner back plate and air cleaner back plate support bracket from carburetor body.

7. Remove fuel and V.O.E.S. hoses from carburetor.

8. Disconnect throttle and choke controls from carburetor. Remove carburetor.

9. Remove rocker cover fasteners.

NOTE

An access hole has been provided through the frame to remove the 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 accidental dropping of the bolt into the frame opening.

10. Remove carburetor intake manifold clamps.

11. Remove exhaust pipes.

At this stage, the three piece 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. 34641 to compress the spring.

To remove engine crankcase or complete engine, continue stripping motorcycle as follows:

12. Remove right footrest, brake pedal and master cylinder assemilby.

13. Drain engine oil from tank.

14. Remove primary cover. Remove compensating sprocket shaft nut. Remove clutch and sprocket assemblies as described in CLUTCH, Section 6. Remove primary chain.

15. Remove four bolts attaching inner primary housing to engine.

16. Remove any hoses from connections at back of inner primary housing.

17. Disconnect shifter linkage.

18. Remove alternator rotor using ROTOR PULLER TOOL, Part No. HD-95960-52A. See ALTERNATOR, Section 8.

19. Disconnect timer wires at coil or connector. Disconnect alternator plug from crankcase and remove rectifier/regulator. Unplug ignition wires.

20. Remove oil sending unit wire.

21. Remove exhaust system.

22. Remove clutch cable bracket from engine.

23. Disconnect wire from oil pressure switch. Drain oil tank and remove oil lines from oil pump.

24. Remove two front and two rear engine mounting bolts.

25. Remove engine with hoist from right side of motorcycle.

Installing the Engine

1. Place the engine in position on the frame motor mounting pads.

2. Install and hand tighten front and rear engine mounting bolts with washers.

3. Insert the four inner primary mounting bolts and reconnect any hoses to the inner primary housing. Leave the four primary mounting bolts loose at this time.

4. Torque the engine mounting bolts in the following 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. Insert safety wire through the two bolts at the inside of the inner primary housing and twist the wire ends together securely.

6. Install the top center motor mounting bolt paying specific attention to proper alignment. Shim as needed. Tighten the mounting nut to 35-40 ft-lbs torque.

7. Install primary chain as described in CLUTCH ASSEMBLY.

8. Install primary cover and new gasket.

9. Install rectifier/regulator. Plug in charging system and ignition wires.

10. Install oil lines to oil pump and crankcase. Use new hose clamps.

11. Install oil sending unit wire.

12. Attach clutch cable bracket to engine.

13. Attach throttle and choke cables to carburetor.

14. Install carburetor and tighten clamps.

15. Install air cleaner.

16. Install exhaust system.

17. Install right footrest, brake pedal and master cylinder assembly.

18. Install gas tank and connect fuel lines. Use new hose clamps.

19. Install seat.

20. Install new oil filter and engine oil.

21. Install spark plugs and cables.

22. Connect battery cables, positive cable first.

CYLINDER HEAD

REMOVAL
(Figure 3-2)

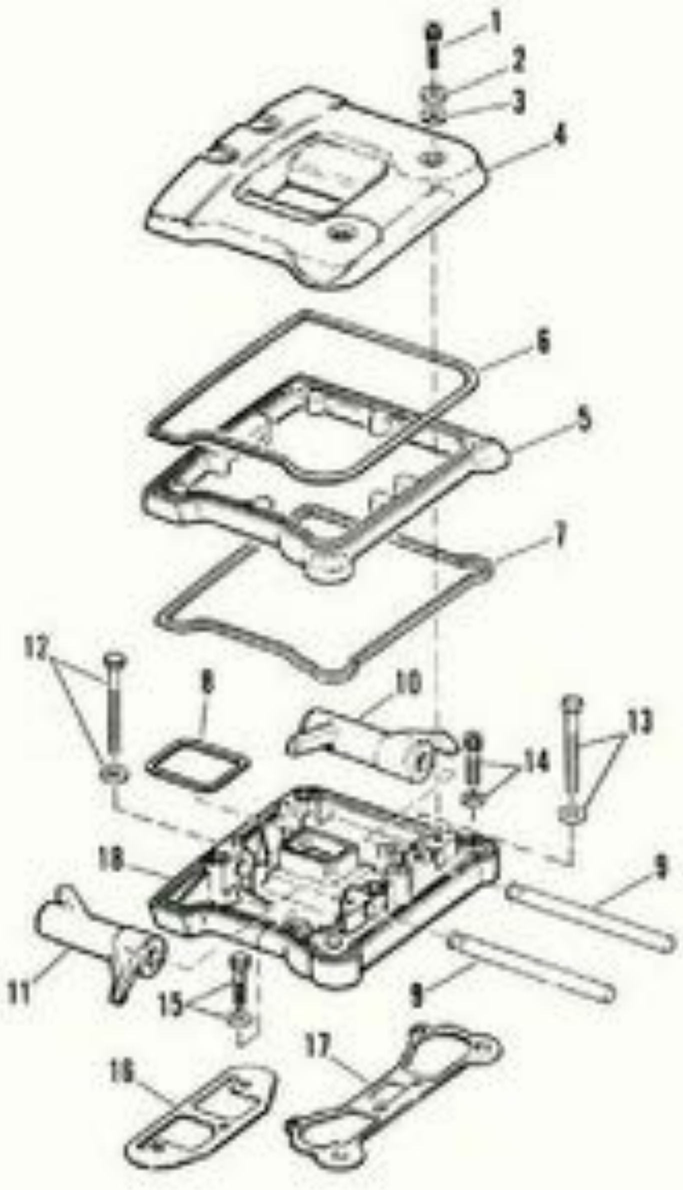
Before removing cylinder head assembly, strip motorcycle as described in STRIPPING MOTORCYCLE FOR ENGINE REPAIR. The front engine mount must be removed and the engine lowered to the frame. The rocker arm covers and internal components must be removed before removing heads.

1. See Figure 3-2. Remove four bolts (1) along with their washer (2) and copper seals (3).

NOTE

All washers and fasteners used in the V² engine are hardened, so they must not be mixed or replaced with unhardened parts.

2. Remove top (4) and middle (5) sections of rocker box. Remove cork gaskets (6), (7) and (8) and discard.
3. Rotate the engine so both valves are closed on the head being repaired.



1. Bolt (4)
2. Washer (4)
3. Copper seal (4)
4. Upper rocker cover
5. Middle rocker cover
6. Gasket
7. Gasket
8. Gasket
9. Rocker arm shafts
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 Covers

4. See Figure 3-3. Remove the two 5/16 in. bolts nearest the rocker arm shafts at the push rod end.

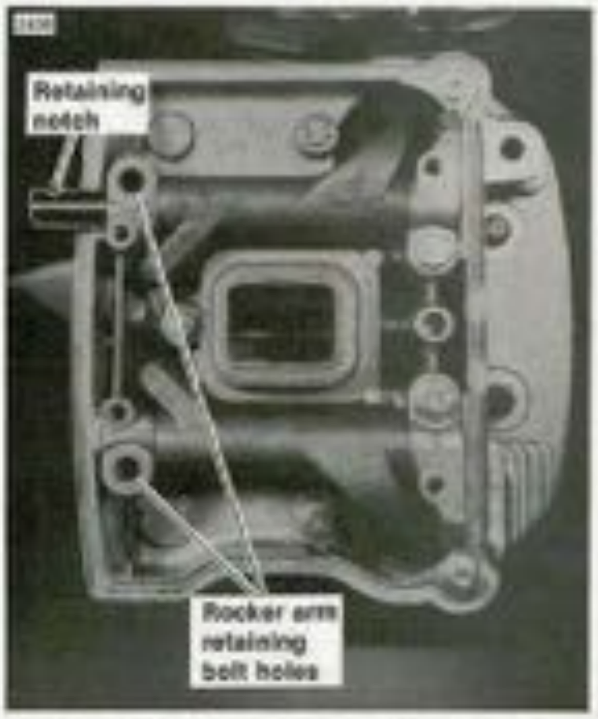


Figure 3-3. Removing Rocker Arm Shafts

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. Remove rocker arms (10 & 11, Figure 3-2) and mark them so they will be reassembled in their original locations.

7. Figure 3-4. Remove the push rods (1) and mark their location and orientation top to bottom.

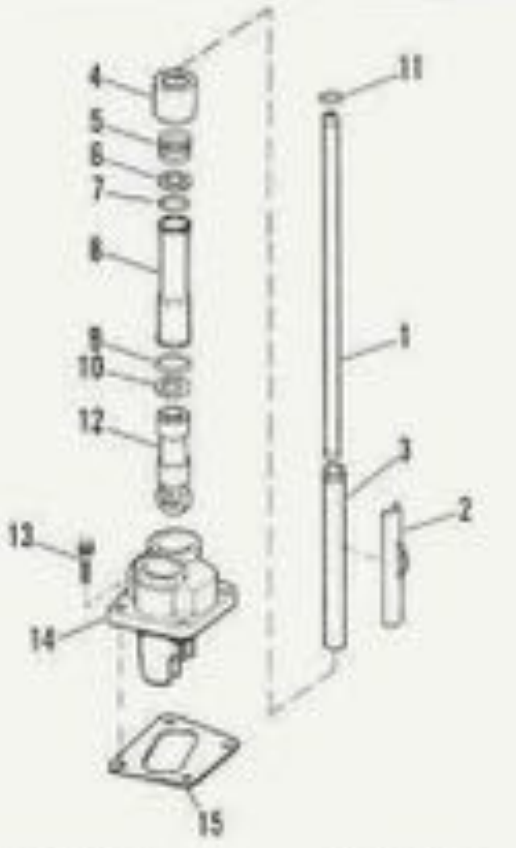
8. Remove spring cap retainers (2) on push rod covers and remove push rod covers and associated parts, (items 3 thru 11, Figure 3-4).

9. Remove the seven remaining fasteners holding the lower rocker arm cover to the cylinder head.

10. Remove the lower rocker cover.

11. See Figure 3-5. Loosen each head bolt 1/8 turn following the cross pattern sequence shown in Figure 3-5. (Gradual loosening is required to prevent distortion to the head, cylinder and crankcase studs.)

12. Continue loosening in 1/8 turn increments until bolts are loose. Remove bolts and thick washer.



1. Pushrod (2)
2. Spring cap retainer (2)
3. Upper push rod cover (2)
4. 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 3-4. Middle Valve Train Components

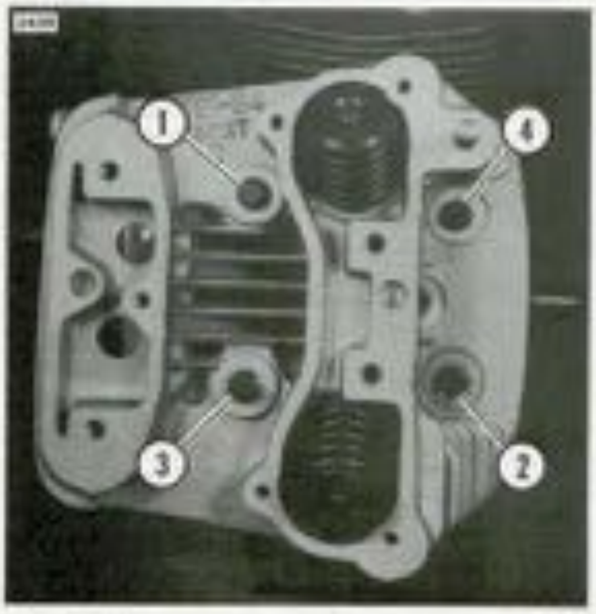


Figure 3-5. Head Bolt Loosening and Tightening Pattern

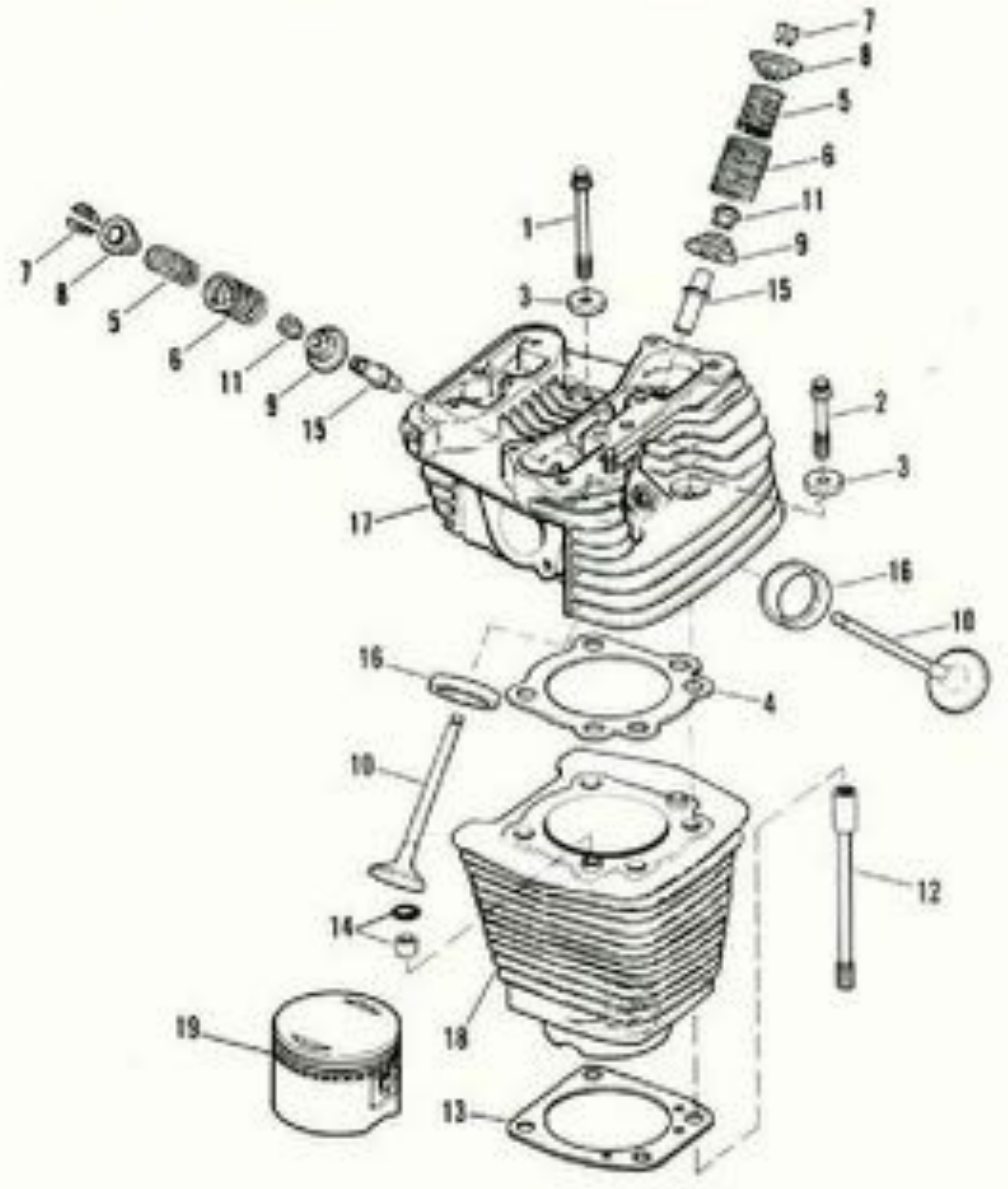
13. Remove cylinder head and head gasket.

14. Repeat Steps 1 thru 13 for the other head.

DISASSEMBLY (Figure 3-6)

1. Compress valve springs (5 & 6) with VALVE SPRING COMPRESSOR, Part No. HD-34843 as shown in figure 3-7.

2. Remove keepers (7), upper collar (8), springs (5 & 6) and lower collar (9). Mark keepers so they will be reinstalled on the same valve.



1. Head bolt, long (2)
2. Head bolt, short (2)
3. Head bolt washer (4)
4. Cylinder head gasket
5. Inner valve spring
6. Outer valve spring (2)
7. Valve keeper (4)
8. Upper collar (2)
9. Lower collar (2)
10. Valve (1) intake
    (1) exhaust
11. Valve stem seal (2)
12. Cylinder stud (4)
13. Cylinder base gasket
14. O-ring and dowel (2)
15. Valve guide (2)
16. Valve seat (2)
17. Cylinder head
18. Cylinder
19. Piston

Figure 3-6. Cylinder Head, Cylinder and Piston — Exploded View

Figure 3-7. Compressing Valve Springs

3. Remove any burrs on the valve stem at the keeper groove with a fine tooth file.
4. Before removing valve, mark it so it will be reassembled in the same head.
5. Remove valve (10) and valve stem seal (11).
6. Repeat Steps 1 thru 5 for the other valve.
7. Disassemble the other head following Steps 1 thru 6.

CLEANING AND INSPECTION

1. Bead blast or 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.
2. Soak cylinder head in Hydro-Seal to loosen carbon deposits.
3. Wash all parts in non-flammable solvent followed by a thorough washing with hot soapy water. 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. Polish valve stem with very fine emery cloth or steel wool.
4. Check rocker arms for uneven wear or pitting at pad or push rod end. Replace rocker arm if either exists.
5. Measure rocker arm shaft diameter where it fits in lower rocker arm cover and where rocker bushings ride. Record the measurements.
6. Measure rocker arm shaft bores in the lower rocker cover and the rocker arm bushing diameter. Record the measurements.
7. Check the clearances and measurements obtained in Steps 5 and 6 against the SERVICE WEAR LIMITS.
8. Repair or replace parts exceeding the SERVICE WEAR LIMITS.
9. Assemble rocker arms, and rocker arm shafts into lower rocker cover.
10. Check end play of rocker arm with feeler gauge.
11. Replace rocker arm or lower cover or both if end play exceeds .035 in.
12. Valve heads should have a seating surface about 1/16 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.
13. Valve seats are also subject to wear, pitting and burning. They should be resurfaced whenever valves are refinished.
14. Clean valve guides by lightly honing with VALVE GUIDE HONE, Part No. HD-34723.
15. Scrub guides with VALVE GUIDE BRUSH, Part No. HD-34751 and hot soapy water. Measure valve stem and guide bore and check measurements against SERVICE WEAR LIMITS.
16. 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.
17. 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.
18. Examine push rods, particularly the ball ends. Replace any rods that are bent, worn, discolored or broken.
19. Check head gasket surface on head for flatness.

REPAIRING ROCKER ARMS AND BUSHINGS (Figure 3-8)

1. To replace worn bushings, press or drive them from the rocker arm. If bushing is difficult to remove, turn a 9/16-18 tap into bushing. From op-

Figure 3-8. Removing Rocker Arm Bushing

posite 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. Using remaining old bushing as a pilot, line ream new bushing with Harley-Davidson ROCKER ARM BUSHING REAMER, Part No. HD-94804-57.

4. Repeat for other end of rocker arm.

REPLACING VALVE GUIDES

Replacing valve guides, if necessary, must be done before valve seat is ground since the valve stem hole in valve guide is the basis from which all seat grinding is done. Valve stem-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 Guides (Shoulder Type)

Early 1984 engines will have guides with shoulders.

1. Scrape carbon from outside of guide. Press valve guides out with a shouldered drift pin (from combustion chamber side).

2. Clean and measure valve guide bore in head.

3. Measure outer diameter of a new standard valve guide. The guide diameter should be .0020-.0033 in. larger than bore in head. If it is not, select one of the following oversizes: Intake and exhaust - .001, .002, and .003in.

Valve Stem Clearances and Service Limits

Valve	
Exhaust	.0015-.0040
Intake	.0008-.0035

4. Insert replacement guide using an arbor press. Be particularly careful to press replacement guides squarely into hole. If replacement guides are shoulder-less type they must be installed with VALVE GUIDE INSTALLATION TOOL, Part No. HD-34731. See Valve Guides (Shoulder-less). When guides are pressed into cylinder heads, they may close up slightly; also the ends may be burred. Therefore, after new guides are in place, they must be sized with an expansion reamer.

5. The guides must be reamed to within .0005-.001 in. of finished size with VALVE GUIDE REAMER, Part No. HD-94810-80. Use liberal amounts of cutting oil to prevent reamer chatter.

6. See Figure 3-9. 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 3-9. Honing Valve Guides

7. Clean guide bores with VALVE GUIDE BRUSH, Part No. HD-34751 and hot soapy water after honing.

Valve Guides (Shoulder-less)

Later 1984 engines will have shoulder-less guides. Their replacement and sizing is the same as shouldered guides; except for the following:

1. Press or tap shoulder-less guides toward combustion chamber to remove.

2. See Figure 3-10. Install shoulder-less guides using VALVE GUIDE INSTALLATION TOOL, Part No. HD-34731 and DRIVER HANDLE, Part No. HD-34740. Press or drive guide until the tool touches the machined surface surrounding the guide. At this point the correct guide height has been reached.

Figure 3-10. Installing Shoulder-less Valve Guides

GRINDING 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 1/32 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.

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. Correct 3-angle valve seat angles are shown in Figure 3-11. Use a NEWAY VALVE SEAT CUTTER, Part No. 444-HDF, to cut the seats. Always grind valves before cutting the seats. See Figure 3-11.

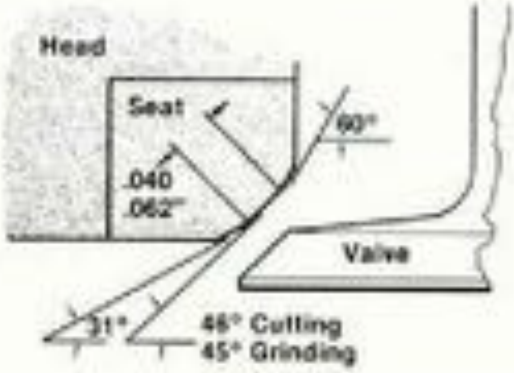


Figure 3-11. Valve Seat Angles

1. Cut 46° valve seat angle first, using cutting oil to avoid chatter. Cut only enough to clean up the seat.

2. 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-96550-36.

3. Check the contact pattern on the valve face. It should be .040 - .062 in. wide and 2/3 the way towards the outside edge of the face.

4. If valve seat pattern is too close to stem side of valve face, cut 60° angle to raise seat. If pattern is too close the edge of the valve face, cut 31° angle to lower seat.

5. After cutting either or both 31° or 60° angles to position seat, final cut 46° seat angle to obtain proper .040 - .062 in. width.

6. Recheck valve seat width and location with lapping compound as described in Step 2.

7. To achieve a smooth, even finish, place a piece of 280 grit emery paper under the cutter head and rotate cutter.

8. Wipe valve seats and valve faces clean and measure the valve stem protrusion. See Figure 3-12.

Figure 3-12. Valve Stem Protrusion

9. If valve stem protrudes more than 2.034 in. the seal must be replaced.

10. If valve stem protrusion is within the range given in Figure 3-12, the valves and seats are ready for lapping.

REPLACING VALVE SEATS

Replacing a valve seat is a complex operation requiring special equipment. If the seat is loose or not seated 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.

LAPPING VALVE FACES AND SEATS (Figure 3-13)

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-96550-36.

2. Lift valve and rotate it about 1/3 of a turn.

3. Repeat lapping procedure as shown in Figure 3-13.

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 sealed. If lapped finish is not complete, further lapping, or grinding and lapping is necessary.

Figure 3-13. Lapping Valves

ASSEMBLING CYLINDER HEAD

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.

6. See Figure 3-14. Place a protective sleeve over the valve stem keeper grooves. Coat the sleeve with oil and place a new seal over the valve stem. If the seal is installed without using the protective sleeve, the seal will be damaged.

Figure 3-14. Installing Valve Guide Seal

7. Tap the seal onto the guide using the VALVE SEAL INSTALLATION TOOL, Part No. HD-34643 and DRIVER HANDLE, Part No. HD-34740. The seal is completely installed when the tool touches the head surface.

CAUTION

Do not remove valve after seal is installed. Sharp edges on keeper groove will cut and ruin seal.

8. See Figure 3-6. Install lower collar (9), valve springs (5 & 6), upper collar (8).

9. Compress springs with VALVE SPRING COMPRESSOR, Part No. HD-34736.

10. Insert keepers (7) into upper collar (8) making sure they engage groove in valve stem. The keeper gaps must be equally spaced and located at the top and bottom of the stem diameter.

11. Release and remove VALVE SPRING COMPRESSOR.

12. Gently tap the upper collar with a soft hammer to ensure keepers are fully seated.

13. Repeat steps 4 thru 12 for the remaining valves.

14. Install the compliance fittings using a new gasket.

INSTALLING CYLINDER HEAD (Figure 3-5 and 3-6)

If only cylinder head work was needed, reinstall cylinder head following these instructions. If further repair is required go the CYLINDER AND PISTON.

1. Make sure the stud (12) holes are clean and dry. Place new head gaskets (13) and O-rings (14) on the cylinders and position the heads on the dowels (14). Dip the head bolt threads in oil then wipe off any excess. Install the head bolts and washers finger tight. The bolts are a special grade 8 material and the washers are countersunk and through hardened. Do not interchange any of these components.

2. The procedure for tightening the head bolts is extremely critical to not only prevent gasket leaks, but to prevent failure of the studs and distortion of the heads and cylinders. See Figure 3-5. Always tighten the head bolts in a cross pattern sequence in three steps with the engine cold as follows:

   A. Tighten each bolt to 7 - 9 ft-lbs torque.

   B. Tighten each bolt to 15 - 17 ft-lbs torque.

   C. Tighten each bolt to 24-26 ft-lbs torque.

CAUTION

The cylinder head bolts are not to be checked for tightness after final torqueing at reassembly is completed. Retightening the bolts to specified torque at regular intervals will place undue stress on bolts and bolt anchoring threads.

3. See Figure 3-2. Install the lower rocker cover assembly (16) using new gaskets (14 and 15) with the bead on the gaskets facing up. Install all bolts; except, the two rocker arm shaft retaining bolts. Tighten the 5/16 in. bolts to 22-25 ft-lbs torque and the 1/4 in. bolts to 11-12 ft-lbs torque. Do not install rocker arms or shafts. Push rod length must now be checked.

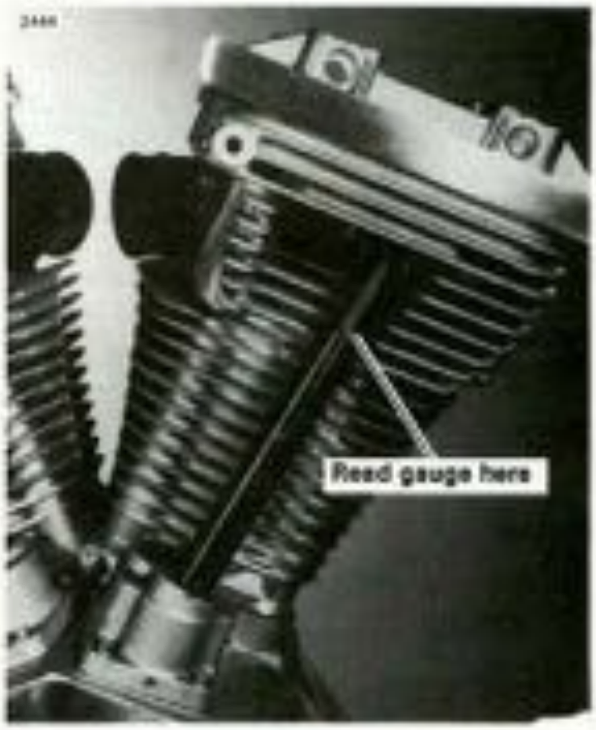


Figure 3-15. Push Rod Gauge

PUSH ROD LENGTH MEASUREMENT AND SELECTION (Figure 3-16 and 3-17)

1. Rotate camshaft so tappet is at its lowest point (on base circle of camshaft).

2. See Figure 3-15. Insert the round end of the correct color coded male adaptor (part of PUSH ROD HEIGHT GAUGE TOOL, Part No. HD-34199) through the push rod opening in the cylinder head, from the bottom side.

3. Seat the round end of the lower sleeve in the tappet socket.

4. Position the rocker arm in the lower corner so that the socket in the rocker arm engages the end of the male adaptor.

5. Install the rocker arm shaft.

6. Sight along top of lower sleeve to determine correct push rod zone (1, 2 or 3).

7. Use the chart to determine the correct color coded push rod.

NOTE

There are 12 push rod lengths available each being identified by one, two or three color stripes. Push rod lengths are likely to change when a valve train component is replaced or when valves and seats are reconditioned.

PUSH ROD INSTALLATION

1. Remove the rocker arms and shafts.

2. Make a piece of wire .050-.060 in. diameter and 13-14 inches long and insert it through the push rod oil galley. Use the wire to depress the check valve in the lifter and push downward on push rod to depress the lifter. While keeping the lifter depressed, remove the wire and install the rocker arm and shaft (tappet must be on the base circle of the cam for the rocker arm being installed).

NOTE

A small diameter welding wire can be used by grinding about 2 in. back on one end to .005-.060 in. diameter.

3. Repeat Step 2 for the other push rods.

NOTE

If the original push rods are being installed, make sure you do not turn them end for end from their original position since they have worn in to their mating components.

4. See Figure 3-3. Install the middle (5) and top (4) rocker arm covers, using new cork gaskets and new copper washers. The copper washers must be under the steel washers. Make 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 criss-cross pattern.

5. Install the carburetor, V.O.E.S. and ignition components.

PUSHROD POSITION	MALE ADAPTER COLOR CODE	PUSH ROD COLOR CODE (HD PART NO.)		
		1	2	3
REAR EXHAUST	PURPLE	1 BAND PURPLE (17922-83)	2 BANDS PURPLE (17921-83)	3 BANDS PURPLE (17923-83)
REAR INTAKE	BLUE	1 BAND BLUE (17925-83)	2 BANDS BLUE 17924-83)	3 BANDS BLUE (17926-83)
FRONT INTAKE	YELLOW	1 BAND YELLOW (17931-83)	2 BANDS YELLOW (17930-83)	3 BANDS YELLOW (17932-83)
FRONT EXHAUST	GREEN	1 BAND GREEN (17928-83)	2 BANDS GREEN (17927-83)	3 BANDS GREEN (17929-83)

EXAMPLE: REAR INTAKE

Using the blue striped male adapter, a gauge reading within the (1) zone is indicated. The correct push rod will have one blue band, Part No. 17925-83.

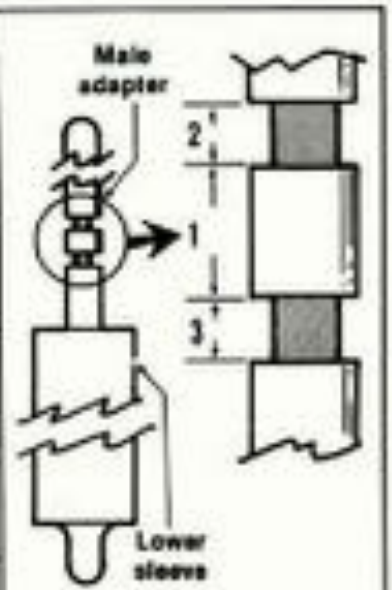


Figure 3-16 and 3-17. Pushrod Length Measurement and Selection Chart

CYLINDER AND PISTON

REMOVAL CYLINDER AND PISTON

1. Strip motorcycle as described in STRIPPING MOTORCYCLE FOR ENGINE REPAIR.

2. Remove cylinder head as described in 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. 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 1/2 in. inside diameter plastic or rubber hose over each stud. This not only protects the studs but the pistons as well.

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.

7. The piston pin retaining rings must not be reused.

8. 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 V^2 engine.

9. Mark the piston by scribing an "F" or "R", for front or rear cylinder, on the piston pin boss opposite the boss having the raised "nub". Marking the piston is important since the piston pin is offset and the pistons must not be installed backwards.

10. Handle the piston with extreme care since the alloy used in these pistons is very hard, any scratches, gouges or other marks in the piston could score the cylinder during engine operation.

Figure 3-18. Marking Piston

CLEANING AND INSPECTION

1. Where carbon deposit is thick and hard, it is advisable to scrape carbon off. Use a putty knife or ground tip on an old file. Use care to keep from scraping into aluminum of 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 outside of 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. 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 (.0002-.0007 in.) fit in piston and has .0003-.0009 in. clearance in connecting rod upper bearing. If piston pin-to-bushing fit exceeds .001 in., replace worn parts. See CONNECTING 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 3/8 in. wide and appear as the engine accumulates running time. They are normal and require no attention.

10. Check rods for up-and-down play in lower bearings. When up-and-down play is detected, lower bearing should be refitted. This requires removing engine and disassembling engine crankcase.

REFINISHING CYLINDER

1. Check the gasket surfaces for flatness. The top or head gasket surface must be flat within .006 in. and the base gasket surface must be flat within .008 in. Check the above surfaces by laying a straight-edge across the surface and then try to insert the proper feeler gauge between the straight-edge 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. See Figure 3-19. Before measuring the cylinder bore, make sure the gasket surfaces are free of burrs and install a head and base gasket and the CYLINDER TORQUE PLATES, Part No. HD-33446. Tighten the bolts to 28 ft-lbs torque. This will simulate engine operating conditions. Your measurements will vary as much as .001 in. if you don't use the torque plates.

4. Take cylinder bore measurement in the ring path, starting about 1/2 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.

6. If cylinders are not scuffed, scored and are not worn beyond service limits it is not necessary to rebore oversize at this time.

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 LIMITS.

Boring And Honing Cylinder

1. The cylinder must be bored with gaskets and torque plates attached. Bore the cylinder to .003 in. under the desired finished size.

Figure 3-19. Measuring Cylinder Bore

2. Hone the cylinder to its finished size using a 280 grit rigid hone followed by a 240 grit flexible ball hone. Honing must be done with the torque plates attached. All honing must be done from the bottom (crankcase) end of the cylinder. Work for a 60° cross hatch pattern.

3. Improper cross hatch pattern or too fine a hone will result in insufficient oil retention and possible piston seizure.

4. Final cylinder bore sizes, after honing are as follows:

Standard bore	3.4980 in. ± .0002 in.
.005 Oversize (O.S.) bore	3.5030 in. ± .0002 in.
.010 O.S. bore	3.5080 in. ± .0002 in.
.020 O.S. bore	3.5180 in. ± .0002 in.
.030 O.S. bore	3.5280 in. ± .0002 in.

Measuring Piston

Because of their complex shape, the pistons cannot be accurately measured with standard measuring instruments.

The pistons have the typical elliptical shape when viewed from the top. However, they also are barrel shaped as 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 leading to problems.

Fitting Cylinder to Piston

Since pistons cannot be accurately measured with standard measuring instruments, the bore sizes given in Step 4 under Boring and Honing Cylinder must be observed. Example: A .005 in. oversize piston will have the proper clearance with a bore size of 3.5030 in. ± .0002 in.

Fitting Piston Rings

Piston rings are two types — compression (plain face) and oil control ring. The two compression rings are positioned in the two upper piston ring grooves with the dot on the second compression ring facing upward. Rings are regularly supplied to fit standard oversize pistons.

1. See Figure 3-20. Check the end gap on both oil rails and the compression rings. Use the top of the piston to square the ring in the bore.

Figure 3-20. Checking Ring Gap

2. See SERVICE WEAR LIMITS for end gap dimensions. Do not file rings to obtain proper gap.

3. Install the new rings on the piston making sure the dot on the second compression ring is facing up. Stagger the ring gaps as shown in Figure 3-21.

Figure 3-21. Positioning Ring Gaps

4. See Figure 3-22. 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 3-22. Measuring Ring Side Clearance

Replacing Rod Bushings (Figure 3-23)

If the piston pin to rod bushing clearance is greater than .001 in. replace the rod bushing.

1. When replacing bushings in connection with only a top overhaul, use Harley-Davidson PISTON PIN BUSHING TOOL, Part No. HD-95970-32A, to remove and install the bushing and CONNECTING ROD CLAMPING FIXTURE, Part No. HD-95952-33.

2. To use CONNECTING ROD CLAMPING TOOL, Part No. HD-95952-33, 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

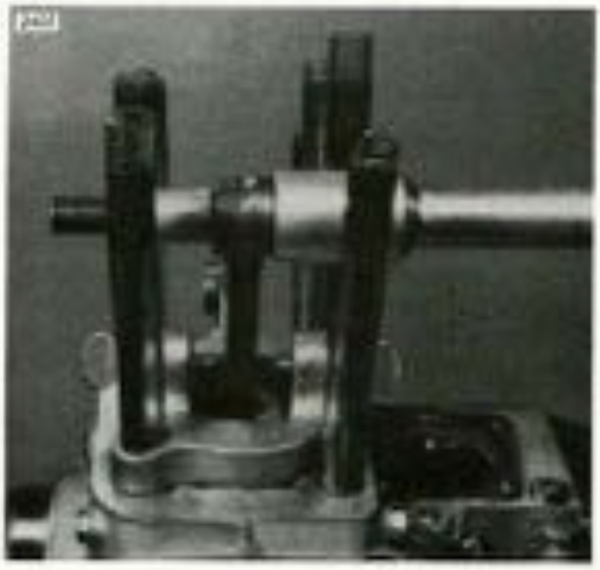


Figure 3-23. Replacing Rod Bushing

hoses over the studs wedging them inside the holes in the tool.

3. Be careful to start new bushing with oil hole in bushing aligned with oil hole in rod.

4. Ream new bushing to size with EXPANSION REAMER, Part No. HD-94800-26. A properly fitted pin should have .0003-.0009 in. clearance. Fitting tighter is likely to result in a seized pin or bushing loosened in rod. Check finished bore by passing a piston pin through the bushing. The pin must pass through without binding. Check for burrs if pin binds and recheck for proper clearance.

STRAIGHTENING CONNECTING RODS

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.

ASSEMBLING CYLINDER AND PISTON

1. Install the pistons making sure they are properly oriented front to back. The raised nub on the pin boss must go to the left or sprocket shaft side. See Figure 3-18. Install the piston pin retaining rings with the PISTON PIN RETAINING RING INSTALLER, Part No. HD-34623. Make sure the ring groove is clean and that the ring is fully seated in the groove with the gap away from the slot at the bottom.

2. Make sure the piston ring end gaps are properly positioned as shown in Figure 3-21.

3. Lubricate cylinder walls, pistons, pins and rod bushings with engine oil.

4. Turn engine until crankpin is at top center.

5. See Figure 3-24. Compress the piston rings using PISTON RING COMPRESSOR, Part No. HD-96333-51B.

Figure 3-24. Slipping Cylinder Over Piston

6. Remove cylinder stud sleeves and install a new cylinder base gasket. Make sure the pistons do not bump the studs or crankcases damaging their surface.

7. Support the piston with one hand while sliding the cylinder on with the other.

8. Remove piston ring compressor.

9. Assemble cylinder heads as indicated in ASSEMBLING CYLINDER HEADS.

GEARCASE

OIL PUMP

General

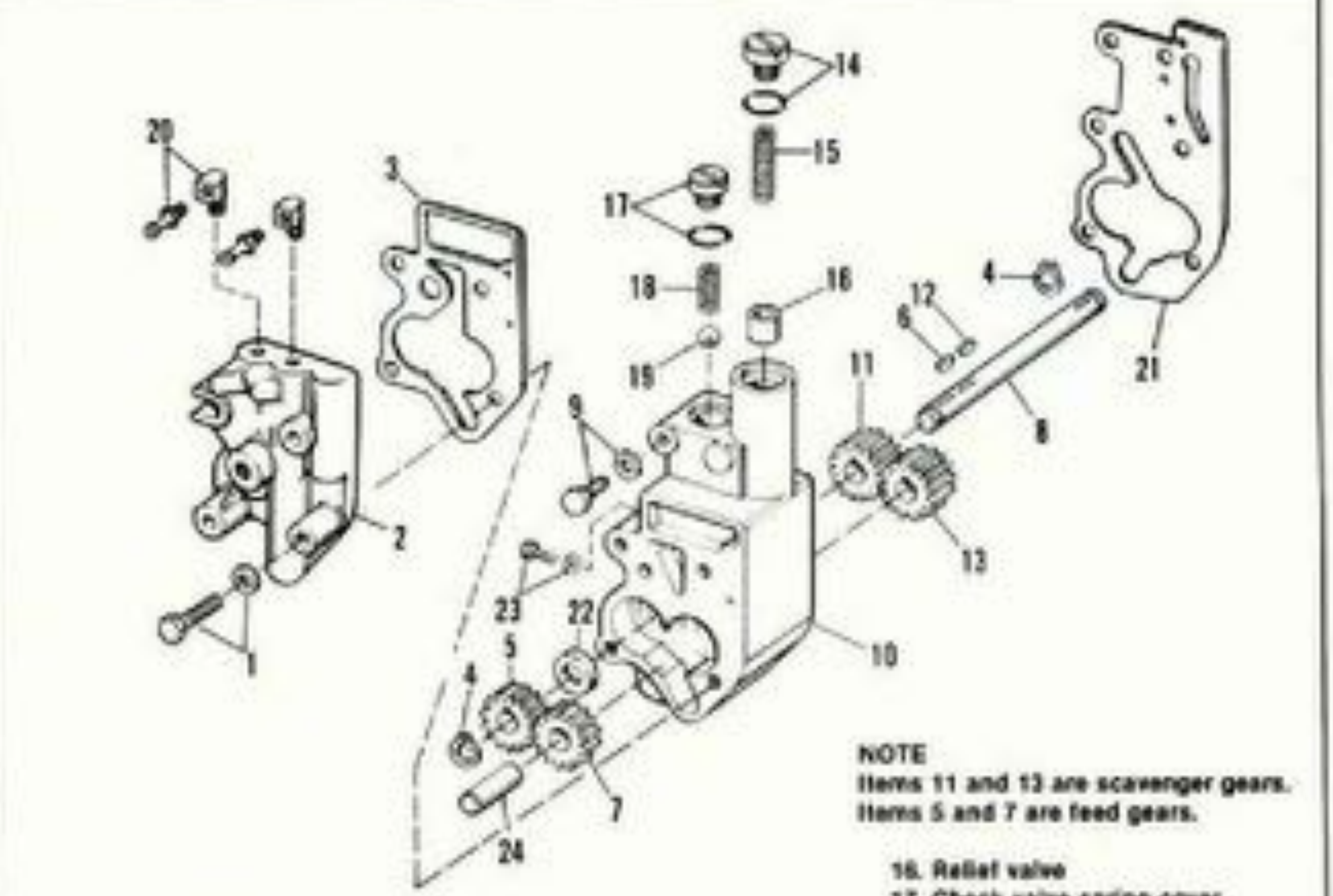
The oil feed pump and scavenger (oil return) pump are gear type pumps housed in one pump body and located on rear of gearcase on right side of motorcycle. The feed pump incorporates an automatic relief valve that reroutes surplus oil (above the amount needed to lubricate the engine) directly back to the feed section of the pump. A check valve is located ahead of the pressure regulating valve to prevent oil drainage from tank when engine is not running.

Under normal operating conditions, the pump is a comparatively trouble free unit. The most common trouble with pump operation is the introduction into the pump of a metal or hard carbon chip. 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 shearing of the 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 3-25)

The oil pump may be disassembled, piece-by-piece without removing gearcase cover, with engine in chassis as follows:



1. Cover bolt and lockwasher (4)
2. Oil pump cover
3. Cover gasket
4. Lock ring
5. Drive gear
6. Gear key
7. Idler gear
8. Oil pump gear drive shaft
9. Oil pump body mounting bolts and lockwashers (2)
10. Oil pump body
11. Drive gear
12. Gear key
13. Idler gear
14. Relief valve plug and O-ring
15. Relief valve spring
16. Relief valve
17. Check valve spring cover and O-ring
18. Check valve spring
19. Check valve ball
20. Oil line elbow (2) and nipple (2)
21. Body gasket
22. Seal
23. Plug and gasket
24. Idler shaft

Figure 3-25. Oil Pump — Exploded View

NOTE

Gears and keys must be replaced in the same position as removed.

1. Disconnect oil lines from pump.

2. Remove bolts and lockwashers (1) that hold oil pump cover in place. The upper inside pump cover bolt 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.

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 3-25)

Thoroughly clean all parts in cleaning solvent and blow pump body passages clear with compressed air. Inspect valves and valve seats for pitting and wear. Replace pump having worn or damaged valve seat. Inspect keys and keyways. Inspect scavenger and feed pump gear teeth for gouging or cracking caused by foreign materials going through pump. Lay a straight-edge across the feed gears with the gears installed in the pump body. With a feeler gauge check clearance between straight-edge and pump body. Gears should extend above the pump body .003 - .004 in. Repeat above check on scavenge gears. If gears do not extend .003 - .004 above pump body the oil pump must be replaced.

Assembly (Figure 3-25)

NOTE

Do not mix gears and keys, replace in original location. Oil pump gaskets should not be reused. Use only FACTORY MADE gaskets. 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 snug mounting hardware (9).

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 (2 and 9) evenly to 90-120 in-lbs torque.

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.

10. 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. See Figure 3-26.

Figure 3-26. Hose Clamp Connection

VALVE TAPPETS AND GUIDES

General

The tappet assembly consists of tappet and roller. The tappet and roller, under compression force from valve spring, 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 allow the unit to pump itself full of engine oil to take up all play in the entire 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 for some time. Tappets have a definite leak down rate which permits the oil in the tappets cylinder 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.

Removal and Disassembly of Tappets

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, push rods and push rod covers following the REMOVAL procedure of the CYLINDER HEAD section.

3. Remove the four bolts holding the tappet guide to the crankcase. Remove the oil pressure sending switch for rear tappet guide removal.

4. 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.

5. Mark tappets and guides so they will be reassembled in their original locations.

Cleaning And Inspecting

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 rollers if they are damaged or if clearances are excessive.

4. After replacing a roller assembly, make sure the side play is correct and the pin is not loose.

5. If you suspect there might be dirt in the tappet or internal parts are malfunctioning, replace the tappet.

6. Tappets should be soaked in clean engine oil and kept covered until assembly.

Assembling Tappets (Figure 3-27)

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. Insert the TAPPET GUIDE ALIGNMENT TOOL, Part No. HD-33443, in the screw hole nearest the tappet oil feed and install and tighten the other three screws. Remove the tool and install the fourth screw.

Repeat the above procedure for the other tappet guide. Install TAPPET GUIDE ALIGNMENT TOOL in the hole directly to the left of where tool is shown in Figure 3-27.

Figure 3-27. Aligning Tappet Guide

After tappets and guides are installed, check push rod length following the procedure given in the CYLINDER HEAD section.

NOTE

See Figure 3-17. To permit the installation of the rocker arm shaft, insert a large wire into the hole in the top of the lifter and "pump" it up and down several times. This will bleed down the lifter and allow rocker arm shaft to be inserted.

GEARCASE COVER AND TIMING GEARS

General

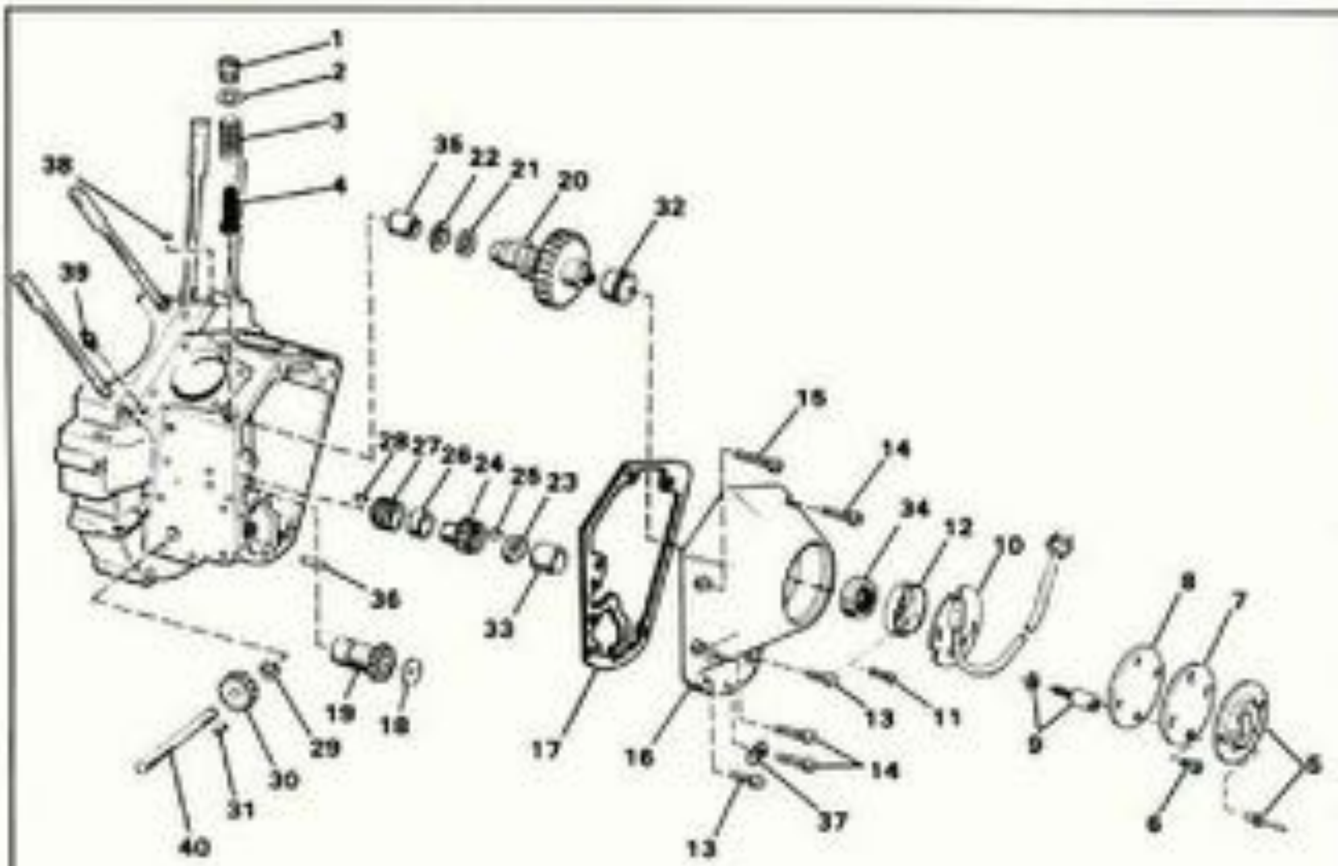
The gearcase, located on the right side of the engine crankcase, contains a train of gears which transmit engine power to the cam shaft and ignition timer, crankcase breather and oil pump. The gearcase is lubricated with engine oil through the breather valve from engine crankcase.

Shafts run in bushings except the crankcase side of the cam shaft which operates in a needle roller bearing.

Disassembling Gearcase (Figure 3-28)

Before disassembling gearcase, it is necessary to remove push rods, tappets, and tappet guides as described earlier in this section.

1. Remove tappet oil screen cap (1), O-ring (2), screen



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 bolt
12. Rotor
13. Gear cover screw, 1 in. (2)
14. Gear cover screw, 1-1/4 in. (3)
15. Gear cover screw, 1-3/4 in. (1)
16. Gear cover
17. Gear cover gasket
18. Breather gear washer
19. Breather gear
20. Cam gear
21. Cam gear spacing washer
22. Cam gear thrust washer
23. Gear shaft nut
24. Pinion gear
25. Pinion gear key
26. Pinion gear spacer
27. Oil pump pinion shaft gear
28. Oil pump pinion shaft gear key
29. Oil pump drive gear lock ring
30. Oil pump drive gear
31. Oil pump drive gear key
32. Gear cover camshaft bushing
33. Gear cover camshaft bushing
34. Camshaft oil seal
35. Camshaft needle bearing
36. Cover dowel pin (2)
37. Wire clip
38. Welch plug
39. Oil pressure switch
40. Oil pump shaft

Figure 3-28. Gearcase — Exploded View

spring (3) and screen (4). Drill out two cover rivets (5) and remove cover.

2. Remove two ignition sensor cover screws (6), cover (7) and gasket (8).

3. Remove sensor plate screws and lockwashers (9).

4. Disconnect sensor plate wires at connection so that sensor plate may be moved out of the way.

5. Remove bolt (11) and rotor (12).

6. Remove gearcase cover screws (13, 14 and 15).

7. Tap gearcase cover with wood or rawhide mallet to loosen and remove gear cover (16) and gearcase cover gasket (17).

8. Remove breather valve spacing washer (18) and breather gear (19).

9. Remove cam gear (20), spacing washer (21) and thrust washer (22).

10. Remove pinion gear shaft nut (23) which has a left-hand thread. Use PINION SHAFT NUT SOCKET, Part No. HD-94555-55A. Pull pinion gear (24) using PINION GEAR PULLER AND INSTALLER, Part No. HD-96830-51A, as shown in Figure 3-29. Tool has lefthand threads.

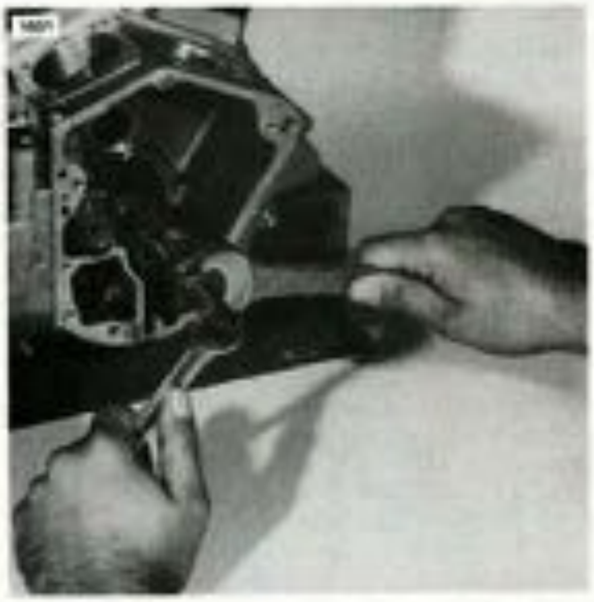


Figure 3-29. Pulling Pinion Gear

11. Remove key (25), gear shaft pinion spacer (26), oil pump pinion shaft gear (27) and key (28).

12. Use a LOCK RING PLIERS such as Snap-On No. PR129A and remove oil pump drive gear shaft lock ring (29), drive gear (30) and drive gear key (31).

13. If necessary, remove oil pump bolts and washers and remove oil pump from gearcase. See OIL PUMP DISASSEMBLY.

Cleaning, Inspection and Repair (Figure 3-28)

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 no grease or solvent into crankcase when washing gearcase.

2. Inspect oil screen (4) carefully to make 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 (32 and 33) in gearcase cover for pitting, scuffing and grooving. Determine amount of pinion and cam shaft wear in cover bushing. If it exceeds service 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 if worn more than .003 in. or is damaged in any way, replace both the cam and the needle bearing (35). See steps 8 and 9.

5. Replace the cam if any of the lobes are damaged or worn more than .006 in. Measure the lobes on a new cam for comparison. Make sure you use an Evolution cam that is marked with the letter "V". Since the lift and profile on the cam lobes differs from earlier engines, cams must not be interchanged.

6. Inspect cam gear oil seal (34) in cover to see that lip is in good condition.

7. See Figure 3-30. 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 .002 in., the bearing must be refitted. See FITTING PINION SHAFT BEARING in the CRANKCASE section.

8. Inspect needle bearing (35) for wear, 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. Needle bearing can be removed and installed in crankcase without disassembling crankcase using PULLER TOOL, Part No. HD-95760-69, as shown in Figure 3-31. Press needle roller bearing into crankcase with NEEDLE BEARING TOOL, Part No. HD-97272-60, as shown in Figure 3-31. Press from heavier end having the manufacturer's name only.

Figure 3-30. Checking Pinion Shaft Bearing

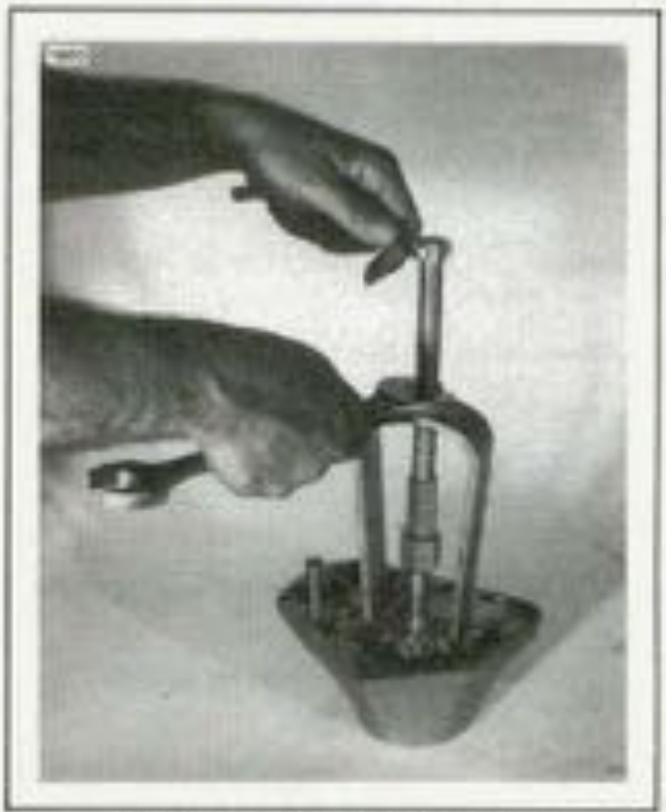


Figure 3-32. Removing Cover Bushing

Pressing from opposite end will crush roller race and bind rollers.

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 considered ideal when no play between gears can be felt and cam gear can be moved back and forth along shaft axis with slight drag.

Replacing Gearcase Cover Bushings (Figure 3-28)

Remove pinion shaft cover bushing using PULLER TOOL, Part No. HD-95760-69, as shown in Figure 3-32.

Install new pinion gear shaft bushing (33) in hole in cover as follows:

1. Position bushing in cover so flat on bushing is in line with oil hole in cover. Press in bushing on ar-

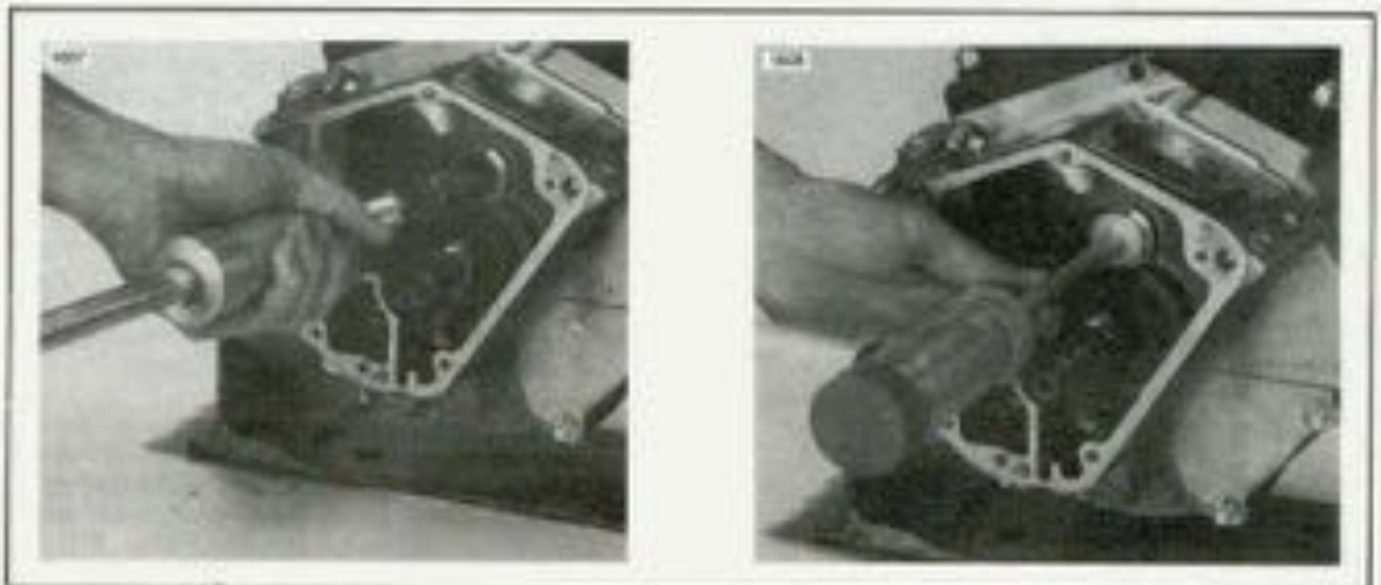


Figure 3-31. Removing and Installing Cam Gear Needle Bearing

bor press until top of bushing is flush with case bushing boss on cover.

2. The original bushings are not pinned. The replacement bushings must be pinned. Locate and center punch dowel pin location 1/8 in. or more from oil hole in cover. Drill No. 31 hole 3/16 in. deep. Press in bushing until it bottoms on shoulder in cover boss hole. Continue drilling dowel pin hole to depth of 9/32 in. from top of bushing. Drive in new dowel pin and carefully peen edges of hole to lock pin in place.

3. To replace cam shaft cover bushing (32), proceed as follows:

   Use PULLER TOOL, Part No. HD-95760-69, to extract old bushing. Press in new bushing with arbor press until shoulder is against cover boss. Center punch and drill No. 31 hole exactly 9/32 in. deep. Drive in new dowel pin and peen bushing edges over dowel to secure it.

4. Drill lubrication oil hole through wall of bushing with 5/32 in. drill using oil hole in bushing boss as a drill guide.

   Pinion shaft and cam shaft 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.

5. To ream pinion shaft bushing, insert reamer pilot in right crankcase roller race as shown in Figure 3-33. Insert 9/16 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.

   To ream cam gear cover bushing, use a 1 in. expansion reamer and ream to 1.003/1.002 in. diameter.

Figure 3-33. Line Reaming Cover Bushing

Assembling

1. Before assembling gear train, determine amount of end play in breather gear as follows: Assemble breather gear and dry cover gasket to gearcase. Select spacer washer (use washer disassembled unless it is known to give incorrect spacing) and position on end of breather gear. Place a steel straightedge across gearcase at spacer. 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. An end play tolerance of 0.001 to 0.016 in. is correct. If end play exceeds maximum, insert thicker spacer. Breather valve and gear spacer washers are available 0.110, 0.115, 0.120 and 0.125 in. thick.

2. See Figure 3-34. Establish proper cam gear end play as follows: Install thrust washer, spacing washer and cam gear. Position cover gasket and secure cover with at least four screws. Measure cam shaft end play between cam gear shaft and thrust washer with thickness gauge through tappet guide hole in gearcase. End play should be from 0.001 to 0.016 in. If measurement is under or over tolerance, remove cover and replace spacing washer to give suitable clearance. Cam gear spacing washers are available in .005 increments from 0.050 to 0.095 in.

Figure 3-34. Checking Camshaft End Play

3. See Figure 3-28. Make sure that chamfer on oil pump pinion shaft gear (27) faces toward the inside. Tighten pinion gear shaft nut (23) to 35–45 ft-lbs torque. Make sure that gear shaft pinion spacer

(26) has noticeable end play. Breather, cam and pinion gears contain timing marks which must be aligned or matched as shown in Figure 3-35. Rotate gear train and note if it revolves freely. A bind indicates gears are meshed too tightly.

NOTE

Pinion gears and cam gears are color coded according to their pitch diameters. When replacing only one of these gears, it is advisable to replace it with a gear having the same color code. If gears are not matched according to their color, lifter 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.

4. Apply a coat of non-hardening gasket sealer to crankcase and cover gasket surface. Position new cover gasket and secure cover with all cover screws. Tighten screws to 80–110 in-lbs torque. After securing cover, pour about 1/4 pint of engine oil through tappet guide hole over gears to provide initial lubrication.

5. Assemble remainder of gearcase and ignition timer. See IGNITION SYSTEM, Section 8.

Figure 3-35. Timing Gears with Marks Aligned

COLOR CODE	1 PINION GEAR		2 CAM GEAR	
1340cc MODELS (MATCHED SET PART NO. 24582-77)				
	Part No.	Size (in.)	Part No.	Size (in.)
ORANGE	24040-78	1.4756/1.4751	25536-84	2.7324/2.7334
WHITE	24041-78	1.4751/1.4745	25537-84	2.7334/2.7344
YELLOW	24042-78	1.4745/1.4737	25538-84	2.7344/2.7354
RED	24043-78	1.4737/1.4729	25539-84	2.7354/2.7364
BLUE	24044-78	1.4729/1.4721	25544-84	2.7364/2.7374
GREEN	24045-78	1.4721/1.4715	25545-84	2.7374/2.7384
BLACK	24046-78	1.4715/1.4710	25546-84	2.7384/2.7394

CRANKCASE

GENERAL

When rod bearings, pinion shaft bearings or sprocket shaft bearings are in need of repair, the engine must be removed from the motorcycle as described in STRIPPING THE MOTORCYCLE FOR ENGINE REPAIR. It is recommended procedure to check and make repairs to cylinder heads, cylinders and gearcase at the same time, or in other words, perform an entire engine overhaul.

Flywheel End Play Check (Figure 3-36)

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.

3. Install BEARING INSTALLATION TOOL, Part No. HD-97225-55, to 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 between .001 and .004 in., the bearing inner spacer must be replaced. Choose spacer from the chart. A thinner spacer will result in less end play.

Bearing Inner Spacers (10, Figure 3-38)	
PART NO.	SIZE
9120	.0925/.0915
9121	.0945/.0935
9122	.0965/.0955
9123	.0985/.0975
9124	.1005/.0995
9125	.1025/.1015
9126	.1045/.1035
9127	.1065/.1055
9128	.1085/.1075
9129	.1105/.1095
9130	.1125/.1115
9131	.1145/.1135
9132	.1165/.1155
9133	.1185/.1175
9134	.1205/.1195

DISASSEMBLING CRANKCASE

1. Remove cylinder heads as described in CYLINDER HEAD REMOVAL.

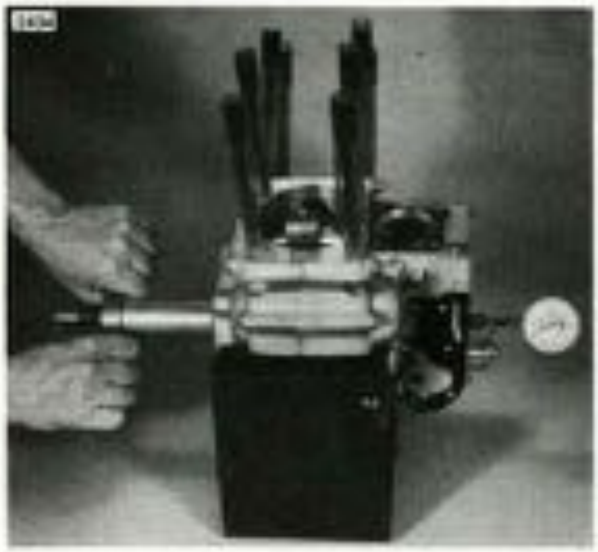


Figure 3-36. Checking Flywheel End Play

2. Remove cylinders as described in CYLINDER AND PISTON REMOVAL.

CAUTION

After removing cylinders, install 1/2 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.

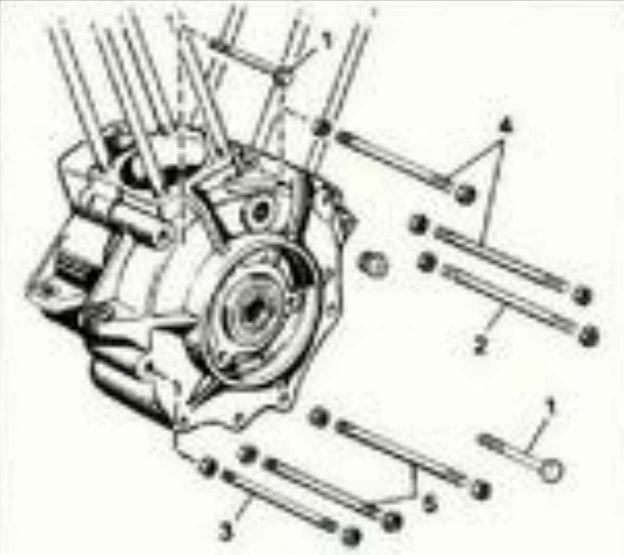
4. See Figure 3-37. Remove crankcase bolts and studs (1, 2, 3, 4, 5). It is necessary to remove only one stud nut and slip stud and other nut out opposite side of crankcase.

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 reinstalled in their original location.

5. See Figure 3-38. Position crankcase with gearcase (right side) up. Tap crankcase with rawhide or soft metal mallet to loosen right half. Lift right crankcase half (1) off pinion shaft main bearings. Remove spiral lock ring (2) from pinion shaft with tip of screwdriver. Lift bearing washers (3 and 5) with bearings and bearing retainers (4) off pinion shaft.

6. Mount flywheel and left case assembly on press table supporting case on parallel bars (Figure 3-39) and press on end of sprocket shaft with arbor press until flywheel assembly (8) drops out.



