Harley-Davidson Motor Company
Technical Communications, Standards and Graphics
Milwaukee, WI 53201

99483-90

1984 TO 1990 FLT/FXR MODELS SERVICE MANUAL

SERVICE MANUAL

1984 TO 1990 FLT/FXR MODELS

OFFICIAL FACTORY MANUAL

HARLEY-DAVIDSON, INC.

Part No. 99483-90

IMPORTANT NOTICE

Harley-Davidson motorcycles conform to all applicable U.S.A. Environmental Protection Agency regulations effective on the date of manufacture.

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

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

Harley-Davidson Motor Company

1984 - 1990 FLT/FXR 1340cc 5-SPEED

SERVICE MANUAL

The maintenance and repair information in this manual applies to the 1984 through 1990 FLT, FXR Models.

Printed in U.S.A.
on Recycled Paper

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READERS COMMENTS

The Harley-Davidson Technical Communications Department maintains a continuous effort to improve the quality and usefulness of its publications. To do this effectively we need user feedback — your critical evaluation of this manual.

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

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Did you find errors in this manual? _____

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How can this manual be improved? _____

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Occupation: _____

Name_____ **Dealership**_____

Street_____ **Department**_____

City_____ **State**_____ **Zip**_____

1984 - 1990 FLT/FXR

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

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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 technician the latest field-tested and factory-approved major repair methods. We sincerely believe that this manual will make your association with Harley-Davidson products more pleasant and profitable.

HOW TO USE YOUR SERVICE MANUAL

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

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

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

3. Information is presented in a definite order as follows:
   Specifications
   General
   Troubleshooting
   Adjustment/Testing
   Removal/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.

Procedures having "FLT" in their titles apply to FLT, FLHS and FLHT models. Also those procedures having "FXR" in their titles cover all FXR models. Procedures that only apply to one model are identified with that model's designation.

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 Allied Division
Sealed Power Corporation
29784 Little Mack
Roseville, Michigan 48066-2239
Telephone: (313) 774-9500

Loctite Products

Some procedures in this manual call for the use of Loctite products. If you have questions regarding correct use of Loctite products or where to obtain them, please call Loctite Corp. at 1-800-323-5106.

WARNING

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

CONTENTS

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

Harley-Davidson Inc., reserves the right to change specifications, equipment, or designs at any time without notice and without incurring obligation.

WARNINGS AND CAUTIONS

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

WARNING

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

CAUTION

Means there is the possibility of damage to the vehicle.

We recommend you take special notice of these items.

WARNING

Proper service and repair is important for the safe, reliable operation of all mechanical products. The service procedures recommended and described in this Service Manual are effective methods for performing service operations. Some of these service operations require the use of tools specially designed for the purpose. These special tools should be used when and as recommended.

It is important to note that some warnings against the use of specific service methods which could damage the motorcycle or render it unsafe are stated in this Service Manual. However, please remember that these warnings are not all inclusive. Since Harley-Davidson could not possibly know, evaluate and advise the service trade of all possible ways in which service might be done or of the possible hazardous consequences of each way, we have not undertaken any such broad evaluation. Accordingly, anyone who uses a service procedure or tool which is not recommended by Harley-Davidson must first thoroughly satisfy himself that neither his nor the operator's safety will be jeopardized by the service methods selected.

WARNING

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

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.

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PRODUCT

SUBJECT **PAGE NO.**

SERVICE

BREAK-IN MAINTENANCE

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.

The performance of new motorcycle initial service is required to keep new motorcycle 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 5000 miles, a Harley-Davidson dealer should perform the following initial service operations.

CHECK AT FIRST 500 MILES

After 500 miles have a Harley-Davidson dealer perform the 500 mile maintenance listed in your Owner's Manual. (See Regular Maintenance Intervals chart on next page.)

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, cuts and wear.
2. Belt for proper tension or chain 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. Don't overfill oil tank.
7. Wheel spoke tightness if applicable.
8. Headlight, taillight and directional light operation.

REGULAR SERVICE INTERVALS

Regular lubrication and maintenance will help you keep Harley-Davidson motorcycles operating at peak performance, and will provide for longer motorcycle life and greater riding pleasure.

Also, any alterations to the emission system components, such as carburetor and exhaust system, may be in violation of federal and state laws.

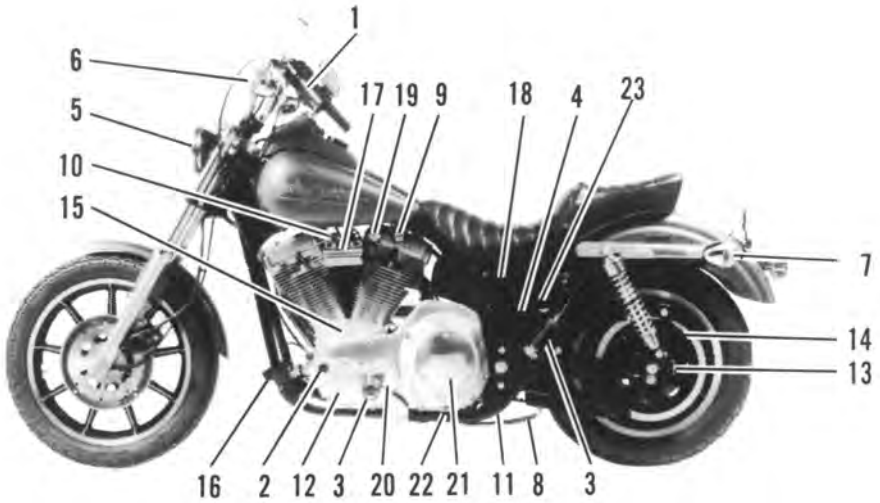
Regular Maintenance Intervals — FLT/FXR

ODOMETER READING (miles) / SERVICE OPERATIONS (see chart code below)	Pre-ride	500	2,500	5,000	7,500	10,000	12,500	15,000	17,500	20,000	22,500	25,000	27,500	30,000	32,500	35,000	37,500	40,000	42,500	45,000	47,500	50,000
Engine oil*	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R
Oil filter		R		R		R		R		R		R		R		R		R		R		R
Air cleaner		IL		IL		IL		IL		IL		IL		IL		IL		IL		IL		IL
Tappet oil screen		I		I		I		I		I		I		I		I		I		I		I
Rear belt/chain	I	A	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Primary chain		I		I		I		I		I		I		I		I		I		I		I
Primary chaincase lubricant		R		R		R		R		R		R		R		R		R		R		R
Battery fluid level, connections*		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Rear brake pedal height adjustment and free play**		I		I		I		I		I		I		I		I		I		I		I
Brake pad linings and discs for wear		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Brake fluid level and condition*		I		I		I		I		I		I		I		I		I		I		I
Clutch adjustment		A		A		A		A		A		A		A		A		A		A		A
Fuel valve, lines and fittings for leaks		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Front brake hand lever, throttle control cables, choke control cable, clutch control cable and hand lever		L		L		L		L		L		L		L		L		L		L		L
All fasteners except head bolts		T		T		T		T		T		T		T		T		T		T		T
Tire pressure and inspect tire for wear/damage	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Wheel spoke tightness**		I		I		I		I		I		I		I		I		I		I		I
Engine low and fast** idle speed adjustment	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Operation of throttle and choke or enrichener controls	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Operation of all electrical equipment and switches	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Ignition timing and vacuum operated electric switch (V.O.E.S.)		I		I		I		I		I		I		I		I		I		I		I
Spark plugs				I		R		I		R		I		R		I		R		I		R
Transmission lubricant*		R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R
Rear fork pivot nut		I		I		I		I		I		I		I		I		I		I		I
Engine mounts		I		I		I		I		I		I		I		I		I		I		I
Stabilizer links		I				I				I				I				I				I
Air suspension components**		I		I		I		I		I		I		I		I		I		I		I
Front fork bearing adjustment		I		I		IL		I		IL		I		IL		I		IL		I		IL
Condition of rear shock absorbers		I		I		I		I		I		I		I		I		I		I		I
Throttle control grip sleeve, speedometer cable				L		L		L		L		L		L		L		L		L		L
Grease fitting, rear brake linkage**				IL		IL		IL		IL		IL		IL		IL		IL		IL		IL
Condition of rear brake caliper mounting pins and boots				IL		IL		IL		IL		IL		IL		IL		IL		IL		IL
Wheel bearings*						IL				IL				IL				IL				
Front fork oil						R				R				R				R				R
Cruise control throttle disengage switch and other components**		I		I		I		I		I		I		I		I		I		I		I
Road test		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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

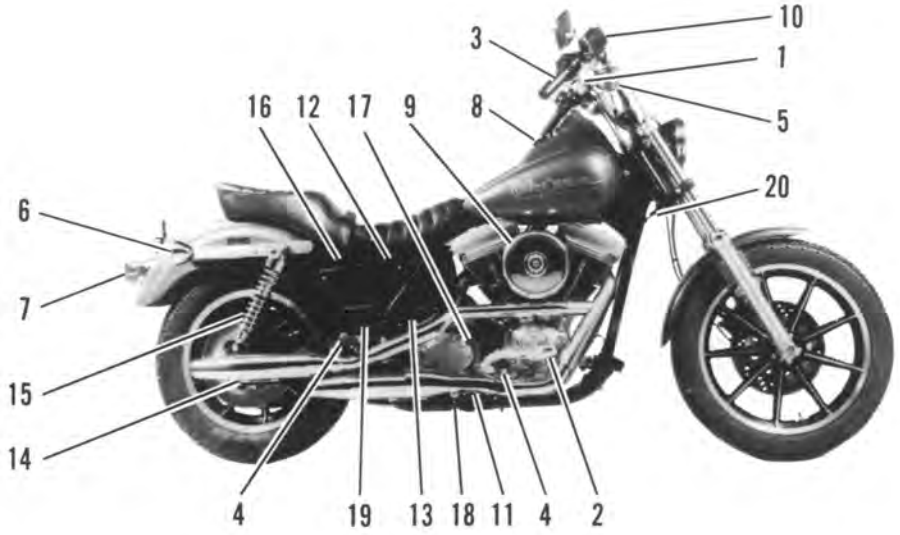
Chart Code:

I — Inspect, and if necessary correct, adjust, clean or replace.
A — Adjust.
R — Replace or change.
T — Tighten to proper torque.
L — Lubricate with lubricant specified in Operator's Manual.
X — Perform.



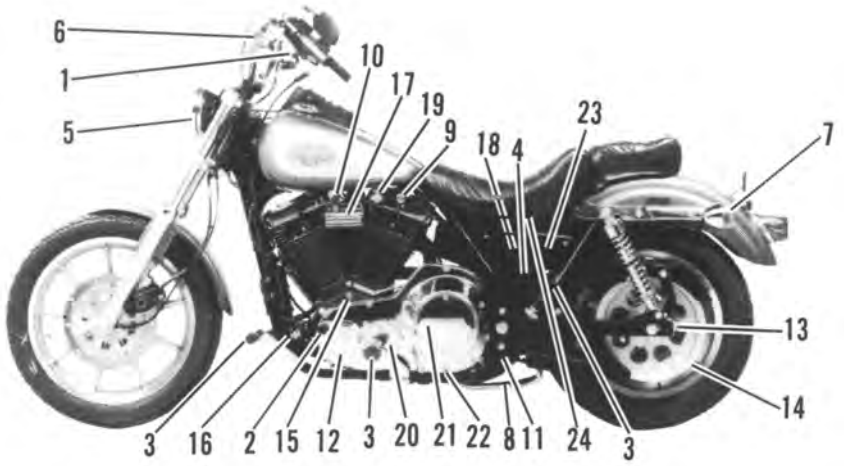
1. Clutch handlever
2. Gear shifter
3. Footrest(s)
4. Horn
5. Headlamp
6. Front turn signal & running lamp
7. Rear turn signal lamp
8. Jiffy stand
9. Ignition/light switch
10. Carburetor choke knob
11. Engine oil filter
12. Primary chain cover
13. Rear axle adjuster
14. Rear sprocket and drive
15. Timing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

FXR - Left Side View



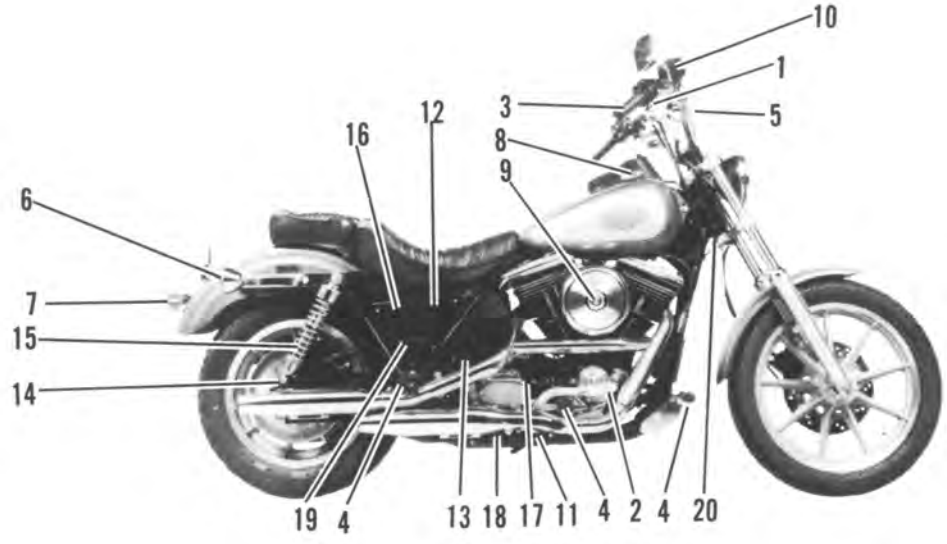
1. Front brake handlever
2. Rear brake pedal
3. Throttle control grip
4. Footrest(s)
5. Front turn signal & running lamp
6. Rear turn signal lamp
7. Tail/stop lamp
8. Fuel Filler cap
9. Carburetor/air cleaner
10. Front brake master cylinder & reservoir
11. Rear brake master cylinder
12. Engine Oil fill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

FXR - Right Side View



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

FXRS - Left Side View



1. Front brake handlever
2. Rear brake pedal
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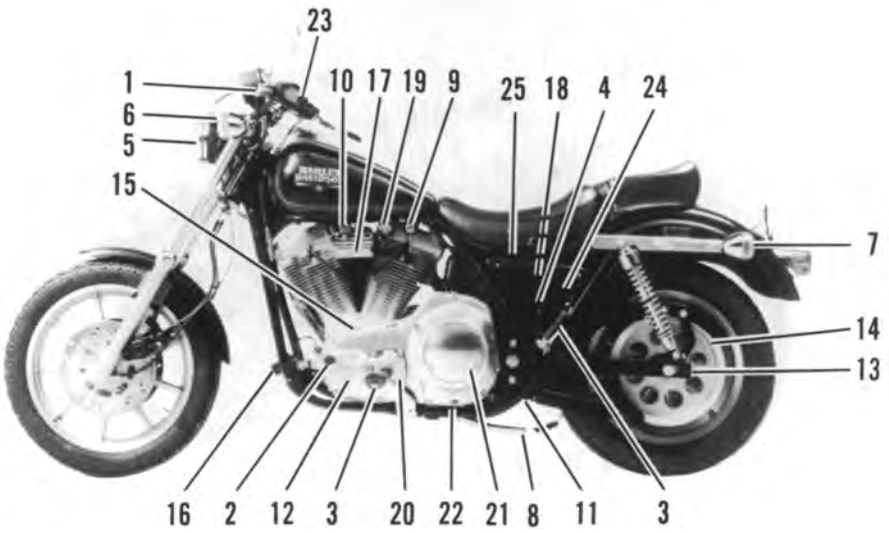
9. Carburetor/air cleaner
10. Front brake master cylinder & reservoir
11. Rear brake master cylinder
12. Engine Oil fill plug & dipstick
13. Electric starter motor
14. Rear axle Adjuster
15. Shock absorber(s)
16. Battery (under seat)
17. Transmission fill plug
18. Transmission drain plug
19. Rear brake fluid reservoir
20. Fork lock brackets

FXRS - Right Side View



1. Clutch handlever
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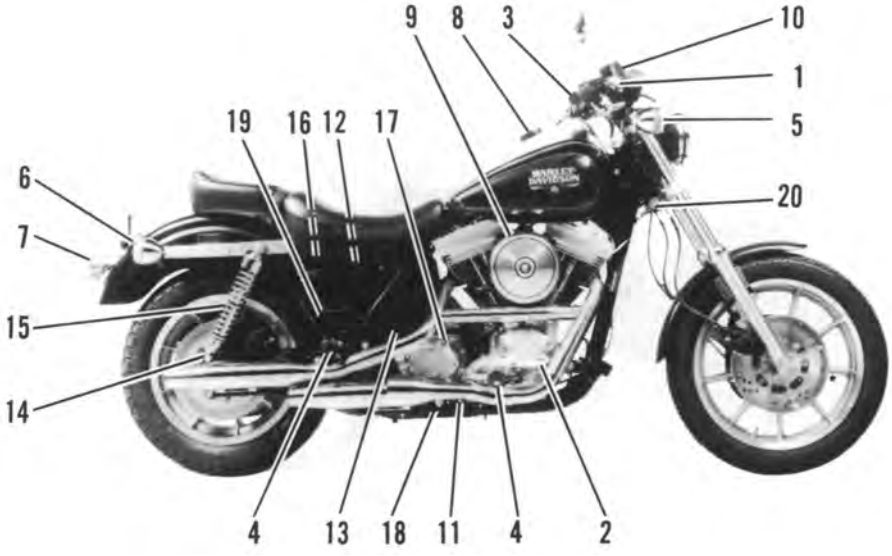
11. Engine oil filter
12. Primary chain cover
13. Rear axle adjuster
14. Rear sprocket and drive
15. Timing inspection hole plug
16. Voltage regulator
17. Ignition coil
18. Ignition module
19. Fuel supply valve
20. Primary chain inspection cover
21. Clutch inspection cover
22. Primary drain plug
23. Front suspension air valve
24. Engine Oil tank drain (under side cover)
25. Seat release

FXRS-SP - Left Side View



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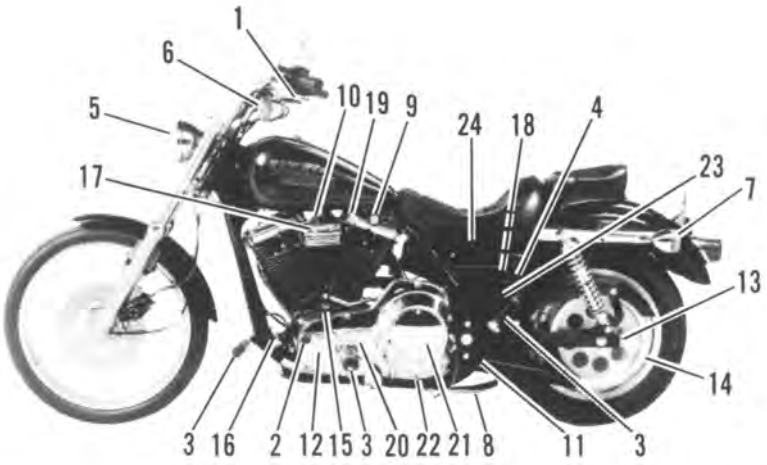
4. Footrest(s)
5. Front turn signal & running lamp
6. Rear turn signal lamp
7. Tail/stop lamp
8. Fuel Filler cap
9. Carburetor/air cleaner
10. Front brake master cylinder & reservoir
11. Rear brake master cylinder
12. Engine Oil fill plug & dipstick
13. Electric starter motor
14. Rear axle Adjuster
15.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

FXRS-SP - Right Side View



1. Clutch handlever
2. Gear shifter
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4. Horn
5. Headlamp
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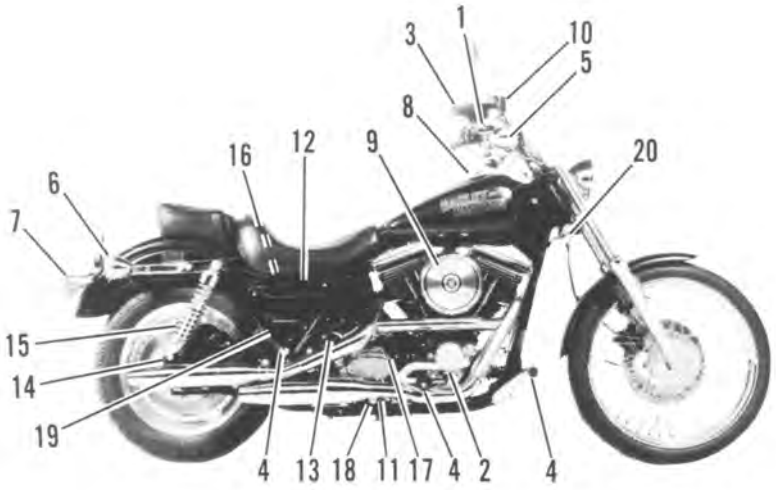
7. Rear turn signal lamp
8. Jiffy stand
9. Ignition/light switch
10. Carburetor choke knob
11. Engine oil filter
12. Primary chain cover
13. Rear axle adjuster
14. Rear sprocket and drive
15. Timing inspection hole plug
16. Voltage regulator
17. Ignition coil
18. Ignition module
19. Fuel supply valve
20. Primary chain inspection cover
21. Clutch inspection cover
22. Primary drain plug
23. Engine Oil tank drain (under side cover)
24. Seat release

FXLR - Left Side View



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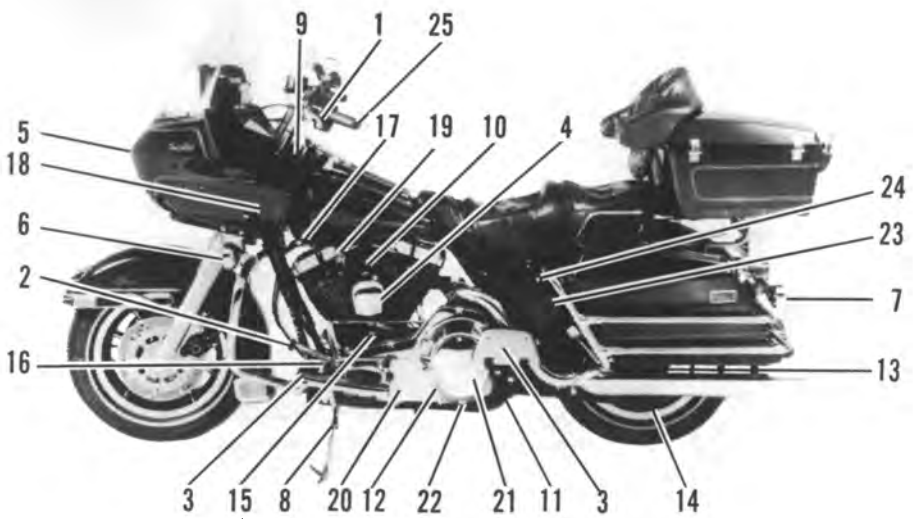
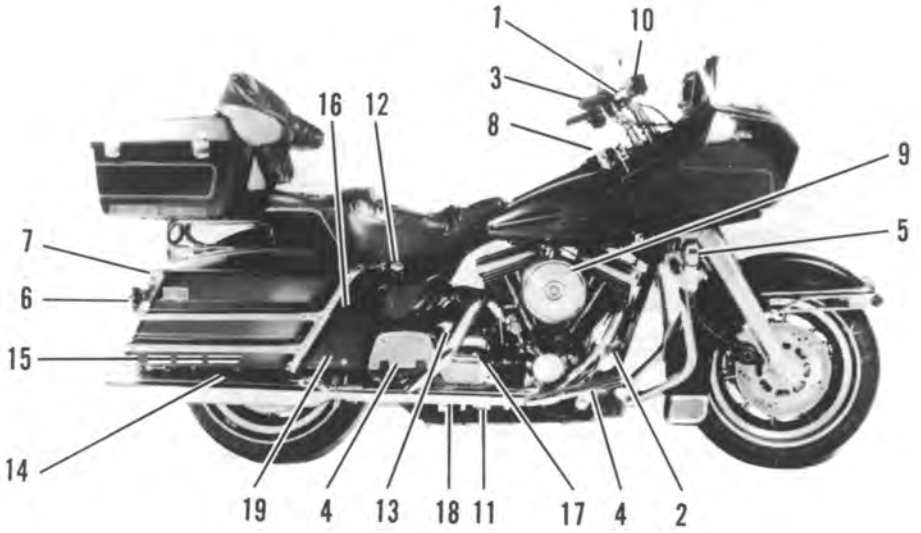
4. Footrest(s)
5. Front turn signal & running lamp
6. Rear turn signal lamp
7. Tail/stop lamp
8. Fuel Filler cap
9. Carburetor/air cleaner
10. Front brake master cylinder & reservoir
11. Rear brake master cylinder
12. Engine Oil fill plug & dipstick
13. Electric starter motor
14. Rear axle Adjuster
15.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

FXLR - Right Side View



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

FLTC - Left Side View



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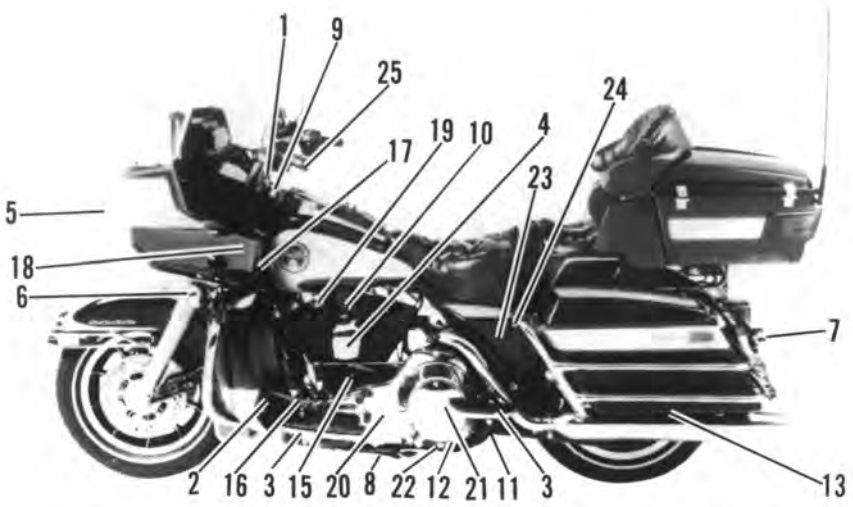
10. Front brake master cylinder & reservoir
11. Rear brake master cylinder
12. Engine Oil fill plug & dipstick
13. Electric starter motor
14. Rear axle Adjuster
15. Shock absorber(s)
16. Battery (under side cover)
17. Transmission fill plug
18. Transmission drain plug
19. Engine Oil tank drain (under side cover)

FLTC - Right Side View



1. Clutch handlever
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4. Horn
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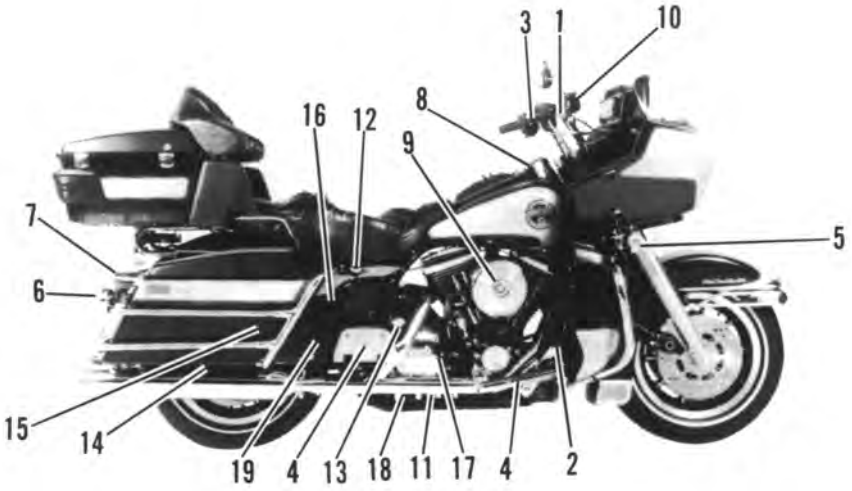
8. Jiffy stand
9. Ignition/light switch/fork lock
10. Carburetor choke knob
11. Engine oil filter
12. Primary chain cover
13. Rear axle adjuster
14. Rear sprocket and drive
15. Timing inspection hole plug
16. Voltage regulator
17. Ignition coil
18. Ignition module
19. Fuel supply valve
20. Primary chain inspection cover
21. Clutch inspection cover
22. Primary drain plug
23. Rear brake fluid reservoir (under side cover)
24. Rear suspension air valve
25. Front suspension air valve

FLTC Ultra - Left Side View



1. Front brake handlever
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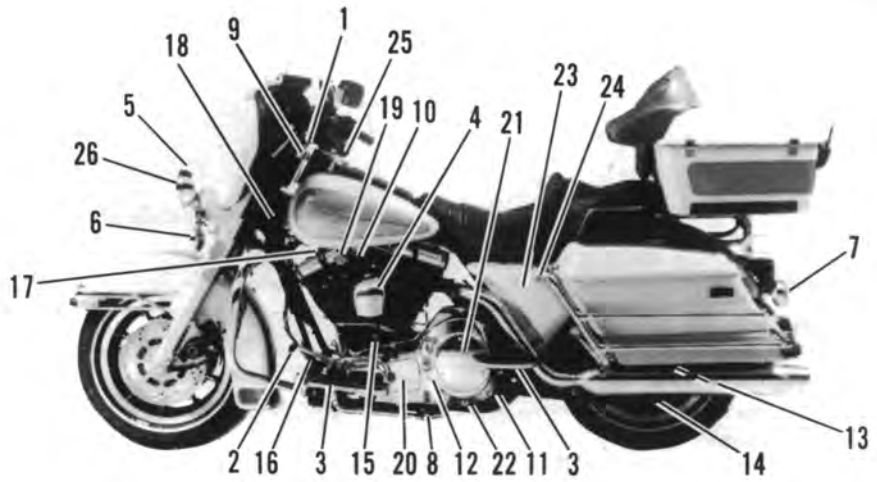
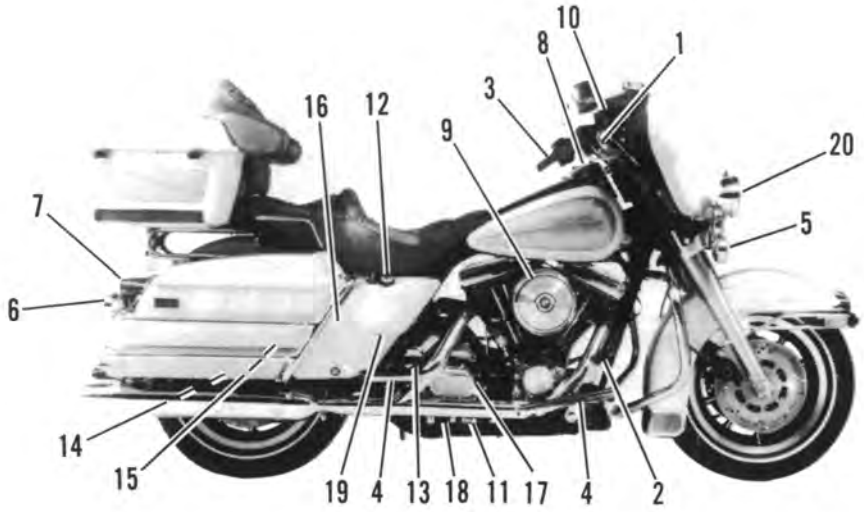
16. Battery (under side cover)
17. Transmission fill plug
18. Transmission drain plug
19. Engine Oil tank drain (under side cover)

FLTC Ultra - Right Side View



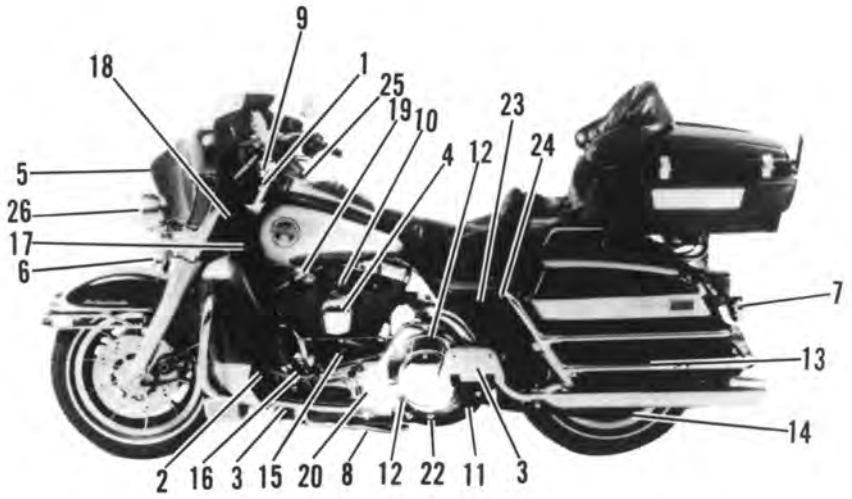
1. Clutch handlever
2. Gear shifter
3. Footrest(s)
4. Horn
5. Headlamp
6. Front turn signal & running lamp
7. Rear turn signal lamp
8. Jiffy stand
9. Ignition/light switch/fork lock
10. Carburetor choke knob
11. Engine oil filter
12. Primary chain cover
13. Rear axle adjuster
14. Rear sprocket and drive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

FLHTC - Left Side View



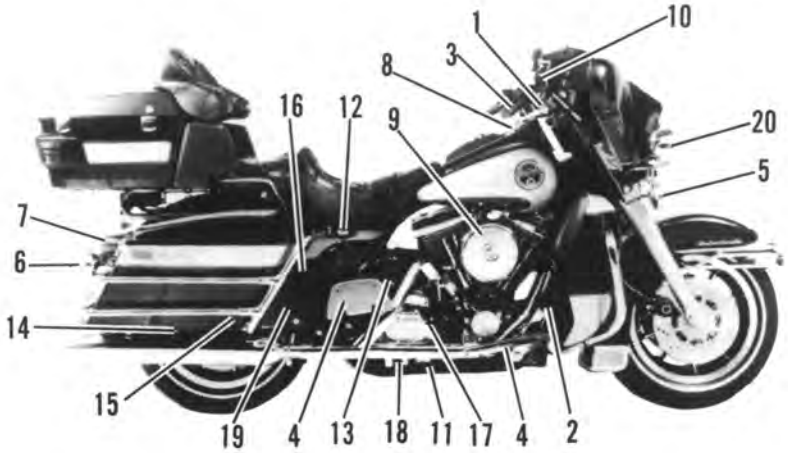
1. Front brake handlever
2. Rear brake pedal
3. Throttle control grip
4. Footrest(s)
5. Front turn signal & running lamp
6. Rear turn signal lamp
7. Tail/stop lamp
8. Fuel Filler cap
9. Carburetor/air cleaner
10. Front brake master cylinder & reservoir
11. Rear brake master cylinder
12. Engine Oil fill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

FLHTC - Right Side View



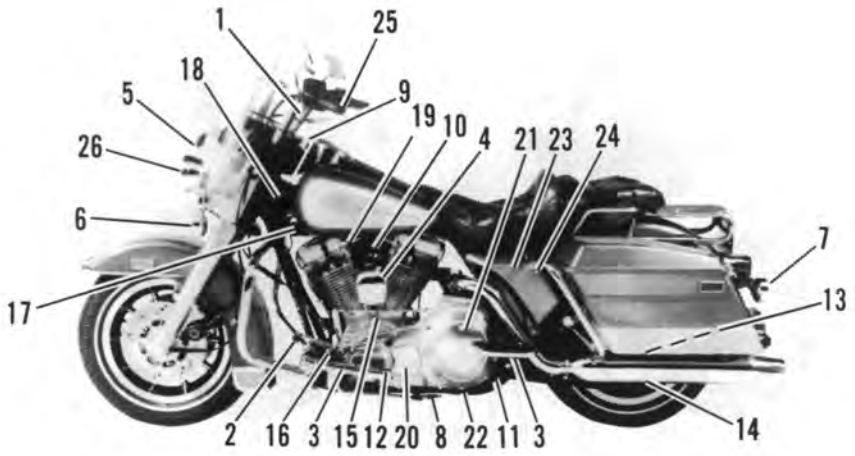
1. Clutch handlever
2. Gear shifter
3. Footrest(s)
4. Horn
5. Headlamp
6. Front turn signal & running lamp
7. Rear turn signal lamp
8. Jiffy stand
9. Ignition/light switch/fork lock
10. Carburetor choke knob
11. Engine oil filter
12. Primary chain cover
13. Rear axle adjuster
14. Rear sprocket and drive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

FLHTC Ultra - Left Side View



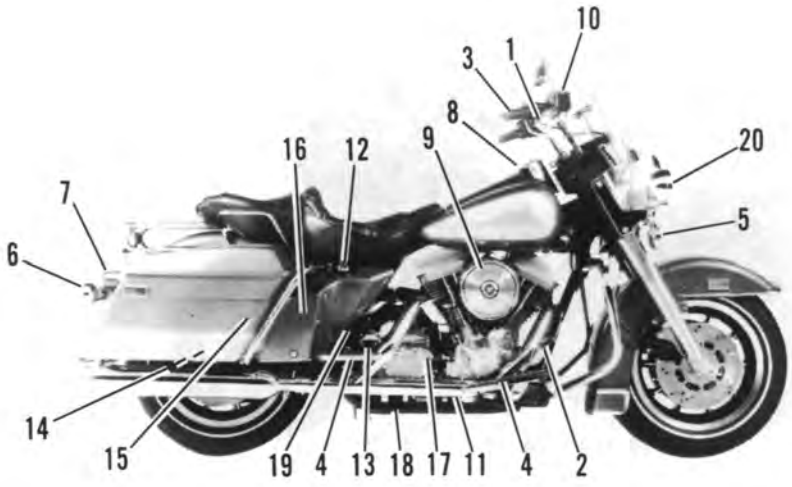
1. Front brake handlever
2. Rear brake pedal
3. Throttle control grip
4. Footrest(s)
5. Front turn signal & running lamp
6. Rear turn signal lamp
7. Tail/stop lamp
8. Fuel Filler cap
9. Carburetor/air cleaner
10. Front brake master cylinder & reservoir
11. Rear brake master cylinder
12. Engine Oil fill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

FLHTC Ultra - Right Side View



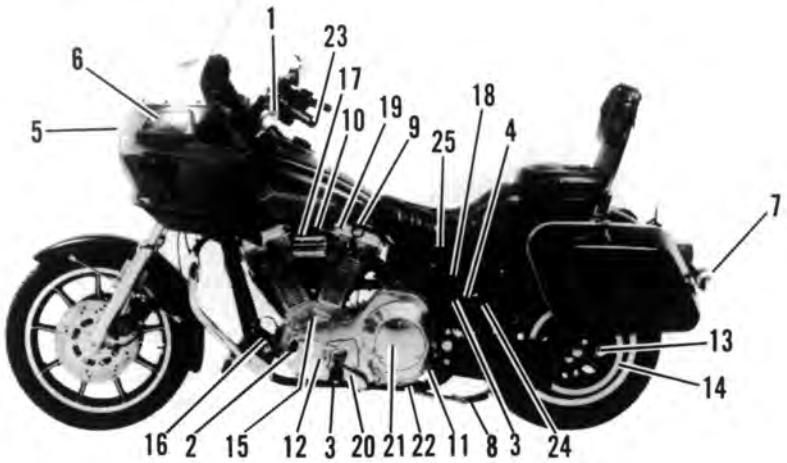
1. Clutch handlever
2. Gear shifter
3. Footrest(s)
4. Horn
5. Headlamp
6. Front turn signal & running lamp
7. Rear turn signal lamp
8. Jiffy stand
9. Ignition/light switch/fork lock
10. Carburetor choke knob
11. Engine oil filter
12. Primary chain cover
13. Rear axle adjuster
14. Rear sprocket and drive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

FLHS - Left Side View



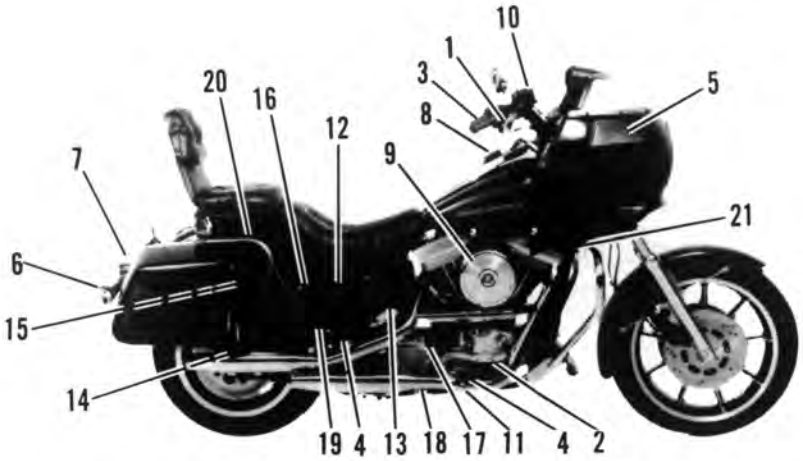
1. Front brake handlever
2. Rear brake pedal
3. Throttle control grip
4. Footrest(s)
5. Front turn signal & running lamp
6. Rear turn signal lamp
7. Tail/stop lamp
8. Fuel Filler cap
9. Carburetor/air cleaner
10. Front brake master cylinder & reservoir
11. Rear brake master cylinder
12. Engine Oil fill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

FLHS - Right Side View



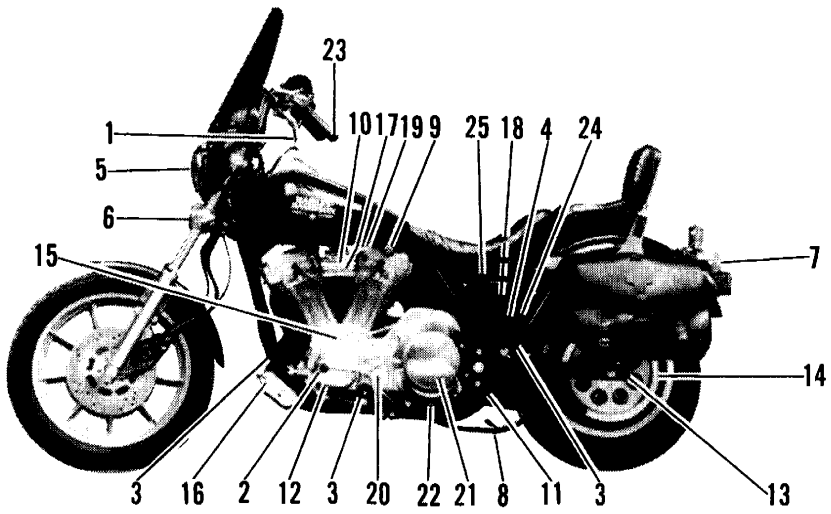
1. Clutch handlever
2. Gear shifter
3. Footrest(s)
4. Horn
5. Headlamp
6. Front turn signal & running lamp
7. Rear turn signal lamp
8. Jiffy stand
9. Ignition/light switch/fork lock
10. Carburetor choke knob
11. Engine oil filter
12. Primary chain cover
13. Rear axle adjuster
14. Rear sprocket and drive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

FXRT - Left Side View



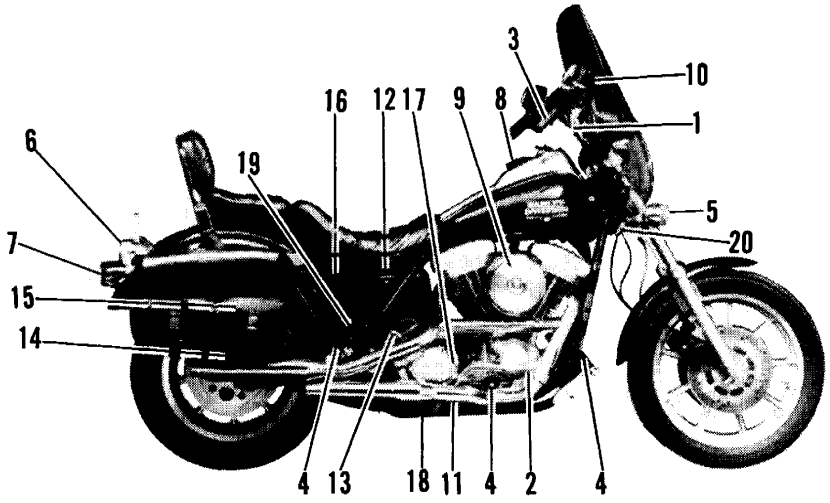
1. Front brake handlever
2. Rear brake pedal
3. Throttle control grip
4. Footrest(s)
5. Front turn signal & running lamp
6. Rear turn signal lamp
7. Tail/stop lamp
8. Fuel Filler cap
9. Carburetor/air cleaner
10. Front brake master cylinder & reservoir
11. Rear brake master cylinder
12. Engine Oil fill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

FXRT - Right Side View



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

FXRS-CON - Left Side View



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

FXRS-CON - Right 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

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

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

   OR . . .