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 3-37. Crankcase Studs — Exploded View

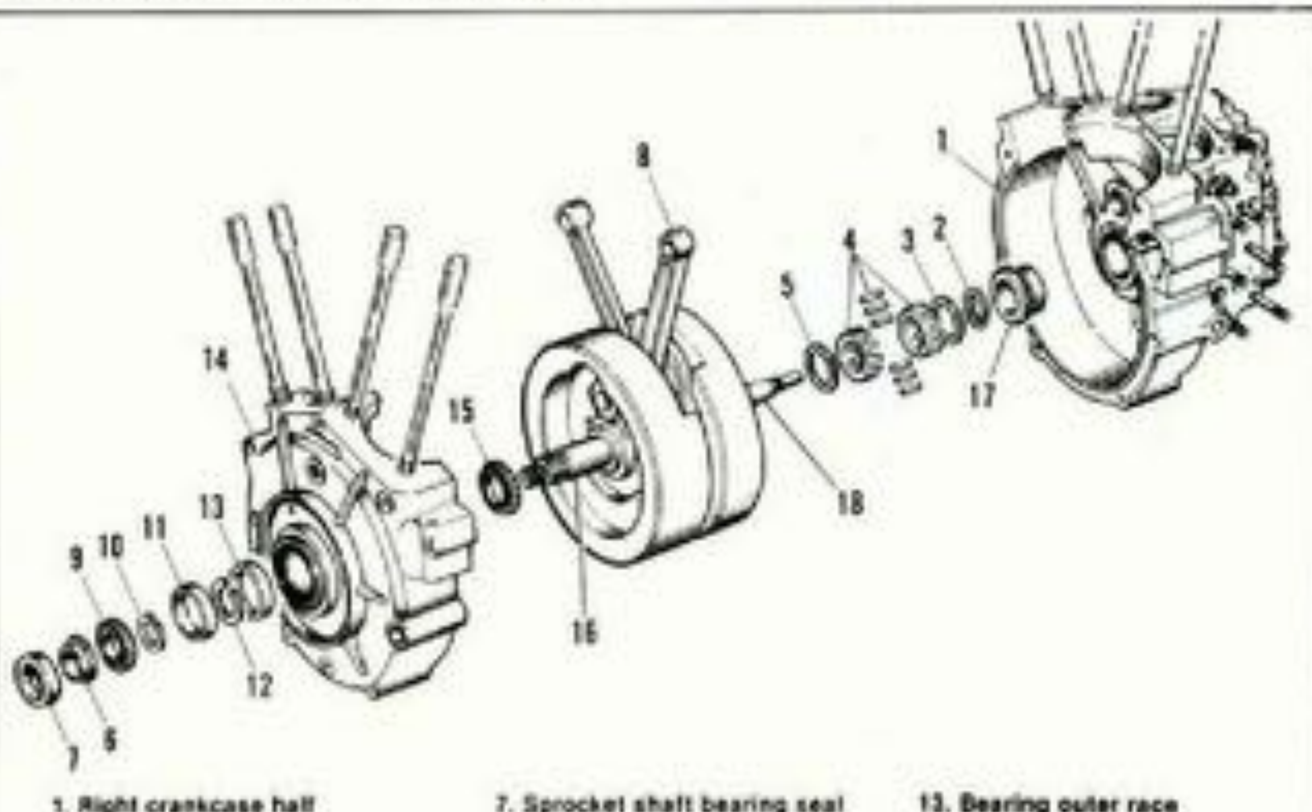
Remove seal (7), freeing sprocket side bearing half (9), spacer (6) and spacer (10).

7. See Figure 3-40. If left main bearing is to be replaced, press out bearing races (11 and 13) from opposite sides of crankcase hole, using CRANKSHAFT BEARING REMOVAL & INSTALLATION TOOL, Part No. HD-94547-80. If bearing set is being replaced, remove lock ring (12) using a pin punch or similar tool. Rotate lock ring in groove so that one edge covers oil hole. Insert tool into oil hole with tapered end underneath lock ring. Tap on tool to force one end out of groove as shown in Figure 3-41. Starting at this free end, push ring out of bearing bore.

INSTALLING CYLINDER STUDS

1. Cylinder studs that are bent, scratched or broken must be replaced.

2. Threads on new studs must have an interference fit in the crankcase threaded holes. Use Loctite STUD 'N BEARING MOUNT on the threads in place of engine oil if threads seem loose.



1. Right crankcase half
2. Spiral lock ring
3. Bearing washer (2)
4. Bearings and retainer
5. Bearing washer (see item 3)
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 snap 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 3-38. Crankcase — Exploded View

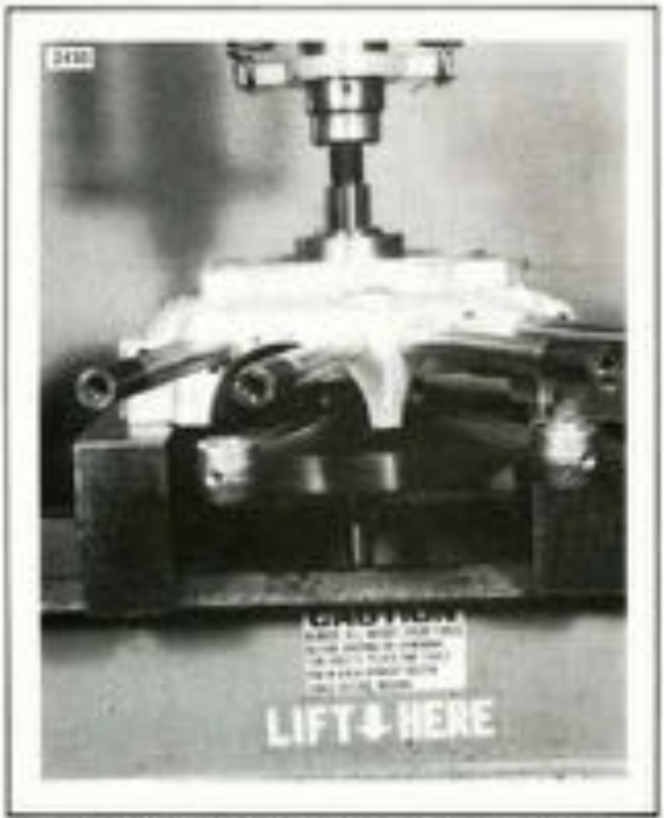


Figure 3-39. Pressing Flywheels Out of Crankcase

Figure 3-40. Removing Left Crankcase Bearing Races.

3. See Figure 3-42. Apply a film of engine oil to threads of stud and drive stud in crankcase hole with the CYLINDER STUD INSTALLER, Part No. HD-34624 and an air or electric impact wrench. Do **not** use a ratchet or breaker bar since they will bend the stud.

Figure 3-41. Removing Lock Ring

Figure 3-42. Installing Cylinder Studs

4. A properly installed stud should extend 5.67 - 5.77 in. above the base gasket surface and must be straight.

FLYWHEELS

Disassembly (Figure 3-43)

1. If flywheels are to be disassembled, place a flywheel holding fixture such as Rowe number HD 09-1194 in a vise. Insert pinion shaft into fixture

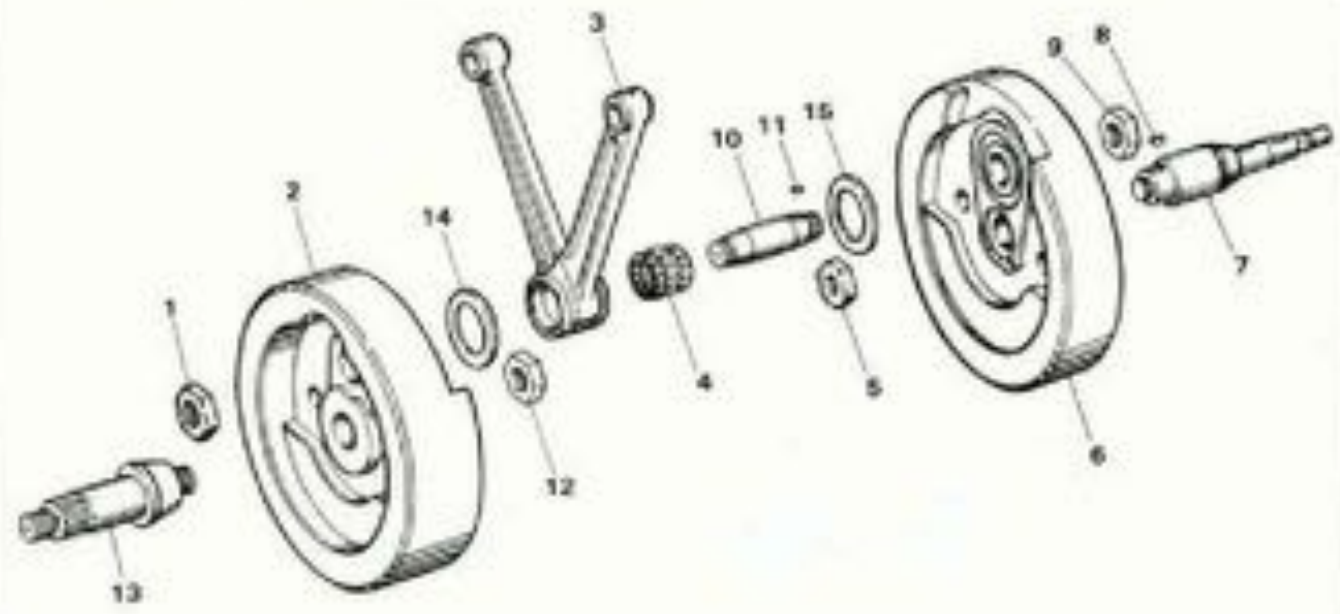


Figure 3-43. Flywheel Assembly — Exploded View

Figure 3-44. Pulling Bearing from Sprocket Shaft

and install BEARING PULLER, Part No. HD-96015-56A over sprocket shaft bearing as shown in Figure 3-44. Turn forcing screw to remove bearing. Keep bearings in a set with proper bearing outer races.

2. Remove flywheels and insert sprocket shaft into fixture. Remove crank pin nut using FLYWHEEL NUT WRENCH, Part No. HD-94546-41, as shown in

Figure 3-45. Removing Crank Pin Nut

Figure 3-45. To loosen flywheel, strike right flywheel rim with soft metal mallet at 90 degrees to crankpin. Remove right flywheel and gear shaft assembly. Remove crank pin key (11, Figure 3-43).

3. 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 crank pin.

4. Using 1 5/8 in. socket, Snap-On Part No. S6202, remove sprocket shaft nut (12). Tap sprocket shaft (13) out of flywheel.

5. Turn flywheel over in fixture and remove crank pin nut (1). Tap crank pin out of flywheel.

6. Place pinion shaft and flywheel in fixture and remove pinion shaft nut (5). Tap pinion shaft (7) out of flywheel and remove key (8) from shaft.

Cleaning and Inspecting Flywheels (Figure 3-43)

1. Wash all parts in grease solvent and blow dry with compressed air. Examine crank pin for wear, grooving and pitting. If the surface is at all worn, replace with new pin. Examine flywheel washers (14 and 15). 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 bearing rollers installed. If they appear badly worn, grooved or pitted, new rods should be installed, preferably as an assembly with new bearings and crankpin.

3. Examine pinion shaft and right crankcase bearing race (17, Figure 3-38) for pitting, grooving and gouging at point where right main roller bearings ride. A shaft that is worn must be replaced. If bushing 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. If a new bearing set is installed, check flywheel end play as described earlier in this section.

Replacing Flywheel Washers

Replace worn flywheel washers as follows:

1. Washer is a close fit in recess in flywheel and is secured originally by punching flywheel metal tight against the washer at several points. It is usually necessary to drill a small hole (1/8 in. or smaller) at the outer edge of 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 is not likely to 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 .045 in. deep and .050 in. away from the edge of the washer.

Lapping Connecting Rod Races

1. 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, as shown in Figure 3-46.

Figure 3-46. Lapping 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 rod, 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 .0002 in.

Fitting Rod Bearings

Connecting rod bearings rollers are available in the following sizes:

SIZE	DIAMETER (in.)
Standard	0.1874 - 0.1875
0.0002 oversize (O.S.)	0.1876 - 0.1877
0.0004 O.S.	0.1878 - 0.1879
0.0006 O.S.	0.1880 - 0.1881
0.0008 O.S.	0.1882 - 0.1883
0.0010 O.S.	0.1884 - 0.1885

There are two ways to determine oversize rollers to use. Both methods will result in properly fitted bearings if applied correctly.

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.

METHOD 1:

Use a micrometer to measure the outside diameter of the crank pin at its center. Use an inside micrometer or telescoping hole gauge to measure the inside diameter of the rod races. Subtract the diameter of the crank pin from the inside diameter of the bearing race. Subtract from this figure the standard allowance for bearing running fit size. This answer, divided by two will give proper roller size. To find oversize amount of bearing, subtract from this figure the diameter of a standard roller.

EXAMPLE:

The rod bearing race measures 1.6263 in. after lapping and truing. The crank pin is slightly worn and measures 1.2485 in. Subtract 1.2485 in. from 1.6263 in. The answer, 0.3778 in., represents the diameters of both rollers (one on each side) plus clearance for running fit. Subtract minimum clearance for running fit (0.0007 in.). The answer, 0.3771 in., is then divided by two to get the diameter of each oversize roller. In this case it would be 0.18856 in. To find how much oversize each roller must be, subtract from this figure the diameter of a standard roller, or 0.1875 in. Rollers must be 0.0010 in. oversize.

METHOD 2:

Install any new set of oversize rollers to bearing races and position on crank pin. Slip rods over bearings. If they will not fit, it is obvious rollers are too large and a smaller size must be tried. If they fit and spin freely, install a larger set of rollers. Try various sets of roller sizes until the rods will turn with a very slight drag. This is a plug fit. Determining running fit is merely a matter of subtracting one half the desired running fit clearance (0.00035 in.) from the roller size to find the running fit roller size.

It may be easier to gauge a plug fit as follows:

Fit any size roller sets into races. Position bearings in rods. Support rods and bearings with left hand. Drop crank pin (not attached to flywheel) through crank pin hole. Plug fit has been achieved when crank pin will slide slowly through hole from its own weight. Running fit is then determined by subtracting one half running clearance (0.00035 in.)from oversize of rollers used to make plug fit.

Check overall width of roller retainer assembly. It must be less than width of female rod end.

Assembling Flywheels (Figure 3-43)

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 acetone.

2. Assemble the sprocket shaft (13) and left flywheel half (2) and apply two drops of Loctite 620 RETAINING COMPOUND to the threads and two more drops to the face of the nut. Do not use any type of primer and do not put Loctite on the shaft tapers.

3. Tighten the nut to 290 - 320 ft-lbs torque.

4. Assemble the pinion shaft (7) and right flywheel half (6) in a similar manner. Tighten the nut to 140 - 170 ft-lbs torque.

   Assemble the crank pin to the right flywheel. Again, place two drops of Loctite on the threads and face of the nut. Tighten the crank pin nut to 180 - 210 ft-lbs torque.

5. Check to make sure oil passages through pinion shaft, right flywheel and crank pin are clear by blowing compressed air into hole in end of pinion shaft.

6. Position right flywheel assembly in flywheel fixture, crank pin up.

7. Install the rods and bearings on the crank pin using a thin film of petroleum jelly to retain the rollers. Never use a stiff, high temperature grease on roller bearings. Make sure the forked rod faces the rear cylinder and that the offset reinforcement on the front rod faces forward. See Figure 3-47. If the front rod is turned 180° it will interfere with the rear rod.

8. Install the left flywheel and shaft on the crank pin and apply Loctite to the threads and face of the nut.

9. Hold steel straightedge along outer face of wheel rims at 90 degrees from crank pin as shown in

Figure 3-47. Connecting Rod Location

Figure 3-48. Tap outer rom of top wheel until wheels are concentric. Tighten nut, recheck with straightedge at frequent intervals. Use soft mallet hammer to realign wheels.

10. See Figure 3-49. When nut is fairly tight, install flywheel assembly in FLYWHEEL TRUING STAND, Part No. HD-96650-80. Adjust so centers are snug. 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.

NOTE

The flywheels must be trued and nuts retightened within 25 minutes of assembly before the Loctite has taken a set.

Figure 3-48. Squaring Flywheel Faces

11. 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. Remove flywheel from truing stand and make corrections as stated in Step 12.

12. Flywheel may be out of true three ways, A, B and C, in Figure 3-50 or a combination of two of the three ways.

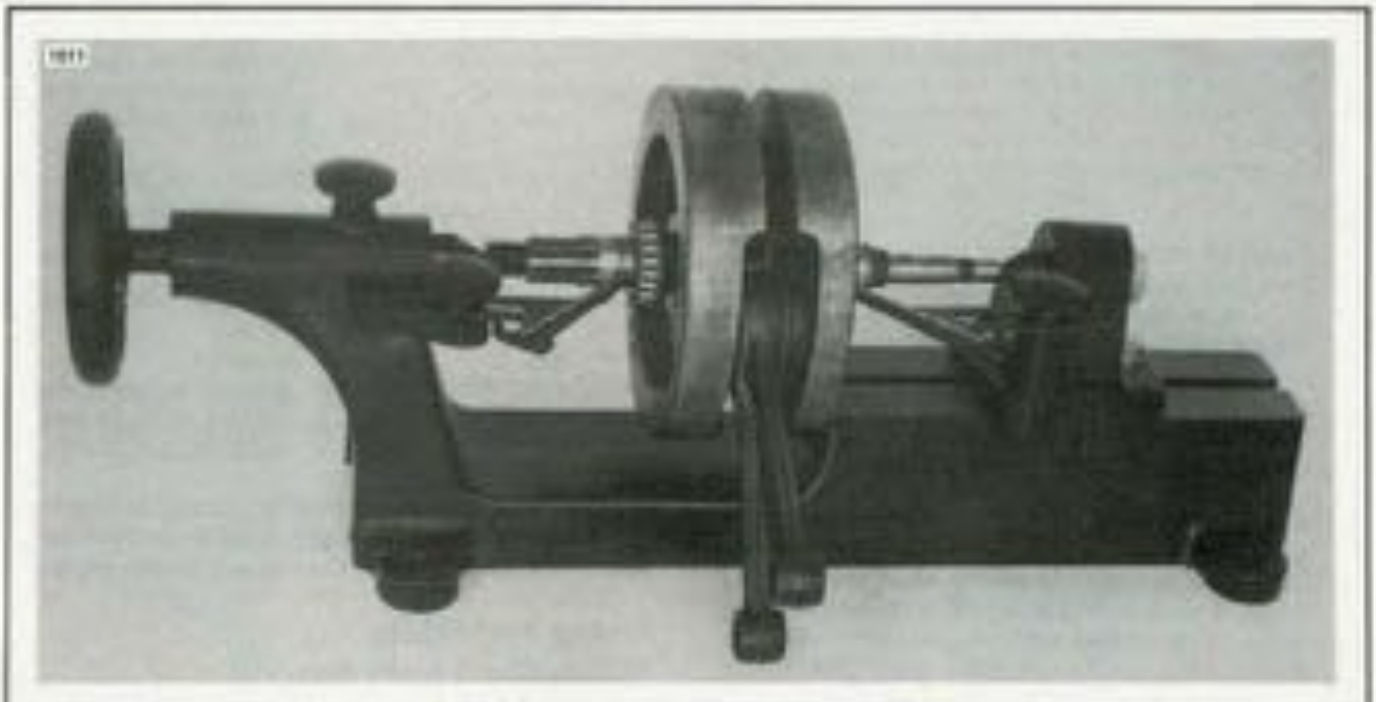


Figure 3-49. Truing Flywheels on Truing Stand

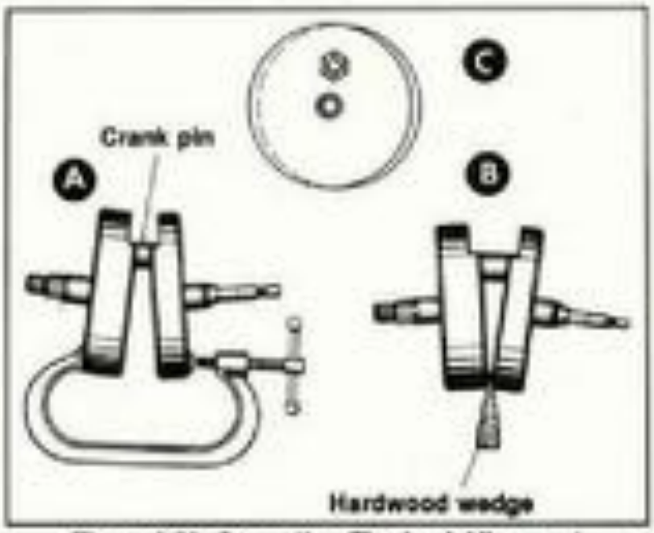


Figure 3-50. Correcting Flywheel Alignment

When wheels are both out of true as indicated in "A", tighten C-clamp on rims or wheels opposite crank pin and lightly tap the rim at the crank pin with lead or copper mallet.

When wheels are both out of true as indicated in "B" drive a hardwood wedge between the wheels opposite the crank pin and lightly tap the rims near the crank pins with a mallet.

When wheels are out of true as indicated in "C," strike the rim of the wheel with a firm blow at about 90 degrees from crank pin on high side.

When wheels are out of true in a combination of any of conditions shown, correct A or B first, tapping rim of offending wheel only, and then correct condition C.

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 crank pin. Use only a soft metal mallet. Never strike wheels a hard blow near crank pin. This could result in a broken crank pin.

13. 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.).

14. Place a dial indicator on the flywheel rim and check the runout. If the runout exceeds .006 in., replace the crank pin or the flywheels.

15. If it is impossible to true wheels, check for a cracked flywheel, damaged or enlarged tapered hole, or a sprocket or pinion shaft worn out of round at surface where indicator reading is being taken. When wheels are true, position in vise and draw crank pin nuts very tight using CRANK PIN and FLYWHEEL NUT WRENCH, Part No. HD-94546-41. Use torque wrench to finish tightening to 180— 210 ft lbs torque. Check connecting rod side play with thickness gauge as shown in Figure 3-51. If it is greater than tolerance shown in engine SPECIFICATIONS, draw up crank pin nuts until within tolerance. Insufficient play between rods and flywheel face is caused by one of the following conditions:

Figure 3-51. Checking 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 crank pin. As last resort, grind down width of forked rod.

c. Tapered holes enlarged as a result of having been taken apart several times. Replace wheel seating deepest.

d. Cracked flywheel at tapered hole. Replace flywheel.

If sides of forked rod are ground to get desired clearance, backs of bearing retainers must be ground down to remain narrower than width of female rod.

After rod side play is checked and adjusted crank pin nut tightened to specified torque, again recheck wheel trueness on truing stand. Correct any runout as above.

Truing And Sizing Pinion Shaft Main Bearing

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.

A race that is worn beyond limits of oversize bearings must be replaced. To remove bearing race, heat case to 275-300 degrees F. Heating expands case and makes it possible to remove bearing race using less force. Press worn race (17, Figure 3-38) 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 Bearings (Figure 3-52)

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.

Figure 3-52. Lapping Pinion Shaft Main Bearing Race

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 5/32 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 fine 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.

Fitting Pinion Shaft Bearing

The fitting of pinion shaft bearing is done in much the same way as fitting lower rod bearings (see FITTING ROD BEARINGS.)

All fitting must be done with bearings that are clean and dry. Oiled surfaces will take up some clearance and give a false reading.

1. A plug fit is first determined using the pinion shaft that will be used on engine being overhauled, or spare shaft of exactly same size. When a plug fit has been found, pinion shaft will enter bearing slowly under its own weight, will turn with only a very light drag and will have no perceptible shake.

2. A running fit is determined from a plug fit by subtracting one half the desired running fit clearance from the size of the plug fit rollers.

EXAMPLE:

Running fit clearance is 0.0008 to 0.002 in. loose. See engine SPECIFICATIONS. If a plug fit was achieved with 0.0008 in. oversize rollers, subtract one half running fit clearance from plug fit roller oversize. Use figure representing middle or average of tolerance span, .014 in. One half the average of tolerance (.0007 in.), subtracted from roller oversize (0.0008 in.), indicates that 0.0001 in. oversize rollers should be used to produce a suitable running fit.

3. Oversize rollers are available in 0.0001, 0.0002, 0.0003, 0.0004, 0.0005, 0.0006, 0.0008 and 0.0010 in. sizes. All calculations should therefore be made to nearest available size.

Fitting Sprocket Bearing

If flywheel end play is within tolerance and if Timken tapered roller bearings and races pass visual check and have no apparent wear, the same set may be reinstalled. Make 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.

ASSEMBLING CRANKCASE (Figure 3-38)

1. Install flywheel side outer race lock ring (12) in case. 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 widest ends outward to match taper of bearings. Be sure each race bottoms on the lock ring.

2. Position flywheel assembly, sprocket shaft up, in flywheel fixture. Press bearing (15) on sprocket shaft using BEARING INSTALLATION TOOL, Part No. HD-97225-55. SPROCKET SHAFT SPACER, Part No. 24036-70, may be needed with BEARING INSTALLATION TOOL as shown in Figure 3-53. Press the parts on using the sprocket shaft spacer as a pressing tool only.

Figure 3-53. Pressing Bearing on Sprocket Shaft

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. Install the bearing inner spacer (10) and tool sleeve and press bearing against flange on flywheel using the tool as shown in Figure 3-53.

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 pressing bearings tightly together. Bearings must be tight against the bearing inner spacer to provide correct bearing clearance.

6. Remove assembly from fixture and install bearing washer (5), bearings (4) and bearing washer (3) on pinion shaft. Install new spiral lock (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 to mating surfaces.

7. See Figure 3-37. 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 nuts on studs to 12-15 ft-lbs torque. Tighten bolts to 22-26 ft-lbs torque.

8. Check exact amount of flywheel end play with dial indicator as directed at the beginning of this section to determine if within specified limits. See Figure 3-36.

9. See Figure 3-38. Install spacer (6). Press seal (7) into crankcase with lip toward flywheels.

10. 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.

FUEL SYSTEM

SUBJECT	PAGE NO.

1. Specifications 4-1
2. Carburetor 4-3
3. Air Cleaner 4-15
4. Fuel Supply Valve 4-19
5. Fuel Tank 4-21

FUEL SYSTEM

SPECIFICATIONS

JET SIZES

FLH Model

Main jet .... No. 165
Slow jet .... No. 70

FX Models (except FXST)

Main jet .... No. 160
Slow jet .... No. 72

FXST Model

Main jet .... No. 160
Slow jet .... No. 50

CAPACITY

Fuel Tank

FLH Models	Total	5 or 3.5 Gallons (US)
	Reserve	1.2 or 1 Gallons (US)
FXE	Total	3.2 Gallons (US)
	Reserve	.6 Gallons (US)
FXS/FXEF/FXB FXSB	Total	3.5 Gallons (US)
	Reserve	1 Gallon (US)
FXWG/FXST ...	Total	5 Gallons (US)
	Reserve	1.2 Gallons (US)

TORQUES

FL/FX (except FXST)

Carburetor mounting nuts .... 10-14 ft-lbs
(1983 and earlier)

Carburetor mounting capscrews .... 5-6 ft-lbs
(1984)

FXST

Carburetor mounting capscrews .... 6-8 ft-lbs

Air cleaner bracket bolts .... 13-17 ft-lbs
(to cylinder heads)

Air cleaner backing plate .... 7-10 ft-lbs
(to bracket and carburetor)

Backing plate bottom bolt .... 13-17 ft-lbs

Air cleaner cover .... 12-17 ft-lbs
(button head socket screw)

CARBURETOR

GENERAL

The carburetor is a horizontal, gravity fed type with a float operated inlet valve, an accelerating pump, a throttle stop screw for idle speed adjustment, and choke system with a high idle speed adjustment.

The carburetor has been specifically designed to control exhaust emissions. All jets are fixed. The idle mixture has been preset at the factory. On 1978½ and 1979 models, the idle-mixture-screw has a limiter cap. Tune-up adjustments should be within the adjustment range that is available without removing the limiter cap.

On 1980 and later models, the idle-mixture-screw has been recessed in the carburetor casting. The opening is sealed with a plug because it is intended that the idle-mixture be non-adjustable.

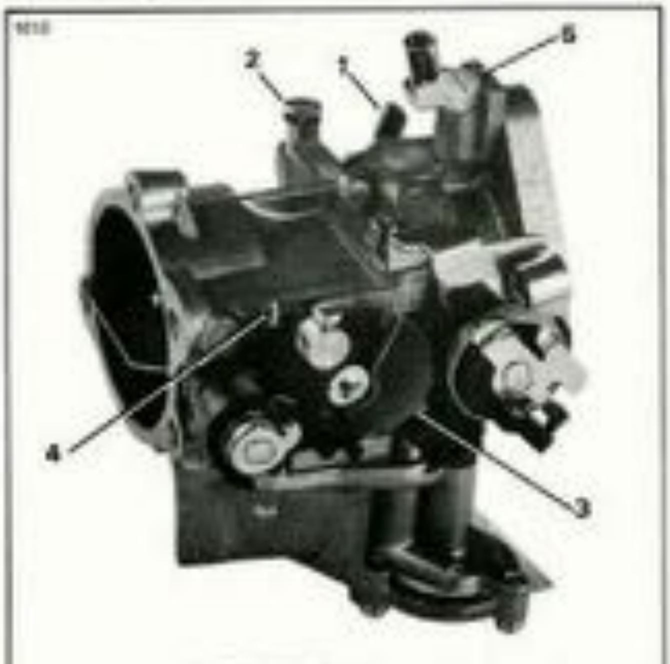
CAUTION

Adjusting mixture setting by procedures other than specified in this section may be in violation of Federal or State regulations.

A high altitude carburetor conversion kit may be required to improve carburetion at altitudes over 4000 feet above sea level and should be installed where there is evidence of over-richness causing loss of smooth combustion, stumbling upon acceleration or other driveability problems at high altitudes.

1. Throttle lever
2. Throttle stop screw
3. Fast idle cam
4. Fast idle adjusting screw

Figure 4-2. Carburetor — 1980

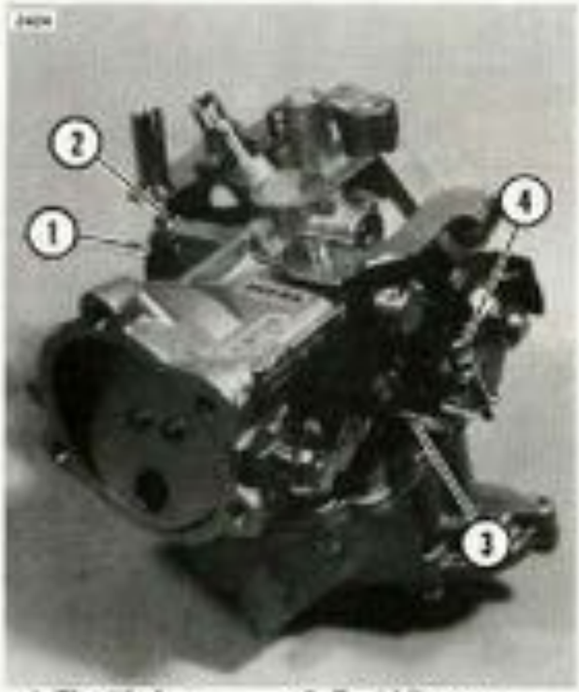


1. Throttle lever
2. Throttle stop screw
3. Fast idle cam
4. Fast idle adjusting screw
5. Low speed mixture limiter cap

Figure 4-1. Carburetor — 1978½ - 1979

1. Throttle lever
2. Throttle stop screw
3. Fast idle cam
4. Fast idle adjusting screw

Figure 4-3. Carburetor — 1981-1983



1. Throttle lever
2. Throttle stop screw
3. Fast idle cam
4. Fast idle adjusting screw

Figure 4-4. Carburetor — 1984

CAUTION

If motorcycles modified for high altitudes are to be operated at altitudes below 4000 feet, they must be converted back to standard to prevent possible engine damage due to over-lean fuel mixture.

OPERATION

Choke (Figure 4-5)

The choke system is composed of a choke valve and a fast idle cam. The fast idle cam increases engine speed as the choke knob is pulled out. By moving the choke knob, the choke valve and high idle can be adjusted for a cold or a warm engine.

1. With the choke knob all the way out, the choke plate is fully closed and the throttle valve is in its highest idle position for cold engine starting.

2. After a cold start the span between fully closed and fully open is used to adjust the choke for best idle during warm-up.

3. During warm-up the choke is moved progressively to the "Run" position with the choke knob all the way in. In the "Run" position the choke plate is fully open and the engine operates at low idle speed.

Figure 4-5. Setting the Choke

Fuel Supply System (Figure 4-6)

Fuel from the gas tank passes through the inlet valve into 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.

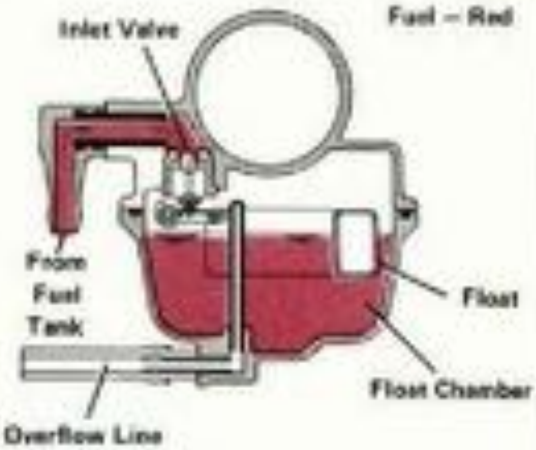


Figure 4-6. Fuel Supply System

Idle Circuit (Figure 4-7)

The Idle Circuit functions at idle, low and intermediate speeds when the throttle valve is closed or only partially open. Fuel is first metered at the main jet and then is metered again as it passes through the slow jet. Air is drawn through the slow air jet and is mixed with fuel in the bleed tube portion of the slow jet. When the throttle valve is closed, this air fuel mixture flows into the air stream almost entirely through the idle port where it is metered by the idle mixture screw.

As the throttle valve opens slightly the mixture also flows through the idle transfer ports as they become uncovered by the throttle valve.

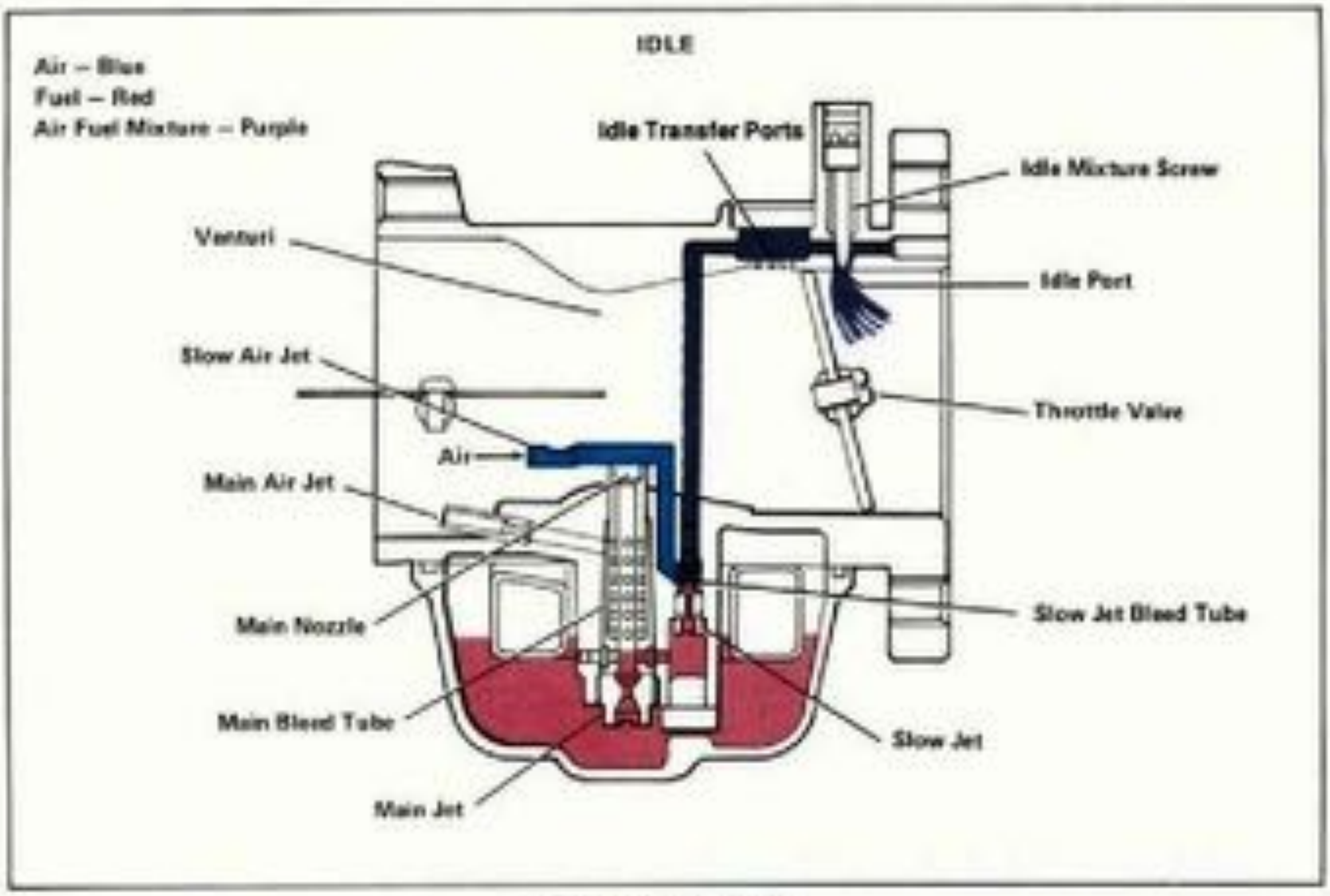


Figure 4-7. Idle Circuit

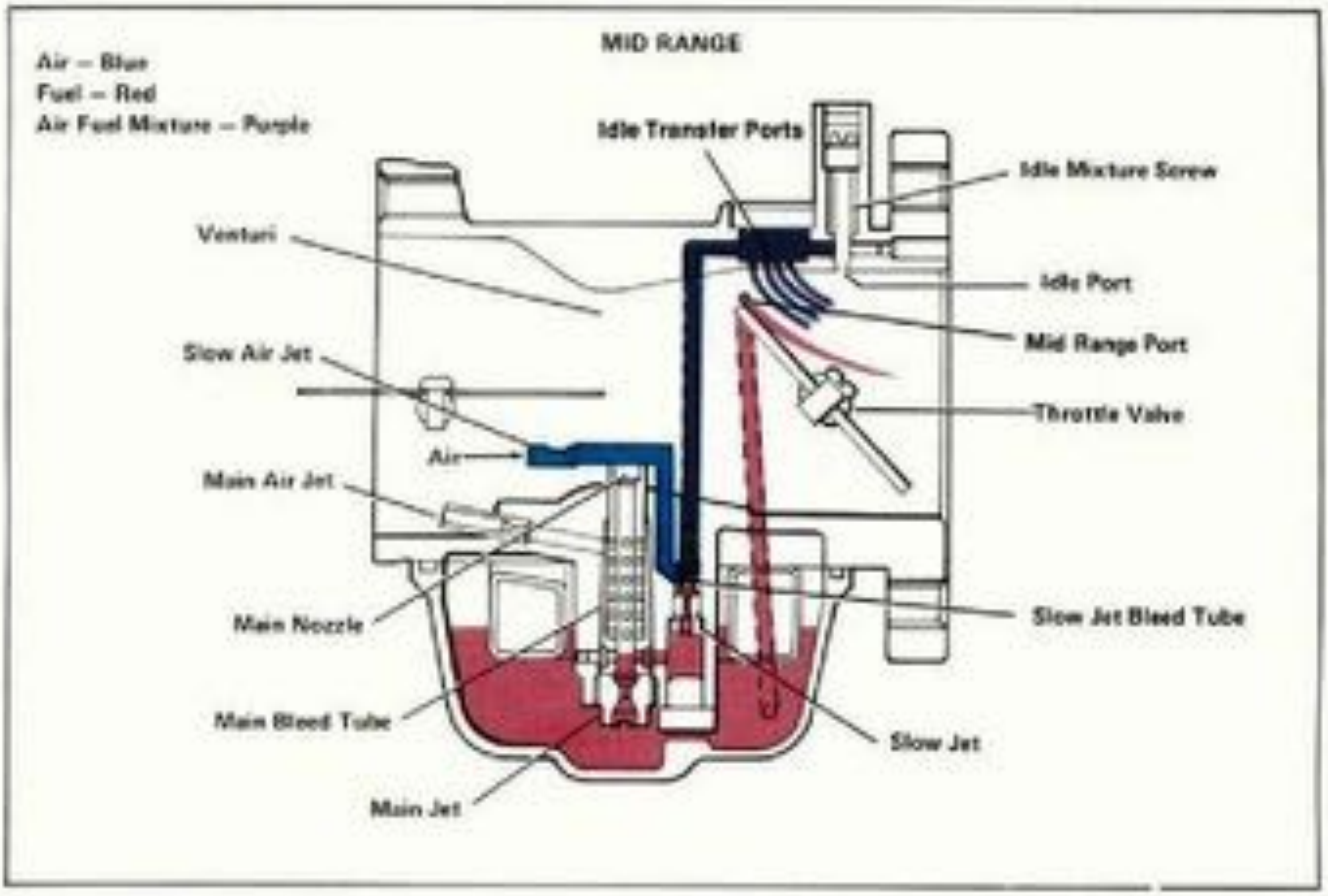


Figure 4-8. Mid Range Circuit

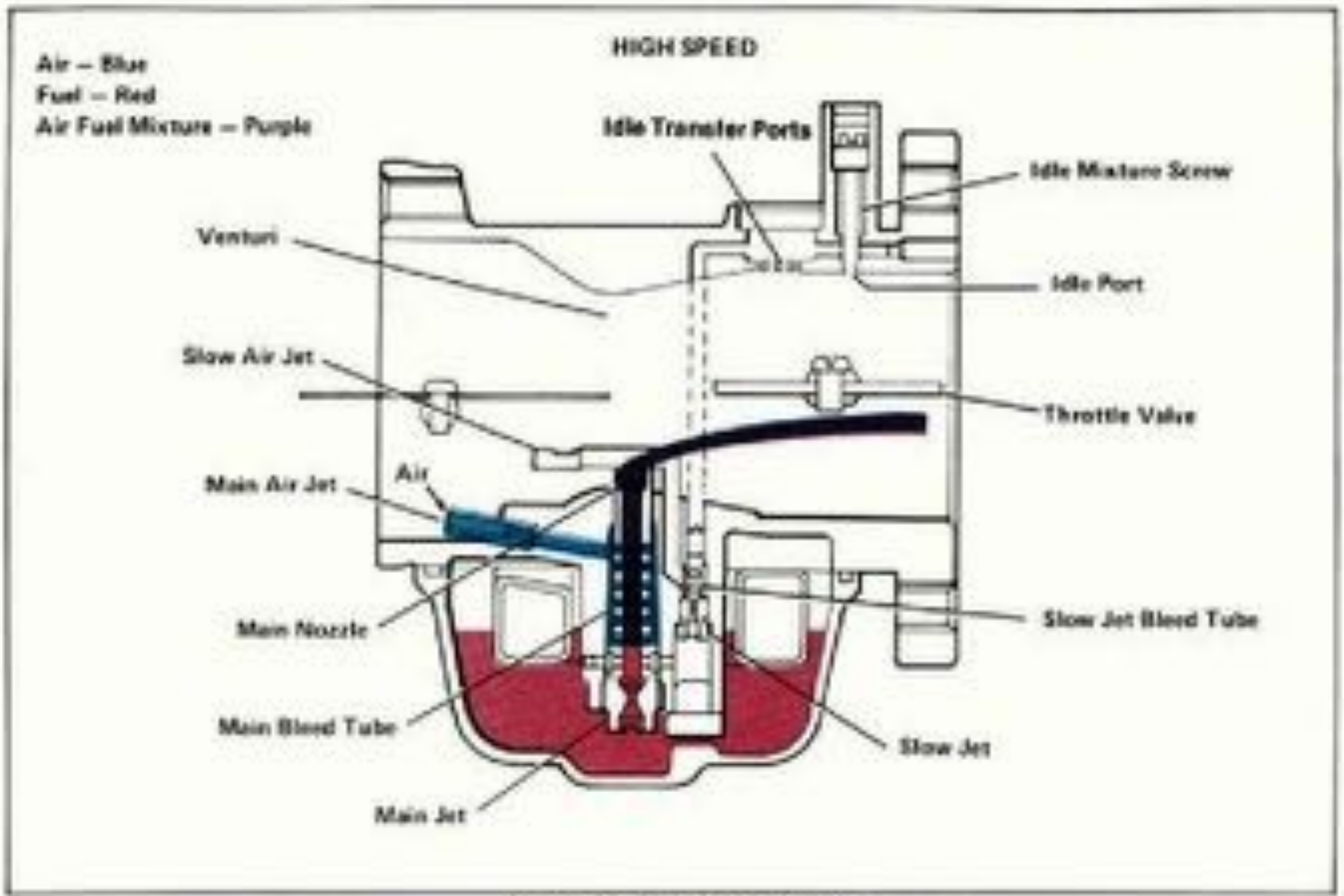


Figure 4-9. High Speed Circuit

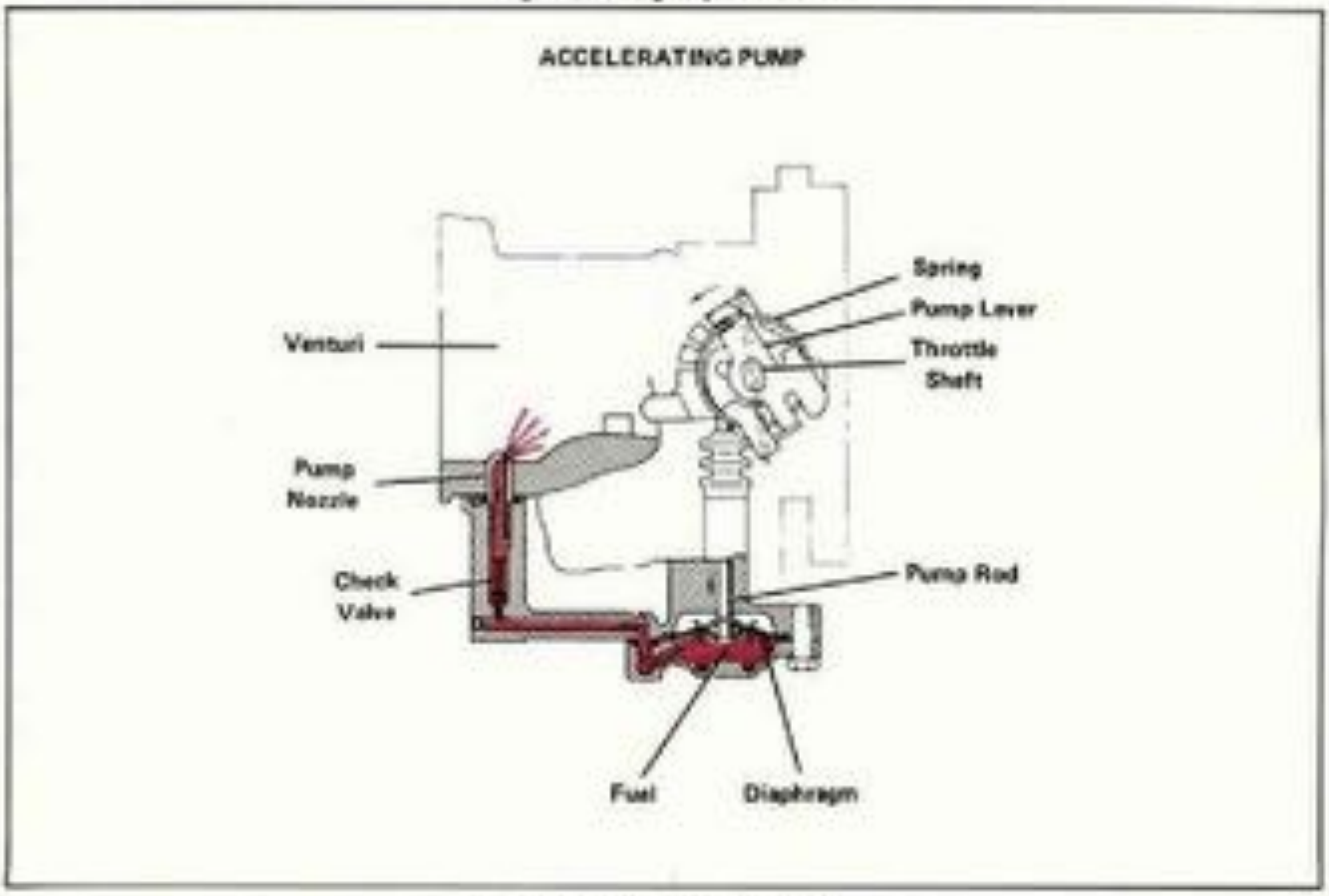


Figure 4-10. Accelerating Pump

Mid-Range Circuit (Figure 4-8)

As the throttle valve opens the air/fuel mixture from the slow jet is drawn into the air stream through the idle transfer ports. When the throttle valve uncovers the mid range port, fuel from the float chamber is also drawn into the engine.

High Speed Circuit (Figure 4-9)

During full throttle operation, fuel is metered through the main jet, mixed with air from the main air jet in the main bleed tube and this mixture is drawn into the venturi through the main nozzle.

Accelerating Pump (Figure 4-10)

The accelerating pump system uses sudden throttle openings (rapid accelerations) to quickly inject fuel into carburetor venturi to provide extra fuel for smooth acceleration.

Rapid throttle action, during the first half of throttle travel, pushes the pump rod down, flexing diaphragm. This flexing action forces fuel past a check valve into the venturi. 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.

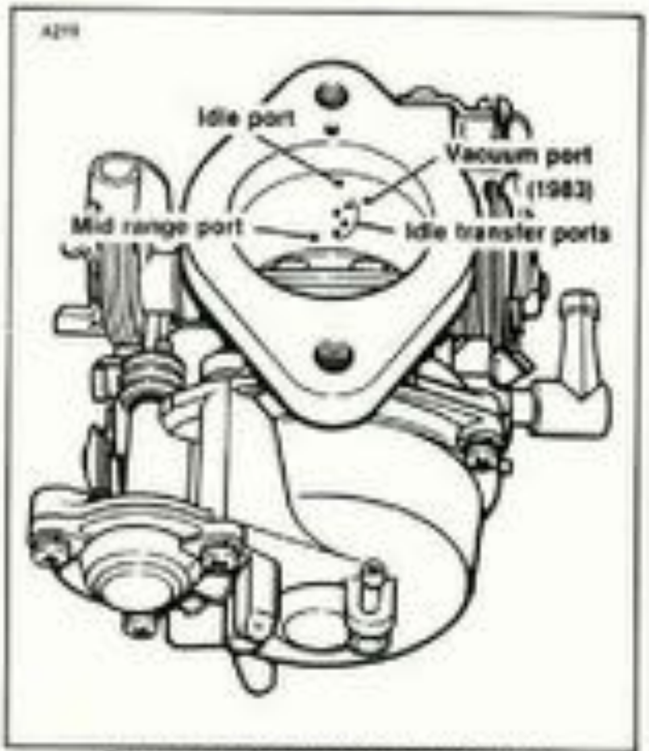


Figure 4-11. Engine Side of Carburetor

ADJUSTMENTS

Low Speed Mixture Adjustment (1978½ and 1979)

NOTE

On 1980 and later models, the low speed mixture is set at the factory and sealed.

In normal service, the low speed mixture limiter cap should not be removed. Low speed mixture may be adjusted within the limited range of the cap if necessary.

If the limiter cap has been removed and low speed mixture altered, proceed as follows:

1. Carefully turn low speed mixture screw all the way in, clockwise, until just seated. Do not over tighten.
2. Back screw out to specification found in Figure 4-13.
3. With screw in this position, install limiter cap in central position on adjusting screw.
4. With the engine warm and the choke off, adjust the throttle stop screw so that engine idles at 900 rpm.
5. Turn the limiter cap clockwise for a leaner mixture, counterclockwise for a richer mixture. The mixture should be adjusted to the leanest setting that results in a smooth idle.
6. Recheck slow idle speed setting and readjust to 900 rpm if necessary.

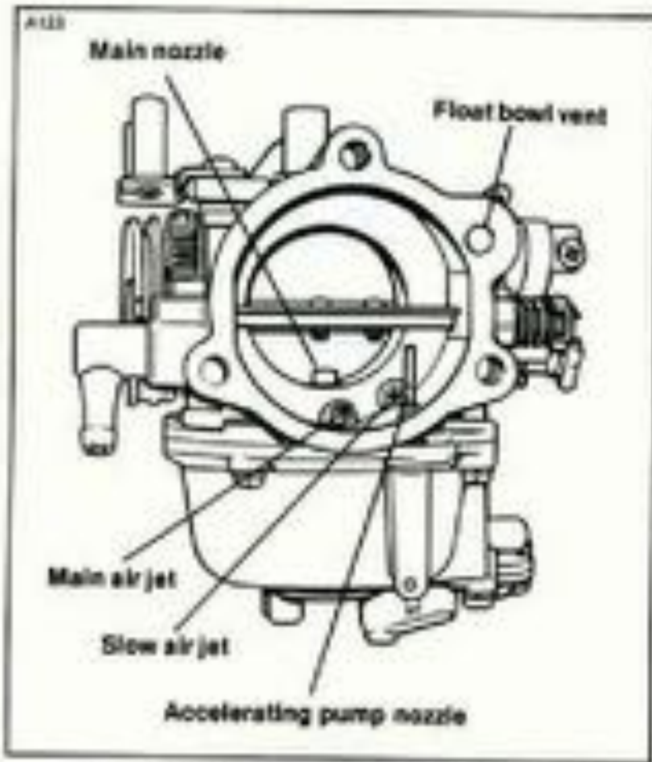
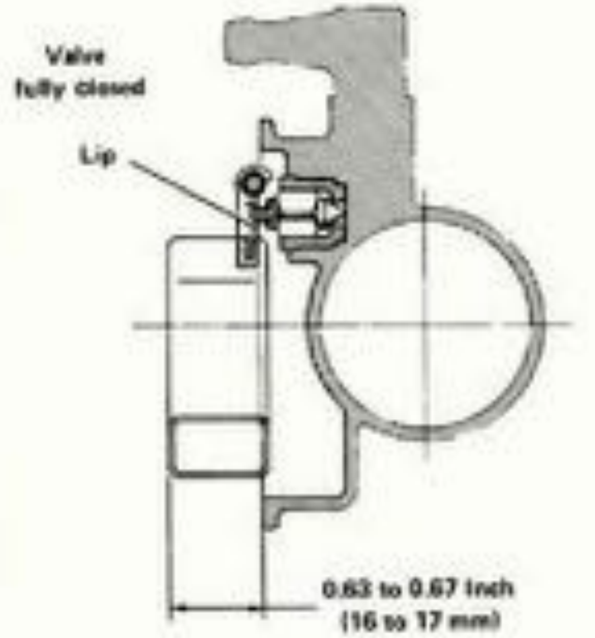
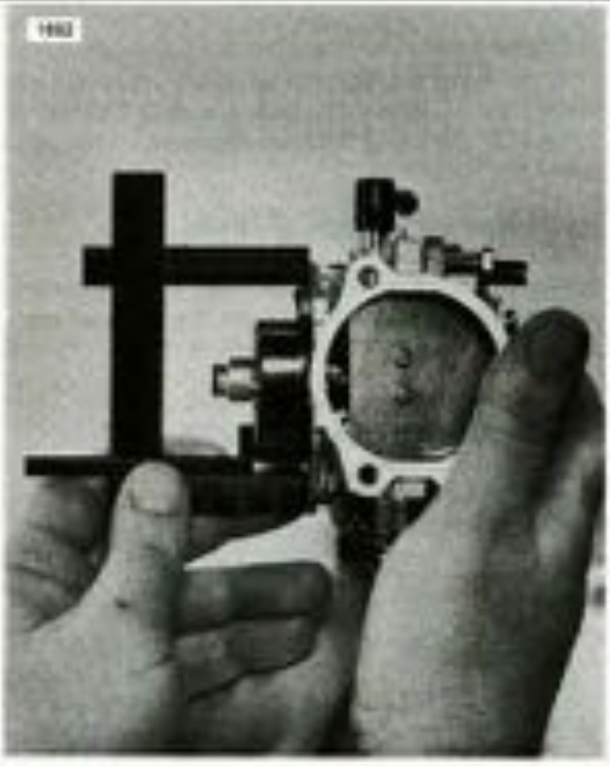


Figure 4-12. Air Cleaner Side of Carburetor





CARBURETOR FLOAT GAUGE

Figure 4-14. Float Adjustment

Model	Carburetor Part No.	Turns Open
FX-1200	27466-78A	1-1/8
FLH-1200	27467-78A	1-1/8
FLH-80	27466-78	3/4

Figure 4-13. Low Speed Mixture Screw Setting — 1978½ and 1979 Only

Slow Idle Adjustment

Remove the air cleaner. With the engine at normal operating temperature and the choke knob all the way in (choke fully open), adjust the throttle stop screw (Figure 4-1, 4-2, 4-3 or 4-4) so the engine idles at 900-950 rpm.

Fast Idle Adjustment

There are several detent positions or stops where the fast idle cam will meet momentary resistance as it is rotated from the choke plate fully open position to the choke plate fully closed position. These detents are only detectable when rotating the high idle cam by hand instead of through the choke knob and cable. Remove the air cleaner and loosen the choke cable anchor screw at the fast idle cam (3), figure 4-1, 4-2, 4-3 or 4-4. Slowly rotate the cam, from the choke plate fully open position, to the first noticeable click or detent. Turn the fast idle adjusting screw (Figure 4-1, 4-2, 4-3, 4-4) in or out to set the fast idle at 1500 rpm.

Float Level

1. Remove the carburetor as listed in the REMOVAL section.

2. Remove the float bowl as described under carburetor DISASSEMBLY.

3. See Figure 4-14. Hold carburetor on its side so that the float will be suspended, from the float pin, in a vertical position. Use FLOAT LEVEL GAUGE, Part No. HD-94752-77 and measure the distance from the face of the bowl mounting flange to the bottom surface of the float. If the measurement is not within the specified limits, bend the metal valve actuator lip up or down a slight amount to give the correct setting.

4. Assemble the float bowl and install the carburetor as described in each respective section.

TROUBLESHOOTING

NOTE

Callouts refer to Figures 4-16, 4-17 and 4-18

Overflow

Check for:	Remedy:
1. Worn fuel valve (18) or dirty fuel valve seat.	1. Replace valve (18) or clean valve seat.
2. Improper fuel level in float chamber (26).	2. Adjust float (26) mounting tabs for correct fuel level.
3. Worn float (20) mounting tabs.	3. Replace float (20).
4. Worn float pin (5) or loose screw (6).	4. Replace pin (5) or tighten screw (6).
5. Damaged float chamber gasket (25).	5. Replace gasket (25).
6. Loose float chamber screws (31).	6. Tighten screws (31).
7. Deformed float (20).	7. Replace float (20).

Poor Idling

Check for:	Remedy:
1. Idle improperly adjusted.	1. a. Adjust fast and slow idle speeds. b. Adjust low speed idle mixture screw limiter cap to full rich or full lean limit. (1979 and earlier)
2. Damaged low speed mixture screw.	2. Replace screw (1979 and earlier).
3. Clogged bypass or idle port.	3. Clean.
4. Clogged low speed jet (22).	4. Clean jet (22).
5. Loose low speed jet (22).	5. Tighten jet (22).
6. Air leaking into system.	6. Replace insulator block (17) and tighten screws.
7. Excessive fuel from accelerating pump.	7. Check accelerating pump rod (7) length.

Poor Fuel Economy

Check for:	Remedy:
1. Fuel level too high.	1. Adjust level of float (20).
2. Clogged bleed tubes.	2. Clean.
3. Loose jets.	3. Tighten.
4. Idle improperly adjusted.	4. A. Adjust fast and slow idle speeds. B. Adjust low speed mixture cap within its limits (1979 and earlier).
5. Choke not opening fully.	5. Inspect choke and choke wire and adjust or replace.
6. Dirty air cleaner.	6. Clean.

Poor Acceleration

Check for:	Remedy:
1. Clogged accelerating system.	1. Clean.
2. Damaged accelerating pump diaphragm (28).	2. Replace diaphragm (28).
3. Low speed system improperly adjusted.	3. Adjust low speed system (1979 and earlier).
4. Clogged low speed jet (23) or bleed tube.	4. Clean.
5. Fuel level too low.	5. Adjust level of float (20).

Hard Starting

Check for:	Remedy:
1. Choke plate (36) not operating properly.	1. Adjust choke system.
2. Generally dirty carburetor.	2. Disassemble and clean.
3. Loose carburetor mounting nuts.	3. Tighten mounting nuts.
4. Fuel overflow.	4. Inspect float (20) and fuel valve (18) and adjust or replace.

NOTE

Callouts refer to Figures 4-16, 4-17 and 4-18.

Poor Performance On Road	
Check for:	Remedy:
1. Idle improperly adjusted.	1. Adjust idle.
2. Fuel overflow.	2. Inspect float (20) and fuel valve (18) and adjust or replace.
3. Main jet (23) loosened.	3. Inspect main jet (23) and tighten.
4. Air leak in intake system.	4. Check air cleaner backing plate and manifold mounting.
5. Faulty operation of accelerating pump.	5. Correct rod (7) (straighten or replace).
6. Dirty or clogged carburetor or air cleaner.	6. Clean.
Poor High Speed Performance	
Check for:	Remedy:
1. Loose main jet (23).	1. Inspect main jet and tighten.
2. Improper fuel level in float chamber.	2. Adjust float (20) valve actuator tab for correct fuel level.
3. Dirt lodged in strainer in fuel tank.	3. Clean strainer.
4. Clogged main jet (23) or main jet air passage.	4. Clean.
Abnormal Combustion (Fuel Mixture)	
Check for:	Remedy:
1. Generally dirty carburetor.	1. Disassemble and clean.
2. Dirty or clogged fuel line.	2. Clean fuel line or replace.
3. Air leaking into system.	3. Check mounting nuts for tightness or replace insulator block (17).
Loss of Power (Fuel Insufficient)	
Check for:	Remedy:
1. Clogged fuel line.	1. Clean.
2. Dirty fuel tank.	2. Clean.
3. Air leaking into system.	3. Check mounting nuts for tightness or replace insulator (17).
4. Accelerating pump not working.	4. Repair and adjust.
5. Clogged fuel strainer in fuel tank.	5. Clean strainer.
6. Generally dirty carburetor.	6. Disassemble and clean.
Loss of Power (Air Insufficient)	
Check for:	Remedy:
1. Dirty air cleaner.	1. Clean or replace air cleaner element.
2. Throttle cable not working.	2. Check throttle cable and adjust or replace.
3. Correct jetting for high altitude operation.	3. Install high altitude kit.
4. Loose jets.	4. Tighten jets.

REMOVAL

1. Remove the air cleaner and backing plate. See air cleaner REMOVAL section.

2. See Figure 4-14. Turn the gas valve off. Disconnect the fuel hose (1), throttle cable(s) (2) and choke cable (3) from the carburetor.

3. Remove the two locknuts and lockwashers that fasten the carburetor to the manifold. Remove the carburetor and insulator block.

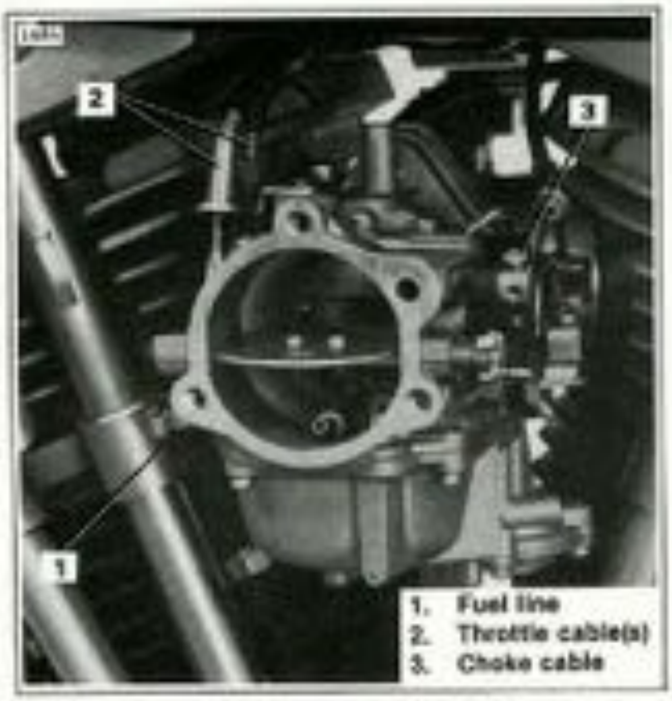


Figure 4-15. Carburetor Mounting

DISASSEMBLY (Figure 4-16, 4-17 or 4-18)

Accelerating Pump

1. Remove two screws (31), one long screw (32), the housing (30), spring (29) and diaphragm (28). Remove the O-ring (27A) from the housing (30).

Float Chamber

1. Remove the three screws (31), one screw (32), and float bowl (26).

2. Loosen the screw (6) and remove the pin (5) and float (20).

3. Remove the inlet valve (18) and clip (19) from the float (20).
4. Remove the rubber boot (8) from the float bowl (26) and remove the accelerator pump rod (7) from the rocker arm (40).

Carburetor Body

1. Remove the plug (24) to unscrew the low speed jet (22). Main jet (23) can be threaded out.
2. Remove the nut (16), washer (15), pump lever and high idle cam assembly (14) spring (13) from the throttle shaft.

3. If required, remove the brackets (2) and (12) by removing the screws (1) and (11).

CAUTION

The throttle valve assembly should not be disassembled. These parts are matched specifically to the carburetor and are non-replacement parts. If problems arise involving these assemblies the carburetor must be replaced.

CLEANING, INSPECTION AND REPAIR

Accelerating Pump (Figure 4-16, 4-17 or 4-18)

1. Inspect the diaphragm (28) for holes, cracks or deformation and replace as necessary.

2. Replace the rod (7) if it is bent and replace the boot (8) if it is cracked.

Float Chamber

1. Blow any dirt out of the accelerating pump passage. Blow from the side opposite the nozzle to prevent the check valve inside the bowl from closing.
2. Clean all dirt from inlet valve and valve seat.
3. Replace the float if it is cracked or damaged.

Carburetor Body

Clean the carburetor body in a cleaning solvent such as GUNK to remove varnish and carbon from the fuel and air passages. Blow dry with compressed air. Reverse the air flow through all passages to remove all dirt particles.

CAUTION

Never scrape carbon deposits from the carburetor using steel instruments. Do not use wire or drills to clean passages. Any one of these things can change the size of the passage holes or alter the carburetor. Do not use carburetor cleaner on rubber or plastic parts.

ASSEMBLY (Figure 4-16, 4-17 or 4-18)

Carburetor Body

1. Install the brackets (2) and (12) using the two screws (1) and (11).

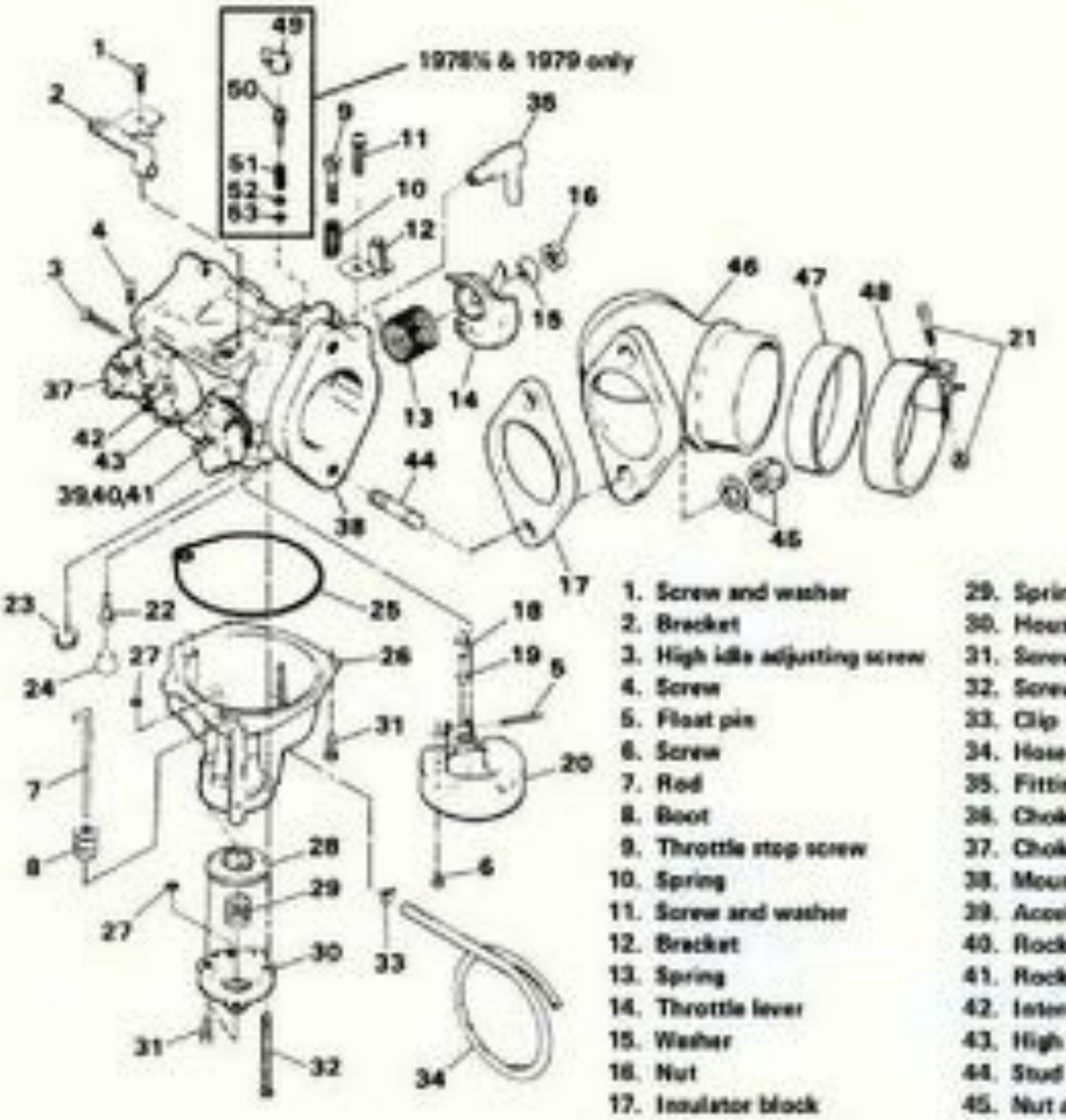
2. Install the spring (13), pump lever and high idle cam assembly (14), washer (15) and nut (16) on the throttle shaft.