   Drain all fuel from the fuel tank and carburetor float bowl. Spray the inside of the fuel tank with one of the commercially available rust preventatives. Follow the manufacturer's instructions.

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 in 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 and lubricate rear chain if applicable.

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 and reduce tire pressure to 20 psi.

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 battery and store in coolest area available above 0 degrees F. Trickle charge battery monthly to maintain full charge.

8. Repack wheel bearings.

REMOVAL FROM STORAGE

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

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. Inflate tires to proper pressure.

8. Before starting engine, place transmission in gear, disengage the clutch and push vehicle back and forth to ensure proper clutch disengagement.

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

10. Stop engine, drain and flush the oil tank. Install a new oil filter and fill oil tank with the proper grade oil. Check the transmission lubricant level.

11. 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:

Harley-Davidson Type	Viscosity	Harley-Davidson Rating	Ambient Temperature (° F.)	Cold Weather Starts Below 50° F.
H.D. Multigrade	SAE20W50	HD 240	Above 20° to 100°	Excellent
H.D. Regular Heavy	SAE50	HD 240	Above 60° to 100°	Poor
H.D. Extra Heavy	SAE 60	HD 240	Above 80° to 100°	Poor

Fuel

Use a good quality leaded or unleaded gasoline (87 pump octane or higher).

"Pump Octane" is the octane number usually shown on the gas pump.

CAUTION

Using gasolines that have alcohol additives (such as methanol) may cause failure of rubber components in the fuel system and/or internal engine damage.

Transmission Lubricant

Use Harley-Davidson TRANSMISSION LUBRICANT, Part No. 99892-84.

Primary Chaincase Lubricant

Use Harley-Davidson PRIMARY CHAINCASE LUBRICANT, Part No. 99887-84.

Brake Fluid

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

WHEEL BEARING GREASE

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

TORQUE VALUES

Torque specifications for specific components are listed in each respective section. When converting to Newton-meters use the formulas given under the metric chart. For all other fasteners, use the values listed in one of the tables below. In the English table, torque figures are in ft-lbs except those marked with an asterisk (*) which are in in-lbs. In the metric table, figures are in Newton-meters.

ENGLISH

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.																		

*** in-lbs**

METRIC

FASTENER	TYPE	MINIMUM TENSILE STRENGTH	MATERIAL	Body Size or Outside Diameter																
				2	3	4	5	6	8	10	6.4	7.9	9.5	11.1	12.7	14.3	15.9	19.1	22.2	25.4
	SAE 2 STEEL	5,202 kg/cm^2	LOW CARBON								8.3	16.6	27.7	44.3	65.0	95.4	132.8	214.4	283.5	428.7
	SAE 5 STEEL	8,436 kg/cm^2	MEDIUM CARBON HEAT TREAT						1.6	2.5	13.8	26.3	45.6	74.7	107.9	157.7	213.0	355.4	528.3	811.8
	SAE 7 STEEL	9,350 kg/cm^2	MEDIUM CARBON ALLOY								18.0	34.6	60.8	98.2	152.1	213.0	297.3	497.9	788.3	1161.7
	SAE 8 STEEL	10,545 kg/cm^2	MEDIUM CARBON ALLOY								19.4	40.1	65.0	107.9	164.6	233.7	318.1	525.5	829.8	968.1
	SOCKET HEAD CAP SCREW	11,248 kg/cm^2	HIGH CARBON QUENCHED TEMPERED								22.1	45.6	74.7	116.2	172.9	248.9	345.7	553.2	885.1	1341.5
	SOCKET SET SCREW	14,904 kg/cm^2	HIGH CARBON QUENCHED TEMPERED					1.0	1.8	3.4	8.1	16.1	24.9	40.1	59.5	87.1	138.3	201.9		
	STUDS	Use SAE 2, 5 and 8 values when grade is known, with nut of sufficient strength.																		

pounds foot X 1.36 = Newton-meters **pounds inch X .113 = Newton-meters**

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	.5905	48	1.890	81	3.189	114	4.488	3/16	4.762	1 9/16	39.69	2.9	73.66	4.3	109.22
16	.6299	49	1.929	82	3.228	115	4.527	.2	5.080	1.6	40.64	2 15/16	74.61	4 5/16	109.54
17	.6693	50	1.968	83	3.268	116	4.567	1/4	6.350	1 5/8	41.27	3	76.20	4 3/8	111.12
18	.7086	51	2.008	84	3.307	117	4.606	.3	7.620	1 11/16	42.86	3 1/16	77.79	4.4	111.76
19	.7480	52	2.047	85	3.346	118	4.645	5/16	7.938	1.7	43.18	3.1	78.74	4 7/16	112.71
20	.7874	53	2.086	86	3.386	119	4.685	3/8	9.525	1 3/4	44.45	3 1/8	79.37	4 1/2	114.30
21	.8268	54	2.126	87	3.425	120	4.724	.4	10.160	1.8	45.72	3 3/16	80.96	4 9/16	115.89
22	.8661	55	2.165	88	3.464	121	4.764	7/16	11.112	1 13/16	46.04	3.2	81.28	4.6	116.84
23	.9055	56	2.205	89	3.504	122	4.803	1/2	12.700	1 7/8	47.62	3 1/4	82.55	4 5/8	117.47
24	.9449	57	2.244	90	3.543	123	4.842	9/16	14.288	1.9	48.26	3.3	83.82	4 11/16	119.06

TROUBLESHOOTING

GENERAL

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

Starter 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 faulty.
5. Electric starter shaft pinion gear not engaging or overrunning clutch slipping.

Engine Turns Over But Does Not Start

1. Fuel tank empty.
2. Fuel supply valve turned off.
3. Fuel 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 shorting or cable connections loose.
7. Ignition timing badly out of adjustment.
8. Loose wire connection at coil, battery or plug between ignition sensor and module.
9. Faulty ignition coil.
10. Faulty ignition module .
11. Faulty ignition sensor.
12. Sticking or damaged valve or wrong length push rod.
13. Engine flooded with gasoline as a result of overchoking.
14. Engine lubricant too heavy (winter operation).
15. For cold weather starts, always disengage clutch.

Starts Hard

1. Spark plugs in bad condition or have improper gap or are partially fouled.
2. Spark plug cables in bad condition and leaking.
3. Battery nearly discharged.
4. Loose wire connection at one of the battery terminals, coil or plug between ignition sensor and module.
5. Carburetor controls not adjusted correctly.
6. Faulty ignition coil.
7. Engine lubricant too heavy (winter operation).
8. Ignition not timed properly.
9. Fuel tank cap vent plugged, or carburetor fuel line closed off, restricting fuel flow.
10. Water or dirt in fuel system and carburetor.
11. Choke disc stuck in open position or enrichener valve inoperative.
12. Air leak at intake manifold.
13. Valves sticking.
14. For cold weather starts, always disengage clutch.

Starts But Runs Irregularly or Misses

1. Spark plugs in bad condition or partially fouled.
2. Spark plug cables in bad condition and leaking.
3. Spark plug gap too close or too wide.
4. Faulty ignition coil.
5. Faulty ignition module.
6. Faulty ignition sensor.
7. Battery nearly discharged.
8. Damaged wire or loose connection at battery terminals or coil.
9. Intermittent short circuit due to damaged wire insulation.
10. Water or dirt in fuel system, carburetor or filter.
11. Fuel tank cap vent plugged or carburetor vent line closed off.
12. Carburetor controls misadjusted.
13. Damaged carburetor.
14. Weak or broken valve springs.
15. Air leak at intake manifold or air cleaner.
16. Damaged intake or exhaust valve.
17. Incorrect valve timing.
18. Faulty vacuum operated electric switch (V.O.E.S.)
19. Loose or dirty ignition module connector at crankcase.

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.
4. Valve guides or 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. Faulty spark plugs.
4. Ignition timing advanced.
5. Fuel octane rating too low.
6. Faulty V.O.E.S.

Overheating

1. Insufficient oil supply or oil not circulating.
2. Leaking valve.
3. Heavy carbon deposit.
4. Ignition timing retarded.
5. Faulty V.O.E.S.

Valve Train Noise

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

Excessive Vibration

1. Stabilizer links worn or loose.
2. Rubber mounts loose or worn.
3. Rear fork pivot shaft nuts loose.
4. Front engine mounting bolts loose.
5. Engine to transmission mounting bolts loose.
6. Broken frame.
7. Primary chain badly worn or links tight as a result of insufficient lubrication or misalignment.
8. Wheels and/or worn tires.
9. Internal engine problem.
10. Engine/transmission/rear wheel not aligned properly.
11. Ignition timing incorrect poorly tuned engine.

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. Insufficient chain case vacuum (1984 "dry clutch").
4. Valve guides or seals worn.
5. Restricted oil return line to tank.
6. Restricted breather hose.
7. Oil tank overfilled.
8. Restricted oil filter.

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.
5. Breather valve incorrectly timed.
6. Restricted oil filter.
7. Oil tank overfilled.

ELECTRICAL SYSTEM

Alternator Does Not Charge

1. Faulty regulator-rectifier module.
2. Module not grounded.
3. Engine ground wire loose or broken.
4. Loose or broken wires in charging circuit.
5. Faulty stator.
6. Faulty rotor.

Alternator Charge Rate Is Below Normal

1. Faulty regulator-rectifier module.
2. Faulty stator.
3. Faulty rotor.
4. Weak or damaged battery.
5. Loose connections.

CARBURETOR

Carburetor Floods

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

TRANSMISSION

Transmission Shifts Hard

1. Bent shifter rod.
2. Clutch dragging slightly.
3. Shifter forks (inside transmission) sprung.
4. Corners worn off shifter clutch dogs (inside transmission).
5. Shifter return spring (inside transmission) bent or broken.

Transmission Jumps Out Of Gear

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

Clutch Slips

1. Clutch controls improperly adjusted.
2. Insufficient clutch spring tension.
3. Worn friction discs.
4. Oil soaked friction discs (1984 "dry clutch").

Clutch Drags Or Does Not Release

1. Clutch controls improperly adjusted.
2. Insufficient clutch spring tension.
3. Friction discs gummy (1984 "dry clutch").
4. Clutch shell keys or hub studs badly worn.
5. Clutch discs warped.
6. Primary chain badly misaligned.
7. Lubricant level too high in primary chaincase (1990 only).

Clutch Chatters

1. Clutch hub friction disc rivets loose (1984 "dry clutch").
2. Friction discs or steel discs worn or warped.

BRAKES

Brake Does Not Hold Normally

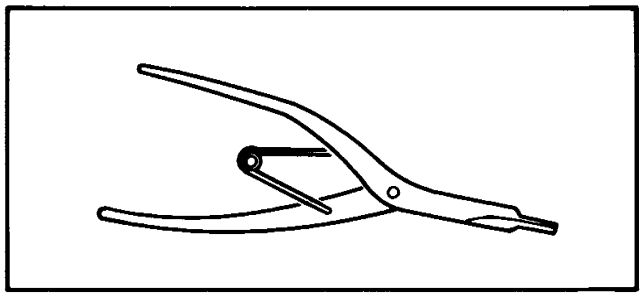
1. Master cylinder reservoir low on fluid.
2. Brake system contains air bubbles.
3. Master or wheel cylinder piston worn or parts damaged.
4. Brake pads contaminated with grease or oil.
5. Brake pads badly worn (1/16 in. minimum lining thickness).
6. Brake disc badly worn or warped.
7. Brake fades due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

HANDLING

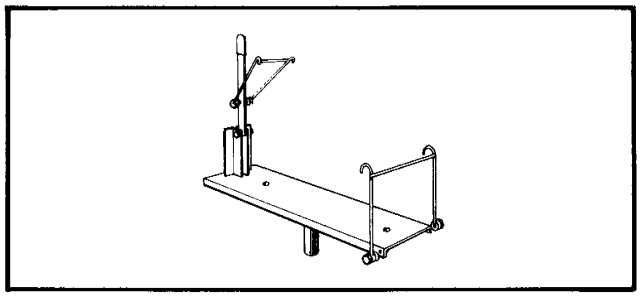
Irregularities

1. Loose wheel axle nuts. Tighten to recommended tightness.
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.
5. Rims and tires out-of-round or eccentric with hub.
6. Irregular or peaked front tire tread wear.
7. Incorrect tire pressure. Check TIRE DATA section.
8. Tire and wheel unbalanced.
9. Steering head bearings improperly adjusted. Correct adjustment and replace pitted or worn bearings and races. See FORKS.
10. Shock absorber not functioning normally.
11. Shock absorber springs improperly adjusted.
12. Improperly loaded motorcycle. Non-standard equipment on the front end such as heavy radio receivers, extra lighting equipment or luggage tends to cause unstable handling.
13. Worn engine stabilizer links.
14. Damaged rear engine mounts.
15. Swing arm pivot shaft nut improperly tightened or assembled.
16. Incorrect air suspension pressure.

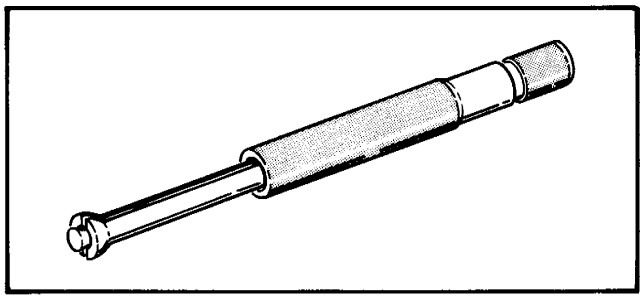
TOOLS



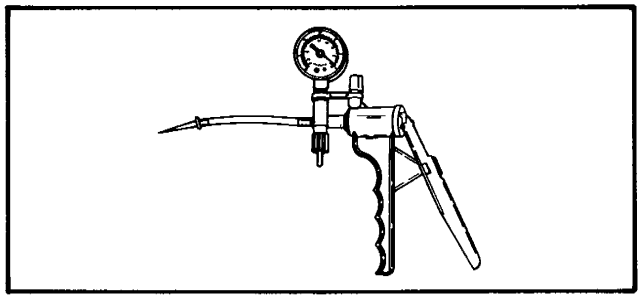
Part No. J-5586 Transmission Shaft Retaining Ring Pliers



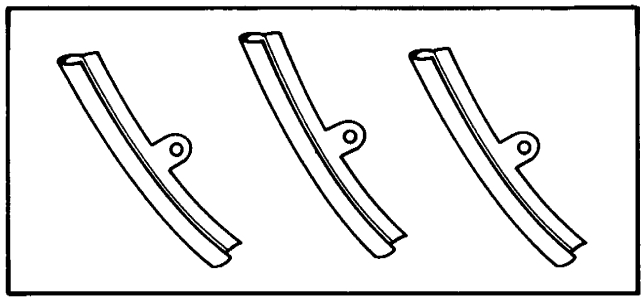
Part No. HD-21000 Tire Spreader



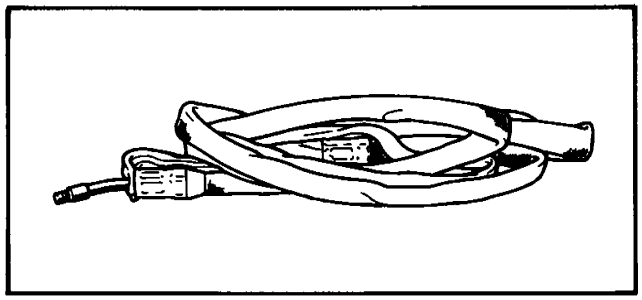
Part No. J 26900-14 Small Hole Gauge



Part No. HD-23738 Vacuum pump



Part No. HD-01289 Rim Protector



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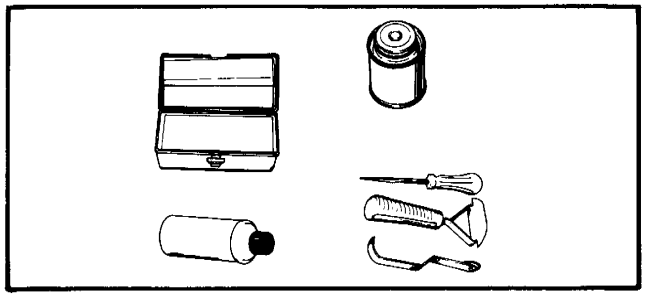

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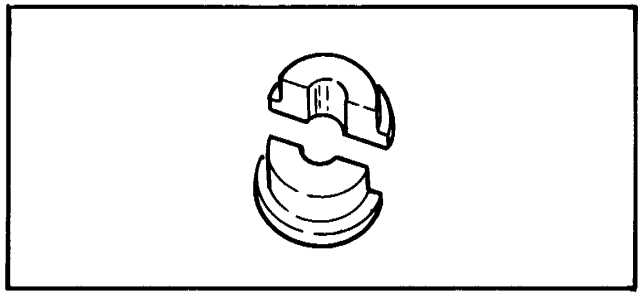
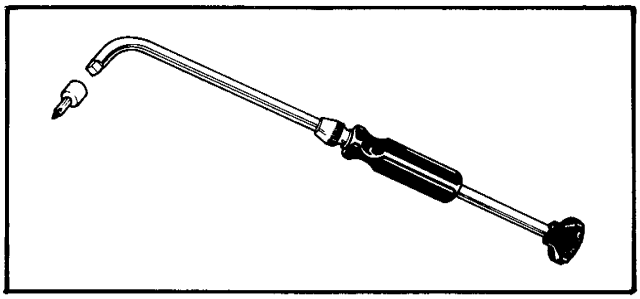
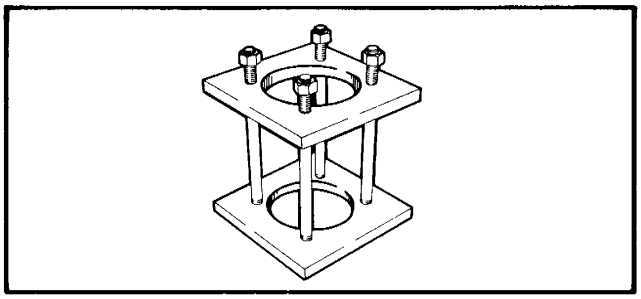


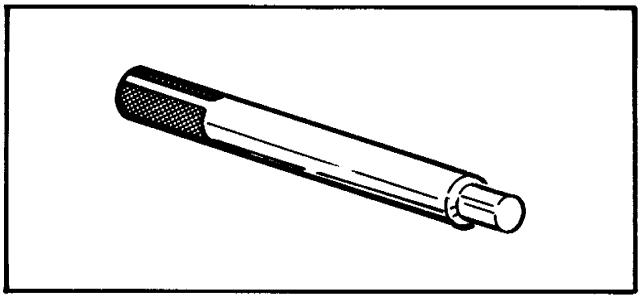
Part No. HD-33071 Wheel Bearing
Race Remover and Installer



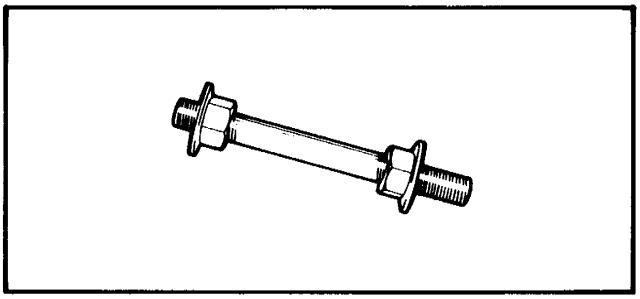
Part No. HD-33413 Carburetor Idle Adjustment Tool



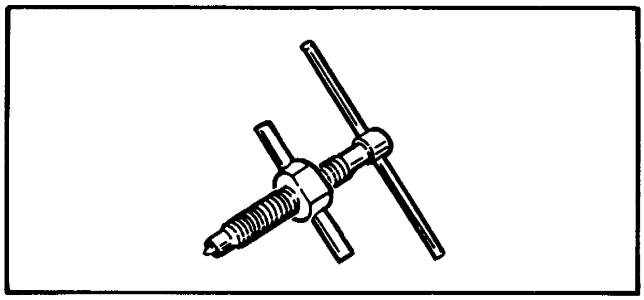
Part No. HD-33446 Cylinder Torque Plates



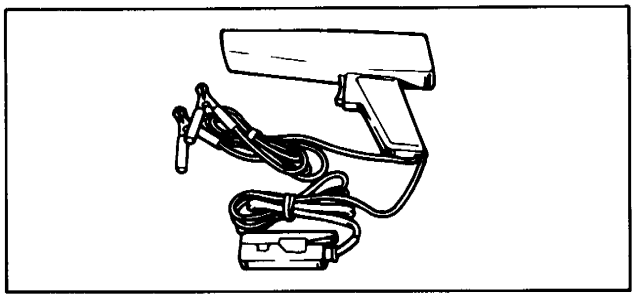
Part No. HD-33416 Universal Driver Handle



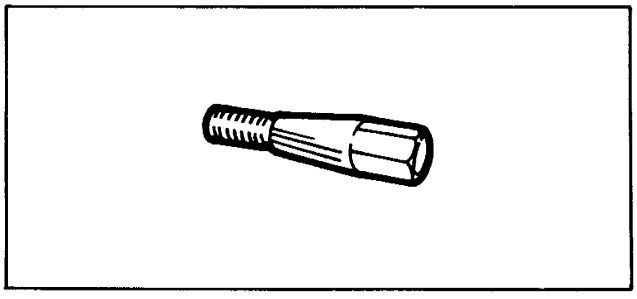
Part No. HD-33805 Clevebloc Spreading Tool



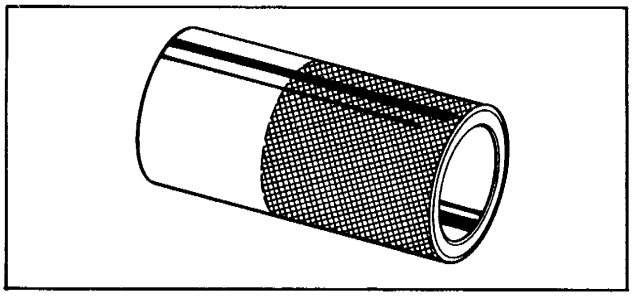
Part No. HD-33418 Universal Puller Forcing Screw



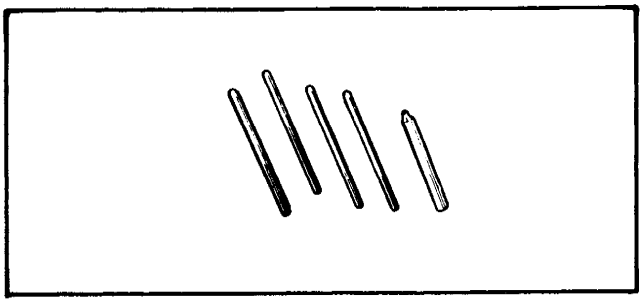
Part No. HD-33813 Inductive Timing Light



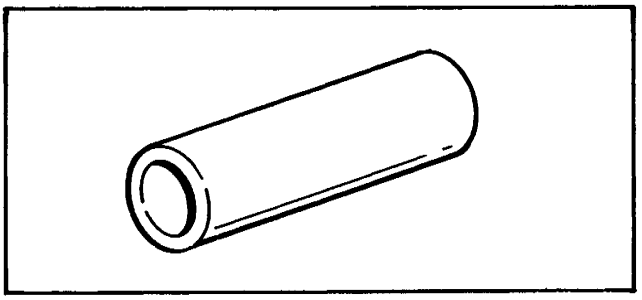
Part No. HD-33443 Tappet Guide Alignment Tool



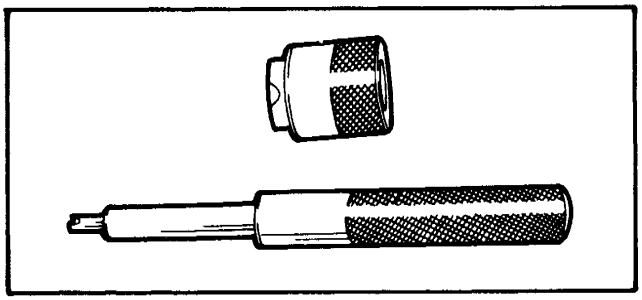
Part No. HD-34190 Fork seal Installation Tool



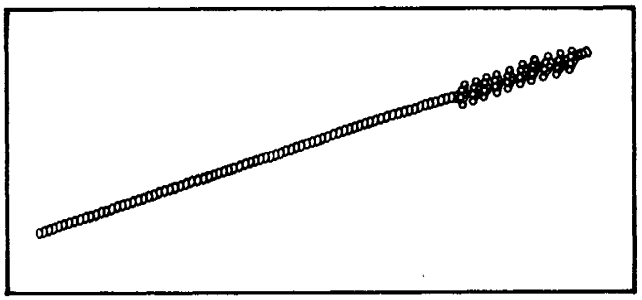
Part No. HD-34199 Pushrod Height Gauge Tool



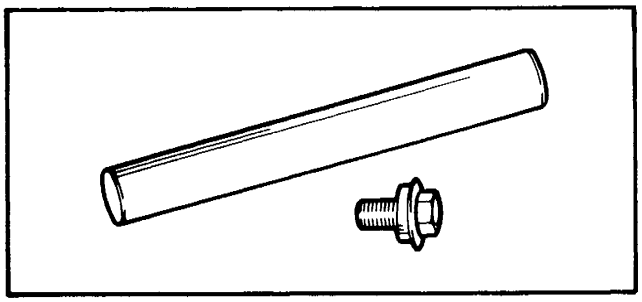
Part No. HD-34643 Valve Guide Seal Installer



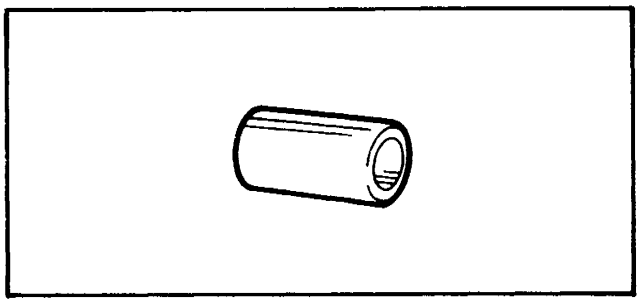
Part No. HD-34623 Piston Pin Retaining Ring Installer



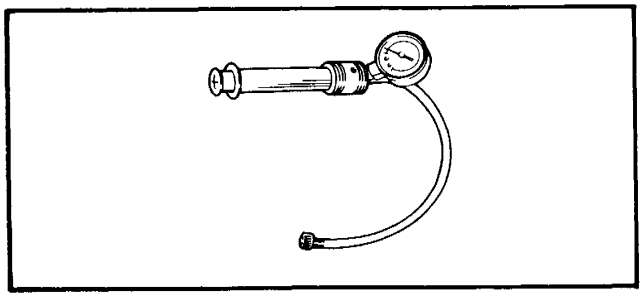
Part No. HD-34723 Valve Guide Hone



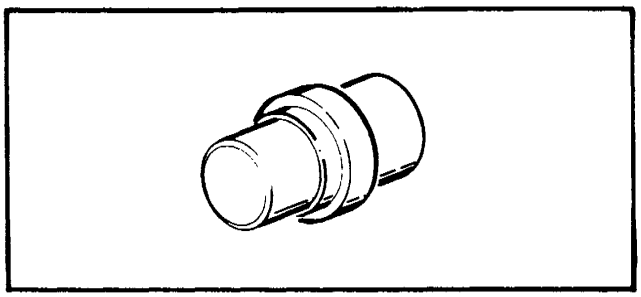
Part No. HD-34624 Cylinder Stud Installer



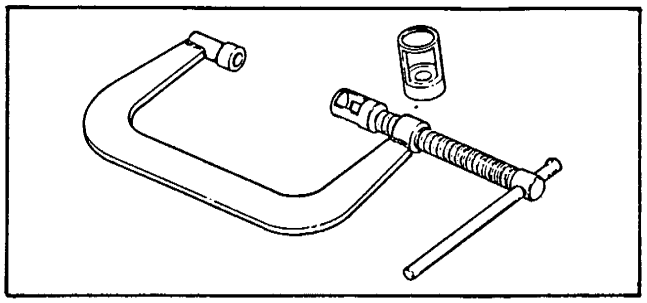
Part No. HD-34731 Shoulderless Valve Guide Installer



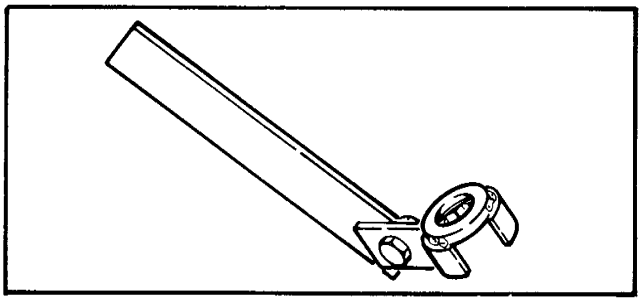
Part No. HD-34633 Air Suspension Pump and Gauge



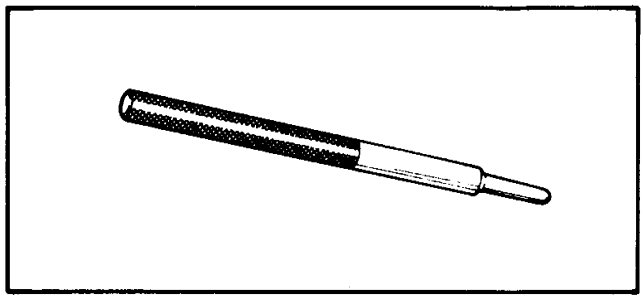
Part No. HD-34734 Main Drive Gear Bearing and Seal Installer



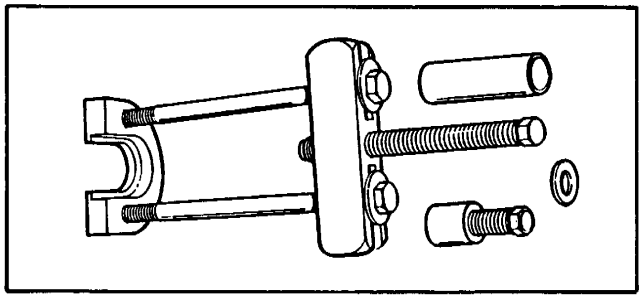
Part No. HD-34736B Valve Spring Compressor



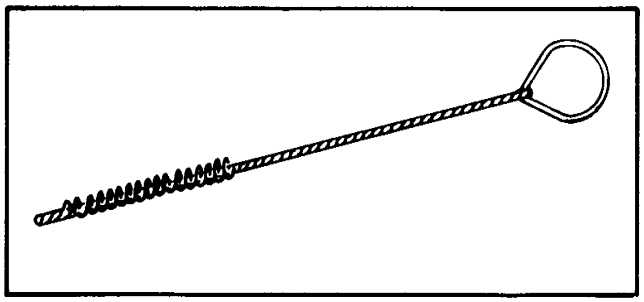
Part No. HD-34816 Oil Pressure Switch Wrench



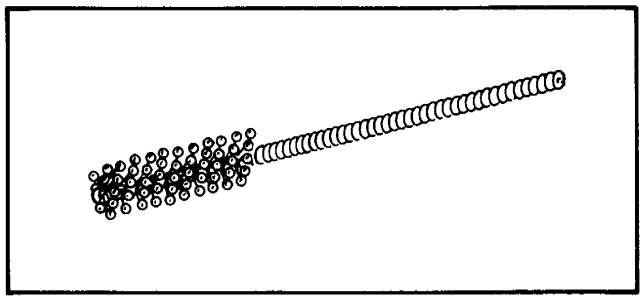
Part No. HD-34740 Driver Handle and Remover



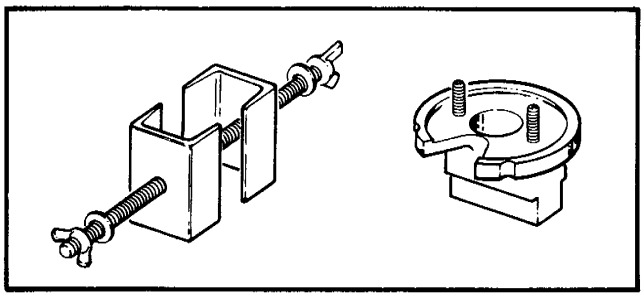
Part No. HD-34902 Mainshaft Primary Bearing Race Remover and Installer



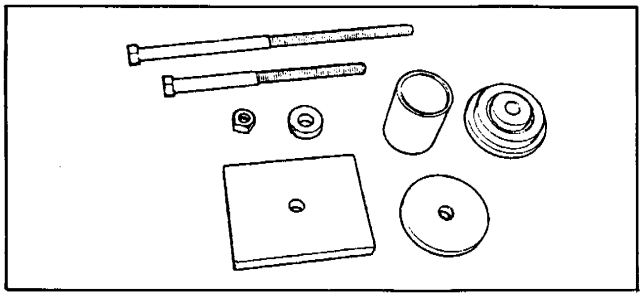
Part No. HD-34751 Nylon Clearing Brush



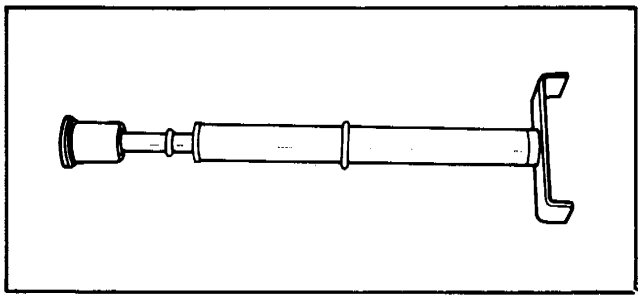
Part No. HD-35102 Wrist Pin Bushing Hone



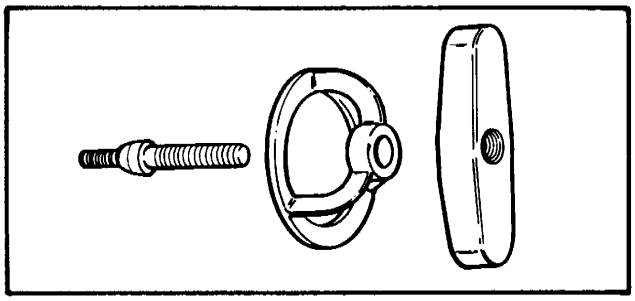
Part No. HD-34813 Rowe Flywheel Rebuilding Jig



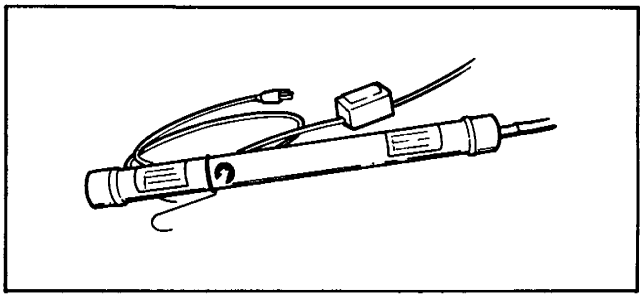
Part No. HD-35316 Main Drive Gear Remover & Installer and Main Drive Gear Bearing Installer



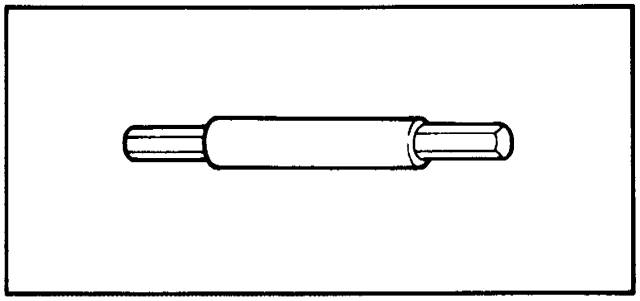
Part No. HD-35381 Belt Tension Gauge



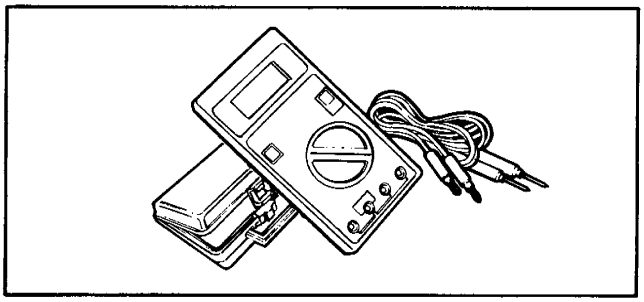
Part No. HD-38515 Clutch Spring Compressor



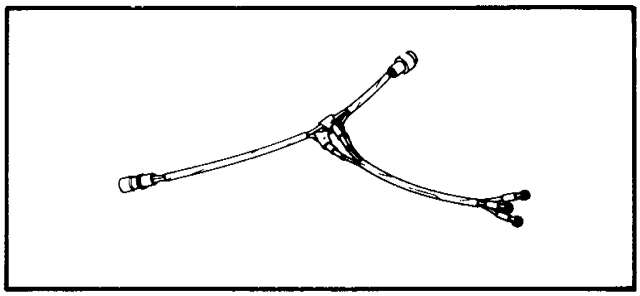
Part No. HD-35457 Black Light Leak Detector



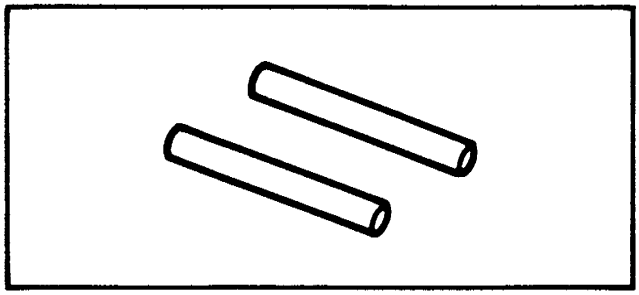
Part No. HD-94437-79 Rear Wheel Sprocket Wrench



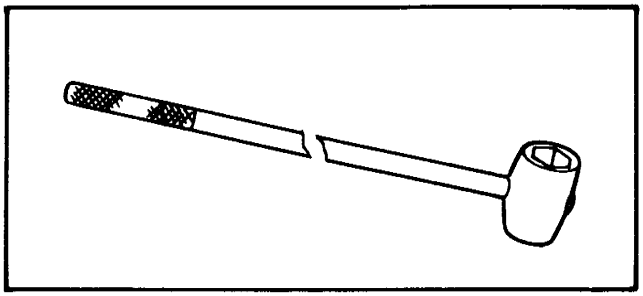
Part No. HD-35500 Digital Multi-Meter



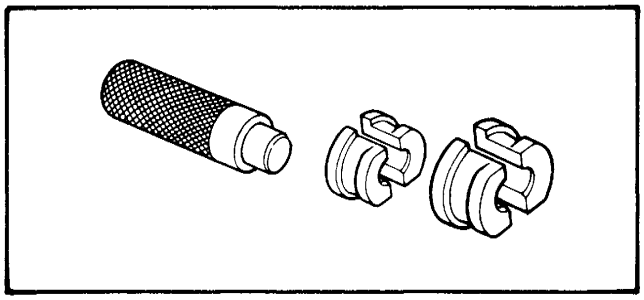
Part No. HD-94465-81 Ignition Test Adapter



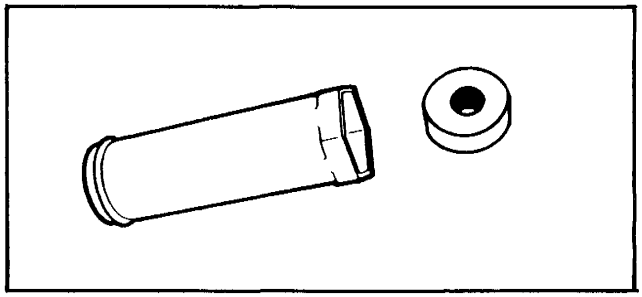
Part No. HD-38361 Gauge Pin Set, 0.108 in. Diameter



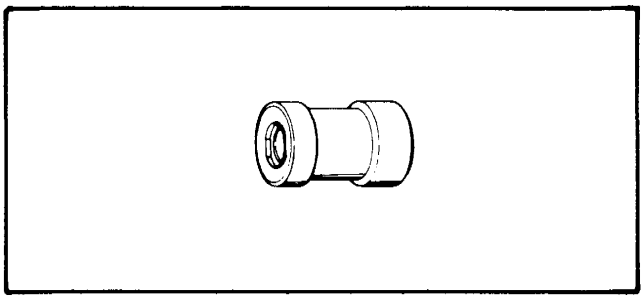
Part No. HD-94546-41 Flywheel Shaft Nut Wrench



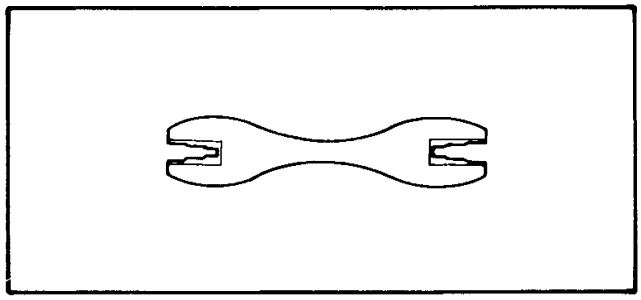
Part No. HD-94547-80 Crankshaft Bearing Tool



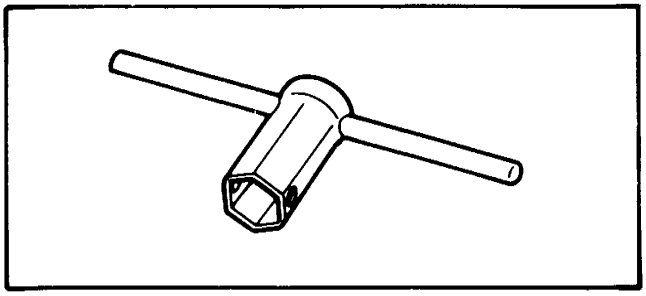
Part No. HD-94660-37A Big Twin Mainshaft Locknut Wrench



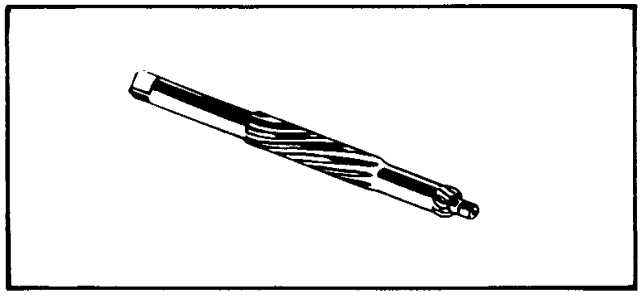
Part No. HD-94555-55A Gear Shaft Nut Socket Wrench



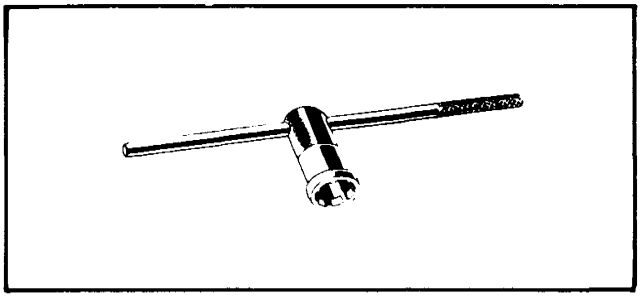
Part No. HD-94681-80 Spoke Nipple Wrench



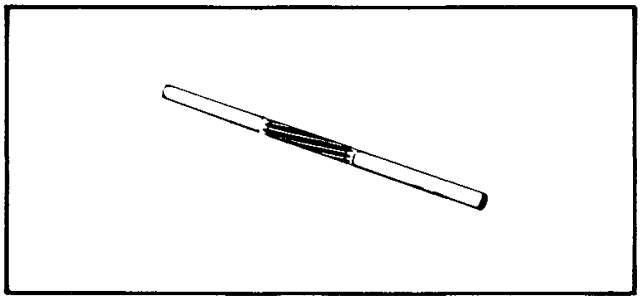
Part No. HD-94575-58A Spark Plug Wrench



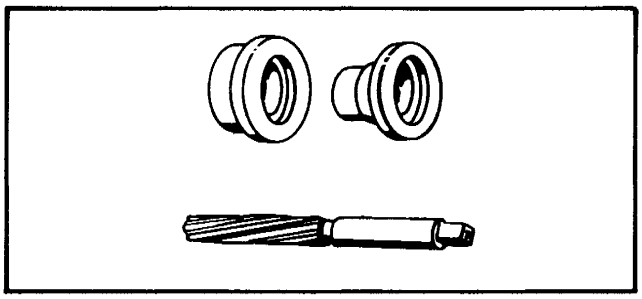
Part No. HD-94800-26 Spiral Expansion Reamer



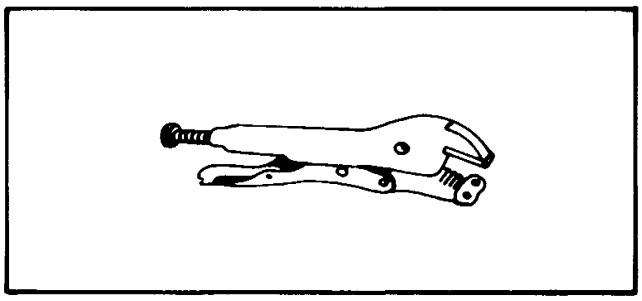
Part No. HD-94645-41 Clutch Hub Nut Wrench



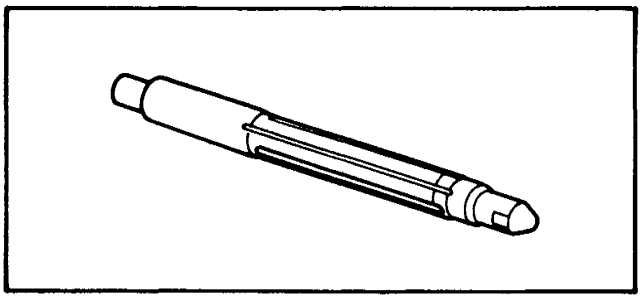
Part No. HD-94804-57 Rocker Arm Bushing Reamer



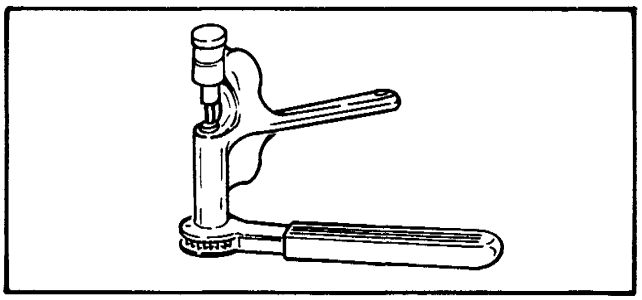
Part No. HD-94805-57 Pinion Shaft Bushing-Reamer and Pilots



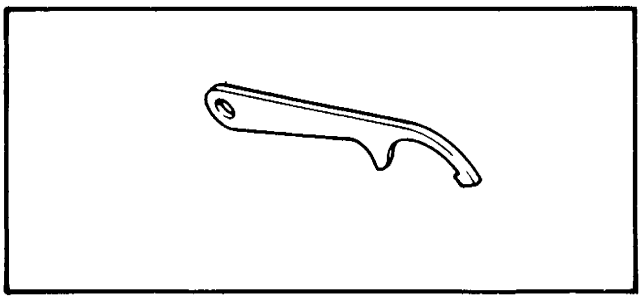
Part No. HD-95020-66 Chain Installing Tool



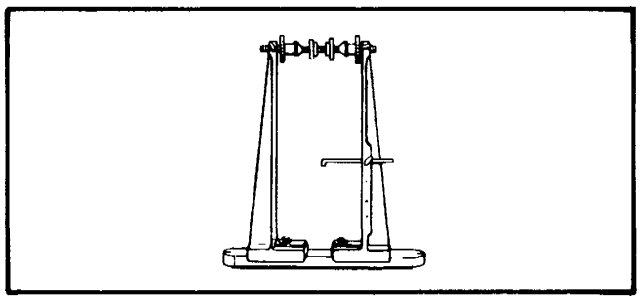
Part No. HD-94808-80 Valve Guide Reamer



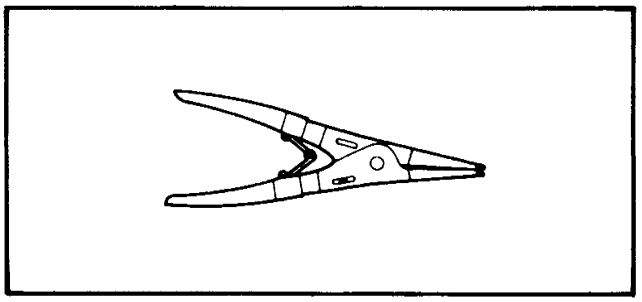
Part No. HD-95021-29A Chain Breaking Tool



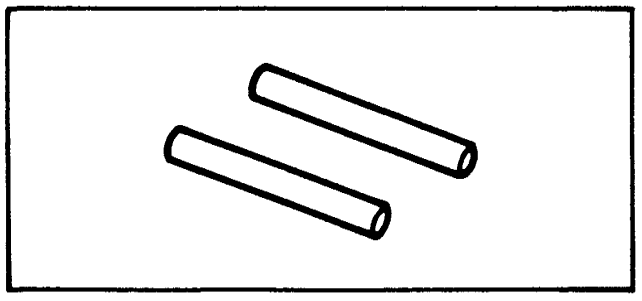
Part No. HD-94820-75 Spanner Wrench



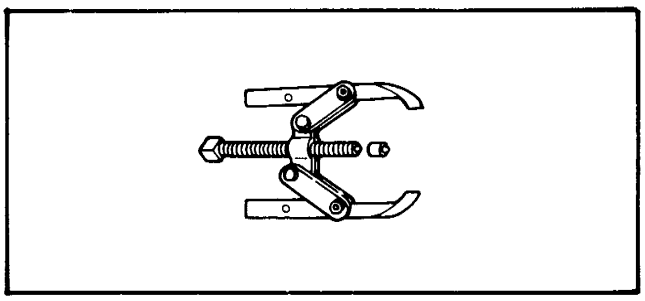
Part No. HD-95500-80 Wheel Truing Stand



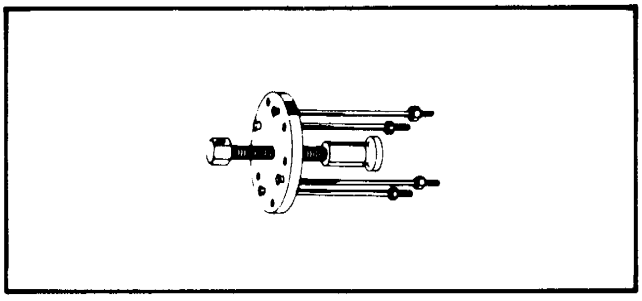
Part No. HD-95017-61 External Retaining Ring Pliers, Large



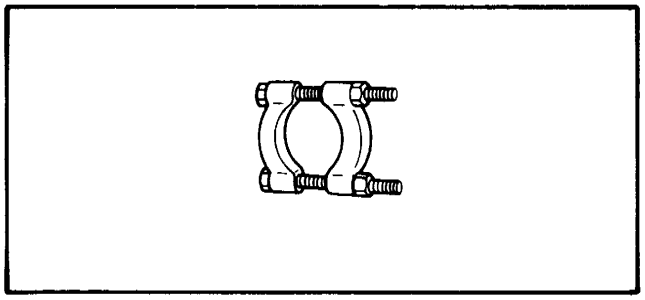
Part No. HD-95632-79 Gauge Pin Set, 0.105 in. Diameter



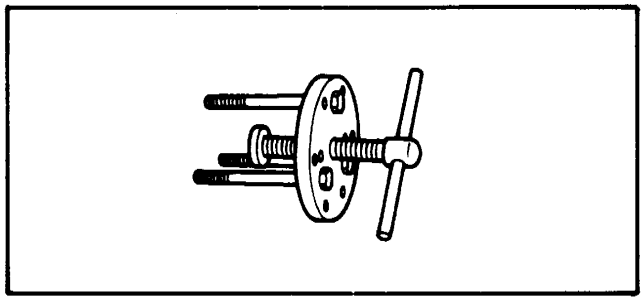
Part No. HD-95635-46 All Purpose Claw Puller



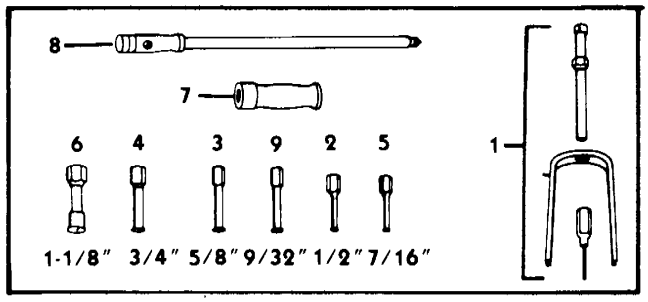
Part No. HD-95960-41A Clutch Hub and Chain Housing Puller



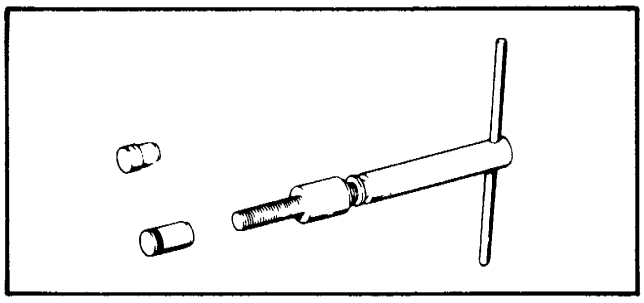
Part No. HD-95637-46 Wedge Attachment for Claw Puller



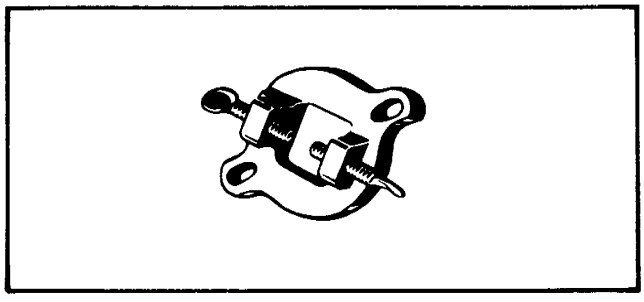
Part No. HD-95960-52B Alternator Rotor Puller



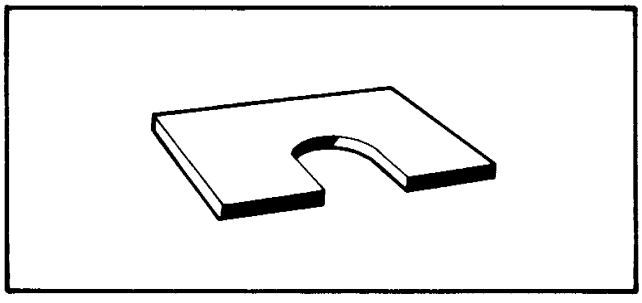
Part No. HD-95760-69 Bushing and Bearing Puller Tool Set (Includes Items 1, 2, 3 and 4) Items 5 (HD-95768-69), 6 (HD-95769-69), 7 (HD-95770-69) and 8 (HD-95771-69) are optional extras



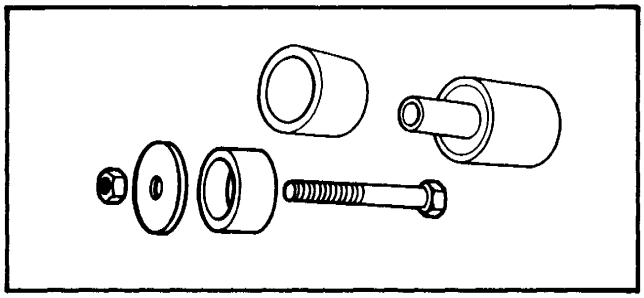
Part No. HD-95970-32A Piston Pin Bushing Tool



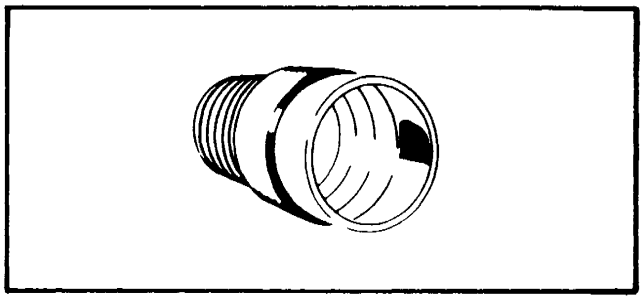
Part No. HD-95952-33 Connecting Rod Clamping Tool



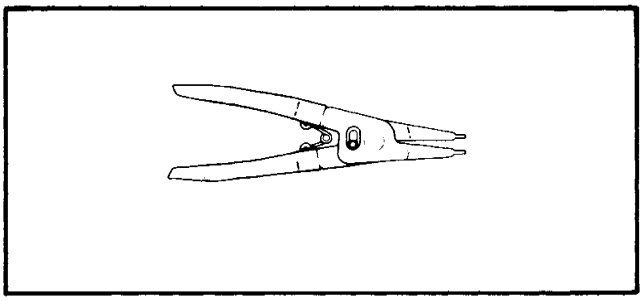
Part No. HD-96137-52A Flywheel Support Plate



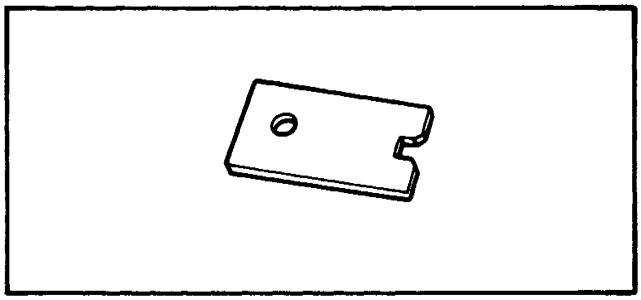
Part No. HD-96200-80 Rear Swing Arm Assembly Tool



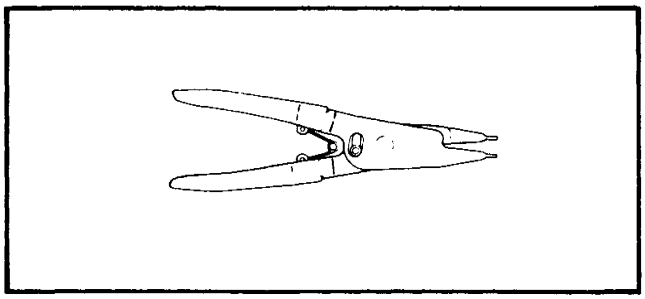
Part No. HD-96295-65 Timing Mark View Plug



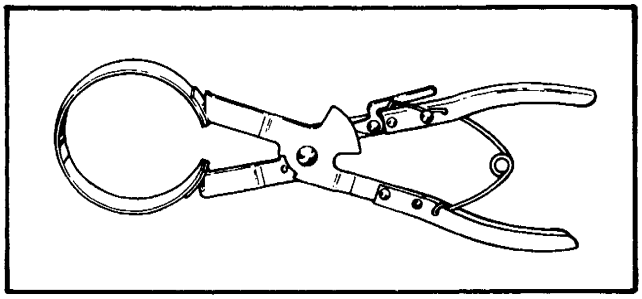
Part No. HD-96215-49 Small Internal Retaining Ring Pliers



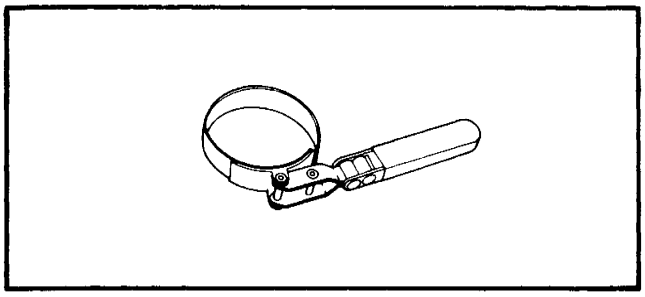
Part No. HD-96315-80 Ignition Fork Lock Gauge



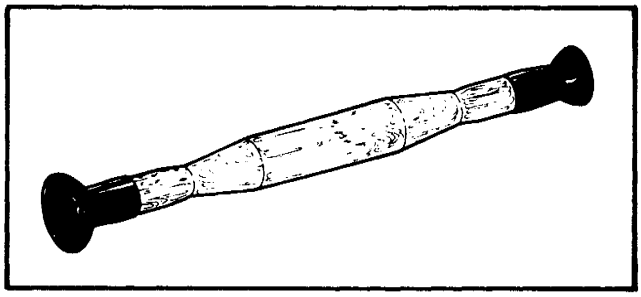
Part No. HD-96216-49 Large Internal Retaining Ring Pliers



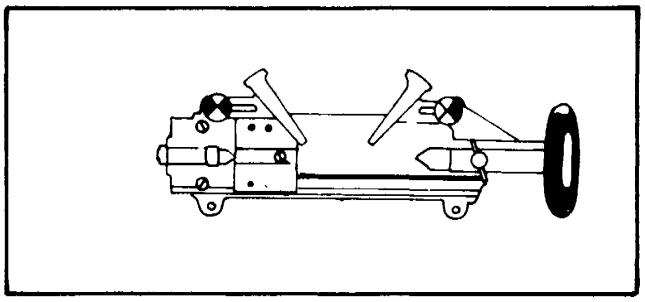
Part No. HD-96333-51B Ring Compressor



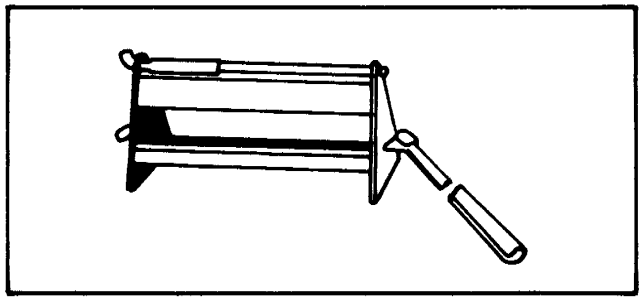
Part No. HD-96221-80 Oil Filter Wrench



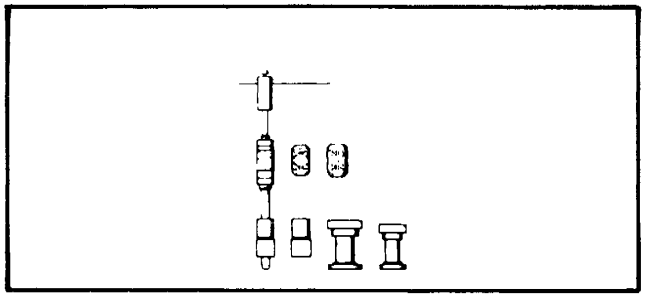
Part No. HD-96550-36A Valve Lapping Tool



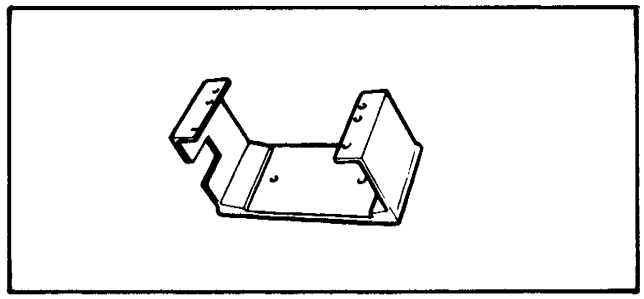
Part No. HD-96650-80 Flywheel Truing Stand



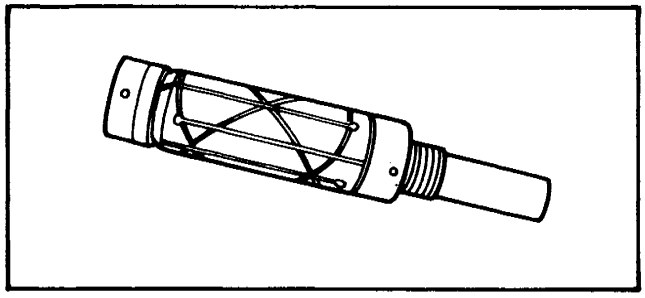
Part No. HD-96810-63 Shop Stand



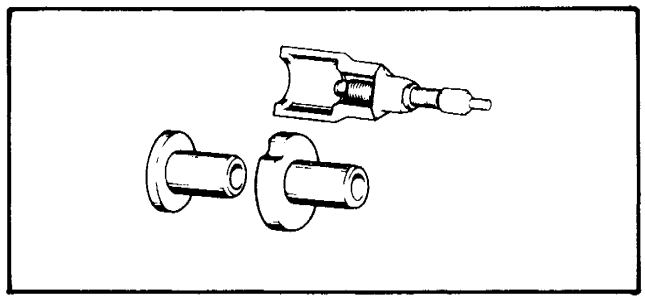
Part No. HD-96710-40 Crankcase Main Bearing Lap



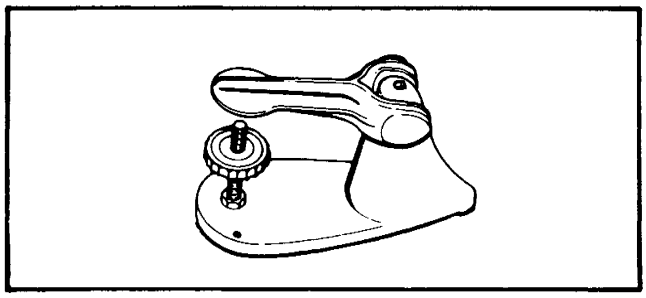
Part No. HD-96815-46 Engine Repair Stand



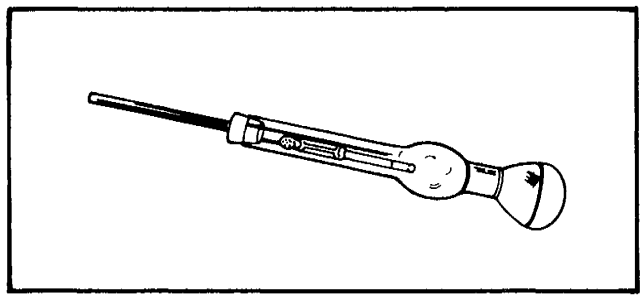
Part No. HD-96740-36 Connecting Rod Lapping Arbor



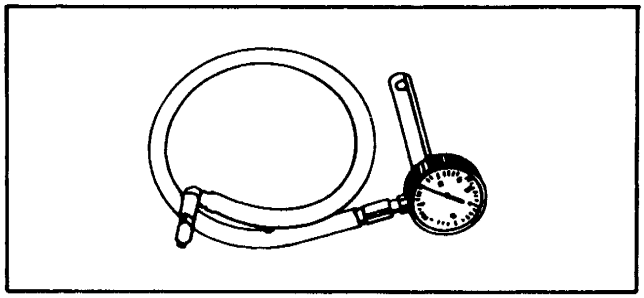
Part No. HD-96830-51A Pinion Gear Puller and Collars



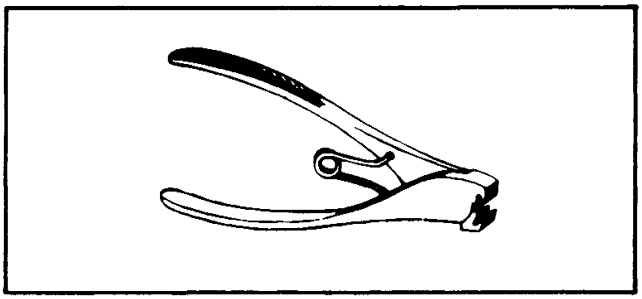
Part No. HD-96796-47 Valve Spring Tester



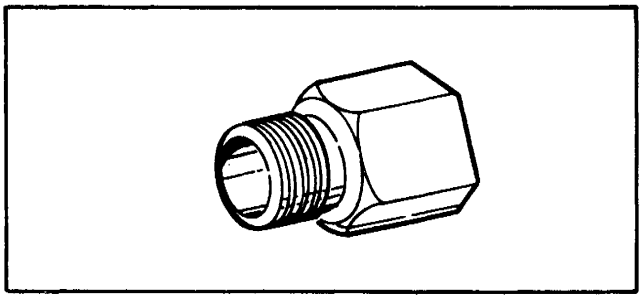
Part No. HD-96910-35 Hydrometer



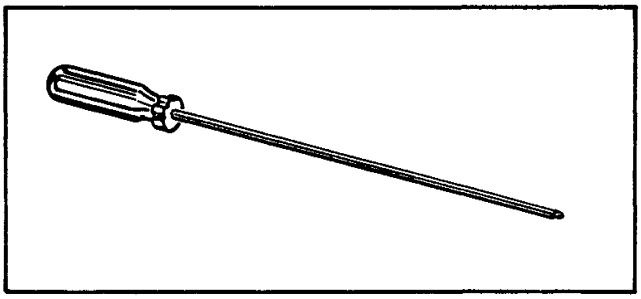
Part No. HD-96921-52 Oil Pressure Gauge



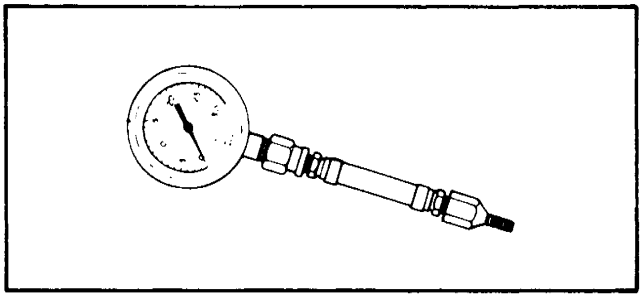
Part No. HD-97087-65A Hose Clamp Pliers



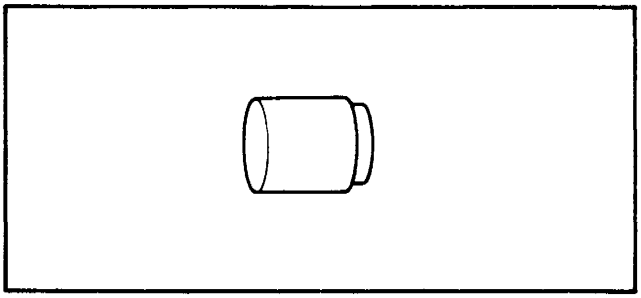
Part No. HD-96921-107 Oil Pressure Gauge Adapter



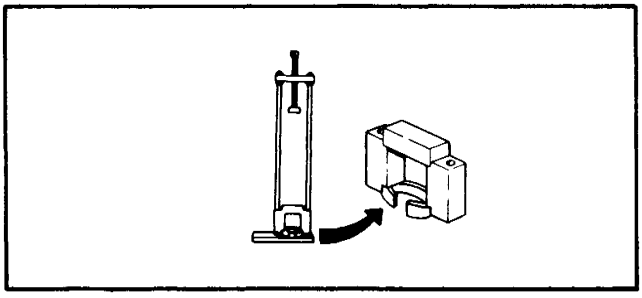
Part No. HD-97101-81 Rear Chain Housing Remover



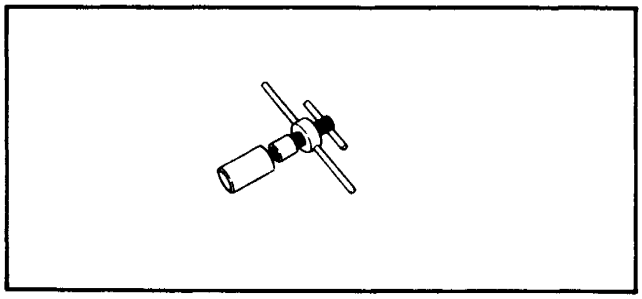
Part No. HD-96950-68 Vacuum Gauge, 30" Water



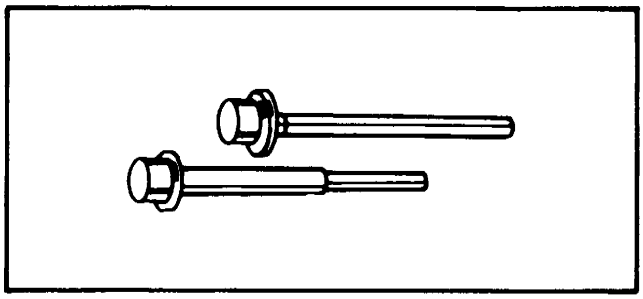
Part No. HD-97194-57 Timken Bearing, Outer Race Press Plug



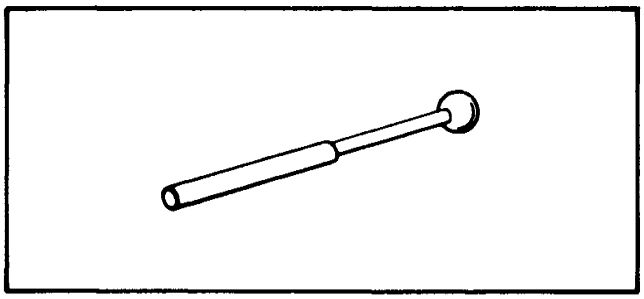
Part No. HD-97010-52A Shock Compressor Tool
Part No. HD-97019-52A Block Only



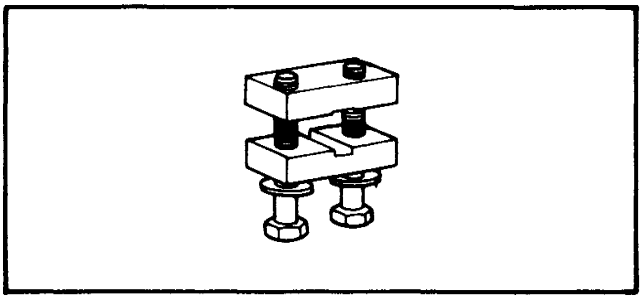
Part No. HD-97225-55 Sprocket Shaft Bearing Tool



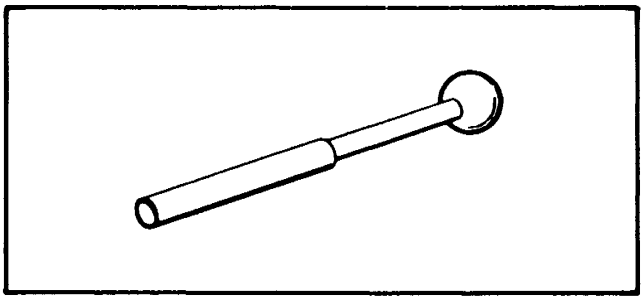
Part No. HD-97272-60 Needle Bearing Tool



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



Part No. HD-97334-80 Connecting Link Assembly Tool



Part No. HD-97364-71 Socket Terminal Tool (large)

CHASSIS

SPECIFICATIONS

DIMENSIONS (in.)

1984 to 1985

	FLHT/C	FXRT	FLT/C	FXRS
Wheel Base	62.9	64.7	62.9	63.13
Overall Length	94.2	94.2	94.2	91.65
Overall Width	37.0	34.5	37.0	31.0
Road Clearance	5.1	6.0	5.1	5.25
Overall Height	60.5	59.5	59.0	48.0
Saddle Height	28.0	28.0	28.0	28.10

1986 to 1990

	FXR/ FXRS	FLTC	FLHT/C FLHS**
Wheel Base	63.13	62.94	62.94
Overall Length	91.65	94.25	94.25
Overall Width	31.0	37.0	39.0
Road Clearance	5.25	5.12	5.12
Overall Height	48.0	58.75	61.0
Saddle Height	26.50	29.6	28.0

	FXRS* (SE) (SP) (CON)	FXRT	FXRD	FXLR
Wheel Base	64.7	64.7	64.7	63.2
Overall Length	93.2	94.2	98.0	91.6
Overall Width	31.0	34.5	34.5	31.0
Road Clearance	6.0	6.0	6.0	5.25
Overall Height	50.0	59.5	59.5	48.0
Saddle Height	27.50	27.75	28.25	26.5

***SE - 1987,**
SP - 1988-1990
CON - 1989½-1990
****FLHS - 1987-1990**

WEIGHT (lbs.)

1984 to 1985

	FXRT	FLT/C	FLHT/C	FXRS
DRY WEIGHT (as shipped from the factory)	640	741	712	575
GVWR	1085	1180	1180	1085
GAWR — Front	390	410	410	390
GAWR — Rear	695	770	770	695

1986 to 1990

	FXR/ FXRS/FXLR	FLTC	FLHT/C FLHS**
DRY WEIGHT (as shipped from the factory)	575	741	722
GVWR	1085	1180	1180
GAWR — Front	390	410	410
GAWR — Rear	695	770	770

* Sport Edition

	FXRS* (SE) (SP) (CON)	FXRT	FXRD
DRY WEIGHT (as shipped from the factory)	585	640	672
GVWR	1085	1085	1085
GAWR — Front	390	390	390
GAWR — Rear	695	695	695

***SE - 1987**
SP - 1988-1990
CON - 1989½-1990

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.

CAPACITIES (U.S.)

Early 1984

	FXRT	FLT/C	FLHT/C	FXRS
Fuel Tank (Gallons)				
Total	4.2	5	5	4.2
Reserve	0.4	0.7	0.7	0.4
Oil Tank (Quarts) w/filter	3.0	4	4	3.0
Transmission (Pints)	1	1	1	1
Rear Chain Case (Ounces)	6	6	6	—
Front Fork — Each (Ounces)	7.2	7.75	7.75	6

Late 1984 to 1985

	FXRT	FLT/C	FLHT/C	FXRS
Fuel Tank (Gallons)				
Total	4.2	5	5	4.2
Reserve	0.4	0.7	0.7	0.4
Oil Tank (Quarts) w/filter	3.0	4	4	3.0
Transmission (Pints)	1	1	1	1
Front Fork — Each (Ounces)	7.2	7.75	7.75	6
Primary Chaincase (Quarts)	1.5	1.5	1.5	1.5
Rear Chaincase (Ounces)	6	6	6	—

1986 to 1990

	FLTC	FLHT/C FLHS**	FXR/ FXRS 1986 FXRS* (SE) (SP) (CON)
Fuel Tank (gallons)			
Total	5	5	4.2
Reserve	0.7 0.9 (1989)	0.7 0.9 (1989)	0.4
Oil Tank (Quarts) w/filter	4	4	3.0
Transmission (Pints)	1	1	1
Front Fork — Each (Ounces)	7.75	7.75	6
Primary Chaincase (Approx.) (Quarts)	1.5	1.5	1.5

***SE - 1987**
SP - 1988
CON - 1989½-1990
****FLHS - 1987-1990**

	FXRT	FXRD	FXLR	FXRS* (SE) (SP) (CON)
Fuel Tank (gallons)				
Total	4.2	4.2	4.2	4.2
Reserve	0.4	0.4	0.4	0.4
Oil Tank (Quarts) w/filter	3.0	3.0	3.0	3.0
Trans. (Pints)	1	1	1	1
Front Fork — Each (Ounces)	7.2	7.2	10	11.5
Primary Chaincase (Approx.) (Quarts)	1.5	1.5	1.5	1.5

***SE - 1987**
SP - 1988
CON - 1989½-1990

ADJUSTMENTS

Brakes

Rear Master Cylinder
Push Rod Free Play — FLT Models . . . . . 3/32-1/8 in.
Rear Master Cylinder
Push Rod Free Play — FXR Models . . . . . 1/16-1/8 in.
(Late 1987 and later models - no push rod free play adjustment required)
Rear Brake Pedal Clearance
Above Footboard — FLT Models . . . . . 2 1/4 in. min.
Rear Brake Pedal Height
Above Pivot Shaft — FXR Models . . . . . 4 1/8-4 3/8 in.

TIRE DATA

WARNING

For your own personal safety, tires, rims and air valves must be correctly matched to wheel rims. See your Harley-Davidson dealer. Mismatching tires, tubes, rims and air valves may result in damage to the tire bead during mounting or may allow the tire to slip on the rim, possibly causing tire failure. In addition, using tires other than those specified may adversely affect motorcycle stability. Use only tube tires on all Harley-Davidson laced (wire spoke) wheels and tubeless type tires on all Harley-Davidson cast and disc wheels. Protective rubber rim strips must be used with tube type tires when mounted on laced (wire spoked) wheels. Tire sizes are molded on the tire sidewall. Tube sizes are printed on the tube.

1984 to 1985

DUNLOP TIRES ONLY		TIRE PRESSURE PSI (COLD)	
		FRONT	REAR
Solo Rider	FLT/C		
	FLHT/C-K101A	28	36
	FXRS-K291T	30	36
	FXRT-K291T	30	36
Rider & one passenger	FLT/C, FLHT/C	28	36
	FXRS	30	40
	FXRT	30	40
	FLT Sidecar	28	40

1986 to 1990

DUNLOP K291T TIRES* ONLY		TIRE PRESSURE PSI (COLD)	
		FRONT	REAR
Solo Rider	FXR Models	30	36
	FLT Models	36	36
Rider & one passenger	FXR Models	30	40
	FLT Models	36	40

*Touring Elite or Ribbed Front.

WARNING

Maximum inflation pressure must not exceed specification on tire sidewall.

REAR WHEEL SPROCKET

Belt drive ..... 70 Teeth
Enclosed chain ..... 48 Teeth
Open Chain
FXR ..... 48 Teeth
FXRS ..... 51 Teeth

TORQUES

FLT Models

Fork Stem Nut ..... 35-45 ft-lbs
Slider Cap Nuts ..... 9-13 ft-lbs
Front Axle Nut ..... 50-55 ft-lbs
Rear Axle Nut ..... 60-65 ft-lbs
Brake Disc Screws (Front) ..... 16-18 ft-lbs
Brake Caliper Mounting Bolts (Front) ..... 25-30 ft-lbs
Brake Bleeder Nipple ..... 32-40 in-lbs
1984-Rear Wheel Sprocket Screws (Enclosed Chain)
— Lubricated ..... 65-75 ft-lbs
1984-Rear Chain Rubber Boots
Mounting Hardware ..... 3-4 ft-lbs
Front Fender Mounting Bracket Bolts ..... 16-20 ft-lbs
Rear Brake Reservoir Cover Screws ..... 8-14 in-lbs
Rear Brake Reservoir Mounting Screws ..... 18-24 in-lbs
Rear Shock Absorber Mounting Bolts:
Top Bolt, 1984 - Early 1988 ..... 35-40 ft-lbs
1988 and Later ..... 33-35 ft-lbs
Bottom Bolt ..... 35-40 ft-lbs
Rear Wheel Sprocket Screws:
Grade 5 ..... 45-50 ft-lbs
Grade 8 ..... 65-70 ft-lbs
Rear Caliper Mounting Bolts ..... 15-20 ft-lbs
Pivot Shaft Nut, 1984 to early 1986 ..... 45 ft-lbs
Pivot Bolt, Late 1986 - 1988 (12 point head) ..... 85 ft-lbs
Pivot Shaft Nut, 1989 - 1990 ..... 45 ft-lbs
Brake Disc Screws (Rear) ..... 24-30 ft-lbs
Brake Line Fitting in Caliper (Rear)
1984 and 1985 ..... 70-80 in-lbs
All Brake Line Banjo Bolts:
1986 - 1988 (Copper Washer) ..... 30-35 ft-lbs
1989 and later (Steel and Rubber Washer) . 17-22 ft-lbs

NOTE

Brake line banjo bolt at rear master cylinder (1986-1988) must use copper washer only.

FXR Models

Slider Cap Nuts (FXLR/1987 FXRSE) ..... 7-9 ft-lbs
Slider Cap Nuts ..... 9-13 ft-lbs
Front Axle Nut ..... 50 ft-lbs
Rear Axle Nut ..... 60-65 ft-lbs
Front Brake Disc Screws — Cast Wheel .... 16-18 ft-lbs
Front Brake Disc Screws — Laced Wheel ... 16-18 ft-lbs
Rear Brake Disc Screws — Cast and
Disc Wheel ..... 23-27 ft-lbs
Rear Wheel Sprocket Bolts — Cast and
Disc Wheel - See FLT Models, Torques
Front Brake Caliper Mounting Screws ..... 25-30 ft-lbs
Rear Brake Caliper Mounting Screws ..... 15-20 ft-lbs
Brake Bleeder Nipples (1984 to Early 1987) .... 3-5 ft-lbs
Brake Bleeder Nipples (Late 1987 and Later) . 32-40 in-lbs
Brake Line Fitting in Caliper (Rear)
1984 - Early 1987 ..... 70-80 in-lbs
All Brake Line Banjo Bolts (Late 1987 and Later):
Copper Washers ..... 30-35 ft-lbs
Steel and Rubber Washers ..... 17-22 ft-lbs
Front Fender Mounting Bracket Bolts ..... 16-20 ft-lbs
Pivot Shaft - See FLT Models, Torques
Rear Master Cylinder Mounting Nut
(Late 1987 and Later) ..... 30-40 ft-lbs

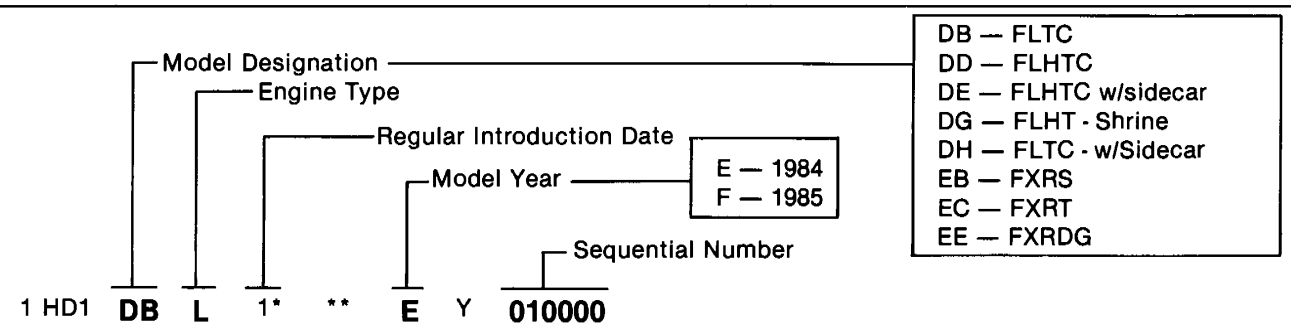
VEHICLE IDENTIFICATION NUMBER (V.I.N.)

The Vehicle Identification Number (VIN) is stamped on the right side of the steering head on FXR's and on the left side of frame backbone to the rear of the steering head on FLT's. The VIN is also stamped on a label on the right front frame downtube. An abbreviated VIN is stamped on the left side crankcase under the rear cylinder.

NOTE

Always give the complete VIN when ordering parts or making an inquiry about your motorcycle.

1984 and 1985

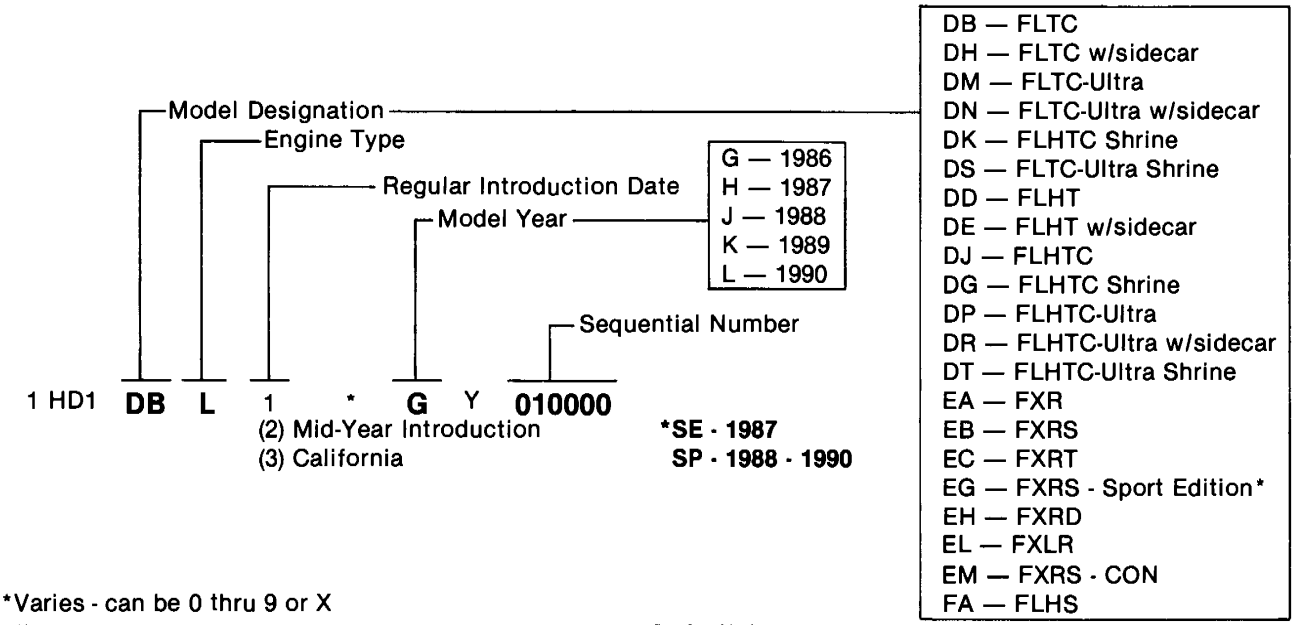


*May be 1, 2, or 3 (Factory use)
**Varies - can be 0 thru 9 or X

Sample V.I.N. as it appears on the steering head - 1 HD1DBL31 EY010000

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

1986 - 1990



*Varies - can be 0 thru 9 or X

Sample V.I.N. as it appears on the steering head - 1 HD1DBL1 GY010000

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

FRONT WHEEL — FLT MODELS

GENERAL

Maximum tire mileage and good handling qualities are directly related to care given wheels and tires. Wheels and tires should be inspected regularly for wear. If handling problems occur, check TROUBLESHOOTING in section 1 for possible causes.

Always keep tires inflated to the recommended pressure and balance the wheel whenever a tire or tube is replaced.

NOTE

FLT models have 10-spoke wheels for 1987 and later. All service information for 16-spoke wheels applies to the 10-spoke wheels.

REMOVAL (Figure 2-1)

1. Block motorcycle under the frame so the front wheel is raised off the ground.

2. Remove the brake caliper mounting bolts (1) and let the calipers hang down loose.

CAUTION

Do not operate the front brake lever when calipers are detached because the caliper piston may be forced out. Reseating the piston requires disassembly of the caliper.