3. Install the low speed jet (22), plug (24) and main jet (23).

Float Chamber

1. Install the rubber boot (8) on the float bowl (26).

2. Install the inlet valve (18) and clip (19) on the float



1. Screw and washer
2. Bracket
3. High idle adjusting screw
4. Screw
5. Float pin
6. Screw
7. Rod
8. Boot
9. Throttle stop screw
10. Spring
11. Screw and washer
12. Bracket
13. Spring
14. Throttle lever
15. Washer
16. Nut
17. Insulator block
18. Inlet valve
19. Clip
20. Float assembly
21. Screw and nut
22. Low speed jet
23. Main jet
24. Plug
25. Gasket
26. Float bowl
27. O-ring (2)
28. Diaphragm
29. Spring
30. Housing
31. Screw and washer (5)
32. Screw and washer
33. Clip
34. Hose
35. Fitting
36. Choke plate (not shown)
37. Choke lever shaft
38. Mounting flange
39. Accelerating pump lever
40. Rocker arm
41. Rocker arm spring
42. Intermediate lever
43. High idle cam
44. Stud
45. Nut and washer
46. Intake manifold
47. Seal
48. Clamp
49. Limiter cap x
50. Idle mixture screw x
51. Spring x
52. Washer x
53. O-ring x

x 1978½ and 1979 only.

Figure 4-16. Carburetor — 1978½ - 1980

(20). Secure the float (20) and pin (5) to the carburetor using the screw (6).

NOTE

At this time, check the float level as described under ADJUSTMENTS.

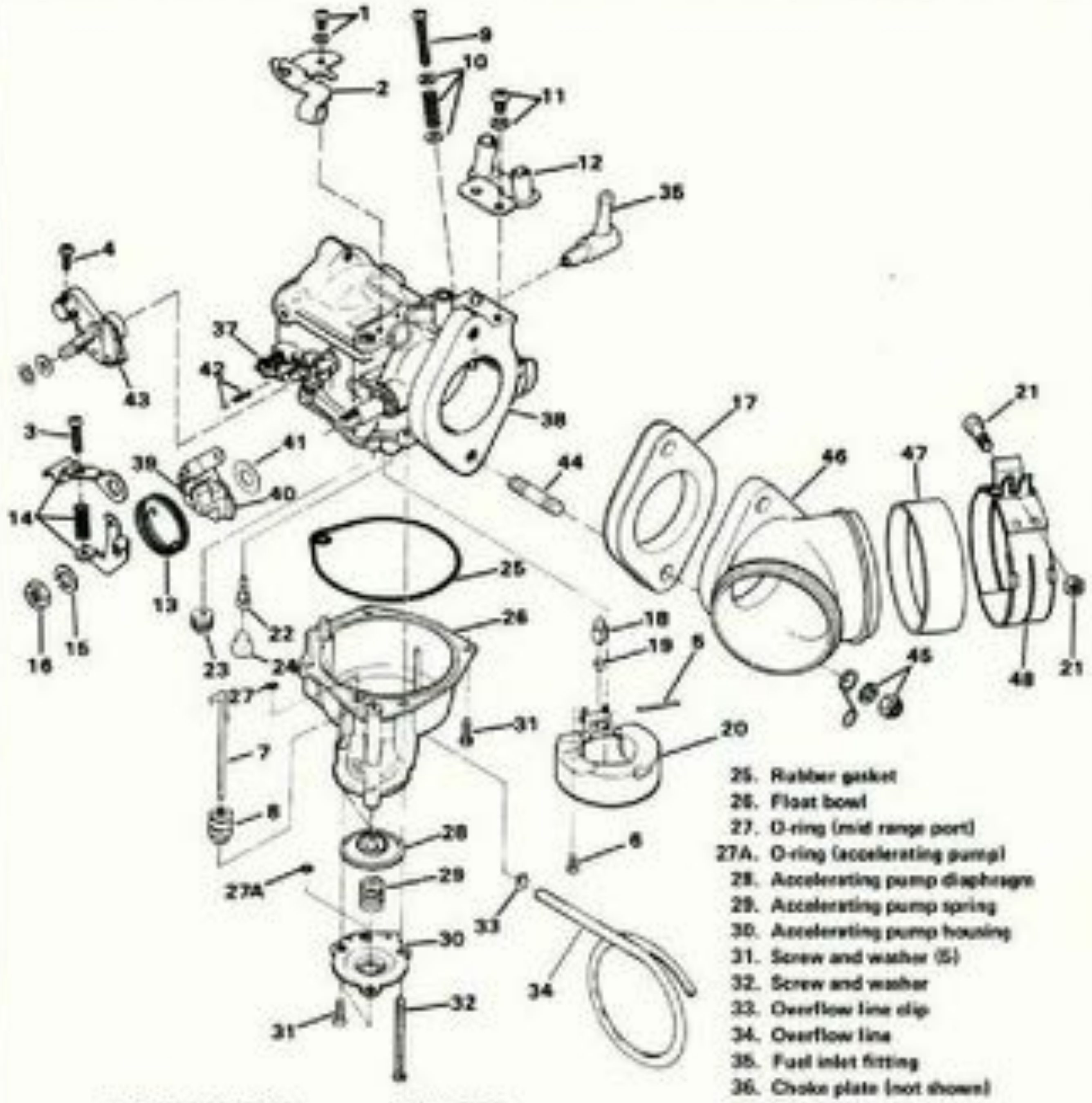
3. Install the float bowl to the carburetor body and secure it with the three screws (31).

Accelerating Pump

Install the diaphragm (28), spring (29), O-ring (27) and housing (30). Secure with the two screws (31) and one long screw (32).

INSTALLATION (Figure 4-16, 4-17 or 4-18)

1. Fasten the carburetor and insulator block to intake

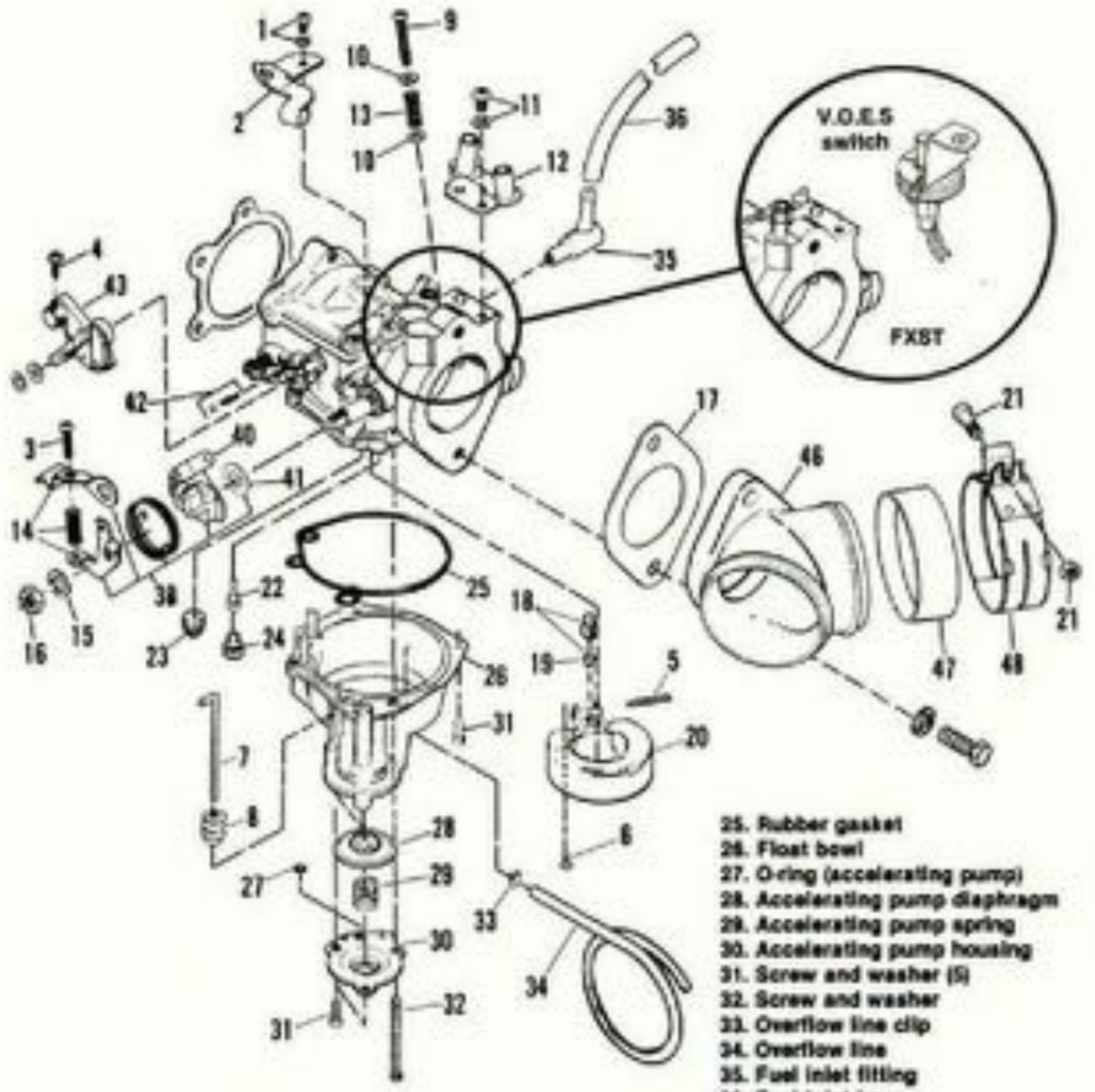


1. Screw and washer
2. Choke cable bracket
3. Fast idle adjusting screw
4. Choke cable screw
5. Float pin
6. Float retaining screw
7. Accelerating pump rod
8. Rubber boot
9. Throttle stop screw
10. Spring and washers
11. Screw and washer
12. Throttle cable bracket
13. Spring
14. High idle cam assembly
15. Lockwasher
16. Nut
17. Insulator block
18. Inlet valve
19. Clip
20. Float assembly
21. Screw and nut
22. Low speed jet
23. Main jet
24. Plug
25. Rubber gasket
26. Float bowl
27. O-ring (mid range port)
27A. O-ring (accelerating pump)
28. Accelerating pump diaphragm
29. Accelerating pump spring
30. Accelerating pump housing
31. Screw and washer (5)
32. Screw and washer
33. Overflow line clip
34. Overflow line
35. Fuel inlet fitting
36. Choke plate (not shown)
37. Choke lever shaft
38. Mounting flange
39. Accelerating pump rod hole
40. Rocker arm
41. Washer
42. Choke detent ball and spring
43. High idle cam
44. Mounting stud
45. Mounting nut and lockwasher
46. Intake manifold
47. Intake seal
48. Intake clamp

Figure 4-17. Carburetor — 1981-1983

manifold using the lockwashers and nuts (45). Tighten the nuts alternately to 19 ft-lbs torque.

2. See Figure 4-15. Connect the fuel hose (1), throttle cable (2) and choke cable (3) to the carburetor.
3. Run float bowl vent line (34) down between engine and transmission.
4. Install the air cleaner and backing plate.



1. Screw and washer
2. Choke cable bracket
3. Fast idle adjusting screw
4. Choke cable screw
5. Float pin
6. Float retaining screw
7. Accelerating pump rod
8. Rubber boot
9. Throttle stop screw
10. Washers
11. Screw and washer
12. Throttle cable bracket
13 Spring
14. Fast idle cam assembly
15. Lockwasher
16. Nut
17. Gasket
18. Inlet valve with clip
19. Clip
20. Float assembly
21. Screw and nut
22. Low speed jet
23. Main jet
24. Plug
25. Rubber gasket
26. Float bowl
27. O-ring (accelerating pump)
28. Accelerating pump diaphragm
29. Accelerating pump spring
30. Accelerating pump housing
31. Screw and washer (5)
32. Screw and washer
33. Overflow line clip
34. Overflow line
35. Fuel inlet fitting
36. Fuel inlet hose
37. Choke lever shaft
38. Accelerating pump lever kit
39. Spring
40. Rocker arm
41. Washer
42. Choke detent ball and spring
43. Fast idle cam
44. Mounting stud, washers and nut
45. Mounting bolt and lockwasher
46. Intake manifold
47. Intake seal
48. Intake clamp

Figure 4-18. Carburetor — 1984

AIR CLEANER

GENERAL (Figure 4-19)

The air cleaner contains a plastic foam element that traps air borne dust and dirt to keep it from entering the carburetor and engine.

Remove the air cleaner cover (3), service the filter (5) and on late models empty drain line (17) every 1250 miles, or more often if the motorcycle is run in a dusty environment.

SERVICING AIR CLEANER — FL/FX (Except FXST) (Figure 4-19)

1. Remove the three Allen head screws (1) and washers (2).

2. Remove the cover (3), baffle plate (4) and element (5).

NOTE

The filter should be cleaned and re-oiled if a film of dirt has built up covering the surface pores or if light spots appear on the surface. This indicates that dust is drying out the oil. Use the following steps to clean the filter.

3. Remove the foam element from the wire mesh core and clean it with soap and hot water.

4. Allow the element to dry. Evenly apply 1 to 1½ tablespoons of engine oil to the filter element with an atomizer or work that amount of oil into the filter by hand. Install element in the screen and place into the air cleaner backing plate.

NOTE

It is important that the sides of the element are clamped between the backing plate and cover. If the foam element has a fold on the side faces or the center support

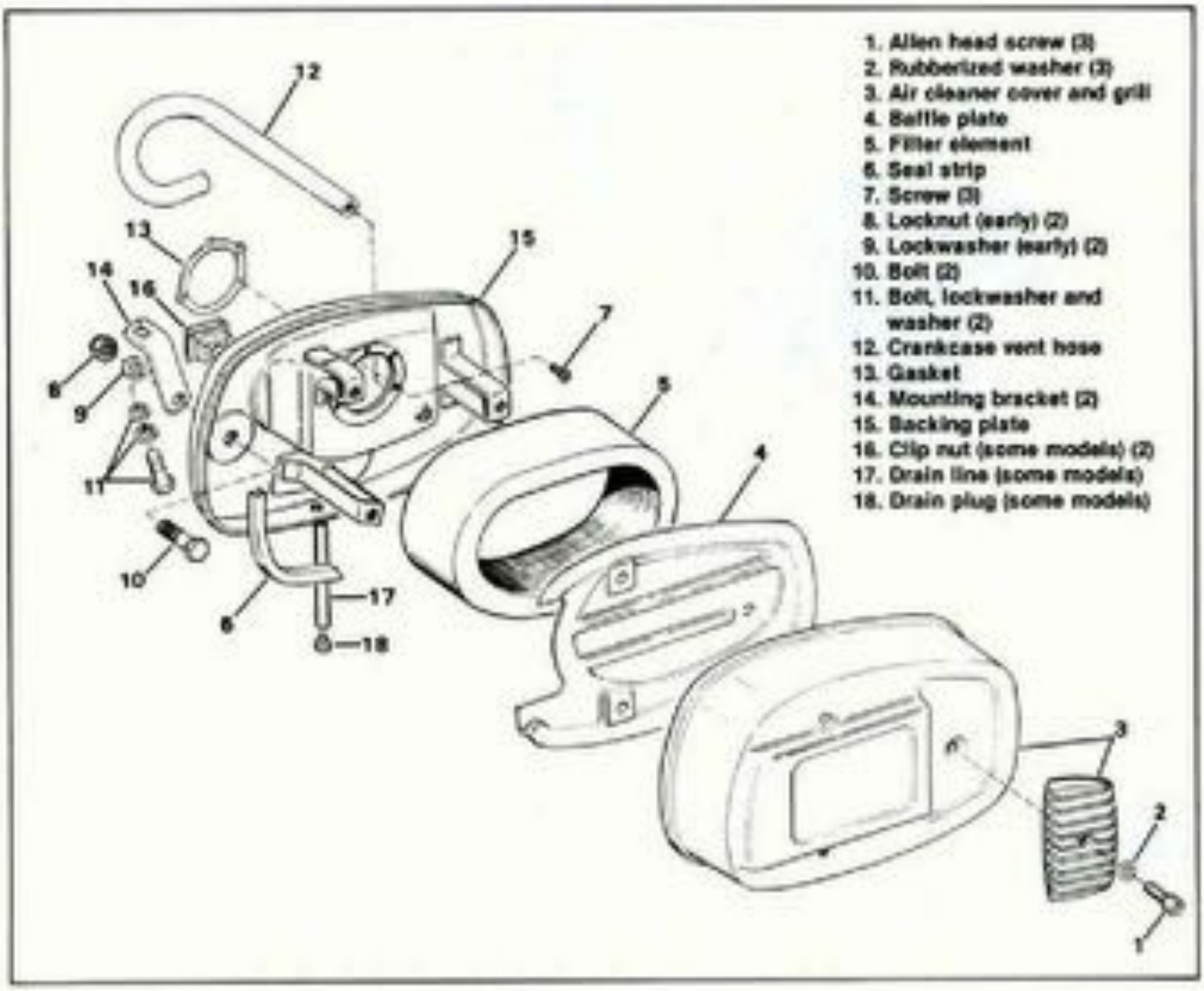


Figure 4-19. Air Cleaner

is not a snug fit within the foam, the element must be replaced. Incorrect element installation results in contaminants entering the engine causing accelerated wear and excessive oil consumption.

5. *Install baffle plate (4), cover (3), washers (2) and screws (1).*

6. *On models so equipped remove drain plug (18) and allow any accumulation of oil to drain from hose (17). Replace plug (18) when draining is complete.*

REMOVAL (Figure 4-19)

1. Remove the three screws (1) and washers (2). Remove the air cleaner cover (3), backing plate (4) and element (5).

2. Remove bolts (10) from lockwashers (9) and nuts (8), or clip nuts (16).

3. Remove screws (7).

4. Remove backing plate (15) and gasket (13).

INSTALLATION (Figure 4-19)

1. Connect the hose (12) to the backing plate (15). Install the gasket (13) and plate to the carburetor using the three screws (7). Tighten the screws to 75-80 in-lbs torque.

2. Install the bolts (10), lockwashers (9) and nuts (8) or clip nuts (16). Tighten the bolts to 10-15 ft-lbs torque.

3. Install the element (5) and gasket (6) so the opening in the gasket is to the top. Install the baffle plate (4) and cover and grill (3). Secure it with the three washers (2) and screws (1).

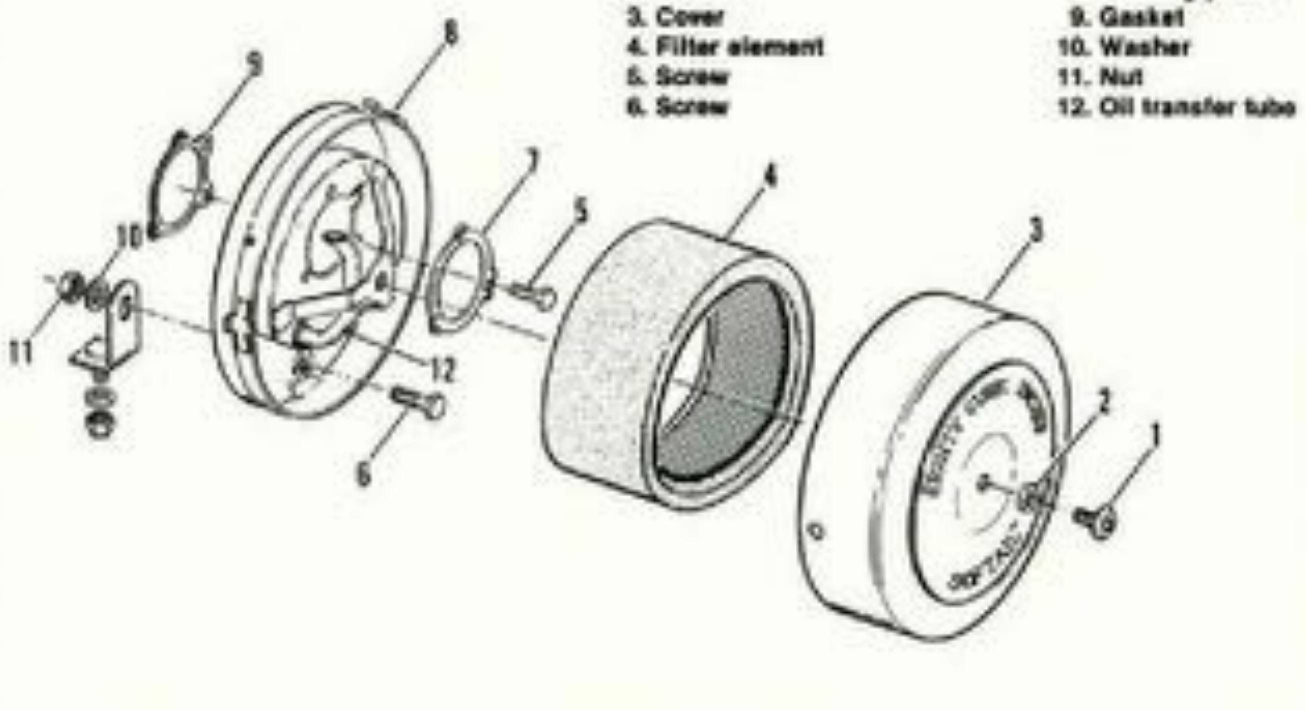


Figure 4-20. Air Cleaner FXST

SERVICING AIR CLEANER — FXST (Figure 4-20)

1. Remove capscrew (1), washer (2) and cover (3).

2. Remove element (4).

3. Remove the foam element from the wire mesh core and clean it with soap and hot water.

4. Allow the element to dry. Evenly apply 1 to 1½ tablespoons of engine oil to the filter element with an atomizer or work that amount of oil into the filter by hand. Install element in the screen and place into the air cleaner backing plate.

NOTE

It is important that the sides of the element are clamped between the backing plate and cover. If the foam element

has a fold on the side faces or the center support if not a snug fit in the foam, the element must be replaced. Incorrect element installation results in contaminants entering the engine causing accerated wear and excessive oil consumption.

5. Place cover (3) in position over backing plate (8). Place washer (2) on capscrew (1). Insert capscrew through cover (3). Then thread into the tapped hole at the center of the backing plate. Tighten the screw with an allen wrench to 12-17 ft-lbs torque.

REMOVAL (Figure 4-20)

1. Remove capscrew (1), washer (2) and cover (3).
2. Remove element (4).
3. Bend down locking tabs on locktab ring (7). Back out screws (5) from the tapped holes in the carburetor flange.
4. Remove screw (6) with washer (10) and nut (11). Lift the backing plate free of the carburetor and carefully remove gasket (9). Disconnect the vent hose from oil transfer tube (12).

INSTALLATION (Figure 4-20)

1. Inspect gasket (9) and replace if damaged. Hold gasket (9) on carburetor mounting flange and position backing plate (8) against the gasket. Place locktab ring (7) against the backing plate with holes aligned. Thread screws (5) through locktab ring (7), the backing plate (8) and into the tapped holes in the carburetor flange. Bend the tabs on locktab ring (7) that are best positioned to flatten against a full flat of the capscrew. Turn the capscrew an additional amount if necessary.
2. Insert bolt (6) through backing plate (8) and the engine bracket. Place washer (10) on the bolt. Then thread on nut (11). Tighten nut (11) to 13-17 ft-lbs torque.
3. Install element (4) in the screen and place into the air cleaner backing plate.
4. Place cover (3) in position over backing plate (8). Place washer (2) on capscrew (1). Insert button head capscrew (1) through cover (3) and thread into the tapped hole at the center of the backing plate. Tighten the screw to 12-17 ft-lbs torque.

FUEL SUPPLY VALVE

GENERAL (Figure 4-21)

The fuel supply valve is located under the left side of the fuel tank. The gasoline supply to the carburetor is shut 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.

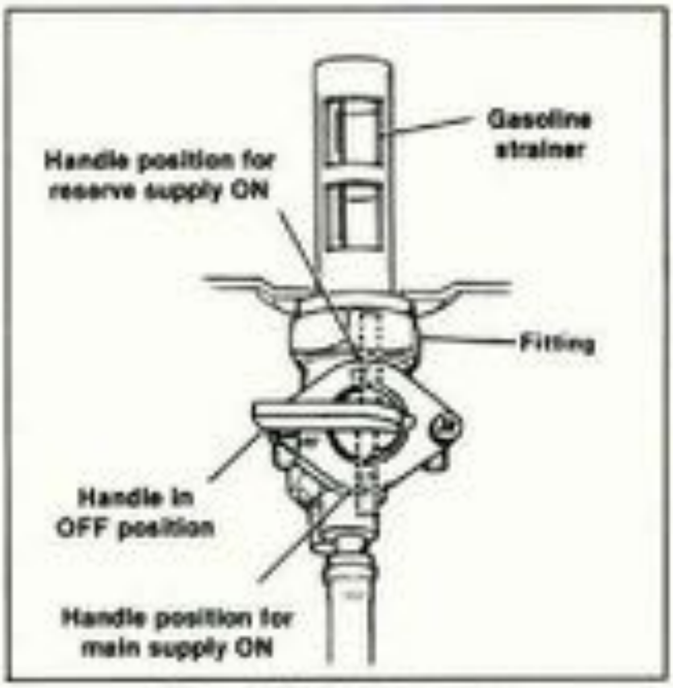


Figure 4-21. Fuel Supply Valve

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 carburetor and drain the gasoline into a proper, clean container.

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 fuel supply valve.

2. Flush the tank to remove all dirt.

INSTALLATION

1. Coat the valve threads with Harley-Davidson PIPE SEALANT WITH TEFLON, Part No. 99630-77 and tighten fitting.

2. Connect the hose to the carburetor.

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 while the motorcycle is stored.

REMOVAL

WARNING

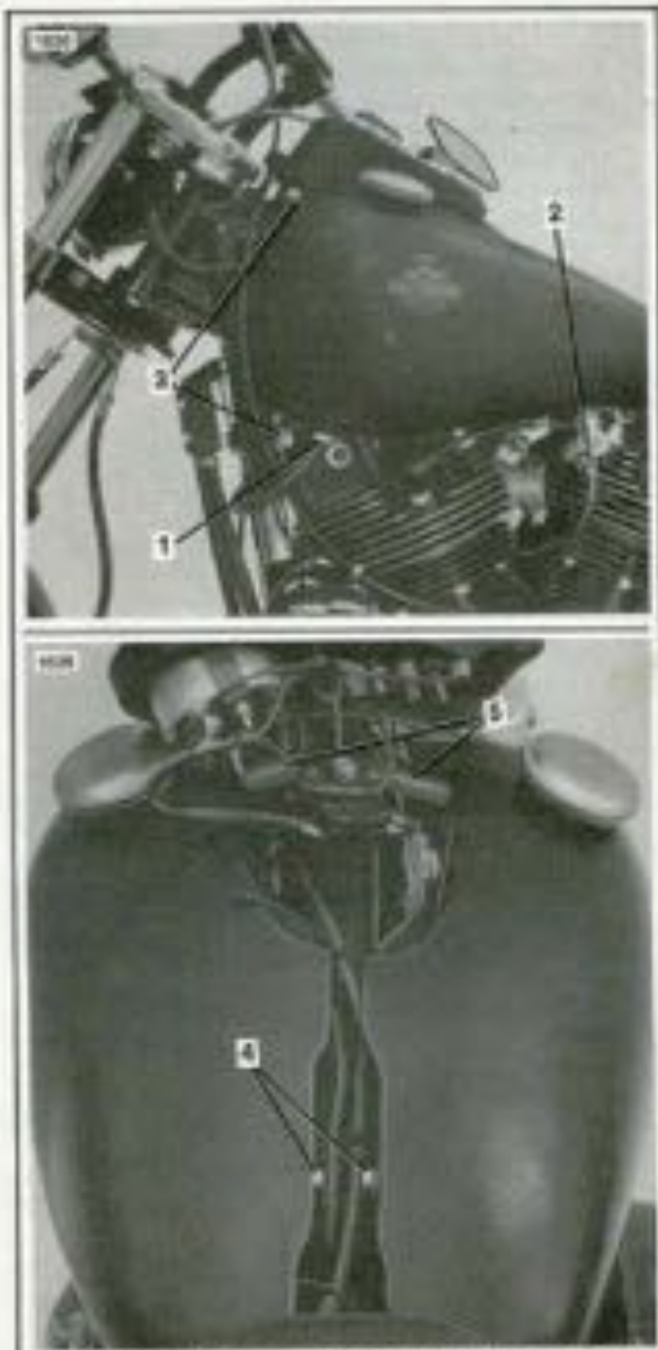
Gasoline is extremely flammable and highly explosive under certain conditions. Do not smoke or allow open flame or sparks anywhere in the area when refueling or servicing the fuel system.

All Models Except FXE/FXST (Figure 4-22)

1. Remove instruments and center trim panel. See INSTRUMENTS in Section 2.
2. Check to be sure fuel supply valve is in "OFF" position. Remove fuel line to carburetor.
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 two rear mounting bolts (4) and hardware. Disconnect upper vent line and remove tank halves from vehicle.

FXE Model

1. Check to be sure fuel supply is "OFF". Disconnect fuel feed line at carburetor. Connect suitable hose to fuel supply valve, turn valve to "OPEN", and drain fuel into adequately sized approved gasoline container.
2. Remove rear hold down spring and lift off tank.



1. Crossover line
2. Fuel line
3. Front mounting hardware
4. Upper mounting bolts
5. Upper crossover line

Figure 4-22. Tank Mounting — All Models Except FXE

FXST Model (Figure 4-23)

1. Remove instruments and center trim panel. See INSTRUMENTS in Section 2.
2. Check to be sure fuel supply valve is in "OFF" position. Remove fuel line to carburetor.
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 (10).
5. Remove the upper and lower front mounting bolts (6), washers (2), washers (4) and nuts (1).
6. Remove the two rear mounting capscrews (9), spacer (10), lockwasher (8), flat washers (2) and (4).
7. Disconnect upper vent line (11) and remove tank halves from motorcycle.

CLEANING, INSPECTION AND REPAIR

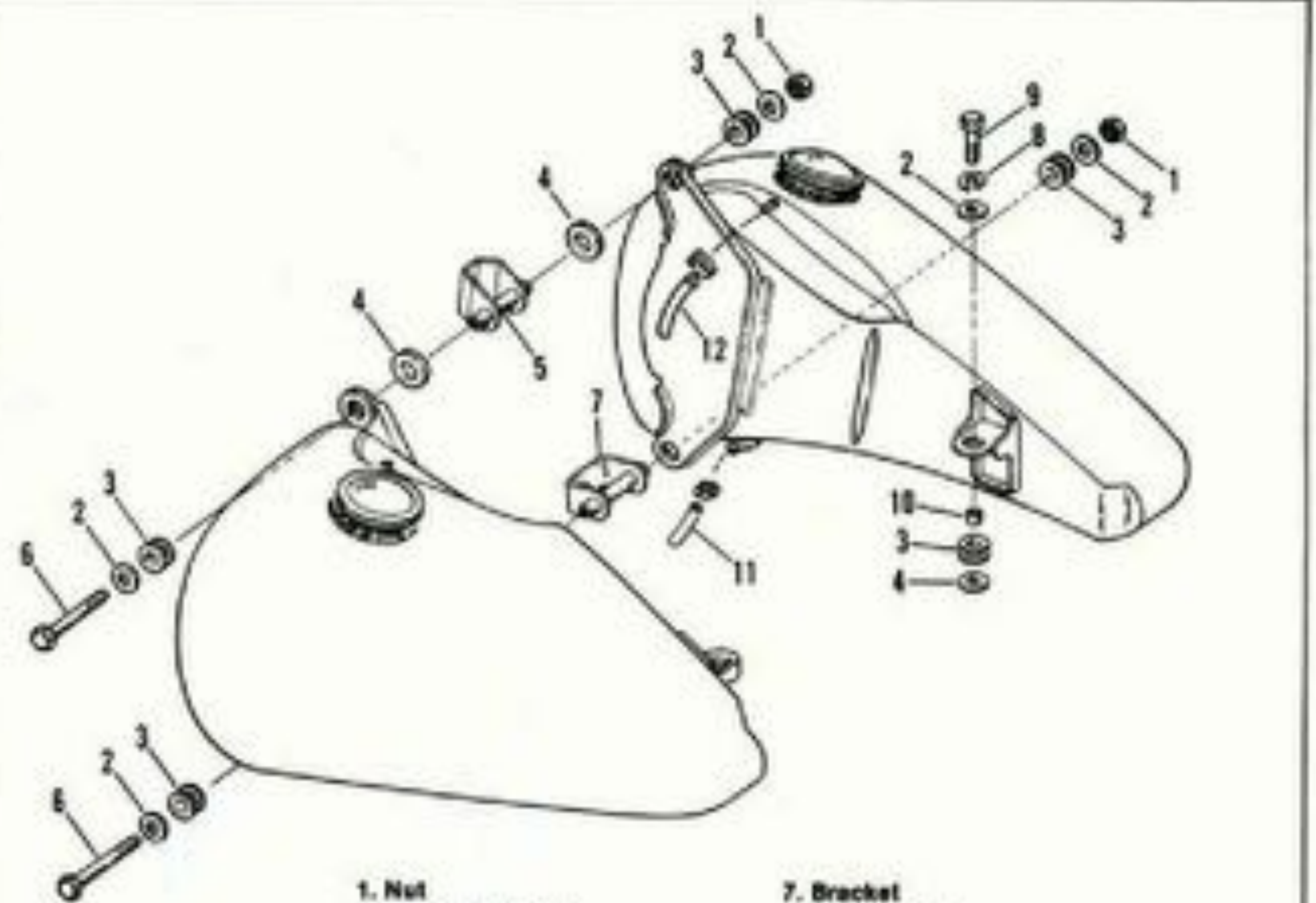
1. Clean the tank interior with commercial cleaning solvent or a soap and water solution. Plug the tank openings and shake the tank to agitate the cleaning agent. If necessary, metallic balls or pellets may be added to the tank to assist in loosening deposits.

2. Flush the tank thoroughly after cleaning and allow it to air dry.

3. Inspect the interconnect line 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. To repair minor leaks in the tank walls use a commercially available gas tank sealer to stop leaks. Carefully follow the sealant manufacturer's instructions for best results. Replace damaged tank that cannot be successfully repaired with sealant.



1. Nut
2. Washer, .328" ID
3. Rubber grommet
4. Washer, .531" ID
5. Bracket (upper)
6. Bolt
7. Bracket
8. Lockwasher
9. Cap screw
10. Spacer
11. Cross over line
12. Vent line

Figure 4-23. Tank Mounting — FXST

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

All Models Except FXE/FXST (Figure 4-19)

1. Place tank halves on motorcycle, connect upper vent line (5) and fasten tanks with the two front mounting bolts (3), four flatwashers, two lockwashers and two nuts.

2. Secure rear of tanks with bolts (4) and hardware.

3. Install instruments. See INSTRUMENTS Section 2. Install center trim.

4. Connect fuel feed line (2) and crossover line (1). Use new hose clamps. Inspect fuel lines for cuts, cracks or holes and replace if necessary.

NOTE

Route the crossover line (1) in front of the frame downtubes.

5. Fill fuel tank and check for leaks.

FXE Model

1. Hook front tangs on tank under front mounting rubbers.

2. Hook rear of tank with hold down spring.

3. Connect fuel feed line. Use new hose clamp. Inspect fuel line for cuts, cracks or holes and replace if necessary.

4. Fill fuel tank and check for leaks.

FXST Model (Figure 4-23)

1. Place a large I.D. washer (4) over each end of the spacer tube at the upper bracket (5). Place a large I.D. washer (4) over each of the two tapped anchor inserts mounted in the frame tube.

2. Position the fuel tank halves with the rubber grommets (3) over the spacer tubes at each side of the upper and lower brackets (5) and (7). 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.

3. Place a small I.D. washer (2) over each bolt (6) and insert the bolts through the front tank mounting lugs and through the bracket spacer tubes. Place lockwasher (8) followed by flat washer (2) over cap screw (9). Insert the cap screw through the tank mounting lug, through spacer (10), through washer (4) and thread into the tapped anchor insert.

4. Place a washer (2) over the ends of bolts (6) and thread nut (1) onto each other.

5. Tighten the front bolts (6) and the rear cap screw (9) to a torque of 15-19 ft-lbs.

6. Connect the upper vent tube (11) and the lower cross over tube (10). Route tube (10) in front of the frame downtubes.

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 instruments.

10. Check for leaks.

SUBJECT | PAGE NO.

1. General Information 5-1
2. Starter Motor — 1978½ to 1982 FL, FLH, FLH-80
   And 1979 to 1981 Classic 5-3
3. Starter Motor — 1978½ to 1984 FX, 1982 Classic
   And 1983 - 1984 FL Models 5-7
4. Solenoid 5-11
5. Starter Shaft and Gear Housing
   1984 and Earlier, all models except FXB/FXSB/FXDG, 1982 FLHC,
   1983 and 1984 FLH and 1984 FXWG 5-15
6. Starter Shaft and Gear Housing
   FXB/FXSB/FXDG, 1982 FLHC, 1983-1984 FLH Models and 1984 FXWG 5-19

ELECTRIC STARTER

GENERAL INFORMATION

NOTE

Kick starter information can be found in TRANSMISSION Section 7.

SPECIFICATIONS

Starter

Free speed	10,000 rpm (min) @ 10.0V
Free current	45 amp (max.) @ 10.0V
Stall current	300 amp @ 4.0V
Stall torque	3.2 ft-lbs. @ 4.0V

DESCRIPTION

The starter motor is a 12-volt, 4-pole drive motor. The starter engages the clutch ring gear through a Bendix drive and a reduction gear unit. A solenoid relay provides battery current directly to the starter. The solenoid is controlled by the starter button on the handlebar.

NOTE

Never operate the starter motor continuously for more than 30 seconds without pausing to let it cool for at least two minutes. The starter can be seriously damaged if run for long periods of time.

TROUBLESHOOTING

If the starter motor fails to operate properly, the following checks should be made before removing the starter for inspection.

1. Make sure the mounting and wiring connections are tight and in good condition. The solenoid switch should be firmly mounted and all wiring connections should be clean and tight.
2. Check the battery state of charge. See the BATTERY Section. If the battery is charged and full voltage is reaching the starter, the trouble is in the engine or the starter motor.
3. If the battery is charged but there is no current flow to the starter, check the handlebar starter switch, RUN-OFF switch, starter relay or the solenoid switch. Check each switch by bypassing it with a jumper.
4. Excessive friction in the engine caused by tight bearings, tight pistons or too heavy oil makes the engine harder to turn over. If the engine is in good condition and all else checks okay, the trouble is in the starter motor.

STARTER RELAY

The starter relay is a non-repairable part and must be replaced if it becomes defective.

Figure 5-1 shows a test circuit using a 12-volt battery and stop lamp bulb. Contacts should close and bulb should light when connection is made at positive post of battery and should go out when connection is broken.

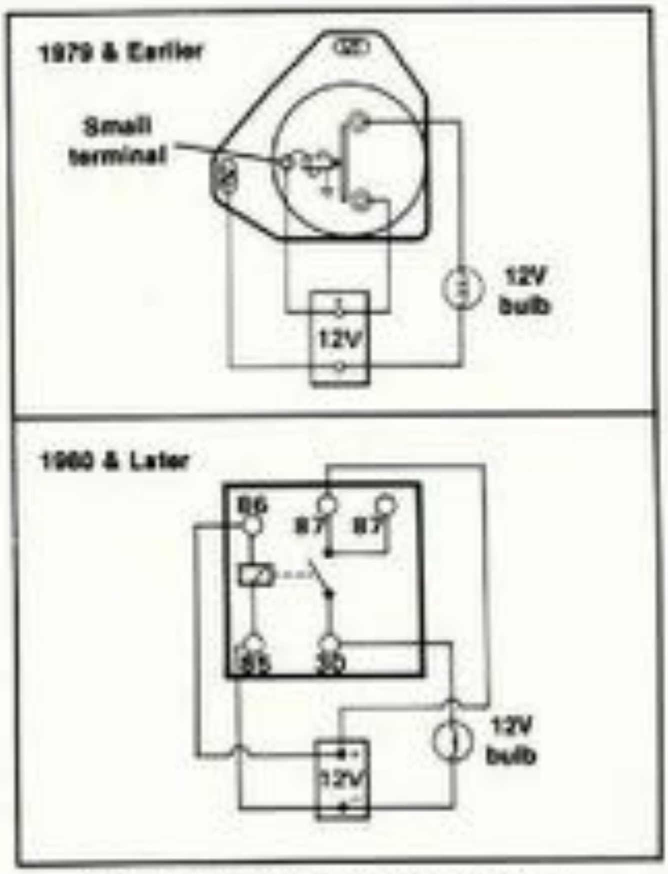


Figure 5-1. Starter Relay Internal Wiring Diagram and Test Circuit

1978½ TO 1982 FL, FLH, FLH-80 AND 1979 TO 1981 CLASSIC

STARTER DRAW TEST (Figure 5-2)

Starter draw should be checked with an induction ammeter before disconnecting the battery.

1. Make sure transmission is in neutral. Connect one end of a heavy jumper wire to the positive terminal of the battery.

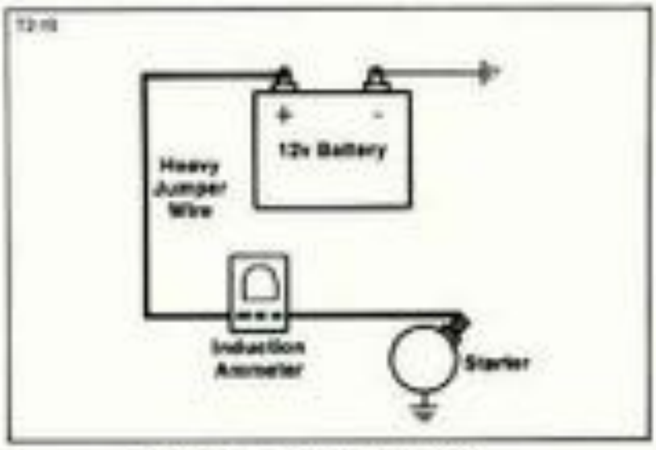


Figure 5-2. Starter Draw Test

2. Place the ammeter over the jumper wire and touch the other end of the wire to the large terminal on the starter.

3. If starter draw exceeds 100 amps, it should be removed and tested further.

REMOVAL (Figure 5-3)

WARNING

Disconnect the battery cables (negative cable first) to prevent accidental start-up of vehicle and possible personal injury.

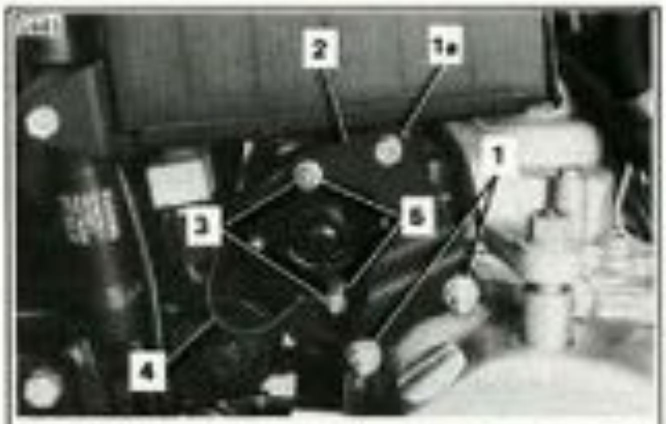
1. Disconnect solenoid cable from starter terminal.

2. Remove nuts and washers (1 and 1a) that fasten starter bracket (2) to transmission and battery carrier.

3. Remove nuts and washers (3) which secure starter bracket (2) and ground wire (4) to starter thru bolts.

4. Remove starter thru bolts (5).

5. Grasp starter by front and rear covers to prevent it from coming apart, and remove starter.



1. Starter bracket mounting nuts and washers (2)
1A. Starter bracket to battery carrier nut and washer
2. Starter bracket
3. Starter to bracket mounting nuts and washers (2)
4. Ground wire
5. Starter thru bolts (2)

Figure 5-3. Starter Mounting

DISASSEMBLY (Figure 5-4)

1. Remove thru bolts (1) washers and lockwashers (2).

2. Remove end cover (3).

3. Remove end cover (6), bearing (7) and armature (5) as an assembly.

4. Move brushes (10) out of the way and remove springs (8) and brush holder (4).

CLEANING, INSPECTION AND REPAIR

Frame and Field Assembly

The frame and field assembly is tested for open circuits using an ohmmeter.

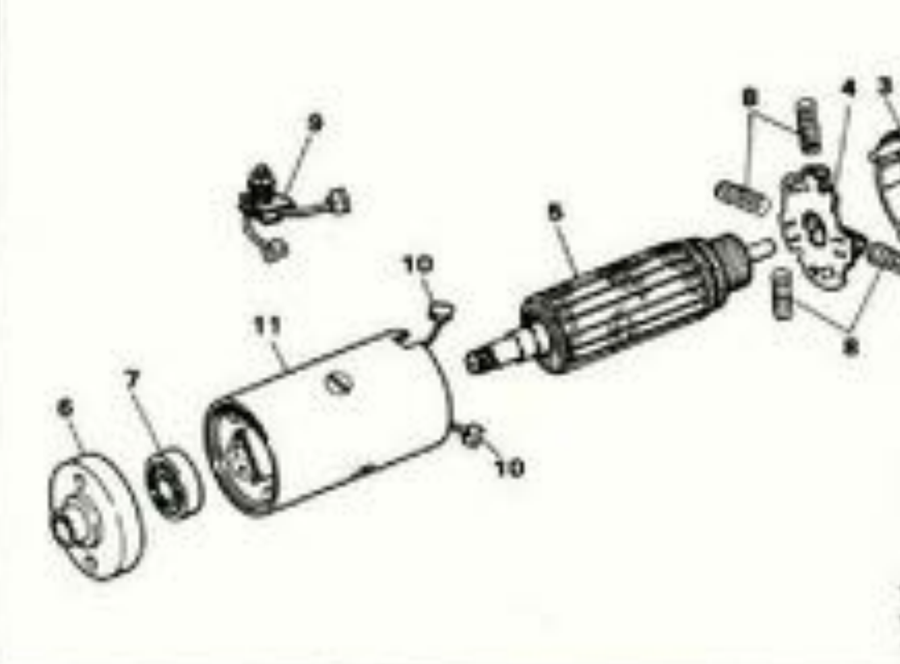
1. Place one probe of the tester against frame while placing the other probe against each of the brushes attached to the field coils.

2. If either one of the brushes indicates an open circuit, (any reading other than zero ohms), the entire frame and field assembly must be replaced.

Armature

1. If the armature commutator is dirty use crocus cloth, not sandpaper or emery cloth to clean it.

2. Armatures should be tested for open or grounded circuits using an ohmmeter.



Figue 5-4. Starter Motor

3. See Figure 5-5. Touch one probe of the ohmmeter to a commutator segment and the other probe to the adjoining segment. There should be continuity (zero ohms).

4. Continue around the commutator until all pairs of segments have been tested. Any reading other than zero ohms indicates an open circuit in the armature windings and the armature must be replaced.

5. See Figure 5-6. Touch one probe of the ohmmeter to the armature core and the other probe to any commutator segment. There should be no continuity (infinite ohms). Any other reading indicates a grounded armature which should be replaced.

6. Test the armature for short circuits using an armature growler as shown in Figure 5-7. Place the armature on the growler and turn it on.

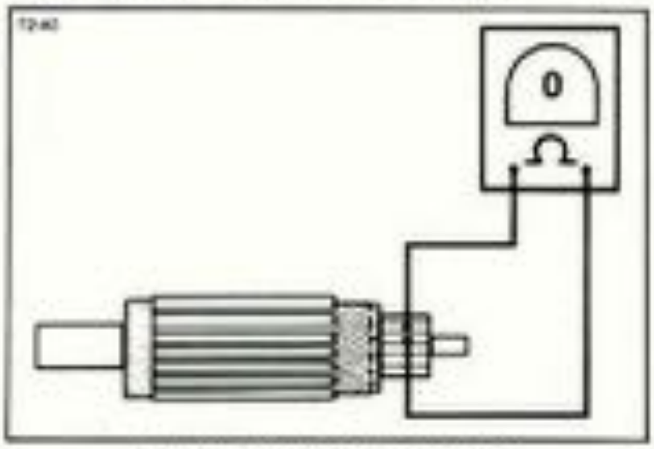


Figure 5-5. Armature Open Test

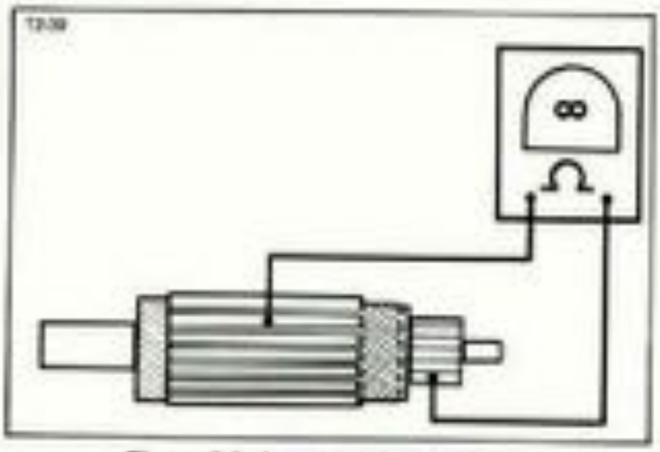


Figure 5-6. Armature Ground Test

7. Hold a thin strip of steel or hacksaw blade over the armature core while rotating the armature. A shorted armature winding will cause the steel strip to vibrate and be attracted to the core. Shorted armatures must be replaced.

8. If commutator is worn, out of round or has high mica insulation between segments, commutator can be turned down in a lathe.

   If the commutator is badly out of round due to burned bars, indicating open windings, replace the armature.

9. If the mica insulation is high between segments, use an undercutting machine to undercut the mica 1/32 in. deep. The slots should then be cleaned to remove any dirt or copper dust.

Figure 5-7. Armature Short Test

If an undercutting machine is not available, under cutting can be done satisfactorily using a thin hacksaw blade. See Figure 5-8. After undercutting, lightly sand the armature with crocus cloth to remove any burrs.

10. Inspect the bearing (7, Figure 5-4). If it is worn or loose, replace it.

11. Inspect the bushing in the commutator end cover (12, Figure 5-4) and the corresponding bearing surface of the armature shaft. If the bushing is worn, replace the commutator cover. If the armature shaft is worn, replace the armature.

Brushes

The brushes should be replaced if they are worn close to ¼ in. minimum. Harley-Davidson BRUSH REPLACEMENT KIT, Part No. 31541-66, is available from the factory. Always replace brushes in sets of four.

1. See Figure 5-9. Two of the brushes (2 and 4) are attached to the terminal. To replace these brushes, remove the terminal assembly and slide the new assembly on the frame.

2. See Figure 5-9. The outer two brushes (1 and 3) are attached to the field coils. To replace these brushes, cut the old brushes and leads about 1/2 in. from the field coils. Using rosin core solder, solder the new brushes in place making sure the new brushes are in the same position as the old ones.

ASSEMBLY

1. See Figure 5-10. Place the brush holder on the frame and position the brushes as shown. The holder has a notch that must line up with the terminal.

2. See Figure 5-11. Insert the springs and brushes in the holder and use clamps to hold them in place while installing the armature.

3. See Figure 5-4. Install the armature (5), bearing (7)

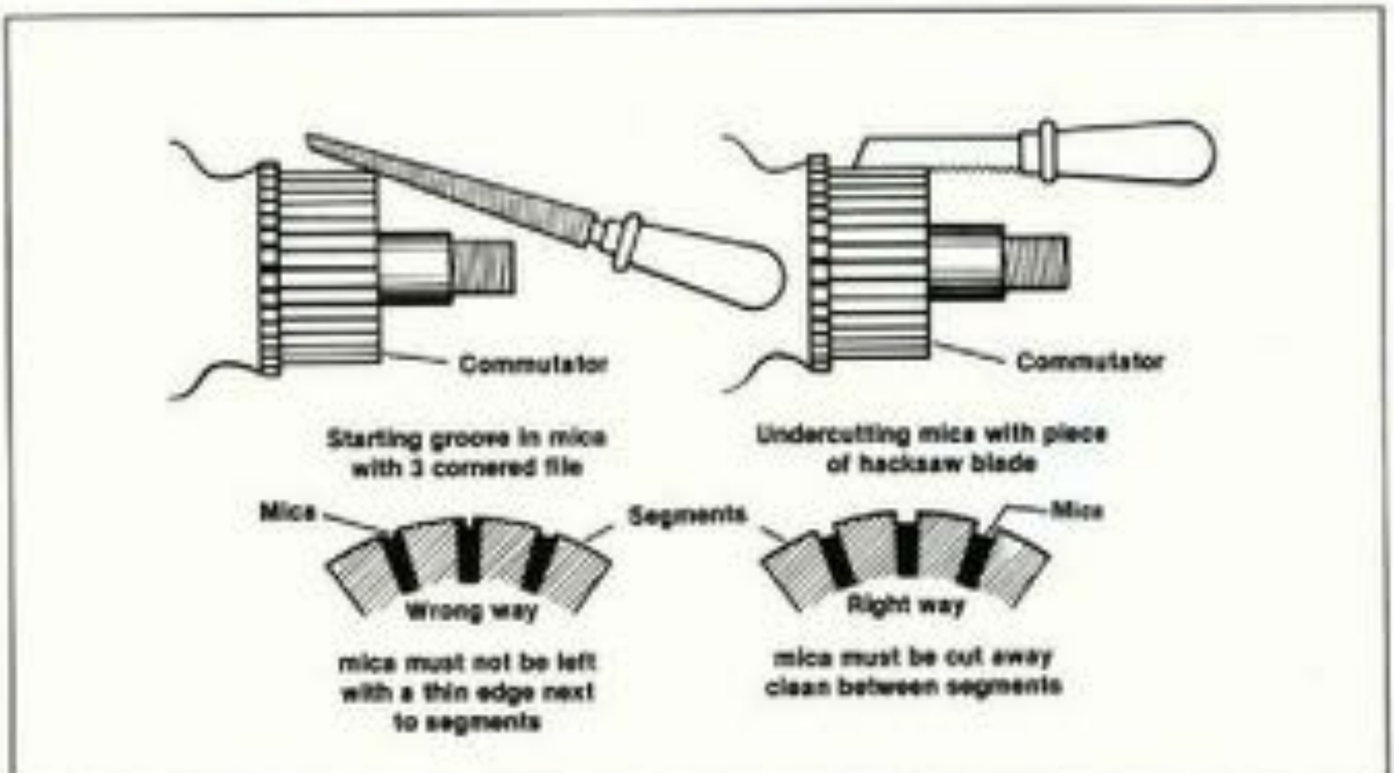


Figure 5-8. Recessing The Mica Separators

Figure 5-9. Brush Identification

and drive end cover (6) as an assembly. Install the commutator end cover (3).

4. See Figure 5-12. The drive end cover has a lip (1) that must register in a notch on the frame assembly. The commutator end cover has two lines (2) that must line up with the terminal.

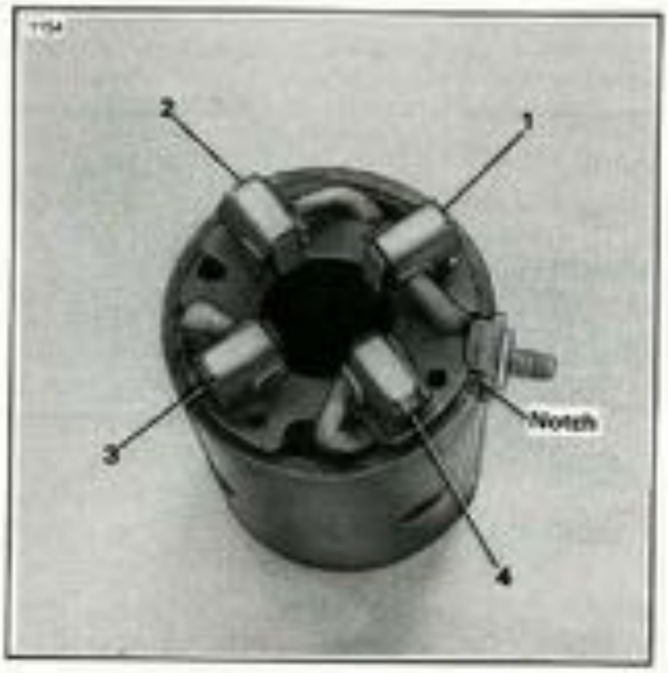


Figure 5-10. Installing Brush Holder

INSTALLATION (Figure 5-3)

1. With thru bolts installed through starter, install starter to housing with terminal to the front. Tighten thru bolts to 60-80 in-lbs torque.

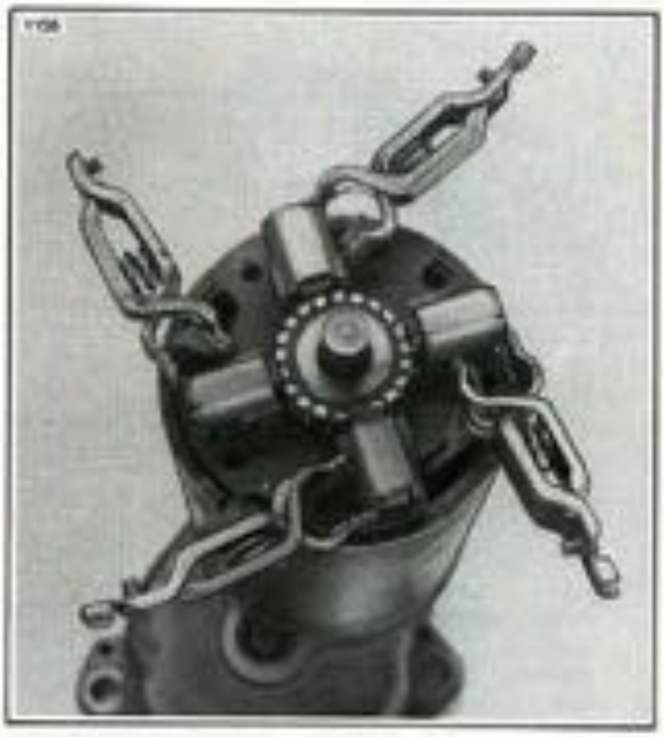


Figure 5-11. Holding Brushes in Brush Holder

Figure 5-12. Starter Motor Assembly

2. Install battery cable to starter terminal, tighten starter terminal nut to 65-80 in-lbs torque.

3. Install starter bracket (2) over transmission studs and install nuts and washers (1 and 1a).

4. Install ground wire (4) and nuts and washers (3) to starter thru bolts.

5. Tighten nuts (1) to 12 ft-lbs torque, nut (1a) to 6 ft-lbs torque and nuts (3) to 60-80 in-lbs torque.

1978½ TO 1984 FX, 1982 CLASSIC AND 1983-1984 FL MODELS

STARTER DRAW TEST (Figure 5-13)

Starter draw should be checked with an induction ammeter before disconnecting the battery.

1. Make sure transmission is in neutral. Connect one end of a heavy jumper wire to the positive terminal of the battery.

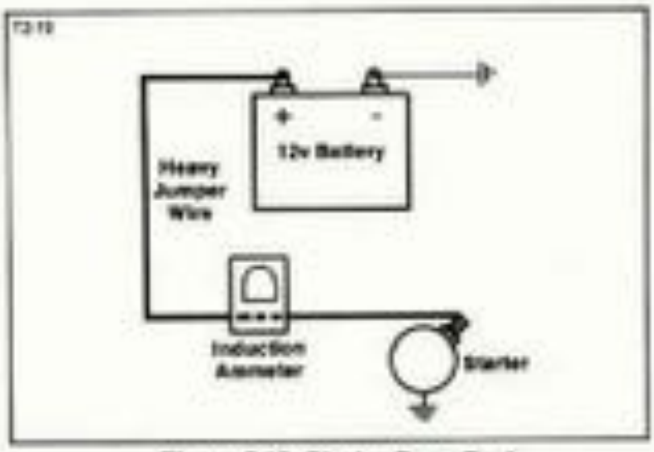


Figure 5-13. Starter Draw Test

2. Place the ammeter over the jumper wire and touch the other end of the wire to the large terminal on the starter.

3. If starter draw exceeds 100 amps, it should be removed and tested further.

REMOVAL (Figure 5-14)

WARNING

Disconnect the battery cables (negative cable first) to prevent accidental start-up of vehicle and possible personal injury.

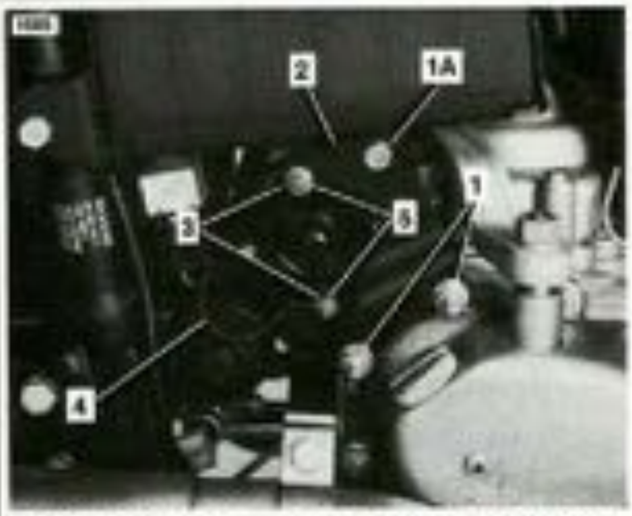
1. Disconnect solenoid cable from starter terminal.

2. Remove nuts and washers (1 and 1a) that fasten starter bracket (2) to transmission and battery carrier.

3. Remove nuts and washers (3) which secure starter bracket (2) and ground wire (4) to starter thru bolts.

4. Remove starter thru bolts (5).

5. Grasp starter by front and rear covers to prevent it from coming apart, and remove starter.



1. Starter bracket mounting nuts and washers (2)
1A. Starter bracket to battery carrier nut and washer
2. Starter bracket
3. Starter to bracket mounting nuts and washers (2)
4. Ground wire
5. Starter thru bolts (2)

Figure 5-14. Starter Mounting

DISASSEMBLY (Figure 5-15)

1. Remove thru bolts (3) and lockwashers (2).

2. Remove rear cover screws and lockwashers (4).

3. Remove rear cover (5).

4. Use a wire hook to pull up on brush springs and remove brushes (7 and 8) from brush holder assembly (9).

5. Remove front cover (10) and pull armature (11) from frame (14).

6. Note position of thrust washer(s) (13).

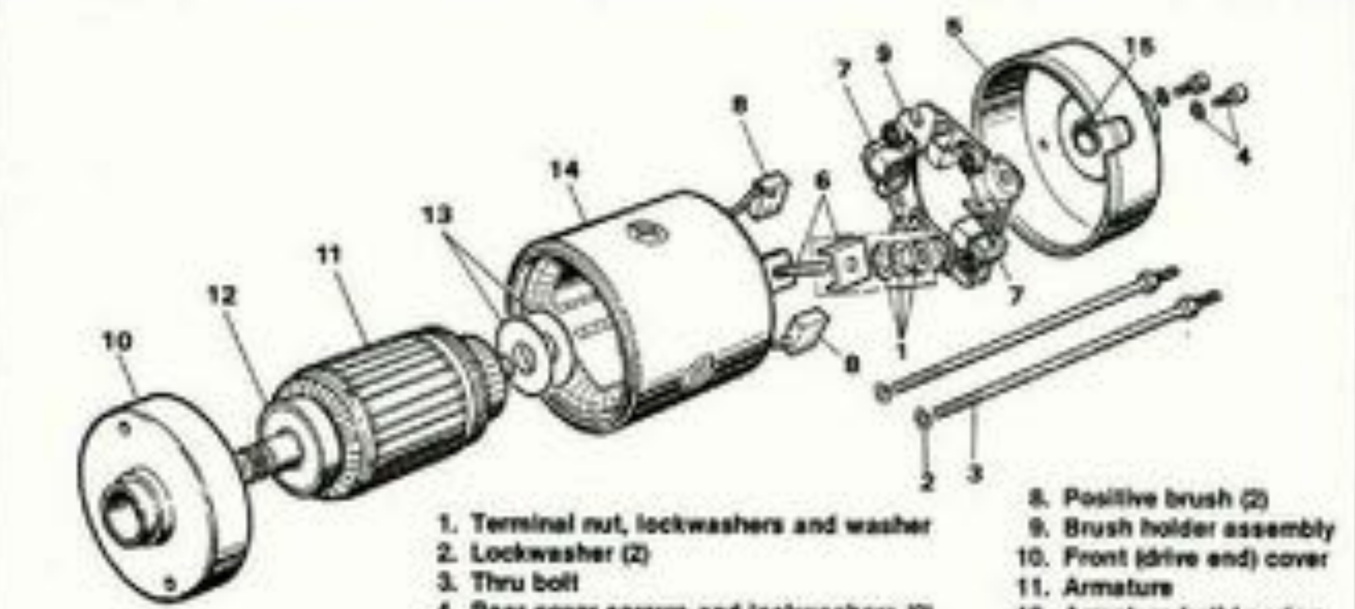
CLEANING, INSPECTION AND REPAIR

Frame and Field Assembly

The frame and field assembly is tested for open circuits using an ohmmeter.

1. Place one probe of the tester against frame while placing the other probe against each of the brushes attached to the field coils.

2. If either one of the brushes indicates an open circuit (any reading other than zero ohms), the entire frame and field assembly must be replaced.



1. Terminal nut, lockwashers and washer
2. Lockwasher (2)
3. Thru bolt
4. Rear cover screws and lockwashers (2)
5. Rear (commutator end) cover
6. Terminal and insulator
7. Negative brush (2)
8. Positive brush (2)
9. Brush holder assembly
10. Front (drive end) cover
11. Armature
12. Armature ball bearing
13. Thrust washer
14. Frame
15. Rear cover bushing

Figure 5-15. Starter Motor

Armature

1. If the armature commutator is dirty use crocus cloth, not sandpaper or emery cloth to clean it.

2. Armatures should be tested for open or grounded circuits using an ohmmeter.

3. See Figure 5-16. Touch one probe of the ohmmeter to a commutator segment and the other probe to the adjoining segment. There should be continuity (zero ohms).

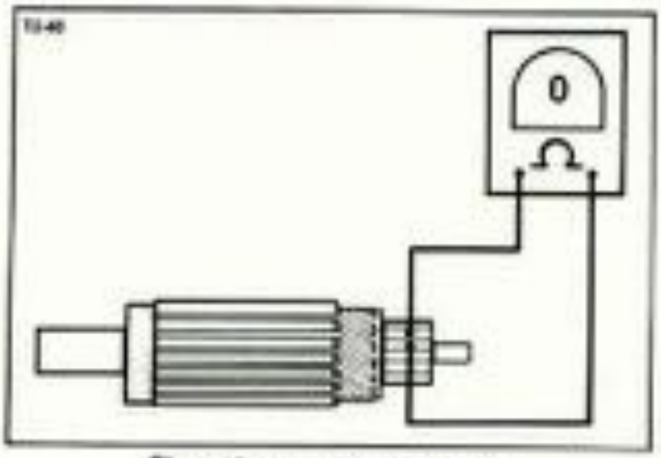


Figure 5-16. Armature Open Test

4. Continue around the commutator until all pairs of segments have been tested. Any reading other than zero ohms indicates an open circuit in the armature windings and the armature must be replaced.

5. See Figure 5-17. Touch one probe of the ohmmeter to the armature core and the other probe to any commutator segment. There should be no continuity (infinite ohms). Any other reading indicates a grounded armature which should be replaced.

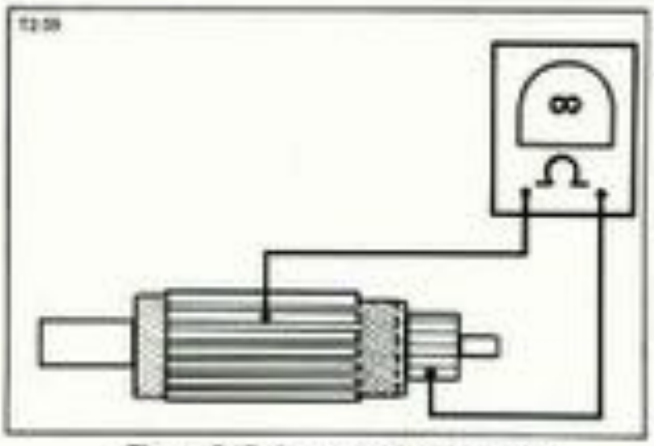


Figure 5-17. Armature Ground Test

6. Test the armature for short circuits using an armature growler as shown in Figure 5-18. Place the armature on the growler and turn it on.

7. Hold a thin strip of steel or hacksaw blade over the armature core while rotating the armature. A shorted armature winding will cause the steel strip to vibrate and be attracted to the core. Shorted armatures must be replaced.

8. If commutator is worn, out of round or has high

Figure 5-18. Armature Short Test

mica insulation between segments, commutator can be turned down in a lathe.

If the commutator is badly out of round due to burned bars, indicating open windings, replace the armature.

9. If the mica insulation is high between segments, use an undercutting machine to undercut the mica 1/32 in. deep. The slots should then be cleaned to remove any dirt or copper dust.

If an undercutting machine is not available, undercutting can be done satisfactorily using a thin hacksaw blade. See Figure 5-19. After undercutting, lightly sand the armature with crocus cloth to remove any burrs.

10. Inspect the bearing (12, Figure 5-15). If it is worn or loose, replace it.

11. Inspect the bushing in the commutator end cover (15, Figure 5-15) and the corresponding bearing surface of the armature shaft. If the bushing is worn, replace the commutator cover. If the armature shaft is worn, replace the armature.

Brushes and Brush Holder Plate Assembly

1. Remove negative brushes from brush holder plate. Clean plate thoroughly with contact cleaner.

2. The brushes should be replaced if they are worn close to 7/16 in. minimum. Harley-Davidson BRUSH REPLACEMENT KITS, Part No. 31575-73 Field Coil Brush and 31582-73 Negative Brush are available from the factory. Always replace brushes in sets of four.

3. The field coil brushes are soldered in place. To replace the field coil brushes, heat to unsolder and remove old brushes. Solder the new brushes in place using a rosin core solder.

4. To insure integrity of field brushes during reassembly, test for a ground using an ohmmeter. Place one probe of the tester against brush plate

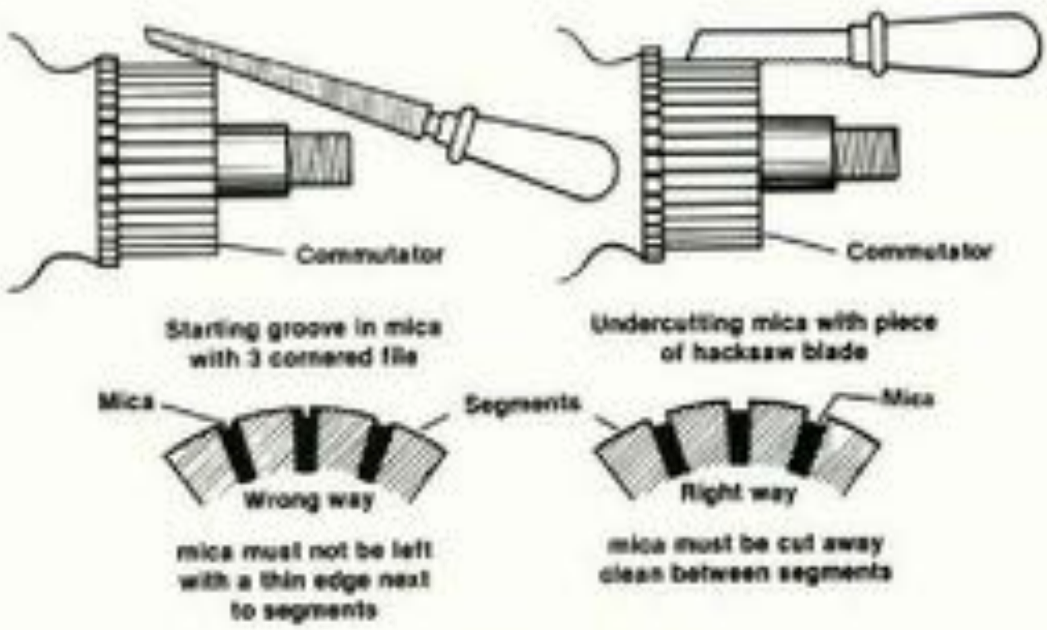


Figure 5-19. Recessing the Mica Separators

frame while placing the other probe against each of the brushes attached to the field coil.

NOTE

Be certain that the brush holder plate is not contacting the armature.

If either one of the field brushes indicate a ground, any reading other than infinite resistance, replace the brush holder plate.

ASSEMBLY (Figure 5-15)

1. Install armature (11) into frame (14). Install front cover (10).
2. Install brush holder (9) in frame (14).
3. Use a wire hook to pull brush spring up and install brushes (7 and 8).
4. Install thrust washer(s) (13) on armature (11) shaft.
5. Install rear cover (5), thru bolts (3) and lockwashers (2).
6. Secure brush plate assembly (9) to rear cover (5) with screws and lockwashers (4).

INSTALLATION (Figure 5-14)

1. With thru bolts installed through starter, install starter to housing with terminal to the front. Tighten thru bolts to 20-25 in-lbs torque.
2. Install battery cable to starter terminal, tighten starter terminal nut to 65-80 in-lbs torque.
3. Install starter bracket (2) over transmission studs and install nuts and washers (1 and 1a).
4. Install ground wire (4) and nuts and washers (3) to starter thru bolts.
5. Tighten nuts (1) to 12 ft-lbs torque, nut (1a) to 6 ft-lbs torque and nuts (3) to 20-25 in-lbs torque.

SOLENOID

GENERAL

The solenoid switch is designed to open and close the circuit electromagnetically. The switch consists basically 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.

TESTING THE SOLENOID

It is not necessary to remove the solenoid to test for continuity. Use the following procedure:

WARNING

Disconnect the battery cables (negative cable first) to prevent accidental start up of vehicle and possible personal injury.

1. See Figure 5-23. Disconnect wires 1, 2 and 3 from the solenoid.

2. See Figure 5-20. Connect a 12-volt battery with one post to the small diameter solenoid terminal and the second post to the shorter of the two larger diameter solenoid terminals.

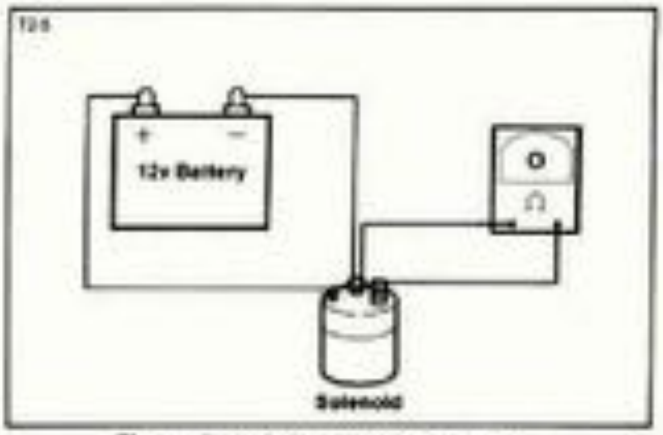


Figure 5-20. Solenoid On-Bike Test

3. See Figure 5-20. Check for continuity with an ohmmeter. With the vehicle battery disconnected and the test battery connected as shown, the ohmmeter should register zero ohms when connected across the two larger diamater terminals.

4. See Figure 5-21. Check the pull-in coil for continuity by touching the ohmmeter probes to the small diameter terminal and to the shorter of the two larger diameter terminals. There should be continuity (less than one ohm approximately .3 ohm resistance).

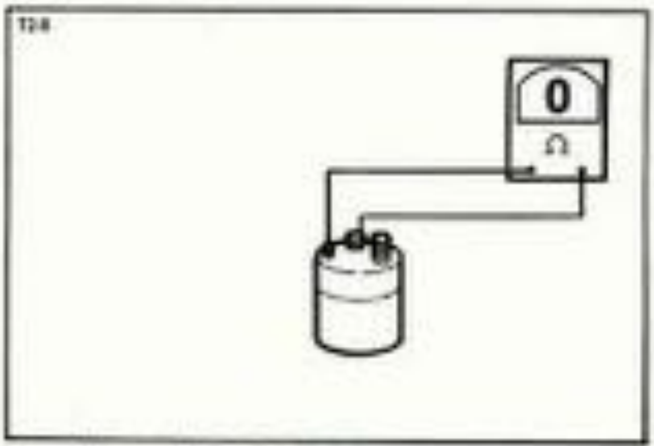


Figure 5-21. Testing Solenoid Pull-In Coil

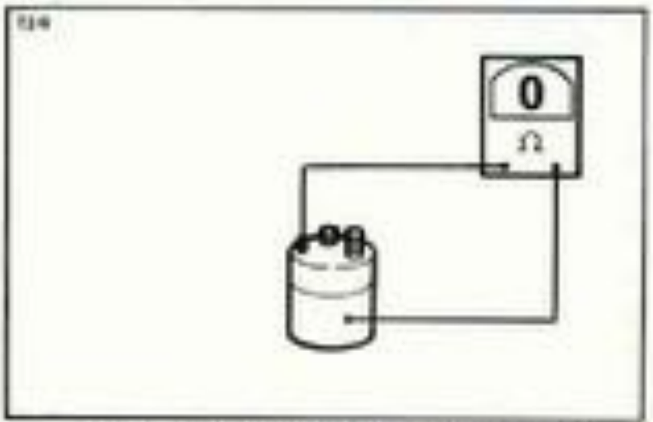


Figure 5-22. Testing Solenoid Hold-In Coil

5. See Figure 5-22. Check the hold-in coil for continuity by touching one ohmmeter probe to the solenoid case and the other probe to the smaller diameter terminal. Again there should be continuity less than one ohm approximately .6 ohm resistance.

REMOVAL (Figure 5-23)

WARNING

Disconnect the battery cables (negative cable first) to prevent accidental start up of vehicle and possible personal injury.

1. Loosen the nuts and disconnect the battery positive terminal (1) and starter motor cable (2).

2. Loosen the nut and disconnect the starter relay wire (3).

3. Remove the two mounting bolts and lockwashers (4). Remove the solenoid along with the spacer (5), spring and felt gasket.

1. Battery positive terminal (long)
2. Starter motor cable terminal (short)
3. Starter relay wire
   (small diameter terminal)
4. Bolt and lockwasher (2)
5. Spacer

Figure 5-23. Removing Solenoid

DISASSEMBLY (Figure 5-24)

1. Remove the two cover mounting screws (1), raise the cover (2) and remove the gasket (3).

2. If the studs are to be replaced, remove the nuts (4). Remove the stud (5) and copper plate (6). Remove stud (7) and stud (8) by cutting the wires as close to the studs as possible. Solder the wires to the new studs.

3. Remove the plunger assembly (9) and disassemble as follows: Remove the small spring (10), collar (11), plastic washer (12), copper washer (13), seat (14), large spring (15), collar (11), and spacer (26) from the plunger (16).

CLEANING, INSPECTION AND REPAIR (Figure 5-24)

1. If the copper washer (13) is grooved or burnt on one side, turn it over on the plunger. This will double the life of the washer.

2. Replace the studs if they are pitted, corroded or burnt.

3. Replace the cover (2) and gasket (3) if cracked or broken.

ASSEMBLY (Figure 5-24)

1. Lightly coat the surface of plunger (16) and the plunger bore in solenoid housing (17) with a brake type grease such as LUBRIPLATE 110. Position collar (11) so that it is seated in the second groove in plunger (16). Place spring (15) against collar (11) followed by seat (14), washer (13) and plastic washer (11). Carefully push collar (11) onto the plunger against stacked assembly until it seats in the first groove.

NOTE

The spacer (26) is required so that the inner plunger on certain FXB models, 1982 FLHC models, 1983 FXSB, FXDG and FLH models will travel far enough to allow the copper washer (13) to make contact between the battery terminal (5) and the starter motor terminal (8) of the starter solenoid, thus actuating the starter motor. Use this spacer if applicable. Not used on 1984 models.

CAUTION

Do not use this spacer in a starter solenoid that is functioning properly.

2. If the studs were removed install them into the cover and fasten them using the nuts (4).

3. Insert the plunger assembly into the solenoid housing. Stand the solenoid upright and place spring (10) on the end of plunger (16). Place gasket (3) on the face of the solenoid housing and carefully place cover (2) in position with spring (10) and plunger (16) entering the cover bore. Place washers (1) on screws (1) and insert each screw through cover (2) and thread into the tapped holes in the solenoid housing. Tighten screws (1) thoroughly.

CAUTION

When installing the cover, position the internal wires so they do not interfere with the copper washer travel. If wires are allowed to contact the washer, the wire insulation will eventually wear away causing the circuit to remain constantly closed.

INSTALLATION (Figure 5-23, 5-24)

1. Be sure gasket (18, Figure 5-24) is in good condition and install solenoid to primary cover with spacer (5) between solenoid and cover. Tighten mounting bolts (4) to 12 ft-lbs torque.

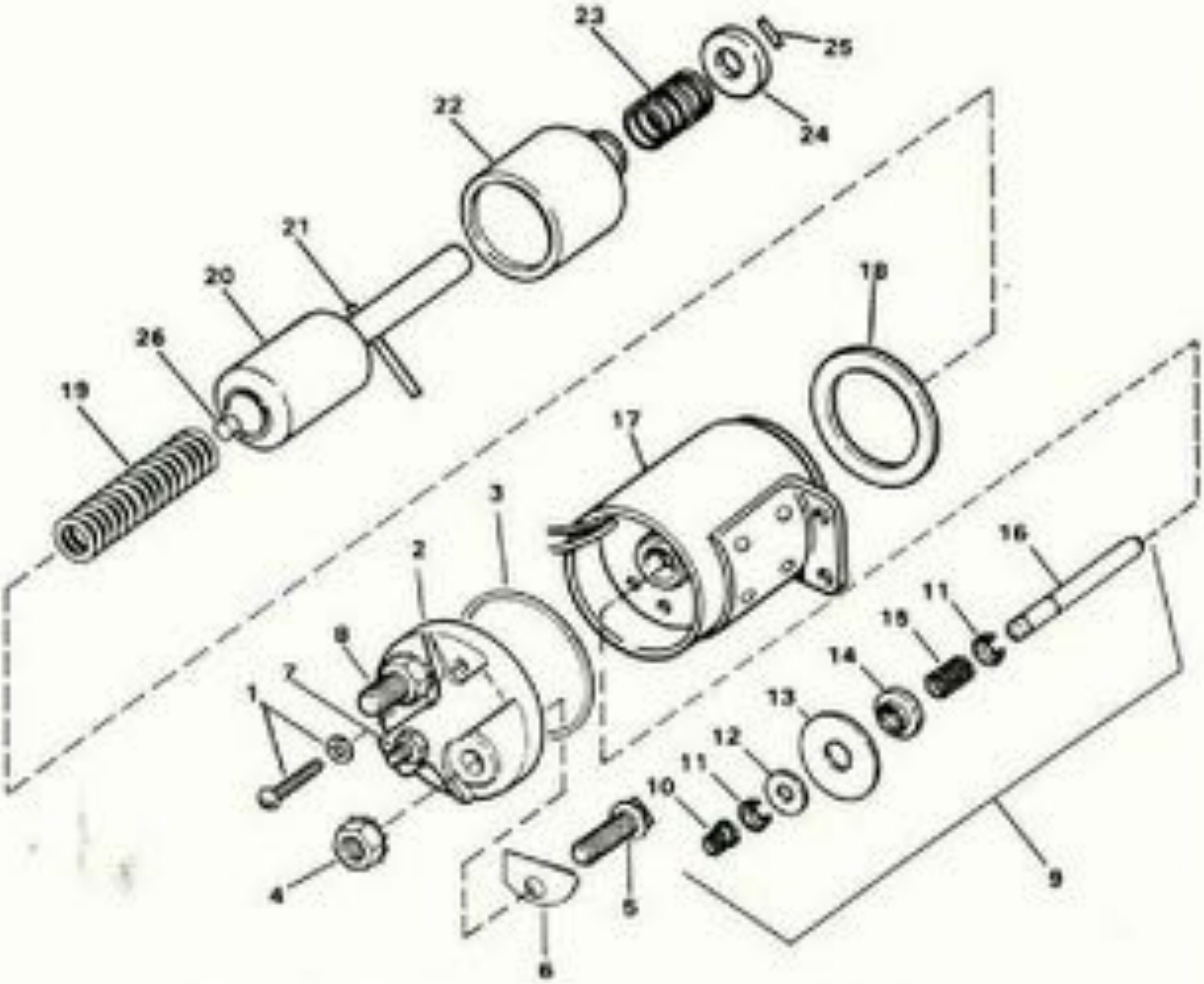
2. Install battery positive cable (1) to LONG solenoid stud. Place lockwasher under cable end.

3. Install starter motor cable (2) to SHORT solenoid stud. Place lockwasher under cable end.

4. Install starter relay wire (3) to small solenoid stud. Place lockwasher under wire end.

NOTE

After reassembly, on all models equipped with a primary chain, primary housing must be airtight. Check



1. Screw and washer (2)
2. Cover
3. Gasket
4. Nut and gasket (3)
5. Stud (positive battery)
6. Plate
7. Stud (starter relay)
8. Stud (starter motor connection)
9. Plunger assembly (inner)
10. Spring (small)
11. Collar (2)
12. Plastic washer
13. Copper washer
14. Seat
15. Spring (large)
16. Plunger
17. Solenoid
18. Felt gasket
19. Spring
20. Plunger (outer)
21. Pin (large)
22. Rubber boot
23. Spring
24. Collar
25. Pin (small)
26. Spacer

Figure 5-24. Solenoid — Exploded View

using VACUUM GAUGE, Part No. HD-96950-68. Remove one of the three screws securing the clutch inspection cover and in its place screw in the threaded fitting of the gauge. Then, with engine running, check gauge to see that there is a reading indicating 25 inches water vacuum at 2000 rpm. Perform check with vent hose to primary case pinched closed with a pliers. A lower reading indicates an air leak.

STARTER SHAFT AND GEAR HOUSING (1984 AND EARLIER ALL MODELS EXCEPT FXB/FXSB/FXDG 1982 FLHC, 1983 AND 1984 FLH AND 1984 FXWG)

REMOVAL (Figure 5-25)

WARNING

Disconnect the battery cables (negative cable first) to prevent accidental start up of vehicle and possible personal injury.

1. Remove starter mounting hardware and bracket, see STARTER Section.

NOTE

Starter may also be removed to ease removal of housing assembly (2).

2. Remove primary cover, see CLUTCH Section 6.

3. Remove drive gear housing mounting hardware (1) and drive gear housing assembly (2).

NOTE

Drive gear housing assembly (2) may be mounted to primary case one of three ways: two bolts and lockwashers from starter side, two studs, lockwashers and nuts, or front bolt and lockwasher from clutch side and rear bolt and lockwasher from starter side.

4. Remove oil deflector (3) and gasket (4).

NOTE

Gasket (4) was not used in pre 1981 production. It is recommended that this gasket be installed on pre 1981 motorcycles to ensure primary case seal. Gasket part no. is 60559-80.

5. From clutch side, remove pinion gear and shaft assembly (5) by disengaging fingers of shifter lever (7) from shifter collar (18).

6. Remove solenoid, see SOLENOID Section, and shifter lever screw (6) to remove shifter lever (7).

NOTE

It will be necessary to remove battery, battery carrier and oil tank mounting hardware to gain access to shifter lever screw (6).

CLEANING, INSPECTION AND REPAIR

Drive Gear Housing (2, Figure 5-25)

1. Remove, and inspect for wear, drive gear (8) and thrust washer (9) if used.

NOTE

If drive gear (8) is worn, also inspect starter gear for wear.

2. Inspect O-ring (10) (inside of oil deflector (3) and bearing (11)) inside housing (12) for wear. Replace if necessary. Lubricate bearing (11) with high temperature grease such as LUBRIPLATE 110®.

3. Lubricate and install thrust washer (9) if used, and drive gear (8) in housing (12).

Pinion Gear And Shaft Assembly (5, Figure 5-25)

1. Inspect thrust washer (14) and bearing (15) (inside outer primary cover) for wear. Inspect bearing surface of pinion shaft collar (16). If either bearing (15) or collar (16) are worn replace them both.

2. Inspect pinion gear (17). If pinion gear (17) is worn, also check clutch ring gear for wear.

3. Inspect fingers of shifter lever (7) and groove of shifter collar (18) for wear. If worn, replace these parts (7 and 18) as a pair.

4. To disassemble pinon gear shaft assembly (5), remove pinion shaft nut (19).

NOTE

Pinion shaft nut (19) is left-hand thread

5. Remove collar (16) and slide pinion gear (17) with shifter collar (18) attached from pinion shaft (20). Remove spacer (21).

6. To remove shifter collar (18) from pinion gear (17), remove lock ring (22).

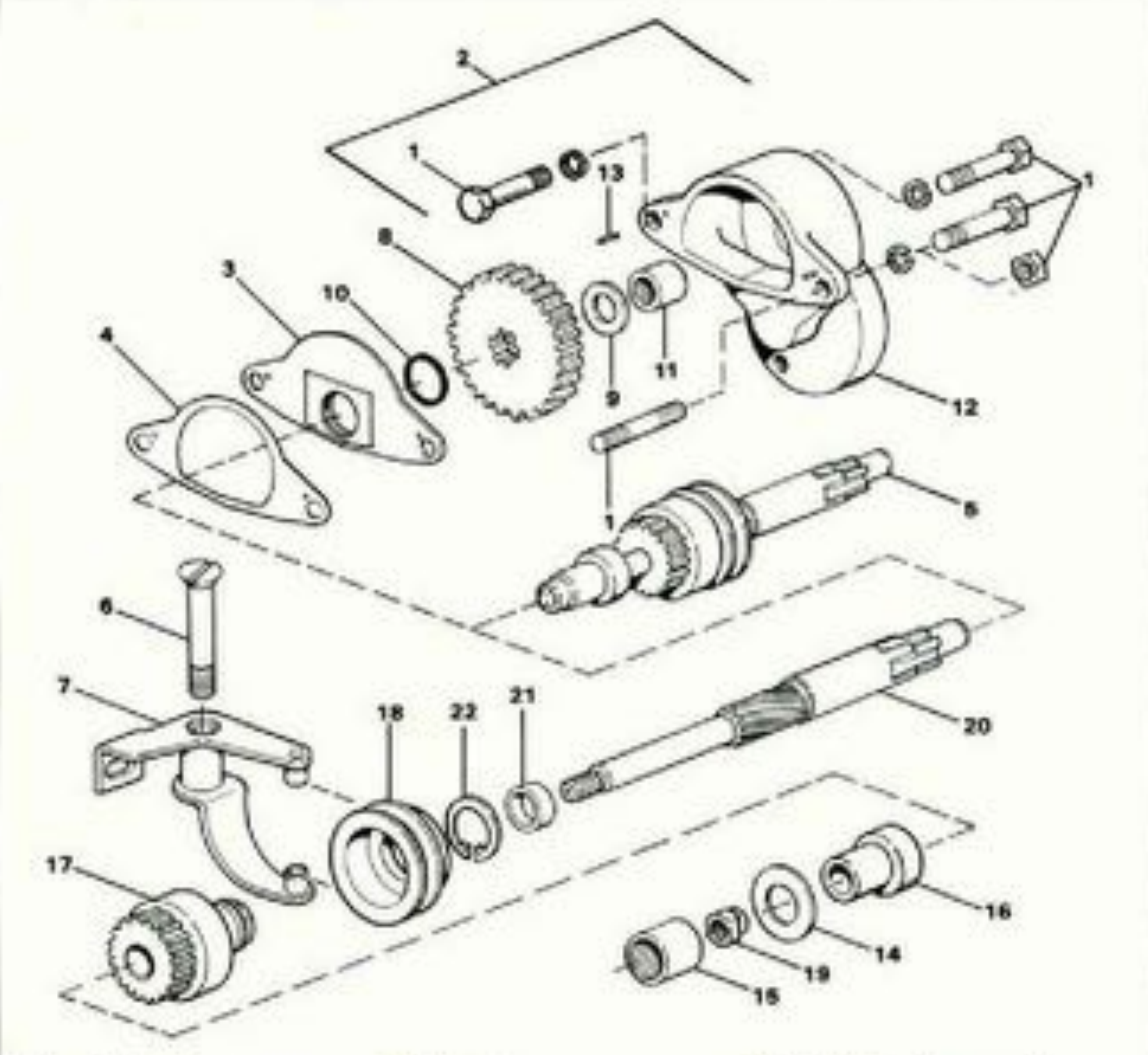
7. Clean, inspect for wear and lubricate pinion shaft assembly parts with high temperature grease such as LUBRIPLATE 110®.

8. Assemble lubricated pinion shaft assembly and tighten pinion shaft nut (19).

9. Lubricate shifter lever screw (6), shifter lever (7) fingers and bearing (15) with high temperature grease such as LUBRIPLATE 110®.

INSTALLATION (Figure 5-25)

1. Install shifter lever (7) fingers to shifter collar (18), and install assembly into inner primary case.



1. Housing hardware
2. Drive gear housing assembly
3. Oil deflector
4. Gasket
5. Pinion gear and shaft assembly
6. Shifter lever screw
7. Shifter lever
8. Drive gear
9. Thrust washer
10. O-ring
11. Bearing (in drive gear housing)
12. Drive gear housing
13. Locating pin (2)
14. Thrust washer
15. Bearing (in primary cover)
16. Pinion shaft collar
17. Pinion gear
18. Shifter collar
19. Pinion shaft nut (left hand thread)
20. Pinion shaft
21. Spacer
22. Lock ring

Figure 5-25. Starter Shaft Assembly and Drive Gear Housing — All Models Except FXB/FXSB, FXDG 1982 FLHC, 1983-1984 FLH Models and 1984 FXWG

2. Install lubricated shifter lever screw (6).

3. Install new gasket (4) and oil deflector (3).

NOTE

Gasket (4) must be installed between oil deflector (3) and inner primary cover.

4. Install drive gear housing assembly (2) with mounting hardware (1).

5. Install lubricated thrust washer (14) onto pinion shaft collar (16) and install primary cover, see CLUTCH Section 6.

6. Install starter (if removed) and starter mounting

hardware, see STARTER in this Section.

NOTE

After reassembly, primary chain housing must be air tight. Check using VACUUM GAUGE, Part No. HD-96950-68. Remove one of the three screws securing the clutch inspection cover and in its place screw in the threaded fitting of the gauge. Then, with engine running, check gauge to see that there is a reading indicating 25 inches water vacuum or more at 2000 rpm. Perform check with vent hose to primary case pinched closed with a pliers. A lower reading indicates an air leak.

STARTER SHAFT AND GEAR HOUSING (FXB/FXSB/FXDG 1982 FLHC, 1983-1984 FLH MODELS AND 1984 FXWG)

REMOVAL (Figure 5-26)

WARNING

Disconnect the battery cable (negative cable first) to prevent accidental start up of vehicle and possible personal injury.

1. Remove starter, see STARTER Section.
2. Remove primary cover, see CLUTCH Section 6.
3. Remove outer drive gear housing (3) by removing the two hex head bolts, washers and lockwashers (1), and the one allen head bolt (2).
4. Remove gasket (4) and drive gear (5).
5. Remove inner drive gear housing (7) by removing the two bolts (6).
6. Remove gasket (8).
7. From clutch side remove pinion gear and shaft assembly by disengaging fingers of shifter lever (10) from shifter collar (17).
8. Remove solenoid, see SOLENOID Section, and shifter lever screw (9) to remove shifter lever (10).

NOTE

It will be necessary to remove battery, battery carrier, and oil tank mounting hardware to gain access to shifter lever screw (9).

CLEANING, INSPECTION AND REPAIR

Drive Gear Housing (Figure 5-26)

1. Inspect drive gear (5) for wear.

NOTE

If drive gear (5) is worn, also inspect starter gear for wear.

2. Inspect bearing (11), pressed in outer drive gear housing half (3). Replace if necessary. Lubricate bearing (11) with high temperature grease such as LUBRIPLATE 110®.
3. Inspect seal (12), pressed in inner drive gear housing half (7). Replace seal if necessary with lip side toward drive gear.
4. Check to see that the four locating pins (22) are tight and gaskets (4 and 8) are in good condition.

Pinion Gear And Shaft Assembly (Figure 5-26)

1. Inspect thrust washer (13) and bearing (14) (inside primary cover) for wear. Inspect bearing surface of pinion shaft collar (15). If either bearing (14) or collar (15) is worn, replace them both.
2. Inspect pinion gear (16). If pinion gear (16) is worn, also check clutch ring gear for wear.
3. Inspect fingers of shifter lever (10) and groove of shifter collar (17) for wear. If worn, replace these parts (10 and 17) as a pair.
4. To disassemble pinion gear shaft assembly, remove pinion shaft nut (18).

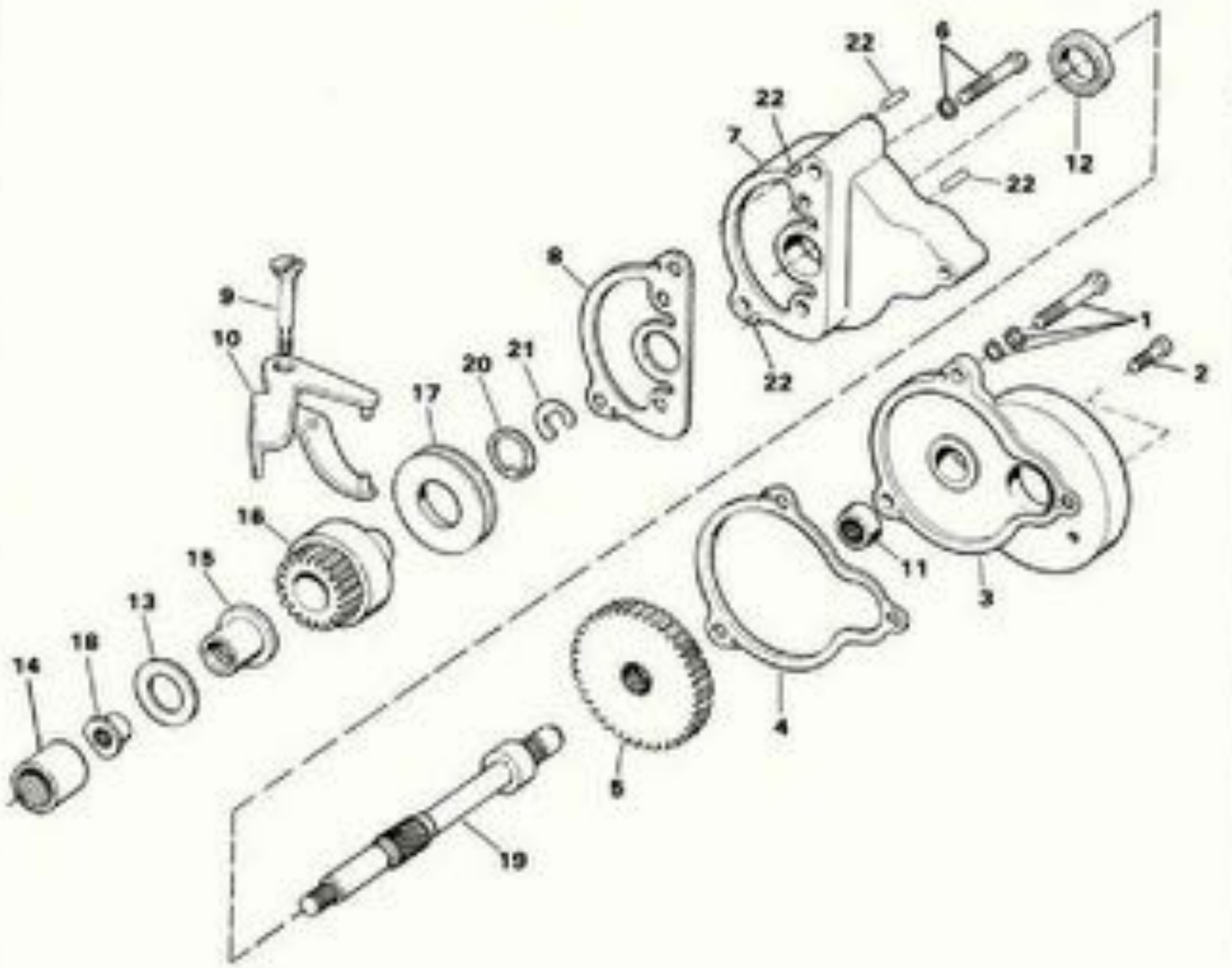
NOTE

Pinion shaft nut (18) is left-hand thread.

5. Remove collar (15) and slide pinion gear (16), with shifter collar (17) attached, from pinion shaft (19).
6. To remove shifter collar (17) from pinion gear (16) remove snap ring (20).
7. Check condition of pinion gear stop clip (21) and its groove in pinion shaft (19). Replace clip and/or shaft if worn (1983 and earlier FXSB only).
8. Clean, inspect and lubricate pinion shaft assembly parts with high temperature grease such as LUBRIPLATE 110®.
9. Assemble lubricated pinion shaft assembly and tighten pinion shaft nut (18).
10. Lubricate shifter lever screw (9), fingers of shifter lever (10) and bearing (14) with high temperature grease such as LUBRIPLATE 110®.

INSTALLATION (Figure 5-26)

1. Install shifter lever (10) and lubricated shifter lever screw (9), if removed.
2. Install pinion shaft assembly, line fingers of shifter lever (10) with groove in shifter collar (17).
3. Glue gasket (8) to inner drive gear housing (7). Install inner gear housing (7) over pinion shaft assembly and onto primary case lining up locating pins (6). Install the two mounting bolts and lockwashers (6) to secure inner drive gear housing.
4. Install lubricated drive gear (5) on pinion shaft.



1. Bolt, lockwasher and washer (2)
2. Allen head bolt
3. Outer drive gear housing half
4. Gasket
5. Drive gear
6. Bolt and lockwasher (2)
7. Inner drive gear housing half
8. Gasket
9. Shifter lever screw
10. Shifter lever
11. Bearing (in outer drive gear housing)
12. Seal (in inner drive gear housing)
13. Thrust washer
14. Bearing (in outer primary cover)
15. Pinion shaft collar
16. Pinion gear
17. Shifter collar
18. Pinion shaft nut (left hand thread)
19. Pinion shaft
20. Snap ring
21. Stop clip
22. Locating pins (4)

Figure 5-26. Starter Shaft Assembly and Drive Gear Housing — FXB/FXSB/FXDG 1982 FLHC, 1983-1984 FLH Models and 1984 FXWG

5. Cement gasket (4) to outer drive gear housing (3) and secure outer housing with the two hex head bolts, washers and lockwashers (1), and the one allen head bolt (2).

6. Install starter, see STARTER Section.

7. Install lubricated thrust washer (13) to pinion shaft collar (15) and install primary cover, see CLUTCH Section 6.

Starter Shaft

See Figure 5-27. Starting with VIN 1HD1BDK12BY017428, all 1981 FXB models have a new style STARTER SHAFT, Part No. 31310-80A. This shaft has an added shoulder in place of the retaining ring groove and RETAINING RING, Part No. 31310-80. The new shaft is a direct replacement for the old and should be used whenever replacing a starter shaft.

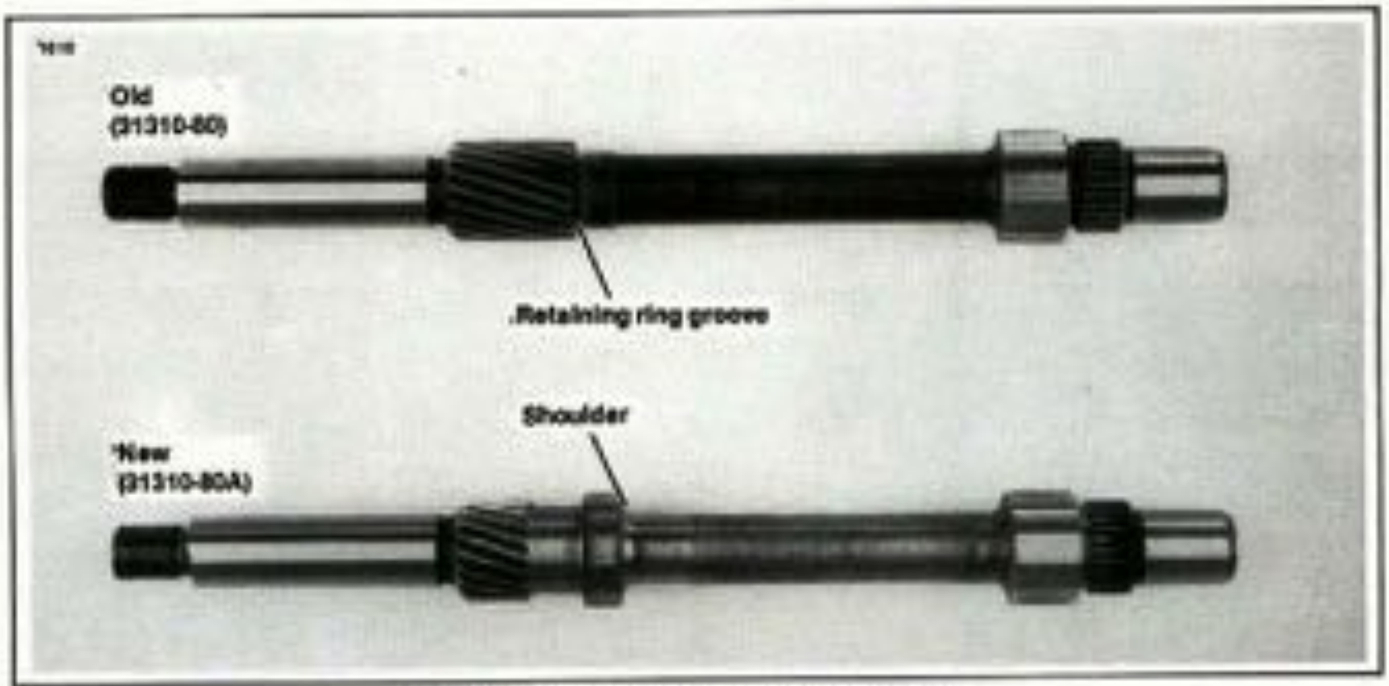


Figure 5-27. Old and New Style Starter Shafts

SUBJECT | PAGE NO.

1. Specifications 6-1
2. Primary Chain and Sprockets 6-3
3. Secondary Chain and Sprockets 6-4
4. Primary Belt and Sprockets 6-9
5. Secondary Belt and Sprockets 6-12
6. Dry Clutch 6-17
7. Wet Clutch 6-23
8. Primary Case 6-29

DRIVE

DRIVE

SPECIFICATIONS

CHAINS

Primary chain:
- Cold engine .... 5/8-7/8 in. slack
- Hot engine .... 3/8-5/8 in. slack

Rear chain .... 1/2 in. slack

BELTS

Primary .... 3/8-1/2 in. slack
Secondary .... 5/8-3/4 in. slack

CLUTCH

Type .... Dry-multiple disc
Capacity .... 206 ft-lbs torque
Spring pressure (total) .... 315 lbs
Spring adjustment .... 1-1/32 in. from pressure plate edge to releasing disc surface
Clutch lever free play .... 1/16 in.

LUBRICANTS

FXB/FXSB compensating sprocket rubber dampers .... Harley-Davidson POLY-OIL Part No. 99880-81
Rear chain .... Harley-Davidson CHAIN LUBE PLUS Part No. 99865-81
Harley-Davidson CHAIN SPRAY Part No. 99870-58
Primary chaincase (late 1984) .... Harley Davidson PRIMARY CHAINCASE LUBRICANT Part No. 99887-84

SPROCKETS

Sprocket	No. of teeth
Engine	24
Clutch	37
Transmission	
FL Models — Chain	22
— Belt	33
FX Models — Chain	23
— Belt	33
Rear wheel — Chain	51
— Belt	70

PRIMARY CASE

Vacuum 1978½ - early 1984 (with vent hoses pinched closed) .... 25 in. of water min. @ 1500 rpm

TORQUES

Primary cover screws .... 18-22 ft-lbs
Compensating sprocket nut .... 80-100 ft-lbs
Transmission sprocket locknut
- (early 83 and earlier) .... 105-120 ft-lbs
- (late 83 and later) .... 80-90 ft-lbs

CHAINS AND SPROCKETS

PRIMARY CHAIN

General

Inspect the chains periodically for cracked, broken or badly worn links. Chain adjustment must be checked every 2500 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.

Figure 6-1. Primary Chain Adjustment

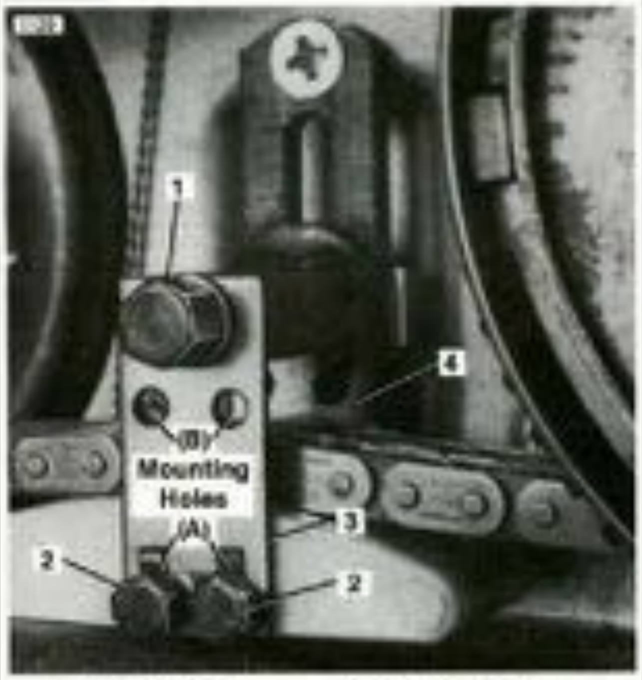
Adjustment (Figure 6-1)

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 slack should be equal to 5/8-7/8 in. with the engine cold and 3/8-5/8 in. with the engine hot. Adjust the chain as follows:

WARNING

Before primary chain cover is removed, disconnect battery cable from starter solenoid to prevent accidental starter operation and possible injury.

1. See Figure 6-1. Remove the primary case inspection cover.
2. Loosen the center bolt (1) and move the shoe assembly up or down to obtain the specified free play.
3. Tighten the bolt.
4. Reinstall the cover.



1. Center bolt
2. Mounting bolt (2)
3. Outer plate
4. Support bracket

Figure 6-2. Replacing the Adjusting Shoe

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 the center bolt (1) and two bottom bolts (2). Remove the shoe and replace it.

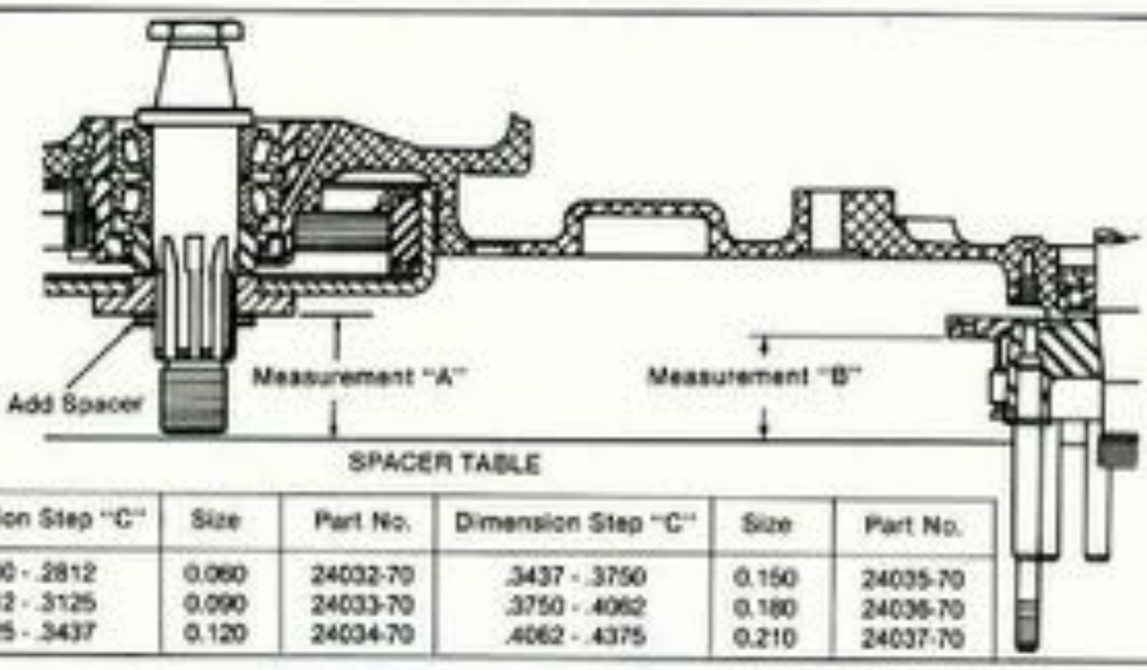
The outer plate (3) has two sets of mounting holes (A and B) so the entire assembly can be inverted to accommodate various sprocket sizes and chain lengths. To change over, perform steps 2-3.

2. Invert the shoe and attach it to the second set of mounting holes (B) using the two bolts (2).
3. Invert the support bracket (4) and outer plate (3). Reattach the assembly with the center bolt (1) engaged in the backplate.

Lubrication

A fixed amount of oil is supplied through an oil line running from the oil pump to the primary case. Oil drops on the chain from the oil outlet and is drawn back into the engine gearcase breather.

There is no adjustment for metering the oil. When the primary chain adjustment is checked every 2500 miles, check to see that oil comes out of the oil outlet. If oil does not come out of the outlet, check for restrictions in the oil hose and the oil outlet.



SPACER TABLE

Dimension Step "C"	Size	Part No.	Dimension Step "C"	Size	Part No.
.2500 - .2812	0.060	24032-70	.3437 - .3750	0.150	24035-70
.2812 - .3125	0.090	24033-70	.3750 - .4062	0.180	24036-70
.3125 - .3437	0.120	24034-70	.4062 - .4375	0.210	24037-70

Figure 6-3. Primary Chain Sprocket Alignment

Disassembly

The chain must be replaced when it is worn to the point that it cannot be properly adjusted.

WARNING

Disconnect the battery cables (negative cable first) to avoid accidental start-up of vehicle and possible personal injury.

1. Remove primary chain following procedure under clutch DISASSEMBLY given later in the section.
2. See Figure 6-4 or 6-5. Disassemble components of compensating sprocket.

Cleaning, Inspection And Repair

1. Inspect compensating sprocket components for wear and damage. Replace damaged or broken parts.
2. See Figure 6-4. Apply grease to cam lobes (4 and 5).
3. Inspect clutch sprocket for wear and damage. If broken or damaged teeth are found, the clutch shell and sprocket assembly must be replaced.
4. Inspect clutch shell bearing surface. If it is grooved or pitted, replace the clutch shell.

Sprocket Alignment Dry Clutch

The engine sprocket is aligned with the clutch sprocket by a variable thickness spacer installed between the alternator rotor and sprocket extension. Reinstall the same thickness spacer removed, or determine the correct spacer size as follows:

1. See Figure 6-3. Reinstall the clutch hub and take measurement "A" from the chain cover surface to the alternator rotor surface.
2. Take measurement "B" from the chain cover surface to the clutch disc friction surface.
3. Subtract "B" measurement from "A" measurement to determine which spacer listed in dimension "C" to use.

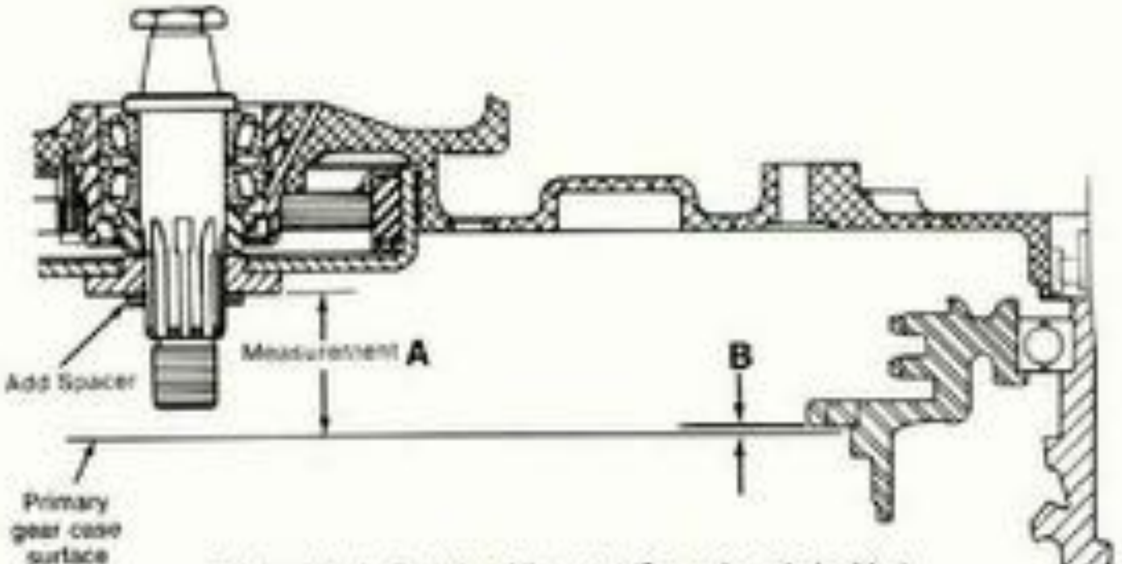
Sprocket Alignment Wet Clutch (Figure 6-4)

The method of sprocket alignment will differ slightly between vehicles equipped with secondary chains, or belt drives. This is due to the wider secondary belt sprocket which moves the clutch starter ring gear to a position outside the chaincase cover surface.

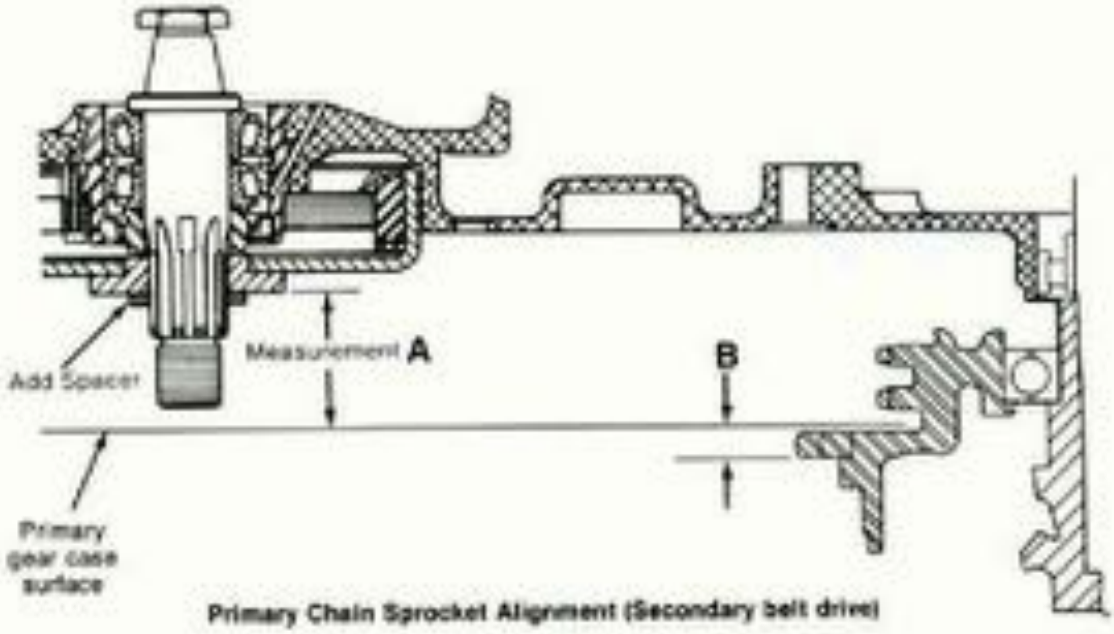
1. Install the clutch on the transmission without the chain. Tighten the nut to the proper torque taking care not to overtighten it since this could crack the clutch hub.

   Place a straightedge across the primary housing gasket surface and measure the distance between it and the face of the alternator rotor hub. Record this as Measurement A.

2. Now measure the clearance between the straightedge and the outer face of the ring gear. Record



Primary Chain Sprocket Alignment (Secondary chain drive)



Primary Chain Sprocket Alignment (Secondary belt drive)

Figure 6-4. Chain Sprocket Alignment

this as Measurement B. On rear belt drive models, the ring gear extends outside the primary gasket surface because the belt sprocket is wider than the chain sprocket. Here again, measure to the outer face of the ring gear.

3. On rear chain drive models add 1.633 in. to Measurement B and record this as Measurement C.

On rear belt drive models subtract Measurement B from 1.988 in. to obtain Measurement C.

REAR CHAIN	REAR BELT
Meas. B	1.988 in.
+ 1.633 in.	− Meas. B
= Meas. C	= Meas. C

4. Subtract Measurement C from Measurement A and round off your answer to the nearest .010 in. This will give you the thickness of the spacers needed

between the sprocket shaft extension and alternator rotor.

Choose the combination of spacers you will need from the Parts Catalog.

ALL MODELS
Measurement A
– Measurement C
= Spacer Thickness

Assembly

Assemble sprockets, chain and chain adjuster as an assembly following procedure under dry clutch or wet clutch ASSEMBLY. Make sure correct spacer (6, Figure 6-6) is used.

SECONDARY CHAIN AND SPROCKETS

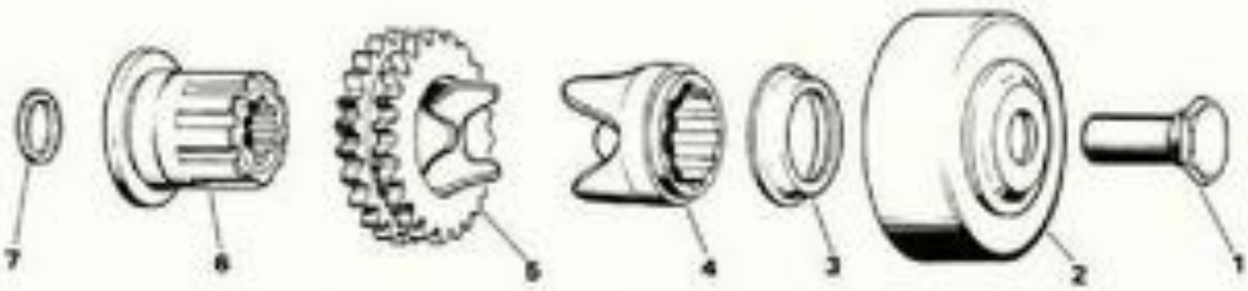
General

The rear wheel sprocket is bolted to the rear wheel. Replacement procedures are given in Section 2.

The transmission sprocket is located on the mainshaft between the primary chain housing and the transmission case.

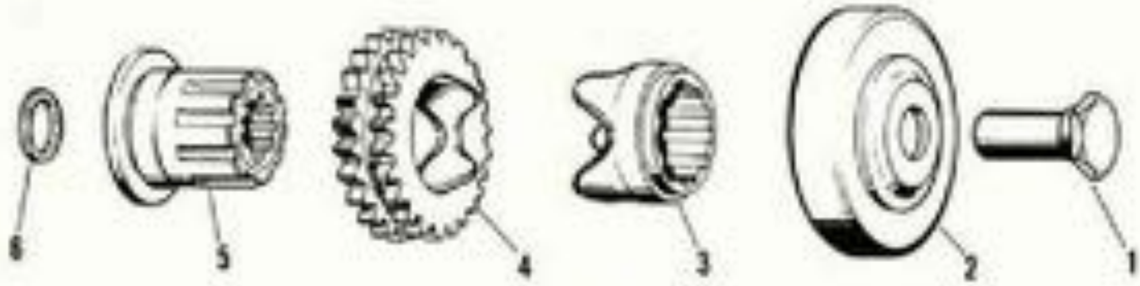
Adjustment (Figure 6-7)

1. Remove the cotter pin (1). Loosen the brake caliper anchor nut (2) and the axle nut (3).
2. With the motorcycle upright, the transmission in neutral and with normal rider weight (one or two persons) on the vehicle, check for proper chain adjustment at the lower span midway between sprockets. A properly adjusted chain should have 1/2 in. free up and down movement midway between the transmission sprocket and the rear wheel sprocket.
3. If the chain adjustment is not correct turn the adjusting nuts (4) clockwise to tighten the chain and counterclockwise to loosen the chain. Turn each adjusting nut an equal number of flats or turns to keep the rear wheel in alignment.



1. Nut
2. Cover
3. Cup
4. Sliding cam
5. Compensating sprocket
6. Shaft extension
7. Spacer (variable thickness)

Figure 6-5. 1983 and Earlier Compensating Sprocket



1. Nut
2. Cover
3. Sliding cam
4. Compensating sprocket
5. Shaft extension
6. Spacer (variable thickness)

Figure 6-6. 1984 Compensating Sprocket

1. Cotter pin
2. Brake anchor nut
3. Axle nut
4. Axle adjusting nuts
5. Rear axle
6. Rear chain

Figure 6-7. Adjusting Rear Chain

Rear axle must remain parallel with swing arm pivot shaft. See REAR WHEEL ALIGNMENT PROCEDURE in Section 2. Check the rear wheel alignment.

4. When readjustment is completed, tighten axle nut (3) to 65-70 ft-lbs torque. Tighten brake anchor nut (2) finger tight. Install cotter pin (1). The FXST motorcycle does not have a cotter pin through the brake anchor nut. The brake anchor locknut on FXST vehicles must be tightened to 20-22 ft-lbs torque.

NOTE

Once the chain adjusters have reached their limit and proper chain adjustment can no longer be achieved, replace rear chain.

Lubrication (Figure 6-8)

1982 and earlier models are equipped with a rear chain oiler. At regular 300 mile intervals, make a close inspection of rear chain. If rear chain does not appear to be getting sufficient lubrication, or if there is evidence of an over-supply of oil, readjustment should be made with rear chain oiler adjusting screw. The rear chain oiler is located on the oil pump as shown. Normal setting is 1/4 turn open which provides 2 or 3 drops per minute.

Figure 6-8. Rear Chain Oiler Adjustment

If chain oiler is not being used, during the pre-ride inspection, brush dirt off chain and lubricate with Harley-Davidson CHAIN SPRAY or CHAIN LUBE PLUS.

If the motorcycle is operated under extremely dusty or dirty conditions, thorough cleaning and lubrication of the rear chain may be advisable from time to time. Under these conditions, proceed as follows:

CLEANING CHAIN OILER

Normal setting of adjusting screw is 1/4 turn open. If orifice becomes blocked it will be necessary to clean as follows:

1. Remove adjusting screw and clean orifice with compressed air.
2. Re-install adjusting screw and turn it inward until it bottoms on its seat.
3. Turn adjusting screw outward 1/4 turn.

LUBRICATION — UNUSUAL CONDITIONS

If motorcycle is operated under extremely dusty conditions, additional lubrication of the rear chain may be advisable from time to time. Lubricate as follows:

1. Remove the rear chain as described in REMOVING AND INSTALLING THE REAR CHAIN.
2. Soak and wash the chain thoroughly in a pan of solvent such as kerosene.
3. Remove chain from solvent and blow dry with com-

pressed air. After chain is completely dry, apply Harley-Davidson CHAIN SPRAY or CHAIN LUBE PLUS. Follow the instructions on the label.

4. Wipe all surplus lubricant from chain surface and install the chain.

5. Inspect the connecting link and spring clip for wear. Replace them if they are in bad condition.

See Figure 6-9. Be sure clip is correctly and securely locked on pin ends with open end trailing direction of chain travel.

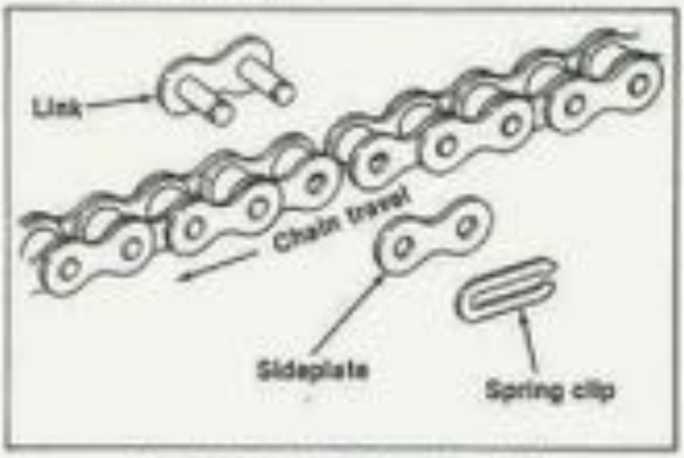


Figure 6-9. Chain Connecting Link

Removing and Installing

1. See Figure 6-9. Locate and remove the spring clip on the chain connecting link.

2. Using CHAIN TOOL, Part No. HD-95021-29A, press the connecting link from the side plate.

3. Place transmission in neutral. Connect one end of the new chain to the old chain using the connecting link and side plate. Run the chain on the sprockets until the new chain is on both the wheel and transmission sprockets.

4. Disconnect the old chain from the new chain.

5. Using CHAIN ASSEMBLY TOOL, Part No. HD-97334-80, connect the ends of the new chain with a new connecting link, side plate and spring clip. Make sure that the spring clip open end trails the direction of chain travel.

TRANSMISSION SPROCKET

Removal

1. Remove primary chain and case as described under primary case REMOVAL later in this section.

2. Bend tabs on lockwasher away from sprocket nut or on later vehicles remove the socket head cap screw installed next to one of the nut flats. Apply rear brake and remove the sprocket nut using SPROCKET NUT WRENCH, Part No. 94660-37. Nut has a left hand thread.

3. Disconnect rear chain as described earlier and remove the transmission sprocket, lockwasher and nut.

Cleaning, Inspection And Repair

1. Clean sprocket of all grease and dirt using solvent.

2. If teeth are worn to a fish hook shape, sprocket must be replaced. Replace sprocket if there is any damage or cracks.

Installation

1. Place sprocket on main drive gear and install lockwasher and nut. Make sure inner tabs on lockwasher fit inside splines of sprocket.

2. Install rear chain as described earlier making sure spring clip open end trails the direction of chain travel.

3. On 1983 and earlier vehicles apply rear brake and tighten sprocket nut to 105-120 ft-lbs torque. Bend tabs on lockwasher over nut flats. On late 1983 and 1984 vehicles apply rear brake and tighten sprocket nut to 80-90 ft-lbs torque. Turn the sprocket nut an additional amount, just enough to

Figure 6-10. Securing Sprocket Nut

expose one of three locking screw holes. The proper hole location in relationship to the nut is shown in Figure 6-10. Coat threads of locking screw with Loctite LOCK-N-SEAL. Install locking screw in the exposed hole and tighten to 50-60 in-lbs torque.

exposed hole and tighten to 50-60 in-lbs torque.

4. Install primary chain and case as described under primary case ASSEMBLY later in this section.

BELTS AND SPROCKETS

PRIMARY BELT

General

The primary belt inner tooth surface has a thin coating of polyethelene lubricant. During initial operation, this coating will wear off as it is burnished into the belt fabric and the material will collect in the inner primary housing. This is a normal condition and not an indication of belt wear.

Adjustment (1980 and Early 1981)

Belt tension is set at the factory and should be checked every 10,000 miles. The belt is non-adjustable and must be replaced if tension measurement exceeds 1 in. with 10 lbs. of force applied at the mid-point of the top strand of the belt.

Adjustment (Late 1980 and Later)

Belt tension is set at the factory and should be checked every 10,000 miles. The belt must be adjusted if tension measurement exceeds 1 in. with 10 lbs. of force applied at the mid-point of the belt's bottom strand.

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 primary cover and gasket.

2. See Figure 6-11. Cut and remove safety wire, loosen four 5/16 in . dia. bolts securing primary case to crankcase.

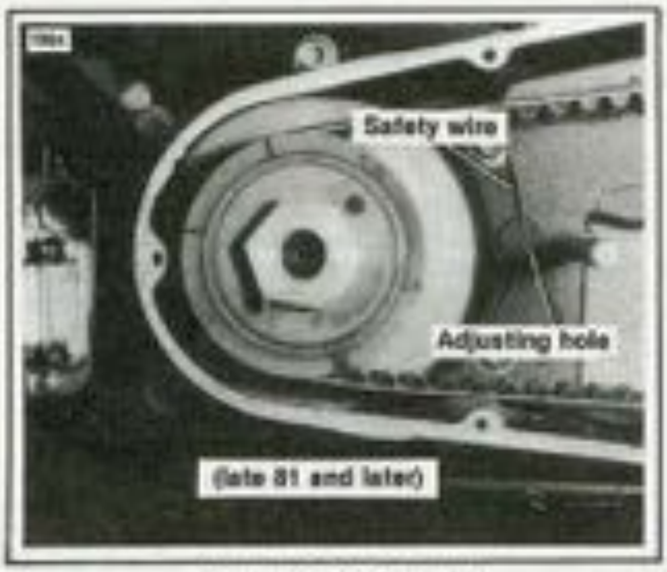


Figure 6-11. Safety Wire

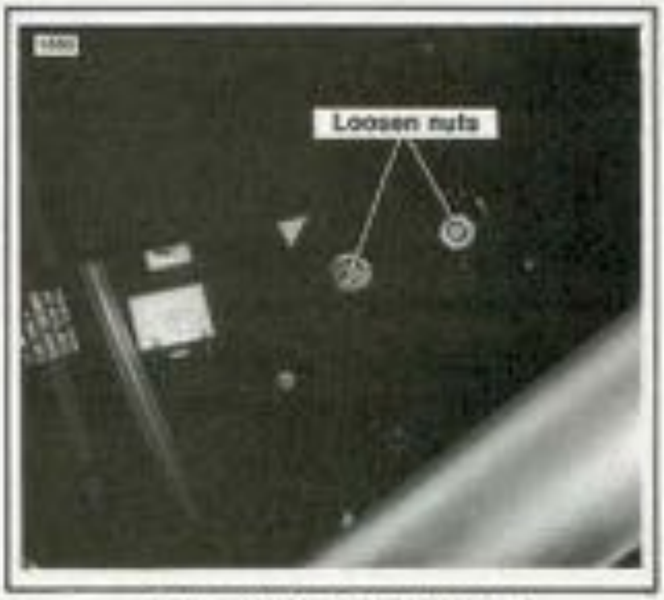


Figure 6-12. Starter Motor Frame

3. Loosen four nuts securing transmission to transmission mounting plate and bolt securing transmission to frame tab.

4. See Figure 6-12. Loosen two nuts securing starter motor.

5. See Figure 6-13. Carefully insert a screwdriver, or similar tool through hole in housing. Pry against crankcase to increase tension on belt.

   Check belt free play; increase or decrease belt tension, as necessary, until free play is within specifications shown. Insufficient free play will result in clutch drag; excess free play will be felt as PLAY in the drive train, with accompanying noise.

   Holding screwdriver in place, to maintain correct tension, tighten two inside bolts to 19 ft-lbs torque. Tighten two outside bolts to 19 ft-lbs torque.

NOTE

Some vehicles manufactured just after the design change was implemented will not have a hole drilled through the case. Carefully pry between the alternator rotor and primary case to increase belt tension.

6. See Figure 6-11. Install a new safety wire through inside bolts.

CAUTION

Operation of the vehicle without a safety wire could cause severe damage within primary case.

7. Tighten four nuts securing transmission to transmission mounting plate to 18-22 ft-lbs torque. Tighten bolt securing transmission to frame tab to 18-22 ft-lbs torque.

8. See Figure 6-12. Tighten two nuts securing starter motor.

9. Reinstall primary cover and new gasket.

NOTE

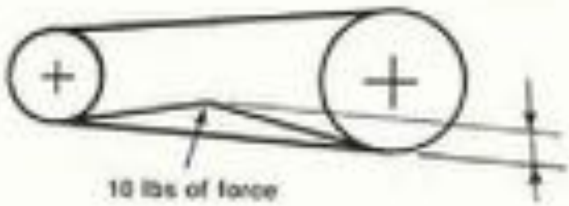
(See Figure 6-16) The inner primary housing has one mounting slot that has been ground out to provide belt clearance. Instead of using eight mounting screws of the same length, the FXB/FXSB/FXDG uses seven long screws and one short screw. The shorter screw must be mounted in the position shown.

10. Perform the following adjustments per SERVICE MANUAL instructions.

A. Adjust rear brake pedal free play.

B. Adjust and align secondary drive belt.

C. Adjust clutch cable.



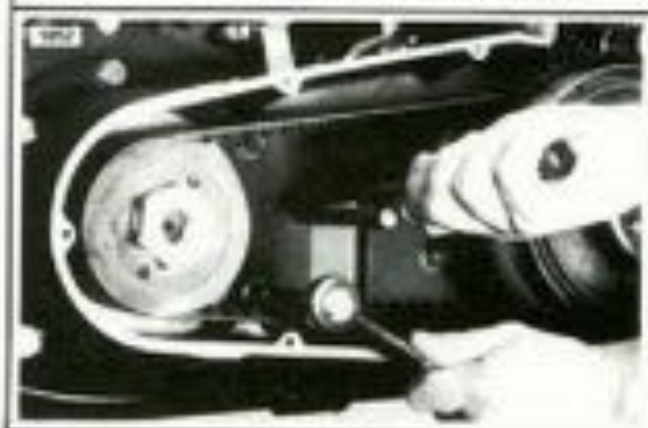


Figure 6-13. Primary Belt Adjustment

D. Adjust shifter linkage.

WARNING

All adjustments must be checked before vehicle is operated to avoid possible damage to vehicle and possible personal injury.