3. Remove the axle nut (2), lockwasher (3) and washer (4) from the left side of the motorcycle. Loosen the slider cap nuts and lockwashers (5) on the right side.

NOTE

1987 and later vehicles have the speedometer drive and its spacer mounted on the left side of the front wheel instead of on the right side as on all previous model years. Speedometer drives are also equipped with a rubber washer-type seal between the drive and the wheel.

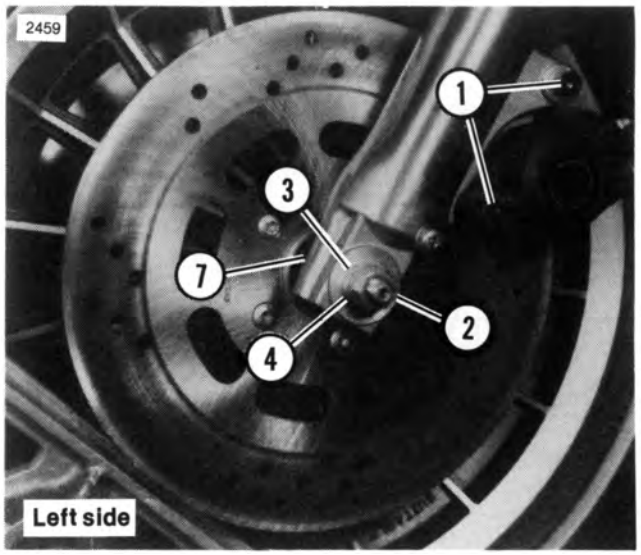
4. Remove the wheel, speedometer drive (6), spacer and if so equipped the speedometer drive seal, by tapping axle (8) out from the left side.

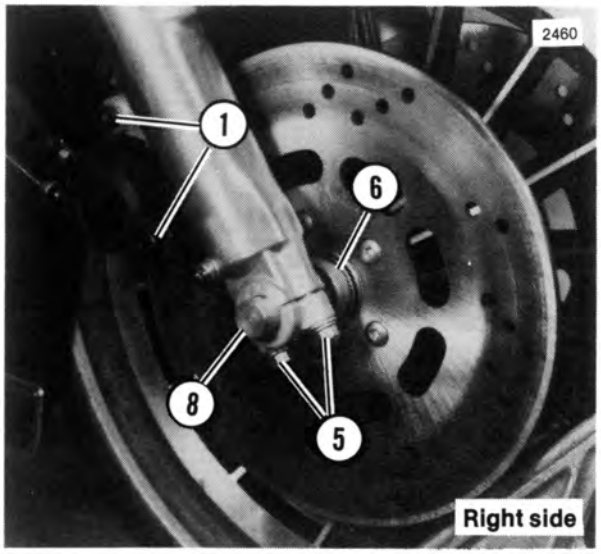
DISASSEMBLY (Figure 2-2)

1. Remove the spacers (1 and 2), oil seals (3), bearings (4), spacer washer (10), spacer (12), and sleeve (11).

2. If it is necessary to remove the bearing races (5), use WHEEL BEARING RACE REMOVER & INSTALLER, Part No. HD-33071 and UNIVERSAL DRIVER HANDLE, Part No. HD-33416.

3. Remove the T-40 Torx screws (8) securing the brake discs. Mark the wheel and discs so they will be assembled in their original positions.





1. **Brake caliper bolt (4)**
2. **Axle nut**
3. **Lockwasher**
4. **Washer**
5. **Slider cap nut and lockwasher (2)**
6. **Speedometer drive**
7. **Spacer**
8. **Axle**

Figure 2-1. Front Wheel Mounting — FLT Models

CLEANING, INSPECTION AND REPAIR (Figure 2-2)

1. Clean all parts, except oil seals and sleeve (11) in solvent and inspect for damage or wear.

WARNING

Never "spin-dry" bearings with compressed air as very high speed can be attained. This can result in serious damage to unlubricated surfaces of bearings. Spinning, may also cause a bearing to fly apart, possibly causing injury.

2. Replace the brake discs if warped, scored or worn beyond the minimum thickness stamped on the disc.
3. Check the bearings and races for wear or corrosion and replace them if necessary. Replace them in sets only.
4. Replace the oil seals.

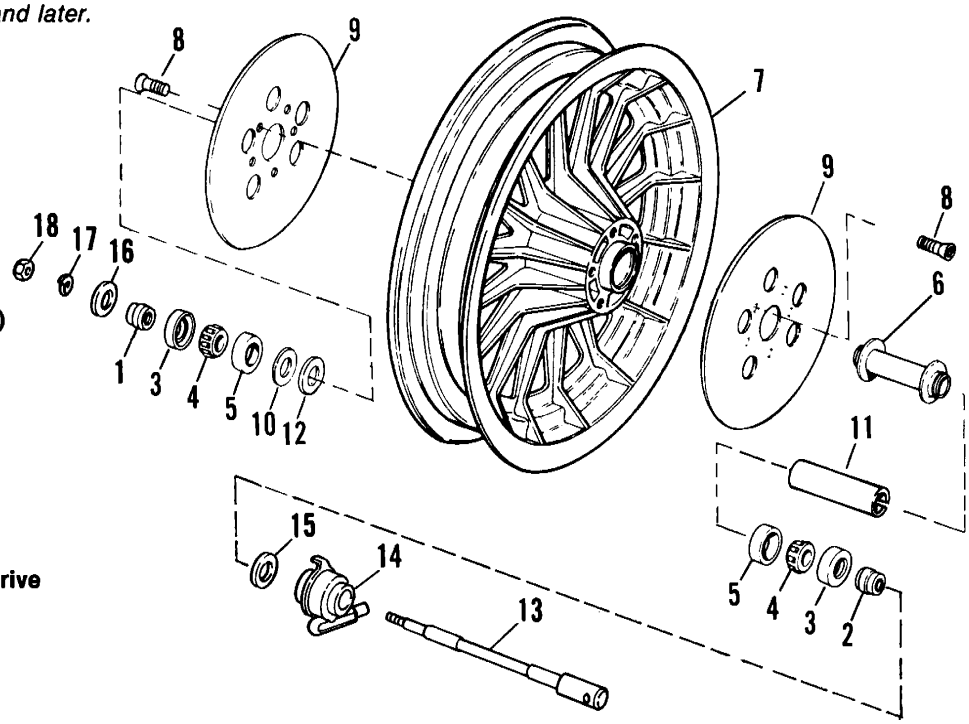
ASSEMBLY (Figure 2-2)

CAUTION

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

1. Make sure brake discs are clean. Then install brake discs in their original positions using new Torx screws (8). Tighten screws to 16-18 ft-lbs torque.
2. If bearing cups (5) were removed for replacement, lubricate the new races with oil and press one race into each side of the wheel hub using WHEEL BEARING RACE REMOVER & INSTALLER, Part No. HD-33071 and an arbor press.
3. Place the sleeve (11), spacer (6), spacer (12) and spacer washer (10) into the wheel (7). Be sure shoulder on spacer washer (10) faces the bearing. Pack the bearings (4) with Harley-Davidson WHEEL BEARING GREASE, Part No. 99855-89 and install one in each side of the wheel hub.
4. Install the longer spacer (2) to the valve stem hole side of the wheel. Install spacer (1) into other side of wheel.
5. Lightly coat the outside lip of each oil seal (3) with engine oil. Press one seal into each side of the wheel so it is 13/64 to 7/32 in. below outside edge of wheel hub.
6. Wheel and tire must be true. See CHECKING CAST RIM RUNOUT.

NOTE
Speedometer drive on right side, 1984-1986 and left side 1987 and later.



1. Spacer
2. Spacer
3. Oil seal (2)
4. Bearing (2)
5. Bearing race (2)
6. Spacer
7. Cast wheel
8. Torx screw (10)
9. Brake disc (2)
10. Spacer washer
11. Sleeve
12. Spacer
13. Axle
14. Speedometer drive
15. Seal
16. Washer
17. Lockwasher
18. Axle nut

Figure 2-2. Cast Front Wheel Exploded View — FLT Models

INSTALLATION

1. See Figure 2-1. Place wheel into front fork with the valve stem hole to the left side. On 1984 to 1986 vehicles install the speedometer drive (6) between the wheel and right fork leg and spacer (7) between the wheel and left fork leg. On 1987 and later vehicles install the speedometer drive, with seal, at the left and the spacer at the right. Be sure the seal is installed between the speedometer drive and wheel. The tab on the speedometer drive fits into the slot on the brake disc.

2. Coat the axle with Loctite ANTI-SEIZE LUBRICANT. Insert axle into the wheel from the right side. Install the spacer (7) between the wheel and left fork side.

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

WARNING

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

4. See Figure 2-3. Mount a magnetic base dial indicator to the brake disc with contact point on end of axle. Move wheel back and forth on axle to check end play.

5. See Figure 2-2. If end play does not fall between 0.002 and 0.006 in., substitute a thicker spacer (12) for more end play or a thinner spacer for less end play. See following chart for spacer sizes and part numbers.

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

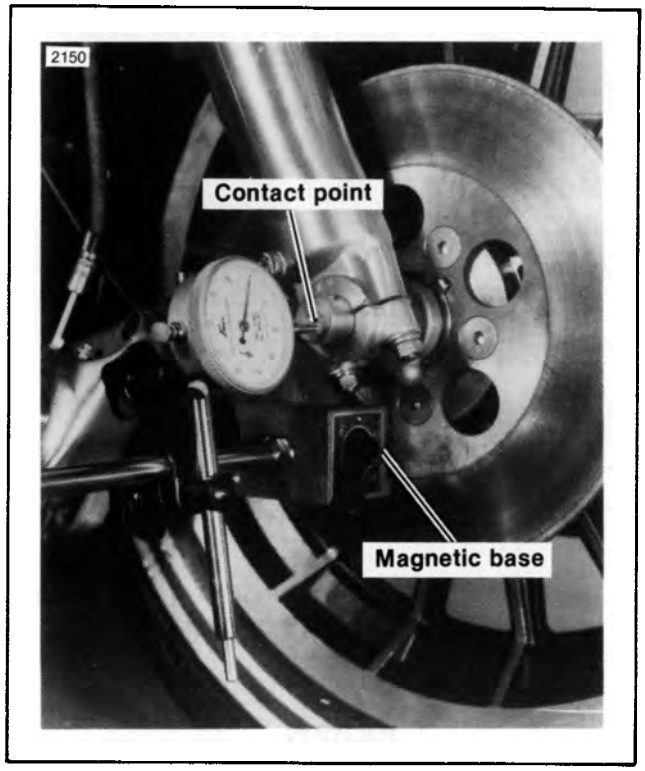


Figure 2-3. Checking Front Wheel End Play — FLT Models

NOTE

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

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

FRONT WHEEL — FXR MODELS

REMOVAL

All Models, 1984 - 1987 (Excluding 1987 FXLR, FXRSE*) (Figure 2-4)

* Sport Edition

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

2. Remove the brake caliper(s) mounting hardware (1) and let the brake caliper(s) hang loose.

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).

1987 FXLR, FXRSE* and ALL 1988-1990 Models (Figure 2-5)

* Sport Edition

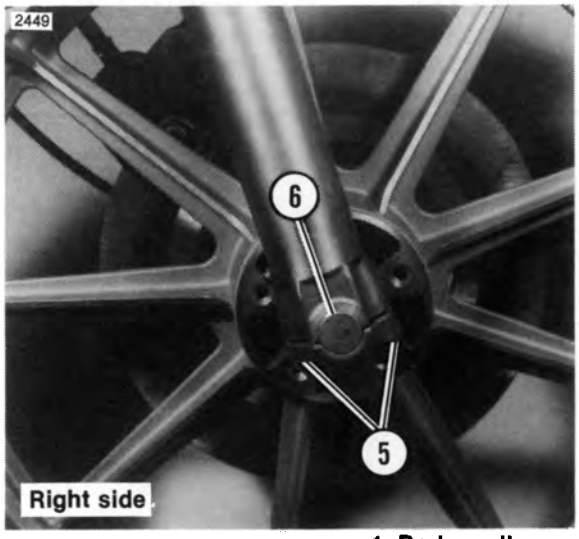
1. Block motorcycle underneath frame so front wheel is raised off the ground.

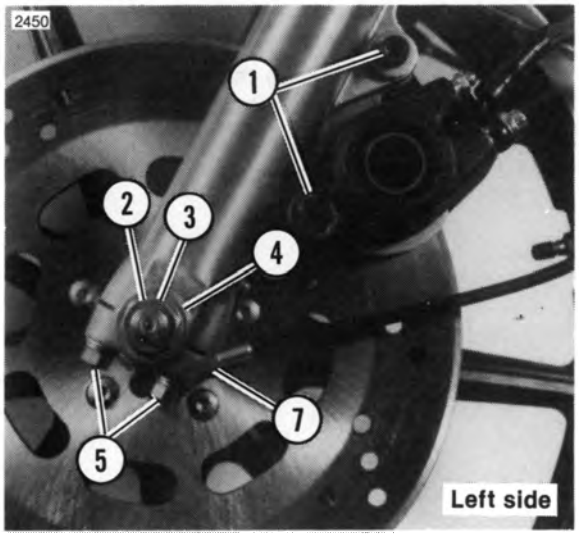
2. Remove axle nut (6), lockwasher (7) and washer (8). Remove the brake caliper(s) and let the caliper(s) hang loose.

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.

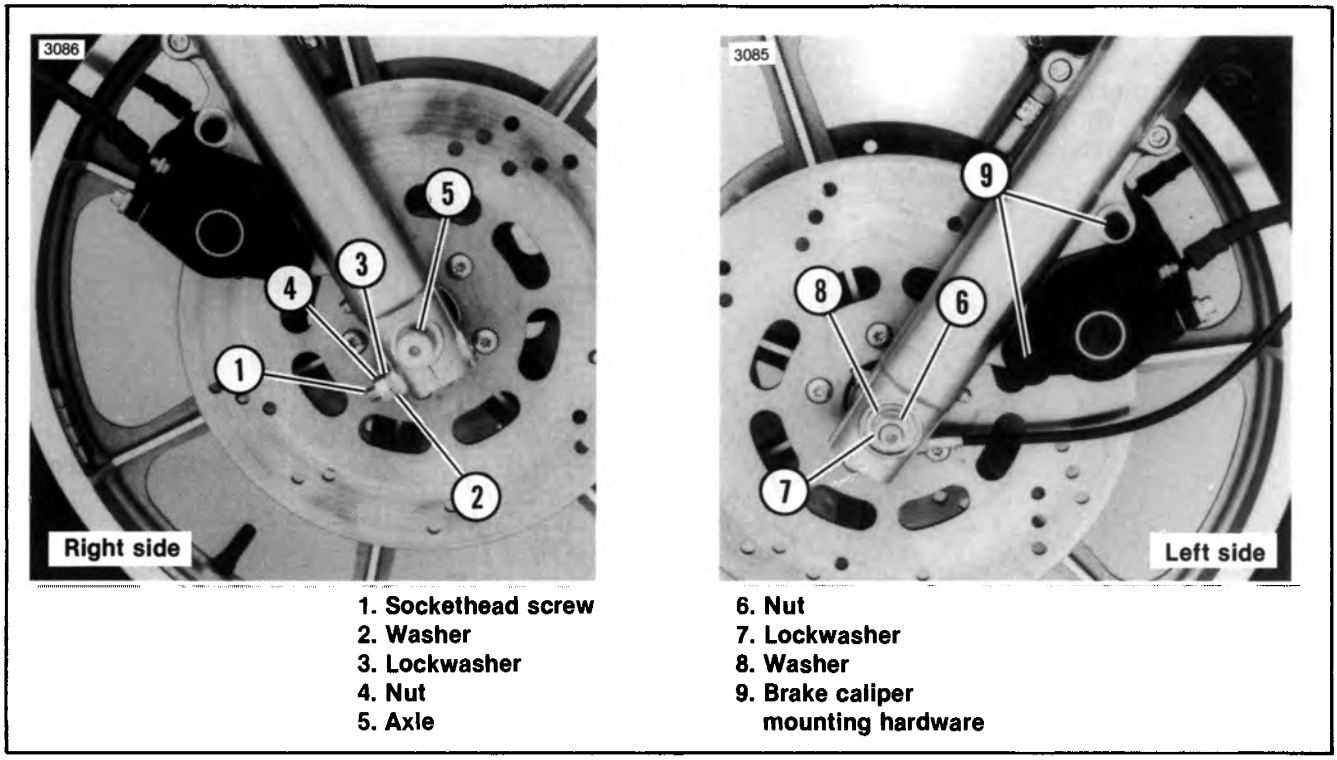
3. Loosen pinch bolt nut (4) and pull the axle (5) free from the wheel and speedometer drive.





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

Figure 2-4. Front Wheel Mounting — 1984-1987 FXR Models Except 1987 FXRSE, FXLR



1. Sockethead screw
2. Washer
3. Lockwasher
4. Nut
5. Axle
6. Nut
7. Lockwasher
8. Washer
9. Brake caliper mounting hardware

Figure 2-5. Front Wheel Mounting — 1987 FXLR, FXRS Sport Edition and All 1988-1990 Models

DISASSEMBLY

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 cups (4), use a standard bearing puller.
3. Remove the T-40 Torx screws (7) and brake disc (6).
4. If it is necessary to disassemble the hub (8) from the wheel, unscrew all the spoke nipples and remove the spokes and rim from the hub.

Cast Wheel (Figure 2-7)

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 WHEEL BEARING RACE REMOVER, Part No. HD-33071.
3. Mark the brake disc(s) and wheel side(s) so they will be assembled correctly later. Remove the T-40 Torx screws (7) and disc(s) (6).

CLEANING, INSPECTION AND REPAIR

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

WARNING

Never "spin-dry" bearings with compressed air as very high speed can be attained. This can result in serious damage to unlubricated surfaces of bearings. Spinning may also cause a bearing to fly apart, possibly causing injury.

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

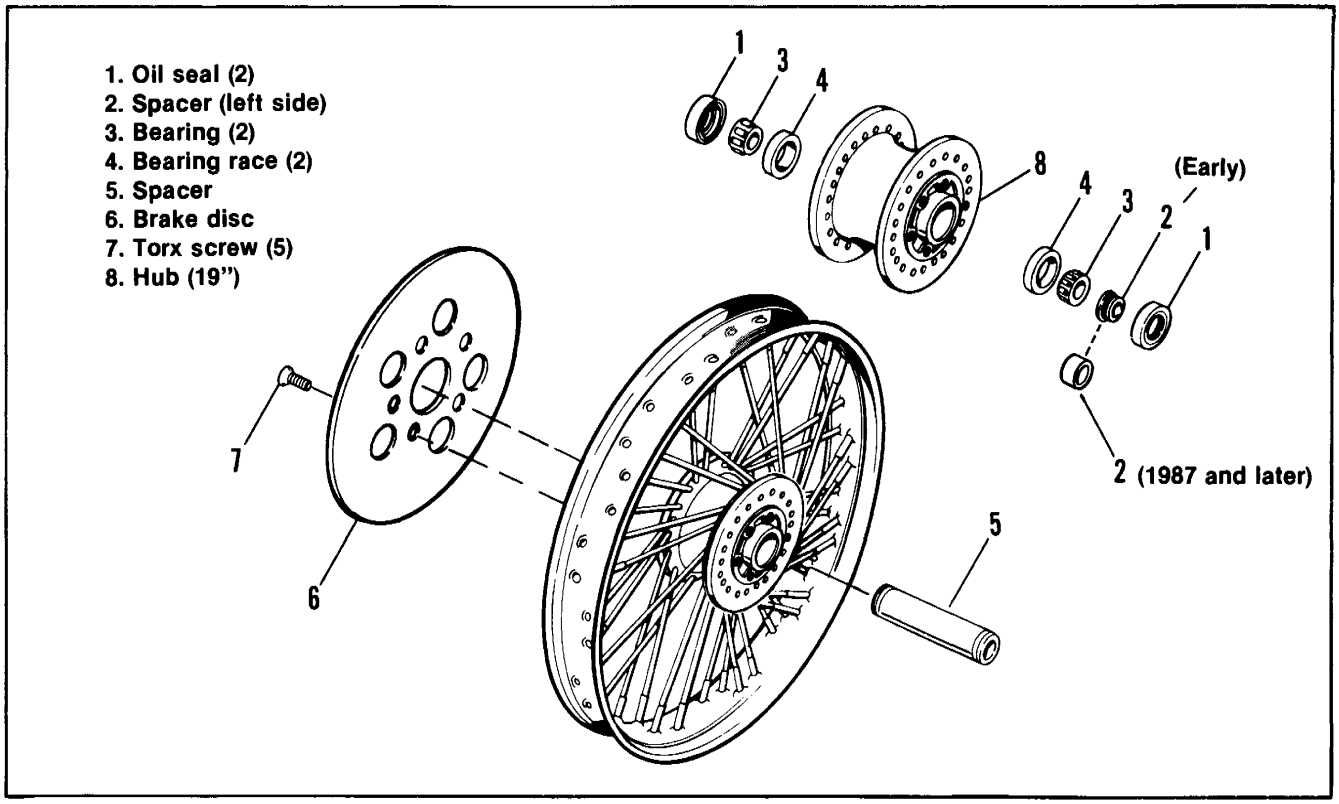


Figure 2-6. Laced Front Wheel — FXR Models

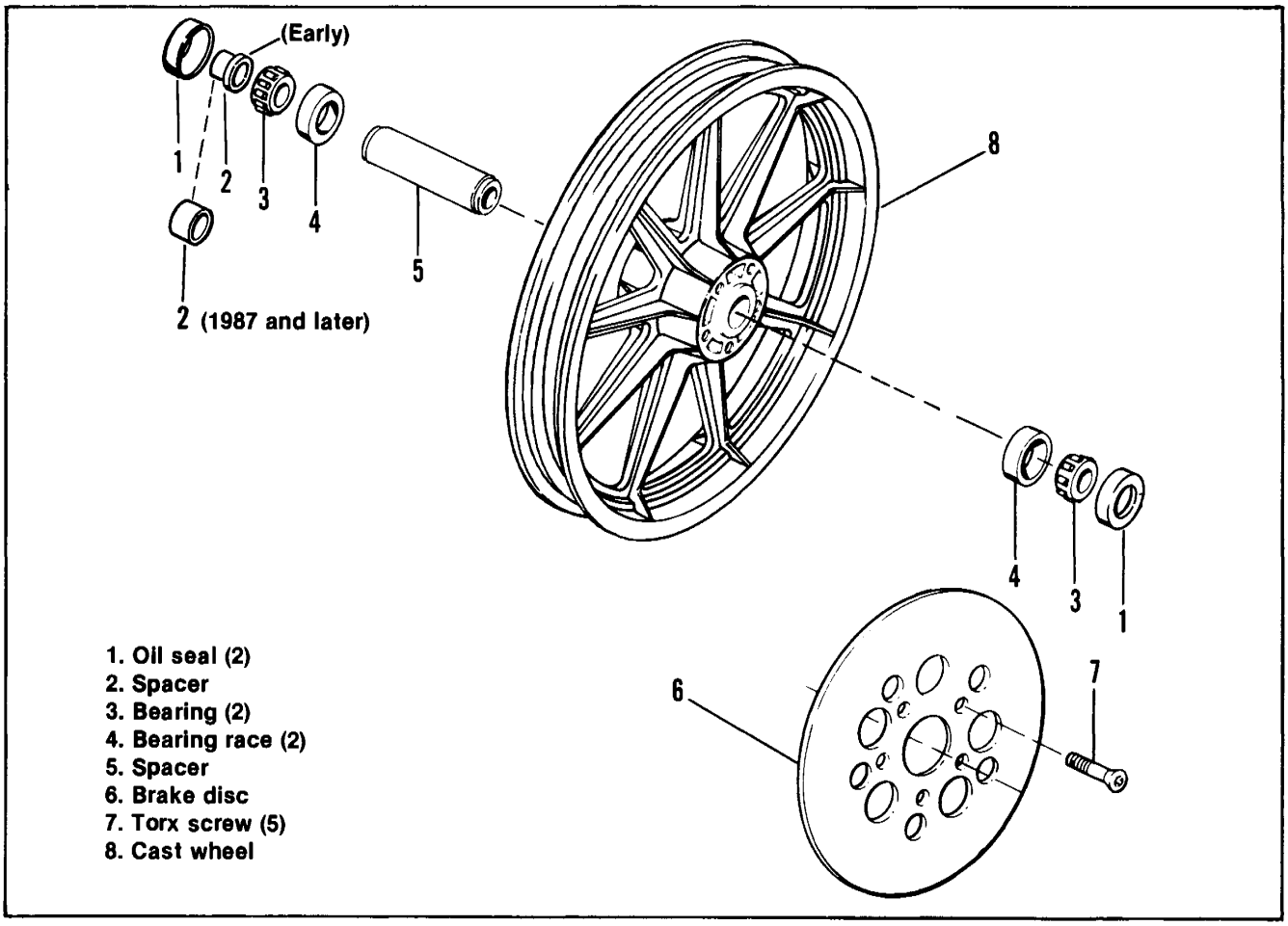


Figure 2-7. Cast Front Wheel — FXR Models

ASSEMBLY

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 disc (6) is clean, then install the disc with the notch aligned with the 1/4 in. hole in the hub using new Torx screws (7). Tighten to 16-18 ft-lbs torque.

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

4. Place the spacer (5) into the hub. Pack the bearings (3) with Harley-Davidson WHEEL BEARING GREASE, Part No. 99855-89 and install one into each side of the hub.

5. Place the spacer (2) in right side of hub. Press an oil seal (1) into each side of the hub. The seals should be pressed in flush with the hub outer surface.

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

Cast Wheel (Figure 2-7)

1. Clean brake disc(s) with Loctite CLEANING SOLVENT. Using new Torx screws (7), install disc to left side of wheel with the notch aligned with the 1/4 in. hole in the hub. Tighten screws (7) to 16-18 ft-lbs torque.

NOTE

If vehicle is equipped with dual disc brakes, be sure the disc mounted at the left has the notch in the disc aligned with the 1/4 in. hole in the wheel hub.

2. If bearing cups were removed for replacement, lubricate the new cups with oil and press one into each side of the wheel hub, using WHEEL BEARING RACE INSTALLER, Part No. HD-33071.

3. Place the spacer (5) into the hub. Pack the bearings (3) with Harley-Davidson WHEEL BEARING GREASE, Part No. 99855-89 and install one into each side of the wheel hub.

4. Place the spacer (2) in right side of hub. Press an oil seal (1) into each side of the hub flush with the outer surface.

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

INSTALLATION

All 1984-1987 Models (Excluding 1987 FXLR and 1987 FXRSE*)

* Sport Edition

1. See Figure 2-7. Place wheel between fork legs with spacer (2) facing to the motorcycle right side.

2. See Figure 2-4. Install axle through right fork leg, wheel, speedometer drive (7) and left fork leg. Secure the axle with the washer (4), lockwasher (3) and axle nut (2). Tighten the axle nut 50 ft-lbs torque. Tighten the slider cap nuts (5) to 11 ft-lbs torque. Check end play before mounting the brake calipers.

WARNING

Wheel bearing end play has been set by the factory at 0.004 to 0.018 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. Excessive end play may cause a handling problem. Lack of adequate end play could result in a bearing seizure.

1987 FXLR, 1987 FXRSE* and ALL 1988-1990 Models

* Sport Edition

1. See Figure 2-6. Place wheel between fork legs with spacer (2) facing to the motorcycle right and brake disc (6) to the left side.

2. See Figure 2-5. With pinch bolt (1) loose, push axle (5) through right fork side (pinch bolt side) wheel assembly, speedometer drive seal, speedometer drive and left fork side until axle shoulder butts against wheel spacer.

3. Place flat washer (8) followed by lockwasher (7) over threaded end of axle (5).

4. Thread on nut (6). Insert rod or screwdriver through hole in axle (5) and hold while tightening nut (6) to a torque of 50-55 ft-lbs.

5. Tighten pinch bolt (1) to a torque of 21-27 ft-lbs. Check end play before mounting the brake calipers.

WARNING

Wheel bearing end play has been set by the factory at 0.004 to 0.018 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. Excessive end play may cause a handling problem. Lack of adequate end play could result in a bearing seizure.

Checking End Play

1. See Figure 2-8. Mount a magnetic base dial indicator on the brake disc with the contact point on the end of the axle. Move wheel back and forth to check end play.

2. See Figure 2-7. If end play does not fall between 0.004 and 0.018 in., substitute a longer spacer (5) for more end play or a shorter spacer for less end play. See chart for spacer part numbers and sizes.

NOTE

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

FXR MODELS — FRONT WHEEL BEARING SPACERS

Part No.	Color Code	Length
43623-78	Violet	2.564
43624-78	Pink	2.550
43625-78	Gold	2.536

3. Install the brake caliper(s) to the fork side. Tighten the caliper mounting bolts to 25-30 ft-lbs torque.

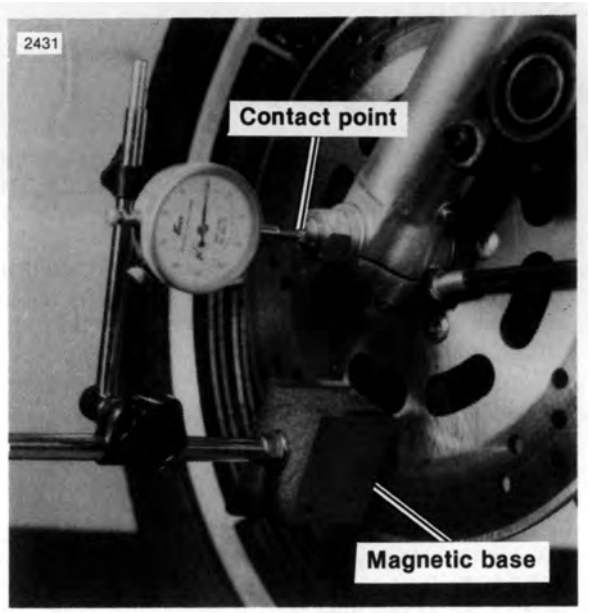


Figure 2-8. Checking Front Wheel End Play — FXR Models

REAR WHEEL — ENCLOSED CHAIN DRIVE

REMOVAL

NOTE

If bearings or sprocket are to be removed, follow procedure under REAR WHEEL SPROCKET — ENCLOSED CHAIN DRIVE.

FLT Models

1. Support motorcycle under the frame with the rear wheel raised off the ground at least 4 in.

2. Remove both saddlebags and mufflers.

3. See Figure 2-9. Remove the plug on the sprocket housing. Remove the sprocket mounting screws using a 3/8 in. Allen wrench or SPROCKET SCREW TOOL, Part No. HD-94437-79, and suitable extension for leverage. Remove lower shock bolts and lower wheel to the ground.

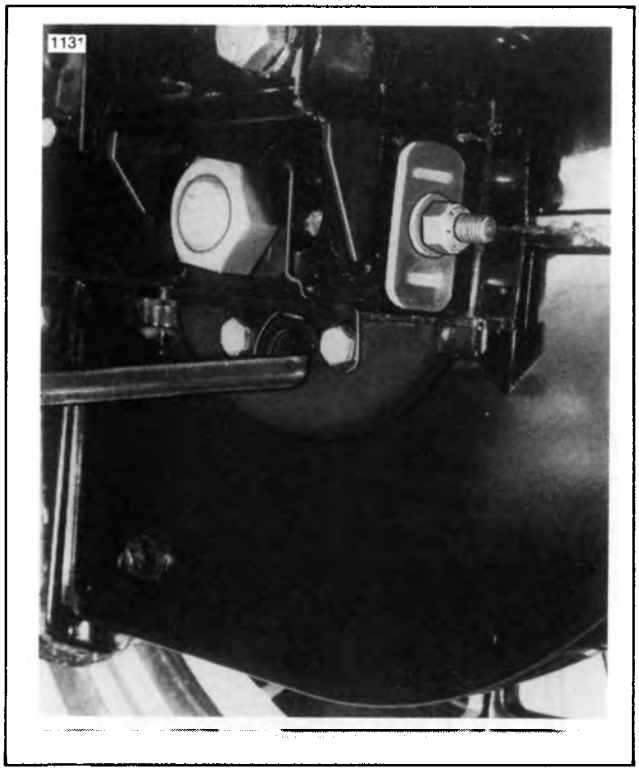
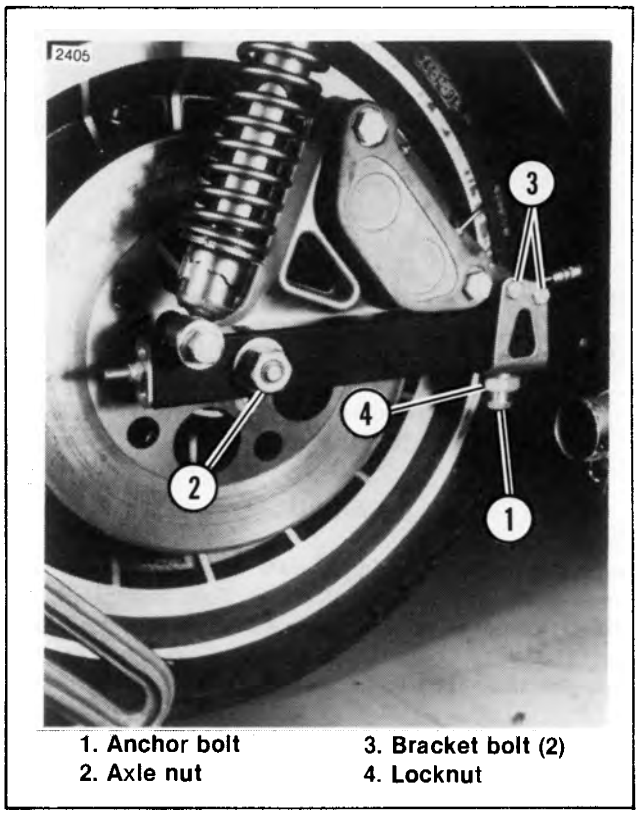


Figure 2-9. Removing Sprocket Screws

4. See Figure 2-10. Remove brake anchor bracket bolts (3) and anchor. Remove axle nut (2), lockwasher and washer and tap axle out far enough to clear wheel, yet still supporting sprocket and chain housing. Slide brake caliper up and swing away from wheel. Separate wheel from sprocket and chain housing.



1. Anchor bolt
2. Axle nut
3. Bracket bolt (2)
4. Locknut

Figure 2-10. Rear Wheel Removal — FLT Models

FXRT

1. Do steps 1 and 3 of FLT procedure; but do not remove shock bolts.

2. Remove axle nut and tap axle out far enough to clear wheel, but still support sprocket and left axle adjuster.

3. Remove the spacer that is located between the rear fork and brake caliper bracket. (Be careful not to lose this spacer as it may drop out when axle is being moved to the left.)

4. Move axle end of caliper bracket to the right and remove wheel.

CAUTION

Do not operate the rear brake pedal when the rear wheel is removed because the brake caliper piston may be forced out of the caliper bore. The brake system will require disassembly to reseat the piston.

DISASSEMBLY (Figure 2-11)

1. Remove the spacer (7), seal (6), bearing (5), spacer (3) and sleeve (2) from the right side of the wheel.
2. Remove the brake disc screws (9) and brake disc (8).
3. If it is necessary to remove the bearing race (4), use WHEEL BEARING RACE REMOVER AND INSTALLER, Part No. HD-33071.

CLEANING, INSPECTION AND REPAIR

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

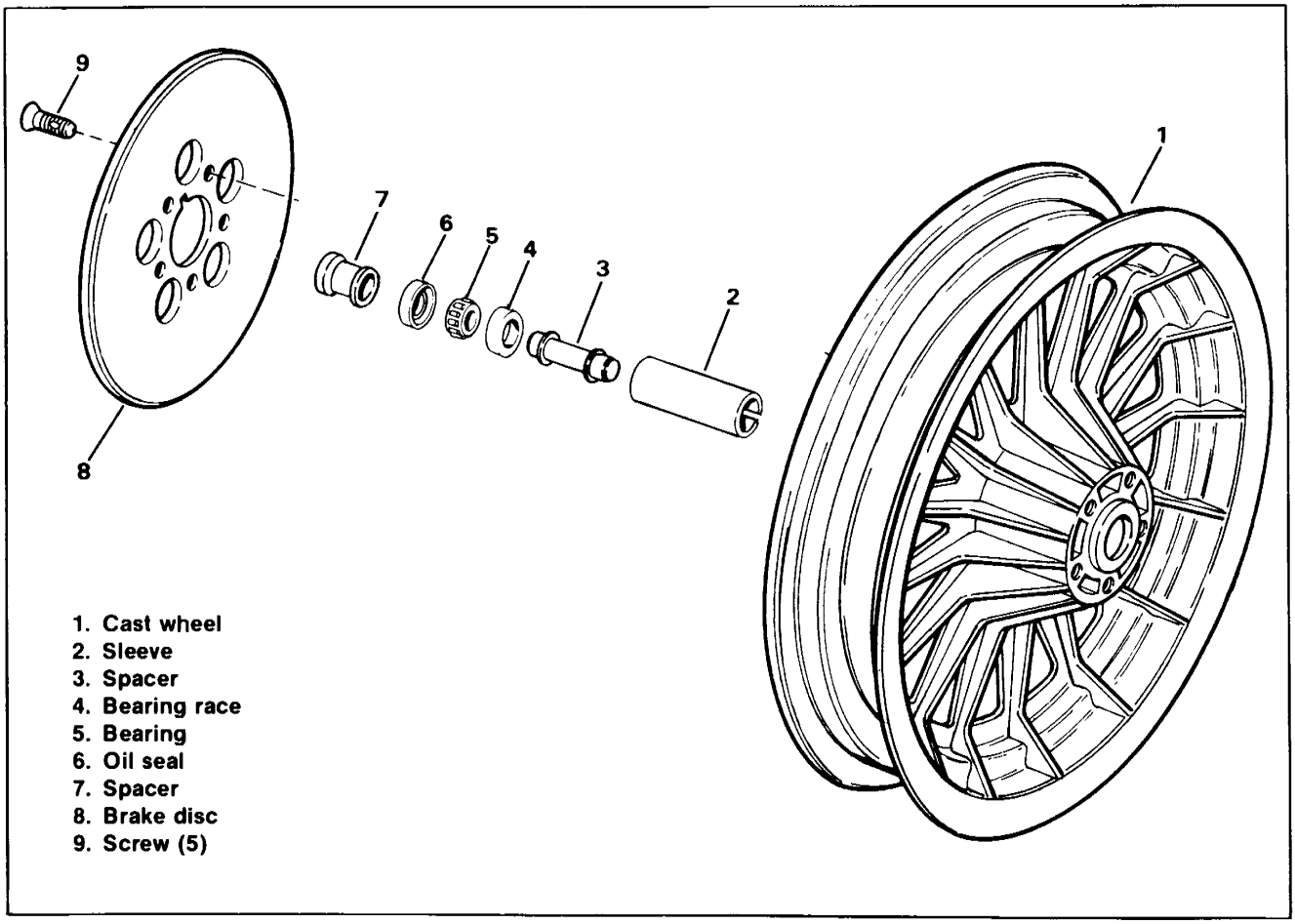
WARNING

Never "spin-dry" bearings with compressed air as very high speed can be attained. This can result in serious damage to unlubricated surfaces of bearings. Spinning, may also cause a bearing to fly apart, possibly causing injury.

2. Replace the brake disc if it is warped, scored or worn beyond the minimum thickness stamped on the disc.
3. Check the bearing race (4). If it is pitted or grooved, replace the race and the bearing.
4. Check the rim trueness. See CHECKING CAST RIM RUNOUT.

ASSEMBLY (Figure 2-11)

1. Clean the disc (8) with Loctite CLEANING SOLVENT and install on the wheel with new screws (9). Apply a drop of Loctite 242 (blue) to screws and tighten to 24-30 ft-lbs torque.
2. If bearing race (4) was removed, lubricate race with oil and press into right side (disc side) of wheel.
3. Install sleeve (2) and spacer (3).
4. Pack bearing (5) with Harley-Davidson WHEEL BEARING GREASE, Part No. 99855-89 and install in wheel. Press seal (6) into hub with garter spring facing inward and seal flush with outer surface of wheel hub.
5. Coat lip of seal with oil and insert spacer (7) into seal.



1. Cast wheel
2. Sleeve
3. Spacer
4. Bearing race
5. Bearing
6. Oil seal
7. Spacer
8. Brake disc
9. Screw (5)

Figure 2-11. Rear Wheel — FLT Models

INSTALLATION

FLT

1. See Figure 2-10. Place the wheel in the rear swing arm with brake disc to the right side. Place brake caliper in position.

2. Tap the axle through the wheel and swing arm from the left side of the motorcycle. Install the axle washer, lockwasher and axle nut (2).

3. Install the brake anchor and two bracket bolts (3) to the brake caliper. Install the brake line and clip to the front anchor bracket bolt (3). Tighten anchor bolt (1) and locknut (4).

4. Install shocks.

5. Coat sprocket screws with engine oil and install. Tighten the screws to 65-70 ft-lbs torque.

6. Adjust the rear chain. See REAR CHAIN, ADJUSTMENT in section 6

7. Install the mufflers and saddlebags.

FXRT

1. Place wheel in rear swing arm and guide brake disc into brake caliper.

2. Tap axle through wheel, brake caliper bracket and spacer.

3. Install the axle washer, lockwasher and nut.

4. Perform steps 5 and 6 of FLT INSTALLATION above.

WARNING

FLT and 1984 FXRT rear wheel bearing end play has been set by the factory at 0.002 - 0.006 in. and should not be altered. If wheel, sprocket, bearings, races or spacers have been replaced, wheel bearing end play must be checked and adjusted. Always check end play with axle nut tightened to 60-65 ft-lbs torque. See INSTALLATION procedure under rear wheel sprocket given later in this section. Excessive end play may cause a handling problem. Lack of adequate end play could result in a bearing seizure.

REAR WHEEL SPROCKET — ENCLOSED CHAIN DRIVE

REMOVAL (Figure 2-12)

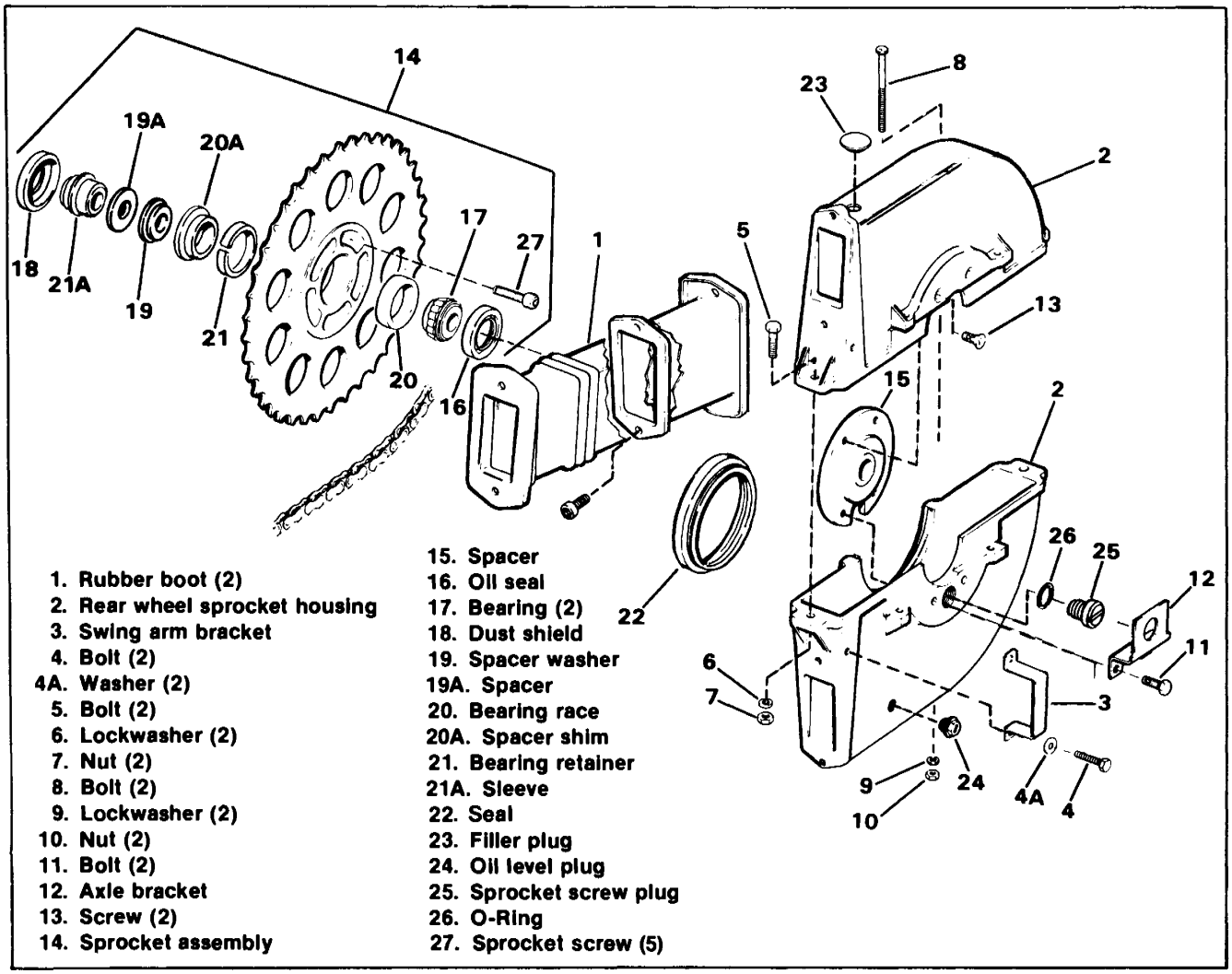
1. Support motorcycle so rear wheel is well off the floor. Remove both saddlebags and left muffler on FLT.
2. Disconnect the upper and lower rubber boots (1) from the rear wheel housing (2). Locate the master link on the chain and disconnect it.
3. Remove the bracket (3), mounting bolts (4) and washers (4A).
4. Remove axle nut and washers from right end of axle and remove axle. Pull wheel and sprocket housing assembly from swing arm.

CAUTION

Do not operate the rear brake pedal when the rear wheel is removed because the brake caliper piston may be forced out of the caliper bore. The brake system will require disassembly to reseat the piston.

DISASSEMBLY (Figure 2-12)

1. Remove the front and rear bolts (5), lockwashers (6) and nuts (7). Remove the two bolts (8), lockwashers (9) and nuts (10) from the right side of the housing.
2. Remove the two bolts (11), axle bracket (12) and screws (13) from the left side of the housing and pull the housing apart.
3. Remove the sprocket assembly (14) and spacer (15) from the wheel.
4. Remove the seal (16), bearing (17), spacer washer (19) and sleeve (21A) from the left side of the sprocket assembly. Remove the dust shield (18) from the right side.



1. Rubber boot (2)
2. Rear wheel sprocket housing
3. Swing arm bracket
4. Bolt (2)
4A. Washer (2)
5. Bolt (2)
6. Lockwasher (2)
7. Nut (2)
8. Bolt (2)
9. Lockwasher (2)
10. Nut (2)
11. Bolt (2)
12. Axle bracket
13. Screw (2)
14. Sprocket assembly
15. Spacer
16. Oil seal
17. Bearing (2)
18. Dust shield
19. Spacer washer
19A. Spacer
20. Bearing race
20A. Spacer shim
21. Bearing retainer
21A. Sleeve
22. Seal
23. Filler plug
24. Oil level plug
25. Sprocket screw plug
26. O-Ring
27. Sprocket screw (5)

Figure 2-12. Rear Wheel Sprocket and Housing Enclosed Rear Chain

CLEANING, INSPECTION AND REPAIR (Figure 2-12)

1. Replace housing seal (22). Install the seal with the garter spring facing inside the housing.

2. Inspect the bearing race (20). If races are pitted or grooved, replace the race and the bearing (17) as a set.

3. Inspect the sprocket and replace if if it is cracked, chipped or worn.

ASSEMBLY (Figure 2-12)

1. Pack the bearing (17) with Harley-Davidson WHEEL BEARING GREASE, Part No. 99855-89 and assemble the dust shield (18), sleeve (21A), spacer (19A), spacer washer (19), bearing (17) and oil seal (16) into the sprocket hub.

2. Place the seal (22) on the sprocket hub with the garter spring facing the sprocket. Lubricate the sprocket screws (27) with oil and install sprocket on wheel. Tighten screws alternately to 65-75 ft-lbs torque.

NOTE

Excessive sealant will contaminate seal.

3. Place spacer (15) in sprocket. Apply a coating of 3M #750 SEALANT or an RTV SILICONE SEALANT to the mating surfaces of the housing halves (2) and spacer (15). Secure the upper half to the lower half with the bolts (5), lockwasher (6) and nuts (7) making sure seal (22) is in the housing grooves.

4. Assemble the two bolts (8), lockwashers (9) and nuts (10).

NOTE

Before installing bolts (11) and screws (13), make sure the opening of the spacer (15) is in line with the sprocket screw hole in the lower housing.

5. Install the axle bracket (12), bolts (11) and screws (13) on the left side of the housing.

INSTALLATION (Figure 2-12)

1. Install wheel and sprocket assembly in the swing arm. Make sure brake disc is between caliper brake pads and that sprocket housing faces forward.

2. Install axle from the left side. Install washer, lockwasher and nut. Tighten axle nut to 60-65 ft-lbs torque. Check wheel bearing end play.

3. On FXRT be certain spacer is installed on axle between caliper bracket and swing arm.

WARNING

FLT & FXRT rear wheel bearing end play should be 0.002 - 0.006 in. If it is not within this range, substitute a thinner spacer (19A) for less end play or thicker spacer for more end play as required. Excessive end play may cause a handling problem. Lack of adequate end play could result in a bearing seizure.

NOTE

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

4. Loosen axle nut and install chain on the sprocket. Fasten master link making sure open end of spring clip trails the direction of the forward wheel travel.

5. Adjust rear chain as described in Section 6 under REAR CHAIN, ADJUSTMENT.

6. Apply a coating of 3M #750 SEALANT or RTV SILICONE SEALANT to the rubber boots and to the mating surfaces of the housing. Fasten the boots to the housing using the original screws. Tighten the screws alternately to 3-4 ft-lbs torque.

7. Assemble the bracket (3), washers (4A), and bolts (4) that fasten the housing to the swing arm.

REAR WHEEL — BELT DRIVE

REMOVAL

1. Support motorcycle so rear wheel is well off the floor. Remove saddlebags, if applicable. Remove left muffler on FLT models.

2. It may be necessary to remove the debris deflector from swing arm.

3. See Figure 2-12A. Remove cotter pin, axle nut, lockwasher (1988 and earlier) and washer (spacer) from right side of axle. Tap axle towards left side and remove.

4. Move wheel forward and slip belt off sprocket.

5. Pull wheel and belt sprocket from swing arm.

6. Remove bolts and washers securing sprocket to wheel.

DISASSEMBLY/CLEANING, INSPECTION AND REPAIR/ASSEMBLY

On FLT Models, refer to REAR WHEEL - ENCLOSED CHAIN DRIVE. On FXR Models, refer to REAR WHEEL -OPEN CHAIN DRIVE.

INSTALLATION

1. Place sprocket in position on wheel.

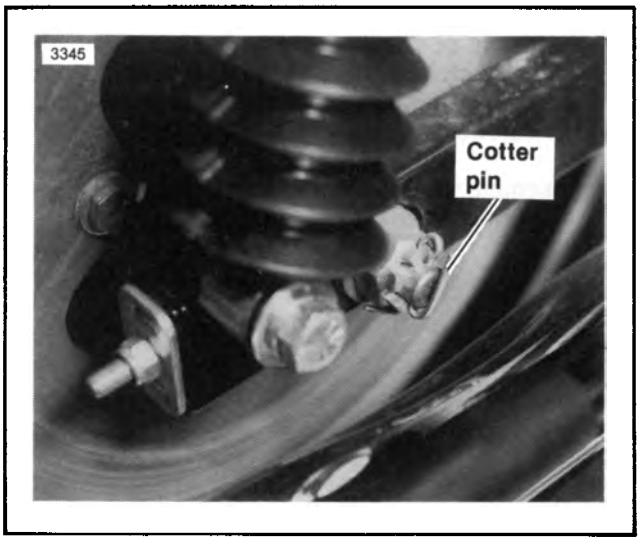


Figure 2-12A. Rear Axle with Cotter Pin — 1989 & Later

2. Install bolts and washers. Tighten bolts alternately to a torque of 45-50 ft-lbs on sprockets with grade five fasteners. Tighten bolts alternately to a torque of 65-70 ft-lbs on sprockets with grade eight fasteners threaded into cast wheels.

3. Place wheel and sprocket forward in the swing arm and place belt on sprocket.

NOTE

On FXR be certain spacer is installed on axle between caliper bracket and swing arm.

4. Move wheel back in swing arm: Coat axle with Loctite ANTI-SEIZE LUBRICANT and carefully slide axle into position.

5. Install washer, lockwasher (1988 and earlier) and axle nut on axle. On 1988 and earlier, tighten axle nut to a torque of 60-65 ft-lbs.

6. On 1989 models, tighten axle nut to 60 ft-lbs torque and check if a new cotter pin can be installed. If required, tighten nut to align axle hole and nut slots.

WARNING

Do not exceed 65 ft-lbs torque.

7. Install cotter pin as shown in Figure 2-12A.

WARNING

Wheel bearing end play should be 0.004 - 0.018 in. If it is not within this range, substitute a thinner spacer for less end play or thicker spacer for more end play as required.

NOTE

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

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

7. Install muffler on FLT models.

8. Adjust belt. See section 6 under Rear Belt Adjustment.

9. Install saddlebags, if applicable.

REAR WHEEL — OPEN CHAIN DRIVE

REMOVAL (Figure 2-13)

1. Block motorcycle underneath frame so rear wheel is raised off the ground.
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) or debris deflector.
4. Lift the chain off the rear wheel sprocket and remove the wheel assembly.

DISASSEMBLY (Figure 2-14)

1. Remove the spacers (1), oil seals (2), bearings (3) and spacer (5).
2. If it is necessary to remove the bearing races (4), use WHEEL BEARING RACE REMOVER AND INSTALLER, Part No. HD-33071.
3. Remove the screws (6) and brake disc (7).
4. Remove the bolts (8), lockwashers (9) and sprocket (10).

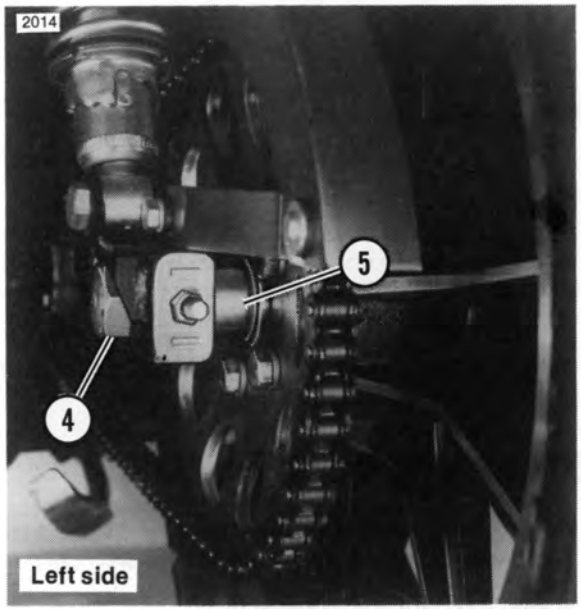
CLEANING, INSPECTION AND REPAIR

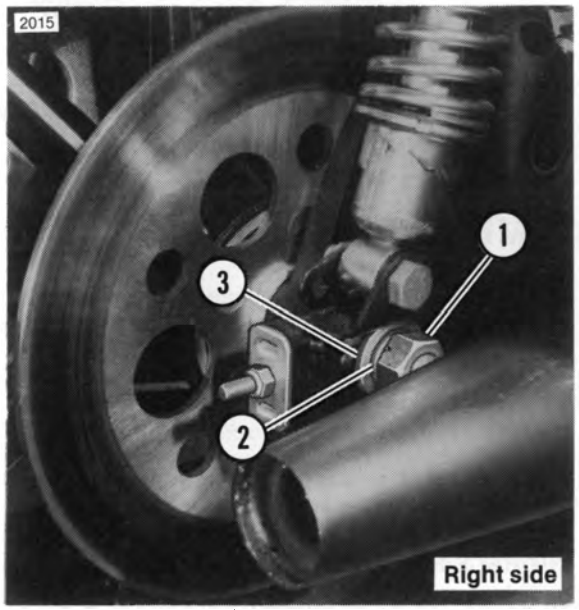
1. Clean all parts, except oil seals, in solvent and inspect for damage or wear.

WARNING

Never "spin-dry" bearings with compressed air as very high speed can be attained. This can result in serious damage to unlubricated surfaces of bearings. Spinning, may also cause a bearing to fly apart, possibly causing injury.

2. Replace the brake disc if it is warped, scored or worn beyond the minimum thickness stamped on the disc.
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.
6. On laced wheels, replace the spokes, rim or hub if damaged.





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

Figure 2-13. Rear Wheel Mounting Open Chain Drive

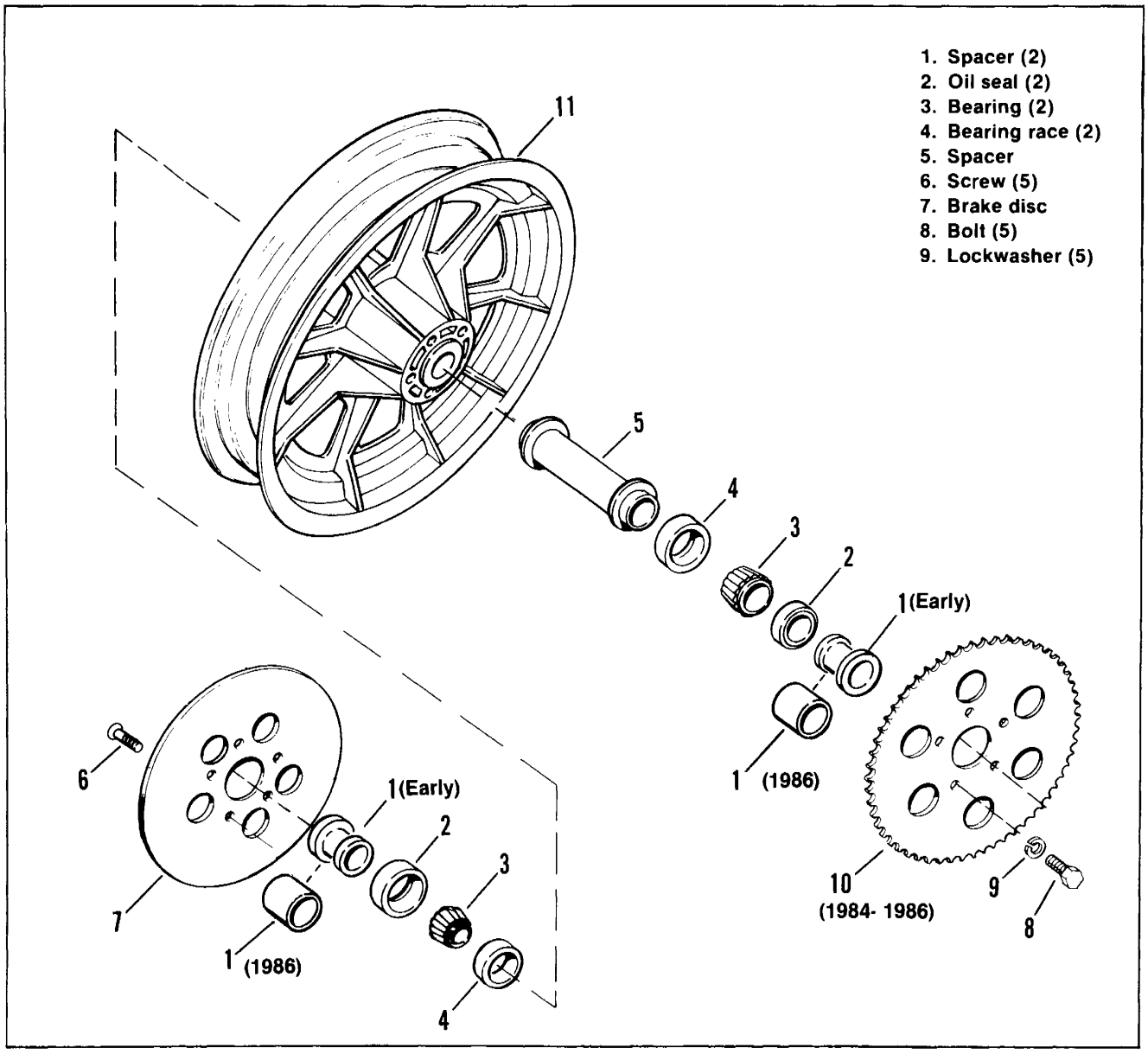


Figure 2-14. Cast Rear Wheel Open Chain Drive

ASSEMBLY (Figure 2-14)

1. Make sure brake disc (7) is clean, then install using five screws (6). Tighten the screws to 23-27 ft-lbs torque.
2. Install sprocket (10) using bolts (8) and lockwashers (9). Tighten bolts to 50-55 ft-lbs torque.
3. If bearing races (4) were removed for replacement, lubricate new races with oil and press one into each side of the wheel hub using WHEEL BEARING RACE INSTALLER, Part No. HD-33071.
4. Place the spacer (5) into the wheel hub. Pack the bearings (3) with Harley-Davidson WHEEL BEARING GREASE, Part No. 99855-89 and install one in each side of the wheel hub.
5. Lightly coat the outside lip of each seal (2) with engine oil. Press one seal into each side of the hub so it is 19/64 - 5/16 in. below outside edge of wheel hub and install the spacers (1).
6. Wheel and tire must be true. See CHECKING RIM RUNOUT.

INSTALLATION (Figure 2-13)

1. Position the wheel between the rear swing arm, place chain into the sprocket and disc into caliper.
2. Coat axle with Loctite ANTI-SEIZE LUBRICANT. Install axle (4) through left side of swing arm, spacer (5) or debris deflector, wheel, rear brake caliper bracket and right side of swing arm.

3. Install the washer (3), lockwasher (2) and nut (1). Tighten axle nut to 60-65 ft-lbs torque.

WARNING

Wheel bearing end play has been set by the factory at 0.004 - 0.018 in. and should not be altered. End play should be checked after tightening axle nut to 60-65 ft-lbs torque. Excessive end play may cause a handling problem. Lack of adequate end play could result in a bearing seizure.

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

5. If end play is not 0.004 - 0.018 in., substitute a longer spacer (5, Figure 2-14) for more end play or shorter spacer for less end play.

NOTE

End play may be checked before installing wheel in swing arm if a suitable spacer is used on the axle. Always check end play with axle nut tightened to 60-65 ft-lbs torque.

6. When correct end play has been achieved, adjust chain as described under REAR CHAIN AND SPROCKETS in section 6.

LACING WHEELS — 19 INCH

1. See Figure 2-15. Divide spokes into two 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 intermix the thread patterns.

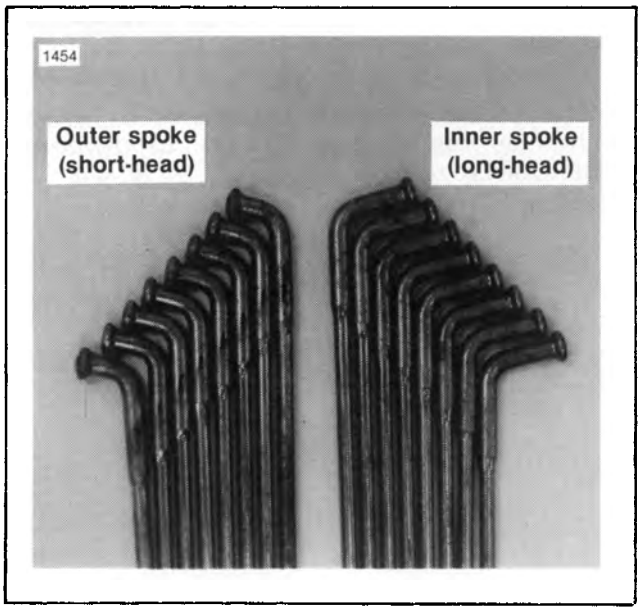


Figure 2-15. Spoke Identification

2. See Figure 2-16. 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.

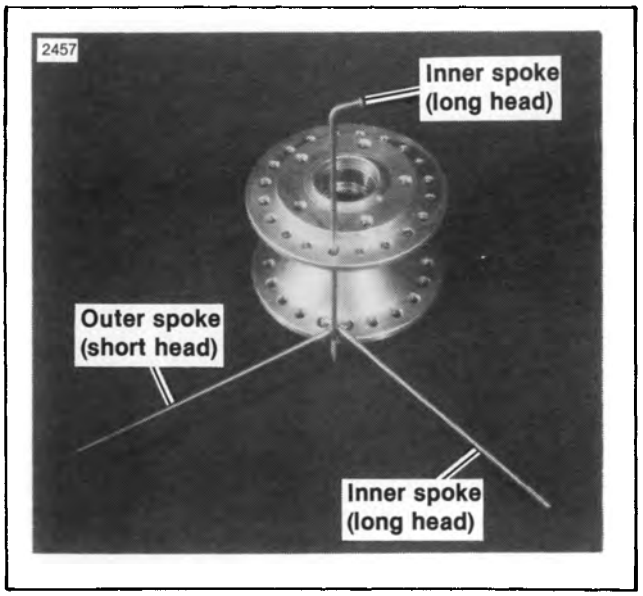


Figure 2-16. Lacing Wheel — 19 in.

3. See Figure 2-16. 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 2-17. With all forty spokes inserted in hub, group all spokes on top flange into two bundles. Secure each group with throttle grips or tape to keep the spokes together.

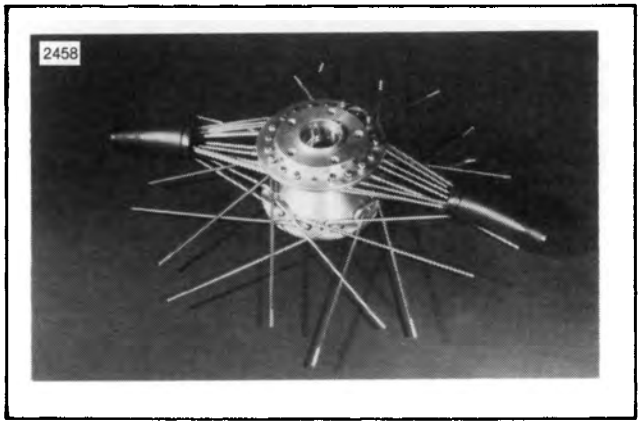


Figure 2-17. Bundling Top Spokes

5. Swing all bottom flange outer spokes (short-head) 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. When complete, all inner spokes will be laying over the outer spokes.

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

7. See Figure 2-18. The rim is divided into ten groups of spoke holes, four 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 will not rotate and it might be necessary to unlace the wheel to untangle them.

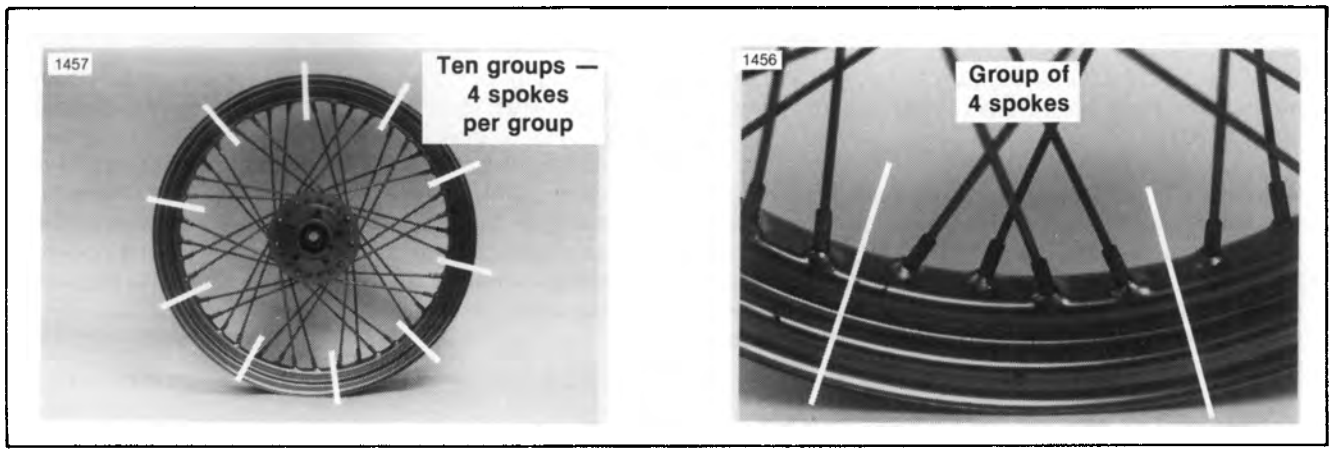


Figure 2-18. Grouping the Spokes

8. Next lace the ten 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 three turns.

NOTE

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

9. Lace all 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 four inner spokes before securing it to the rim.

11. See TRUING LACED WHEEL.

LACING WHEELS — 21 INCH

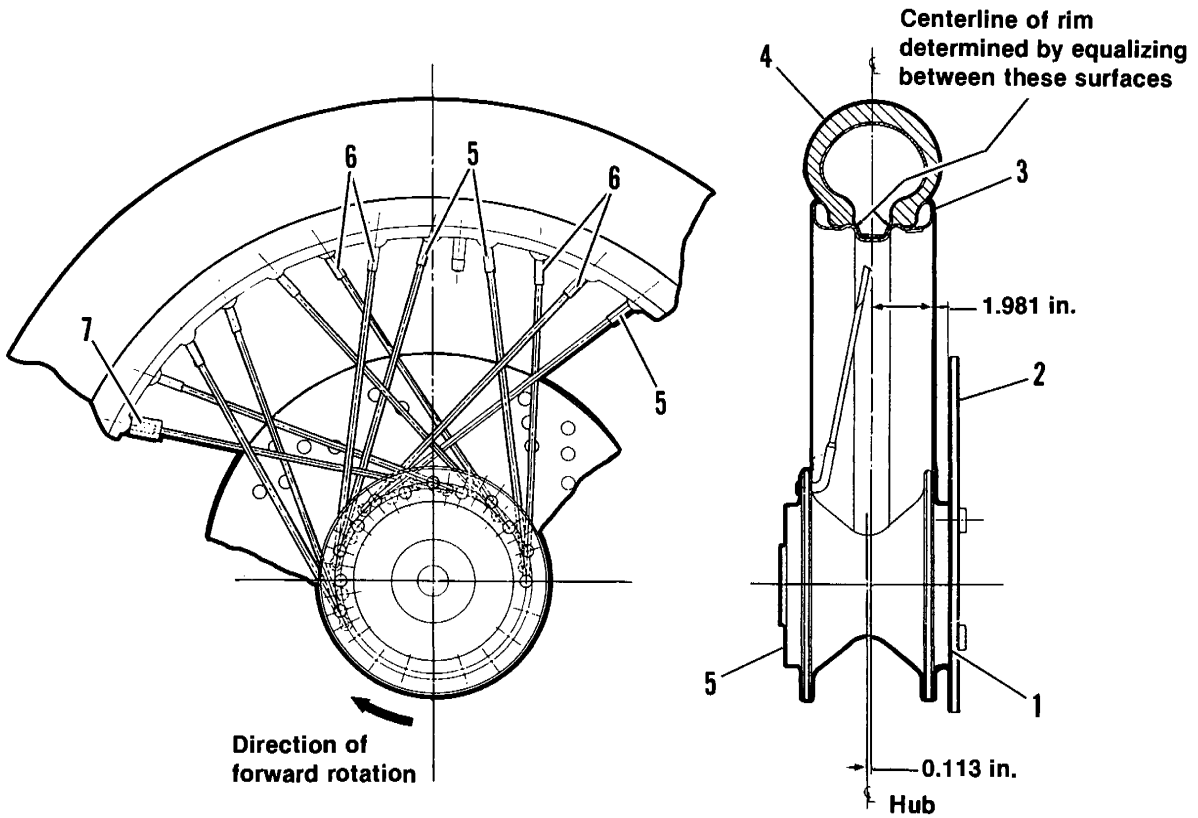
1. See Figure 2-15. Divide spokes into two groups. Inner spokes have long heads, outer spokes have short heads.

2. See Figure 2-19. Place hub on bench either side up. At each flange there is an inner hole circle and an outer hole circle. The spokes with the long heads (5) are installed in the inner hole circle and the spokes with the short heads (6) are installed in the outer hole circle. Insert all spokes in both hub flanges.

3. See Figure 2-17. With all forty spokes inserted in hub, group all spokes on top flange into two bundles. Secure each group with throttle grips or tape to keep the spokes together.

4. Swing all bottom flange outer spokes (short-head) 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. When complete, all inner spokes will be laying over the outer spokes.

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



1. Spacer
2. Brake disc
3. Wheel rim
4. Tire
5. Spoke, long
6. Spoke, short
7. Weight

Figure 2-19. Lacing Wheel — 21 in.

6. See Figure 2-18. The rim is divided into ten groups of spoke holes, four 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 will not rotate and it might be necessary to unlace the wheel to untangle them.

7. Next lace the ten 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 three turns.

NOTE

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

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

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

10. True the wheel in wheel truing stand. See Figure 2-19. When truing the wheel the hub is offset from the center of the wheel rim as shown. See TRUING LACED WHEEL.

TRUING LACED WHEEL

1. See Figure 2-20. Divide the wheel spokes into four groups of four and mark the center of each group with a piece of tape. The groups should be directly across from one another and approximately 90° apart. Tighten the spokes in these four groups finger tight, leaving all others loose.

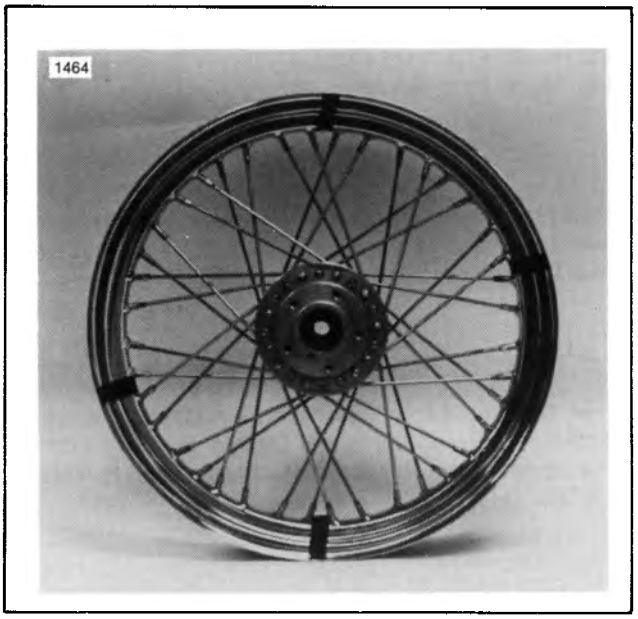


Figure 2-20. Marking Spoke Groups

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.

NOTE

See Figure 2-19. When truing the 21 in. wheel, the wheel hub must be offset 0.113 in. from the center of the wheel rim as shown. The hub is offset toward the brake side to provide clearance between the caliper and the spokes.

3. See Figures 2-21, 2-22. The hub must be centered sideways within 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 four 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 four spokes an equal number of turns until dimension is equal to within 1/32 in. for both sides.

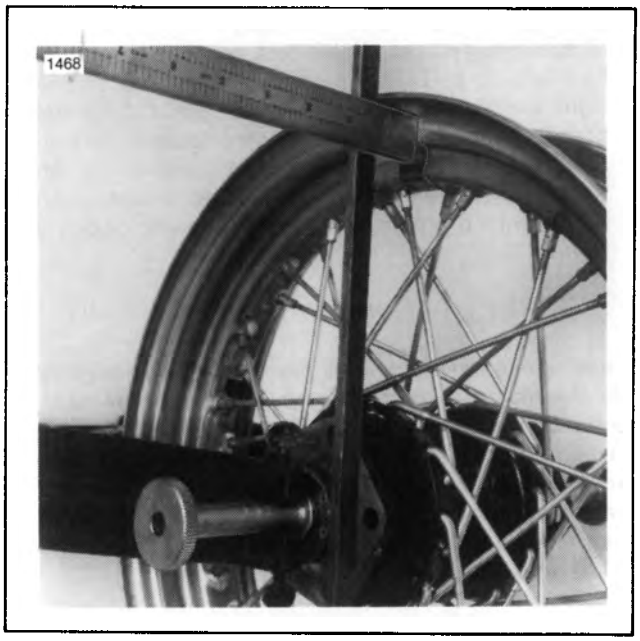


Figure 2-21. Centering Hub — 16 in.

Figure 2-22. Centering Hub — 19 in.

CAUTION

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

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

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

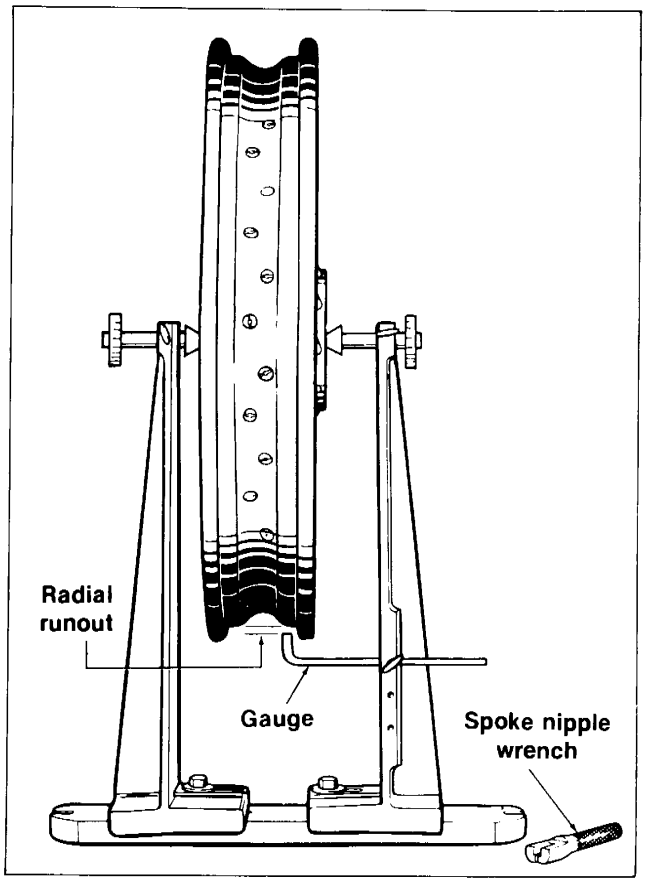


Figure 2-23. Truing Rim Radially

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.

CAUTION

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

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

NOTE

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

CHECKING CAST RIM RUNOUT

Cast wheels should be checked for lateral and radial runout before installing a new tire or tube.

1. See Figure 2-24. Install arbor in the wheel hub and place wheel in the truing stand. To check rim lateral runout place a gauge rod or dial indicator near the rim bead. If lateral runout exceeds 3/64 in. replace the wheel.

2. See Figure 2-25. Check for radial runout as shown here. Replace the wheel if runout exceeds 1/32 in.

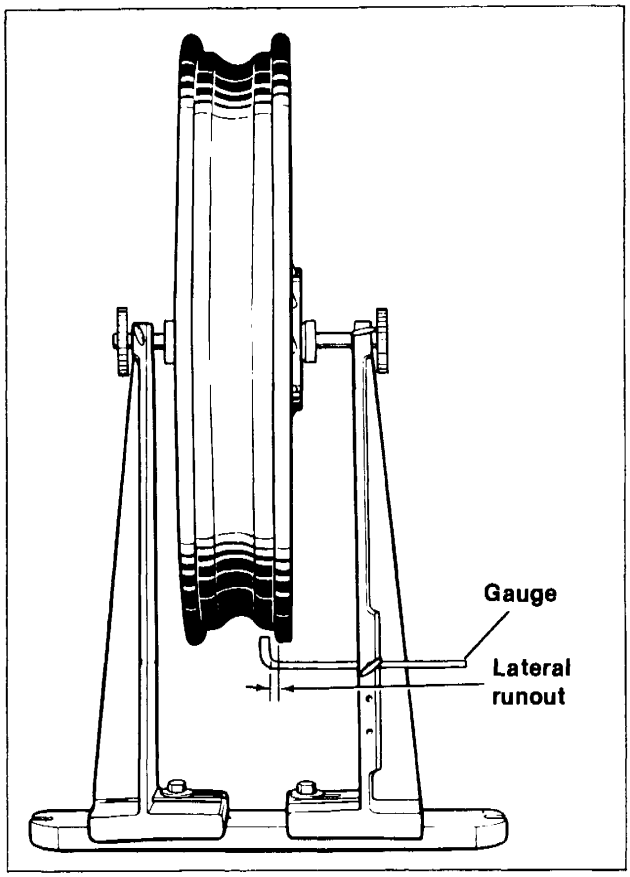


Figure 2-24. Checking Rim Lateral Runout

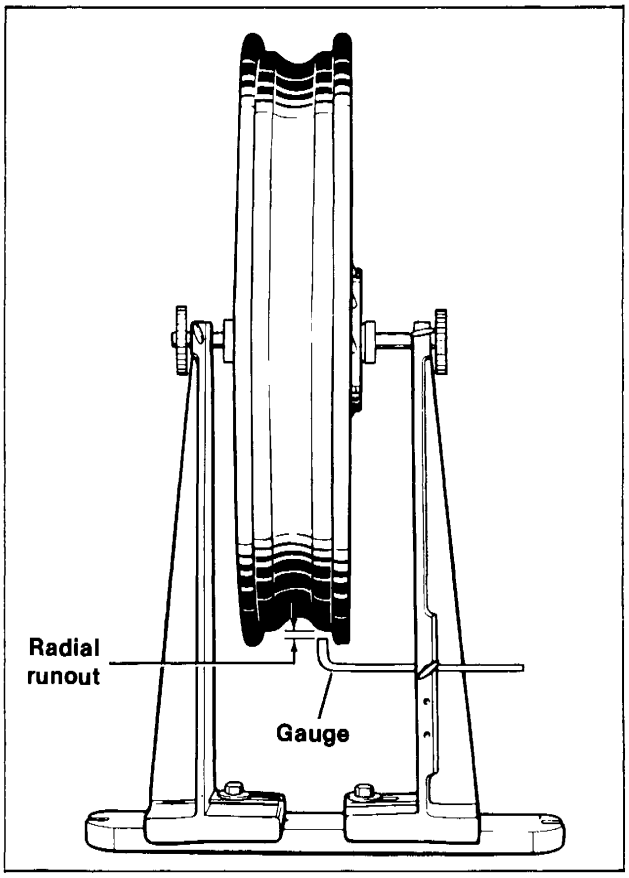


Figure 2-25. Checking Rim Radial Runout

TIRES AND TUBES

GENERAL

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

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

Inner tubes must be used on all Harley-Davidson cast and laced wheels except cast wheels which are clearly marked "suitable for tubeless tires ".

WARNING

Tubeless tires may be repaired in the tread area only and only if the puncture is 1/4 in. or smaller. Never repair a tire with less than 1/16 in. tread depth. All repairs must be made from inside the tire.

Acceptable repair methods include a patch and plug combination, chemical or hot vulcanizing patches or head-type plugs. TIRE REPAIR KIT, Part No. HD-20000 contains acceptable repair materials.

When repairing tubeless tires, use TIRE SPREADER, Part No. HD-21000 to spread the tire sidewalls.

WARNING

Always check both tire sidewalls for arrows indicating proper forward tire rotation. Some tires require different tire rotation depending on whether tire is used on front or rear wheel. Improper mounting can result in premature tire failure and handling problems.

REMOVAL (Figure 2-26)

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

NOTE

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

Figure 2-26. Starting Bead Off Rim

CAUTION

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

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

NOTE

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

CLEANING, INSPECTION AND REPAIR

1. Clean the inside of tire, rim and tube.
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.

CAUTION

Do not interchange tire valves from one type to another. Always replace valves with the same type as originally furnished, either the threaded valve stem or snap-in type. The rim configuration is designed to fit one type only.

1. On tubeless wheels, damaged or leaking valves must be replaced. To replace a threaded stem type valve proceed to step A. To replace a snap-in type proceed to step B.

   A. See Figure 2-27. Place rubber grommet on valve stem with shoulder in recess of the valve stem head. Insert valve stem center facing away from rim. Install first hex nut and tighten to 20-25 in-lbs torque. Tire valves for 19 in. rims have only one nut that must be tightened to 35-40 in-lbs torque. Install second hex nut. While holding first nut with a wrench, tighten second nut to 40-60 in-lbs torque.

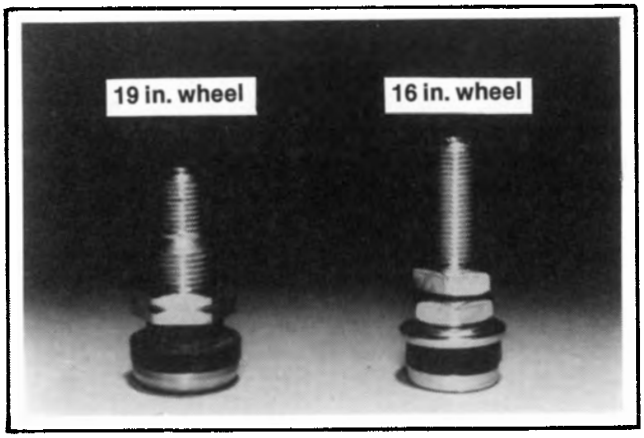


Figure 2-27. Threaded Stem Tire Valve

   B. See Figure 2-28. Moisten the valve with water and insert valve stem through rim hole. Thread plug tool on valve stem and pull valve through rim until all of the indicator ring is visible.

2. 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.

3. Thoroughly lubricate the rim flanges and both beads of the tire with tire lubricant. Install RIM PROTECTORS, Part No. HD-01289 to prevent scarring rims.

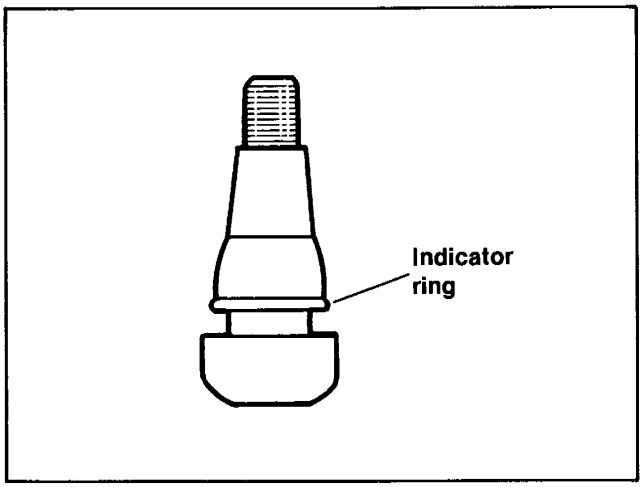


Figure 2-28. Snap-In Tubeless Tire Valves

4. See Figure 2-29. Starting at the valve stem, start the first bead into the rim well. Work the bead on as far as possible by hand. Use the tire tool to pry the remaining bead over the rim flange. If tire has colored dot on sidewall, it is a balance mark and should be located next to valve stem hole.

Figure 2-29. Starting Bead on Rim

5. Inflate tube just enough to round it out. Lubricate thoroughly 360° around the tube base. Insert tube in tire with valve stem in hole.

6. See Figure 2-30. Starting 180° from valve stem, start the second bead onto the rim. Work the bead onto the rim with tire tools, working toward valve in both directions. Remove the valve core from the rim hole before prying the remaining bead over the rim flange.

Figure 2-30. Starting Second Bead on Rim

Make sure inner tube valve stem moves in and out freely, then inflate the tire to recommended pressure to seat the bead. See SPECIFICATIONS. Then deflate tire to allow inner tube to smooth out. Inflate again to recommended pressure to seat the bead.

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

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.

CAUTION

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

Checking Tire Radial Runout (Figure 2-31)

1. Check runout by turning wheel on axle, measuring amount of radial displacement from a fixed point near the tire.

2. Tire tread runout should be no more than 0.090 in. If tire tread runout is more than 0.090 in., remove tire from rim and check rim runout to see if rim is at fault. (See CHECKING CAST RIM RUNOUT or TRUING LACED WHEEL).

NOTE

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

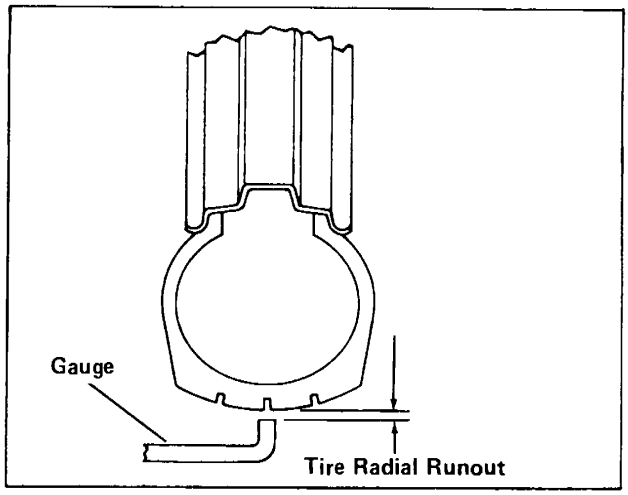


Figure 2-31. Checking Tire Radial Runout

3. If rim runout is less than 1/32 in. (0.031 in.), tire is at fault and should be replaced. If rim runout is more than 1/32 in., correct by replacing cast wheel or truing laced wheel.