11. Reinstall battery cables, positive cable first.

Disassembly/Assembly (Figure 6-14)

1. Perform Steps 1-5 under CLUTCH disassembly later in this section.

2. Remove the set screw (3). Push the outer plate (4), rubber dampers (6, 7), hub (8) and inner plate (9) out of the compensating sprocket (5).

NOTE

The compensating sprocket has one set screw (3). The purpose of this set screw is to keep the holes in the outer plate aligned with holes in the hub in case a puller is required to remove the sprocket assembly.

3. The rubber dampers (6, 7) should be lubricated every 10,000 miles with Harley-Davidson POLY-OIL, Part No. 99860-81.

4. Assemble the compensating sprocket parts as shown in Figure 6-14.

5. Perform the alignment procedure listed under SPROCKET ALIGNMENT.

6. Perform Steps 1 and 2 under CLUTCH assembly later in this section.

SPROCKET ALIGNMENT

WARNING

Disconnect the battery cables (negative cable first) to avoid accidental startup of vehicle and possible personal injury.

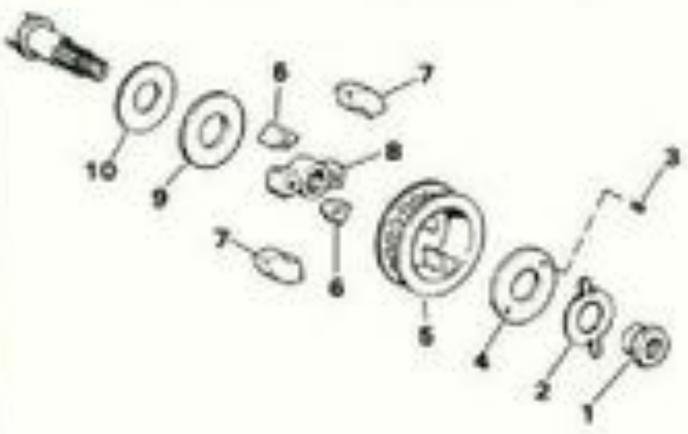
NOTE

Engine compensating sprocket is aligned with clutch sprocket by a selection of spacers between the compensating sprocket hub and alternator rotor hub. Reinstall same thickness of spacers as you removed, or determine the correct spacer size(s) as follows:

1. Remove the clutch shell assembly and compensating sprocket (See Figure 6-15) to determine spacer thickness as follows:

EXAMPLE (refer to Figure 6-15)

A. Measure from primary housing gasket surface to alternator rotor hub surface . . . . 1.750 in.



NOTE

When reassembling the compensating sprocket, it should look like this when viewed from the front with the outer plate removed.

1. Nut
2. Lockwasher
3. Set screw
4. Outer plate
5. Compensating sprocket
6. Rubber damper (small)
7. Rubber damper (large)
8. Hub
9. Inner plate
10. Spacer (variable thickness)

Figure 6-14. Belt Drive Compensating Sprocket

B. Measure from primary housing gasket surface to clutch hub friction surface .... 1.437 in.

C. Subtract measurement (Step B) from measurement (Step A) .... .313 in.

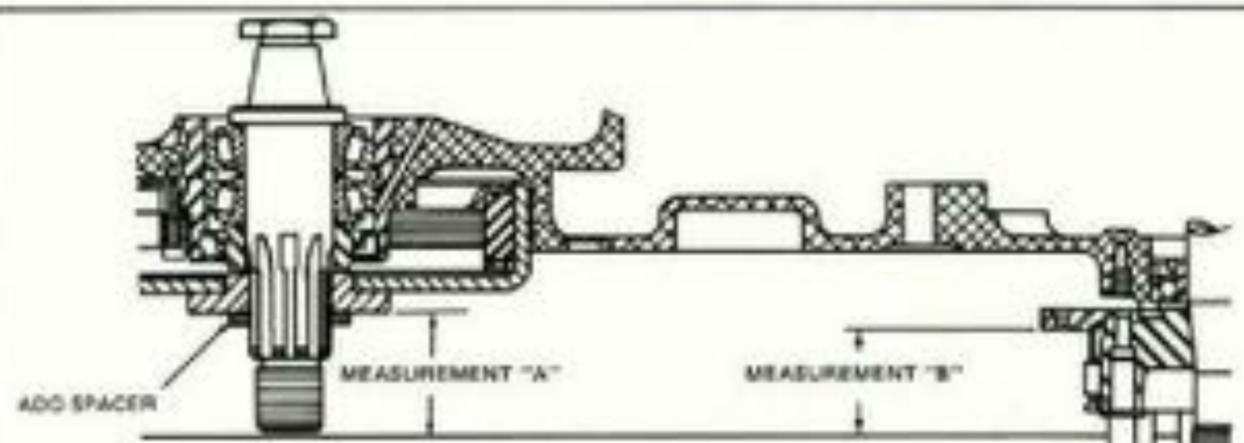
D. Spacer thickness from table .... .060 in.

NOTE

The compensating sprocket contains a set screw. The only purpose for this screw is to hold the outer bearing plate in the proper relationship to the hub which provides accessibility to the holes required to mount the hub puller.

2. Install spacer(s) determined in procedure outlined in Step 1.

3. Reinstall compensating sprocket, lockplate and nut. Tighten nut to 80-100 ft-lbs torque and fold



SPACER TABLE

Dimension Step "C"	Size	Part No.	Dimension Step "C"	Size	Part No.
.324 – .304	0.060	24054-80	.264 – .254	0.010	24051-80
.304 – .284	0.040	24053-80	.254 – .244	0.000	None
.284 – .264	0.020	24052-80			

Figure 6-15. Aligning the Primary Belt

Figure 6-16. FXB/FXSB/FXDG Primary Housing

edge of lockplate against nut flat to hold nut in place.

4. Reinstall cover.

NOTE

(See Figure 6-16.) The inner primary housing has one mounting slot that has been ground out to provide belt clearance. Instead of using 8 mounting screws of the same length, the FXB/FXSB/FXDG uses 8 long screws and 1 short screw. This shorter screw must be mounted in the position shown.

SECONDARY DRIVE BELT AND SPROCKET

The secondary belt inner tooth surface has a thin coating of polyethelene lubricant. During initial operation, this coating will wear off as it is burnished into the belt fabric. This is a normal condition and not an indication of belt wear.

Adjustment And Alignment

Belt tension is set at the factory and should be checked after the first 500 miles and every 10,000 miles thereafter (See Figure 6-15). When 10 lbs of force is applied at the midpoint of the belt's bottom strand, deflection should equal 5/8 to 3/4 in. with rear wheel on the ground and one rider sitting on the motorcycle.

1. See Figure 6-18. Loosen the axle nut (1). Remove the cotter pin and loosen the brake anchor nut (2). Turn adjusting nuts (3) as necessary to move axle and correctly adjust belt tension. Turn each adjuster nut (3) an equal number of turns to keep the wheel aligned. To move axle frontward, loosen adjuster nuts an equal number of turns and tap lightly on ends of adjuster studs (4).

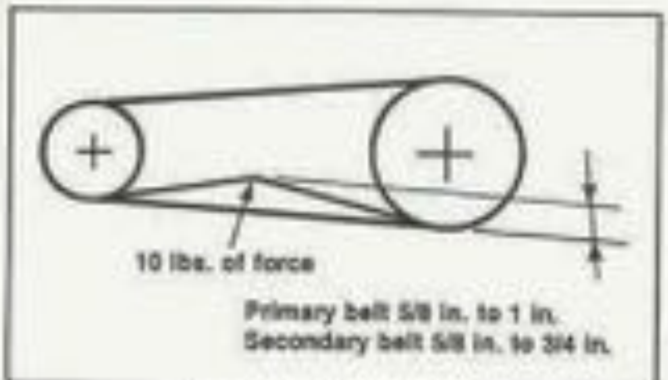
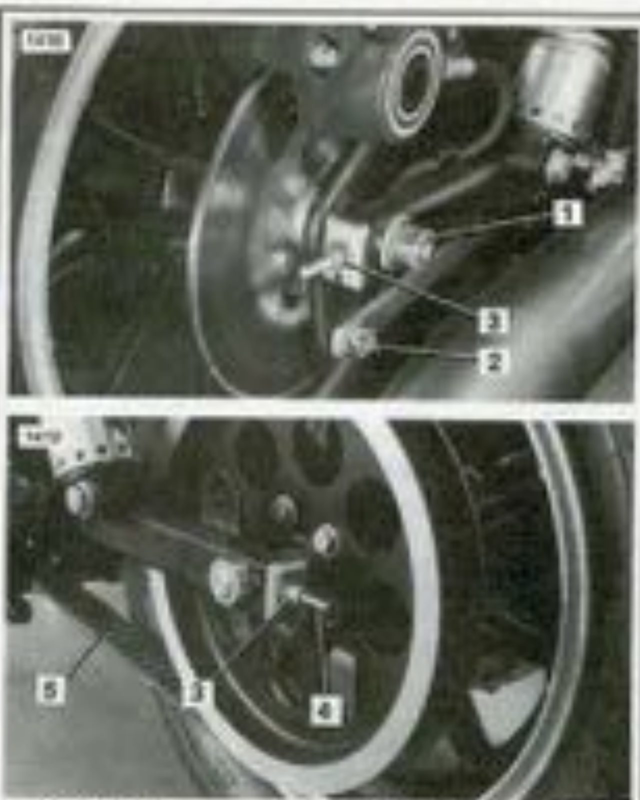


Figure 6-17. Belt Tension



1. Axle nut
2. Brake anchor nut and cotter pin (1982 & earlier)
3. Axle adjusting nuts
4. Axle adjusting studs
5. Belt

Figure 6-18. Secondary Belt Adjustment

2. See Figure 6-20. On 1983 and earlier vehicles lay a straightedge across the side of the rear wheel sprocket near the bottom. The distance between the edge of the belt and the straightedge must be equal along the full length of the straightedge. Turn the adjuster accordingly to correct any misalignment.

See Figure 6-19. On 1984 models a debris deflector prevents checking belt alignment at the bottom of the belt sprocket. To check belt alignment on 1984 vehicles it is necessary to remove the two bolts attaching the chain guard to the swing arm and removing the guard, to provide adequate clearance. On FLH models it will be necessary to remove the left hand saddlebag prior to

1. Straight edge
2. Rule

Figure 6-19. Checking Belt Alignment

removing the guard. Belt alignment is then checked at the top of the sprocket in the same manner as done at the lower end of the sprocket.

3. Re-check the belt tension.

4. Tighten axle nut to 50 ft-lbs torque. Tighten the brake anchor nut finger tight and re-install new cotter pin.

Figure 6-20. Secondary Belt Alignment

Removal And Installation

1. Follow the removal procedures as described under REAR WHEEL.

2. Remove the compensating sprocket and clutch as described under CLUTCH later in this section.

3. Remove the primary housing as described later in this section.

4. Remove the rear swing arm.

5. Remove the old belt from the transmission sprocket and install the new belt. See Caution.

CAUTION

The old belt, if it is to be reused, or a replacement belt must be handled carefully to prevent bending stress. The belts must never be formed into a loop smaller than 3 inches in diameter. Sharp bending can weaken the belt to such an extent that a premature failure will result.

6. Install the rear swing arm.

7. Install the primary housing as described later in this section.

8. Re-install the compensating sprocket, primary belt and clutch as described under CLUTCH later in this section.

9. Follow the installation procedures as described in REAR WHEEL.

TRANSMISSION SPROCKET

Removal

1. Remove primary belt and case as described under primary case REMOVAL later in this section.

2. Bend tabs on lockwasher away from sprocket nut or on later vehicles remove the socket head cap screw installed next to one of the nut flats. Apply rear brake and remove the sprocket nut using SPROCKET NUT WRENCH, Part No. HD-94660-37. Nut has a left hand thread.

3. Remove rear belt as described earlier and remove the transmission sprocket, lockwasher and nut.

Cleaning, Inspection And Repair

1. Clean sprocket of all grease and dirt using solvent.

2. Replace sprocket if there is any damage or cracks.

Installation

1. Place sprocket on main drive gear and install lockwasher and nut. Make sure inner tabs on lockwasher fit inside splines of sprocket.

2. Install rear belt as described earlier.

3. On 1983 and earlier vehicles apply rear brake and tighten sprocket nut to 105-120 ft-lbs torque. Bend tabs on lockwasher over nut flats. On late 1983 and 1984 vehicles apply rear brake and tighten sprocket nut to 80-90 ft-lbs torque. Turn the sprocket nut an additional amount, just enough to expose one of three locking screw holes. The proper hole location in relationship to the nut is shown in Figure 6-10. Coat threads of locking screw with Loctite LOCK-N-SEAL. Install locking screw in the exposed hole and tighten to 50-60 in-lbs torque.

4. Install primary belt and case as described under primary case ASSEMBLY later in this section.

GENERAL

The clutch assembly is located in the primary case. When clutch slips under load or drags in the released position check TROUBLESHOOTING in Section 1 and the ADJUSTMENTS in this section. If the clutch does not work after performing the adjustments, proceed to the DISASSEMBLY procedures. It is not necessary to remove the transmission when disassembling the clutch.

ADJUSTMENTS

Adjusting the Clutch Cable (Figure 6-21, 6-22)

The clutch hand lever should have approximately 1/16 in. free play before disengaging the clutch.

1. Loosen the adjusting sleeve locknut (2).
2. Turn the threaded sleeve (1) out for less free play or in for more free play.

Figure 6-21. Adjusting Clutch Free Play

Adjusting the Clutch

If the clutch cable sleeve is adjusted to the maximum limit and the clutch still does not operate properly, perform the following adjustments.

1. See Figure 6-23. Move the release lever forward as far as it will go. Measure the clearance as shown. If measurement is equal to the distance shown, proceed to Step 6. If measurement is not equal, proceed with Steps 2 through 5.
2. See Figure 6-22. Loosen the locknut (2). Turn the adjusting sleeve (1) all the way into the bracket (3).
3. See Figure 6-24. Remove the clutch cover on the primary cover. Loosen the push rod locknut (1) and turn the screw (2) outward so there is no tension on the push rod.

1. Adjusting sleeve
2. Locknut
3. Bracket

Figure 6-22. Clutch Cable Adjustment

4. See Figure 6-22. Turn the adjusting sleeve (1) outward until the proper measurement as shown in Figure 6-23 is obtained. Tighten the locknut (2).
5. See Figure 6-24. Turn the screw (2) inward until contact is made with the push rod, then back off 1/8 turn. Tighten the locknut (1).

If the clutch slips after performing Steps 1-5, proceed to Step 6.

6. See Figure 6-24. Increase the tension on the spring adjusting nuts (3) 1/2 turn at a time until clutch holds. Test after each 1/2 turn by cranking the engine with the rear wheel raised off the ground. Do not increase spring tension any more than is necessary to make the clutch hold.

NOTE

A new clutch is assembled so the distance from the pressure plate edge (4, Figure 6-24) to the releasing disc (5, Figure 6-24) is exactly 1-1/32 in. If springs are compressed so this distance is 7/8 in. or less, the clutch will probably not disengage.

7. Check the distance between the pressure plate edge and releasing disc to make sure it is equal at all points.
8. Perform Steps 1-5 again.

If clutch will not hold after making these adjustments, repair the unit as described under CLUTCH.

DISASSEMBLY

WARNING

Disconnect the battery cables (negative cable first) to

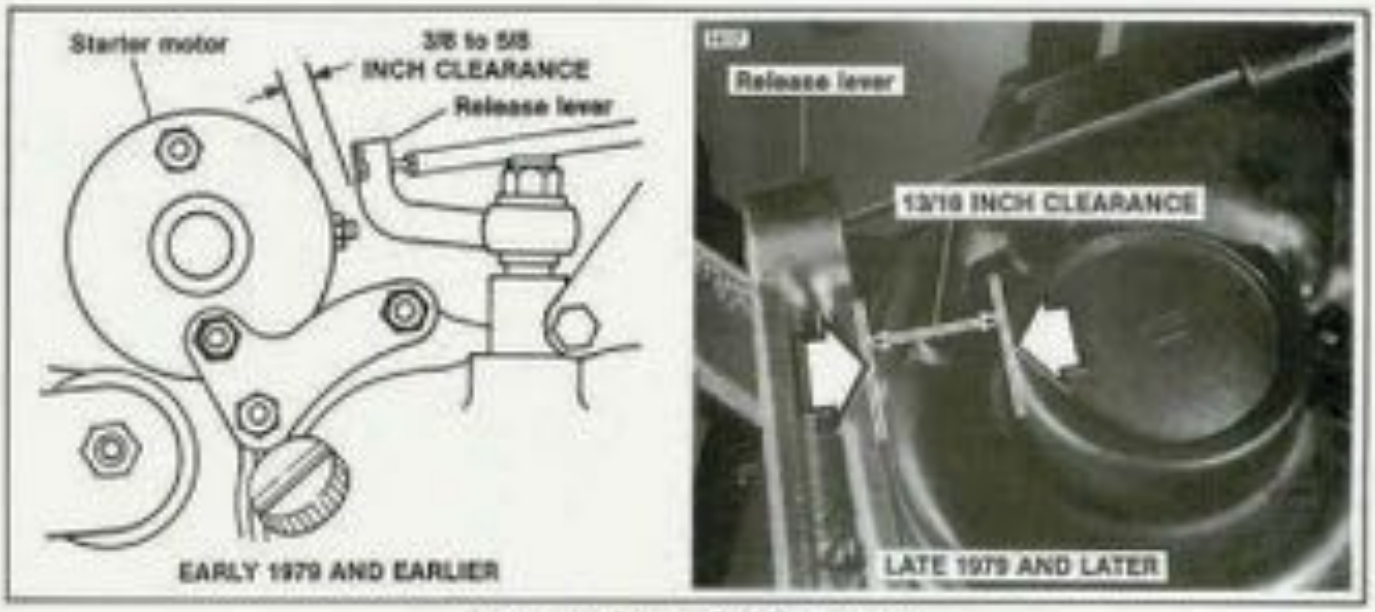


Figure 6-23. Release Rod Measurement

avoid accidental start-up of vehicle and possible personal injury.

1. Remove the primary cover. On FL models, remove the footboard and exhaust pipe from the left side.

2. See Figure 6-25. Remove push rod adjusting screw locknut. Place a flat washer (1) (1/8 in. thick, 1-3/4 in. diameter and 3/8 in. inside diameter) over the adjusting screw and replace the locknut.

   Tighten the locknut until the spring adjusting nuts (2) are free, then remove the nuts.

3. See Figure 6-28. Remove the pressure plate (4), springs (5) and releasing disc (6) as an assembly. Do not disassemble these parts unless replacement is necessary.

4. Remove the steel discs (7) and lined friction discs (8).

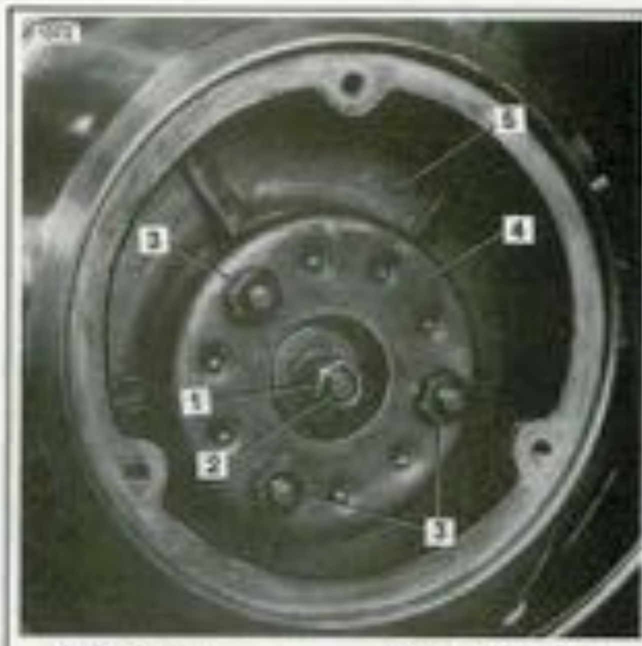
5. See Figure 6-26. Remove the bolt (1) and engine compensating sprocket nut (2). Remove the clutch shell, compensating sprocket chain and adjuster or belt.

NOTE

On belt drive models, the compensating sprocket nut has a tabbed lockwasher behind it. Pry the tab away from the nut before removing the nut.

6. See Figure 6-28. Pry back the ear on the lockwasher (11). Remove the clutch hub nut (10) using the CLUTCH HUB NUT WRENCH, Part No. HD-94045-41. Nut has a left-hand thread. Remove the lockwasher (11).

7. See Figure 6-27. Remove the clutch hub using CLUTCH HUB PULLER, Part No. HD-95960-41A.



1. Locknut
2. Adjusting screw
3. Spring adjusting nuts
4. Pressure plate
5. Releasing disc

Figure 6-24. Push Rod Adjustment

Slip the puller plate onto hub studs and secure it with the spring adjusting nuts.

Turn the tool center bolt clockwise until hub breaks free from end of shaft. Remove the clutch hub key (13).

CLEANING, INSPECTION AND REPAIR (Figure 6-28)

Wash all parts, except for lined discs, in cleaning solvent and blow dry with compressed air.

1. Flat washer 2. Spring adjusting nuts

Figure 6-26. Clutch Assembly

1. Bolt
2. Compensating sprocket nut

Figure 6-28. Compensating Sprocket Mounting

Examine the clutch for the following:

1. Glazed friction disc surface recognizable as a shiny, smooth and sometimes darkened appearance.
2. Oil impregnated friction discs.

Figure 6-27. Removing Clutch Hub

3. Worn or grooved lining surface.
4. Lining thickness worn down to 1/32 in. or less.
5. Cracked or chipped linings.
6. Steel discs grooved or warped.

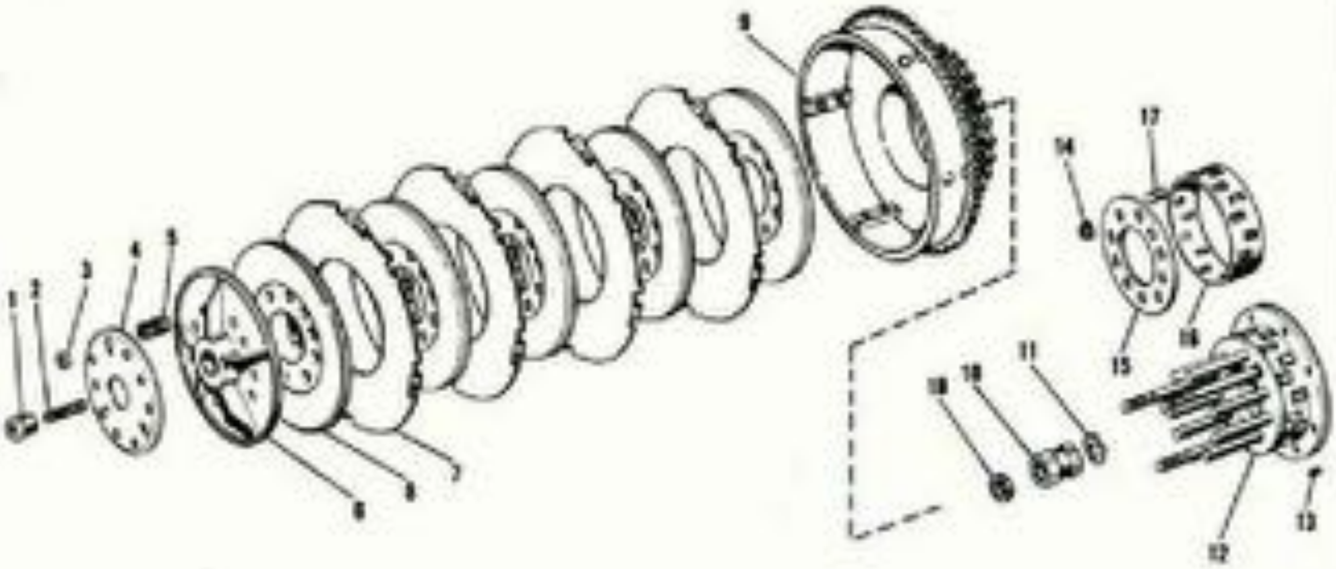
If any of the afore mentioned conditions described are found, replace discs.

7. On 1978½-1980 models depress steel disc buffer balls. If they don't snap back in place, spring is worn and buffer assembly must be replaced. 1981 and later models do not have the buffer assemblies.

NOTE

Replacement steel disc (7) no longer has buffer assemblies.

8. Check bearing race inside clutch shell. If it appears grooved or pitted, replace the clutch shell.
9. Spin the clutch hub roller bearing assembly (14, 15, 16, 17) If it sticks or feels rough, remove the three springs (14). Slip bearing plate (15) off hub pins and remove bearing retainer (16). Inspect the bearing race and replace hub if necessary.
10. Check the clutch spring (5) length and compression. Spring free length should be 1-45/64 in. Check spring compression using the VALVE SPRING TESTER, Part No. HD-96796-47. Compression



1. Push rod adjuting screw locknut
2. Adjusting screw
3. Spring tension adjusting nut (3)
4. Pressure plate
5. Springs (10)
6. Releasing disc
7. Steel disc (4)
8. Friction disc (5)
9. Clutch shell
10. Clutch hub nut (left hand thd.)
11. Hub nut lockwasher
12. Clutch hub
13. Clutch hub key
14. Bearing plate spring (3)
15. Bearing plate
16. Bearing retainer
17. Bearing roller
18. Hub nut seal

Figure 6-28. Clutch Assembly

should be 30-38 lbs. at 1-1/4 in. Replace the springs if they don't meet these specifications.

11. Check the seal (18) and replace it if worn or damaged.

ASSEMBLY (Figure 6-28)

1. Place key (13) in slot on mainshaft and slip clutch hub assembly onto shaft. Install oil seal (18) into nut (10) and install lockwasher (11) and nut (10) on mainshaft. Tighten nut to 50-60 ft-lbs torque. Bend lockwasher ear over nut flat.

2. Grease clutch shell bearing and install clutch shell, primary chain and adjuster (or belt) and compensating sprocket as an assembly. On belt drive models, install the lockwasher behind the compensating sprocket nut. Tighten compensating sprocket nut to 80-100 ft-lbs torque.

3. Install lined and steel discs (8 and 7) as shown. Install steel discs with side stamped OUT facing outward. On 1978½-1980 models, stagger the steel disc buffers in shell.

4. If parts 1, 2, 4, 5 and 6 have been disassembled, assemble as follows: Place retaining disc (6) on hub. Position springs (5) on hub pins and studs. Place pressure plate (4) over springs. Stud holes are arranged so collar will only fit one way. Assemble nut (1) onto stud (2) until stud is flush with top of nut. Install stud into place with 1-3/4 in. washer under nut.

5. Turn nut (1) down and install adjusting nuts (3). Remove 2-3/4 in. washer and reinstall nut (1). Draw down adjusting nuts until distance from pressure plate edge to releasing disc is exactly 1-1/32 in.

6. Make final adjustments as described under ADJUSTMENTS.

7. Install primary cover with a new gasket.

NOTE

On primary chain drive models, primary case must be airtight. Check using VACUUM GAUGE, Part No. HD-96950-68. Remove one of the three screws securing the clutch inspection cover and in its palce screw in the threaded fitting of the gauge. Then, with engine running, check gauge to see that there is a reading indicating 25 inches water vacuum or more at 2000 rpm. Perform check with vent hose to oil tank pinched closed with a pliers. A lower reading indicates an air leak into primary case either at gasket, solenoid, starter shaft or hoses.

WET CLUTCH

GENERAL

The new big twin clutch is termed a diaphragm spring clutch or wet clutch. Oil is now added to the primary chaincase and the primary drive chain runs in an oil bath.

When clutch slips under load or drags in the released position, check TROUBLESHOOTING in section 1 and ADJUSTMENTS in this section. If the clutch does not work after performing the adjustments, proceed to the DISASSEMBLY procedures. It is not necessary to remove the transmission when disassembling the clutch.

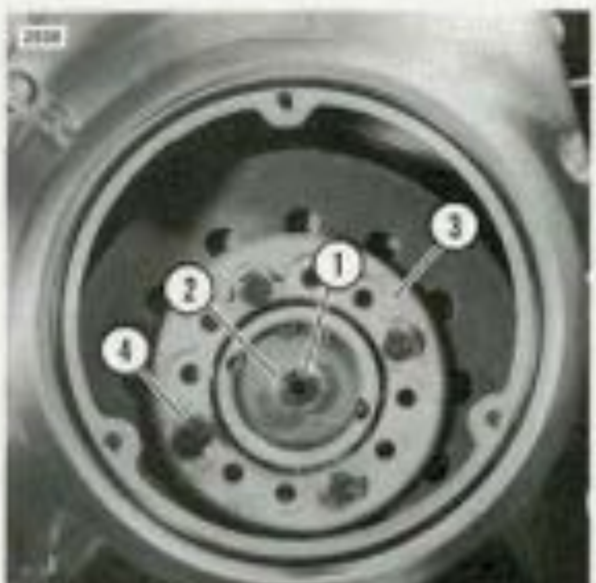
ADJUSTMENTS

Clutch Cable

CAUTION

The Print-O-Seal gasket between the chain adjustment inspection cover and the chaincase cover must be replaced each time the cover is removed.

1. Stand vehicle upright and level.
2. Remove the clutch cable from the release lever.
3. Remove the clutch inspection cover.
4. See Figure 6-29. Loosen locknut (2) and turn adjuster screw (1) to position the release lever 13/16 in. from the tower on transmission cover (See Figure 6-30). Apply light pressure to the release lever to eliminate pushrod free play.



1. Adjuster screw
2. Locknut
3. Adjuster plate
4. Bolt

Figure 6-29. Push Rod Adjustment

Figure 6-30. Release Lever Measurement

5. Use allen wrench to hold adjuster screw in place and tighten locknut (2).
6. Attach clutch cable to release lever.
7. See Figure 6-31. Turn the adjusting screw (1) outward until 1/16 in. clutch lever free play is established. Tighten locknut (2).

1. Adjusting Screw
2. Locknut
3. Bracket

Figure 6-31. Clutch Cable Adjustment

Figure 6-32. Adjusting Clutch Free Play

8. Check primary chaincase lubricant level.

9. Install clutch inspection cover and new nylon washers to screws and tighten.

Diaphragm Spring Clutch

NOTE

Use a .010 in. feeler gauge to check gap between straight edge and diaphragm spring.

1. See Figure 6-34. Lay a straightedge across the face of diaphragm spring (4). The spring should be flat within .010 in (See Figure 6-33). If the spring is bowed outward (convex), the adjuster plate is moved to the next hole position of greater compression. If the spring is dished inward (concave), the adjuster plate should be moved to the next hole position of less compression.

2. See Figure 6-35. If an adjustment is required, remove bolts (1) by backing out each, alternately, 1/2 to 1 turn at a time until spring pressure is relieved. Position adjuster plate (2) at the mounting holes which will give the correct adjustment.

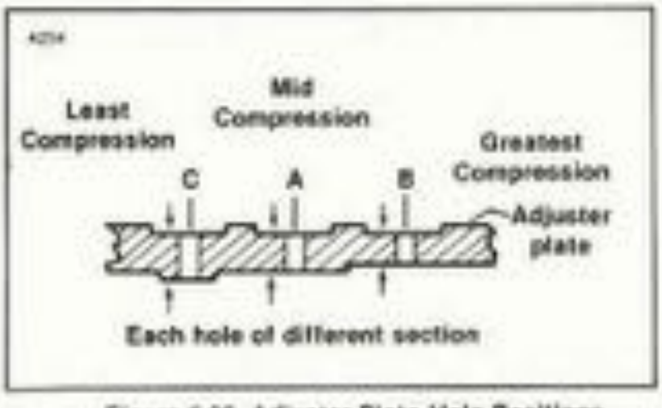


Figure 6-33. Adjuster Plate Hole Positions

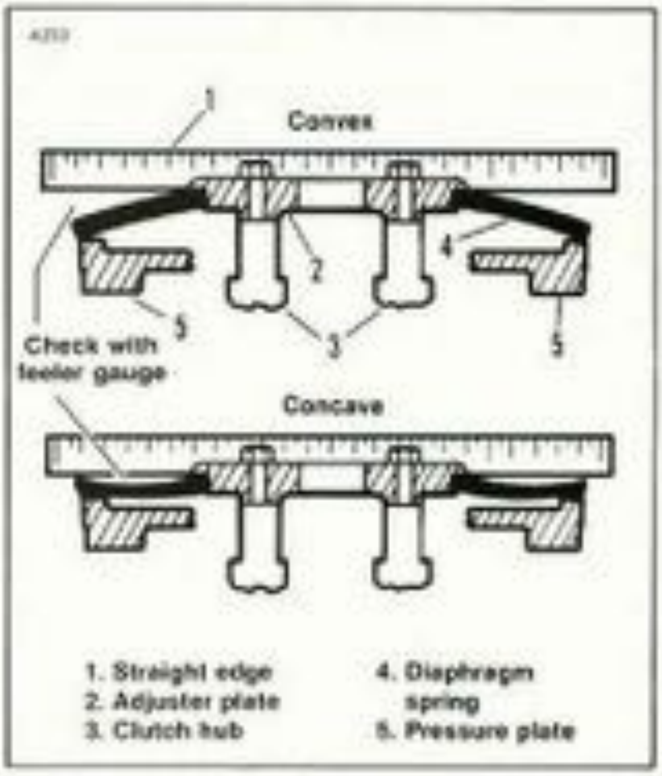


Figure 6-34. Checking Diaphragm Spring Adjustment

3. Reinstall bolts (1) and tighten alternately in a cross pattern to 6.5 - 8 ft-lbs.

NOTE

A new set of friction plates is required when the grooved lining surface has worn smooth. New friction discs can be installed, or inspected, without removing the clutch hub and drum assembly. See DISASSEMBLY.

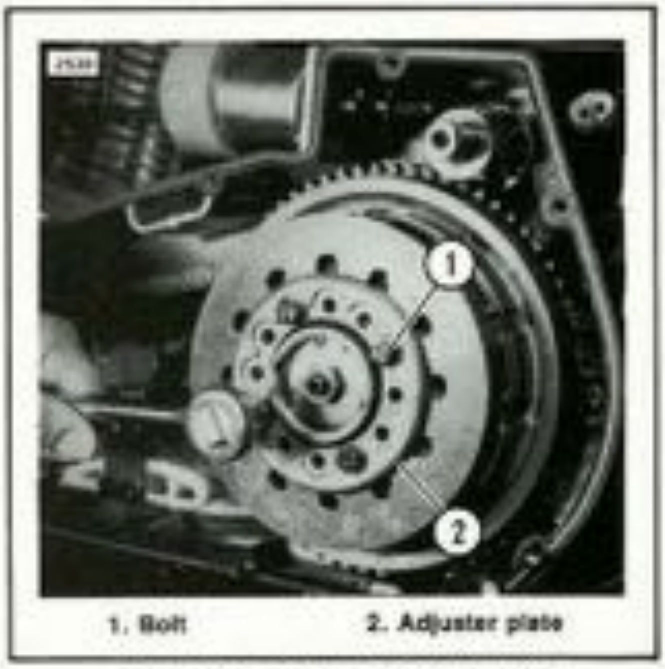


Figure 6-35. Adjuster Plate Removal

DISASSEMBLY

WARNING

Disconnect the battery cables (negative cable first) to avoid accidental start-up of vehicle and possible personal injury.

1. See Figure 6-35. Remove adjuster plate retaining bolts (1) with washers and lockwashers.

2. See Figure 6-38. Remove the adjuster plate (5), spring diaphragm (1) and pressure plate (2).

NOTE

The friction plates (3) can be changed or inspected without any further disassembly.

CAUTION

The nut and transmission shaft have left hand threads.

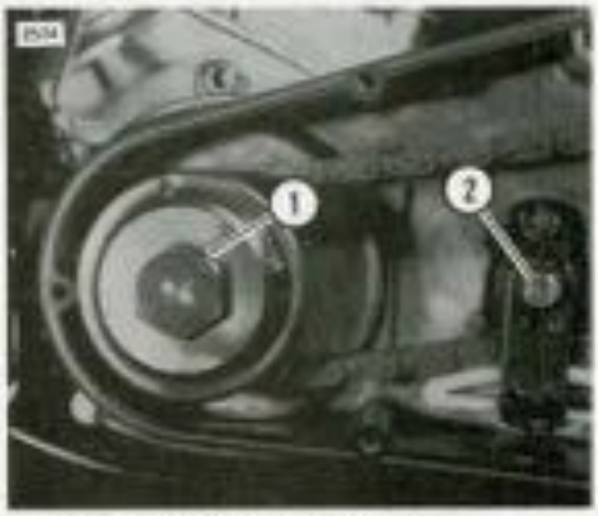
3. See Figure 6-38. Remove nut (18) from the end of transmission mainshaft. Remove push rod end piece.

CAUTION

The push rod end piece must be removed prior to the installation of the clutch puller to prevent damage to related components.

4. See Figure 6-36. Attach the Harley-Davidson CLUTCH PULLER, Part No. HD-95960-52B to the clutch hub.

Figure 6-36. Pulling Clutch Hub Drum Assembly



1. Compensating sprocket nut
2. Nut and washer

Figure 6-37. Compensating Sprocket Mounting

5. See Figure 6-37. Remove the nut and washer (1) and engine compensating sprocket nut (2). Pull the clutch hub-drum assembly while removing the compensating sprocket and chain with adjuster.

6. See Figure 6-38. Remove the steel discs (4) and friction plates (3).

7. With lock ring pliers, remove internal circlip (9) and external circlip (7).

8. Because of possible damage to the pilot bearing (10), the clutch drum and hub assembly should not be disassembled unless the bearing, hub or drum require replacement. If parts require replacement, press clutch hub out of bearing inner race using an arbor press.

CAUTION

Do not press hub out of bearing unless the bearing, clutch hub or clutch drum is to be replaced.

9. Press pilot bearing (10) out of clutch drum.

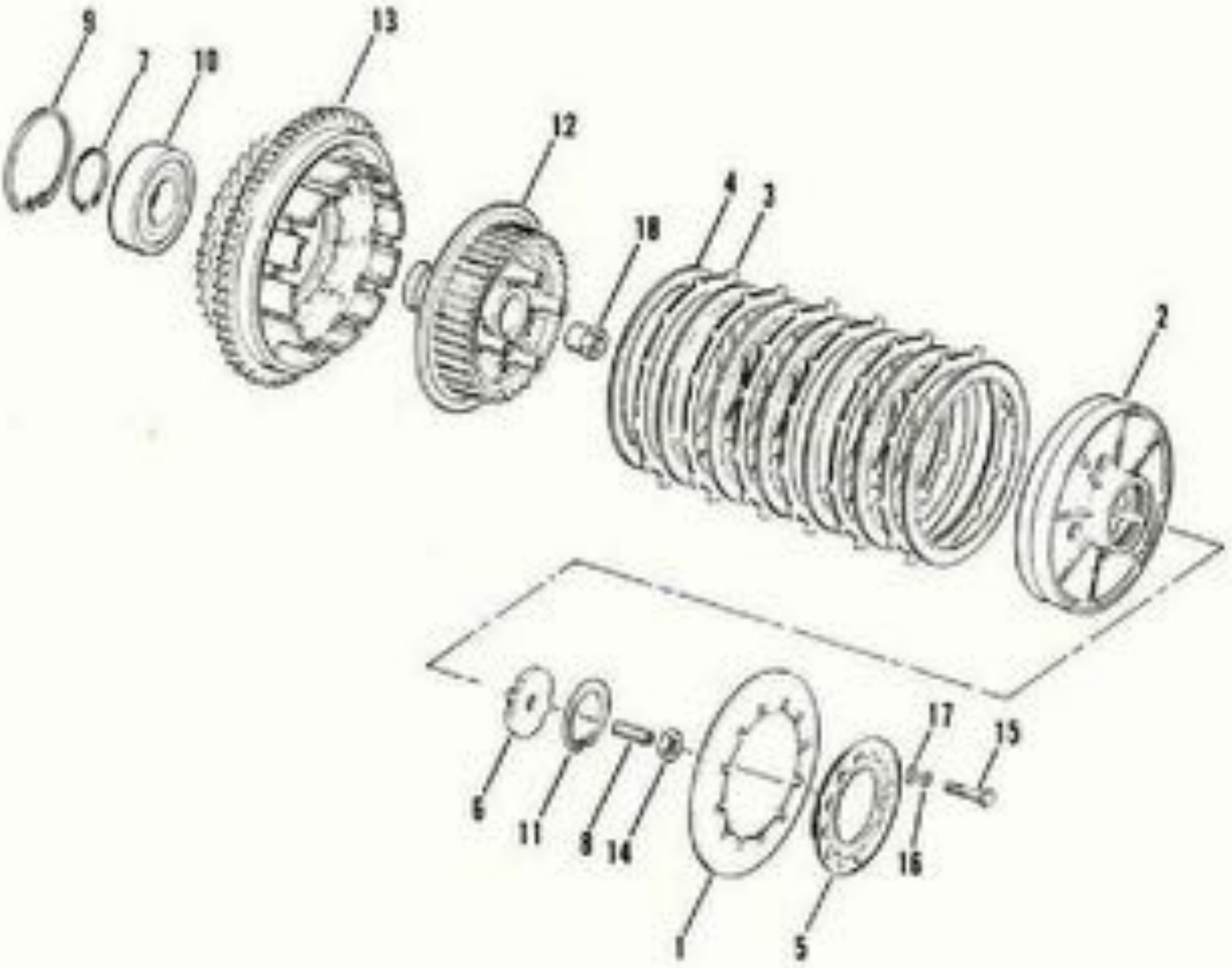
CLEANING, INSPECTION AND REPAIR

See Figure 6-38. Wash all parts, except for lined discs (3) and bearing (10) in cleaning solvent and blow dry with compressed air.

Examine the Clutch for the following:

1. Worn lining surface

2. Checked or chipped lining



1. Spring Diaphragm
2. Pressure plate
3. Friction plate (6)
4. Steel discs (7)
5. Adjuster plate
6. Release plate
7. Circlip, external
8. Screw Adjuster
9. Circlip, internal
10. Bearing pilot
11. Ring, retaining
12. Hub clutch, inner
13. Drum clutch, outer
14. Nut lock
15. Bolt (4)
16. Lockwasher (4)
17. Washer (4)
18. Nut (main shaft)

Figure 6-38. Clutch Assembly

3. Steel discs — grooved or warped

4. Check each steel plate for flatness in several places. Replace any that are warped more than .011 in.

5. Check the plate thickness and replace steel plates that are less than .044 in. thick. Replace any friction disc that is less than .078 in. thick.

6. Before reassembly, soak all plates in PRIMARY CHAINCASE LUBRICANT for at least 5 minutes.

7. Check bearing visually for heat discoloration. Rotate bearing and check for smooth rotation free of interference and noise.

8. Check spring for cracks or damage.

9. Check hub keyway and key for damage.

ASSEMBLY (Figure 6-38 and 6-39)

NOTE

Install the pilot bearing by pressing against the outer race. Be sure the numbered side of the bearing faces out.

1. Press pilot bearing (10) into clutch drum counterbore.

2. Use lock ring pliers and install internal circlip (9) into groove in drum next to pilot bearing.

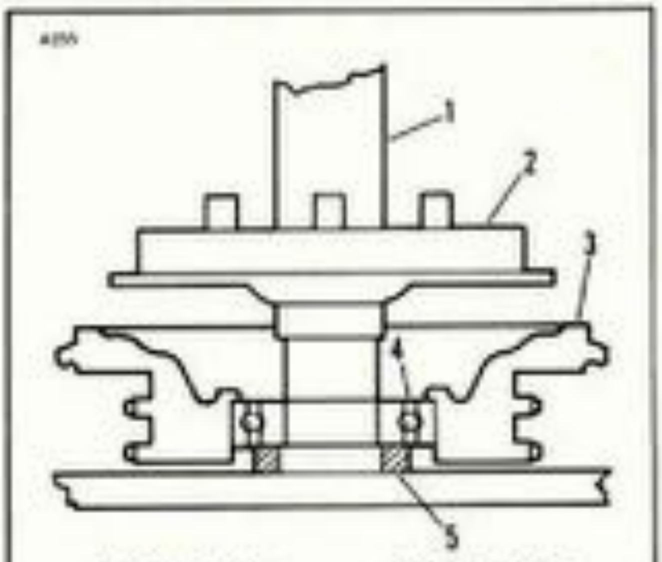


Figure 6-39. Pressing Hub into Pilot Bearing

3. See Figure 6-39. Place drum (3) on arbor press with inner race supported by a sleeve (5). Press hub into bearing against hub shoulder.

4. Use lock ring pliers and install external circlip (7) into groove next to pilot bearing.

NOTE

Minimum thickness of clutch plates: friction plates .078 in., steel discs .044 in. If clutch plates are worn, but have not exceeded minimum thickness, an additional steel disc can be installed to increase the plate-disc stack height.

5. Place steel discs (4) and friction disc (3) alternately over hub (12) and into drum (13) starting and ending with a steel disc.

CAUTION

Check the shaft key to be sure the key does not extend more than .119 in. above the shaft. The top of the key must be parallel with the taper.

6. Position the drum and hub assembly on the transmission mainshaft over shaft key. **Be careful not to disturb key position.**

CAUTION

Be sure key bottoms fully in the keyway and the top of the key is parallel with the taper. Improper installation of the key could damage the clutch hub.

7. Apply 2 drops of LOCTITE 242 to the threads of nut (18). Thread nut (18) onto shaft turning in direction of left hand thread. Tighten nut to a torque of 35-50 ft-lbs.

CAUTION

Clutch hubs can be damaged overtightening nut. Do not use impact wrench for tightening nut (18) unless the wrench is calibrated for torque settings during counterclockwise rotation.

NOTE

Convex side of spring diaphragm must face out when reassembled.

8. Stack pressure plate (2), spring diaphragm (1) and adjuster plate (5), in that order, against hub (12) with holes aligned.

CAUTION

When installing the adjuster plate on the clutch assembly, you must use LOCTITE on the bolts. The ONLY TYPE of Loctite that can be used for this purpose is LOCTITE 222 (purple). Be sure you use only Loctite 222 and clean the threads with Loctite primer before applying the Loctite 222. This will ensure the integrity of the Loctite.

9. Place one lockwasher (16) and washer (17) onto each bolt (15). Insert bolt through holes in stacked components and thread into clutch hub (12). Tighten the bolts to 6.5 - 8 ft-lbs.

NOTE

If bevel retainer (11) has been removed, the beveled edge must face outward on reassembly.

10. Check and adjust clutch as instructed under "Adjustments" earlier in this section.

PRIMARY CHAIN/BELT CASE

GENERAL

The primary case is a sealed housing containing the primary chain/belt, clutch, engine compensating sprocket, chain adjuster and oiler, solenoid and starter drive mechanism.

DISSASEMBLY

1. Remove the primary case cover, chain/belt, clutch and engine compensating sprocket as described under clutch DISASSEMBLY given earlier in this section.

2. Remove the solenoid and plunger as described under solenoid REMOVAL in Section 5.

3. Disconnect the starter drive housing as described under starter motor REMOVAL in Section 5.

4. See Figure 6-28. Disconnect the primary-to-engine mounting hardware (1). Remove the primary-to-transmission mounting hardware (2).

5. On chain models, disconnect the chain oiler hose at the oil pump. Locate the tee fitting near the oil pump with three vent hoses attached. Disconnect the oil pump and crankcase vent hoses from the tee. Pull the inner primary away from the motorcycle and disconnect the last hose from the rear of the primary case.

6. Remove the primary case. The two washers that fall off when the primary is removed belong on the two front transmission-to-primary studs.

CLEANING, INSPECTION AND REPAIR

1. Inspect primary case for cracks or damaged gasket surface.

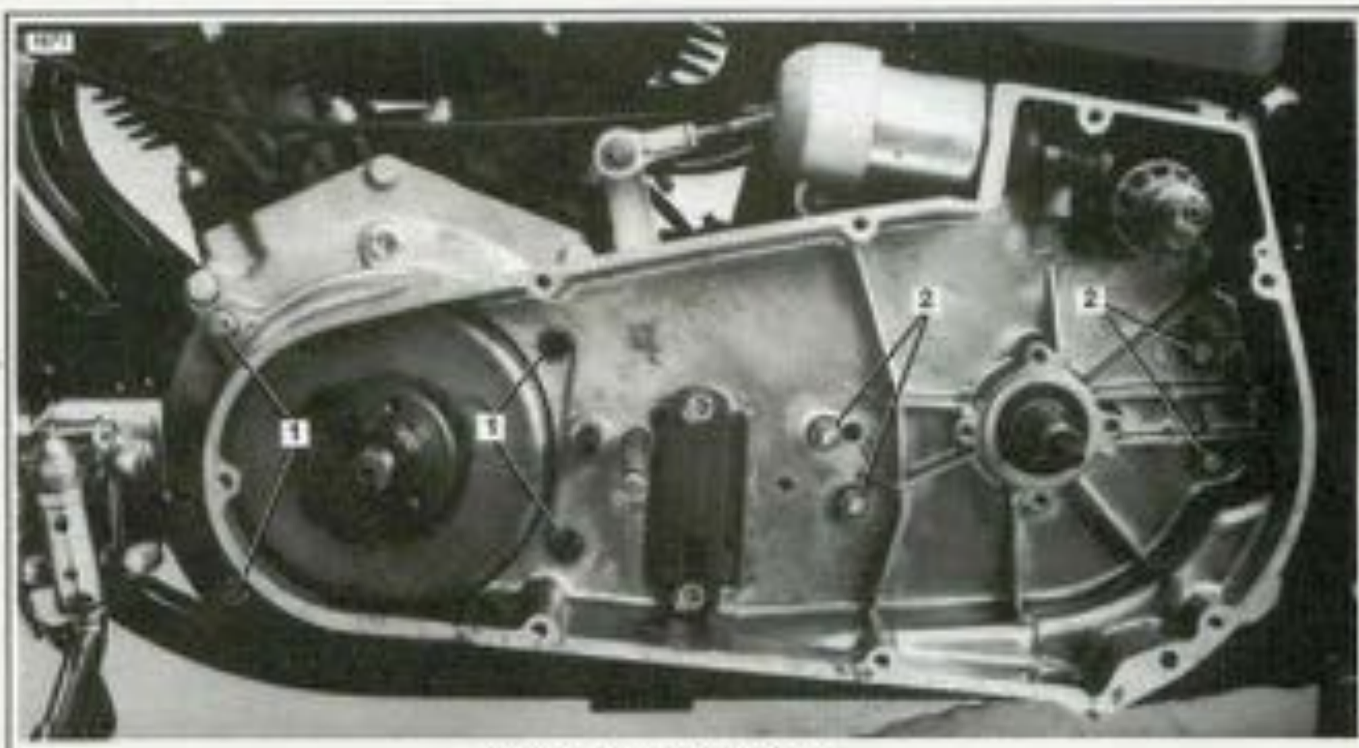
2. Check bearing and replace it if it is rough or sticks.

ASSEMBLY

1. Place the primary case in position on the motorcyle. On chain models make sure the O-ring is in position on the crankcase around the alternator surface.

2. On chain drive models, connect the oil return hose to the fitting at the bottom/rear of the primary housing.

Route the vent hose and chain oiler hose between the transmission and engine. Connect the chain oiler hose to the oil pump. On chain models connect the vent hoses from the oil pump and oil tank to the fitting on the primary vent hose.



1. Primary-to-engine hardware
2. Primary-to-transmission hardware

Figure 6-40. Primary Case Mounting

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.

3. See Figure 6-28. Attach the transmission to the inner primary using the original hardware. Do not tighten hardware yet.

NOTE

Earlier models have bolts and washers in place of the two rear transmission-to-inner primary nuts and washers.

4. See Figure 6-28. Attach the inner primary to the engine using the original bolts and washers. Place the two bolts with the heads drilled through into the rear mounting holes. Tighten all four bolts (1) to 18-22 ft-lbs torque. Safety wire the two rear bolts together as shown.

5. Align the transmission case so the inner primary does not bind on the mainshaft or mounting hardware.

6. Install starter and starter drive housing as described under starter motor INSTALLATION given in Section 5.

7. Install solenoid and plunger as described under solenoid ASSEMBLY Steps 3-6 and solenoid INSTALLATION in Section 5.

8. Install the clutch, engine compensating sprocket, chain/belt adjuster (if applicable) and primary case cover as described under clutch ASSEMBLY given earlier in this section.

SUBJECT | PAGE NO.

1. Specifications 7-1
2. Wear Limits 7-1
3. General Information 7-3
4. Shifter Assembly 7-11
5. Shifter Forks 7-19
6. Transmission Case 7-23
7. 4-Speed Transmissions (Gear & Countershaft Identification) 7-27

TRANSMISSION

SPECIFICATIONS

MAINSHAFT MAIN DRIVE GEAR

End play 1978½ - 1981	.0025-.0135 in.
End play 1982 - 1984	.010-.025 in.
Bushing on mainshaft (loose)	.0018-.0032 in.

MAINSHAFT

Low gear end bearing	
in housing (loose)	.0013 in.
(press)	.0001 in.
On shaft (loose)	.001 in.
(press)	.0007 in.
Housing in case (loose)	.0005 in.
(press)	.0010 in.
Third gear	
End play	.000-.017 in.
Gear on shaft (loose)	.0012-.0023 in.
Bushing in gear	press fit
Shifter clutch	.100-.110 in.

COUNTERSHAFT

Drive gear end bearing (loose)	.0025-.020 in.
Low gear end bearing (loose)	.0005-.0019 in.
Gear end play	.004-.012 in.
Second gear	
End play	.003-.017 in.
Bushing on shaft (loose)	.000-.0015 in.
Bushing in gear (loose)	.0005-.0025 in.
Low gear	
Bushing on shaft (loose)	.000-.0015 in.
Bushing in gear (loose)	.0005-.0025 in.
Shifter clutch	.080-.090 in.
Gear backlash	.003-.006 in.

SHIFTER CAM (1978½-early 1979)

End play	.005-.0065 in.

TORQUES

Primary cover screws	18-22 ft-lbs
Compensating sprocket nut	80-100 ft-lbs
Transmission sprocket locknut	
Early 83 and earlier	105-120 ft-lbs
Late 83 and later	80-90 ft-lbs
Shifter fork nut	10-12 ft-lbs
Shifter clutchnut (kick start models only)	34-42 ft-lbs
Mainshaft ball bearing nut	50-60 ft-lbs
Countershaft nut	55-65 ft-lbs
Drain plug	9-15 ft-lbs
Neutral switch	5-10 ft-lbs
Mounting plate nut	21-27 ft-lbs
Clutch hub nut	50-60 ft-lbs
Top cover screws (Early 79 and earlier)	80-110 ft-lbs
Top cover bolts (late 1979 and later)	13-16 ft-lbs

LUBRICANTS

Transmission	Harley-Davidson
Transmission Lubricant, Part No. 99892-84	(qt.)
Part No. 99891-84	(gal.)

WEAR LIMITS

General

Wear limits are given here as a guideline for measuring transmission components that are not new. For new components or for measurements not given here, use measurements given under SPECIFICATIONS.

SERVICE WEAR LIMITS

Mainshaft Main Drive Gear

End play	.010-.025 in.
Bushing on mainshaft (loose)	.0018-.004 in.

Mainshaft

Run out	.003 in.
Low gear end bearing	
in housing (loose)	.0013-.0020 in.
(press)	.0001-.0005 in.
On shaft (loose)	.001-.0015 in.
(press)	.0007-.001 in.
Housing in case (loose)	.0005-.0009 in.
(press)	.0010-.0015 in.
Third gear	
End play	.000-.020 in.
Gear on shaft (loose)	.0012-.003 in.
Bushing in gear	press fit
Shifter clutch	.100-.110 in.

Countershaft

Run out	.003 in.
Drive gear end bearing (loose)	.0005-.002 in.
Low gear end bearing (loose)	.0005-.002 in.
Gear end play	.004-.015 in.
Second gear	
End play	.003-.020 in.
Bushing on shaft (loose)	.000-.002 in.
Bushing in gear (loose)	.0005-.002 in.
Low gear	
Bushing on shaft (loose)	.000-.002 in.
Bushing in gear (loose)	.0005-.002 in.
Shifter clutch	.080-.090 in.
Gear backlash	.003-.010 in.

Shifter Cam (1978½-early 1979)

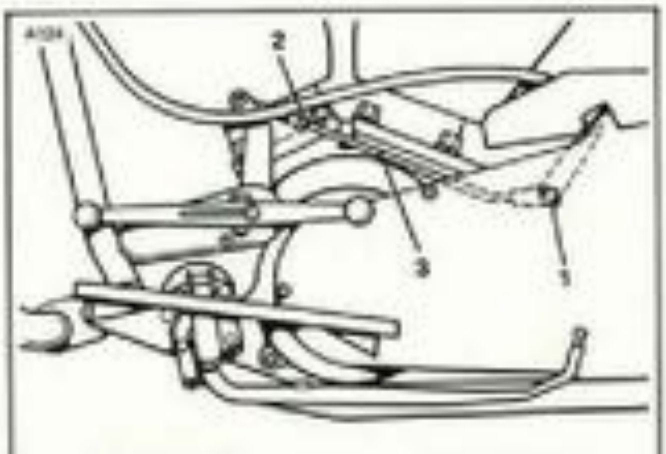
End play	.005-.007 in.

GENERAL INFORMATION

DESCRIPTION

The transmission case contains a series of gears on a mainshaft and countershaft which may be powered in a selection of ratios according to speed and load requirements.

The gear shifter is a unit mounted to the transmission which shifts the transmission into desired ratios by means of shifting forks that slide gears into and out of mesh along shafts.



1. Clevis pin
2. Locknut
3. Shifter rod

Figure 7-1. Shifter Rod — FL/FLHS/FXWG

ADJUSTMENTS

Adjusting the Shifter Linkage

The shift linkage requires adjustment only to compensate for wear or when transmission has been removed.

FL/FXWG MODELS

1. Remove the left side exhaust pipe. (FL models only).
2. See Figure 7-1. Remove the cotter pin and clevis pin (1) securing the shift rod to the shift lever.

1. Retaining ring
2. Locknut
3. Shifter rod

Figure 7-2. Shifter Rod — FX Models

3. Loosen the locknut (2) and adjust the rod (3) so pedal travels its full limit without interference while completing full gear engagement.
4. Reconnect the rod with the clevis and cotter pins.
5. Install the left side exhaust pipe.

FX MODELS (EXCEPT FXWG)

1. See Figure 7-2. Remove the retaining ring (1) and pull shift rod off the clevis pin.
2. Loosen the locknut (2) and adjust the rod (3) so pedal travels its full limit without interference while completing full gear engagement.

If the transmission does not shift properly after making these adjustments, proceed to the repair procedures under SHIFTER ASSEMBLY and SHIFTER FORKS.

SHIFTER ASSEMBLY

SHIFTER COVER — DRUM SHIFTER 1978½-EARLY 1979

Disassembly

1. If only the shifter cover is to be repaired, remove the battery, battery carrier and oil tank. If other transmission repairs are to be made, remove the transmission from the motorcycle. See the REMOVAL procedure under TRANSMISSION CASE.

2. See Figure 7-3. Remove the shifter cover mounting screws, the slotted screw is a vent screw and must be reinstalled in the same location.

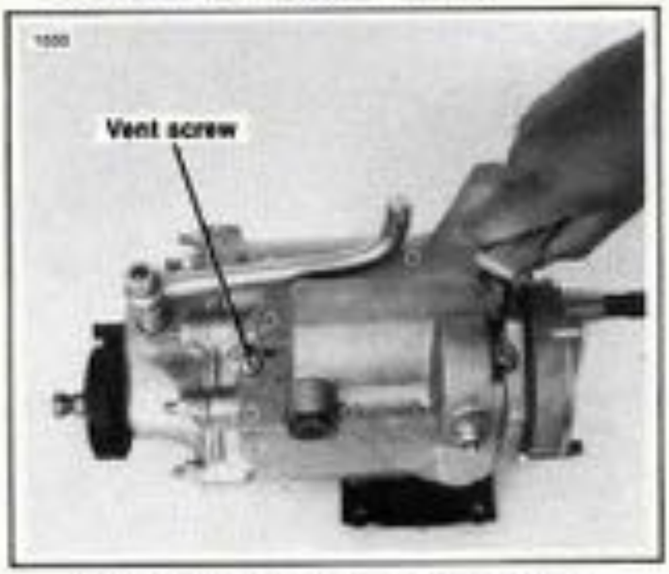


Figure 7-3. Shifter Cover — Drum Shifter

3. See Figure 7-4. Remove the shift lever (1), mounting screws (2), and dust cover (3). Remove the neutral switch (4). Remove the cam follower retainer (5) and lockwasher (6). Remove the spring and cam follower from the retainer (5).

4. See Figure 7-5. Remove the pawl carrier cover (1) mounting screws and gasket. The bottom mounting screw is secured by a nut (2) at the back of the adapter plate.

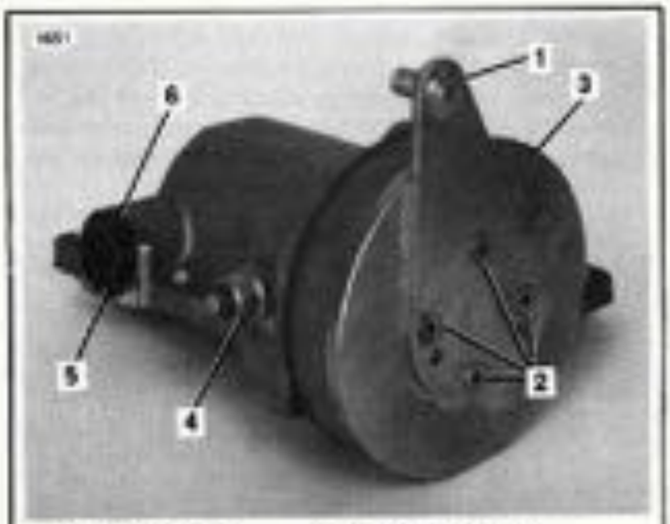
5. See Figure 7-9. Remove the pawl carrier (9), pawls (10) and springs (11, 12).

6. See Figure 7-9. Remove the adapter plate screw (13), washer (14) and adapter plate (15).

7. See Figure 7-6. Remove the set screw (1). Use a suitable drill and tap the cam shaft out of the cover and remove the shifter cam (2).

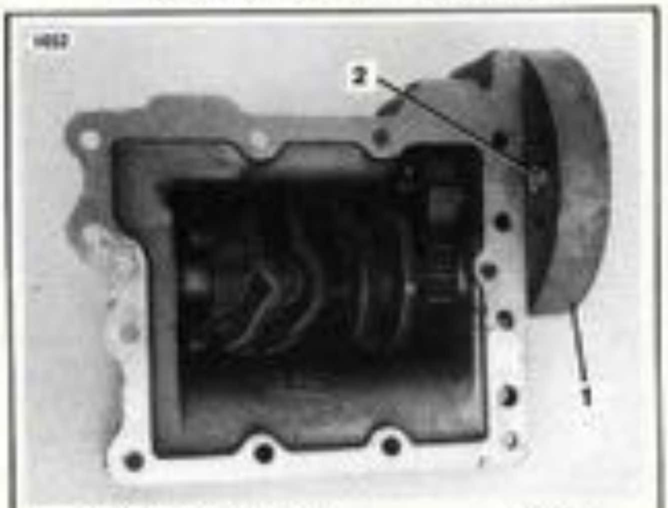
NOTE

See Figure 7-7. The cam shaft has an oil seal on one end. Tap on the opposite end when removing the shaft so the seal is not damaged.



1. Shift lever	4. Neutral switch
2. Screw (4)	5. Cam follower retainer
3. Dust cover	6. Lockwasher

Figure 7-4. Drum Shifter Assembly



1. Pawl carrier cover 2. Nut

Figure 7-5. Pawl Carrier Cover Mounting

8. See Figure 7-8. Remove the cotter pin from the shifter shaft and tap shaft out of the cover. Remove the shifter gear and spring.

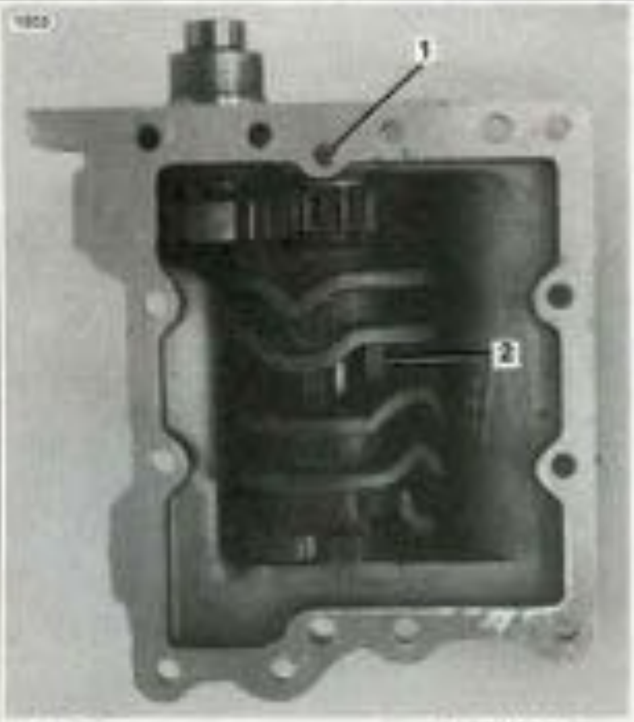
Cleaning, Inspection and Repair (Figure 7-9)

1. Clean all parts, except gaskets (8, 16) and neutral indicator switch (17), in grease solvent.

2. Inspect fit of shaft (30) in bushings (32, 33). If there is considerable side play, replace the bushings.

   The pawl carrier bushing (32) can be pressed out with an arbor press.

The shifter shaft bushing (33) can be removed by threading a 5/8 in. tap into the bushing 1/2 in. deep. Remove the tap and heat the bushing area to about 300° F. Quickly thread the tap back into the bushing and clamp the tap handle in a vise. Drive the cover off the bushing using a rawhide mallet. Insert a new bushing using an arbor press and press until bushing shoulder is seated against the cover.



1. Set screw   2. Shifter cam

Figure 7-6. Shifter Cam Set Screw

3. Inspect all gear teeth. Replace the gear (28) or cam (26) if teeth are worn or damaged.

4. Inspect the neutral switch. If the plunger does not spring back when depressed, replace the switch.

Figure 7-7. Cam Shaft Oil Seal

Figure 7-8. Shifter Shaft Removal

5. Inspect the cam follower (22) and shifter pawls (10). Replace them if the tips are rounded or worn.

6. Inspect the pawl carrier (9) bushing hole for distortion and replace if necessary.

7. Inspect the springs and remaining parts for damage or wear and replace as necessary.

Assembly

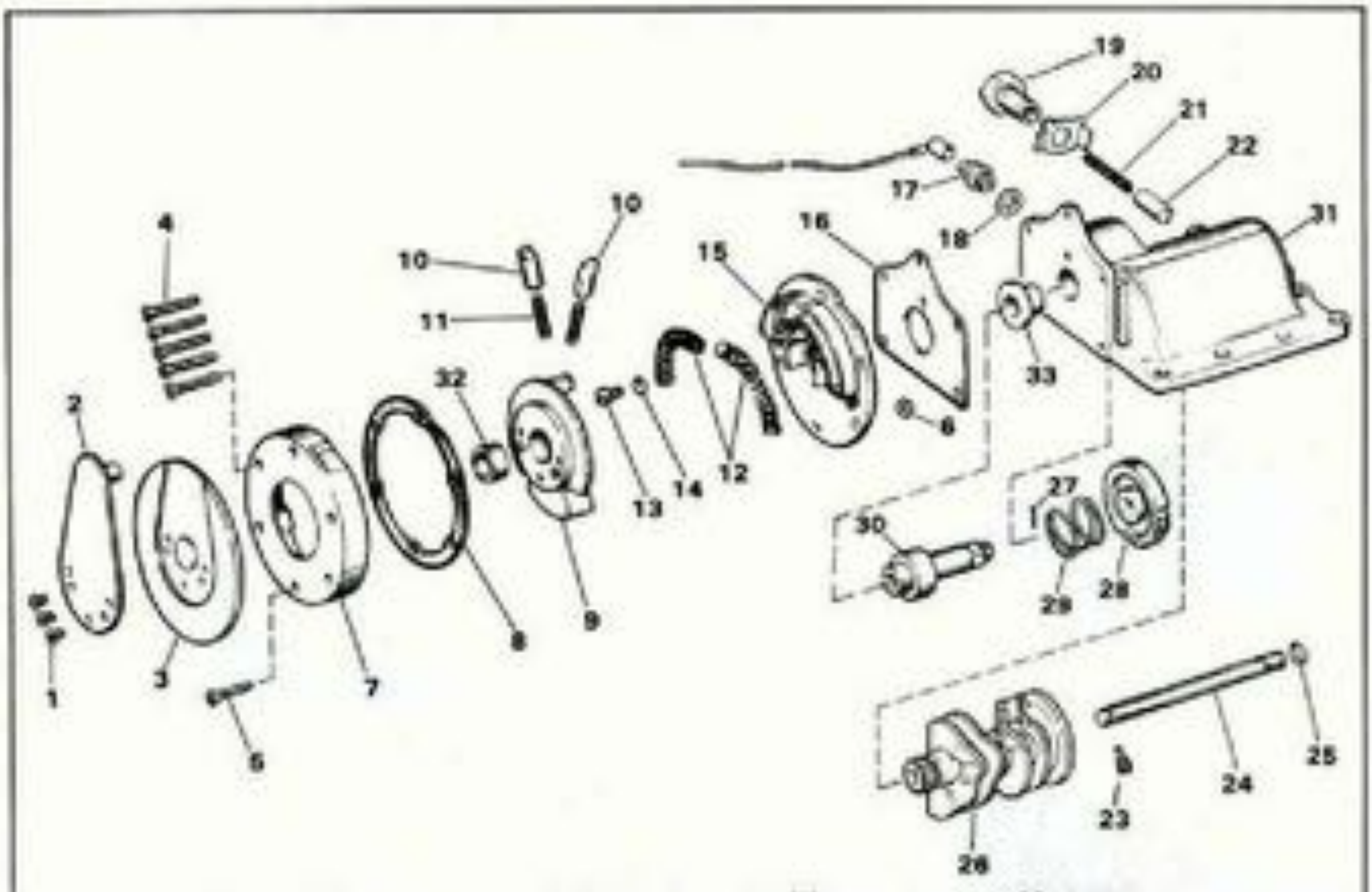
1. See Figure 7-10. Place the shifter gear and spring (28, 29, Figure 7-9) into the cover. Install the shifter shaft into the case and through the spring and gear. Align the timing mark on the gear with the first slot on the shifter shaft as shown.