Checking Tire Lateral Runout (Figure 2-32)

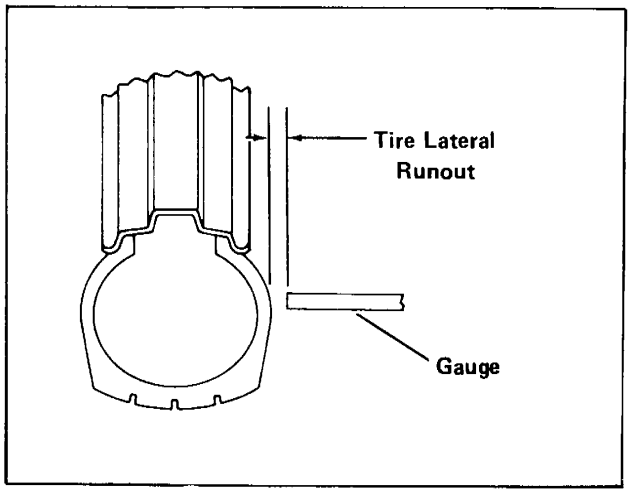


Figure 2-32. Checking Tire Lateral Runout

1. Check runout by turning wheel on axle, measuring tread runout.

2. Tire tread runout should be no more than 0.080 in. If tire tread runout is more than 0.080 in., remove tire from rim and check rim bead runout to see if rim is at fault (see CHECKING CAST RIM RUNOUT or TRUING LACED WHEEL).

NOTE

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

3. If rim bead runout is less than 1/32in. (0.031 in.), tire is at fault and should be replaced. If rim bead runout is more than 1/32 in., correct by replacing cast wheel or truing laced wheel.

Wheel Balancing

Wheel balancing is recommended to improve handling and reduce vibration, especially at high road speeds. Cast aluminum wheels require special self-adhesive weights. Gold Color — 1 oz. weight, ½ oz. weight, Silver Color — ½ oz. and ¼ oz., and Black — ¼ oz. weight.

Laced wheels use balance weights which press over the spoke nipples. 1 oz., 3/4 oz. and 1/2 oz. weights are available.

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 on rim. If 1 oz. or more weight must be added at one location, split the amount so that half is applied to each side of the rim. Wheel should not be used for 48 hours to allow adhesive to cure completely.
3. In most cases, static balancing using WHEEL TRUING STAND, Part No. HD-95500-80, will produce satisfactory results. However, dynamic balancing, utilizing a wheel spinner, should be used to produce finer tolerances for best high and low speed handling characteristics. Follow the instructions supplied with the balance machine you are using. Wheels should be balanced to within 1/2 oz. at 60 mph. The maximum permissible weight to accomplish balance is 3-1/2 oz. total.

VEHICLE ALIGNMENT

WARNING

Vehicle alignment is very important to assure proper handling and vibration control. To ensure proper alignment, follow this procedure carefully and in the sequence given to prevent loss of control.

1. Wheels must be true according to specifications. See CHECKING CAST RIM RUNOUT.

2. Remove the chrome plugs from the swing arm pivot shaft brackets.

3. See Figure 2-33. To assure accurate measurements, obtain a piece of 1/8 in. aluminum welding rod 25 in. long. Grind one end down to a blunt point. With a pliers, bend the rod as shown to clear the frame and extend back past the rear axle. Place a snug fitting grommet on the rod to act as a slide measurement indicator.

4. See Figure 2-34. With the blunt end of the alignment tool inserted in the center of the swing arm pivot shaft, slide the rubber grommet along the tool until it is aligned with the center of the rear axle as shown. Repeat for the other side of the motorcycle.

5. See Figure 2-35. The measurement between the center of the rear axle and the center of the swing arm pivot shaft must be equal on both sides of the motorcycle. If it is not, adjust the rear wheel with the axle adjusters to accomplish the equal measurement. It is extremely important that this adjustment be made as accurately as possible in order to make the remaining adjustments accurate.

6. Raise the rear of the motorcycle so that the rear wheel spins free. Accomplish this by placing a center stand or blocking under the frame.

7. Remove one bolt from the top stabilizer (under fuel tank).

8. Remove the two voltage regulator bracket bolts.

9. Move the voltage regulator and bracket out of the way. Be careful not to damage wires connected to the voltage regulator.

10. Loosen the center thru-bolt and two mount-to-frame bolts that attach mount to frame and engine bracket. Loosen bolts thoroughly.

11. See Figures 2-36, 2-37. The rear wheel must be aligned with the front wheel. On 1984 FLT's this is accomplished by using a straightedge along one side of the wheels and adjusting the front stabilizer until the straightedge contacts two points on each tire. On FXR's and 1985 and later FLT's use two straightedges (one on each side of the wheels) and adjust the front stabilizer so that the front wheel (rear wheel on FLT's) is centered between the straightedges. See NOTE below. Before adjusting stabilizer the two locknuts must be loosened.

NOTE

On FXR models the straightedge will not touch the front tire since the rear wheel and tire are wider than the front. Measure from straightedges to machined outer wheel surfaces to verify front wheel is centered between the straightedges.

NOTE

On late 1985 and later FLT models, the straightedges will not touch the rear tire because the front tire is slightly wider than the rear. Be sure the distance between rear wheel and straightedges is equally spaced. Measure from straightedges to rear wheel as described for FXR above.

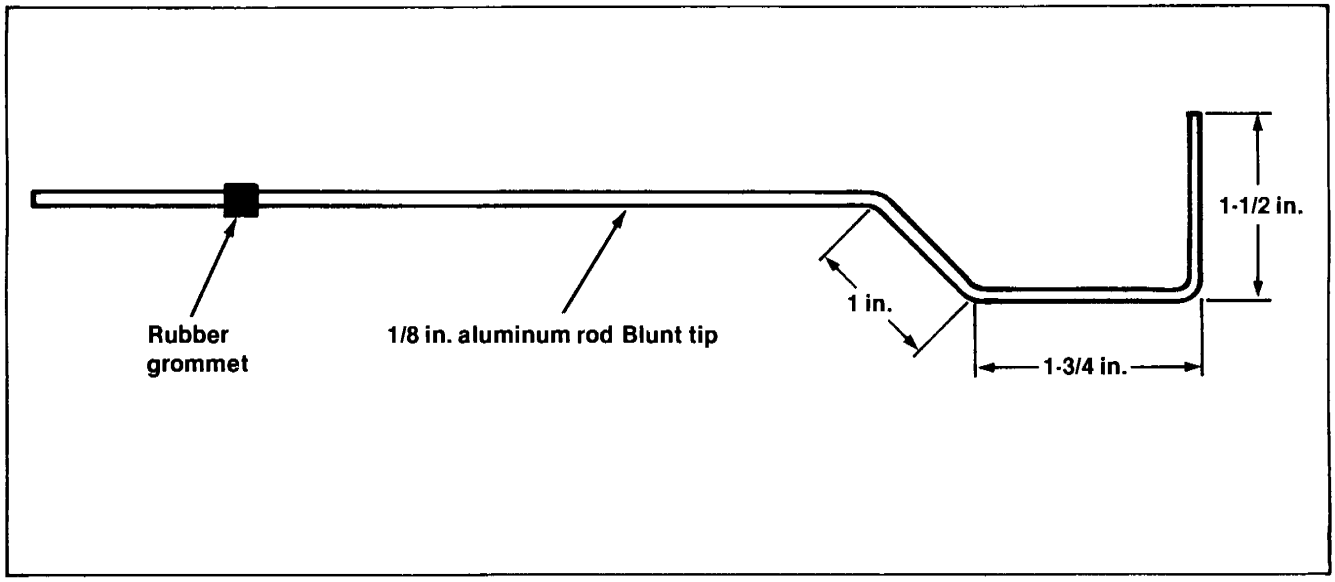
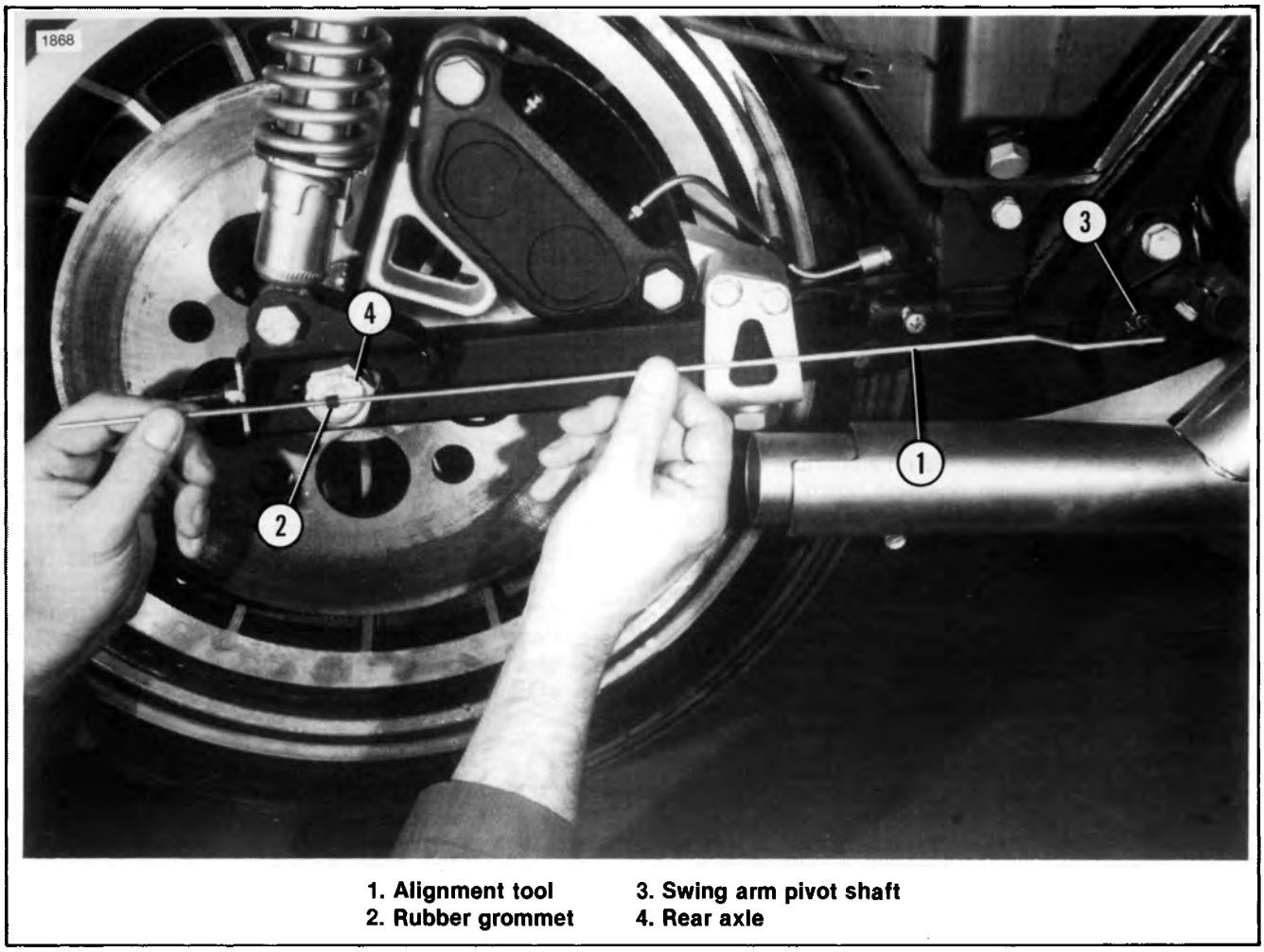


Figure 2-33. Alignment Tool



1. Alignment tool
2. Rubber grommet
3. Swing arm pivot shaft
4. Rear axle

Figure 2-34. Measuring Rear Axle to Pivot Shaft Distance

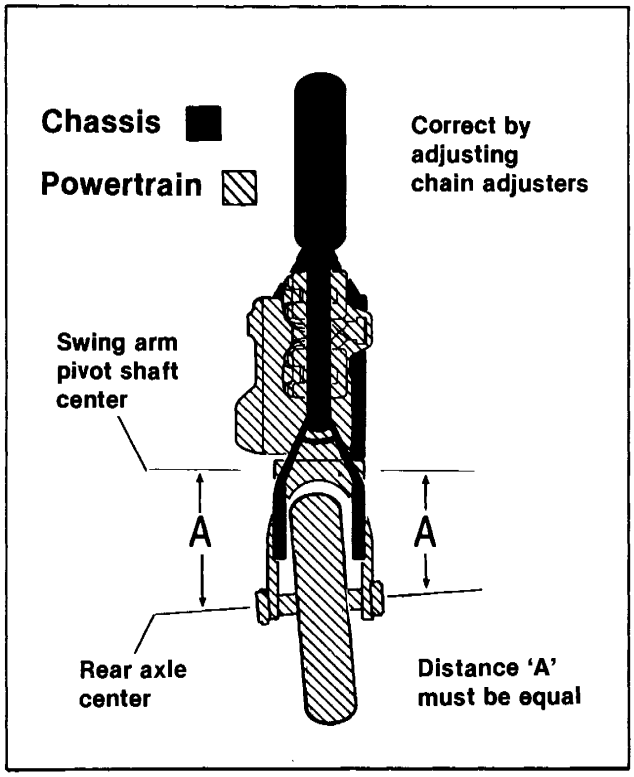


Figure 2-35. Rear Wheel Misaligned

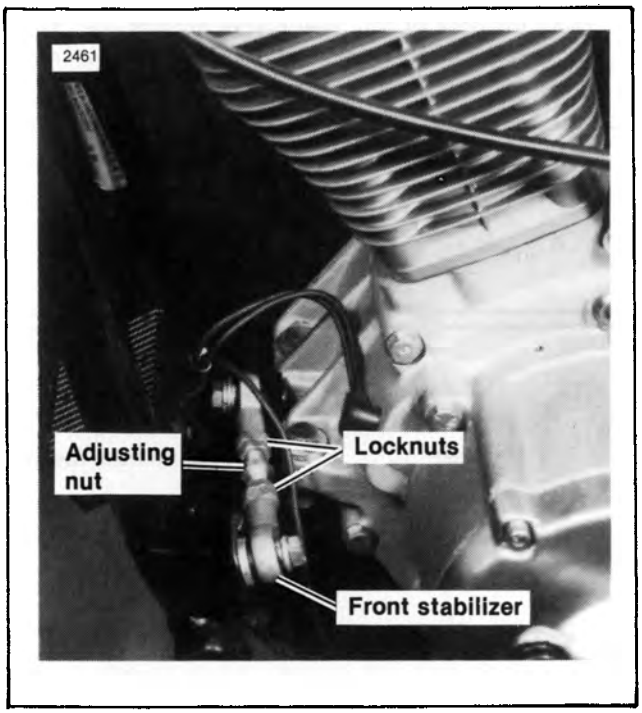


Figure 2-36. Adjusting Front Stabilizer

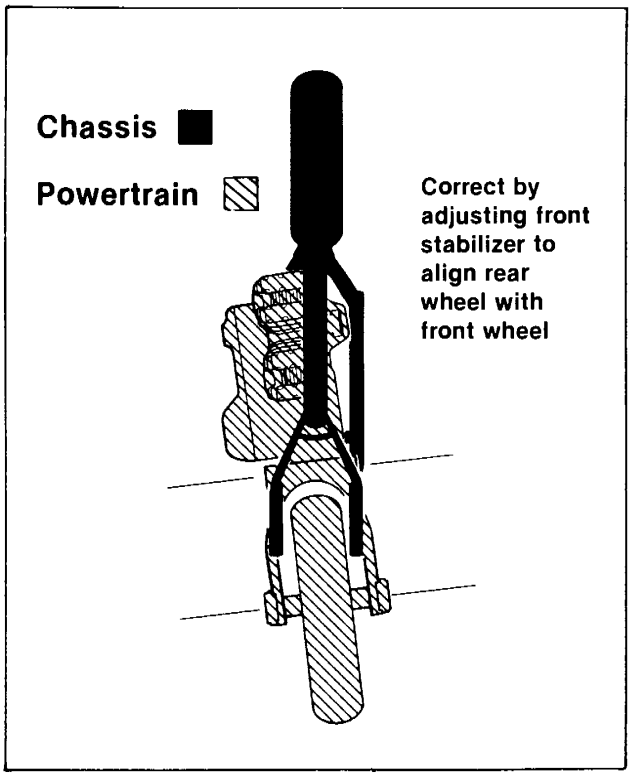


Figure 2-37. Horizontally Misaligned

12. See Figure 2-38. Loosen locknuts on top stabilizer. Adjust the top stabilizer so that the bolt removed in step 7 can be reinstalled without pushing the engine to the right or left.

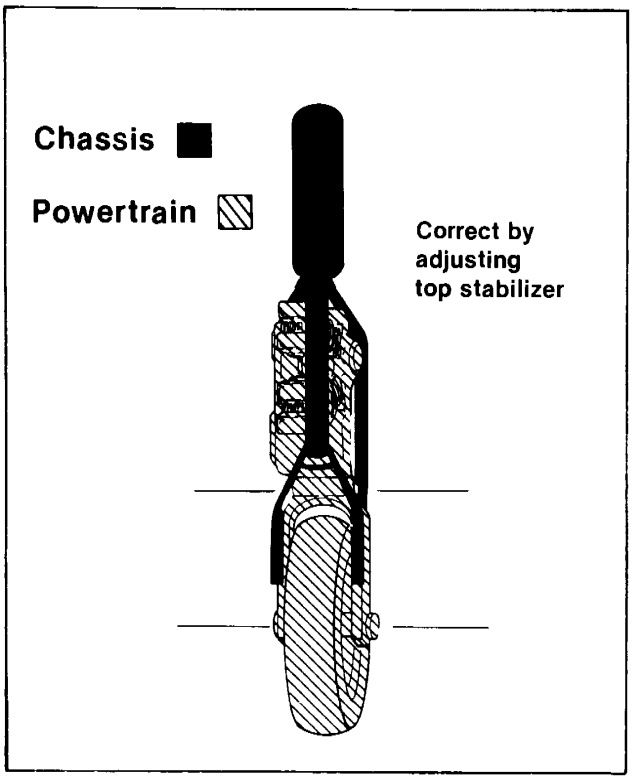


Figure 2-38. Vertically Misaligned

13. Tighten the stabilizer jamnuts on both stabilizers.

14. Install swing arm pivot shaft bracket plugs.

15. With the engine weight on the mount, check that the two mount-to-frame bolts are loose. (These bolts should have been loosened in step 10 of the VEHICLE ALIGNMENT procedure.)

16. See Figure 2-39. Push the mount outer plate from side to side until the rubber bulge feels even with the outer plate at the bottom side of the mount (equal bulge). Retighten the two mount bolts to 33-38 ft-lbs torque.

Figure 2-39. Aligning Mount Sideways

17. See Figure 2-40. Remove the long center bolt. Again, leaving the engine weight on the mount, push the top of the center sleeve fore or aft to center the rubber bulge with the outer plate fore and aft at the bottom (equal bulge).

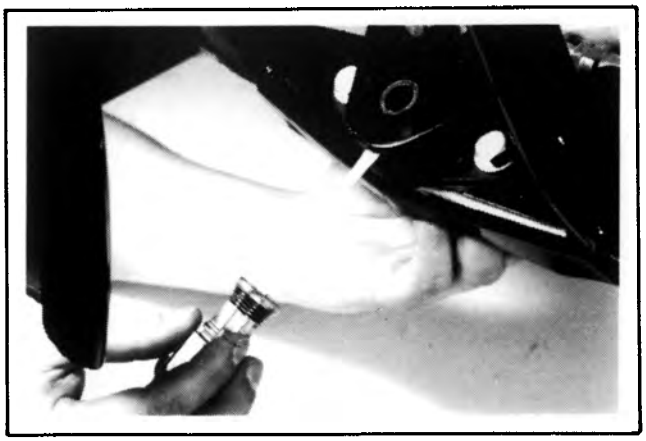


Figure 2-40. Aligning Mount Front-to-Rear

18. See Figure 2-41. With the mount now centered, insert the 3/8 in. diameter bolt and install the two washers and nut.

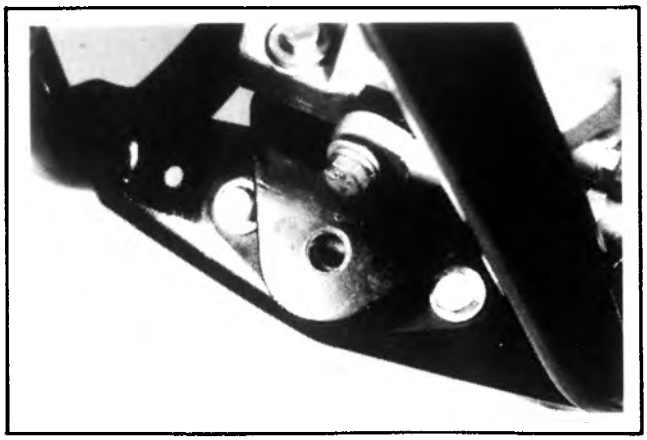


Figure 2-41. Engine Mount Aligned

ITEM	TORQUE (ft-lbs)
3/8 in. bolt Washer (2) Nut	21-27

19. Tighten the center thru-bolt to 21-27 ft-lbs torque. Check mount alignment after tightening all mount fasteners.

20. Install the voltage regulator and bracket.

21. Remove stand or blocking and lower motorcycle to floor.

NOTE

Check the stabilizers for wear every 5000 miles.

BRAKES

GENERAL

The front and rear brakes are fully hydraulic and require little maintenance. Every 2500 miles, check the master cylinders for proper fluid levels. Check brake pads and discs for wear. If brake pads are worn to 1/16 in. thick they should be replaced. Minimum brake disc thickness is stamped on the side of the disc. When filling the master cylinders, use only D.O.T. 5 HYDRAULIC BRAKE FLUID. When removing the master cylinder filler plug or cover, make sure all dirt is removed from the area to keep it from entering the reservoir. Brake master cylinders should be filled to 1/8 in. from the gasket surface with the reservoir in a level position.

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.

ADJUSTMENT

Rear Brake Pedal

FLT MODELS

Rear brake pedal must have a minimum of 2-1/4 in. clearance above footboard. Check this clearance whenever footboard, brake pedal height or master cylinder push rod free play is adjusted.

WARNING

Insufficient rear brake pedal clearance will cause the pedal to contact the footboard and interfere with rear brake operation. Insufficient push rod free play could cause dragging brakes and improper rear brake operation.

1. See Figure 2-42. After adjusting footboard, check brake pedal clearance as shown. Minimum clearance is 2-1/4 in.

2. See Figure 2-43. To change pedal height remove screw from clevis assembly (4). Remove clevis assembly from brake pedal shaft and rotate pedal to new position.

3. Install clevis assembly on shaft. Install screw and tighten to 30-35 ft-lbs torque.

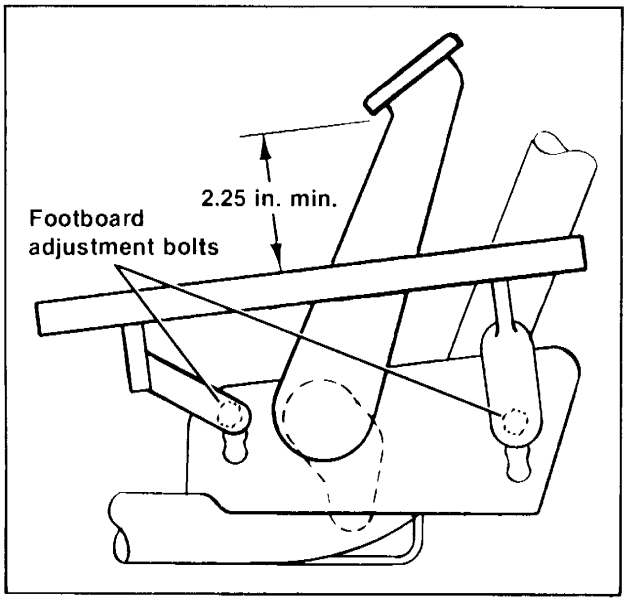
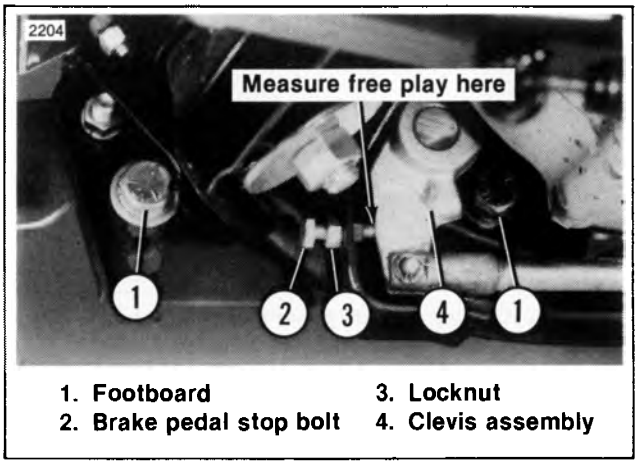


Figure 2-42. Rear Brake Pedal Clearance — FLT



1. Footboard
2. Brake pedal stop bolt
3. Locknut
4. Clevis assembly

Figure 2-43. Rear Brake Free Play Adjustment — FLT

4. Loosen locknut (3) and turn stop bolt (2) in or out to set push rod free play to 3/32-1/8 in. as measured between stop bolt and clevis assembly (4). Tighten locknut while holding stop bolt in place.

FXR MODELS, 1984 - EARLY 1987 (Except FXRD)

There are two important adjustments relating to proper FXR rear brake operation. Brake pedal height and push rod free play should both be adjusted together.

WARNING

An improperly adjusted rear brake pedal could contact the exhaust system and interfere with proper rear brake operation. An improperly adjusted rear brake push rod could cause dragging brakes or interference between brake pedal and exhaust system. Either condition could cause improper rear brake operation.

See Figure 2-44. The top of the rear brake pedal should be 4-1/8 in. to 4-3/8 in. above the centerline of the pivot shaft as shown with vehicle upright. Measure from the floor to the center of the pivot shaft then measure from the floor to the top of the brake pedal. The difference should be 4-1/8 in. to 4-3/8 in. Adjust as follows:

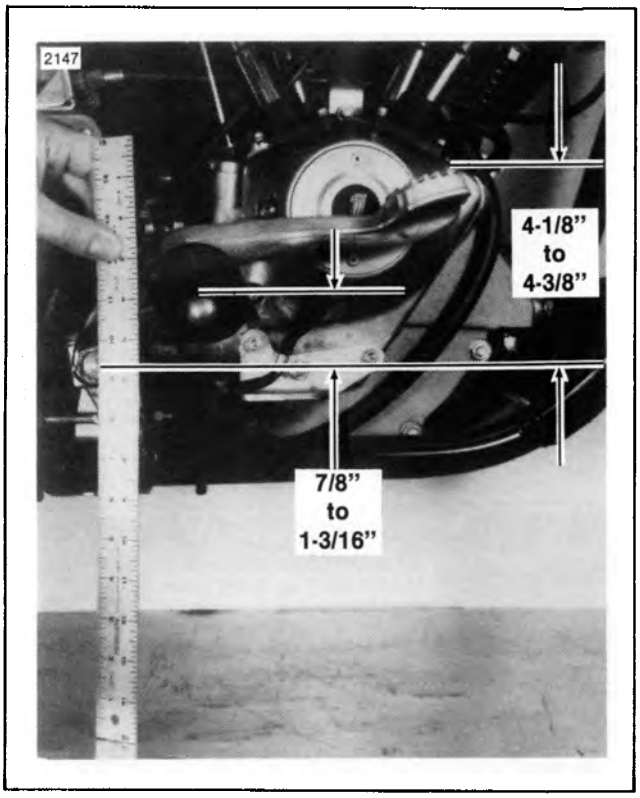


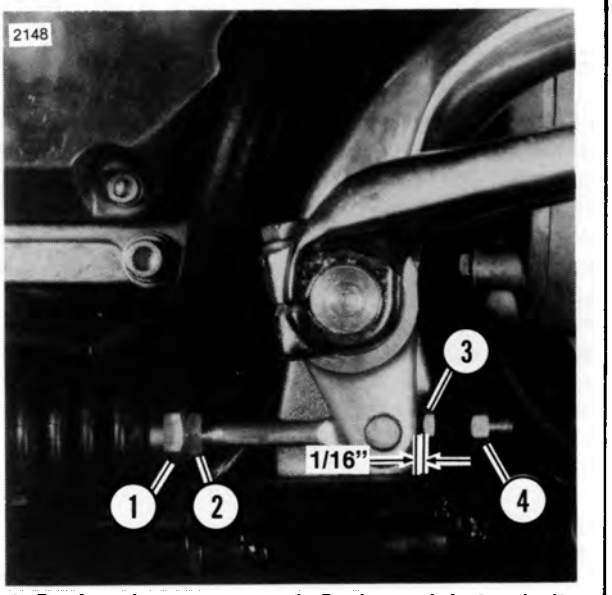
Figure 2-44. Measuring Footrest and Brake Pedal Height — FXR Models (Except FXRD)

1. Make sure pedal arm does not contact footrest bracket. Center of footrest rubber should be 7/8 in. to 1-3/16 in. ABOVE centerline of pivot shaft. Adjust footrest if necessary.

2. See Figure 2-45. Loosen locknut (4) and turn brake pedal stop bolt (3) in or out to achieve proper pedal height.

3. Tighten locknut (4) while holding brake pedal stop bolt (3) in place.

4. Push rod (1) must have 1/16 in. free play before activating master cylinder piston. Measure free play between brake pedal arm and brake pedal stop bolt (3). Loosen push rod locknut (2) and turn push rod in or out to achieve proper free play.



1. Push rod
2. Locknut
3. Brake pedal stop bolt
4. Locknut

Figure 2-45. Adjusting Brake Pedal Height and Free Play — FXR Models — 1984-Early 1987 (Except FXRD)

5. Tighten locknut (2) while holding push rod (1) in place.

FXR MODELS, LATE 1987-1990

1. See Figure 2-44. The top of the rear brake pedal should be 4-1/8 in. to 4-3/8 in. above the centerline of the pivot shaft as shown with vehicle upright. Measure from the floor to the center of the pivot shaft then measure from the floor to the top of the brake pedal. The difference should be 4-1/8 in. to 4-3/8 in. See Figure 2-46. Adjust by loosening jam nut and turning the push rod using the wrench flats on push rod.

WARNING

Do not lengthen linkage excessively or insufficient thread engagement between push rod and brake rod could cause brake loss and possible personal injury.

2. Make sure pedal arm does not contact footrest bracket. Center of footrest rubber should be 7/8 in. to 1-3/16 in. ABOVE centerline of pivot shaft. Adjust footrest if necessary.

NOTE

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

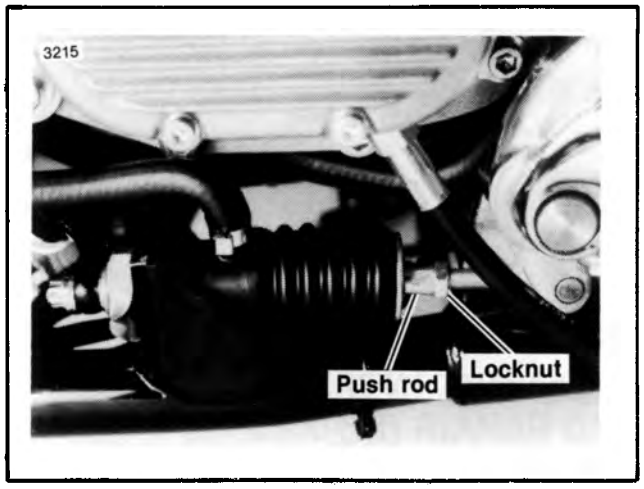
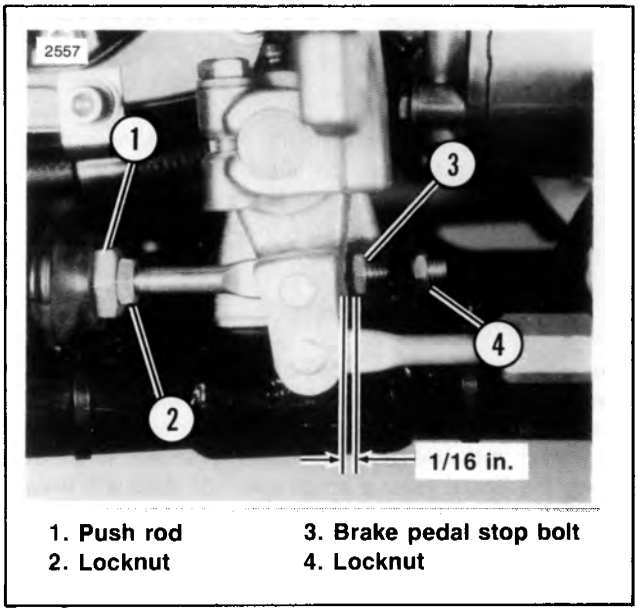


Figure 2-46. Rear Brake Pedal Linkage



1. **Push rod**
2. **Locknut**
3. **Brake pedal stop bolt**
4. **Locknut**

Figure 2-47. Adjusting Brake Pedal — FXRD

FXRD

Brake pedal height and push rod free play are two important adjustments for proper rear brake operation. Because one adjustment affects the other, the brake pedal adjustment is followed immediately by push rod adjustment.

WARNING

When adjusting brake pedal position, it is important that the pedal is not positioned to provide less than 1/16 in. push rod free play. It is also important that the pedal is in a position where full leverage can be applied with good foot-to-pedal contact. The pedal must have full travel to bottom the master cylinder without interference of the footboard. An improperly adjusted rear brake push rod could cause brakes to drag.

The brake pedal is positioned to suit the leg reach of the individual rider. The rider should sit on the vehicle and apply the brake at different pedal positions to establish which position is most comfortable and effective for the individual.

1. See Figure 2-47. Loosen locknut (4) and turn brake pedal stop bolt (3) in or out to achieve proper pedal position.

2. Tighten locknut (4) while holding brake pedal stop bolt (3) in place.

3. Push rod (1) must have 1/16 in. free play before activating master cylinder piston. Measure free play between brake pedal arm and brake pedal stop bolt (3). Loosen push rod locknut (2) and turn push rod in or out to achieve proper free play.

4. Tighten locknut (2) while holding push rod (1) in place.

FRONT BRAKE MASTER CYLINDER

GENERAL

The front hydraulic master cylinder no longer has the flapper valve which was installed between the piston and cup on earlier models. The hexagonal nylon flapper valve is no longer needed as a piston modification accomplished the same purpose.

WARNING

Installation of a flapper valve disc on master cylinders where it is not required may cause brake drag or lockup. Always after servicing the master cylinder actuate the brake lever with the reservoir cover removed. While actuating the brake lever a small spurt of fluid will break through the fluid surface if all internal components are working satisfactorily.

REMOVAL/DISASSEMBLY (Figure 2-48)

FLT Models

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

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

FXR Models

The front master cylinder on FXR models is similar to the FLT master cylinder. To remove the FXR master cylinder follow the FLT REMOVAL AND DISASSEMBLY procedure.

CLEANING, INSPECTION AND REPAIR (Figure 2-48)

FLT Models

WARNING

Do not use repair kit parts from FLT on FXR or vice versa. Parts are not interchangeable because FLT master cylinder has larger bore.

1. Whenever master cylinder is disassembled, a new repair kit (25) should be installed.
2. Clean all metal parts in a non-flammable cleaning solvent and blow dry with compressed air. Clean all rubber parts using denatured alcohol or brake fluid.

WARNING

DO NOT use gasoline or other flammable substances when cleaning the metal parts — use a non-flammable cleaning solvent. Do not use water.

Always use denatured alcohol or D.O.T. 5 HYDRAULIC BRAKE FLUID to clean the brake system rubber components. DO NOT use mineral base solvents such as gasoline or paint thinner. Use of mineral base solvents will cause deterioration of the parts that would continue after assembly. This could result in component failure.

3. Examine the cylinder walls for scratches and grooves. Do not hone or bore the cylinder.
4. Make sure vent holes in the master cylinder cover are open.
5. The gasket (3) should be replaced if torn or punctured.

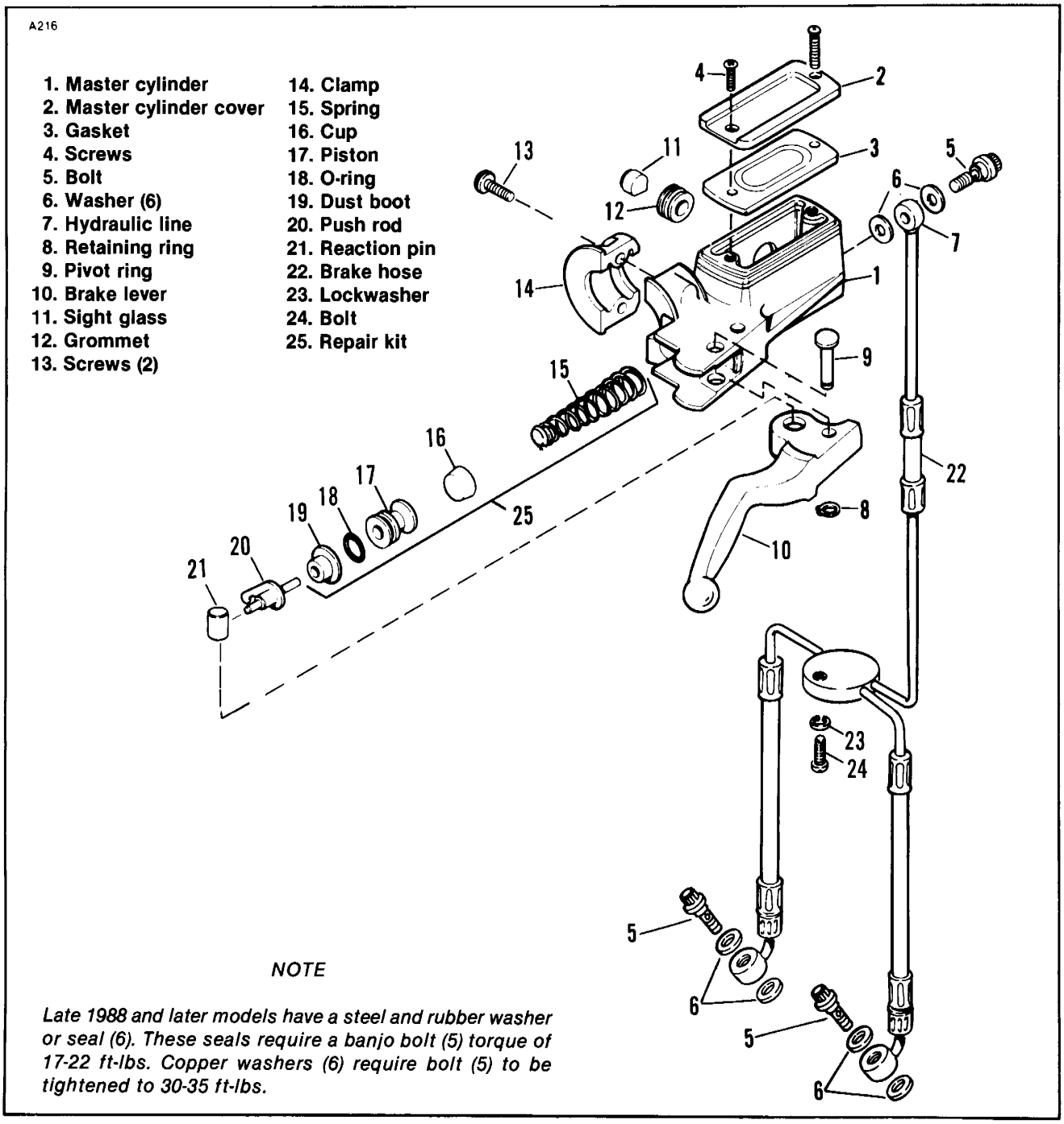


Figure 2-48. Front Hydraulic Master Cylinder — FLT Models

ASSEMBLY (Figure 2-48)

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

2. If it was removed, install grommet (12) coated with D.O.T. 5 HYDRAULIC BRAKE FLUID and sight glass (11).

3. Install spring (15), cup (16), piston and O-ring (17 and 18), dust boot (19) and push rod (20).

4. Lightly coat reaction pin (21) with Loctite ANTI-SEIZE and insert it into the large hole in the brake lever (10). Assemble the brake lever to the master cylinder assembly (1) using pivot pin (9) and retaining ring (8). Make sure the push rod (20) fits into hole in reaction pin (21). Check front brake for proper operation. There should be no free play in the hand lever. A slight preload is permissible.

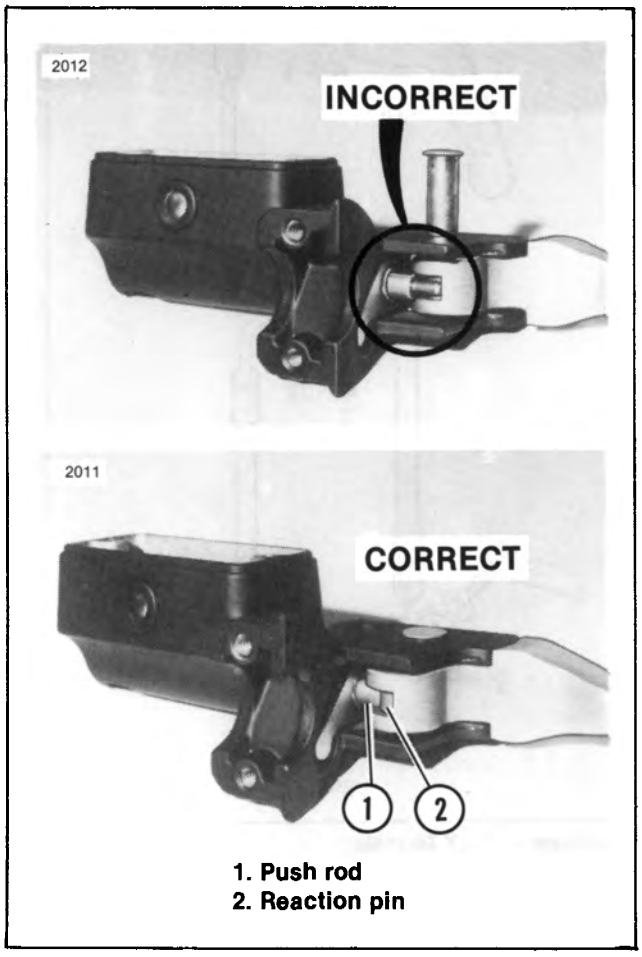
INSTALLATION (Figure 2-48)

WARNING

See Figure 2-49. Ensure that push rod (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 is hitting the inside master cylinder wall. Binding of the hand lever can result in an inoperable front brake.

NOTE

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



1. Push rod
2. Reaction pin

Figure 2-49. Front Brake Hand Lever Assembly

1. Install master cylinder to handlebar by installing clamp (14) and screws (13) making sure master cylinder is tight against switch housing. Tighten screws to 18-24 in-lbs torque.

CAUTION

Early banjo washers were made of zinc coated copper. Later washers were steel with a rubber O-ring at the inside diameter. It is important that the replacement washers are the same type as the ones removed. The banjo bolt is designed for a particular type washer and interchanging washers can cause brake line leakage.

2. Install new washers (6), bolt (5) and hydraulic brake line (7) into master cylinder. Tighten bolt to 35-40 ft-lbs torque if copper washers are used. Tighten bolt (5) to 17-22 ft-lbs torque if steel and rubber washers are used.

CAUTION

To avoid leakage, make sure washers (6), bolt (5), hydraulic brake line (7) and master cylinder bore (1) are free of D.O.T. 5 HYDRAULIC BRAKE FLUID, dirt and metal chips before assembly. Do not allow the hydraulic brake line to rotate while tightening the bolt.

NOTE

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

3. 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. Squeezing the hand lever should produce a slight spurt of fluid from a properly operating relief port. A blocked relief port can result in an inoperable front brake.

NOTE

Screws (4) are of different lengths. The short one should go to the rear of the reservoir.

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

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

6. 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 MASTER CYLINDER — FLT MODELS

DISASSEMBLY (Figure 2-50)

The fluid reservoir is located under the left side cover. The master cylinder (9) is bolted to the lower right frame tube. Disassemble as follows:

1. Remove screws (1), cover (2) and gasket (3) from the reservoir (4). Remove clamp and hose (7) from fitting (8) and drain fluid from reservoir.
2. Remove brake line (29) or (31) and wire connector from stop light switch (28). Remove bolts (10), washers (11) and locknuts (12). Remove master cylinder (9) and continue disassembly on a clean work bench.
3. Remove retaining ring (18), piston and O-ring (16 and 17), piston cup (15), stop (14) and spring (13).