2. See Figure 7-11. Insert a 5/8 in. crescent wrench behind the gear for support and tap the shaft into the gear. Install the cotter pin into the shaft end.

3. See Figure 7-9. The shifter cam (26) has one tooth on its gear that is shorter than the rest.

   Position the cam inside the cover so the short tooth lines up with the timing mark on the shifter gear (28).

   See Figure 7-6. Insert the cam shaft through the cover and cam until the slotted end is visible in the set screw hole. Install the set screw until it bottoms on the shaft.



1. Shift lever screw (3)
2. Shift lever and bushing
3. Dust shield
4. Shifter cover screw (5)
5. Shifter cover screw (short)
6. Cover screw nut
7. Pawl carrier cover
8. Cover gasket
9. Pawl carrier
10. Pawl
11. Pawl spring (2)
12. Pawl carrier spring (2)
13. Adapter plate screw
14. Adapter plate washer
15. Adapter plate
16. Adapter plate gasket
17. Neutral indicator switch
18. Washer
19. Cam follower retainer
20. Cam follower washer
21. Spring
22. Cam follower
23. Lock screw
24. Cam shaft
25. Oil seal
26. Shifter cam
27. Cotter pin
28. Shifter gear
29. Shifter gear spring
30. Shifter shaft
31. Shifter cover
32. Pawl carrier bushing
33. Shifter shaft bushing

Figure 7-9. Drum Shifter — Exploded View

4. See Figure 7-9. Install the cam follower (22), spring (21), lockwasher (20) and retainer (19). Tighten the retainer and turn one lockwasher tab against a retainer flat.

5. See Figure 7-9. Install the gasket (16) and adapter plate (15). Coat the screw (13) threads with Loctite LOCK N' SEAL. Install the washer (14) and screw (13) but do not tighten the screw yet.

6. See Figure 7-12. Rotate the shifter cam into 1st gear as shown. Make sure the cam follower rests in the first detente.

7. See Figure 7-13. The shifter plate will move slightly. Adjust the shifter plate so it aligns with the first notch as shown. Tighten the screw (13, Figure 7-9) to 6-9 ft-lbs torque.

Rotate the shifter cam into all four gears. The adapter plate notch should fall between two gear teeth on each successive gear shift except in neutral. With the cam in neutral, the adapter plate notch will line up on the first gear tooth. If the notch does not line up properly, shifter cam and gear are not aligned properly. Disassemble the cam and repeat Step 3.

8. See Figure 7-9. Apply a multi-purpose grease to the springs (12) and install them on the adapter plate.

9. Grease the end of shifter shaft and lubricate the pawls (10) with light oil. Install the pawl springs (11) and pawls into the pawl carrier (9). Make sure grooves in pawls register on pawl carrier pins. Install the pawl carrier on the shifter shaft so that the tab is positioned between the two springs (12).

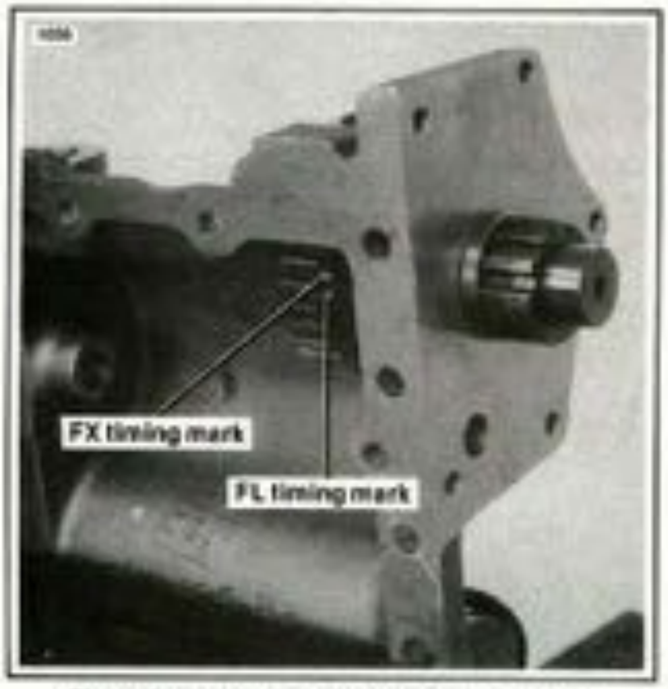


Figure 7-10. Aligning Shifter Gear and Shaft

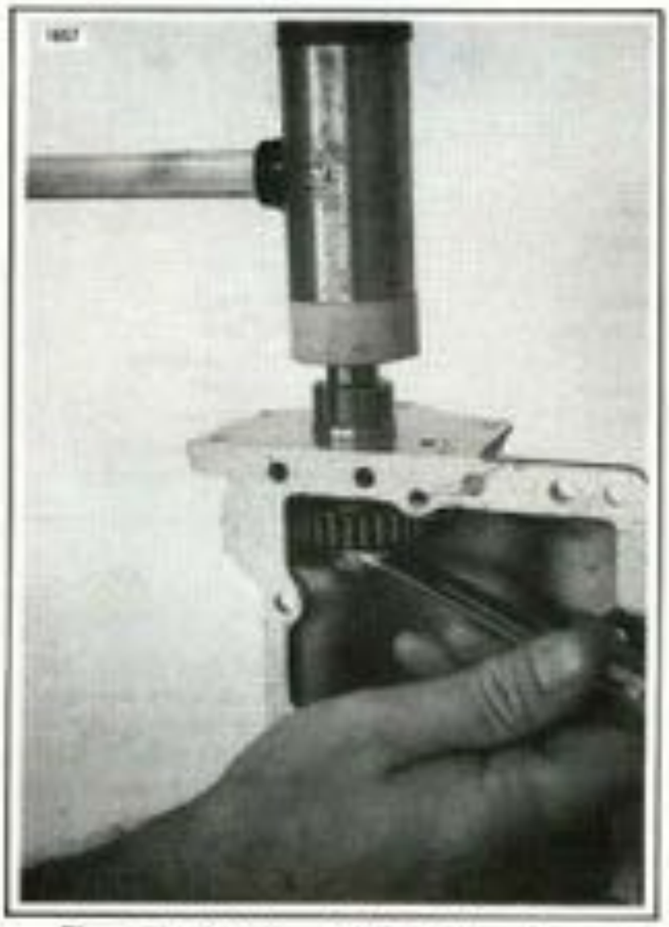


Figure 7-11. Installing Shifter Shaft and Gear

10. See Figure 7-5. Lubricate the back of the pawl carrier with a multi-purpose grease. Install the cover gasket and cover so that the notch on the cover lines up with the notch on the adapter plate. Apply Loctite LOCK N' SEAL to the threads of the mounting screws. Install the shorter mounting screw in the bottom hole and secure it with the original nut. Tighten all screws to 20-24 in-lbs torque.

Figure 7-12. Drum Shifter in 1st Gear

Figure 7-13. Aligning The Shifter Plate

11. See Figure 7-4. Install the dust cover, shift lever and mounting screws. Coat the threads of the mounting screws with Loctite LOCK N' SEAL.

12. Coat the neutral switch threads with Loctite PIPE SEALANT WITH TEFLON. Install the switch and tighten it to 3-5 ft-lbs torque.

13. See Figure 7-3. Install the cover assembly on the transmission with the original screws. Install the vent screw next to the dowel pin as shown. Install the two longer screws in the holes next to the shifter assembly. Tighten screws to 80-110 in-lbs torque.

14. If the transmission was removed, install the transmission to the motorcycle. Install the battery, carrier and oil tank if the transmission was left in the motorcycle. See the INSTALLATION procedure under TRANSMISSION CASE.

SHIFTER COVER — PLATE SHIFTER LATE 1979 AND LATER

Disassembly

1. Remove the battery, battery carrier and oil tank if just the cover is to be repaired. If other repairs are to be done, remove the transmission from the motorcycle. See the REMOVAL procedure under TRANSMISSION CASE.

2. See Figure 7-14. Remove the five cover mounting bolts and washers. The bolt shown with the wrench on it can only be loosened due to interference with the shifter shaft cover. The bolt can be removed from its mounting hole after the shifter shaft cover is removed.

3. Remove the shifter cover and gasket.

4. See Figure 7-15. Remove the two shifter shaft cover bolts (1) and lockwashers (2). Remove the shift lever bolt (3) and washer (4). Remove the shifter linkage assembly from the transmission cover. Remove the remaining transmission cover bolt and washer.

5. See Figure 7-15. To disassemble the linkage, remove the nut and washer (5) and retaining rings (6).

6. See Figure 7-15. Remove the plug (7) by drilling a 1/4 in. hole through it and prying it loose. Discard the plug.

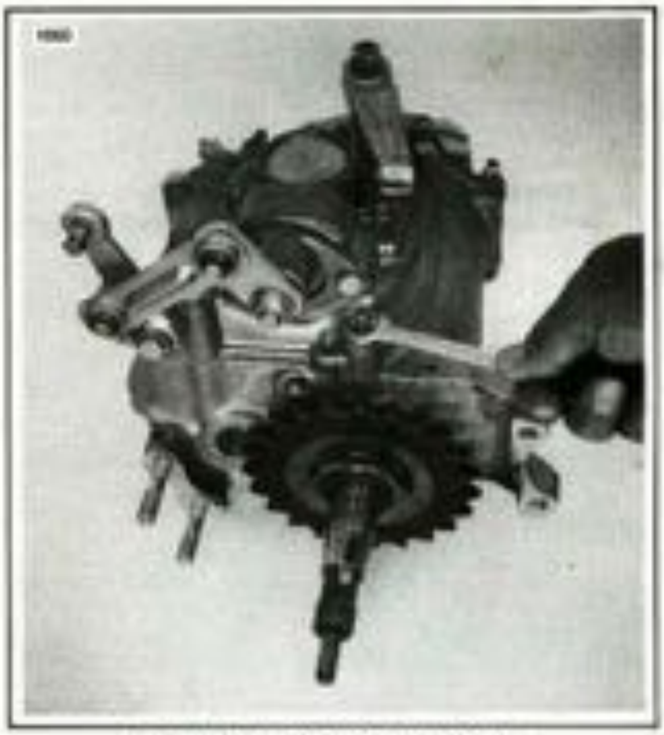
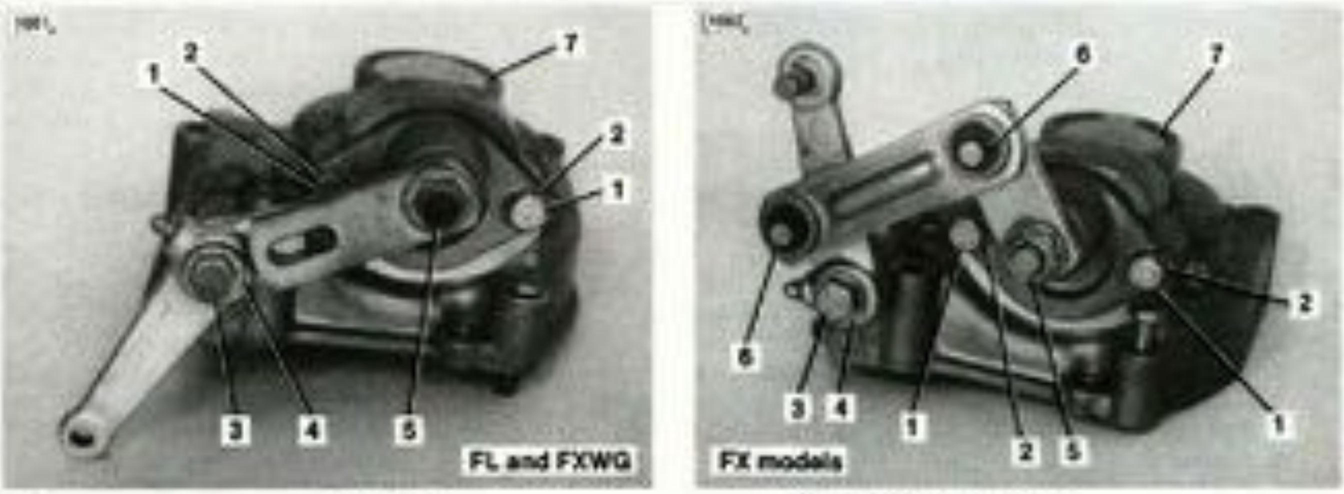


Figure 7-14. Plate Shifter Cover

7. See Figure 7-16. Remove the retaining ring (23) and washer (24) located under the plug and remove the shifter cam (25) and pawl assembly (26 through 30).

8. See Figure 7-17. Remove the cam follower (1) and spring (2). Bend the lock plate (3) tabs away from the bolts (4). Remove the bolts and cam follower body (5).

Remove the four screws (6), pawl stops (7) and springs (8).

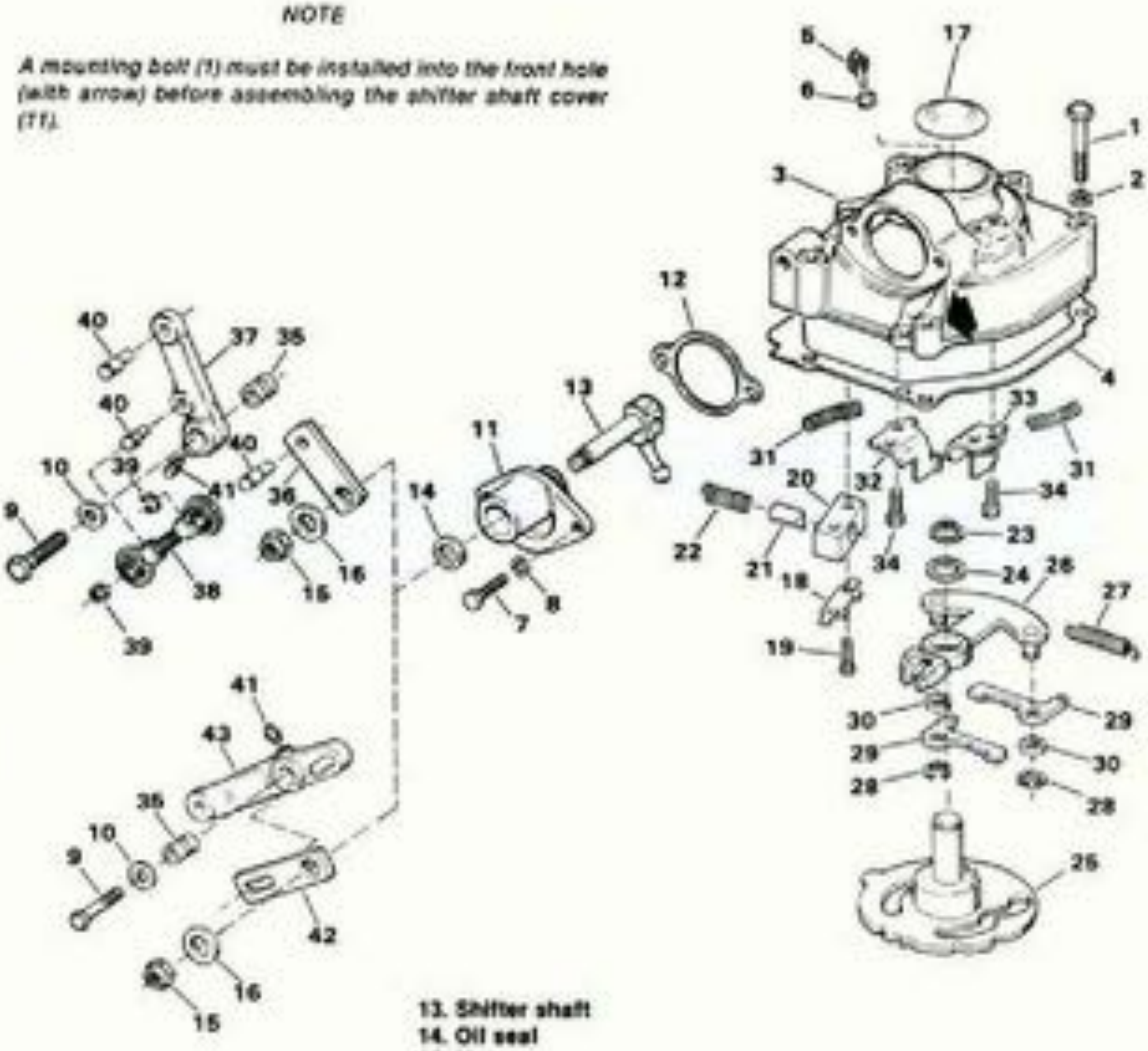


1. Bolt (2)
2. Lockwasher (2)
3. Shift lever bolt
4. Shift lever washer
5. Nut and washer
6. Retaining ring (FX only)
7. Plug

Figure 7-15. Shifter Lever — Plate Shifter

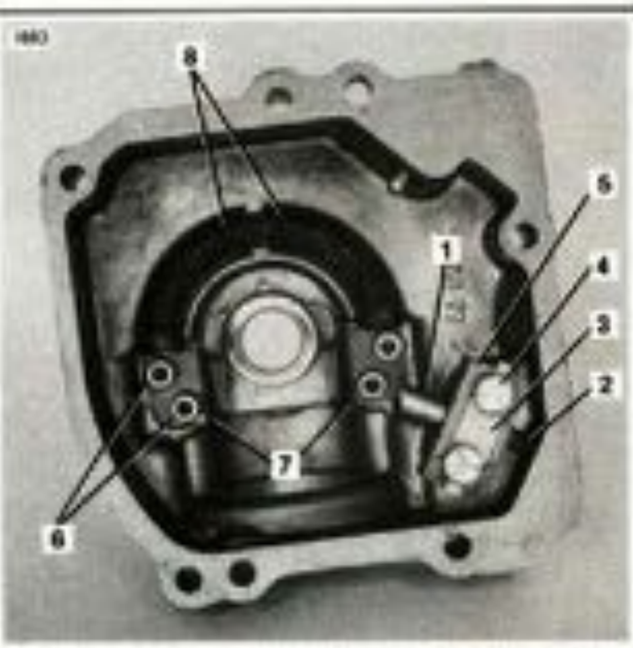
NOTE

A mounting bolt (1) must be installed into the front hole (with arrow) before assembling the shifter shaft cover (11).



1. Bolt (5)
2. Washer (5)
3. Shift cover
4. Gasket
5. Neutral indicator switch
6. Washer
7. Bolt (2)
8. Lockwasher (2)
9. Bolt
10. Washer (2)
11. Shifter shaft cover
12. Gasket
13. Shifter shaft
14. Oil seal
15. Nut
16. Washer
17. Plug
18. Lock plate
19. Bolt (2)
20. Plunger body
21. Plunger
22. Spring
23. Retaining ring
24. Thrust washer
25. Shifter cam
26. Pawl carrier
27. Shifter pawl spring
28. Retaining ring (2)
29. Pawl (2)
30. Spacer (2)
31. Pawl carrier spring (2)
32. Shifter pawl stop, rear
33. Shifter pawl stop, front
34. Socket head screw (4)
35. Bushing
36. Shift lever arm (FX)
37. Shift lever (FX)
38. Shift linkage arm (FX)
39. Retaining ring (2) (FX)
40. Pivot pin (3) (FX)
41. Grease fitting
42. Shift lever arm (FL)
43. Shift lever (FL)

Figure 7-16. Shifter Cover — Late 1979 and Later



1. Cam follower
2. Spring
3. Lock plate
4. Bolt
5. Cam follower body
6. Screw
7. Pawl stop
8. Spring

Figure 7-17. Inside The Shifter Cover

9. Remove the neutral switch from the cover.

Cleaning, Inspection and Repair

1. Clean all parts except gaskets and neutral indicator switch in solvent.

2. Inspect the neutral switch. If the plunger does not spring back when depressed, replace the switch.

3. Inspect the cam follower and pawls. Replace them if they are rounded or worn.

4. Inspect the springs and remaining parts for damage or wear and replace as necessary.

Assembly

1. See Figure 7-17. Lubricate the springs (8) with a multi-purpose grease. Install the screws (6), pawl stops (7) and springs (8).

   Install the cam follower body (5), lock plate (3) and bolts (4). Bend the lock plate tabs against the bolt head flats. Install the spring (2) and cam follower (1).

Figure 7-18. Shifter Cam and Pawl Assembly

2. Coat the neutral switch threads with Loctite PIPE SEALANT WITH TEFLON. Install it and tighten to 5-10 ft-lbs torque.

3. See Figure 7-18. Install the pawl assembly on the shifter cam. Make sure pawls engage on shifter cam gear teeth.

   Install the assembly into the shifter cover. Place the tab on the pawl carrier between the two springs. Secure it with the washer and retaining ring (23, 24, Figure 7-16).

4. See Figure 7-15. Install a new plug (7) into the transmission cover. Coat the plug edges with SEAL-ALL, place plug in recess (dome side up) and hit the middle of the plug with a ball peen hammer to seat it.

5. See Figure 7-15. Assemble the linkage as shown using the original nut and washer (5) and new retaining rings (6).

6. See Figure 7-15. Insert one transmission cover bolt and washer into the left rear mounting hole of the cover. Install the shifter linkage to the cover using the shift lever bolt (3) and washer (4). Install the shifter shaft bolts (1) and lockwashers (2).

7. Install the cover and new gasket on the transmission. Coat all the cover mounting bolt threads with Loctite LOCK N' SEAL. Install the mounting bolts and tighten them to 80-110 in-lbs torque.

8. If the transmission was removed, install it into the motorcycle. Install the battery, carrier and oil tank if the transmission was left in the motorcycle. See the INSTALLATION procedures under TRANSMISSION CASE.

ADJUSTMENT

To perform the adjustment procedure, remove the transmission from the motorcycle. See the REMOVAL procedure under TRANSMISSION CASE.

Setting the Gauge for Drum Shifter

Remove the shifter cover. See the DISASSEMBLY procedure under SHIFTER COVER-DRUM SHIFTER.

1. Place the shifter cam in neutral as shown in Figure 7-19.

2. See Figure 7-20. Place the FORK SHIFTER GAUGE, Part No. HD-96384-39, on the cover as shown. With the 3/8 in. gauge rod, align one gauge block with the straight section of one cam slot. Lock the gauge block in place with the thumbscrew.

3. Rotate the shifter cam to first gear and align the second gauge block to the other cam slot.

4. See Figure 7-21. Remove the gauge from the cover, turn it over and place it on the transmission case as shown. Make sure the shifter forks register in the gauge blocks.

5. Proceed to CHECKING AND SPACING FORKS.

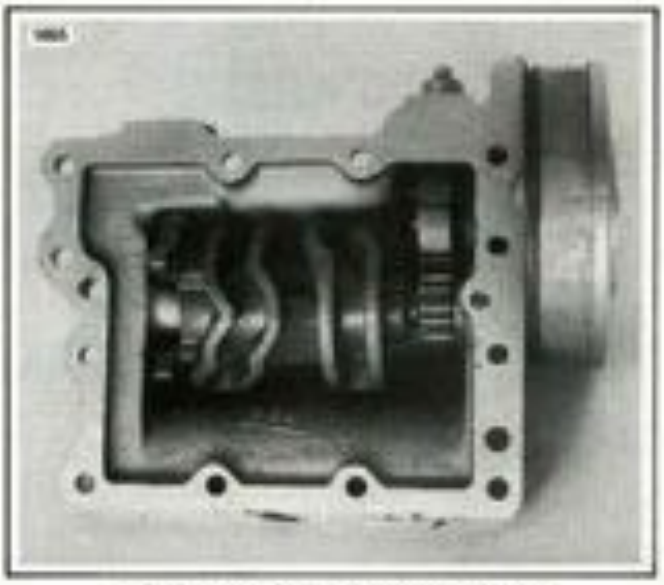


Figure 7-19. Drum Shifter in Neutral

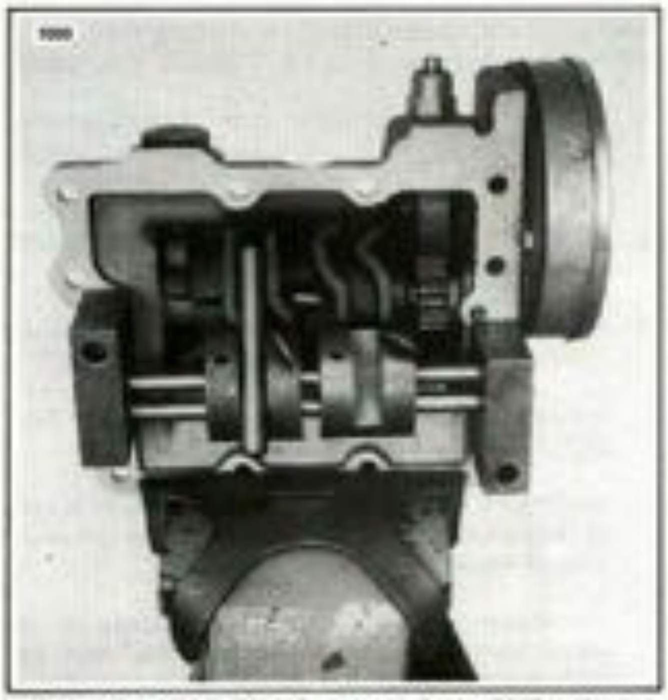


Figure 7-20. Installing Gauge on Drum Shifter Cover

Figure 7-21. Installing Gauge on Drum Shifter Transmission

Setting the Gauge for Plate Shifter

Remove the shifter cover. See the DISASSEMBLY procedure under SHIFTER COVER-PLATE SHIFTER.

1. Place the shifter cam in neutral position as shown in Figure 7-22.

2. See Figure 7-23. Place the FORK SHIFTER GAUGE, Part No. HD-96385-78, on the cover as shown. Make sure the gauge blocks are registered in the cam slots then tighten the thumbscrews.

3. See Figure 7-14. Remove the gauge from the cover, turn it over and place it on the transmission case as shown. Make sure the shifter forks register in the gauge blocks.

4. Proceed to CHECKING AND SPACING FORKS.

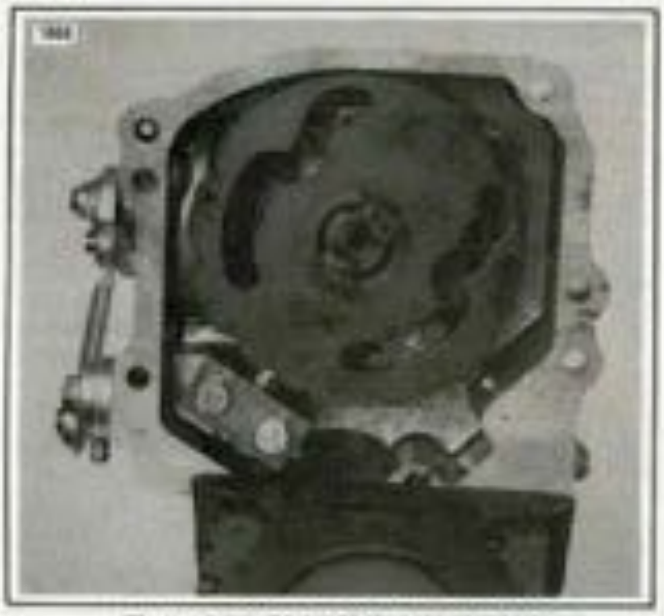


Figure 7-22. Plate Shifter in Neutral

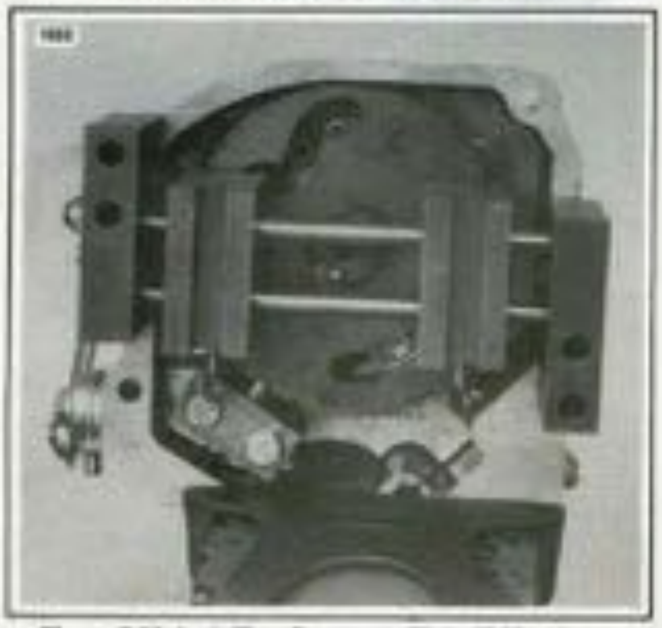


Figure 7-23. Installing Gauge on Plate Shifter Cover

Checking And Spacing Forks

1. All shifting clutches must be centered with the following clearances on both sides of the clutches.

   Countershaft 1st and 2nd gears — 0.80-0.090 in.

   Mainshaft 3rd and 4th gears — 0.100-0.110 in.

2. Check clearances with a feeler gauge as shown in Figures 7-23 and 7-24.

NOTE

When shifter clutch normal engagement occurs with dogs protruding from face of gear, turn the gear so that the shifter dogs and clutch dogs overlap 1/8 in. before checking clearances.

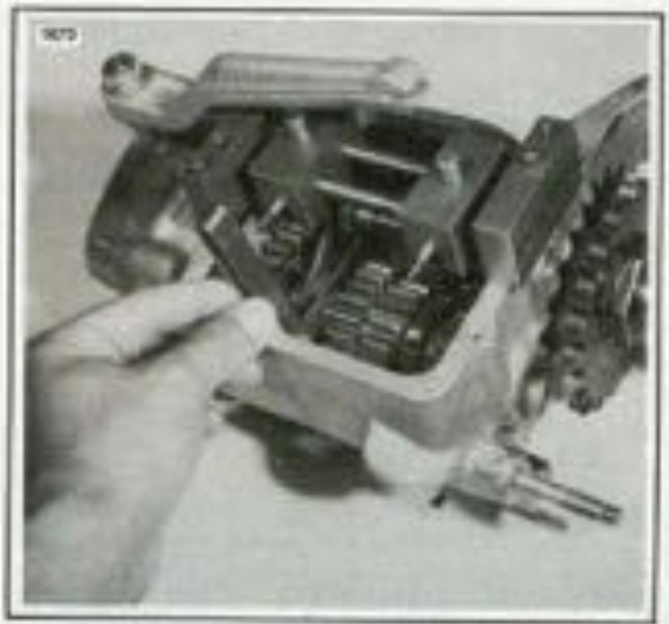


Figure 7-24. Installing Gauge on Plate Shifter Transmission

3. If clearances are not equal and correct, the fork assembly position must be changed by increasing or decreasing the number of spacers (9, Figure 7-26) in the assembly. Spacers are available in .007 and .014 in.

4. Follow the FORK DISASSEMBLY and ASSEMBLY procedures to replace spacers.

DISASSEMBLY

NOTE

The disassembly and assembly procedures are the same for early and late style transmissions. However, on late 1979 and later transmissions, the shifter fork assemblies are reversed on the fork shaft, that is, the nuts are toward the center of the shaft. See Figure 7-26.

1. Remove the transmission from the motorcycle. See the REMOVAL procedures under TRANSMISSION CASE.

2. Remove the shifter cover as described under SHIFTER COVER.

3. Remove the side cover as described under TRANSMISSION CASE.

4. Remove the sprocket from the transmission. See SPROCKETS, Section 6.

5. See Figure 7-25. Remove the lock ring from the end of the fork shaft. Tap the shaft out of the sprocket side of the transmission.

6. See Figure 7-26. Bend the tabs on the lockwashers away from the nuts (5). Remove the nuts (5), lockwashers (6), forks (7 and 8), spacer (s) (9) and shifter rollers (4) from the shifter fingers (10).

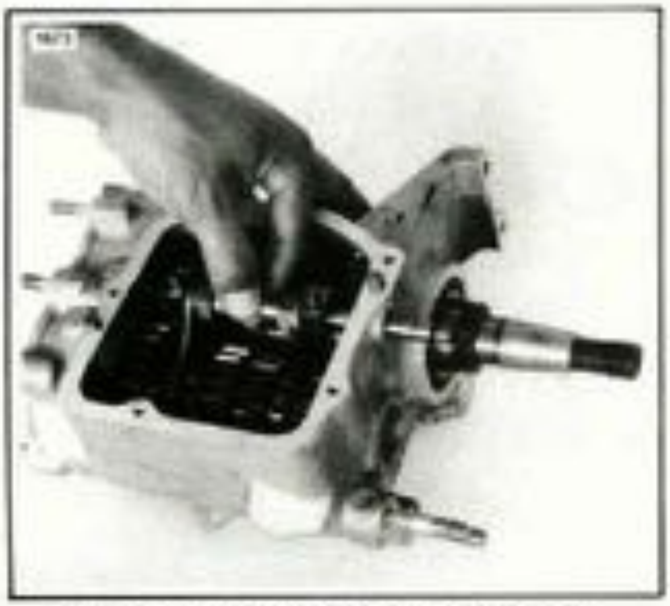


Figure 7-25. Fork Assembly in Transmission

NOTE

Mainshaft and countershaft shifter fork assemblies are not interchangeable. Do not mix parts together. Note the exact arrangement of parts in each assembly and keep the assemblies separate from each other.

CLEANING, INSPECTION AND REPAIR

1. Clean all parts in cleaning solvent and blow dry with compressed air.
2. If shifter forks are bent or worn, replace them. Do not try to straighten them because that will only weaken the forks causing them to break later on.
3. Check the fit of the shifter fingers on the shaft. They should slide freely yet not be too loose. A shifter finger that is too loose will cause gear backlash. Compare the fit of the shifter finger with a new one and replace it if necessary.
4. Lap out the shifter fingers if they bind. Shifting will be difficult unless fingers work freely on shaft.

ASSEMBLY

1. See Figure 7-26. Place the spacer(s) (9), shifter fork (7 and 8), lockwasher (6) and nut (5) on shifter finger. Tighten nut to 10-12 ft-lbs torque. Do not overtighten nut or shifter finger will bind on the shaft.
2. Bend the top tab on the lockwasher down against the nut. This will prevent the tab from interfering with the shifter cam.
3. See Figure 7-25. Place the fork assemblies into the transmission as shown. Install the narrow fork on the mainshaft shifter clutch. Install the shaft and lock ring.
4. Install the shifter rollers (4, Figure 7-26).
5. Check the fork adjustment as shown in the ADJUSTMENT procedure.
6. Install the sprocket, Section 6 and side cover. See TRANSMISSION CASE.
7. Install the shifter cover assembly. See SHIFTER ASSEMBLY.
8. Install the transmission into the motorcycle. See the INSTALLATION procedures under TRANSMISSION CASE.

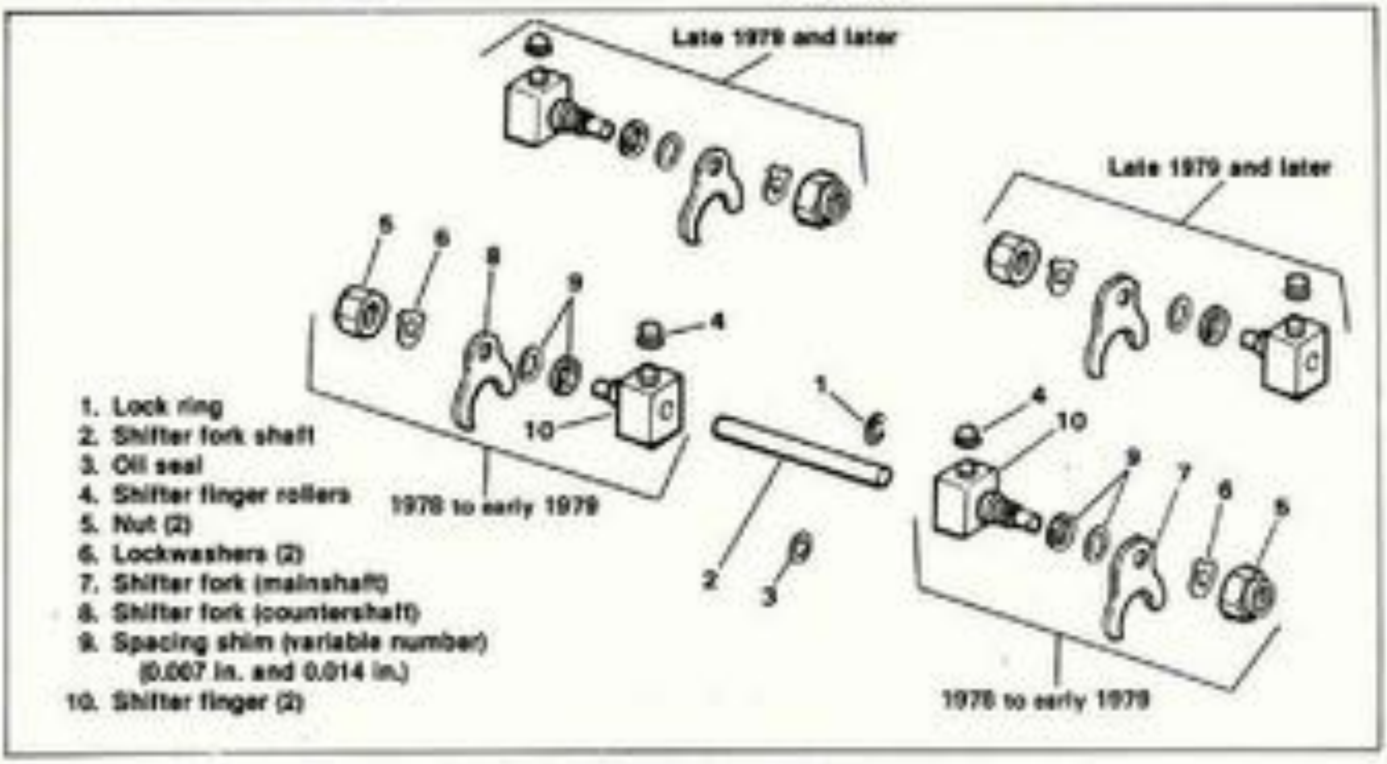


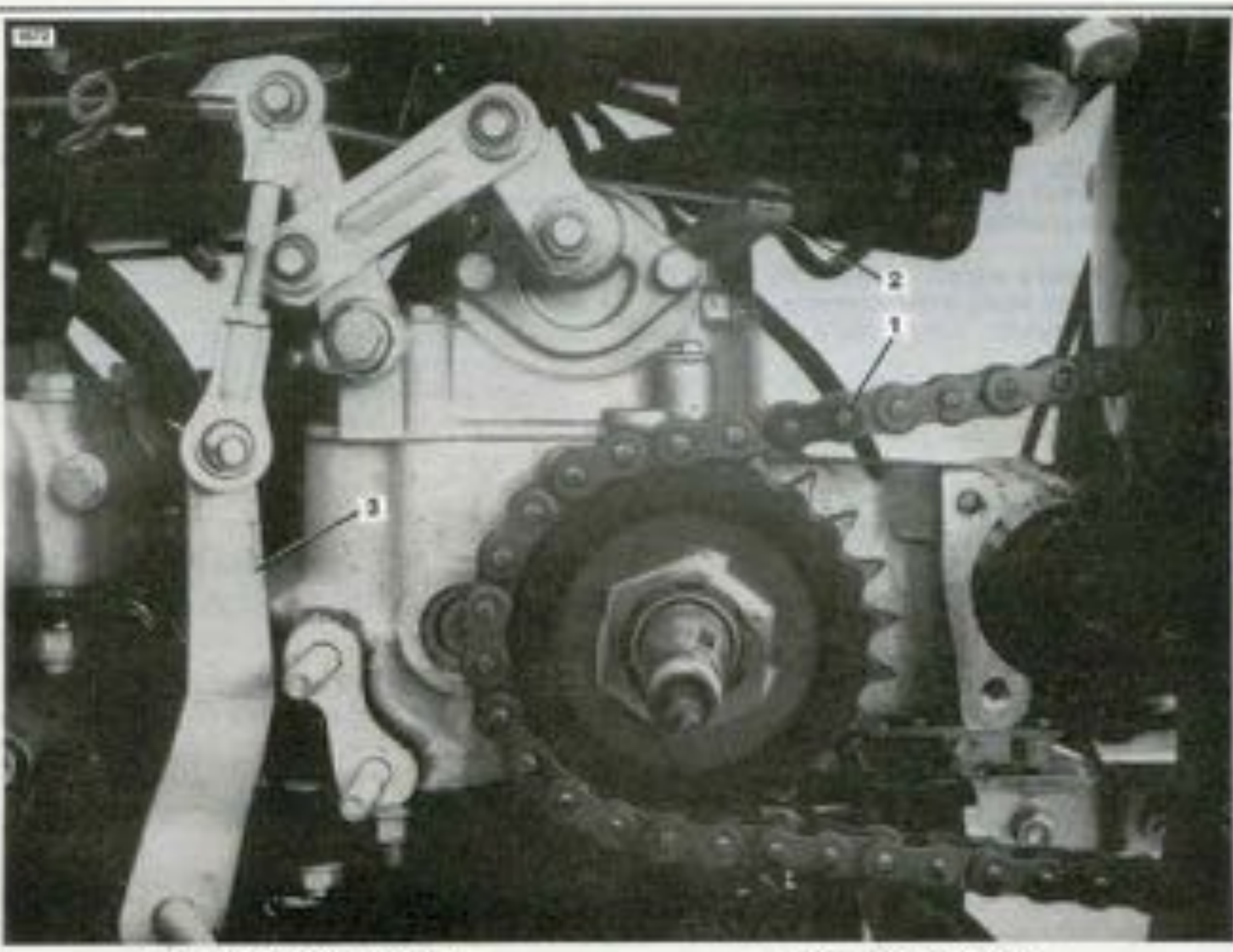
Figure 7-26. Shifter Fork — Exploded View

REMOVAL

WARNING

Disconnect the battery cables (negative cable first) to prevent accidental start-up of vehicle and possible personal injury.

1. Remove the transmission drain plug and gasket and drain the oil. Replace the drain plug and gasket after all the oil has drained. This will prevent hunting for the plug later on.
2. Remove the clutch, chain or belt and compensating sprocket as described under CLUTCH, Section 6.
3. Remove the battery and battery carrier.
4. Remove the starter motor, mounting bracket, starter motor thru bolts, starter motor and starter motor housing. See Section 5.
5. Disconnect the three wires from the solenoid.
6. Disconnect the primary-to-engine mounting hardware as described under PRIMARY CASE, Section 6.
7. See Figure 7-27. On chain drive models, locate the rear chain connecting link (1). Remove the spring clip and master link. Remove the chain from the sprocket. On belt drive models, loosen the rear wheel adjusting nuts (see BELTS, Section 6) and remove the belt from the sprocket.
8. See Figure 7-27. Remove the clutch cable from the release lever (2).
9. Disconnect the shifter rod (3) from the shifter linkage.
10. Remove the oil tank left side mounting nuts.
11. Disconnect the neutral indicator switch wire from the transmission cover. On FX models (except



1. Rear chain connecting link
2. Release lever

3. Shifter rod (FX shown)

Figure 7-27. Primary Case Removed

FXWG/FXST) remove the footrest and brake pedal assembly.

12. On 1980 and earlier FL models and all 1983 and earlier FXWG models, remove the speedometer cable and housing from the transmission.

13. Remove the transmission-to-mounting plate hardware and remove the mounting plate-to-frame hardware. Remove the one transmission-to-frame mounting bolt from underneath the right side.

14. Remove the transmission from the left side of the motorcycle.

CLEANING, INSPECTION AND REPAIR

The sub-sections following the INSTALLATION procedure contain the procedures for repairing the following transmission case sub-assemblies: side cover, countershaft, mainshaft and main drive gear.

INSTALLATION

1. Loosely install the transmission to the mounting plate. Place the transmission assembly in the motorcycle and loosely fasten the mounting plate to the frame.

2. On 1980 and earlier FL models and all 1983 and earlier FXWG models, install the speedometer cable and housing to the transmission.

3. On FX models (except FXWG/FXST) install the footrest and brake pedal assembly. Make sure clevis pin registers in rear brake master cylinder.

4. Install the oil tank left side mounting hardware.

5. Install the shifter rod on the shifter linkage.

6. See Figure 7-27. On chain drive models, install the rear chain on the transmission sprocket and secure it with the connecting link and spring clip. See CHAINS, Section 6. Make sure that the spring clip open end trails the direction of chain travel.

   On belt drive models, place the belt on the transmission sprocket. Tighten the axle adjusters enough to keep the belt from slipping off the sprocket. Final adjustment will be done later.

7. See Figure 7-27. Place the clutch cable into the release rod end.

8. Place the inner primary case in position on the motorcycle as described under ASSEMBLY, PRIMARY CASE, Section 6.

9. Tighten the transmission mounting plate-to-frame hardware to 21-27 ft-lbs torque, then tighten the transmission-to-mounting plate hardware to 18-22 ft-lbs torque.

10. Install the transmission-to-frame mounting bolt on the right side and tighten it to 18-22 ft-lbs torque.

11. Reassemble the starter housing, starter motor and starter motor mounting bracket. See Section 5.

12. Reconnect the three wires to the solenoid.

13. Install the clutch, primary chain/belt and compensating sprocket. See the CLUTCH assembly procedure, Section 6.

14. Remove the drain plug and washer from the transmission. Coat the plug threads with Loctite ANTI-SEIZE. Replace the drain plug and tighten it to 9-15 ft-lbs torque.

15. Fill the transmission with 1½ pints of Harley-Davidson TRANSMISSION LUBRICANT, Part No. 99892-84 qt. and 99891-84 gal.

16. Adjust the belt as described under BELTS, Section 6.

NOTE

On chain drive models, the primary housing must be air-tight after reassembly. Check using VACUUM GAUGE, Part No. HD-96950-68. Remove one of the clutch inspection cover screws and screw in the gauge threaded fitting. Using a pliers, pinch the vent hose shut between the tee and inner primary. The reading should now be 25 inches of water vacuum at 2000 rpms. A lower reading indicates an air leak into the primary case at the gasket, solenoid, starter shaft or hoses.

REPLACING THE MAIN DRIVE GEAR BEARING SPACER OIL SEAL

It is not necessary to remove the transmission from the motorcycle to remove the oil seal.

1. Remove the transmission sprocket. See the SPROCKET disassembly procedure, Section 6.

2. See Figure 7-28. Pry the oil seal from the transmission case using a screwdriver.

3. Tap the new seal into place using a rawhide mallet and a piece of pipe the same diameter as the seal. Install the seal so it is flush with the case surface.

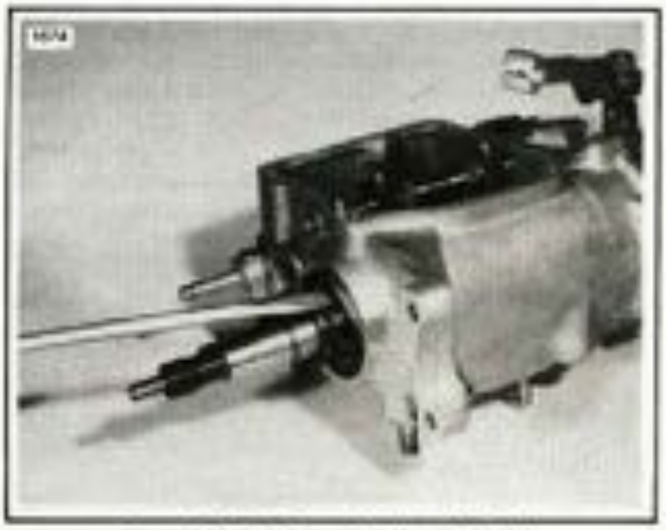


Figure 7-28. Removing the Oil Seal

SIDE COVER-ELECTRIC START (Figure 7-29)

Disassembly

1. If just the side cover is to be repaired, remove the exhaust pipes and starter mounting bracket. On FX models (except FXWG/FXST) remove the brake pedal assembly.

   If the other transmission repairs are required, remove the transmission from the motorcycle. See the REMOVAL procedure.

2. Remove the side cover mounting nuts (1) and washers (2). Remove the side cover (4) and gasket (3).

3. Remove the nut (5) and lockwasher (6). Remove the release arm (7) using an ALL PURPOSE CLAW PULLER, Part No. HD-95635-46.

4. Remove the clip (11). Pull the release lever shaft (8) from the cover and remove the release finger (9) and washer (10).

Cleaning, Inspection and Repair

1. Replace any parts that are worn or broken.

2. The two bushings (12 and 13) are rarely replaced. If replacement is necessary, remove them using a slide hammer.

NOTE

It is easier and faster to replace the cover than to remove the bushings for replacement.

Assembly

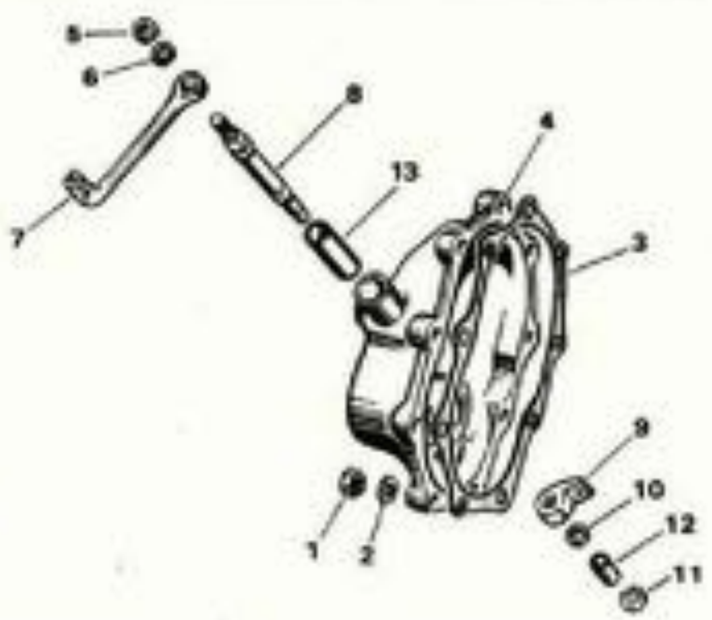
1. Insert the washer (10) and release finger (9) into the cover.

2. Insert the shaft into the cover and through the finger and washer. Secure it with the clip (11).

3. Install the release lever (7), lockwasher (6) and nut (5). Tighten the nut until the release lever bottoms on the shaft.

4. Position the lever to the extreme left, then install the cover, gasket and mounting hardware on the transmission.

5. If the transmission was not removed, install the brake pedal assembly (FX models), starter mounting bracket and exhaust pipes.



1. Cover nut
2. Washer
3. Gasket
4. Cover
5. Nut
6. Lockwasher
7. Release lever
8. Shaft
9. Finger
10. Washer
11. Clip
12. Bushing, lower
13. Bushing, upper

Figure 7-29. Side Cover — Electric Start — Exploded View

If the transmission was removed, install it into the motorcycle. See the INSTALLATION procedure.

SIDE COVER-KICK START (Figure 7-30)

Disassembly

1. If just the side cover is to be repaired, remove the exhaust pipes and starter mounting bracket. On FX models (except FXWG/FXST) remove the brake pedal assembly.

   If other transmission repairs are required, remove the transmission from the motorcycle. See the transmission case REMOVAL procedures.

2. Refer to Figure 7-31. Remove the starter crank bolt (1) and starter crank (2).

3. Remove the side cover mounting nuts (3) and washers (4). Remove the side cover (5) and gasket (6).

4. Clamp the crank shaft (9) in a vise. Bend the lockwasher (8) tab away from the nut (7). Remove the nut and lockwasher.

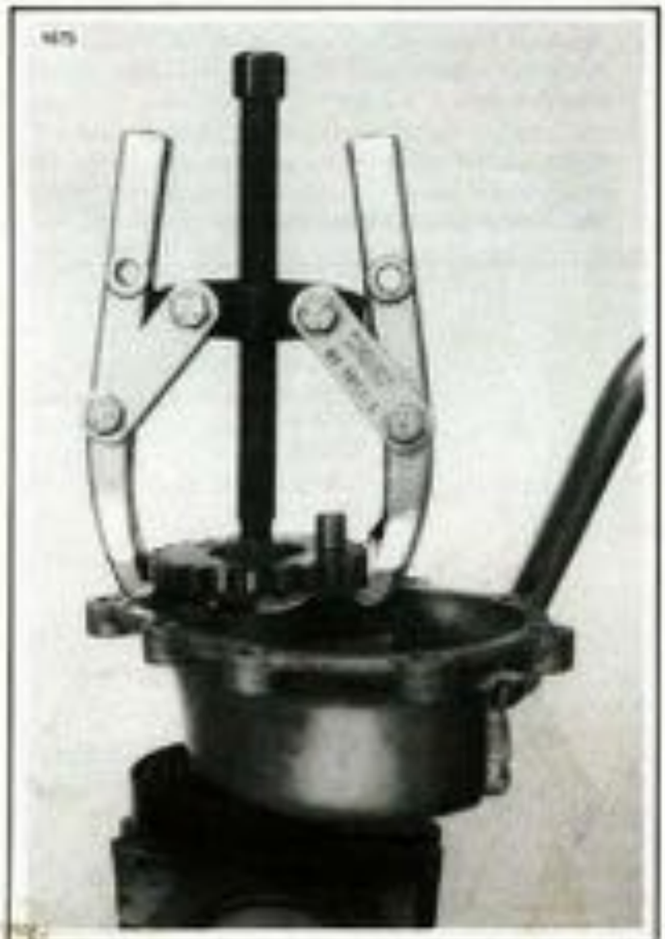


Figure 7-30. Removing Starter Crank Gear

5. See Figure 7-30. Place the nut back on the crankshaft. Install Harley-Davidson ALL-PURPOSE CLAW PULLER, Part No. HD-95635-46, as shown. Remove the gear and nut.

6. See Figure 7-31. Place the side cover in a vise and drive the shaft (9) out of the cover using a rawhide mallet. Remove the thrust washer (11).

7. Remove the nut (14) and lockwasher (15). Pull the release lever (16) off using the ALL-PURPOSE CLAW PULLER.

8. Remove the clip (17) and pull the release lever shaft (20) from the cover and remove the release finger (19) and washer (18).

Cleaning, Inspection and Repair

1. Clean all parts in solvent and blow dry.

2. Insert the starter crank shaft (9) into the cover. If there is appreciable side-to-side free play, replace the bushings (12) and oil seal (13). Bushings can be removed using a slide hammer and blind-end puller.

3. Bushings (21, 22) rarely need replacement. If replacement is necessary because of excessive free play in the release lever shaft, remove them using a slide hammer and blind-end puller.

NOTE

It is easier and faster to replace the cover than to remove the bushings for replacement.

4. If the spring (10) is worn or broken, replace it. Drive the spring from the shaft (9) using a hammer and a small punch.

   See Figure 7-32. When installing a new spring on the starter crank shaft, the outer hook should face to the left when looking at the starter crankshaft from the starter crank end.

Assembly

1. Insert the washer (18) and release finger (19) into the cover.

2. Insert the shaft (20) into the cover and through the finger and washer. Secure it with the clip (17).

3. Install the release lever (16), lockwasher (15) and nut (14). Tighten the nut until the release lever bottoms on the shaft.

4. Apply a light film of oil to oil seal (13) and crankshaft. Install the thrust washer (11) and crankshaft (9) into the cover with the chamfered side of washer facing the spring. Drive the shaft in with a rawhide mallet.

1. Starter crank bolt
2. Starter crank
3. Nut
4. Washer
5. Side cover
6. Gasket
7. Nut
8. Lockwasher
9. Crank shaft
10. Spring
11. Thrust washer
12. Bushing
13. Oil seal
14. Nut
15. Lockwasher
16. Release lever
17. Clip
18. Washer
19. Release finger
20. Shaft
21. Bushing, lower
22. Bushing, upper
23. Stud

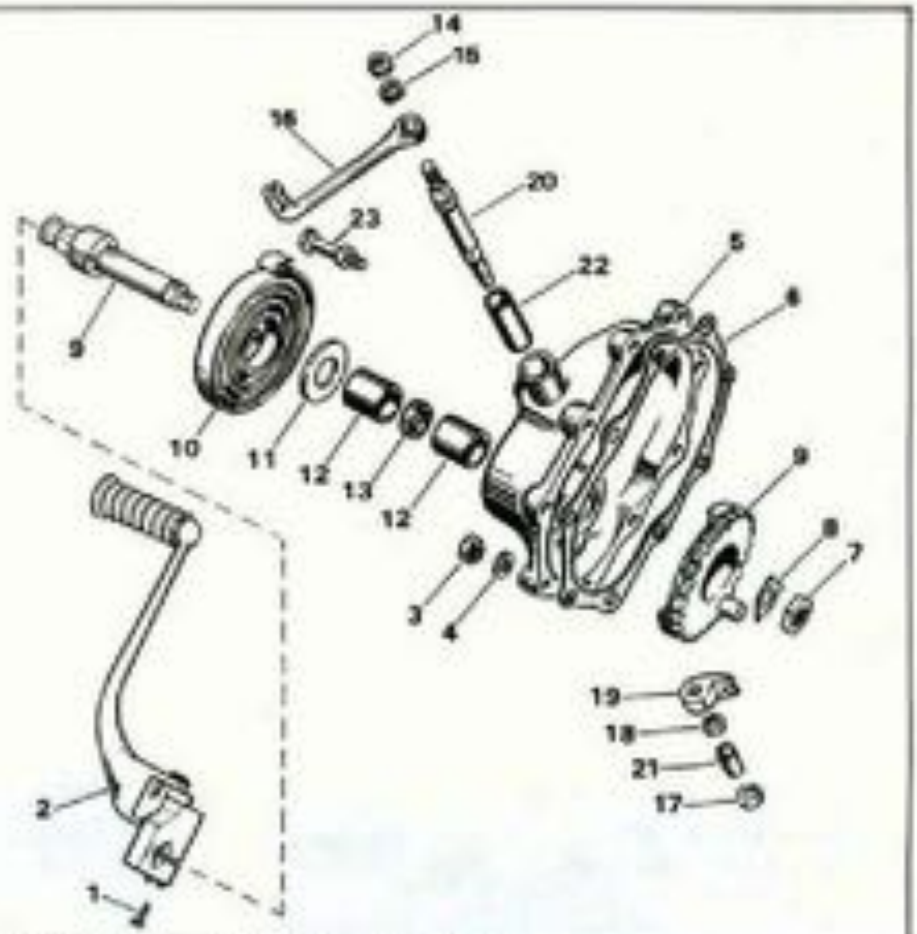


Figure 7-31. Side Cover — Kick Starter — Exploded View

Figure 7-32. Installing the Starter Crank Spring

5. Place the crankshaft in a vise with the spring (10) engaged on the stud (23). Press the starter crank gear onto the shaft using a 3/4 in. socket.

   See Figure 7-33. The gear should be installed so that the flat side of the crankshaft is in the 12 o'clock position and the starter gear dowel pin is in the 7 o'clock position.

6. See Figure 7-31. Install the lockwasher (8) and nut (7). Tighten the nut to 30-40 ft-lbs torque. Bend the lockwasher tab against a nut flat.

7. Position the release lever to the extreme left, then install the cover, gasket and mounting hardware on the transmission. Tighten the nuts to 13-16 ft-lbs torque.

8. If the transmission was not removed, install the brake pedal assembly (FX models), starter mounting bracket and exhaust pipes.

   If the transmission was removed, install it into the motorcycle. See the INSTALLATION procedure.

STARTER CLUTCH-KICK START MODELS ONLY

Disassembly (Figure 7-35)

1. Remove the transmission shifter cover and side cover. See the previous sections.

2. Remove the push rod assembly (1).

3. See Figure 7-35. Lock the transmission into two gears at once. Bend the lockwasher (3) tab away from the nut (2). Remove the nut and lockwasher.

4. See Figure 7-34. Remove the starter clutch using Harley-Davidson's STARTER CLUTCH PULLER, Part No. HD-95650-42.

5. See Figure 7-35. Remove the starter clutch key (5), gear (6) and spring (8).

Cleaning, Inspection and Repair

1. Clean all parts in solvent and blow dry.

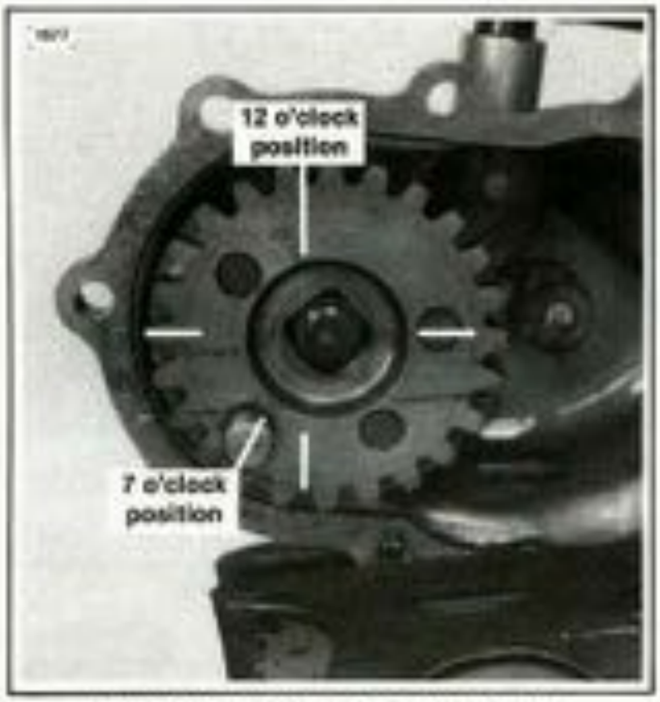


Figure 7-33. Installing Starter Crank Gear

2. Examine the starter clutch and gear. If the teeth are worn or damaged, replace them.

3. Replace the gear bushing (7) if it is pitted, worn or if gear has excessive free play side-to-side. Bushing should be just loose enough on mainshaft so the gear slides under force of the spring.

Assembly (Figure 7-35)

1. Lubricate the mainshaft with engine oil. Slip the spring (8) and gear (6) onto the mainshaft.

2. Install the key (5) and press the starter clutch (4) onto the mainshaft.

3. Lock the transmission into two gears at once. In-

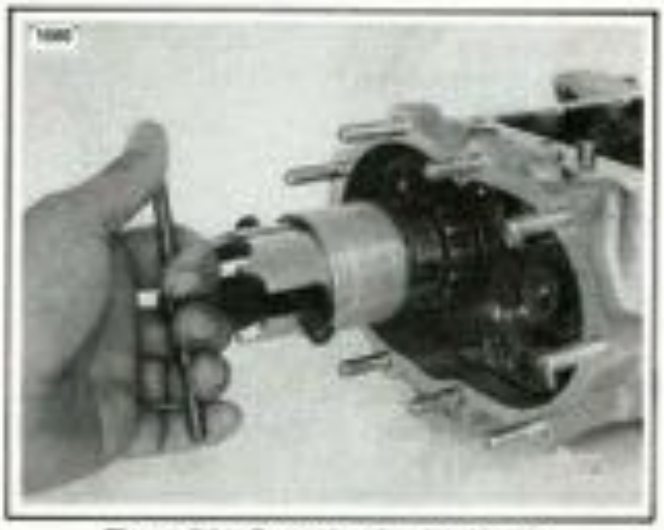


Figure 7-34. Removing Starter Clutch

1. Push rod assembly
2. Nut
3. Lockwasher
4. Starter clutch
5. Key
6. Starter clutch gear
7. Bushing
8. Spring
9. Starter crank stop (79 and earlier)

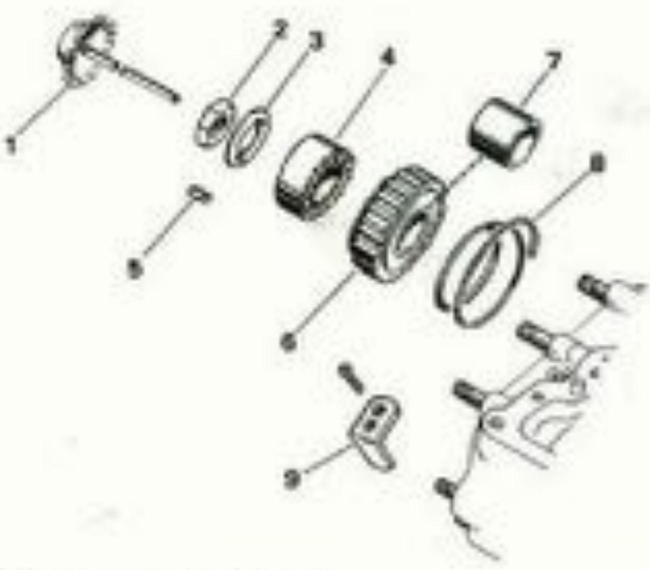


Figure 7-35. Starter Clutch — Exploded View

stall the lockwasher (3) and nut (2). Tighten the nut to 34-42 ft-lbs torque. Bend the lockwasher tab against a nut flat.

4. Install the push rod assembly (1).

5. Install the shifter cover and side cover. See the previous sections.

COUNTERSHAFT

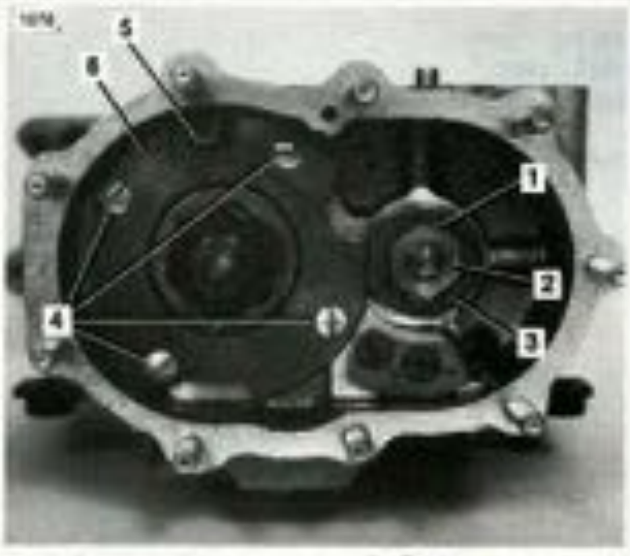
Disassembly

1. Remove the transmission from the motorcycle as described in the REMOVAL procedure.

2. Remove the shifter cover and side cover as described in the previous sections.

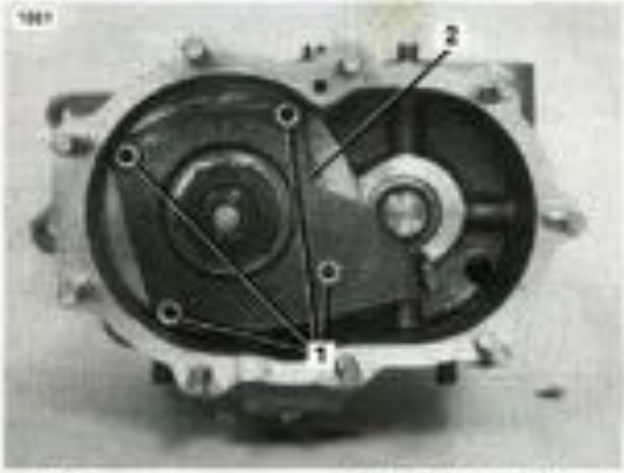
3. Remove the shifter forks. See the removal procedure under SHIFTER FORKS.

4. On 1978½-1979 models, see Figure 7-36. Bend the lockwasher (1) ear away from the nut (2). Remove the nut, washer and retaining plate (3).