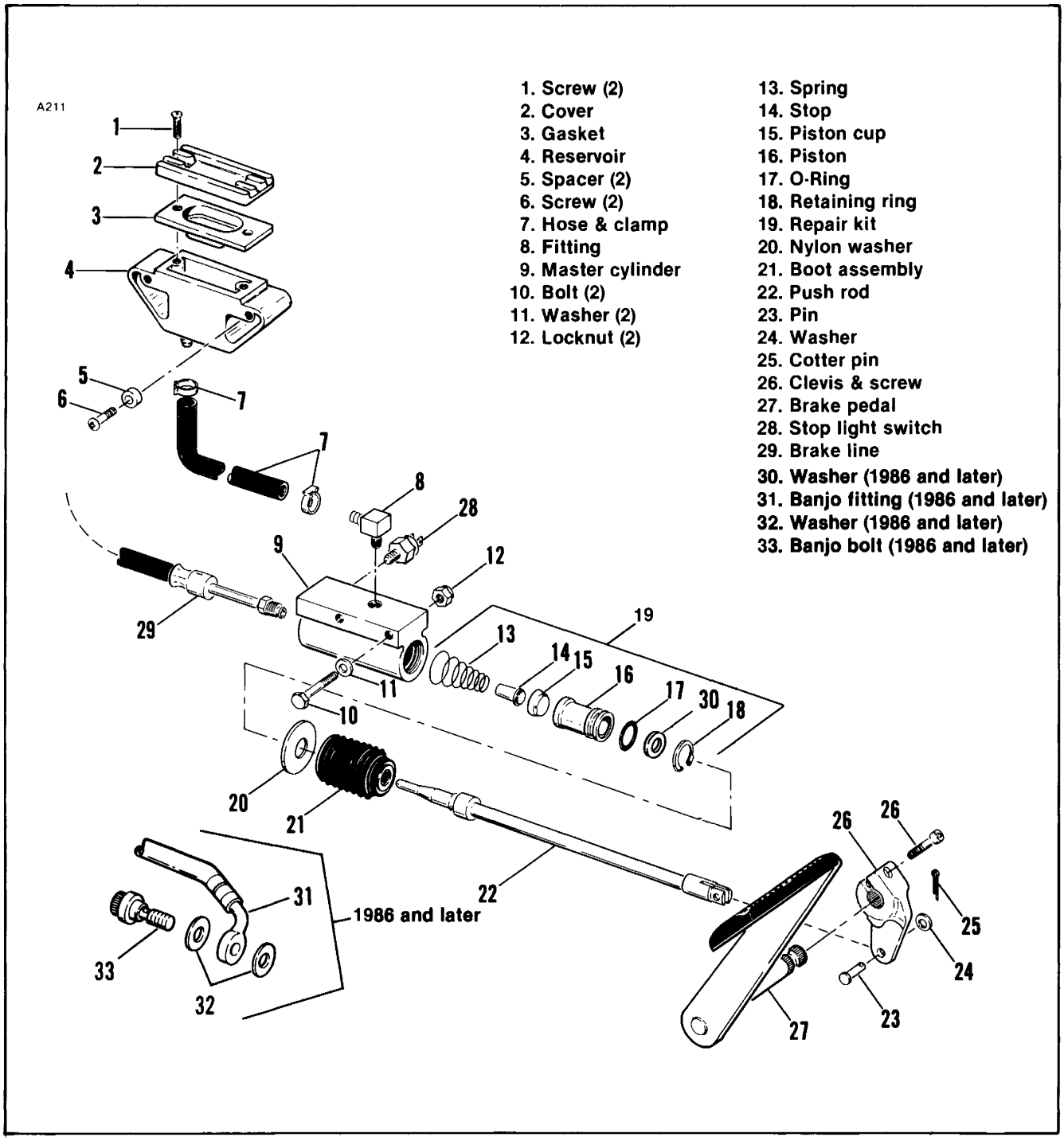


Figure 2-50. Rear Master Cylinder — FLT

CLEANING, INSPECTION AND REPAIR (Figure 2-50)

1. Whenever master cylinder is disassembled, a new repair kit (19) should be installed.

WARNING

DO NOT use gasoline or other flammable substances when cleaning the metal parts — use a non-flammable cleaning solvent. Do not use water.

Always use denatured alcohol or D.O.T. 5 HYDRAULIC BRAKE FLUID to clean the brake system rubber components. DO NOT use mineral base solvents such as gasoline or paint thinner. Use of mineral base solvents will cause deterioration of the parts that would continue after assembly. This could result in component failure and possible vehicle accident.

2. Clean all metal parts in a non-flammable cleaning solvent and blow dry with compressed air. Clean all rubber parts using denatured alcohol or brake fluid.

3. Inspect cylinder bore for scratches and grooves and replace if necessary. Do not hone or bore the cylinder.

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

5. Make sure push rod (22) and brake pedal (27) are not bent. Replace bent parts.

ASSEMBLY (Figure 2-50)

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

2. Install spring (13), stop (14), and piston cup (15), into master cylinder bore. Install O-ring (17) on piston (16) and insert into master cylinder bore. Install retaining ring (18) and washer (1986 and later vehicle).

3. Install boot assembly (21) and nylon washer (20) on push rod (22). Insert push rod into end of master cylinder piston and install master cylinder on frame using bolts (10), washers (11) and locknuts (12). Tighten bolts to 155-190 in-lbs torque.

WARNING

On 1986-1988 FLT models do not use steel and rubber banjo washers (32). The outer diameter of the steel and rubber washer will rest on the lip surrounding the spotface on the rear of the master cylinder and could cause a leak and reduced braking. Use copper sealing washers and tighten them to a torque of 30-35 ft-lbs.

4. On 1984 and 1985 models install brake line (29) and tighten fitting to 70-80 in-lbs. On 1986-1988 models install brake line (31) using new copper washers (32). Tighten bolt (33) to 30-35 ft-lbs (See above WARNING).

CAUTION

Early banjo washers were made of zinc coated copper. Later washers were steel with a rubber O-ring at the inside diameter. It is important that the replacement washers are the same type as the ones removed. The banjo bolt is designed for a particular type washer and interchanging washers can cause brake line leakage.

5. On 1989 and later models, install brake line (31) using new steel and rubber washers. Tighten bolt (33) to 17-22 ft-lbs.

6. Route hose (7) through hose guide clip on frame and connect to fitting (8) using a new clamp.

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

8. Install gasket (3), cover (2) and screws (1). Tighten screws to 8-14 in-lbs torque.

9. Check and adjust brake pedal clearance above footboard and push rod free play as described under ADJUSTMENT, Brake Pedal given earlier in this section.

REAR MASTER CYLINDER
1984 - EARLY 1987 FXR MODELS

DISASSEMBLY (Figure 2-51)

The rear brake control system consists of the brake pedal assembly (18), master cylinder (7) and fluid reservoir (4). Disassemble as follows:

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) and wire connector from stop light switch (19). Remove mounting bolts (8) and washers (22). Master cylinder may now be removed and disassembled on a clean work bench.

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

CLEANING, INSPECTION AND REPAIR (Figure 2-51)

1. Whenever master cylinder is disassembled, a new repair kit (21) should be installed.

WARNING

DO NOT use gasoline or other flammable substances when cleaning the metal parts — use a non-flammable cleaning solvent. Do not use water.

Always use denatured alcohol or D.O.T. 5 HYDRAULIC BRAKE FLUID to clean the brake system rubber components. DO NOT use mineral base solvents such as gasoline or paint thinner. Use of mineral base solvents will cause deterioration of the parts that would continue after assembly. This could result in component failure.

2. Clean all metal parts in a non-flammable cleaning solvent and blow dry with compressed air. Clean all rubber parts using denatured alcohol or brake fluid.

3. Inspect cylinder bore for scratches and grooves and replace if necessary. Do not hone or bore the cylinder.

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

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

ASSEMBLY (Figure 2-51)

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

2. Install spring (9), stop (10) and piston cup (11) in master cylinder bore. Install seat (13) on piston (12) and insert into master cylinder bore. Install retaining ring (14).

3. 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) and washers (22). Tighten bolts to 13-16 ft-lbs torque.

4. Install brake line (20) tightening 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 ADJUSTMENT given earlier in this section.

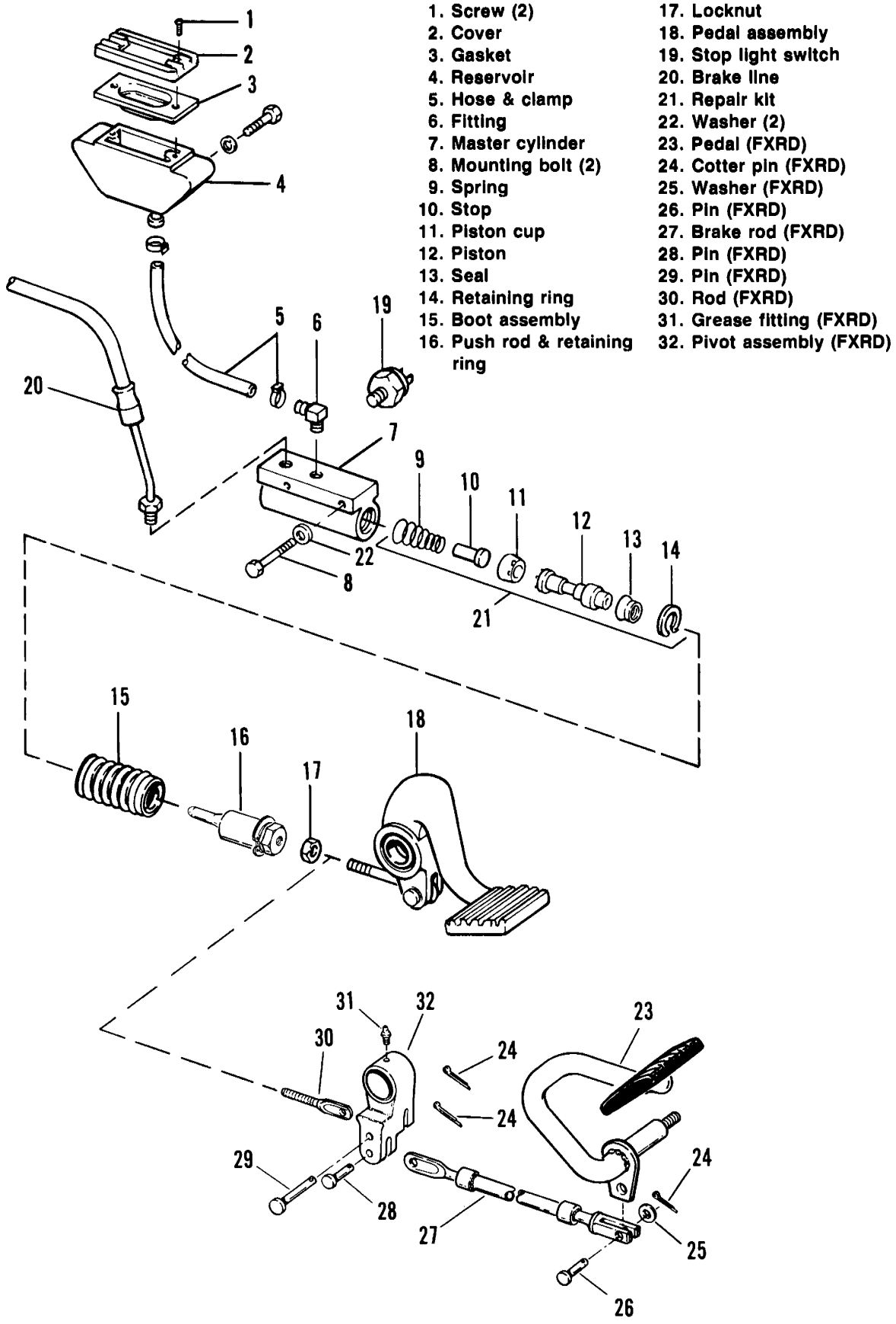


Figure 2-51. Rear Brake Control — 1984 - Early 1987 FXR Models

REAR MASTER CYLINDER
LATE 1987 AND LATER FXR MODELS

GENERAL

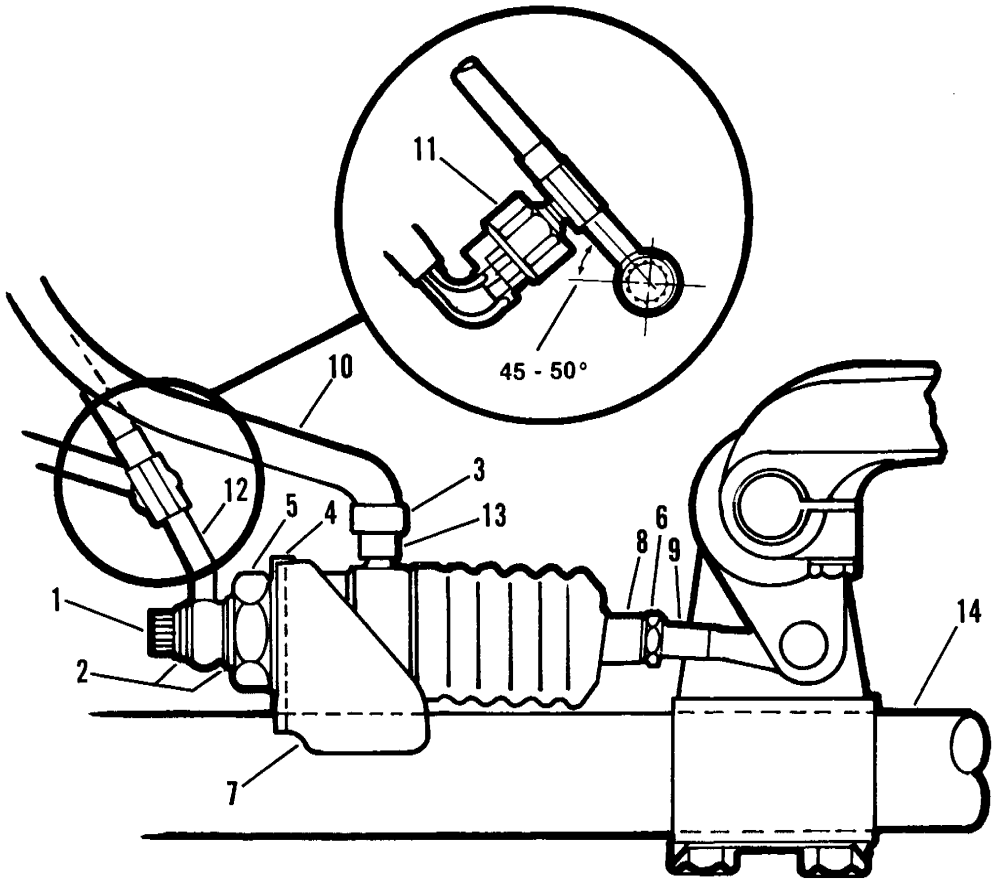
Late 1987 and later model motorcycles are equipped with the Hayes rear brake system. The new Hayes rear brake system can easily be identified by the banjo fittings on the brake line ends at the master cylinder and the rear caliper.

CAUTION

When removing hose clamp and reservoir hose (in next step), do not use excessive side force on master cylinder nipple to avoid breaking nipple. Do not allow brake fluid to remain on painted surfaces as it will damage paint. Wipe brake fluid from painted surfaces if any is spilled.

REMOVAL (Figure 2-52)

1. Remove banjo bolt (1) and washers (2). Discard washers.
2. Remove reservoir hose clamp (3) and reservoir hose (10). Drain brake fluid from reservoir.



1. Banjo bolt
2. Washers (2)
3. Hose clamp
4. Lockplate
5. Nut
6. Jam nut
7. Bracket
8. Push rod
9. Brake rod
10. Reservoir hose
11. Brake light switch
12. Brake line
13. Nipple
14. Frame

Figure 2-52. Master Cylinder Mounting - Late 1987 and Later

3. Pry lockplate (4) from flat on nut (5) and remove master cylinder mounting nut (5).

4. Loosen jam nut (6) on threaded brake rod and raise pedal to move master cylinder forward and out of frame bracket (7).

5. Rotate master cylinder to unscrew push rod (8) from brake rod (9). (Wrench flats on push rod allow a wrench to be used if needed).

CLEANING/DISASSEMBLY

1. Clean exterior of master cylinder with denatured alcohol.

2. See Figure 2-53. Thread banjo bolt (1) into the cartridge body (2).

CAUTION

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

3. Remove boot (3) from groove in reservoir adapter (4). Set master cylinder upright with banjo bolt resting on bench and push reservoir adapter (4) down and off the cartridge body (2).

4. Protect cartridge body from dirt or grease.

5. Press down on large washer (5) to compress return spring (6), keep spring compressed and remove retaining ring (7) from groove in push rod (8).

6. Carefully release spring (6) and remove washer (5), boot (3), spring retainer (9) (inside boot) and spring (6).

7. Remove and discard retaining ring (10) from bore of cartridge body (2) and remove push rod (8) and washer (11).

NOTE

Do not disassemble cartridge body (2). The cartridge body (2) contains the piston and associated components. These parts are not sold; therefore, replace the cartridge body if piston seal leakage is evident.

CLEANING, INSPECTION AND REPAIR (Figure 2-53)

WARNING

DO NOT use gasoline or other flammable substances when cleaning the metal parts — use a non-flammable cleaning solvent. Do not use water.

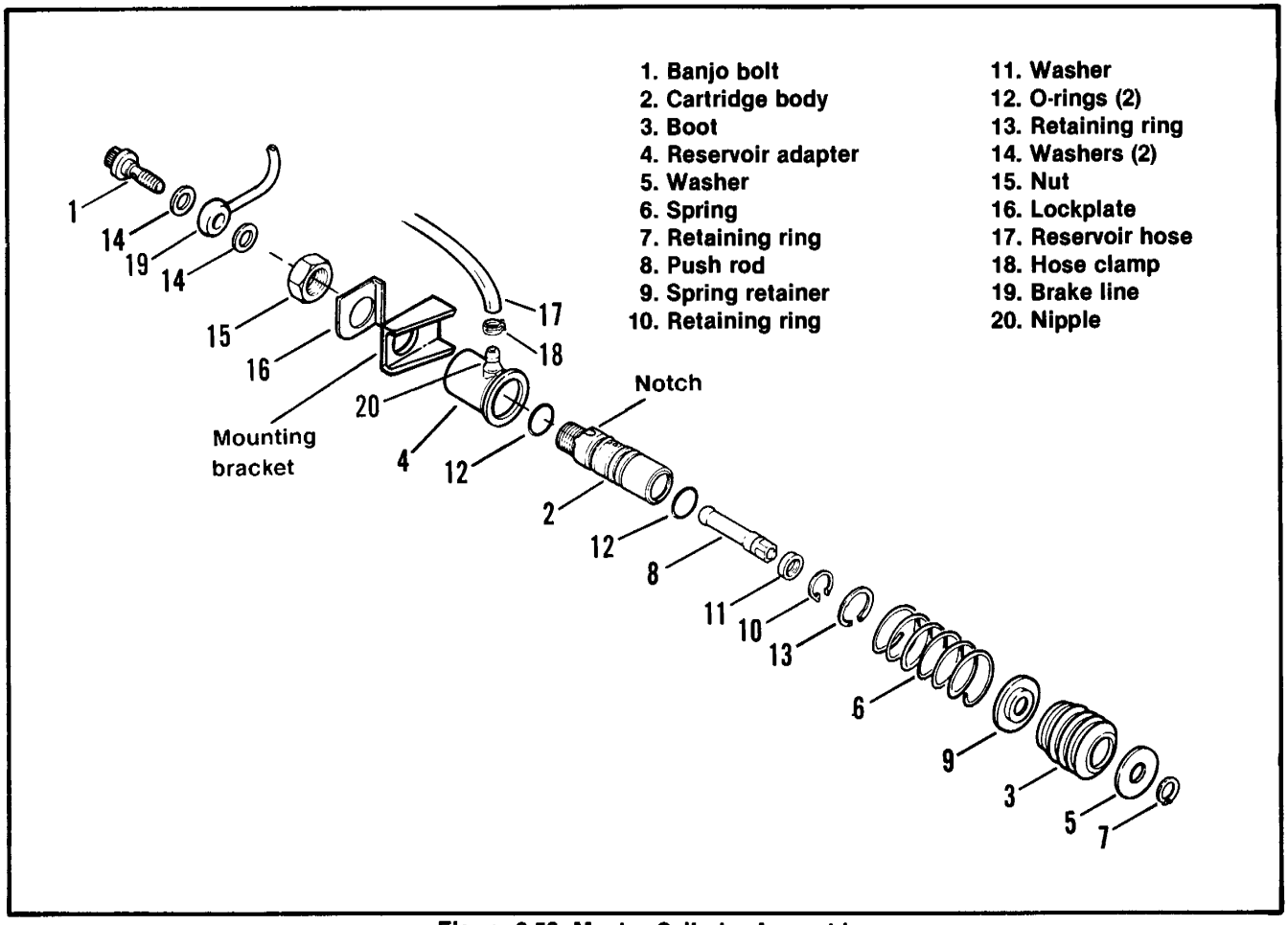


Figure 2-53. Master Cylinder Assembly

Always use denatured alcohol or D.O.T. 5 HYDRAULIC BRAKE FLUID to clean the brake system rubber components. DO NOT use mineral base solvents such as gasoline or paint thinner. Use of mineral base solvents will cause deterioration of the parts that would continue after assembly. This could result in component failure.

1. Clean all metal parts, except cartridge assembly (2), in a non-flammable cleaning solvent and blow dry with compressed air. Clean all rubber parts using denatured alcohol or brake fluid.
2. Inspect reservoir adapter (4) bore for scratches. Replace if scratches are present.
3. Check boot (3) for tears and replace if any exist.
4. Inspect threads on cartridge body (2), push rod (8) and banjo bolt (1). Replace any part with damaged threads. Inspect spring for cracks or broken coils — replace if any exist.
5. Carefully remove large O-rings (12) from cartridge body (2). Do not scratch O-ring grooves. Clean grooves with soft cotton cloth moistened with alcohol. Inspect grooves for scratches and dirt. Remove dirt or replace cartridge body if grooves are scratched.

ASSEMBLY (Figure 2-53)

1. Lubricate two O-rings (12) with DOT-5 brake fluid and install in O-ring grooves on cartridge body (2).
2. Lubricate bore of reservoir adapter (4) with DOT-5 brake fluid and align nipple on reservoir adapter with notch on threaded end of cartridge body.
3. Insert cartridge body (2) into reservoir adapter (4). Using hand-pressure only, press cartridge body into adapter making sure notch on cartridge body engages lug inside bore of the adapter.
4. Thread banjo bolt (1) into cartridge body (2) and stand master cylinder upright with banjo bolt resting on bench.
5. Place washer (11) on push rod (8).
6. Place a new retaining ring (10) on push rod (8), insert ball-end of push rod into piston and push piston downward with push rod until retaining washer (11) is properly seated in the cartridge bore.
7. Install the new retaining ring (10) in groove inside cartridge bore. Make certain retaining ring is fully seated in groove.
8. Release downward pressure on push rod and check that push rod rotates freely.
9. Install retaining ring (13) in groove on cartridge body.

   Install on push rod: return spring (6), spring retaining washer (9) (large cupped side toward spring), boot, with drain hole down, and washer (5).
10. Press down on washer (5) and install retaining ring (7) in push rod groove.
11. Seat sealing lip of boot into groove on reservoir adapter.

INSTALLATION (Figure 2-52)

1. Thread push rod (8) on brake rod (9) by rotating master cylinder assembly. Do not tighten jam nut (6).
2. Raise brake pedal and guide threaded end of master cylinder through hole in bracket (7). Make sure the square body of the master cylinder is engaged in the square hole of the mounting bracket. The reservoir nipple must be pointed upward.
3. Place lockplate (4) on threaded end of master cylinder with lip of lockplate over bracket (7).
4. Install nut (5) and tighten to 30-40 ft-lbs torque. Bend lockplate over flat on nut.

CAUTION

Early banjo washers were made of zinc coated copper. Later washers were steel with a rubber O-ring at the inside diameter. It is important that the replacement washers are the same type as the ones removed. The banjo bolt is designed for a particular type washer and interchanging washers can cause brake line leakage.

5. Install brake line (12) using banjo bolt (1) and new washers (2). Position brake line at 45-50° from horizontal and tighten banjo bolt to 30-35 ft-lbs torque if copper washers are used or 17-22 ft-lbs if steel and rubber washers are used.

CAUTION

Do not use excessive side force installing hose and clamp in next step. Use of excessive force could break nipple.

6. Install reservoir hose (10) and secure with hose clamp (3).
7. Adjust brake pedal height by following the procedure given under ADJUSTMENT, Rear Brake Pedal, FXR MODELS — LATE 1987-1988.
8. Fill reservoir with DOT-5 brake fluid and bleed system as covered in BLEEDING THE HYDRAULIC SYSTEM section that follows the rear caliper section.

FRONT BRAKE CALIPER

GENERAL

The vehicles may have single or dual calipers depending on the model and the model year. Any differences between right and left calipers are covered in the following procedures.

REMOVAL/DISASSEMBLY (Figures 2-54, 2-55)

1. Disconnect the brake line at the caliper fitting.
2. Remove the upper mounting bolt (1) and the lower mounting pin (2) to release the caliper assembly from the vehicle.
3. Move the caliper assembly to a clean bench area and remove 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.

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.

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

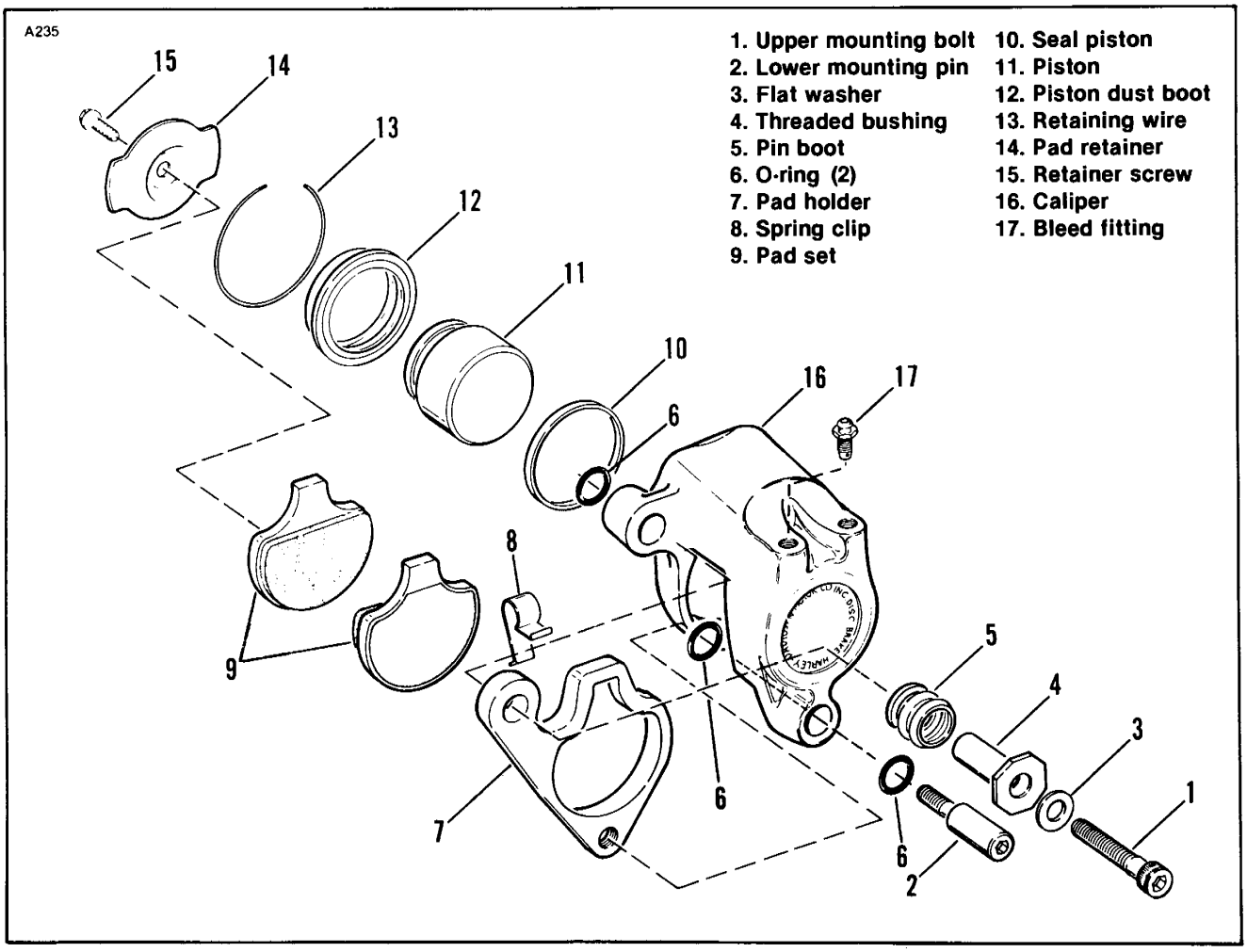


Figure 2-54. Front Brake Caliper (left)

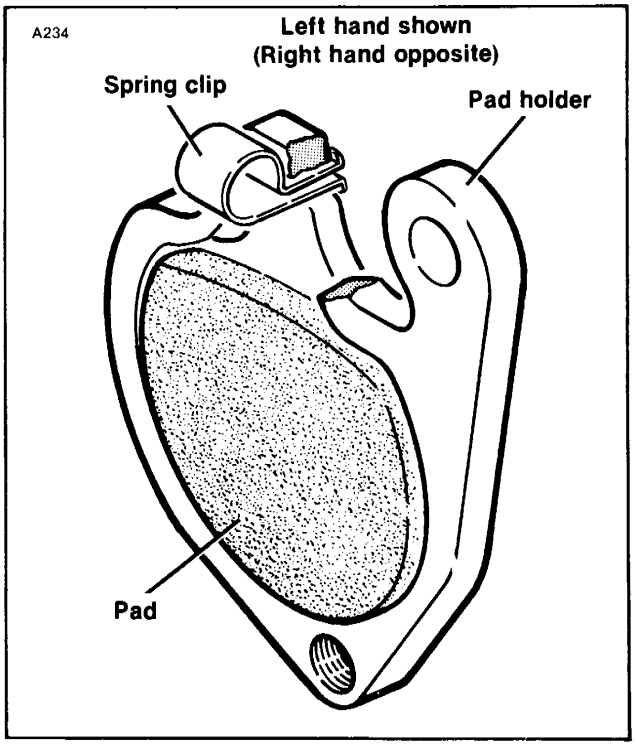


Figure 2-55. Spring Clip Installation

CLEANING, INSPECTION AND REPAIR (Figure 2-54)

If brake pads are worn to 1/16 in. or less of fiber material, 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 pairs.

Inspect all components carefully for excessive wear or damage.

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.

ASSEMBLY (Figures 2-54, 2-55)

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

1. Apply a coating of D.O.T. 5 HYDRAULIC BRAKE FLUID to the exterior surfaces of seal (10). Install seal (10) and O-rings (6) in their respective grooves. Lightly coat the cavity of pin boot (5) with Dow Corning 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 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. If the caliper is right hand, the upper mounting bolt hole must be positioned at the upper left. If the caliper is left hand, the upper mounting bolt hole must be positioned at the upper right.

8. See Figure 2-55. Install the spring clip at the top of pad holder.

9. Take pad (9), the pad that has the insulator backing, and place it on top of the spring clip (8) with the lower end of the pad slightly entering the opening of the pad holder (7). 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 (8).

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 regardless of right or left hand sides. 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 15-20 in-lbs.

INSTALLATION (Figures 2-54, 2-56)

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

WARNING

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

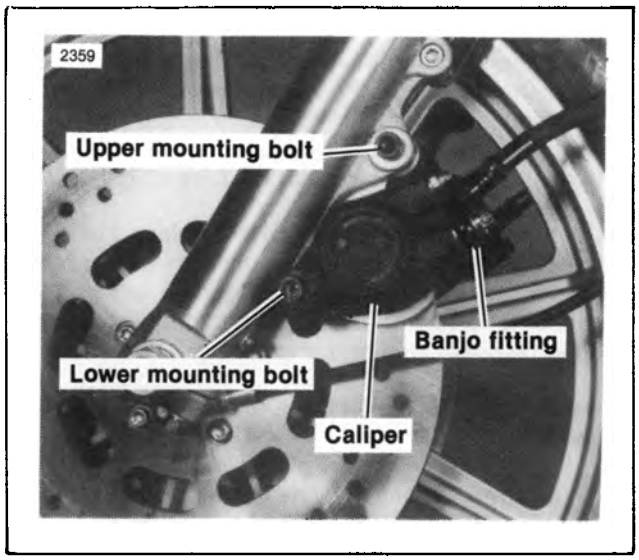


Figure 2-56. Front Brake Caliper Mounting

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 holes 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.

CAUTION

Early banjo washers were made of zinc coated copper. Later washers were steel with a rubber O-ring at the inside diameter. It is important that the replacement washers are the same type as the ones removed. The banjo bolt is designed for a particular type washer and interchanging washers can cause brake line leakage.

7. Using new banjo washers, connect the brake line to the caliper. Torque banjo bolt to 30-35 ft-lbs if copper washers are used or 17-22 ft-lbs if steel and rubber washers are used.

8. With master cylinder nearly level, fill reservoir with D.O.T. 5 HYDRAULIC BRAKE FLUID to 1/8 in. below top. Reservoir may be filled with bladder type pressurized equipment. See BLEEDING 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. Install 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 — 1984 to 1985 FLT MODELS

REMOVAL (Figure 2-57)

1. Remove the bolts (9), washers (10), pins (11) spring washers (12), and seals (14).

2. Remove the caliper (1), plates (16), brake pads (17) and springs (15).

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 (21). Be careful not to lose the brake hose seat (8). Remove the pistons (18), dust boots (20) and seals (19). If the pistons will not come loose, use the following method:

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.

Disconnect the brake hose (21) at the caliper. Place the caliper on a workbench with the pistons facing downward. Place a clean 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.

CLEANING, INSPECTION AND REPAIR (Figure 2-57)

1. If the brake pads are worn to 1/16 in. or less of friction material, 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 seals (19) and piston boots (20) if removed from caliper bore. Do not hone or bore cylinder.

WARNING

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

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

WARNING

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

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

ASSEMBLY (Figure 2-57)

1. Dip all internal components in D.O.T. 5 HYDRAULIC BRAKE FLUID before assembly.

2. If the pistons were removed, install new seals (19) in caliper bore. Push the pistons all the way into the caliper bores. Install the dust boots (20).

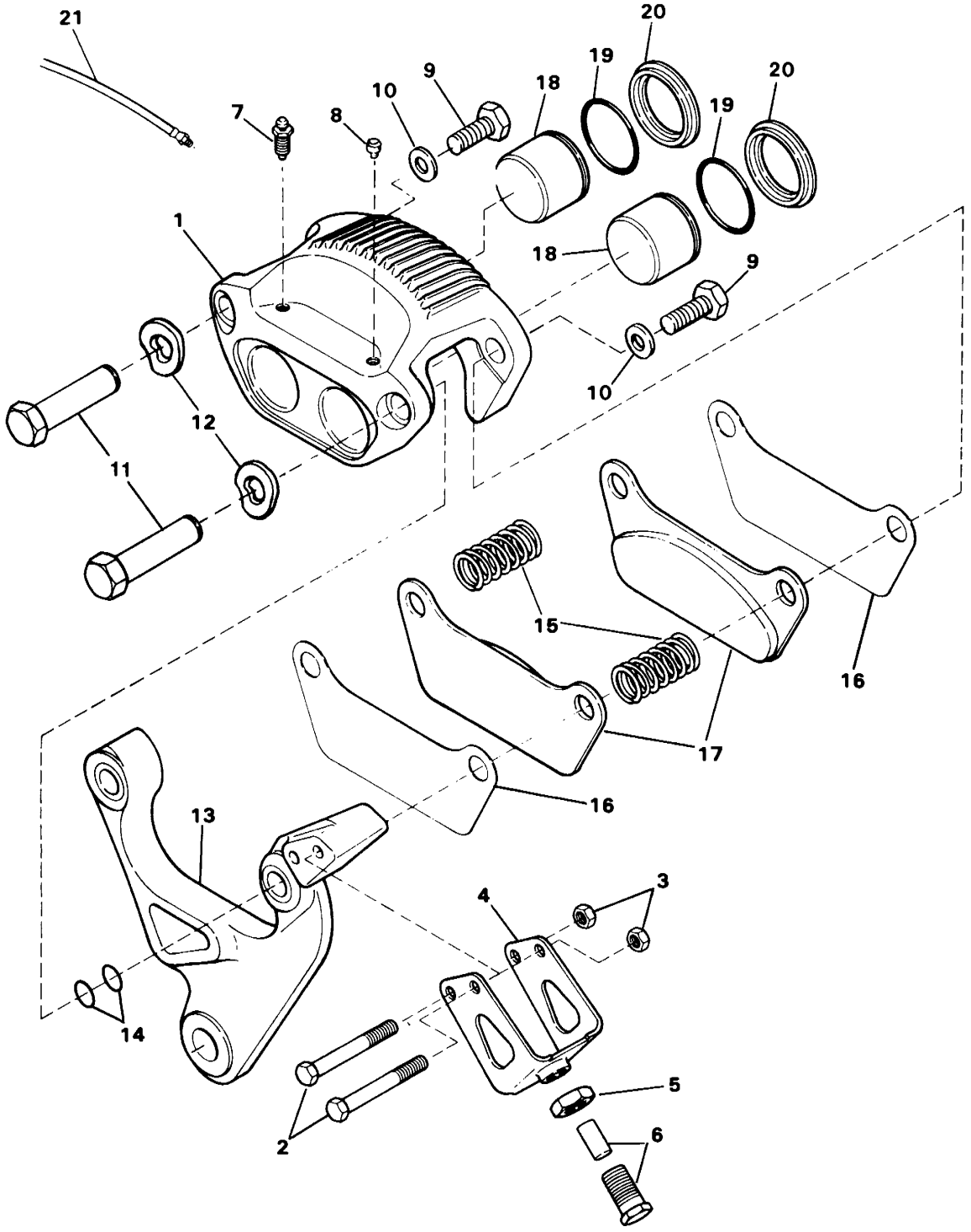
INSTALLATION (Figure 2-57)

1. Install the caliper (1), plates (16), brake pads (17) and springs (15) onto the mounting bracket (3). Make sure brake disc is between pads.

2. Install the seals (14). Coat the pins (11) and bores in the bracket (13) with Loctite ANTI-SEIZE LUBRICANT. Install the pins (11), spring washers (12), washers (10) and bolts (9). Tighten bolts to 12-15 ft-lbs torque.

3. Install the brake hose seat (8) and brake hose (21) if removed.

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



1. Brake caliper
2. Mounting bolt (2)
3. Mounting nut (2)
4. Brake anchor
5. Locknut
6. Bolt with spacer
7. Bleeder fitting
8. Brake hose seat
9. Pin bolts (2)
10. Pin washer (2)
11. Pin (2)
12. Spring washer (2)
13. Mounting bracket
14. Seal (4)
15. Spring (2)
16. Plate (2)
17. Brake pad (2)
18. Piston (2)
19. Seal (2)
20. Dust boot (2)
21. Brake hose

Figure 2-57. Rear Caliper — 1984, 1985 FLT Models

REAR BRAKE CALIPER — 1986 AND LATER FLT MODELS

REMOVAL/DISASSEMBLY (Figure 2-58)

1. Remove right saddlebag.
2. Remove right side cover.
3. Remove battery and battery carrier.
4. Remove pin bolts (11) and carefully lift caliper (10) off of brake disc and brake pads.
5. Remove retainer clip (13). Slide outside brake pad off mounting bracket toward saddlebag carrier. Slide inside caliper off mounting bracket toward wheel.
6. Remove pad shims (3).

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.

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

WARNING

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

Disconnect the brake hose at the caliper. Place the caliper on a workbench with the piston facing downward. Place a clean 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.

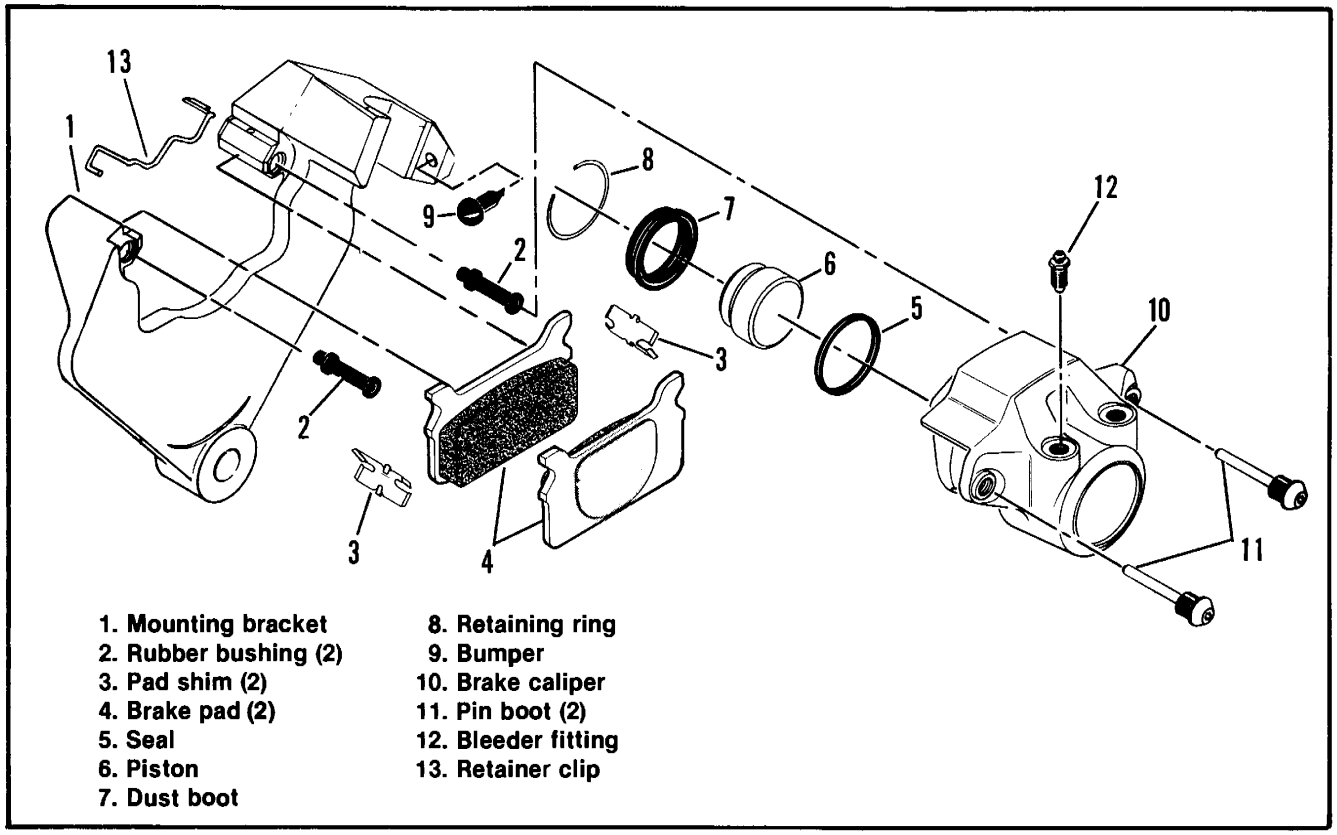
CLEANING, INSPECTION AND REPAIR (Figure 2-58)

1. If the brake pads are worn to 1/16 in. thick or less of friction material, 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 (5) and piston boot (7) if removed from caliper bore. Replace rubber bushing (2) if damaged or worn. Do not hone or bore cylinder.



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

Figure 2-58. Rear Caliper — 1986 and later FLT Models

WARNING

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

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

WARNING

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

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

ASSEMBLY (Figure 2-58)

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

CAUTION

Make sure piston side pad is on the pad shim. Operation of the motorcycle with the pad off the shim will result in rear brake pad drag, uneven pad wear and damage to the mounting bracket.

2. From wheel side of brake disc, slide one brake pad (4)over pad shims (3). Slide second brake pad over pad shims (3) from saddlebag carrier side. Insert retainer clip (13) in holes in mounting bracket (1) and bring clip over the top of outer pad (4) as shown in Figure 2-59.

NOTE

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

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

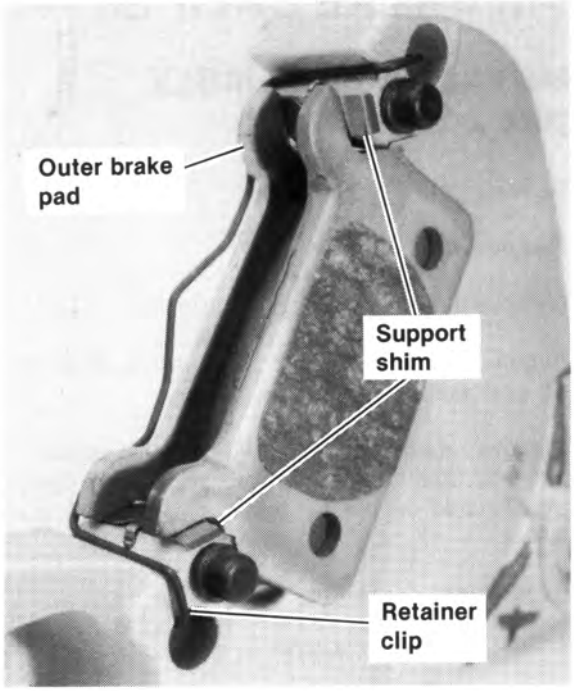


Figure 2-59. Retainer Clip Installation

CAUTION

Early banjo washers were made of zinc coated copper. Later washers were steel with a rubber O-ring at the inside diameter. It is important that the replacement washers are the same type as the ones removed. The banjo bolt is designed for a particular type washer and interchanging washers can cause brake line leakage.