1. Lockwasher
2. Nut
3. Retaining plate countershaft
4. Screw
5. Oil deflector
6. Retaining plate mainshaft

Figure 7-36. Mainshaft and Countershaft Retention — 1978½ - 1979



1. Screws
2. Retaining plate

Figure 7-37. Mainshaft and Countershaft Retention — 1980 & Later

Figure 7-38. Removing Countershaft Washer

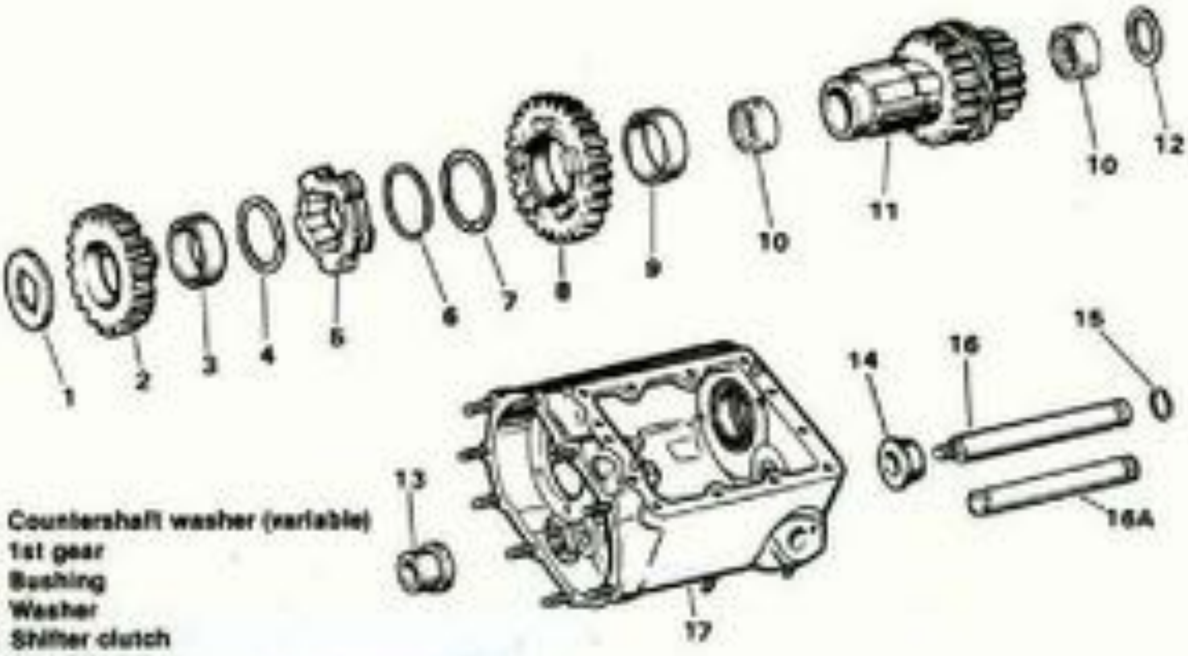
5. On 1980 & later models, see Figure 7-37. Remove the four screws (1) and retaining plate (2).

6. Tap the countershaft out of the transmission case from the side cover end so the oil seal on the other end of the shaft is not damaged.

7. See Figure 7-38. Using a piece of wire with the end bent into a hook, remove the countershaft washer.

8. See Figure 7-39. Remove the gear cluster and thrust washer (12) from the transmission case. Slide 1st gear (2), bushing (3), washer (4) and shifter clutch (5) off of the gear (11).

9. See Figure 7-39. Use a sharp-pointed tool and remove the retaining ring (6) from the gear (11). Remove the washer (7), 2nd gear (8) and bushing (9) from the gear (11).



1. Countershaft washer (variable)
2. 1st gear
3. Bushing
4. Washer
5. Shifter clutch
6. Retaining ring
7. Washer
8. 2nd gear
9. Bushing
10. Bearing
11. Countershaft gear
12. Thrust washer
13. Bushing, right
14. Bushing, left
15. Oil seal
16. Countershaft (1978½ - 1979)
16A. Countershaft (1980 - 1984)
17. Transmission case

Figure 7-39. Countershaft Assembly — Exploded View

Cleaning, Inspection and Repair (Figure 7-39)

1. Inspect all gears, if teeth are rounded, worn or broken, replace the gear.
2. Inspect the engaging dogs on the gears and shifter clutches. Replace the gears and clutches if dogs are rounded or chipped.
3. Inspect the bearings and countershaft. Replace them if there is any sign of wear. When pressing new bearings into gear (11) coat the outer diameter of the bearing with a light weight oil such as 20-W and press only on side of bearing with numbers or letters stamped on the face. This side should face to the outside of the gear.
4. Check the countershaft bushings (13, 14) for pitting or wear. Replace them if necessary after heating the transmission case to about 300°F.

Assembly (Figure 7-39)

1. Install the bushing (9), 2nd gear (8) and retaining washer (7) onto the gear (11). Secure all the parts together using a new retaining ring (6).
2. Slide the shifter clutch (5), washer (4), bushing (3) and 1st gear (2) onto the gear (11).
3. Place a small amount of grease on the washers (1 and 12), to hold them in place, and install the washers into the transmission case. Install the gear cluster.
4. Install a new oil seal (15) onto the countershaft (16, 16A). Tap the countershaft in from the sprocket side of the case. The O-ring should be on the sprocket side of the case.
5. Check the gear end play between the washer (1) and the countershaft gear (11). End play should be .004-.012 in. If end play is not within this range, increase or decrease end play by substituting the appropriate size washer (1). Washers are available in the following sizes: 0.074, 0.078, 0.082, 0.085, 0.090, 0.095 and 0.100 in.
6. On 1978½-1979 models, see Figure 7-36. Install the retaining plate so the flat side registers against the mainshaft retaining plate. Install the lockwasher and nut. Tighten the nut to 55-60 ft-lbs torque. Bend the lockwasher tab against a nut flat.

   On 1980 & later models, see Figure 7-37. If the mainshaft is to be disassembled, leave the retainer assembly disassembled and proceed to the mainshaft DISASSEMBLY procedure. If the mainshaft is not being disassembled, install the retaining plate

(2) and screws as shown. tighten the screws to 7-9 ft-lbs torque.

MAINSHAFT AND MAIN DRIVE GEAR

Disassembly

1. Remove the transmission as described in the transmission removal procedure.
2. On 1978½-1979 models, see Figure 7-36. Remove the four screws (4), retaining plate (5) and oil deflector (6).
3. Remove the shifter cover, forks and countershaft assemblies as described in the preceding sections.
4. See Figure 7-40. Press the mainshaft out the side cover end of the transmission until the mainshaft second gear contacts the case. Pry the lock ring out of the mainshaft groove and slide it onto the splines.
5. Slide the mainshaft out of the case, sliding third gear, washer, lock ring and shifter clutch off the shaft. Remove these parts through the shifter cover opening.
6. See Figure 7-42. Clamp the mainshaft in a copper jaw vise. Bend the lockwasher (2) tab away from the nut (1). Remove the nut and lockwasher. Remove the bearing (3), race (4) and gear (5) one at a time, using the ALL-PURPOSE CLAW PULLER.
7. Remove the main drive gear from the case.

Cleaning, Inspection and Repair (Figure 7-42)

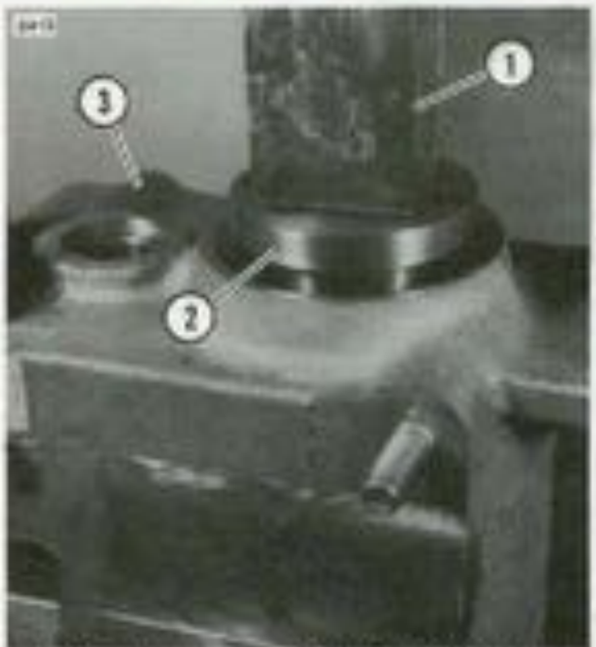
1. Inspect all gears. If teeth are rounded, worn or broken, replace the gear.

Figure 7-40. Removing the Mainshaft

2. Inspect the engaging dogs on the gears and shifter clutch. Replace them if dogs are rounded or chipped.
3. Inspect the bearing (3) and race (4). Replace them if they are worn, pitted or if end play is excessive.
4. Inspect the gear bushing (8) and mainshaft. Replace them if there is any sign of wear.
5. See Figure 7-42. Check the bushing (13) and oil seal (14) in the main drive gear (12). If the seal is worn, pry out and replace it. See Assembly.

   If the bushing is worn, press it out and replace it.
6. Check the bearing (15) and main drive gear bearing surface. If the bearing surface appears pitted or worn, replace the bearing and the gear.

   To replace the bearing, remove the oil seal (17) by prying it out with screwdriver. See REPLACING THE MAIN DRIVE GEAR BEARING SPACER OIL SEAL. Remove spacer (16) and press the bearing from the case. Coat the outside diameter of the bearing with a light oil such as 20-W. Place the transmission case on an arbor press with the case adequately supported to prevent loading on the studs. Set the bearing squarely over the bearing bore and place the MAIN DRIVE GEAR BEARING INSTALLER, Part No. HD-33428 on the bearing with the small diameter centering guide in the bearing cavity. See Figure 7-41. Press the bearing into the bore until the tool bottoms against the steel sleeve insert or housing on earlier transmissions. Once the tool bottoms, the bearing wil be into the bore the specified amount.



1. Arbor press
2. Main drive gear bearing installer
3. Transmission case

Figure 7-41. Main Drive Gear Bearing Installation

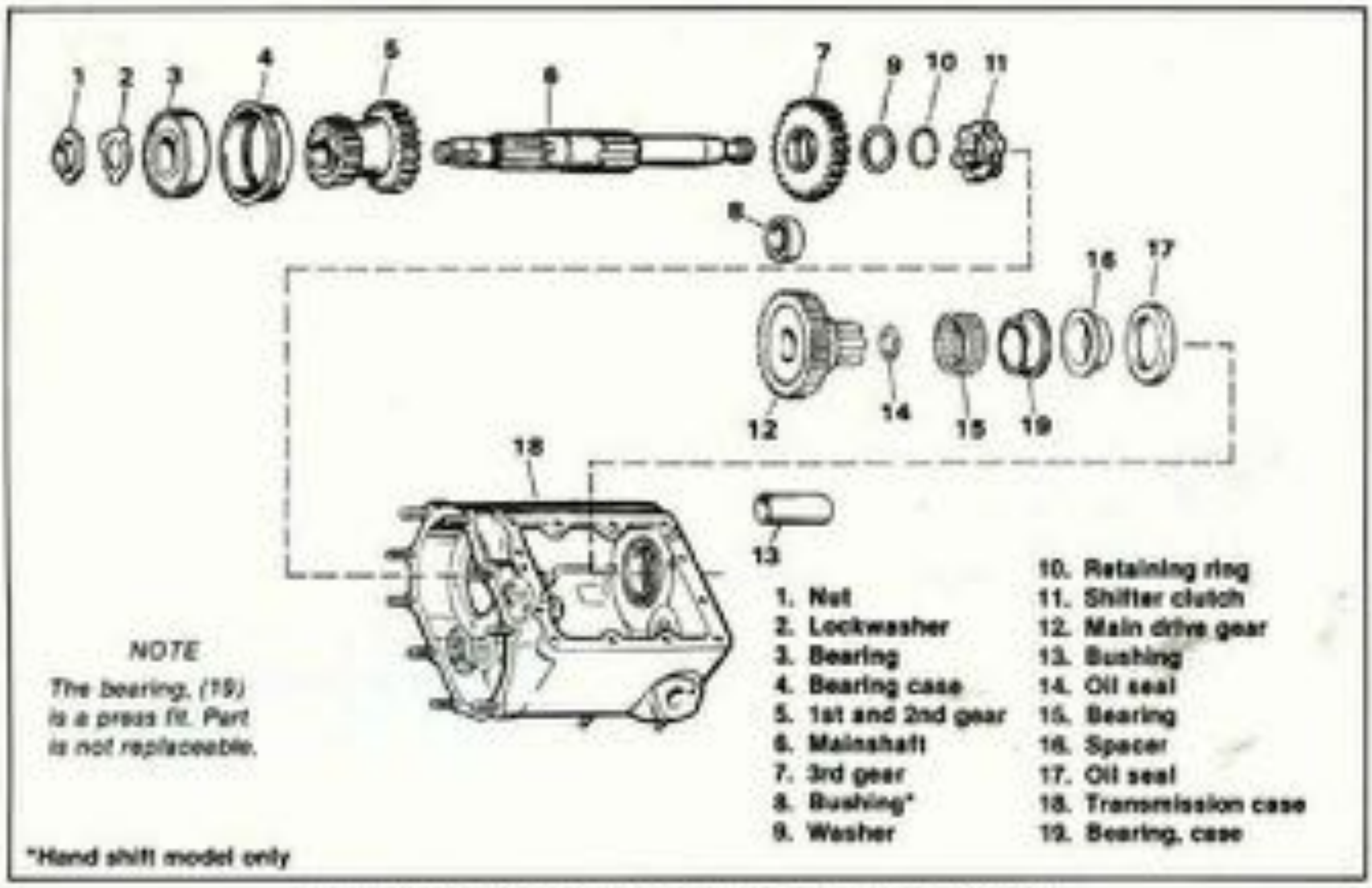


Figure 7-42. Mainshaft and Main Drive Gear — Exploded View

CAUTION

Pressing in the bearings using methods other than the special installation tool may cause permanent damage to the bearing. The MAIN DRIVE GEAR BEARING INSTALLER, Part No. HD-33428 is machined in such a manner that all the loading is on the bearing race outer edge preventing the damage that often occurs to the bearing race when using an ordinary socket as a press in tool.

Assembly

1. Install the main drive gear into the case.

2. See Figure 7-42. Press the gear (5), race (4) and bearing (3) on to the mainshaft using an arbor press.

3. Place the mainshaft in a copper-jaw vise and install the lockwasher and nut. Tighten the nut to 50-60 ft-lbs torque. Bend the lockwasher tab against a nut flat.

4. See Figure 7-42. Install the mainshaft assembly into the case far enough to install the bushing (8), gear (7), washer (9), a new retaining ring (10) and the shifter clutch (11). Make sure retaining ring seats in the mainshaft groove.

NOTE

The shifter clutch has the word HIGH stamped on one side. This side must face toward the main drive gear.

5. Press the mainshaft all the way into the case until the shoulder on bearing case (4) is seated against the transmission case.

6. Install seal (14) on mainshaft. Press seal into main drive gear using a 5" length pipe with a 1" I.D. and 1-3/16" O.D.

7. Install the countershaft as described in the preceding section.

8. On 1978½-1979 models, see Figure 7-36. Install the retaining plate (6), oil deflector (5) and screws (4). Tighten screws to 7-9 ft-lbs torque.

   On 1980 and later models, see Figure 7-37. Install the retaining plate (2) and four screws. Tighten screws to 7-9 ft-lbs torque.

9. Install the transmission as described in the transmission case INSTALLATION procedure.

CS 1st
35785-36
FL-all
FX 1971-1973

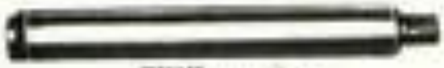
MS 1st & 2nd
35282-59
FL 1958 to present
FX 1971-1973

CS 2nd
35751-36
FL 1936 to present
FX 1971-73

MS 1st & 2nd
35282-74
FX 1974-1979

CS 1st
35717-74
FX 1974 to present

Counter shaft



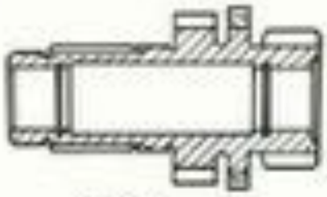
35614-65
Threaded on right end
Groove on left end
44 loose roller bearings
1977 and earlier

35614-76
Threaded on right end
Grooves on both ends
Caged roller bearings
Mid 1977 and later

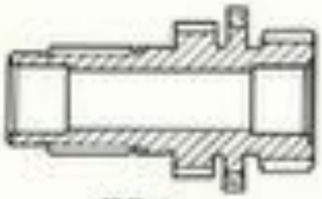
35614-80
Slot on right end
Groove on left end
Caged roller bearings
1980 to present

4-Speed Transmissions

Gear & Countershaft Identification

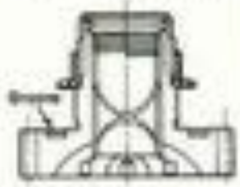


CS Cluster
44 Loose roller bearings
Mid 1977 and earlier
FL and FX



CS Cluster
Caged roller bearings
Mid 1977 and later
FL and FX

MS 4th
35057-77A
FL - Mid 1977 to present
FX - Mid 1977 to present



MS 4th
35056-36B
FL - Mid 1977 & earlier
FX - Mid 1977 & earlier

CS shift clutch
No grooves
FL - all
FX 1971 - 1979
With grooves
FL - all
FX - all

MS 1st & 2nd
35282-79
FX 1980 to present

CS 3rd
35751-79
FX 1980 to present

SUBJECT		PAGE NO.
1.	Specifications	8-1
2.	Ignition System 1979 and Earlier	8-3
3.	Ignition System 1980 and Later	8-9
4.	Spark Plugs	8-15
5.	Ignition Coil	8-17
6.	Ignition-Light Switch	8-19
7.	Charging System	8-21
8.	Battery	8-25
9.	Lights	8-27
10.	Horn	8-31
11.	Wiring Diagrams	

ELECTRICAL

ELECTRICAL

SPECIFICATIONS

IGNITION

Spark timing (FL/FX except FXST)

Fully advanced .... 35° BTDC
Fully retarded .... 3° BTDC

FXST Spark Timing Advance

Range .... 5° - 50° BTDC
Start .... 5° BTDC
Fast idle .... 35° BTDC
1800 - 2800 RPM .... 50° BTDC

Spark Plugs

Size .... 14 mm
Gap .... 0.038 to 0.043 in.
Type
1979 and earlier .... Harley-Davidson No. 5A6A (Standard)
Harley-Davidson No. 5R6A (Resistor type)
1980 and later .... Harley-Davidson No. 5R6A
Harley-Davidson No. 5RL
1984 FXST .... Harley-Davidson No. 5R6A (No Substitute)

NOTE

Harley-Davidson No. 5A6 plug may be used in place of a No. 5A6A plug and a 5R6 plug can be used in place of a 5R6A plug if regapped to 0.038 to 0.043 in.

BULB CHART

The bulb chart below gives location and bulb requirements for your Harley-Davidson motorcycle.

Ignition Coil Resistance

1979 and Earlier
Primary .... 4.7 to 5.7 Ohms
Secondary .... 16,500 to 20,000 Ohms
1980 and Later
Primary .... 3.3 to 3.7 Ohms
Secondary .... 16,500 to 19,500 Ohms

Ignition Timer Air Gap

1979 and earlier .... 0.004 to 0.006 in.
1980 and later .... not applicable

BATTERY

FL/FLH .... 12 volt, 32 amp. hr.
FX .... 12 volt, 7.5 amp. hr.
FXE/FXEF/FXS/FXB
FXSB/FXWG/FXDG/FXST .... 12 volt, 19 amp. hr.

ALTERNATOR

AC Voltage Output .... 19-26 VAC per 1000 rpm
Stator Coil Resistance .... .2-.4 ohms

REGULATOR

Voltage output @ 3600 rpm .... 13.8-15 @ 75°F
Amperes @ 3600 rpm
1978½-1980 .... 16 Amps
1981 .... 17.8 Amps
1982 and Later .... 22 Amps

LAMP DESCRIPTION	NO. OF BULBS REQUIRED	POWER	HARLEY-DAVIDSON PART NUMBER
HEADLIGHT	1 1	60/50 watts 50/35 watts	67697-81 (FL) 67698-81A (FX)
TAIL AND STOP LIGHT Tail light Stop Light	1	 3 C.P. 32 C.P.	68165-64 (FL) (FX)
TURN SIGNAL	4	32 C.P.	68572-64A (FL) (FX)
INSTRUMENT LIGHTS Speedometer Light Tachometer Light High Beam Indicator	 1 1 1	 2 C.P. 1 C.P. 2 C.P.	 71090-64 (FL) (FX) 71099-74 (FX) 68462-64 (FL) (FXWG) (FXDG) (FXST) 71092-68A (FX)
Neutral Indicator	1	2 C.P.	68462-64 (FL) (FXWG) (FXDG) (FXST) 67851-75 (FX)
Oil Pressure Signal	1	2 C.P.	68462-64 (FL) (FXWG) (FXDG) (FXST) 68536-75 (FX)

IGNITION SYSTEM — 1979 AND EARLIER

IGNITION TIMER

Description

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, switch, primary coil winding, ignition timer and associated wiring. The secondary circuit consists of the secondary coil, the spark plugs and associated wiring. See schematic diagram, Figure 8-1.

The ignition timer is located in the gearcase cover on the right hand side of the motorcycle. It has two functions. First, it opens and closes the low voltage circuit between the battery and ignition coil causing the coil to produce high voltage discharge to the spark plugs. Second, the ignition timer times discharge for proper engine firing.

The ignition timer includes a trigger rotor, sensor, electronic control module and advance mechanism. A single ignition coil fires both spark plugs at the same time, but one spark occurs in the exhaust stroke of one cylinder and the other spark fires the combustible gases in the other cylinder to produce the power stroke.

The advance mechanism is an extension on the camshaft and operates at half crankshaft speed. The trigger rotor is advanced automatically as engine speed increases and retarded as speed decreases through the action of flyweights in the advance mechanism. This ensures correct spark timing to suit starting, low and high speed requirements.

Operation (Figure 8-1)

The trigger rotor (1) has two lobes, the small lobe fires the front cylinder and the large lobe fires the rear cylinder. The sensor (2) consists of a number of turns of fine wire wound on a core and is mounted on the timer plate so that the lobes on the trigger rotor pass in close proximity. The air gap must be adjusted to 0.004-0.006 in.

The electronic control module (3) contains all of the solid state components used in the ignition system. Within the control module is an integrated circuit chip (4) which contains oscillator and demodulator circuits. The control module is fully enclosed in a silicone material to protect it from vibration, dust, water or oil. The unit is a nonrepairable item. If it fails, it must be replaced.

When the ignition switch (5) and engine stop switch (12) are on, current flows from the battery (6) to the control module (3). An oscillator section in the integrated circuit chip (4) sets up a signal in the sensor (2). This creates a field around the sensor. When a trigger rotor (1) lobe leading edge enters the sensor's field, it reduces the strength of the oscillating signal. This weakened sensor signal is detected by what is called a demodulator cir-

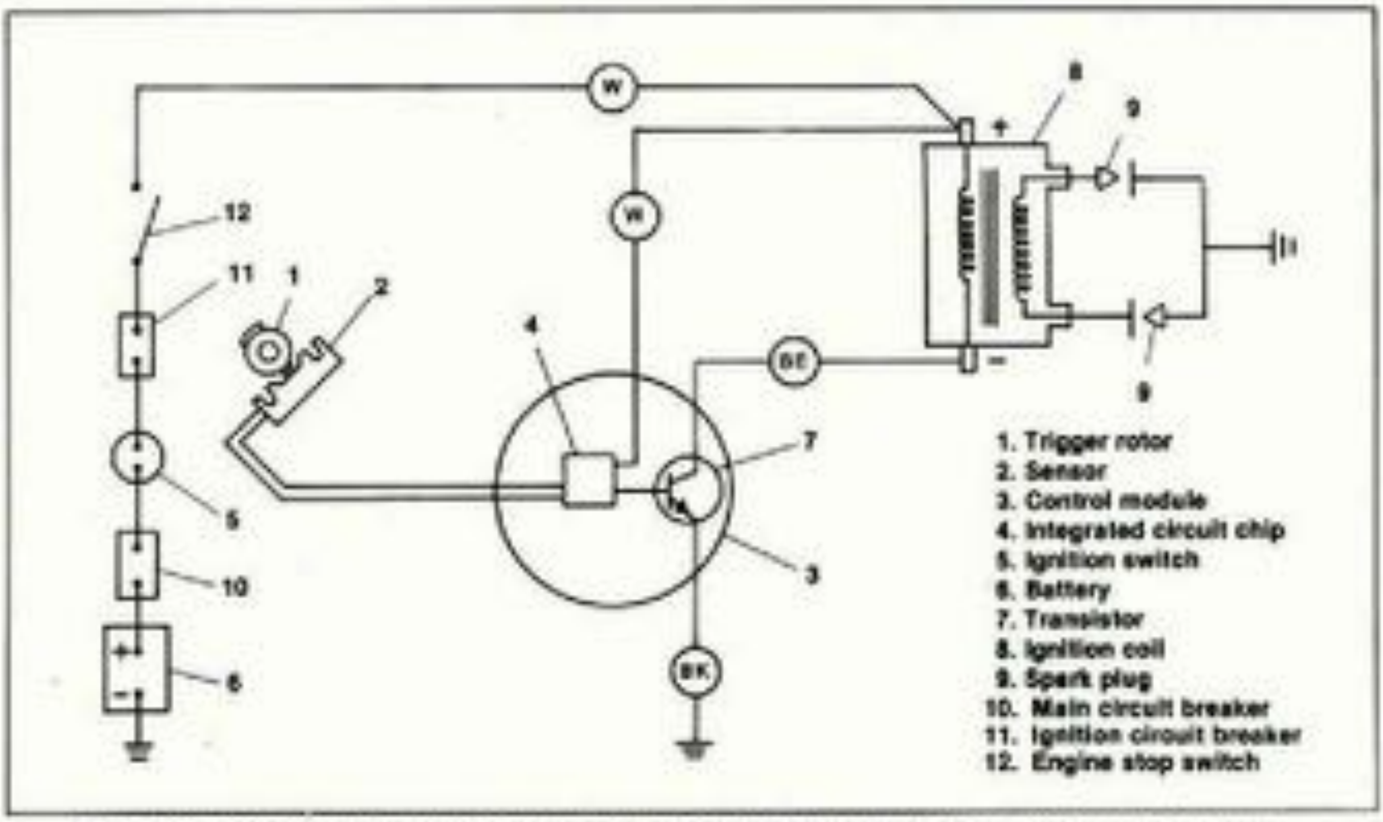


Figure 8-1. 1979 And Earlier Breakerless Inductive Discharge Ignition System — Schematic Diagram

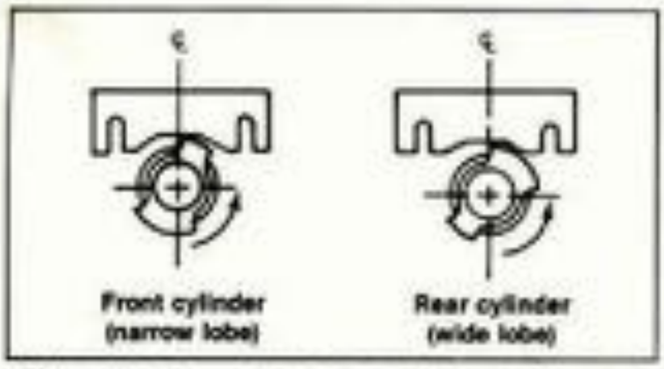


Figure 8-2. Trigger Rotor Position for Ignition Timing

cuit in the integrated circuit. The demodulator controls a transistor (7) which turns off the current in the ignition coil (8) primary circuit. This causes a high voltage to be induced in the secondary of the coil which in turn causes a spark at the spark plug gaps (9).

The time of spark plug firing is when the leading edge of each lobe aligns approximately with the center of the sensor as shown in Figure 8-2.

TROUBLESHOOTING

Refer to Figure 8-1 and to the appropriate vehicle wiring diagram.

When the engine will not start or when hard starting or missing indicates a faulty ignition system, proceed as follows:

1. Remove spark plug cables and plugs. Check condition of plugs and cables. Clean or replace as necessary.

2. Insert an extension adapter into spark plug 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 a spark is obtained across the gap. If a spark is obtained, the problem is not in the electronic system or coil. Check carburetion, choke, spark plugs, and advance mechanism.

3. If no spark is obtained, check battery voltage and battery connection condition. Turn on ignition and engine stop switches to crank engine with a voltmeter across the battery. Voltage should be 11.5 or above. If voltage is low, battery needs charging.

4. Remove the timer case cover and position ignition module to one side. Check the air gap between both trigger lobes and the sensor. Air gap must be 0.004 to 0.006 in. If this gap cannot be held on both rotor lobes, timer mechanism shaft and/or trigger rotor have excessive runout and should be replaced or straightened. Check to make sure that control module ground (black lead) is securely fastened to timer plate and that wires are in good condition.

NOTE

Whenever sensor air gap is adjusted, the ignition advanced timing should be checked and adjusted if necessary. See ADJUSTING ADVANCED TIMING WITH STROBE TIMING LIGHT. If spark is still not evident, continue with the following voltmeter checks.

Position trigger rotor so that the center of the sensor is between two lobes.

5. Connect voltmeter between ignition positive coil terminal (white wires) and engine ground. With ignition and engine stop switches on, the voltmeter reading should equal battery voltage within 0.5 volt. If not, trouble lies in circuit between battery and ignition coil. Check the connections at or in circuit breakers and ignition switches.

6. Disconnect blue wire from coil negative terminal. Connect voltmeter between coil negative terminal and ground. With ignition and engine stop switches on, the voltmeter reading should equal battery voltage. If not, ignition coil primary is defective. Replace coil. Retest for spark after corrections are made.

7. Reconnect blue wire to coil negative terminal. Connect voltmeter between coil negative terminal and ground. Reading should be 1 to 2 volts. Place the blade of a screwdriver against the face of the sensor. If the voltmeter reading switches up to 11.5 to 13 volts, proceed to step 8. If the voltmeter does not switch up and down or does not read 1 to 2 volts, the ignition module is faulty and must be replaced.

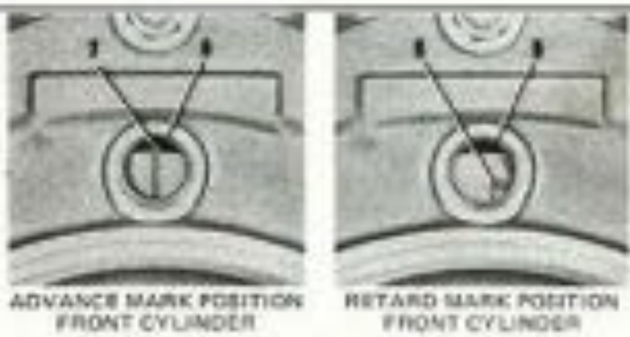
8. Re-establish the 3/16 in. gap between spark plug cable and ground. Check for a spark discharge each time the screwdriver blade is placed against the face of the sensor. If sparks are not observed, the coil secondary is faulty and the coil must be replaced.

CAUTION

Coil wires must be connected correctly. Both white wires must be connected to the same coil primary terminal or ignition control module will be permanently damaged.

ADJUSTING SENSOR AIR GAP (See Figure 8-3)

Ignition timer sensor air gap should be checked initially at 500 miles and thereafter every 2500 miles. Remove spark plugs to permit engine to turn easily and rotate flywheels so that the wide lobe on the trigger rotor (1) is centered in the sensor (2). Check the gap between the rotor and sensor using a narrow feeler gage. If gap is not correct, loosen screws (3) and move sensor as required. Repeat for narrow lobe setting so that gap for



1. Trigger rotor
2. Sensor
3. Sensor screws (2)
4. Timer plate
5. Timer plate screw (2)
6. Plate adjusting notch
7. Advance (35°) timing mark
8. Fully Retarded (0° B.T.C.) position of piston top center mark on flywheel
9. Timing inspection hole
10. Ignition module
11. Ignition module ground screw

Figure 8-3. Ignition Timer and Flywheel Timing Marks

both lobes is between 0.004 and 0.006 in. Tighten screws (3) to 5 to 7 in-lbs torque.

CHECKING ADVANCE TIMING WITH STROBE TIMING LIGHT (Figure 8-3)

Ignition timing should be checked initially at 500 miles and thereafter every 2500 miles.

NOTE

Before checking timing, check sensor air gap as described previously.

1. Use a strobe flash light (timing gun) to view advanced timing mark (7) on flywheel through accessory plastic view plug, Part No. HD-96295-65, screwed into timing inspection hole (9). Make sure view plug does not touch flywheel.

2. Timing light leads should be connected to the front spark plug, ground and battery positive terminal.

3. Start engine and set engine at 2000 rpm. Light will flash each time spark occurs (see Figure 8-4).

4. Loosen timer plate screws (5) just enough so that plate (4) can be shifted using a screwdriver in notch (6) as light aimed into inspection hole (9) stops timing mark (7) in center of hole. Timing will retard 32° automatically when engine is at idle speed or is stopped.

5. Rear cylinder advance timing mark is a single large drilled dot which should appear on or near the front cylinder advance timing mark while viewing with timing light. See Figure 8-4.

SETTING RETARDED TIMING WITH CIRCUIT TESTER (See Figure 8-3)

CAUTION

This procedure will result in approximate timing and engine can be operated in an emergency for a short period of time. Advanced timing should be checked and set under running conditions as soon as possible using a strobe timing light as described in preceding section.

Figure 8-4. Checking Timing with a Strobe Light

NOTE

Whenever ignition components have been disassembled such as during engine disassembly and reas-

sembly, or if a strobe timing light is not available, approximate timing can be obtained by using the following procedure.

1. Remove screw plug from timing inspection hole (9) in left side of crankcase. Then remove front push rod cover so that opening and closing of valve can be observed.

2. Turn engine in direction in which it runs until front piston is on compression stroke (just after front intake valve closes), and continue turning very slowly (less than 1/2 revolution) until piston top dead center timing mark (8) on flywheel is aligned in the inspection hole as shown.

3. With timer rotor fully retarded, the leading edge of the narrow rotor lobe should be aligned with the center of the sensor body as shown in Figure 8-2. At this point the retarded front cylinder ignition spark occurs.

4. A circuit tester, such as a 12-volt light bulb (No. 57) can be used to determine the exact point of ignition firing as follows: Disconnect the blue wire from the ignition coil primary terminal and connect test light to this terminal and to end of removed blue wire.

5. Loosen timer plate screws (5) just enough to shift timer plate (4) using a screwdriver in notch (6), so

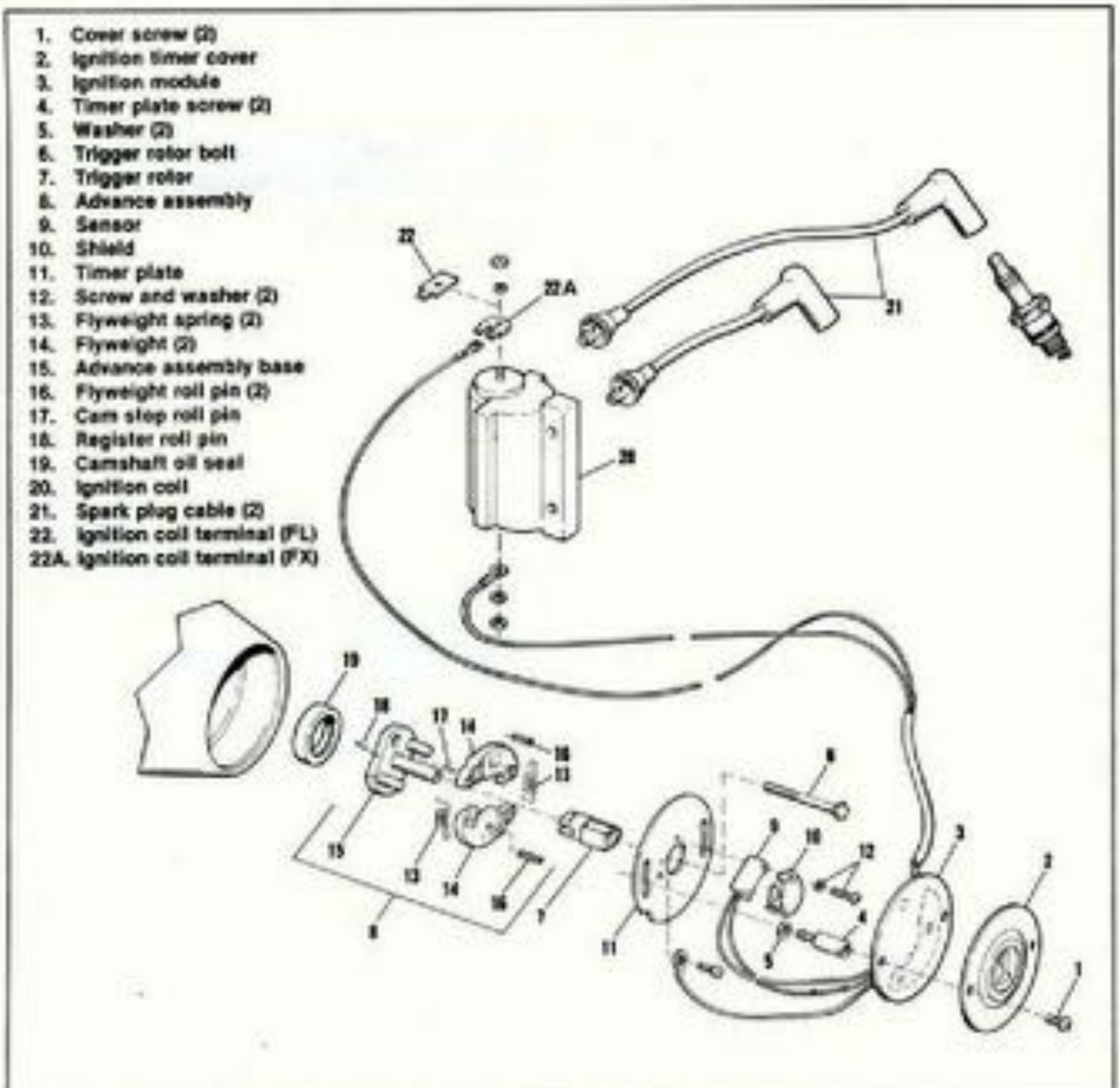


Figure 8-5. Ignition System Components — 1978½ to 1979

light goes on or off when piston top dead center timing mark is aligned in inspection hole (9) as shown in Figure 8-3.

6. Tighten screws (5) to 12 to 18 in-lbs torque.

NOTE

When reinstalling the control module and timer compartment cover, make sure that wires are not pinched between the control module and internal components.

DISASSEMBLING AND ASSEMBLING

Removing Ignition Timer Components (Figure 8-5)

1. Remove ignition timer cover screws (1), cover (2) and ignition module (3).
2. Remove timer plate screws (4) and washers (5).
3. Remove trigger rotor bolt (6) and pull trigger rotor (7) from advance assembly (8).
4. Remove advance assembly from gearcase.
5. To remove sensor (9) and shield (10) from timer plate (11), remove screws and washers (12).
6. To disassemble advance mechanism, unhook spring (13) from grooves in pivot pins and slip flyweights (14) with spring from pivot pins on advance base (15). Do not remove springs from flyweights unless they are to be replaced. Roll pins (16, 17, 18) are pressed in and can be replaced if necessary.

Inspecting And Replacing Parts (Figure 8-5)

1. Inspect lip of seal (19) and replace it if worn or rough. Also replace the seal if there is any evidence of oil leakage into the timer compartment.
2. Check flyweight springs (13), and if bent or stretched, replace them. When installing, be sure that bent end of each spring is hooked through bottom of hole, and that upper looped end grips groove in pin tightly. See Figure 8-6.
3. Check for looseness of rotor (7) on shaft (15) and wear on sides of flyweight (14) ears which engage slots in rotor.
4. Reassemble advance assembly and lubricate moving parts with Loctite ANTI-SEIZE. Check operation by moving rotor in direction required to advance weights to their fully extended position. Then release the rotor and see if springs return to the fully retarded position. Correct causes of faulty action by cleaning and lubricating the shaft and flyweights with Loctite ANTI-SEIZE and replace weak springs. Lubrication of the advance assembly should be performed at 5000 mile intervals.

Assembling Ignition Timer Components (Figure 8-5)

1. Advance assembly must seat squarely and firmly on end of camshaft.
2. Install trigger rotor (7) in correct position so that it engages both flyweights and flat side is next to roll pin (17). Tighten trigger rotor bolt to 20 to 24 in-lbs torque.
3. Adjust sensor air gap and set retarded ignition timing as described in previous section. Check advanced ignition timing under running conditions as described in previous section.

CAUTION

When installing ignition module, make sure wires are not pinched.

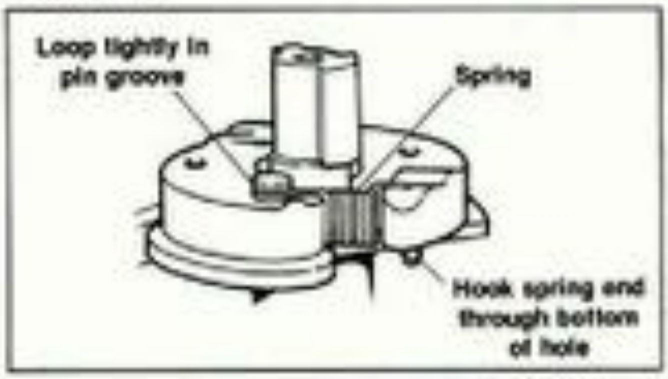


Figure 8-6. Advance Unit Flyweight Spring Assembly

IGNITION SYSTEM
1980 AND LATER

DESCRIPTION

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, 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 two assemblies, rotor and sensor plate and the computer microprocessor module. The rotor and sensor plate are located in the gearcase cover on the right side of the motorcycle. The computer module is mounted below the regulator at the front of the frame. 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.

A single ignition coil fires both spark plugs at the same time, but one spark occurs with no effect in the exhaust stroke of one cylinder, while the other spark fires the combustible gases in the other cylinder to produce the power stroke.

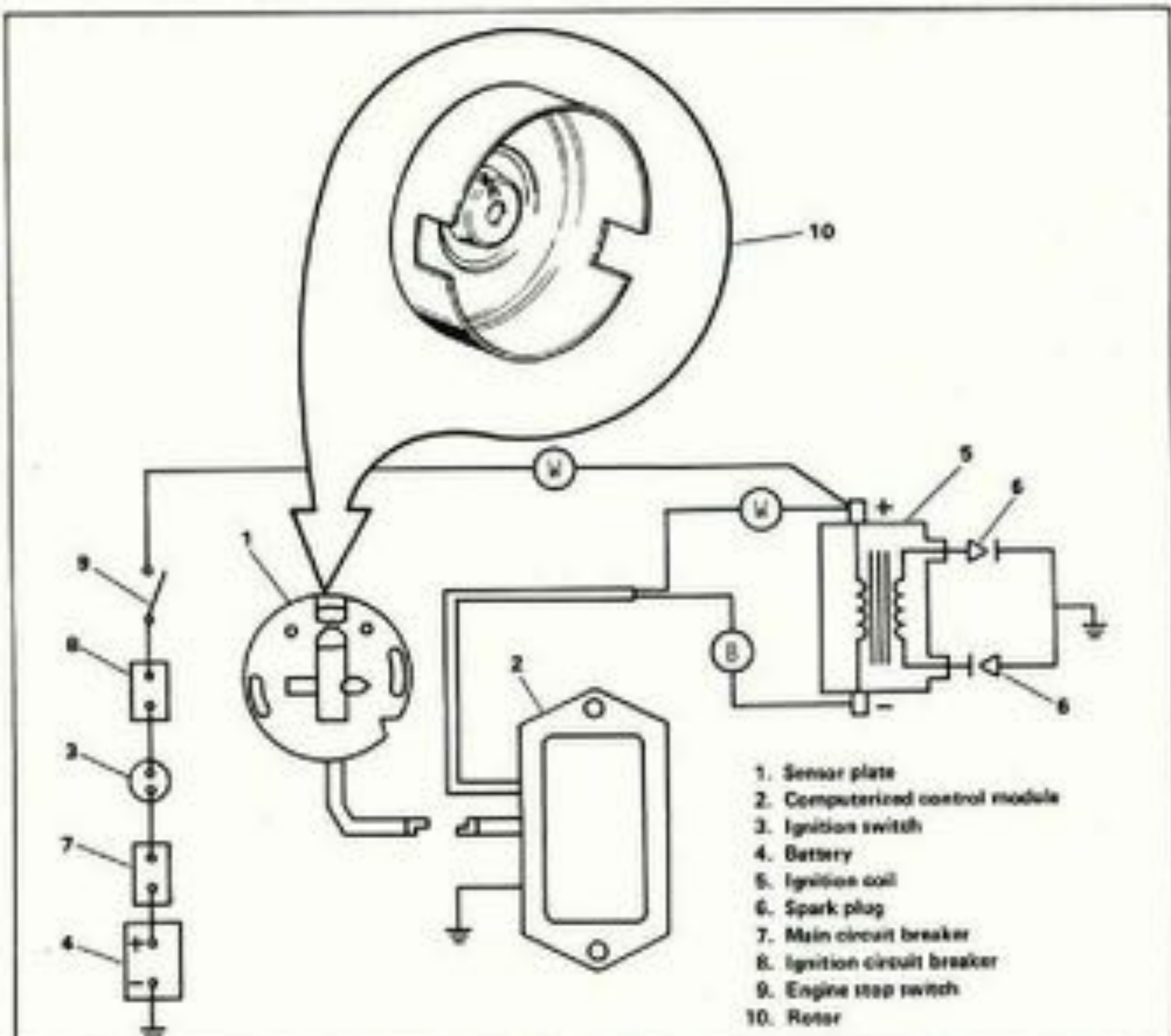


Figure 8-7. Ignition System Components — 1980 And Later

The rotor is bolted on to the camshaft and operates at one-half crankshaft speed. The computer module automatically advances the spark as the engine speed increases, and retards as the speed decreases without the action of flyweights, or an advance mechanism. This ensures correct spark timing to suit starting, low and high speed requirements.

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 above this gives a spark advance somewhere between 3° and 35°. The whole timing program can be shifted by mechanical rotation of the sensor plate. See CHECKING ADVANCE TIMING WITH STROBE TIMING LIGHT and SETTING RETARDED 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 system will operate down to 5.7 volts DC. 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 as follows:

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 a spark is obtained across the gap. If a spark is obtained, the problem is not in the electronic system or coil. Check carburetion, choke and spark plugs.

3. If no spark is obtained, check battery voltage and battery connection condition. Turn on ignition and engine stop switches to crank engine with voltmeter across the battery. Voltage should be 11.5 or above. If voltage is low, battery needs charging.

4. Check to make sure that ignition module (on front of frame above the regulator) 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 spark is still not evident, continue with the following voltmeter checks.

5. Check sensor for grounds, opens and shorts using an ohmmeter.

NOTE

Voltmeter should have a resistance of 20,000 ohm/volt or more in order to obtain correct readings.

NOTE

Always "zero" the meter before testing (Use RX1) scale).

Test for grounds — one probe to plate and one probe to each of the three wires. There should be no continuity, infinite ohms, at all test points.

Test for opens — place red probe in green wire and black probe in black wire. If needle on meter moves, no opens.

Test for shorts — place red probe in green wire and black probe in black wire. Reading should be a minimum of 10-12 ohms. If greater resistanace, okay.

If sensor passes the tests, connect sensor to module. If spark is still not evident, continue with the following voltmeter checks.

6. Position rotor so that the center of the sensor is between the two slots.

   Connect voltmeter between ignition coil positive terminal (white wires) and engine ground. With ignition and engine stop switches on, the voltmeter reading should equal battery voltage within 0.5 volts. If not, trouble lies in circuit between battery and ignition coil. Check the connections at or in circuit breakers and ignition switch.

7. Disconnect blue wire from coil negative terminal. Connect voltmeter between coil negative terminal and ground. With ignition and engine stop switches on, the voltmeter reading should equal battery voltage. If not, ignition coil primary is defective. Replace coil. Retest for spark after corrections are made.

8. See Figure 8-6. Disconnect sensor plate from ignition module at connector. Connect Ignition Test Adapter Part No. HD-94465-81 between the two halves of the connector. There are three test leads that extend from the adapter, one green, one black and one red. Connect a voltmeter between the red lead and the black lead. With the ignition and engine stop switches on, the voltmeter should read 5.0 ± .5 volts. If not, the computer module is defective and must be replaced.

CAUTION

When using the ignition test adapter extreme care must be used not to touch exposed wire terminals to each other or ground which could result in damage to ignition module.

9. After replacing the module reconnect the sensor plate using the test adapter (Figure 8-8). Recheck voltage from the red lead to the black lead. Connect the voltmeter from the green lead to the black lead to check sensor output. This output should be 5.0 ± .5 volts when the slot is not present at the sensor and should be 0 to 1 volt when the slot is at the sensor. A screwdriver blade can be inserted between the sensor and magnet as a substitute for the rotor to check the sensor ouput. If these voltages are not present, the sensor plate must be replaced.

CAUTION

Coil wires must be connected correctly. Both white wires must be connected to the same coil primary terminal or ignition control module will be permanently damaged.

CHECK ADVANCE TIMING WITH INDUCTIVE TIMING LIGHT (Figure 8-9)

Ignition timing should be checked every 2500 miles.

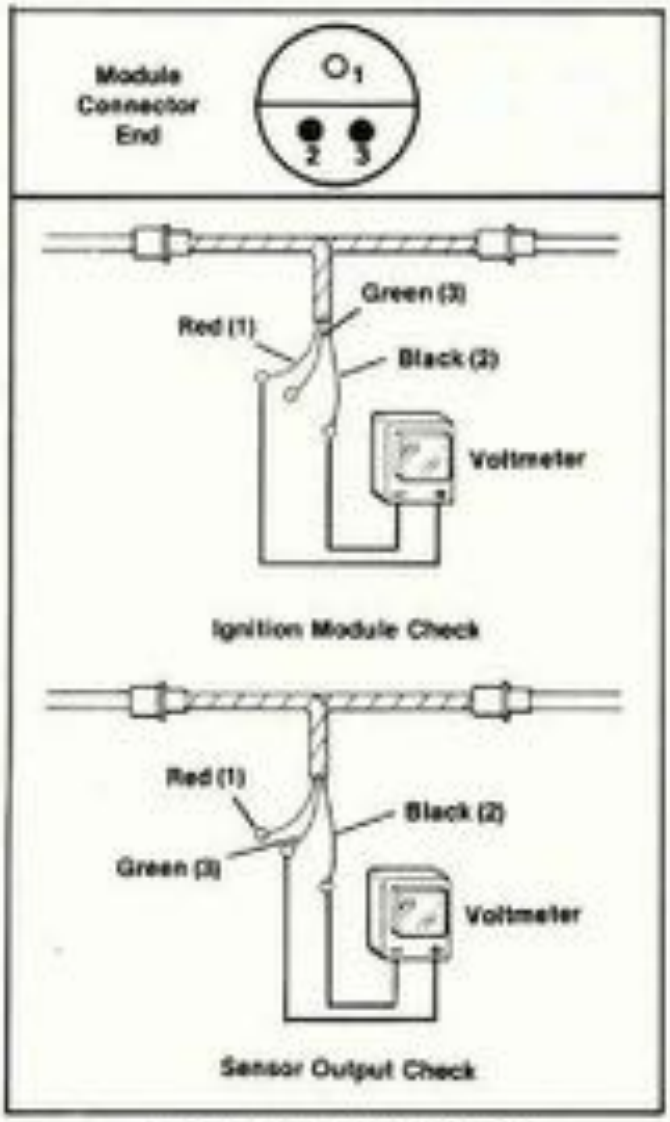


Figure 8-8. Ignition Test Adapter

Use an induction pickup strobe flash timing light, Part No. HD-33813, to view advanced timing of flywheel through accessory plastic view plug, Part No. HD-96295-65, screwed into timing inspection hole. Make sure view plug does not touch flywheels. Timing light leads should be connected to the front spark plug cable, ground and battery positive terminal. Front cylinder timing mark is a small drilled dot shown in Figure 8-9. On FL/FX vehicles except FXST start engine and set engine speed at 2000 RPM. On FXST vehicles start engine and set engine speed at 1300-1500 RPM. Light will flash each time spark occurs. Loosen sensor plate screws just enough so that plate can be shifted using a screwdriver in notch as light aimed into inspection hole stops timing mark in center of hole. Timing will retard automatically when engine is at idle speed or is stopped. The small dot (early 1980) or lazy 8 (∞) (late 1980 and later) which appears on or near the front cylinder advanced timing mark indicates rear cylinder advanced timing.

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.

The horizontal eight (∞) indicates rear cylinder advanced timing.

VACUUM OPERATED FXST ELECTRIC SWITCH (V.O.E.S.)

Checking Operation

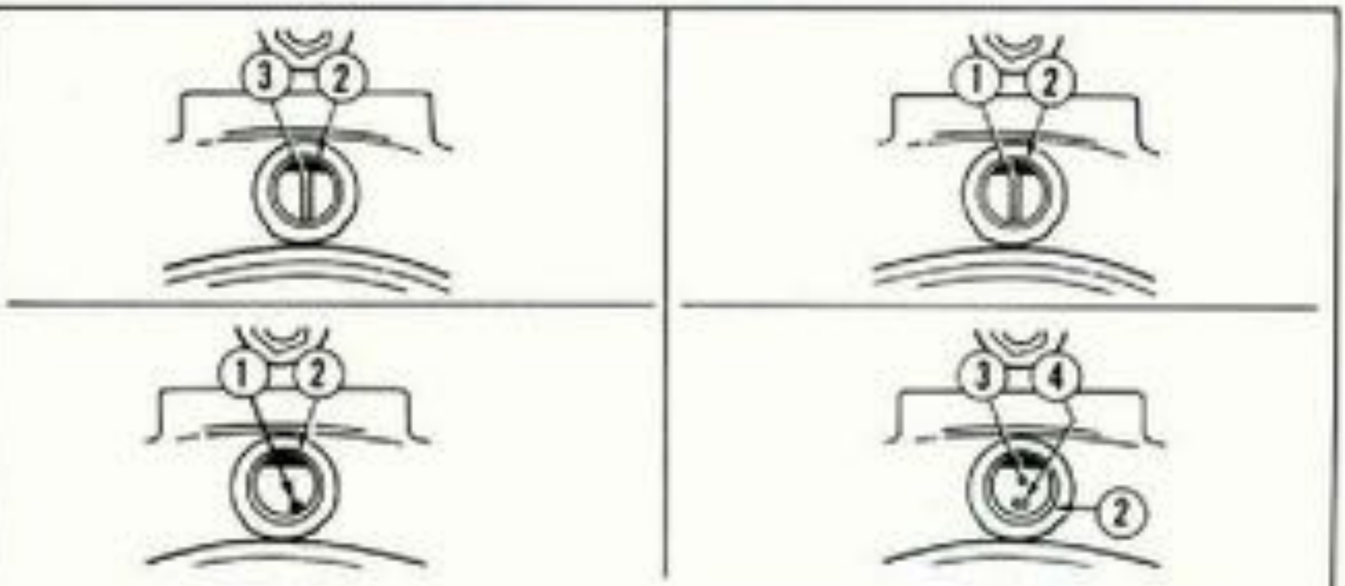
After engine has been timed with an inductive timing light, Part No. HD-33813, perform the following check:

With the light 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 should increase to preset speed.

If speed does not decrease and increase as described, check vacuum operated electric switch (V.O.E.S.) wire connection to computer module and ground wire. V.O.E.S. must be replaced if malfunctioning.

Removal and Inspection

1. Disconnect wire from vacuum operated electric switch (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 Harley-Davidson vacuum pump, Part No. HD-23738 to V.O.E.S. nipple.
6. Slowly squeeze vacuum pump handle and observe vacuum gauge and ohmmeter.
7. The ohmmeter should indicate V.O.E.S. closed (0 ohms) at 3.5 - 4.5 in. of mercury vacuum.



Early Style | **Late Style**

1. Front cylinder top dead center (TDC)
2. Timing inspection hole
3. Front cylinder advance timing mark
4. Rear cylinder advance timing mark

Figure 8-9. Ignition Timing Mark — 1980 And Later

8. Other than specified vacuum reading will require V.O.E.S. replacment.

9. Switch action of the V.O.E.S. is working if ohmmeter needle deflection is noted when releasing and reapplying the vacuum.

10. If ohmmeter needle shows no deflection, V.O.E.S. is not functioning properly and must be replaced.

NOTE

The FXST V.O.E.S. is marked with a dab of blue paint on the underside of the vacuum nipple. This differentiates the FXST switch from other switches with different vacuum ratings.

SETTING RETARDED TIMING (Figure 8-10)

CAUTION

This procedure will result in approximate timing and engine can be operated in an emergency for a short period of time. Advanced timing should be checked and set under running conditions as soon as possible using a strobe timing light as described in preceding section.

Whenever ignition components have been disassembled, such as during engine disassembly and reassembly, or if a timing light is not available, approximate timing can be obtained by using the following procedure:

1. Set sensor plate (8) so that sensor plate screws (6) are centered in the slots. Snug down the screws (6).

2. Engine can now be started.

3. Adjust the advanced timing with timing light following procedure in the preceding section as soon as possible.

REMOVING IGNITION COMPONENTS (Figure 8-10)

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. Using a 3/8 in. drill bit, drill out outer cover rivets (1) and 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.

NOTE

It may be necessary to cut pin and sockets from wires to pull wires through hole in gearcase.

5. Remove rotor screw (9) and rotor (10).

6. Seal (11), if defective, can be pried out from ignition side of gearcase. Use care not to damage camshaft end while prying.

7. Disconnect ignition module wires from coil.

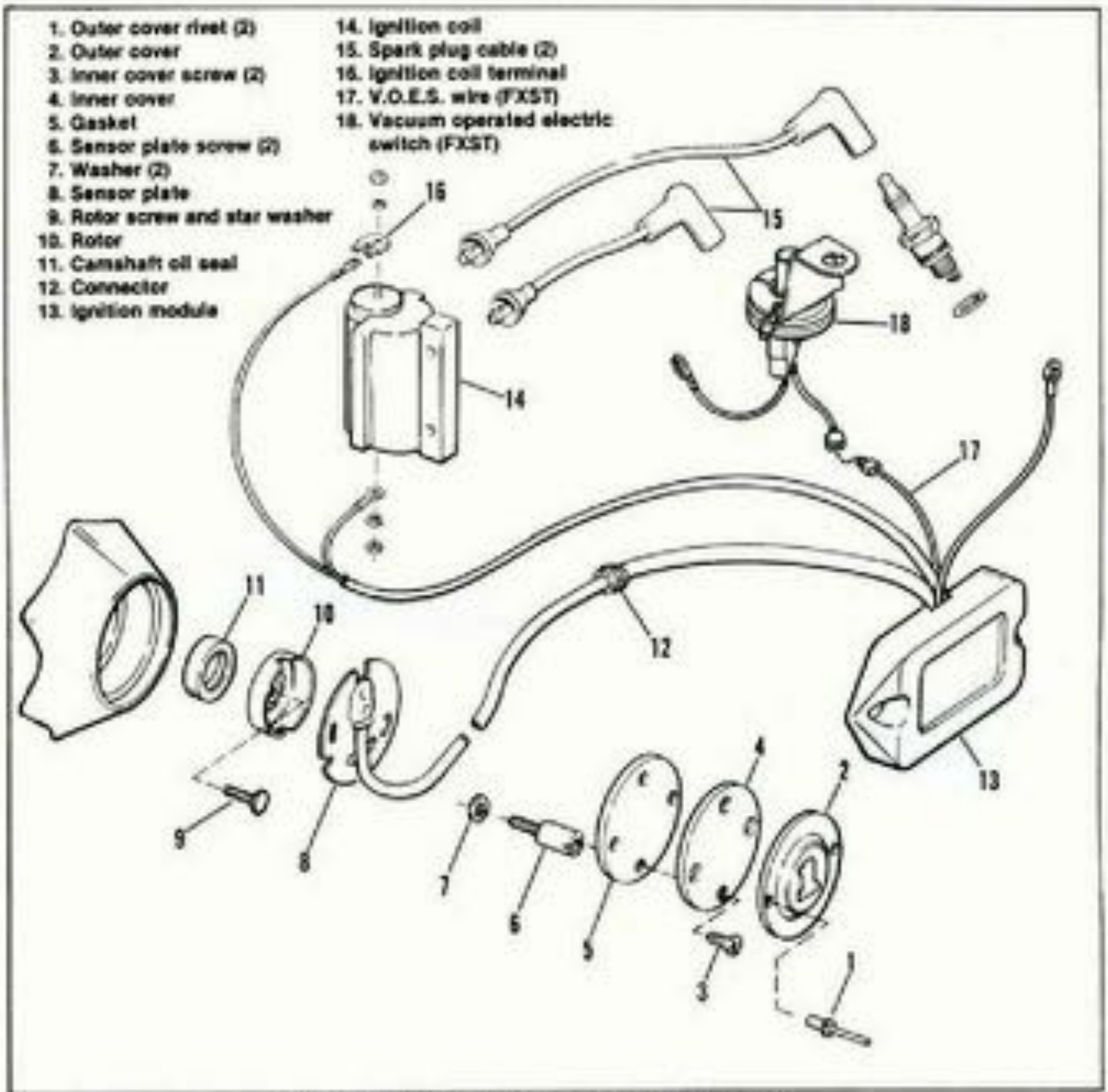


Figure 8-10. Ignition Components — 1980 and Later

8. To remove ignition module (13) from the frame, remove two mounting bolts, and the screw securing the ground wire to the frame.

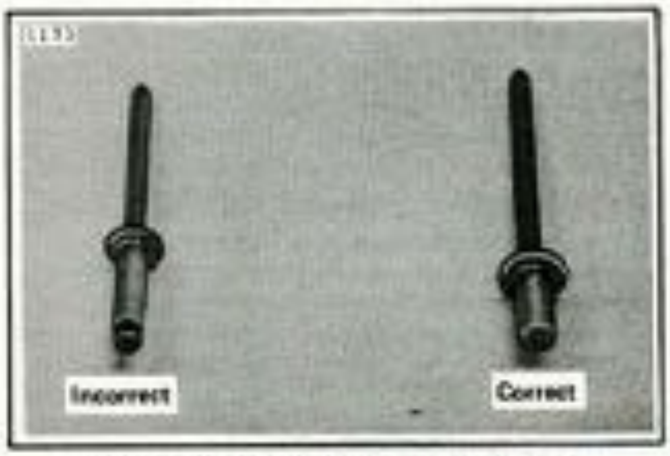


Figure 8-11. Special Timing Cover Rivet

INSPECTION AND REPLACING PARTS

Inspect lip of seal and replace it if worn or rough. Also replace the seal if there is any evidence of oil leakage into the timer compartment.

INSTALLING IGNITION COMPONENTS (Figure 8-10)

1. Assemble ignition module (13) to front frame mounting bracket. Make sure that the black ground wire is secured to the bracket.

2. Connect ignition module wires to ignition coil as shown in the wiring diagrams.

3. If seal (11) was removed, install new seal (11) in gearcase, lip side to ignition side of gearcase.

CAUTION

Seal (11) must be pressed into gearcase until it stops. A seal that is not all the way in may leak.

4. Apply Loctite LOCK 'N SEAL to rotor bolt (9). Install rotor (10) with rotor bolt (9). Tighten bolt to 75-80 in-lbs torque.

CAUTION

Use only the grade of Loctite specified.

5. Install sensor plate (8) with sensor plate screws (6) and washers (7). Tighten screws to 15-30 in-lbs torque.

NOTE

If sensor plate (8) was completely removed it may be necessary to install new wire pins, sockets and body receptacle.

6. Set retarded ignition timing as described in previous section. Check advanced ignition timing under running conditions as described in previous section.

7. Install gasket (5) and inner cover (4) with screws (3). Tighten screws to 15-30 in lbs torque.

8. Rivet outer cover (2) to inner cover (4) with rivets (1).

CAUTION

Use only rivets Part No. 8699 to secure outer cover. (See Figure 8-11.) 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.

SPARK PLUGS

GENERAL

Spark plugs should be replaced every 5000 miles. Use only the replacement spark plugs listed in SPECIFICATIONS page 8-1.

The 5R6, 5R6A and 5RL plugs have a resistor element to reduce radio interference originating in the motorcycle ignition system. Only resistor type plugs should be used with 1980 and later ignition systems.

Inspecting Spark Plugs

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.

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.

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 .038-.043 in.

INSTALLING SPARK PLUGS

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 18-28 ft-lbs torque. If a torque wrench is not available, tighten finger tight and then using a spark plug wrench, tighten an additional 1/4 turn.

3. Check engine idle speed, and adjust if necessary.

IGNITION COIL

DESCRIPTION

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 and sealed in water-proof insulating compound. The ignition coil cannot be taken apart or repaired. If the ignition coil is defective, it must be replaced.

CAUTION

On 1980 and later models, use only ignition coils marked ELECTRONIC ADVANCE. On 1979 and earlier models, use the old style coils. Interchanging these coils could cause a failure in the electronic components.

TROUBLESHOOTING

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:

1979 and Earlier
- Primary .... 4.5 to 5.7 Ohms
- Secondary .... 18,500 to 20,000 Ohms

1980 and Later
- Primary .... 3.3 to 3.7 Ohms
- Secondary .... 18,500 to 19,500 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.

REPLACING 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

FL/FLHS/FXWG/FXST/FXDG

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 left (counterclockwise) of center position is for accessories only. There are two positions to the right (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 FL/FLHS/FXWG ignition switch may be disassembled for repair.

FX/FXE

The ignition/light switch is located below the gas tank on left side of motorcycle. From the OFF vertical position there are two positions to the right for ignition and lights. For U.S.A. operation, both positions operate ignition and lights, with standard wiring. Key can only be removed in the OFF, locked position. The FX ignition switch is not repairable. It must be replaced if it is defective.

FXS/FXEF/FXB/FXSB

The ignition switch is located at the rear of the oil tank, under the seat on the left side of the motorcycle. Operation is identical to the FX models.

DISASSEMBLING IGNITION/LIGHT SWITCH — FL/FLHS/FXWG (Figure 8-12)

1. Remove instrument panel cover by prying out side-cover clip located at trip mileage set knob and turning out mounting base center screw located in the center of instrument panel below speedometer.

2. Disconnect all wires connected to switch terminals and remove four switch mounting screws.

NOTE

See Figure 8-12. 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 with pliers and simultaneously move it upward and away from roller contact (1).

4. Lift off roller contact and switch mounting plate assembly (2). Notice that this plate is positioned with the three-terminal side away from lock cover hinge.

5. Reinforcing plate (3) with contact bar holder (4) and roller contact retainer (5) can be removed from switch cover by slipping part assembly sideways until one set of tabs clears slot in switch cover, then lifting and sliding assembly the opposite direction to clear other tab.

6. Switch base (7) and lock plate (6) can be removed from switch cover.

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.

1. Roller contact	4. Contact bar holder	7. Switch base
2. Switch mounting plate assembly	5. Roller contact retainer	8. Ignition switch cylinder
3. Reinforcing plate	6. Switch lock plate	9. Switch cover

Figure 8-12. Ignition/Light Switch — FL/FLHS/FXWG

7. Lock assembly (8) can now be lifted out of switch cover (9).

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. Loosened terminals on switch mounting plates may also cause a short or an inconsistent positive contact. Replace all worn or rusted parts.

ASSEMBLING IGNITION/LIGHT SWITCH (Figure 8-12)

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 replaced 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.

CHARGING SYSTEM

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.

Regulator

The Tympanium regulator is a series regulator with shunt control. The circuit combines the functions of rectifying and regulating.

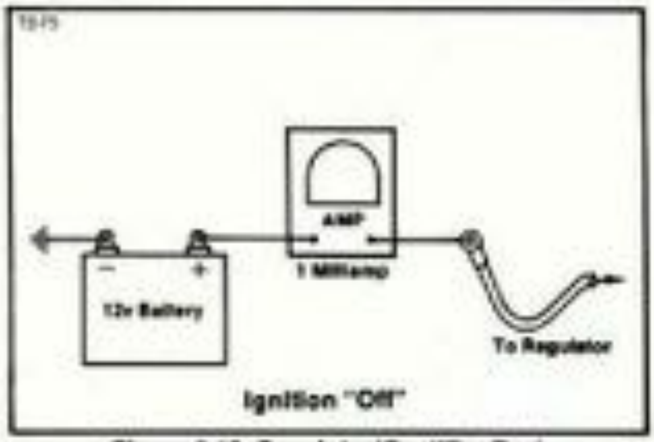


Figure 8-13. Regulator/Rectifier Test

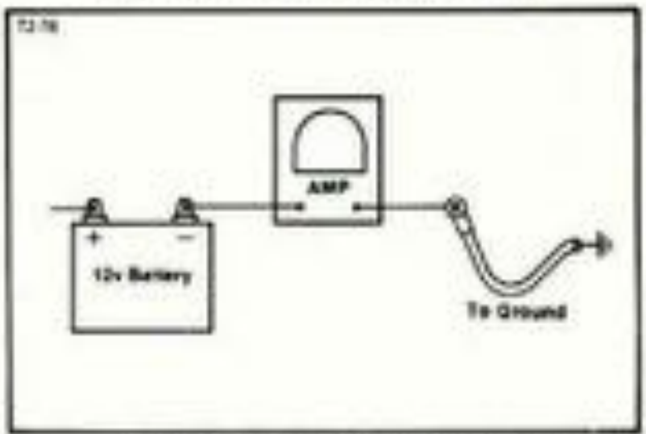


Figure 8-14. Total Current Draw Test

TROUBLESHOOTING

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: Check for corroded or loose connections in the charging circuit. The regulator base must have a clean, tight connection for proper grounding.

If battery runs down when motorcycle is not being used, the problem could be in the regulator/rectifier. With ignition switch off, connect an ammeter between the regulator wire and the battery positive terminal as shown in Figure 8-13. With ignition switch and all lights and accessories turned off, maximum reading should be one milliamp. A higher reading indicates a defective regulator/rectifier which must be replaced.

NOTE

Make sure accessories are not wired so they stay on at all times. Check for this by connecting ammeter as shown in Figure 8-13. With ignition switch and all lights turned off, there should be no more than 1 milliamp current.

If battery runs down during use, the current draw of the motorcycle components and accessories may exceed ouput of the charging system. To check for this condition, connect an ammeter between the battery negative terminal and ground as shown in Figure 8-14.

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

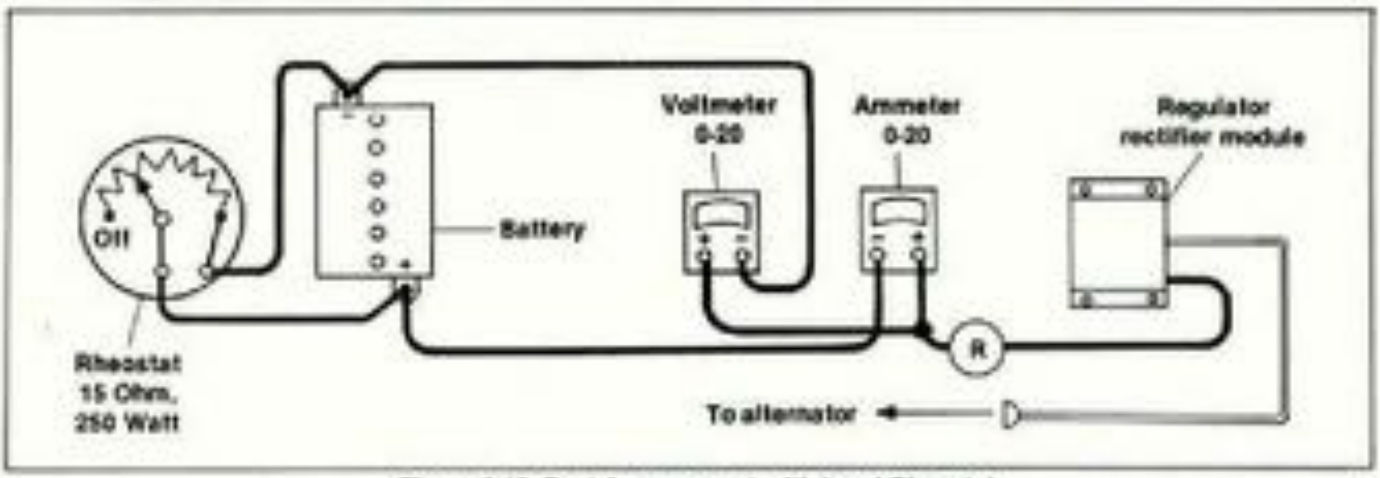


Figure 8-15. Test Arrangement with Load Rheostat

current draw by 3.5 amps minimum. If not, there may be too many accessories for the charging system to handle.

Charging System Output Test Using Ammeter (Figure 8-14)

1. With engine running at 2000 rpm, connect ammeter between ground and battery negative terminal, then disconnect battery ground wire. Leads should be reverse of previous draw test.

CAUTION

Do not disconnect battery ground wire before connecting ammeter. Also, do not try to start engine with ammeter connected. In either case, damage to components could result.

2. With all continuously running lights and accessories (headlamp on high beam) turned on, reading should be 3.5 amps or more. If reading is less than 3.5 amps, problem may be in charging system.

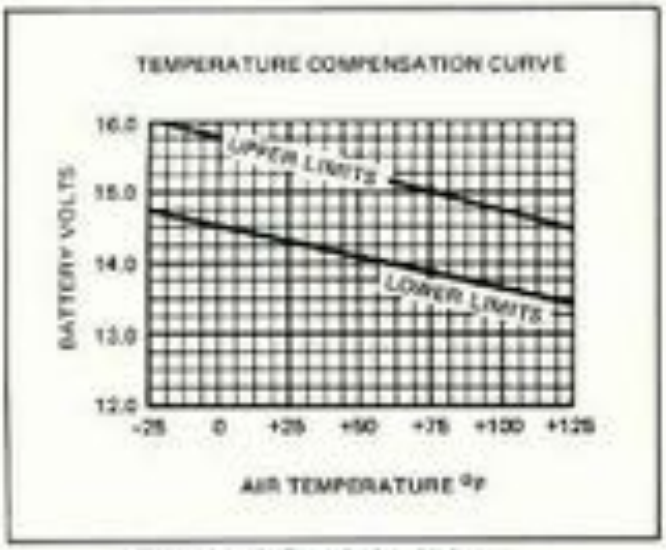


Figure 8-16. Regulating Voltage

Charging System Output Test Using Load Rheostat (Figure 8-15, 8-16)

NOTE

Use this test procedure in place of above procedure if load rheostat is available.

1. Connect an ammeter in series with the alternator output. Connect a load rheostat (carbon pile) and voltmeter across the battery. Check the regulating voltage while running the engine at 2000 rpm.

2. Adjust the load rheostat to 5-6 amperes output. The voltage readings should conform to the values given by the curves shown in Figure 8-16 at the temperature measured when the test is performed.

EXAMPLE

If the air temperature is + 75°F., the upper voltage (from the upper curve) would be 15V and the lower voltage (from the lower curve) would be 13.8V.

Alternator Output Check

Run the engine at 2000 rpm and adjust the load rheostat (carbon pile) to obtain a constant 13.0 volts. The alternator current output should be 14 amperes minimum.

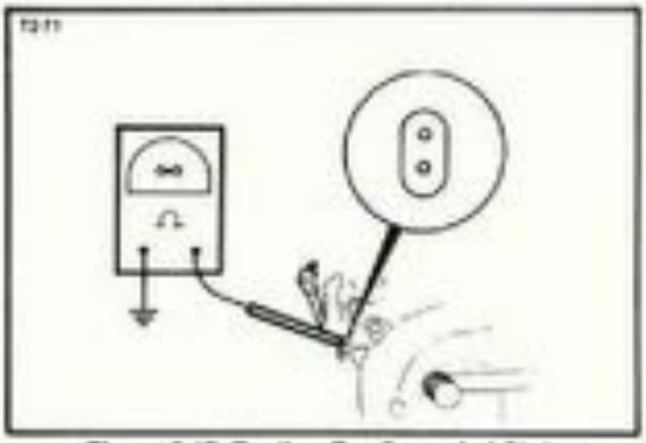


Figure 8-17. Testing For Grounded Stator

Stator Check

1. To check for a grounded stator, turn off ignition and disconnect the regulator/rectifier from the stator at the terminal in the crankcase.

2. See Figure 8-17. Connect an ohmmeter on the RX1 scale between ground and either stator pin or socket. There should be no continuity (infinite ohms) across either test point. Any other reading indicates a grounded stator which must be replaced.

3. Check the resistance using an ohmmeter set on the RX1 scale. Resistance should be 0.2 - .04 (very low) across the stator pins. If the resistance is found to be higher or no needle movement is detected the stator is defective and must be replaced.

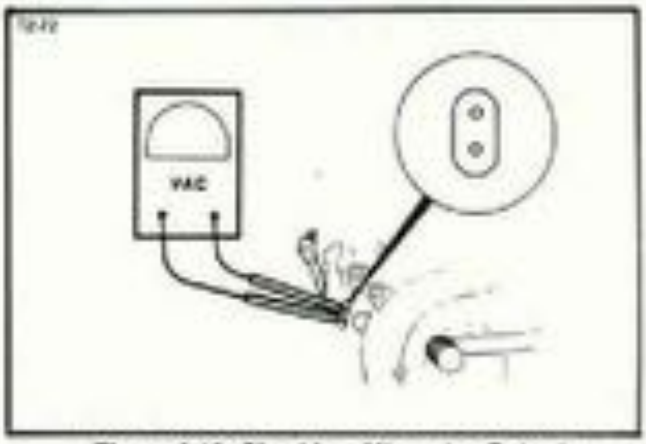


Figure 8-18. Checking Alternator Output

Output Check (Figure 8-19)

1. To test AC output, disconnect the regulator/rec-

tifier and connect an AC voltmeter across both stator pins or sockets. Run the engine at 3000 rpm. If the AC output is not at least 60 volts, the rotor must be replaced.

2. If stator and rotor are good, charging problem could be a faulty regulator/rectifier. Replace the regulator as described under REPLACING THE REGULATOR.

3. Check the output again as described under CHARGING SYSTEM OUTPUT TEST given earlier.

DISASSEMBLING ALTERNATOR

WARNING

Disconnect the battery cables (negative cable first) to avoid accidental start-up of vehicle and possible personal injury.

1. Remove primary cover, primary drive, clutch and primary case under PRIMARY CASE, Section 6.

2. See Figure 8-19. Pull the alternator rotor using the ROTOR PULLER, Part No. HD-95960-52A.

3. See Figure 8-20. Remove the four screws (1) and two locking plates (2). Remove the other two screws (3). Unplug the regulator and remove the stator (4).

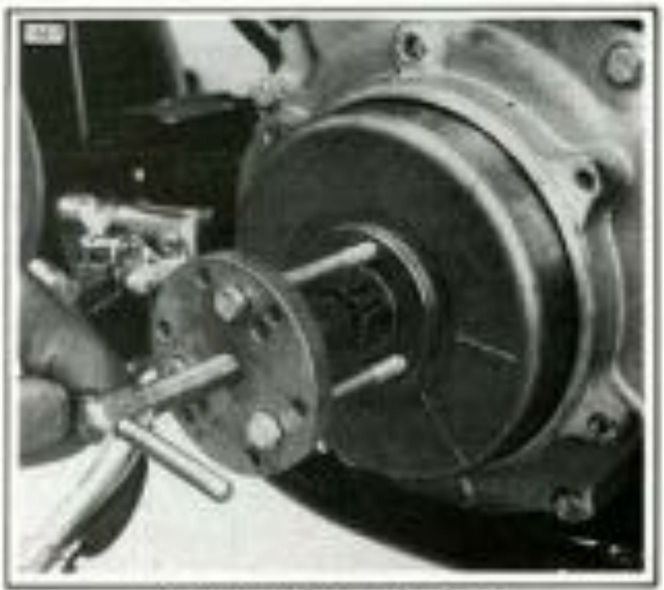


Figure 8-19. Pulling the Rotor

CLEANING, INSPECTION AND REPAIR

The rotor and stator can be replaced individually if either is damaged or defective.

1. Remove all foreign particles from the rotor magnets.

2. Clean the rotor using a petroleum solvent. Clean the stator by wiping it with a clean cloth.

ASSEMBLING ALTERNATOR

1. See Figure 8-20. Install the stator on the sprocket shaft and fasten using the locking plates (2) and four screws (1). Tighten screws (1) to 30-40 in-lbs torque. Install the two screws (3) and plug in the regulator.

2. Install the rotor onto the sprocket shaft.

3. Install primary case, clutch, primary drive and primary cover under PRIMARY CASE, Section 6.

REPLACING THE REGULATOR

The regulator is a non-repairable item and must be replaced if it fails.

1. Unplug the regulator from the crankcase.

2. Disconnect the red regulator lead from the circuit breaker at the positive battery post.

3. Remove the mounting bolts and replace the old regulator with a new one. Reinstall the mounting bolts.

4. Route the wire along the bottom frame member and connect it to the circuit breaker. Secure the wire to the frame with cable straps.

5. Plug the regulator into the crankcase.

1. Mounting screw (4) 3. Connector screw (2)
2. Lockplate (2) 4. Stator

Figure 8-20. Stator

BATTERY

GENERAL

All Harley-Davidson batteries are lead and sulfuric acid electrolyte units. The battery is designed for load requirements under normal intended use.

BATTERY CARE

Batteries should be carefully inspected every week.

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.

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).

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.

TESTING THE BATTERY

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 (tests A and B). As a guide for determining battery condition, use load test B.

Discharged batteries must be recharged in order to have charge sufficient for testing. Use hydrometer (A), or load tester (B), as follows:

A. Using a Hydrometer:

(Refer to chart below)

BATTERY CHARGE CONDITION	
State of Charge	**Specific Gravity (A)**
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 4 points (.004), or deduct 4 points for each 10° below 80° F.

2. Read gravity of each cell and record.

3. If any 2 cells vary more than 50 points (.050), replace the battery.

4. If cells are even or vary only slightly, battery is generally not suspect.

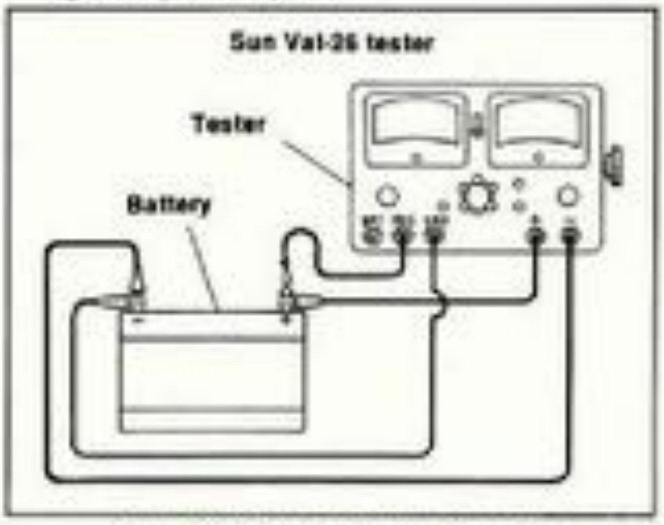


Figure 8-21. Testing Battery Capacity

B. Using a Load Tester (Figure 8-21)

1. Never use on discharged batteries.

NOTE

The SUN VAT-26, though no longer available, is still used at many dealerships. Other load testers with comparable ratings can be substituted satisfactorily.

2. Full charge the battery before testing. Load battery to 3 x amp hour rating using the Sun VAT-26 or equivalent Tester. (The Harley-Davidson) 19 amperes hour battery should be loaded to 57 amperes. Voltage reading after 15 seconds should be 10 volts or more. Note that voltmeter leads must be connected directly to battery posts.

CHARGING THE BATTERY

Never allow a battery to stand in a discharge condition. See chart below. 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.

VOLT	AMPERE HOUR	AMPERE CHARGE RATE
12	19	1.5
12	32	4.0

To determine the condition of a battery charge, check solution in each cell with a battery hydrometer. When hydrometer reading 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 such as the Harley-Davidson AUTOMATIC CHARGER, Part No. 66485-81.

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 3 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 required specific gravity reading is obtained.

WARNING

Hydrogen gas, formed when charging, is explosive. Avoid open flame or electrical spark near battery.

Reclaiming a Sulfated Battery

Allowing a battery to remain in a discharged condition will shorten its life. It is important that a battery be kept well charged during below freezing weather.

If a battery has been allowed to stand in a discharged condition for a period of time, the lead sulfate in the plates will crystalize and not take a charge at normal rates. Such batteries should be charged at half the specified continuous rate for twice the computed time. A longer charging time at a slower rate will many times break down the crystaline structure into active materials and restore the battery.

HEADLAMP (1978½-1980 FL)

The headlamp is a sealed beam type, specially designed and made for Harley-Davidson motorcycles. When replacement is required, use only the prescribed sealed beam unit. Do not attempt to use an automobile sealed beam unit because the current requirements for a motorcycle are much less and damage to battery or alternator may result. If either filament burns out, or the lens breaks, the entire unit must be replaced.

Replacing 1978½-1980 FL Headlamp

1. Loosen door screw enough to remove headlamp door. Remove three retaining ring screws and retaining ring.

2. The sealed beam unit is now free from the headlamp body, and connector block can be removed from the unit by pulling connector block from the unit prongs.

3. Assembly is the reverse order of disassembly. Make sure connector block contacts are clean to ensure good electrical contact.

HEADLAMP (1981 & Later FL)

The headlamp is a replaceable bulb type, not a sealed-beam unit. The bulb is made of Quartz glass filled with Halogen gas. This Quartz Halogen bulb is very delicate and must be handled with care.

CAUTION

Never touch the Quartz glass on the bulb with your fingers. Finger prints 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.

Replacing 1981 & Later FL Headlamp Bulb (Figure 8-22)

1. Remove headlamp door screw (1) and headlamp door (2).

2. Remove the three retaining ring screws (4) and retaining ring (3).

3. Remove headlamp body (5) and unplug connector block (6).

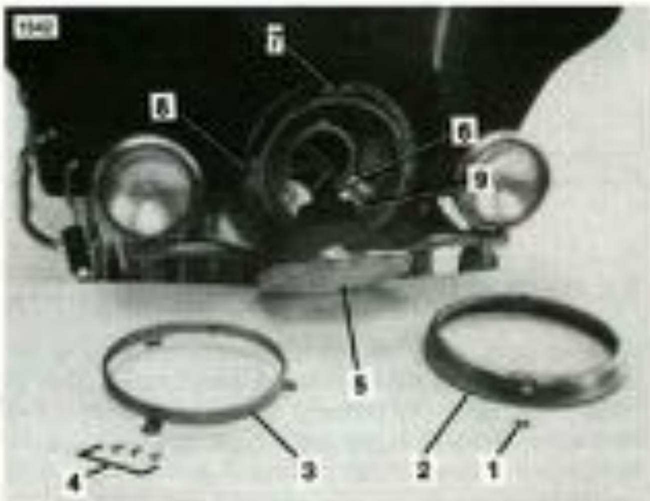
4. Remove rubber boot (9), press wire clip (10) together and remove bulb (11).

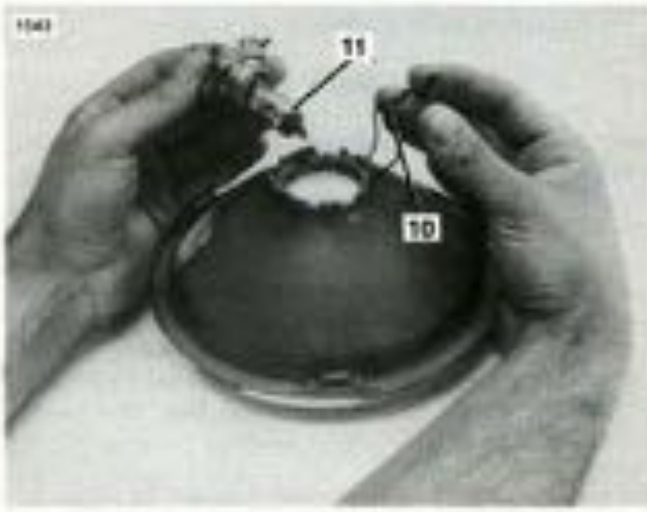
5. Install new bulb into headlamp body (5) and secure with clip (10).

6. Plug connector block (6) into bulb and install in housing.

7. Secure headlamp to housing with retaining ring (3) and screws (4).

8. Install headlamp door (2) with screw (1).





1. Door screw
2. Headlamp door
3. Retaining ring
4. Headlamp body screws
5. Sealed beam unit
6. Connector block
7. Vertical adjustment screw
8. Horizontal adjustment screw
9. Rubber boot
10. Clip
11. Bulb

Figure 8-22. Replacing FL Model Headlamp Bulb — 1981 And Later

HEADLAMP — FX MODELS

The headlamp is of the sealed beam type. When replacement is required use only the prescribed sealed unit available from your Harley-Davidson dealer.

Replacing FX Headlamp Sealed Beam Unit

NOTE

If either filament burns out or if the lens breaks, the entire sealed beam unit must be discarded and a new unit installed.

1. Remove outer molding clamp screw and molding to remove sealed-beam unit from rubber mounting ring. Pull connector block from sealed-beam unit prongs.

2. Install new sealed-beam unit by reversing above operation. Make sure connector block contacts are clean to ensure good electrical contact.

HEADLAMP ADJUSTMENT (Figure 8-23)

The headlamp beam must be adjusted for height and the 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.

1. Have the motorcycle standing on a level surface with tires correctly inflated about 25 feet from, and headed 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:

FL Models (Figure 8-22)

Remove headlamp door. The lamp can be tilted up or down to aim it in relation to the horizontal line by turning vertical adjustment screw (7) in or out. The lamp can be aimed to the right or left in relation to the front wheel by turning the horizontal adjustment screw (8) in or out.

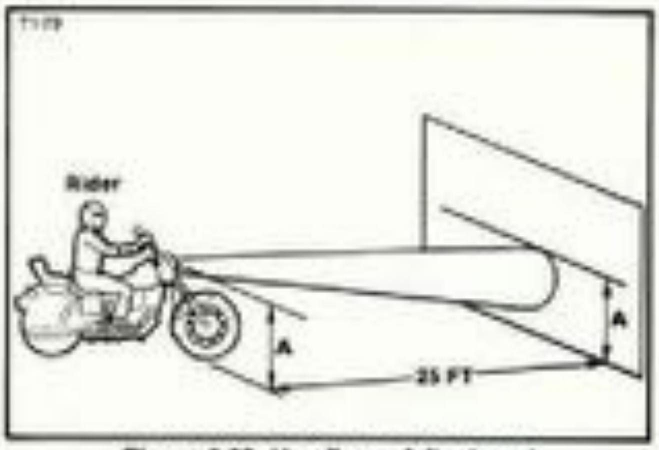
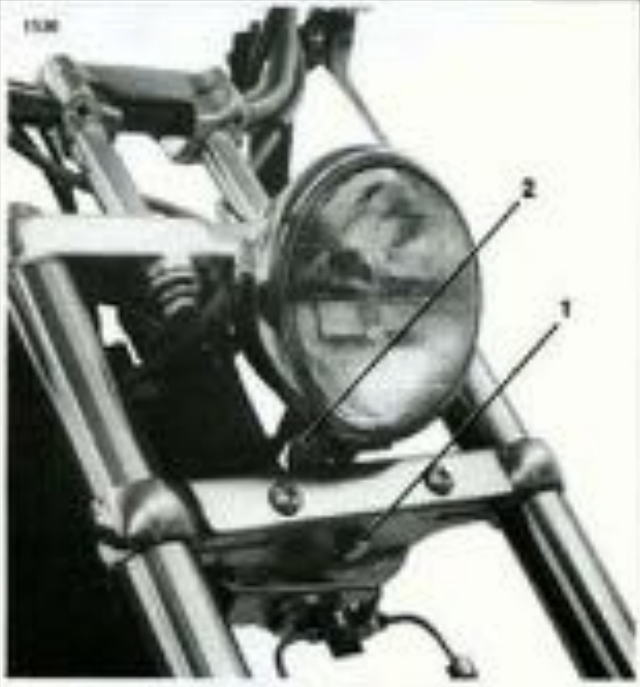


Figure 8-23. Headlamp Adjustment



1. Adjusting bolt (horizontal)
2. Adjusting bolt (vertical)

Figure 8-24. FXWG/FXDG/FXST Headlamp Adjustment

FX Models (Except FXWG/FXDG/FXST)

Remove snap plug on top of headlamp housing and loosen the clamp nut behind the lamp bracket. Tilt the lamp up or down to properly aim it in relation to the horizontal line and at the same time turn it right or left to direct the beam of light straight ahead. Tighten the clamp nut after the lamp is properly positioned.

FXWG/FXDG/FXST Models (Figure 8-24)

Loosen bolt (1) to adjust headlamp beam side to side. Loosen bolt (2) to adjust headlamp beam up and down.

PASSING LAMPS (Figure 8-25)

Replacing Sealed Beam

1. Remove screw (1) and door (2). Disconnect wires from back of sealed beam unit and install in housing. Install door (2) and screw (1).

Adjustment (Figure 8-25)

Passing lamps are mounted on a swivel block. To adjust the passing lamp proceed as follows:

1. Remove two screws (3) on turn signal bracket.
2. Loosen nut inside turn signal bracket and adjust lamp to desired position. See HEADLAMP ADJUSTMENT, in this section.
3. Tighten nut while holding lamp in place.
4. Install turn signal on bracket using two screws (3).

Figure 8-25. Passing Lamp and Turn Signal

TURN SIGNALS

Replacing Bulbs

To change a bulb, remove the lens, turn the bulb 1/4 turn and remove it. Replace the bulb and install the lens.

NOTE

If after replacing a bulb, the turn signal still will not light, check the wiring and/or the switch.

HORN

Horn is shown in Figure 8-26. If the horn fails to blow or does not blow satisfactorily, check for loose, frayed or damaged wiring leading to horn terminal, discharged battery or ground. If these steps do not correct the trouble, turn in contact point adjusting screw, located back of horn, until horn just gives a single click — then retard screw until best tone is obtained. If horn fails to operate after moving adjusting screw, entire horn must be replaced because it is permanently riveted together. Mounting parts are replaceable.

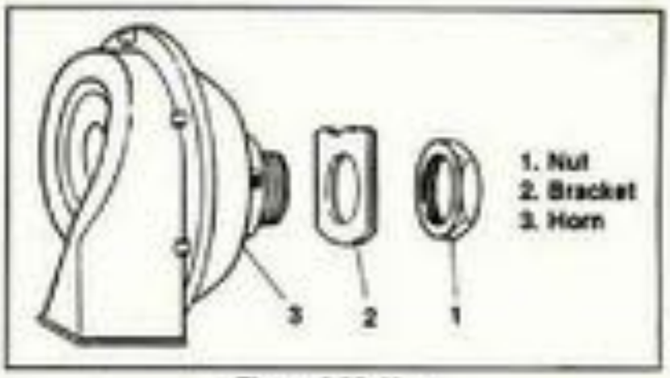
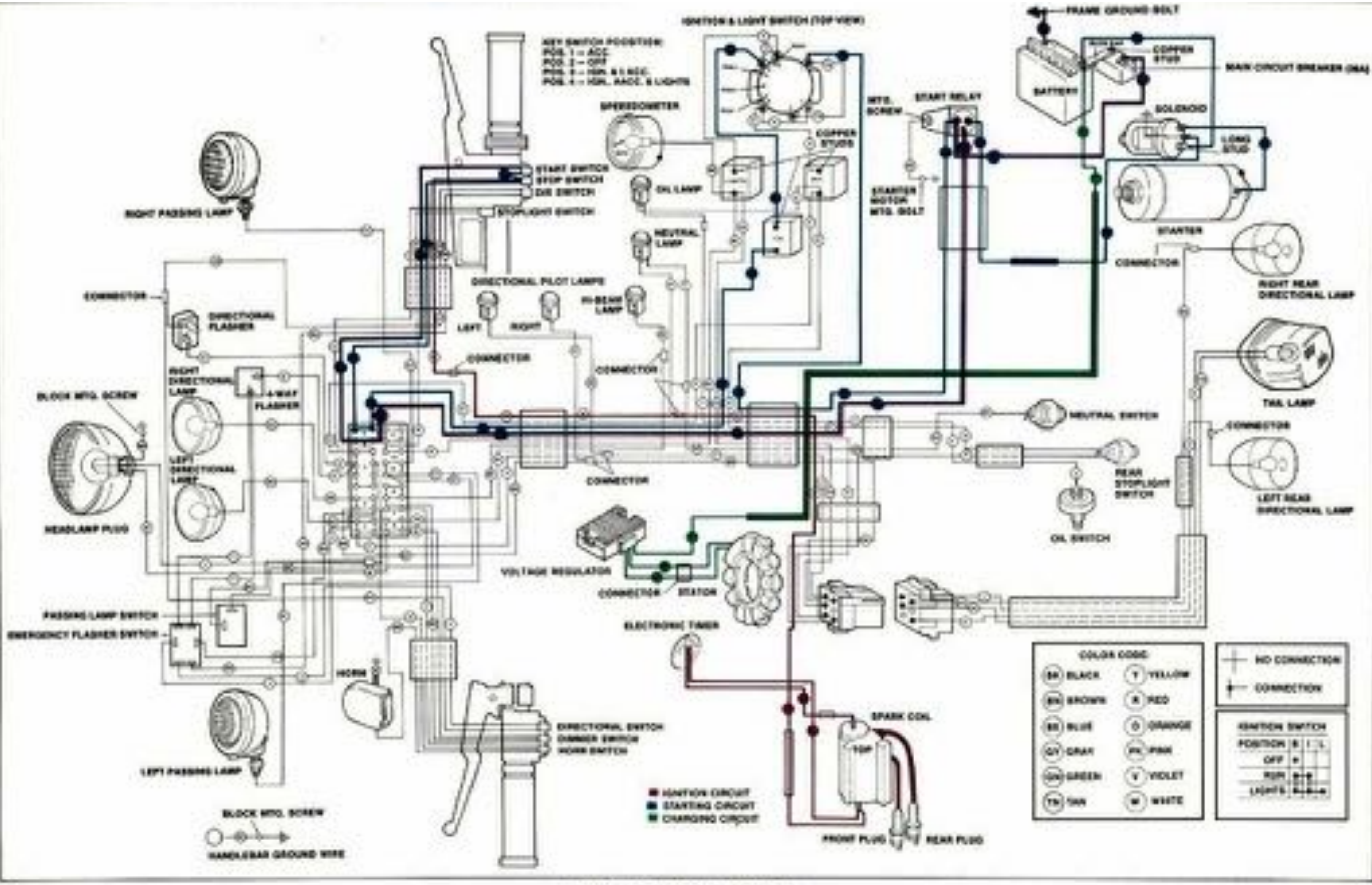
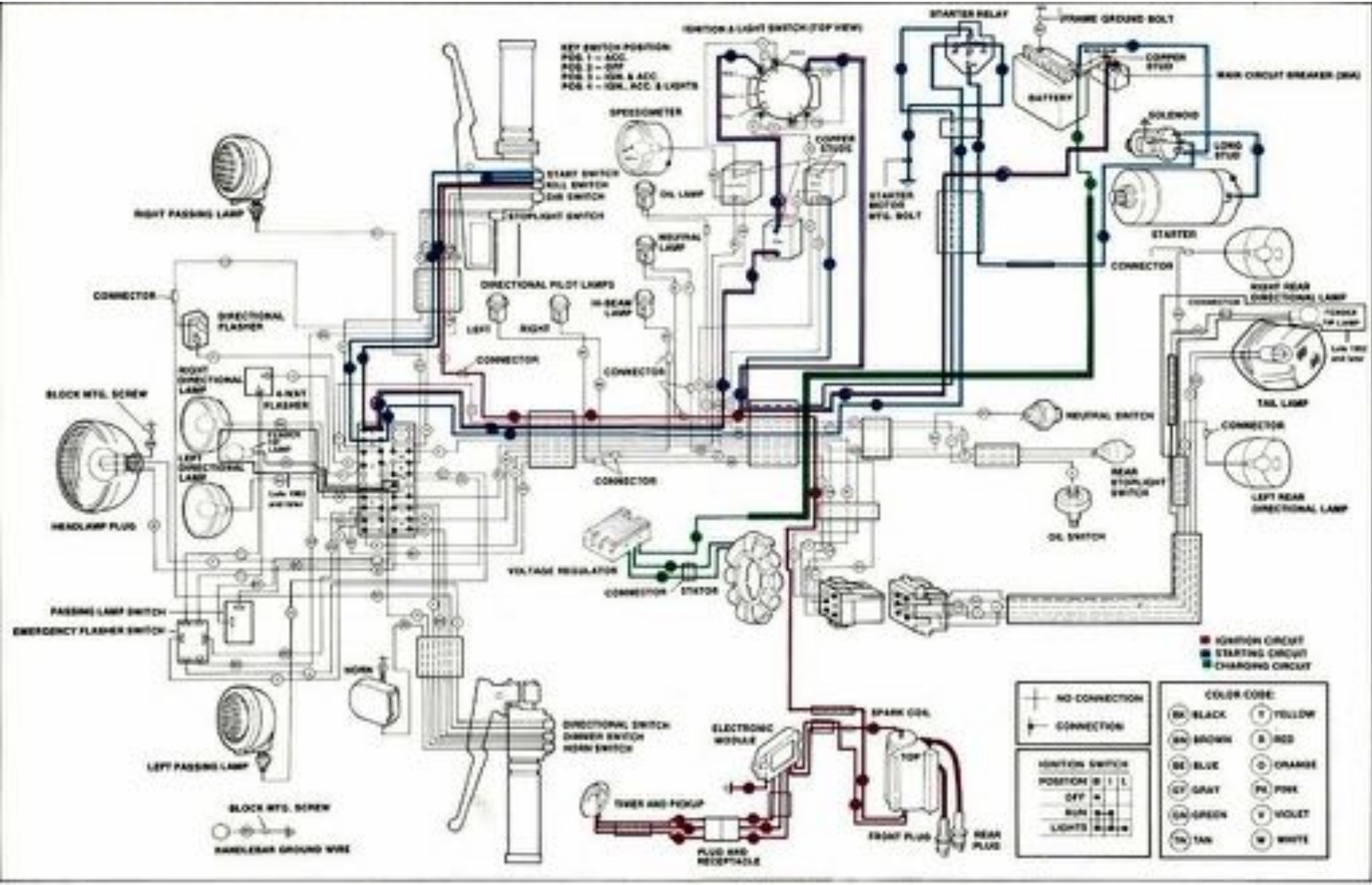


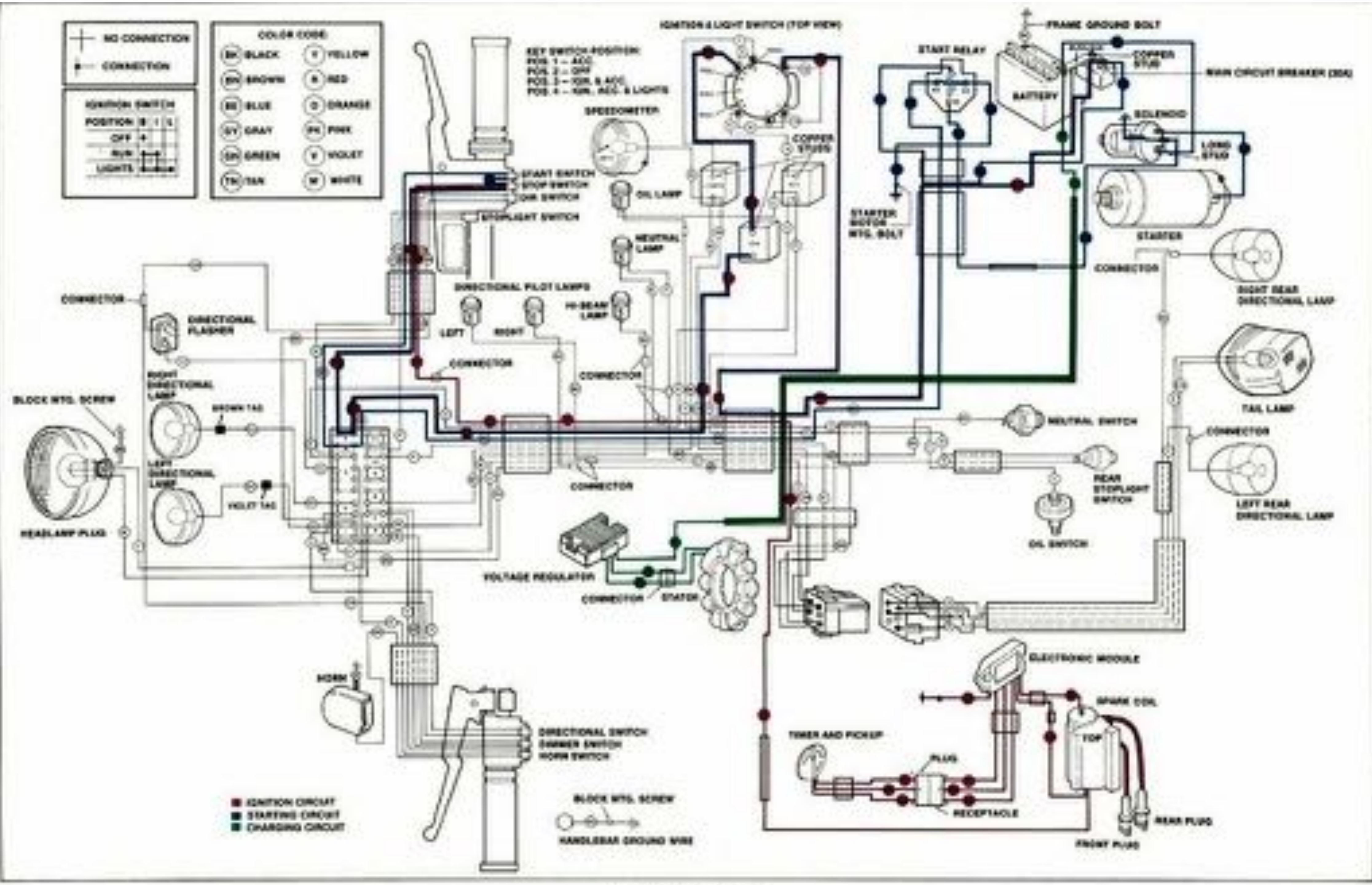
Figure 8-26. Horn



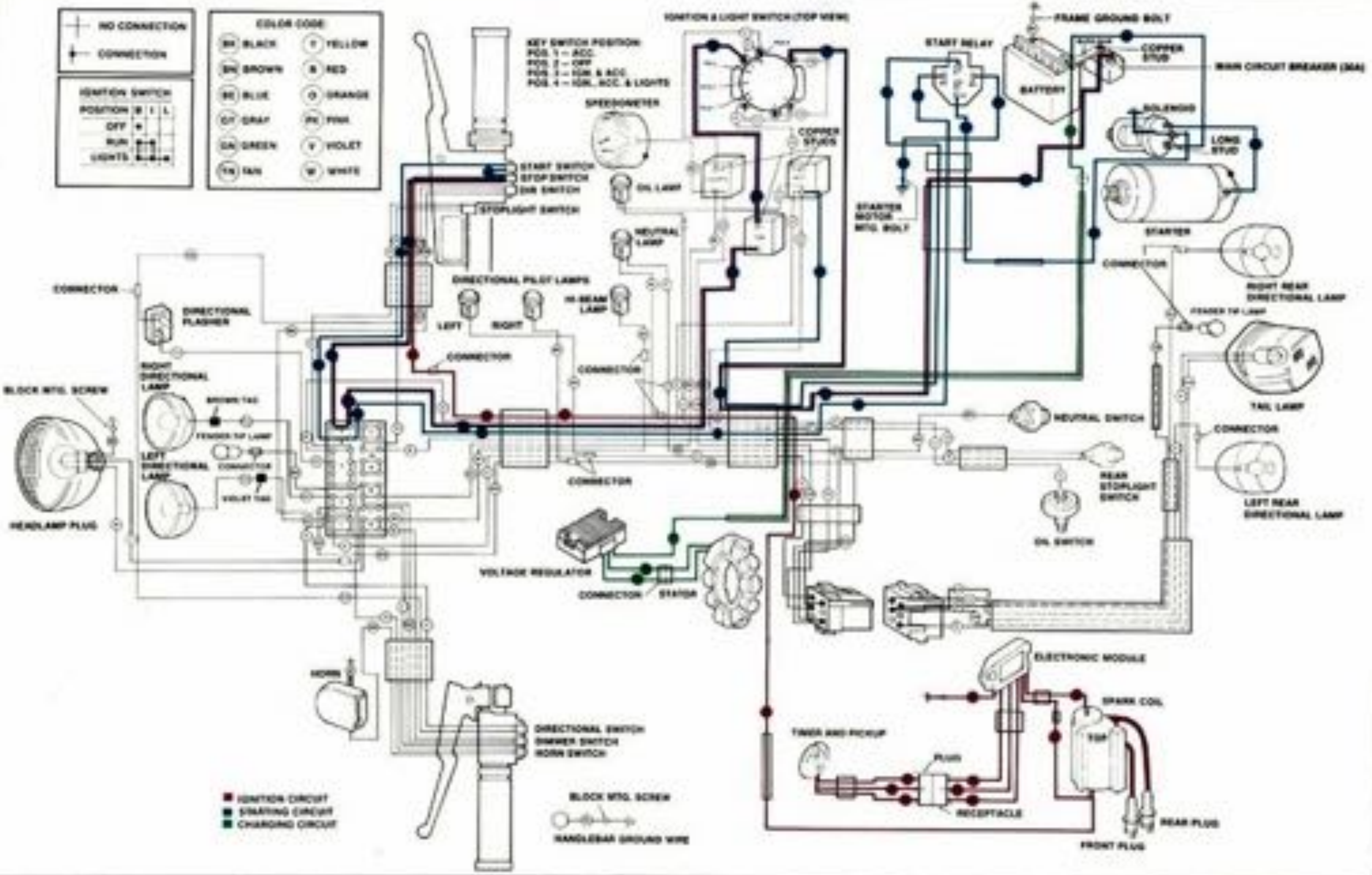
1978½-1979 FL/FLH



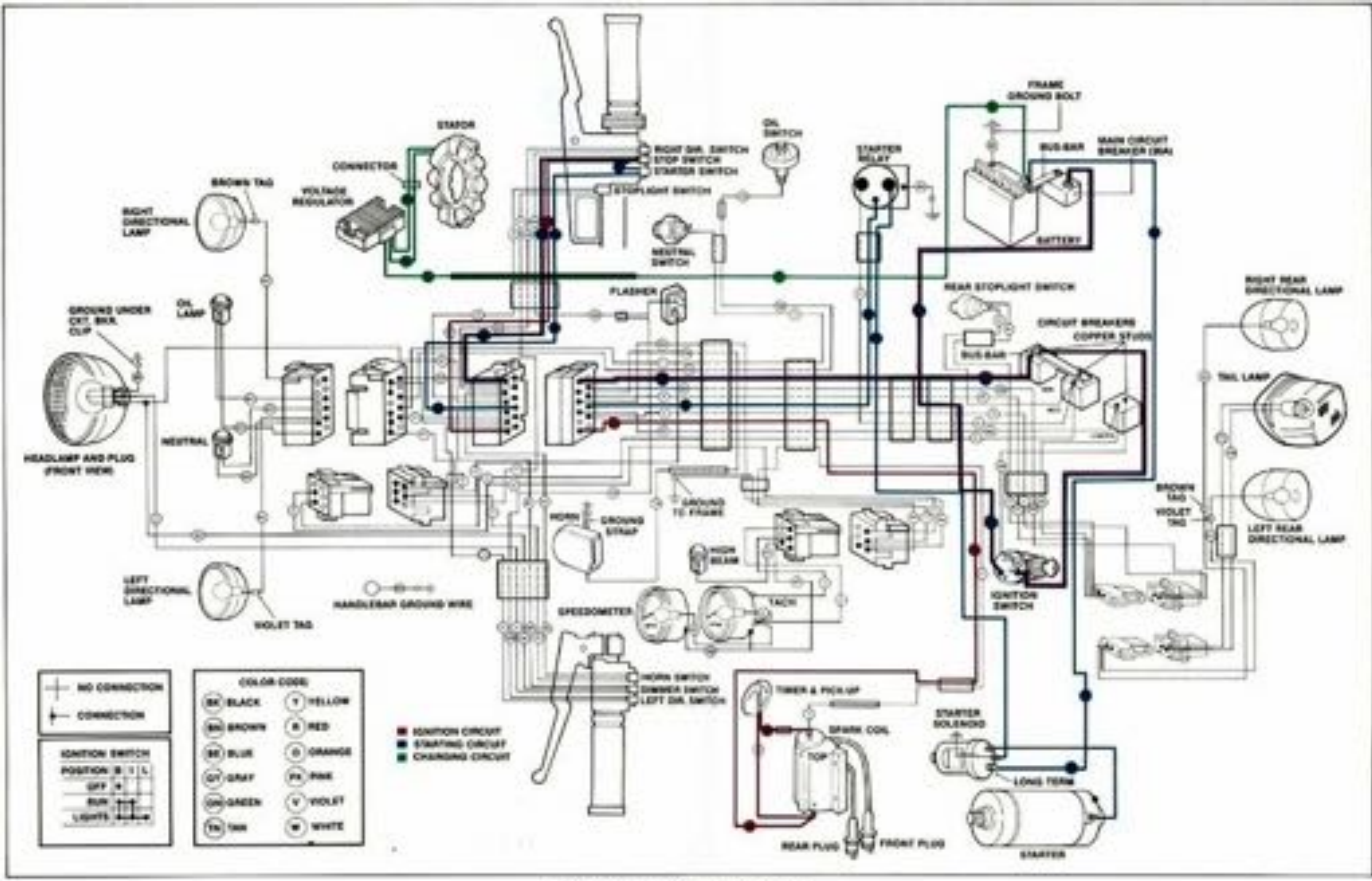
1980-1984 FL/FLH



1980-1981 FLHS

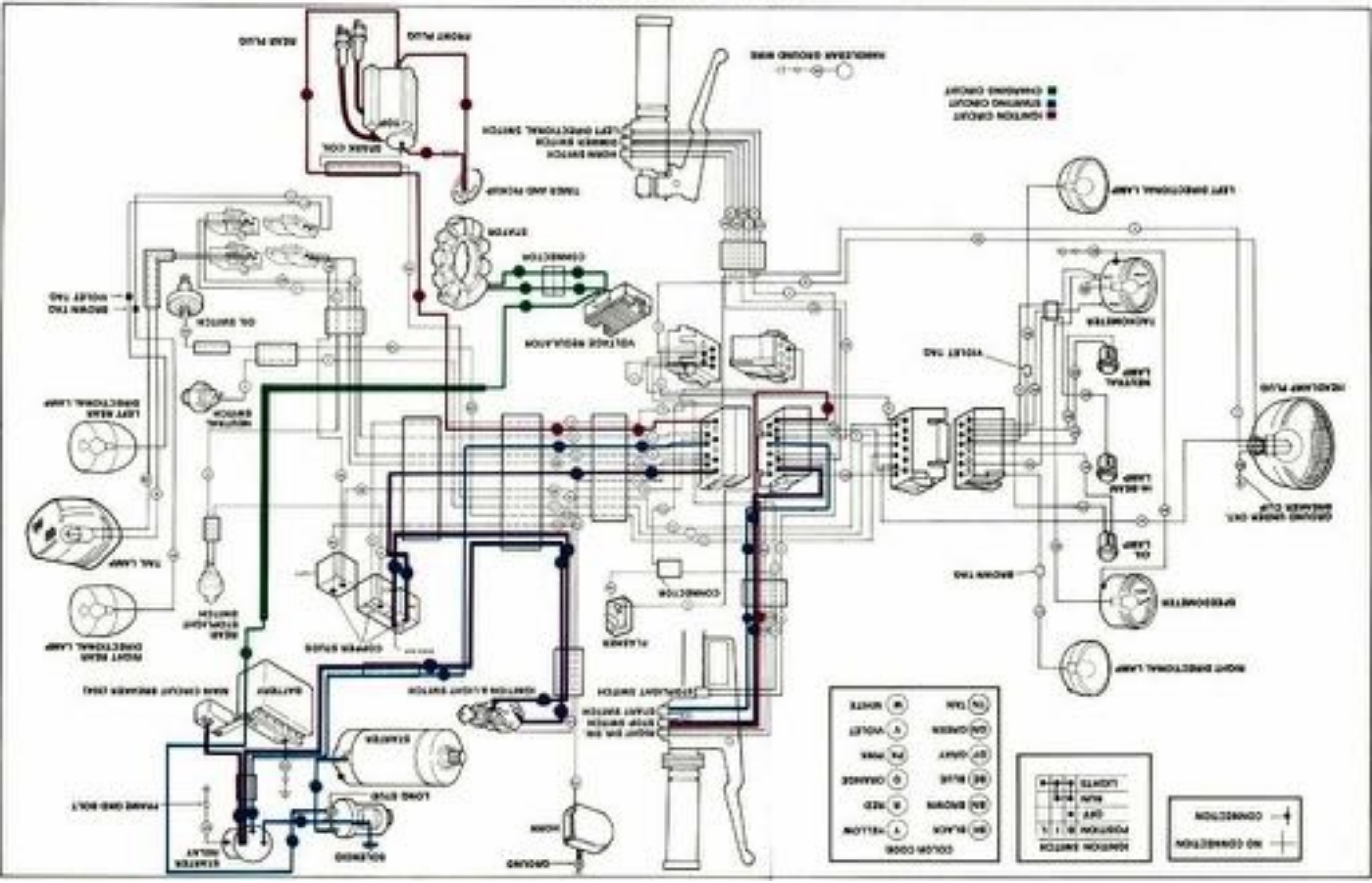


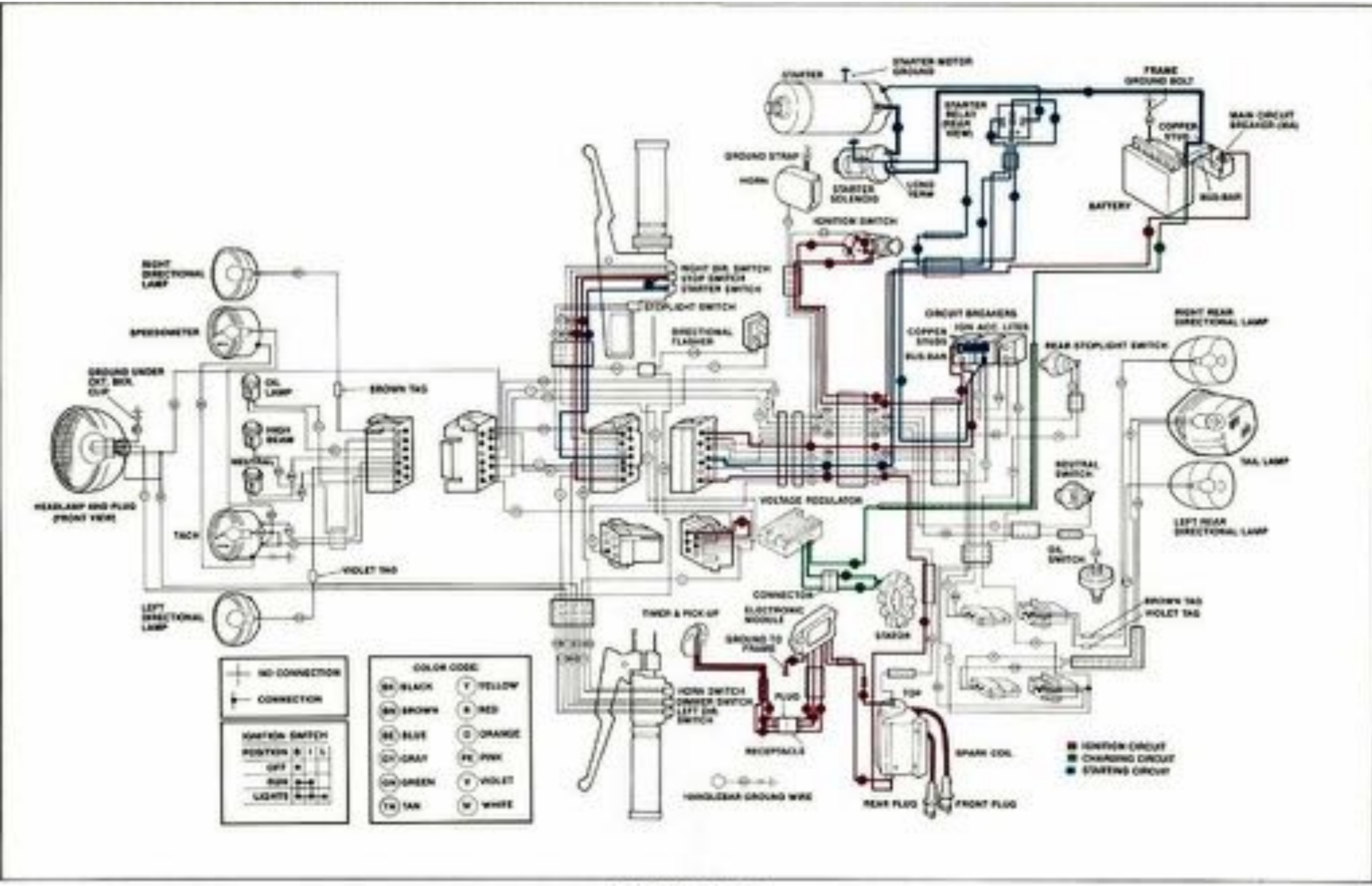
1982-1983 FLHS



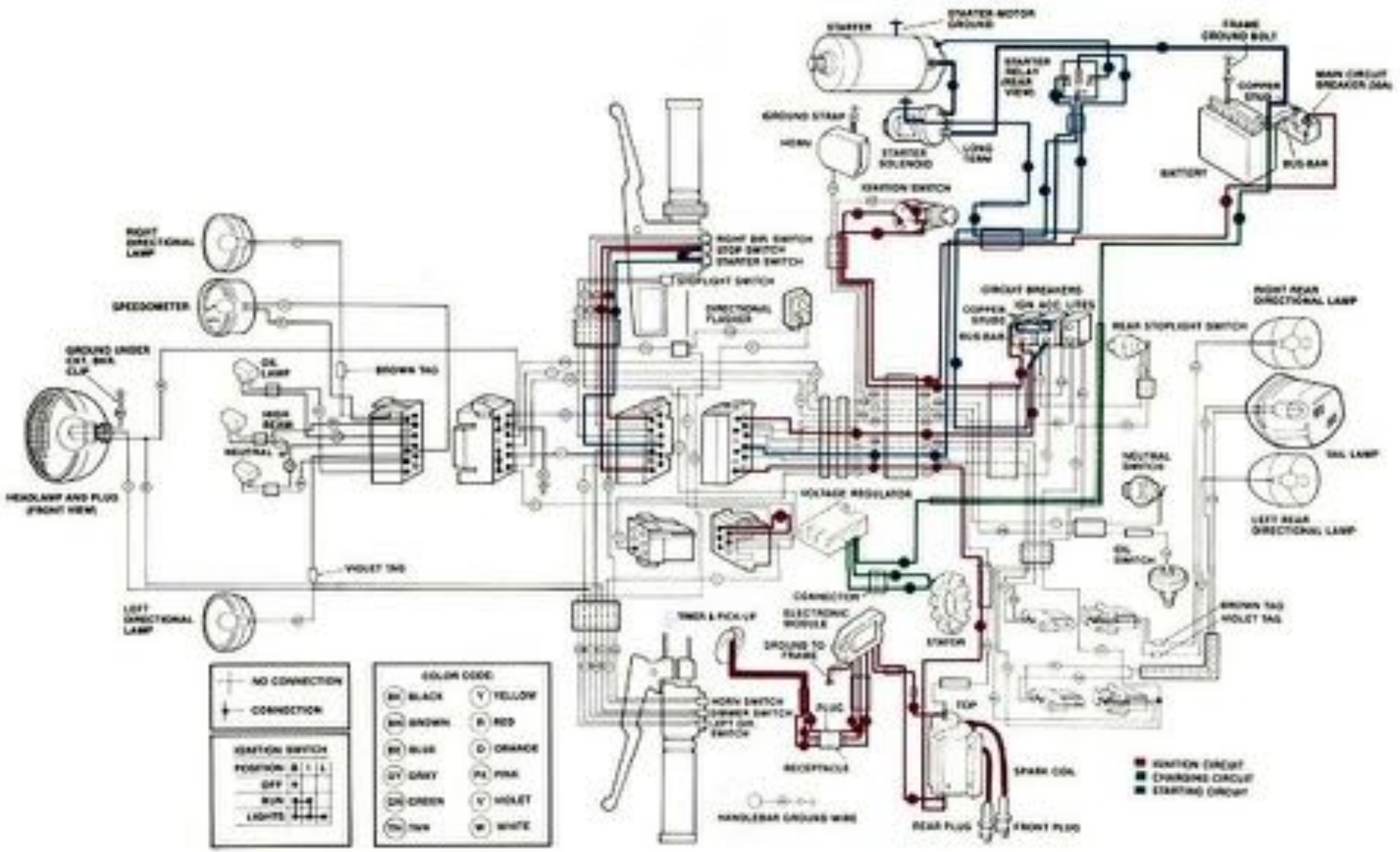
1978½-1979 FXS/FXEF

1978½-1979 FX / FXE

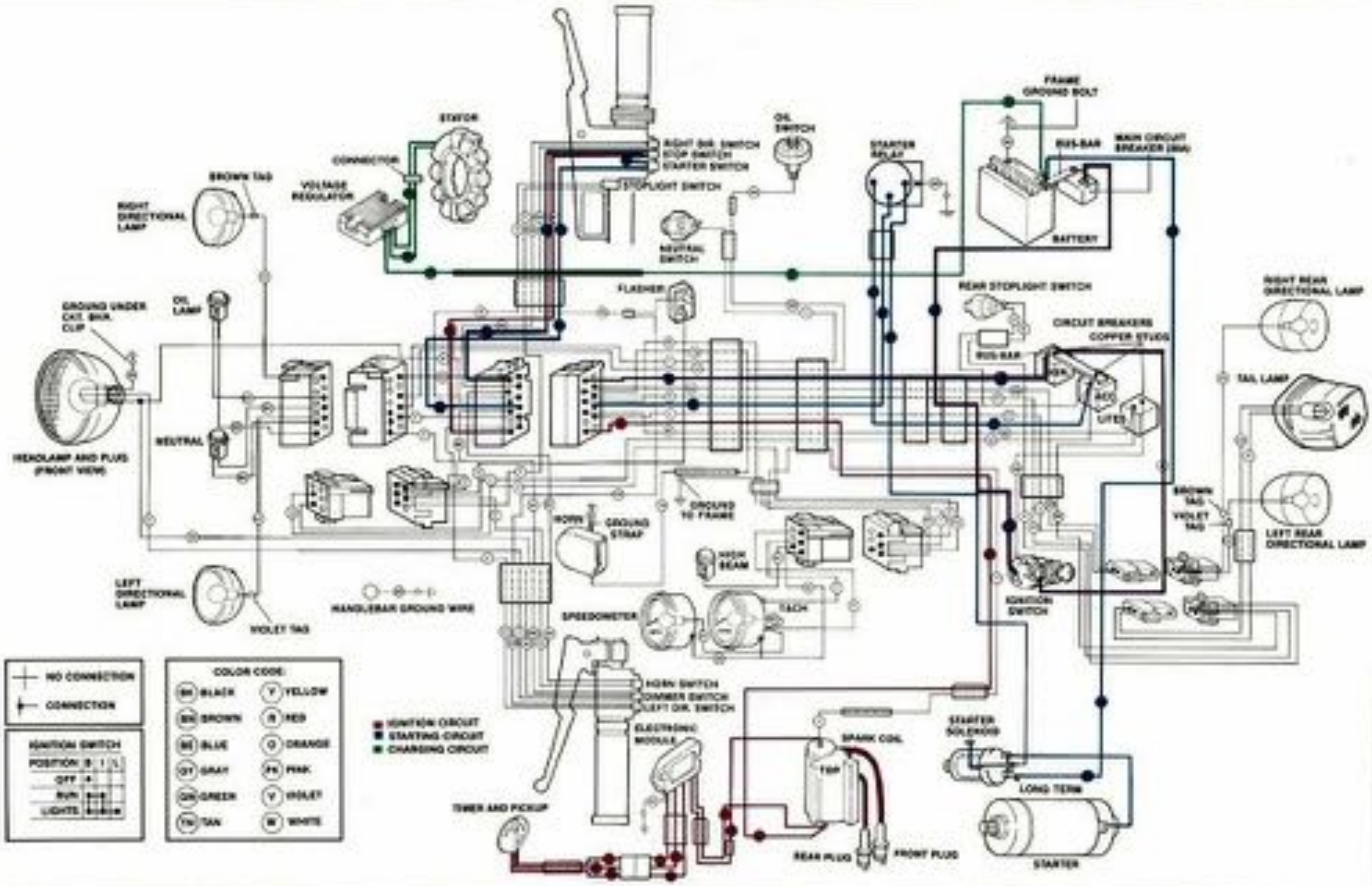




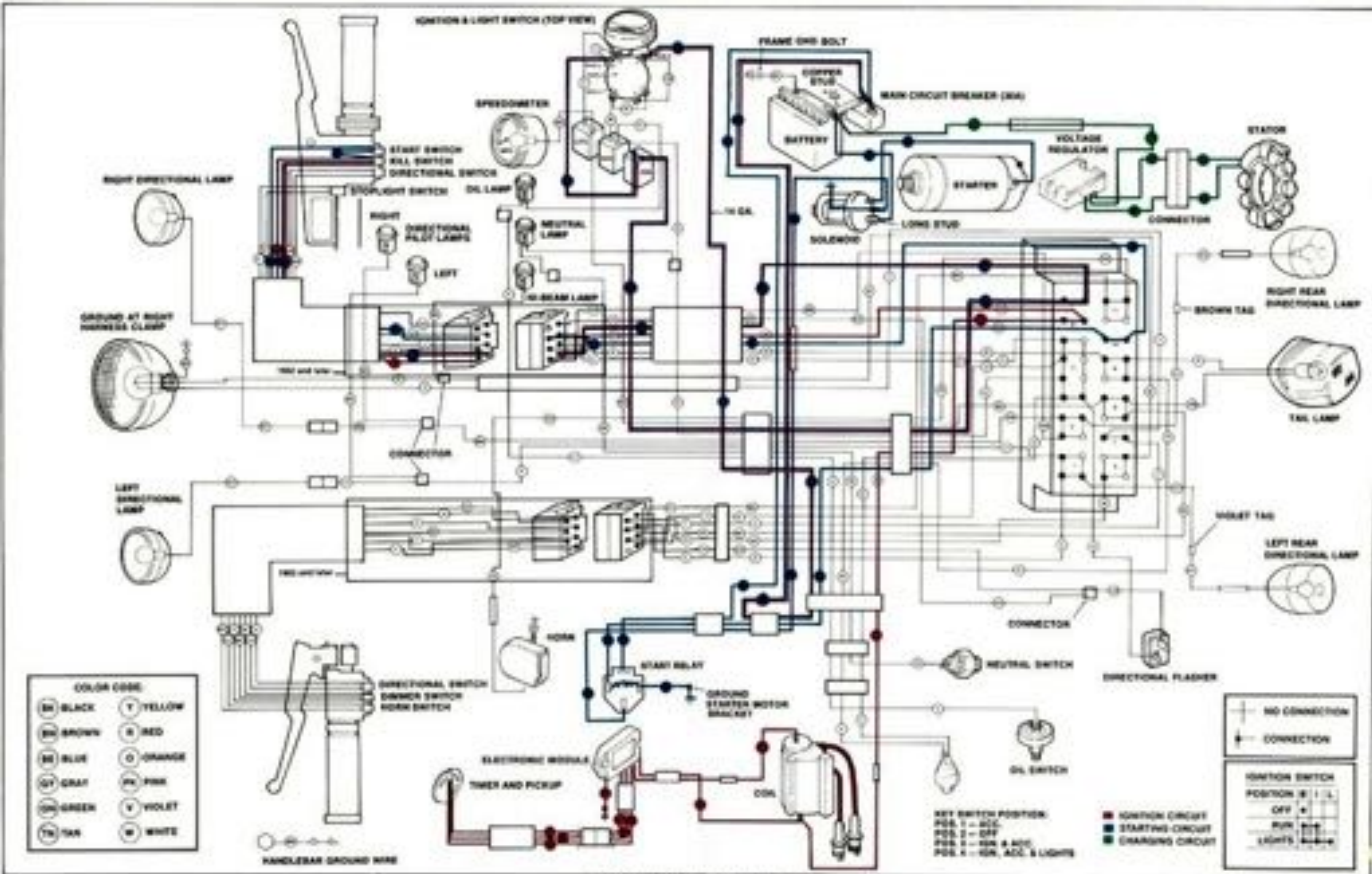
1980-1982 FXE



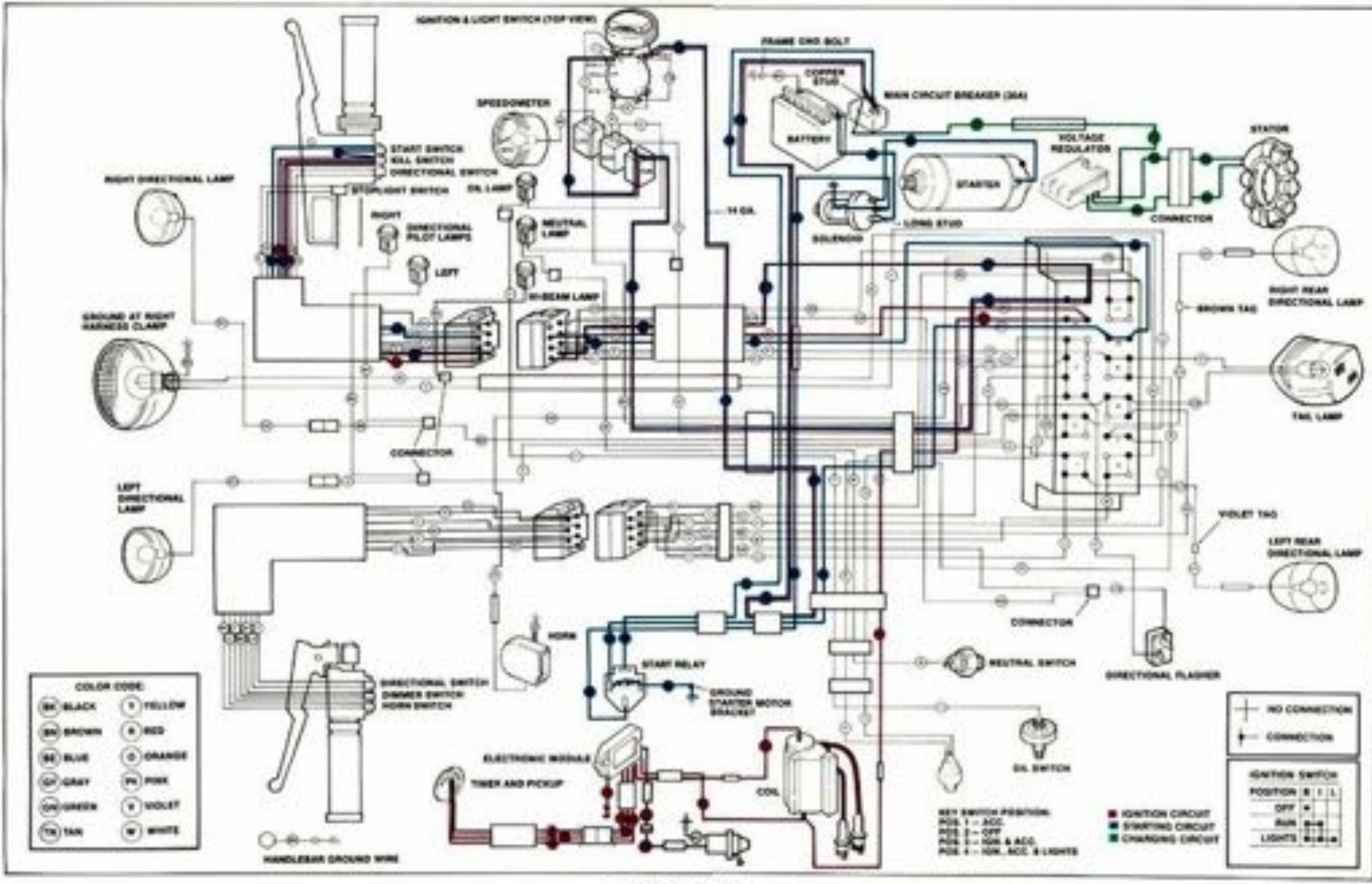
1983 - 1984 FXE



1980-1984 FXB/FXS/FXEF/FXSB



1980-1984 FXWG


IGNITION & LIGHT SWITCH (TOP VIEW)
FRAME GND BOLT
COPPER STUD
MAIN CIRCUIT BREAKER (30A)
BATTERY
VOLTAGE REGULATOR
STATOR
STARTER
CONNECTOR
SOLENOID
LONG STUD
14 GA.
SPEEDOMETER
START SWITCH
KILL SWITCH
DIRECTIONAL SWITCH
STOPLIGHT SWITCH
OIL LAMP
RIGHT DIRECTIONAL LAMP
RIGHT
DIRECTIONAL PILOT LAMPS
LEFT
NEUTRAL LAMP
HI-BEAM LAMP
GROUND AT RIGHT HARNESS CLAMP
RIGHT REAR DIRECTIONAL LAMP
BROWN TAG
TAIL LAMP
CONNECTOR
LEFT DIRECTIONAL LAMP
VIOLET TAG
LEFT REAR DIRECTIONAL LAMP
CONNECTOR
HORN
START RELAY
GROUND STARTER MOTOR BRACKET
NEUTRAL SWITCH
DIRECTIONAL FLASHER
DIRECTIONAL SWITCH
DIMMER SWITCH
HORN SWITCH
COLOR CODE:
BK BLACK
BN BROWN
BE BLUE
GY GRAY
GN GREEN
TN TAN
Y YELLOW
R RED
O ORANGE
PK PINK
V VIOLET
W WHITE
ELECTRONIC MODULE
TIMER AND PICKUP
COIL
OIL SWITCH
HANDLEBAR GROUND WIRE
KEY SWITCH POSITION:
POS. 1 – ACC.
POS. 2 – OFF
POS. 3 – IGN. & ACC.
POS. 4 – IGN., ACC. & LIGHTS
IGNITION CIRCUIT
STARTING CIRCUIT
CHARGING CIRCUIT
NO CONNECTION
CONNECTION
IGNITION SWITCH
POSITION
B
I
L
OFF
RUN
LIGHTS

1984 FXST

Harley-Davidson, Inc.
Technical Communications Dept.
Milwaukee, WI 53201