If brake hose was disconnected, tighten banjo bolt to 30-35 ft-lbs torque if copper washers are used or 17-22 ft-lbs if steel and rubber washers are used. Install battery, battery carrier, right side cover and saddlebag.

REAR BRAKE CALIPER — FXR MODELS 1984 - EARLY 1987

REMOVAL (Figure 2-60)

1. Remove screws (2) and lift caliper body (5) off bracket (3). Remove brake pads (4).

NOTE

Brake pads may now be replaced without further disassembly.

2. Remove upper and lower pins (6 and 7) and boots (8). Remove pad spring (9) 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.

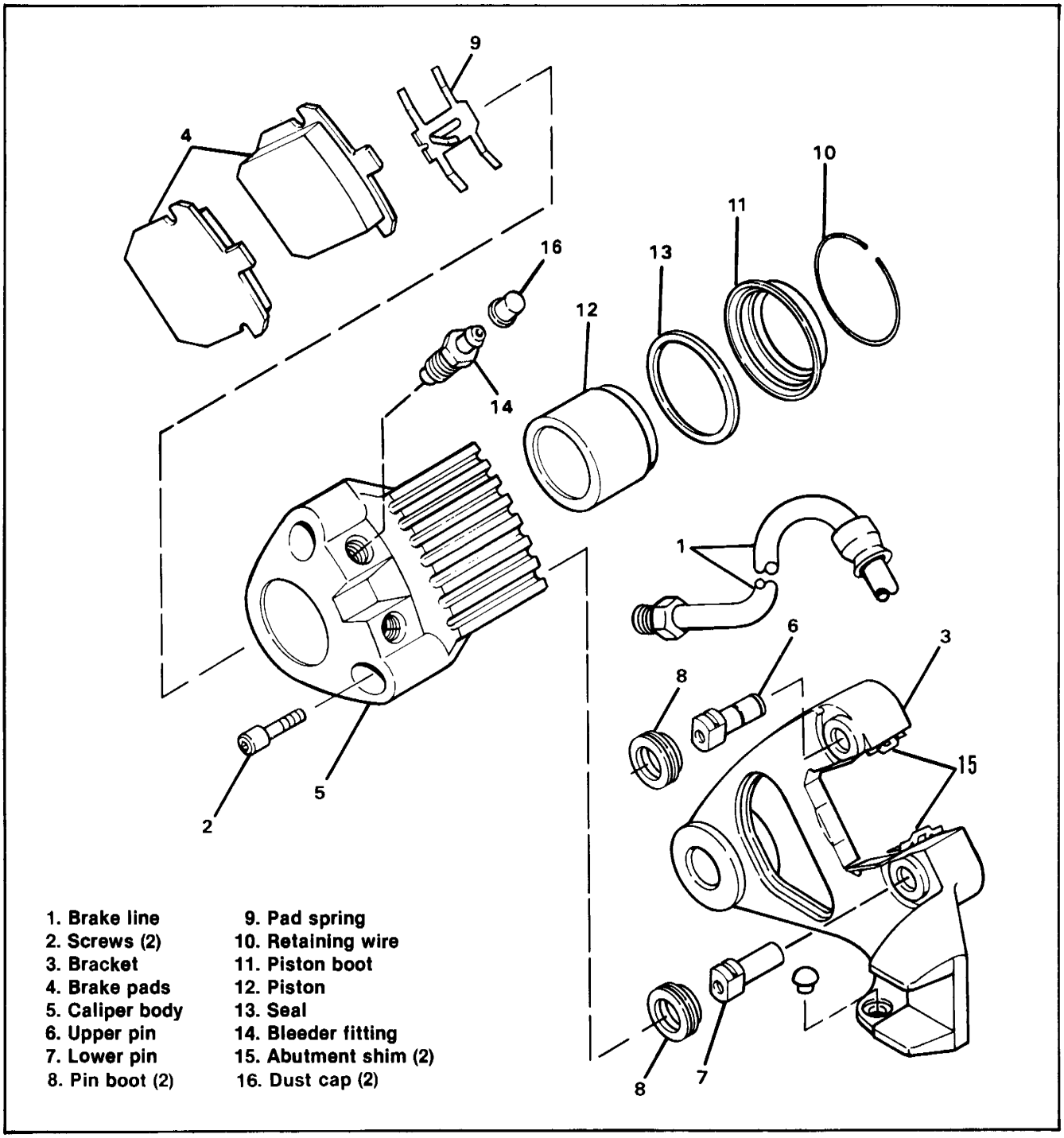


Figure 2-60. Rear Brake Caliper — FXR Models, 1984 - Early 1987

3. Remove retaining wire (10) and piston boot (11). Remove piston (12) and seal (13). If piston cannot be easily removed, use the following method:

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.

Pump brake lever until piston reaches its full travel. Remove brake line (1). Place the caliper on a workbench with the piston facing downward. 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.

CLEANING, INSPECTION AND REPAIR (Figure 2-60)

1. If the brake pads are worn to 1/16 in. thick or less of friction material, 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. Do not hone or bore cylinder. Always replace seal (13) and piston boot (11) if piston is removed. Replace missing or damaged abutment shims (15).

WARNING

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

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

WARNING

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

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

ASSEMBLY (Figure 2-60)

1. If piston was removed install new seal (13) into caliper bore. Install piston (12) all the way into caliper bore and install new boot (11) and retaining wire (10).

2. Place pad spring (9) 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.

3. Install pin boots (8) on upper and lower pins (6 and 7) and coat pins and pin bores with clear silicone grease. Insert pins into pin bores (pin with rubber sleeve goes into top hole) making sure boots are properly seated on boss around holes. Turn pins so flats are parallel with opening in bracket as shown in Figure 2-61.

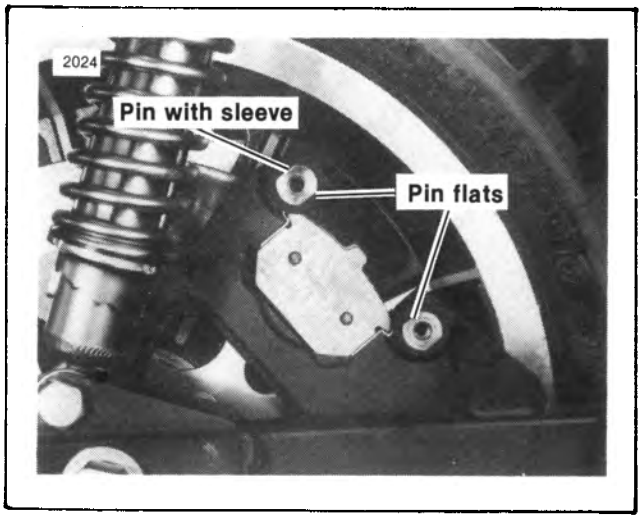


Figure 2-61. Rear Brake Pin Registration — FXR Models

WARNING

Use only Dow Corning 44 GREASE on pins and pin bores. Other lubricants will cause the rubber sleeve to enlarge leading to improper brake caliper operation.

4. Install pads (4) on bracket and place caliper body (5) on bracket making sure pins (6 and 7) do not turn.

5. Install screws (2) and tighten to 12-15 ft-lbs torque. Pins (6 and 7) should still be in same position as described in Step 3.

6. Bleed brake system as described under BLEEDING THE HYDRAULIC SYSTEM.

REAR BRAKE CALIPER — FXR MODELS, LATE 1987 - 1990

The rear brake caliper on late 1987-1989 FXR models is similar to that used on 1986 and later FLT models. Refer to REAR BRAKE CALIPER - 1986 AND LATER FLT MODELS for all service information.

BLEEDING THE HYDRAULIC SYSTEM

NOTE

Bladder type hydraulic brake fluid pressure equipment can be used to fill the front master cylinder at the bleeder fitting. When using this equipment, the master cylinder or reservoir cover must be removed so the system cannot pressurize.

Anytime a hydraulic brake system 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.

WARNING

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

1. See Figure 2-62. Slip a piece of appropriate size clear plastic tubing over the brake caliper bleeder valve. Place the other end of the tubing into a clean container.

2. Open the bleeder valve by turning it counterclockwise about 1-1/2 turns.

3. With the master cylinder full of fluid at all times, slowly depress the brake lever all the way and hold it. Close the bleeder valve when fluid stops flowing. Release the brake lever. Open the bleeder valve and repeat the procedure until the fluid flows from the bleeder valve free of air bubbles.

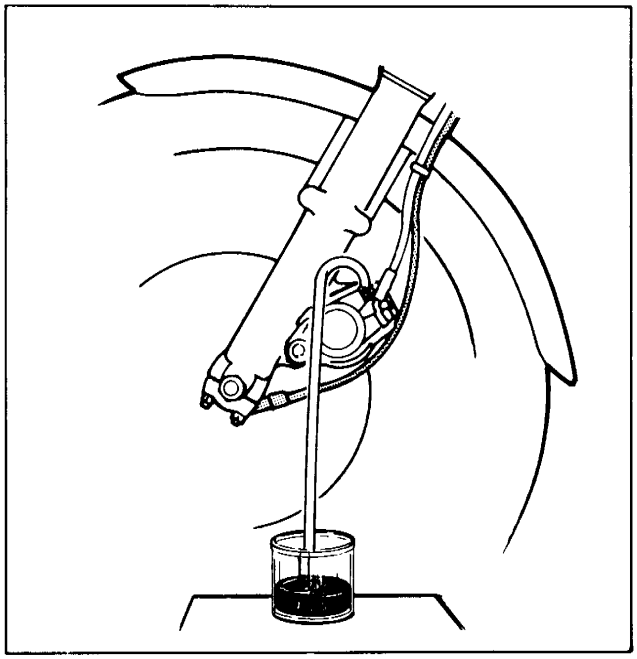


Figure 2-62. Bleeding Brakes

NOTE

Check the system for leaks. If leaks occur at the hydraulic fittings, coat the threads with Loctite PIPE SEALANT WITH TEFLON. Use only this sealant to avoid contamination of the system. Bleed the system again.

STOPLIGHT SWITCHES

FRONT SWITCH

The front stoplight switch is located in the right side handlebar switch assembly. If the stoplight fails to light when the front brake is applied, check to see if the bulb is burnt out. If the bulb is good, check the continuity of the brake light wires. If brake light wires are good, disassemble the switch assembly and check the stoplight switch for continuity. Replace if inoperative.

If stoplight stays on, make sure brake hand lever is contacting handlebar switch housing. If there is a gap between switch housing and hand lever, brake light will stay on.

REAR SWITCH

FLT and 1984 - Early 1987 FXR

The rear switch is on the rear side of the rear master cylinder. If stoplight fails to light when rear brake is applied, check the bulb to see if it is good. If bulb is okay, check the continuity of the brake light wires. If brake light wires are good, check the stoplight switch for continuity with pedal depressed. Replace if inoperative.

FXR — Late 1987 - 1990

The rear switch is mounted in a tee in the rear brake line adjacent to the master cylinder. The above service information applies.

NOTE

The stoplight switches also control the antidive valve on models with air suspension. On 1989 and later Ultra models the stoplight switches also disengage the cruise control when either switch closes.

BRAKE DISCS

REMOVAL

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.

FRONT FORKS

GENERAL

The front fork consists of two telescoping tubes that work against springs with an oil filled (hydraulic) dampening mechanism to control the action. The unit is engineered for a long service life with minimum repairs. FLT Models, FXRT, FXRD and 1988 - 1990 FXRS-SP have a front fork air control system.

Changing Fork Oil

Front fork oil should be changed at the 10,000 mile service interval and every 10,000 miles thereafter.

1. See Figure 2-63. Remove the instrument panel and handlebar on FLT models. On 1986 and later FLHT Models, remove the front light bar and the outer fairing. Raise front wheel so it clears floor and support with blocks under frame.

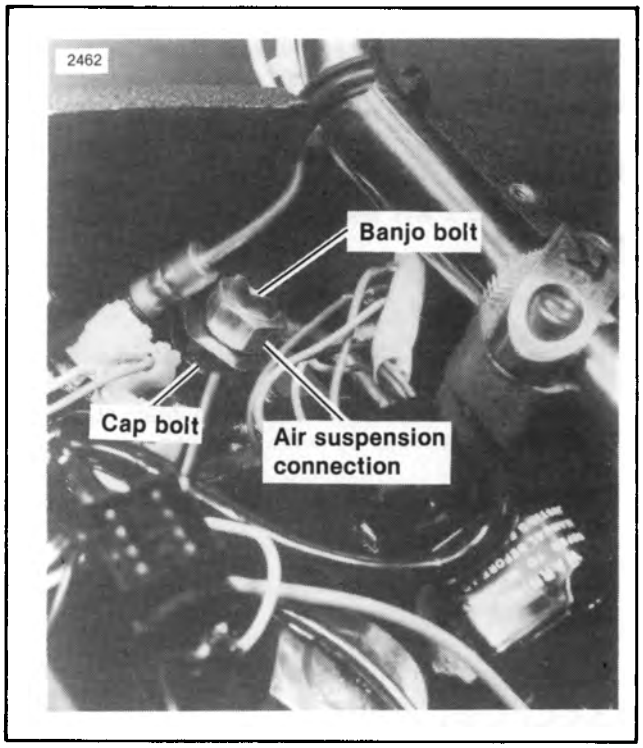


Figure 2-63. Fork Cap Location — FLT

CAUTION

Do not turn instrument panel upside down. The damping fluid in the fuel gauge will leak onto and stain the gauge face.

2. On FLT Models, FXRT, FXRD and 1988 - 1990 FXRS-SP bleed the air from the air control system and remove the banjo bolts from the top of each fork side.

3. On all other FXR Models, remove the cap bolts from the top of each fork side. Use caution as fork caps are under pressure from fork springs.

4. See Figure 2-64. Remove the drain plug from the bottom of each fork and drain the oil.

5. Install the drain plugs on the forks.

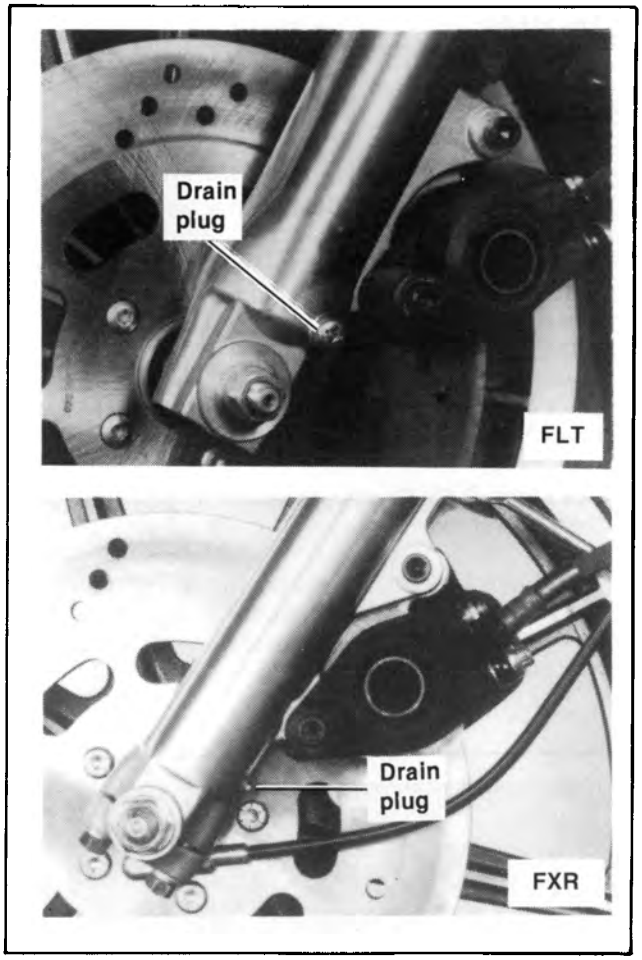


Figure 2-64. Fork Drain Plug — FLT, FXR

6. Pour the specified amount of Harley-Davidson Type E Fork Oil into each fork side.

NOTE

When a fork has been disassembled, cleaned and reassembled it is considered a DRY fork and requires more oil than a WET fork. The difference in the amount of oil is due to oil cling within the WET fork.

MODEL	YEAR(S)	AMOUNT (oz.)	
		WET	DRY
FLT	1984 - 1990	7¾	8½
FXR, FXRS	1984 - 1987	6¼	7
FXRD, FXRT	1984 - 1987	7	7¾
FXLR	1987 - 1990	9.2	10.2
FXRSE	1987	10.5	11.5
FXRT, FXRS- SP	1988 - 1990	10.5	11.5
FXR, FXRS	1988 - 1990	9.2	10.2
Fork oil type: Harley-Davidson type E			

7. Install the fork cap bolts or banjo bolts, handlebar, instrument panel, light bar and outer fairing. Use new gaskets and O-rings when installing banjo bolts.

REMOVAL

FLT Models

1. Remove the front wheel. See the FRONT WHEEL, REMOVAL procedure. Remove the front fender.

2. Remove the instrument panel and handlebar. On 1986 and later FLHT/C Models, remove light bar and outer fairing.

3. Bleed air from air control system. Remove banjo bolts connecting the air control system to the fork tubes.

4. See Figure 2-63. Remove the fork cap bolt and seal from each fork.

5. See Figure 2-65. Loosen the pinch bolts (1). Using a suitable drift and tapping from the top, drive the fork sides from the brackets and remove the rubber fork stop (2) from each fork.

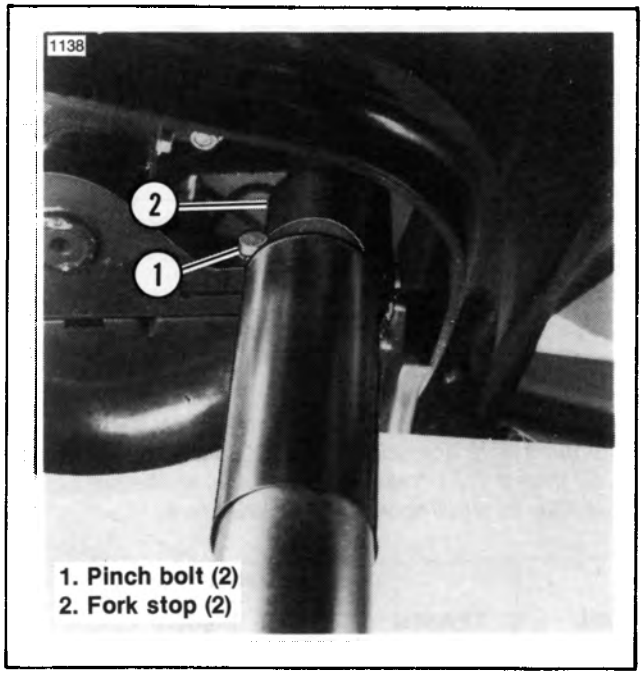


Figure 2-65. Fork Side Mounting — FLT

1984 - 1987 FXR, FXRS — Excluding FXLR and 1987 FXRS Sport Edition (Figure 2-66)

1. Remove the front wheel following the FRONT WHEEL, REMOVAL procedure given earlier in this section. Remove front fender and headlamp bracket. Let headlamp hang loose by wiring harness.

2. Remove two screws (1) and slide cover (2) out of way. Loosen fork tube pinch bolts (3) and pinch screw (9) in upper fork bracket (5).

3. Remove fork tube caps (6) and slide fork side (7) down removing it from upper and lower fork brackets (5 and 12). Use caution as fork caps are under spring pressure.

FXRD, FXRT — 1984 - 1987

1. Remove the banjo bolts from the air control fork connections and loosen or remove the air tubes.

2. Remove the front wheel, front fender and front forks following the FRONT FORKS, REMOVAL—FXRS procedure.

NOTE

It will be necessary to loosen the fork caps two turns and lightly tap against the caps, to separate the tight fit of the tapers on all FXR models.

1987 FXLR, FXRSE*, All 1988-1990 FXR Models (Figure 2-67)

* Sport Edition

1. Remove the front wheel following the front wheel REMOVAL procedure given earlier in this section. Remove front fender and headlamp bracket. Let headlamp hang loose by wiring harness.

2. Loosen screws (2) and (10). Do not remove tube caps (15).

3. Slide fork sides (14) downward clear of fork brackets (9) and (1).

DISASSEMBLY

FLT Models (Figure 2-68)

1. Drain the oil from the fork side.

2. Remove bolt (6) and washer (7).

NOTE

Since there is little resistance to rotation when removing socket screw (6), the job is best done with an air impact wrench.

3. Remove the fork tube cap (3), O-ring (4) and spring (5).

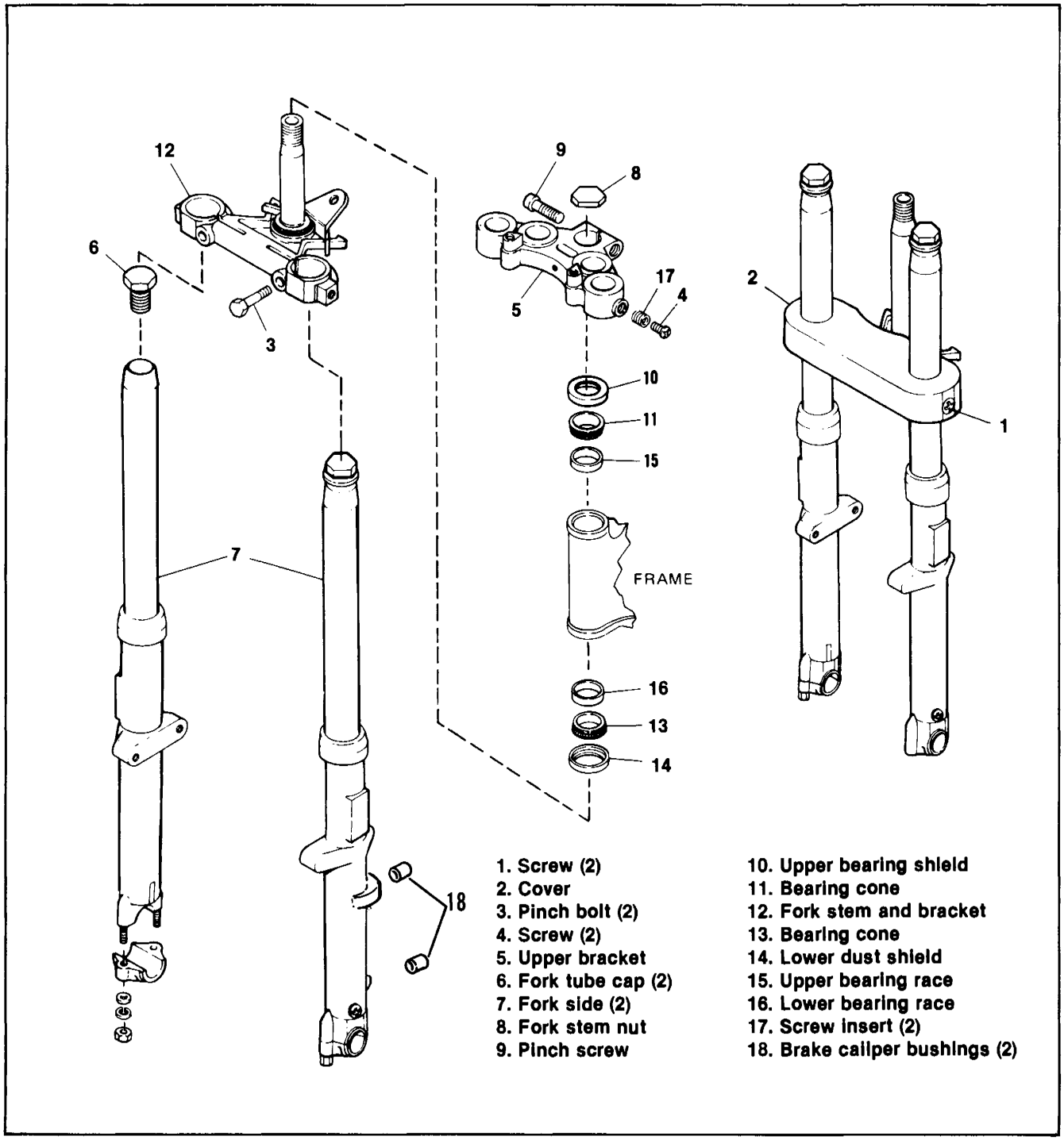


Figure 2-66. Front Fork Assembly — FXR, FXRS — 1984-1987

4. Remove retaining ring (14). Separate the fork tube (12) from the fork slider (13) by using the fork tube as a slide hammer. That is, first push fork tube into fork slider and then pull it outward.

5. Continue slide hammer action until fork tube separates from fork slider.

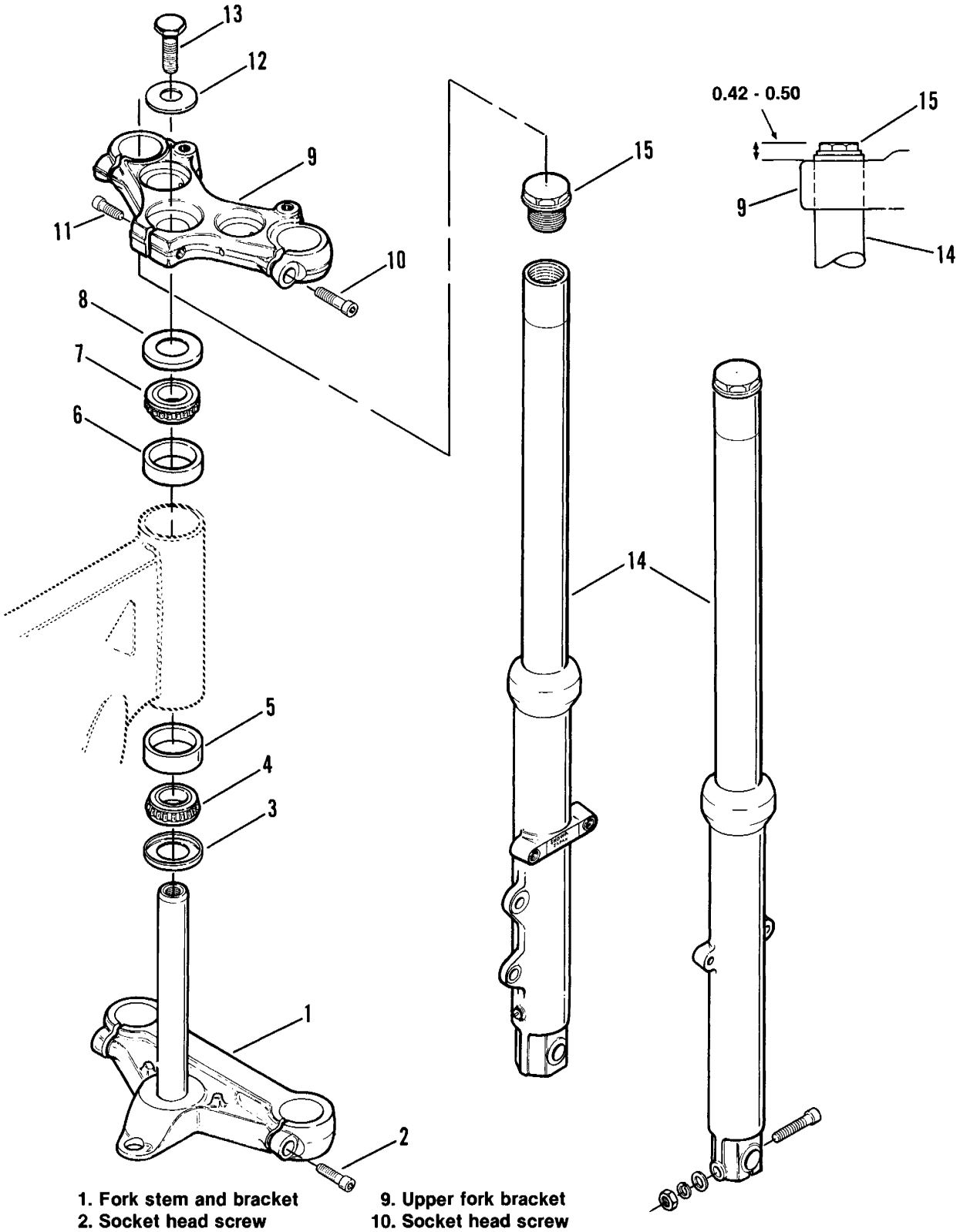
6. Bushing (32), washer (16), and oil seal (15) will all be removed with the fork tube.

NOTE

Bushing (31) is slightly larger than bushing (32) and will drive out bushing (32), washer (16) and oil seal (15).

7. Remove damper tube (8) from fork tube (12). If necessary the damper tube can be pushed out with a small rod inserted through bottom hole of fork tube.

8. Remove the wear rings (9) from the damper tube (8).



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

Figure 2-67. Front Fork Assembly — 1987 FXLR, FXRS Sport Edition, All 1988-1990 FXR Models

1. Bolt and lockwasher (2)
2. Fork cap bolt and seal (2)
3. Fork cap
4. O-ring
5. Spring
6. Screw
7. Washer
8. Damper tube
9. Wear ring (2)
10. Spring
11. Sleeve
12. Fork tube
13. Fork slider
14. Retaining ring
15. Oil seal
16. Washer
17. Fork stem nut
18. Upper bracket
19. Upper bracket seat
20. Dust shield and bearing
21. Lower bracket and stem
22. Bearing race
23. Fork stop (2)
24. Slider cap hardware
25. Shield
26. Bolt and lockwasher
27. Bushings
28. Slider cover
29. Screw and lockwasher
30. Drain screw and lockwasher
31. Bushing
32. Bushing

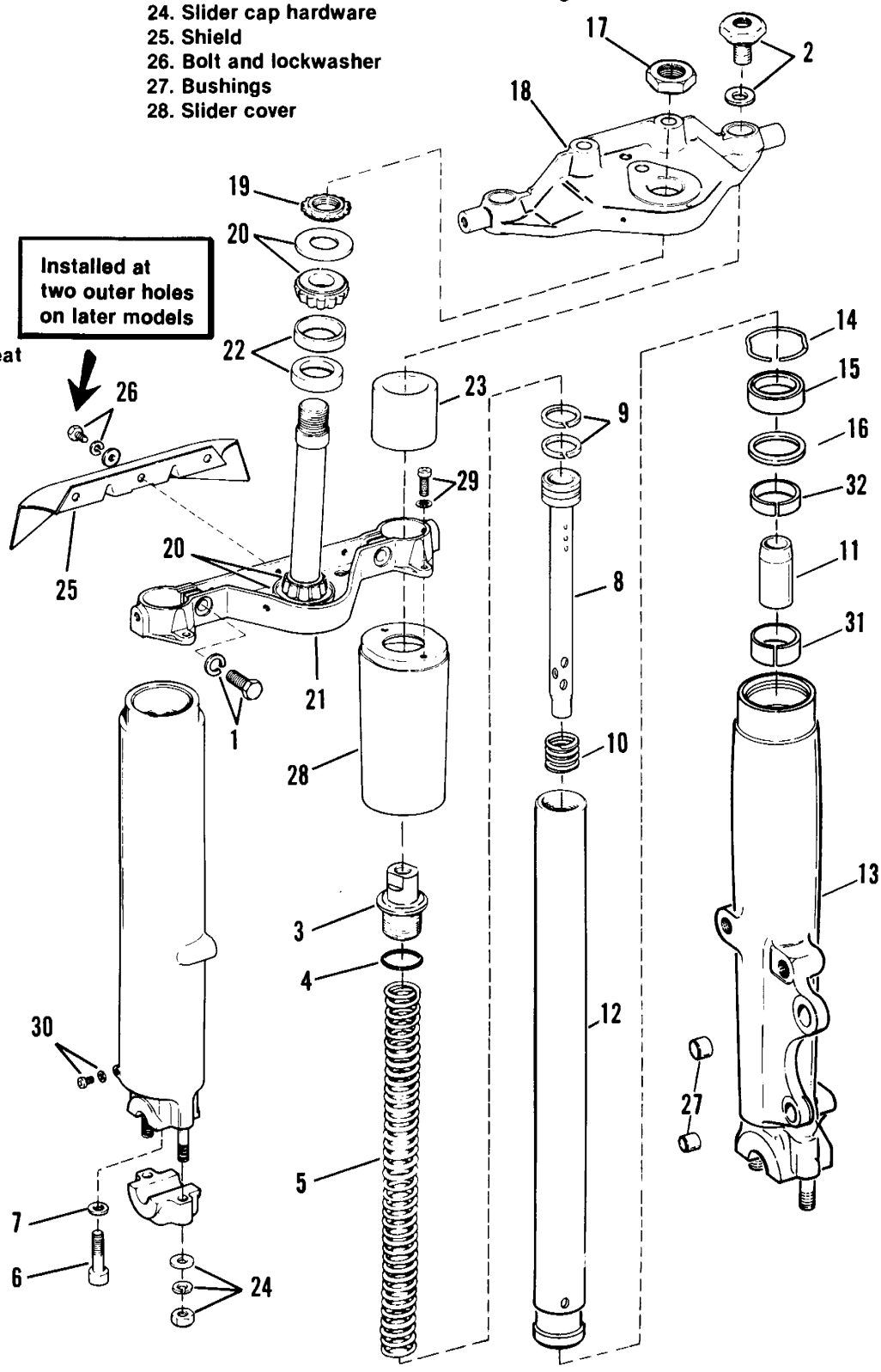


Figure 2-68. Front Fork — FLT Models

FXR Models (Figure 2-69)

1. Remove O-ring (8) from the groove in the tube cap (10) and slide off washer (9). Pull spring (11) out of fork tube (4).

2. Remove dust seal (1). Then compress retaining ring (2) and remove from the internal groove at the top of slider (5).

3. Using an allen wrench, remove socket screw (3) along with washer from the bottom end of fork slider (5). This will free damper tube (12) and fork tube (4) so that they can be removed from fork slider (5).

NOTE

Since there is little resistance to rotation when removing socket screw (3), the job is best done with an air impact wrench.

4. Separate fork tube (4) from the fork slider (5) by using the fork tube as a slide hammer. That is, first push fork tube into fork slider and then pull it outward.

5. Continue slide hammer action until fork tube separates from fork slider.

6. Bushing (6), spacer (15) and oil seal (14) will all be removed with the fork tube.

NOTE

Bushing (7) is slightly larger than bushing (6) and will drive out bushing (6), spacer (15) and oil seal (14).

7. Remove damper tube (12) from fork tube (4). If necessary the damper tube can be pushed out with a small rod inserted through bottom of fork tube.

8. Remove the wear rings (13) from damper tube (12).

CLEANING, INSPECTION AND REPAIR

1. Replace the springs if they are broken or distorted.

2. Replace all seals, and O-rings.

3. Replace any broken or bent parts.

4. Lower bushing on fork tubes should not be removed unless they are to be replaced. When replacing lower bushing, expand the new split bushing only enough to fit over fork tube and slide the bushing into the bushing groove.

ASSEMBLY

FLT Models (Figure 2-68)

1. Install the wear rings (9) onto the damper tube (8). Install the spring (10), tube (8) and spring (5) in the fork tube (12).

2. Place the fork tube into the slider (13) and secure it with the washer (7) and bolt (6).

3. Place upper bushing (32), spacer (16) and oil seal (15) (in that order) over fork tube (12). Be sure that the concave or dished surface of the spacer is downward and lettered side of the seal is facing upward. FORK SEAL AND BUSHING TOOL, Part No. HD-34634 is then placed over fork tube (12). Bushing (32), spacer (16) and seal (15) are then seated into the slider bore by lightly tapping the components into place with the installation tool.

4. Install retaining ring (14).

FXR Models (Figure 2-69)

1. Install the wear rings (13) onto the damper tube (12). Install the spring (17), tube (12) and spring (11) in the fork tube.

2. Place the fork tube into the slider and secure it with the washer and screw (3).

3. Place upper bushing (6), spacer (15) and oil seal (14) (in that order) over fork tube (4). Be sure that the concave or dished surface of the spacer is downward and lettered side of the seal is facing upward. FORK SEAL AND BUSHING TOOL, Part No. HD-34190 is then placed over fork tube (4). Bushing (6), spacer (15) and seal (14) are then seated into the slider bore by lightly tapping the components into place with the installation tool.

4. Install retaining ring (2) and dust cover (2).

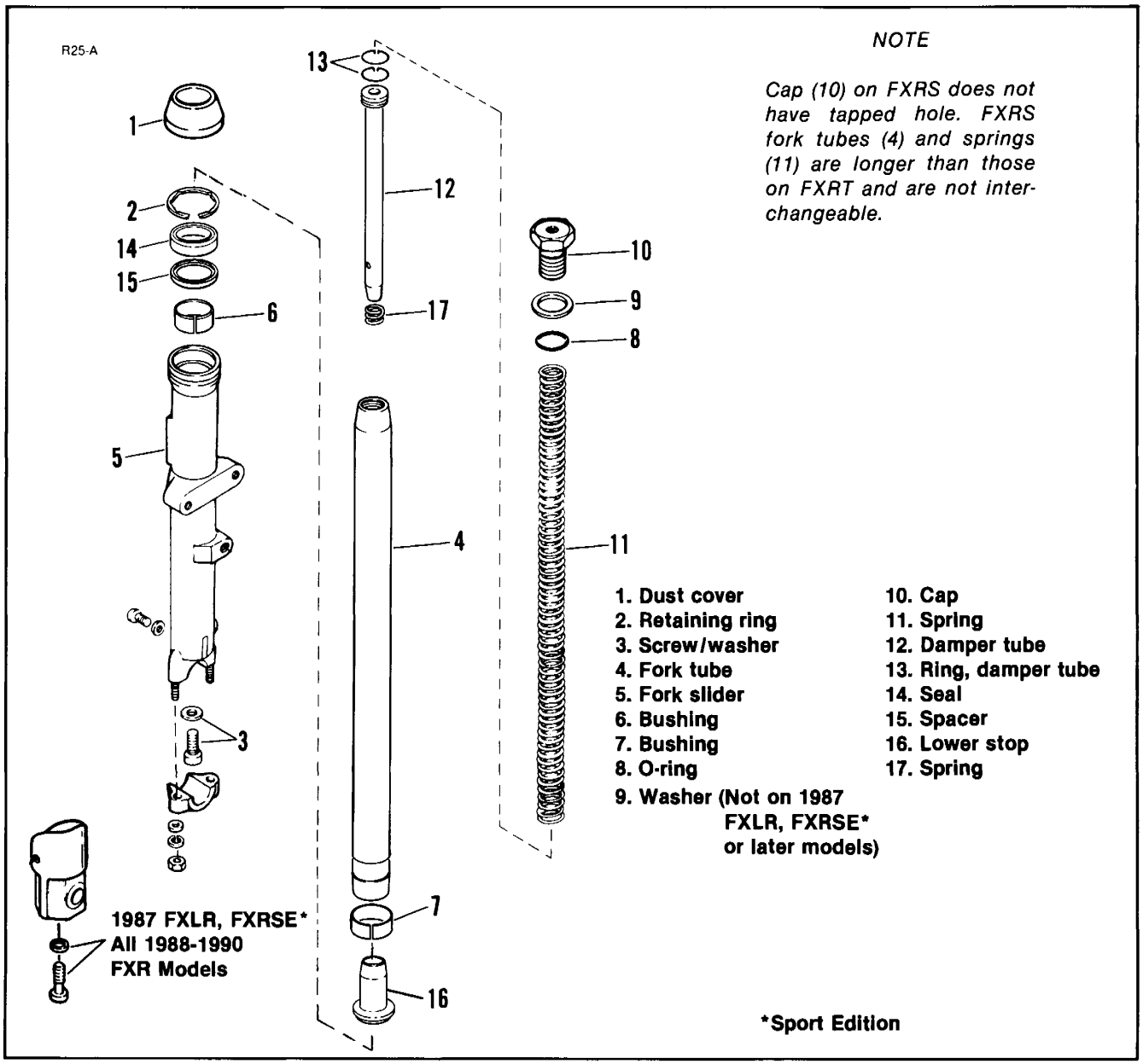


Figure 2-69. Front Fork — FXR Models

INSTALLATION

FLT Models

1. See Figure 2-65. Place fork side assemblies into the upper and lower bracket with the rubber sleeves positioned on the fork sides as shown.

2. Pour the specified amount of Harley-Davidson Type E Fork Oil into each fork side. See CHANGING THE FORK OIL.

3. Install the fork cap bolts and seals (2, Figure 2-68) and tighten the pinch bolts (1, Figure 2-63) to 25 ft-lbs torque.

4. Install the air control system.

5. Install the handlebar and instrument panel. On late FLHT/C and FLHS models, install light bar and outer fairing. Install the fender. Install the front wheel as described under the front wheel ASSEMBLY procedure.

FXR, FXRS, 1984 - 1987 (Figure 2-66)

1. Slide fork side (7) into lower and upper brackets (12 and 5). Tighten fork tube pinch bolts (3) to 30-35 ft-lbs torque. Tighten pinch screw (9) to 21-27 ft-lbs torque.

2. Pour the specified amount of Harley-Davidson Type E Fork Oil into each fork side and replace tube caps (6). See Changing Fork Oil.

3. Install headlamp bracket, cover (2) and screws (1).

4. Install front fender tightening bolts in slider to 10-14 ft-lbs torque. Install front wheel following FRONT WHEEL, INSTALLATION procedure.

FXRD and FXRT — 1984 to 1987

1. Install forks, fender and front wheel following the FRONT FORKS, INSTALLATION, FXR procedure; except, for the following:

2. Pour the specified amount of Harley-Davidson Type E Fork Oil into each fork side. See Changing Fork Oil.

3. Reconnect air control to forks with banjo bolts.

4. Pressurize air control system to recommended pressure.

1987 FXLR, FXRSE* and ALL 1988-1990 FXR Models (Figure 2-67)

*Sport Edition

1. Insert fork side (14) through lower bracket (1) and upper bracket (9). Position fork tubes so that each fork tube extends 0.42 - 0.50 in. from the top surface of upper fork bracket (9) to the top surface of the tube cap (15).

NOTE

On 1988-1990 FXRT and FXRS-SP perform steps 3 and 4 of FXRD and FXRT — 1984 to 1987 installation.

2. Position turn signal light brackets upright and tighten upper fork bracket pinch bolts to 25-30 ft-lbs. Tighten lower fork bracket pinch screws (2) to 25-30 ft-lbs.

3. Install headlamp bracket. Adjust headlamp.

4. Install front fender tightening bolts in slider to 10-14 ft-lbs torque. Install front wheel following FRONT WHEEL, INSTALLATION procedure.

FRONT FORK AIR CONTROL

GENERAL

1984 - 1987

The FLT, FXRD and FXRT models are equipped with a front fork air control system that includes an "anti-dive" feature. The "anti-dive" is controlled by a solenoid that is activated by either front or rear brake switch. The FXRT and FXRD have an air accumulator mounted to the lower triple clamp. The engine guard serves as an air reservoir on the FLT Models.

1988 - 1990

The FLT models (FLTC, FLHTC and FLHS), FXRT and FXRS-SP models are equipped with front fork air control system and "anti-dive". The system is similar to earlier models; but, the handlebar serves as an air reservoir on all models and the FXRT does not have an air accumulator.

RECOMMENDED PRESSURES

The recommended pressures for the air suspensions are as follows:

FLT MODELS AIR SUSPENSION

TYPE OF RIDE	AMOUNT OF ANTI-DIVE	psi
Firm	Stiff	20
Normal	Normal	15
Soft	Soft	10

FXRD, FXRT, FXRS-SP MODELS AIR SUSPENSION		
LOADING	RECOMMENDED PRESSURES (PSI)	
	FORKS	ACCUMULATOR FXRD, FXRT - 1984 - 1987
Rider weight up to 150 lbs:	4 - 8	25 - 30
For each extra 25 lbs., add:	2	—
Passenger weight for each 50 lbs., add:	1	—
Maximum Pressures:	20	30

CAUTION

To prevent damage to air control system use a hand or foot operated air pump and a no-loss air gauge when filling air suspensions. AIR SUSPENSION PUMP AND GAUGE, Part No. HD-34633 is available at your Harley-Davidson dealer.

SYSTEM TESTING

Before removing air control systems check for air leaks. Also check anti-dive solenoid operation by turning ignition switch on, apply either brake and listen for a click at solenoid. The solenoid has a very faint click, so touch the solenoid while applying and releasing either brake to check if solenoid is operating. If solenoid is not working, replace it, following the DISASSEMBLY, INSPECTION AND REPAIR procedure.

Anti-Dive System Check

1. Install no-loss air gauge on air valve at engine guard for FLT models, at accumulator for FXRT/D models. On 1988-1989 models install gauge on valve in end of left handlebar grip.
2. Turn ignition off. Apply front brake and bounce front end. Watch air gauge. Air pressure will fluctuate while bouncing front end.
3. Turn ignition on. Apply front brake and bounce front end. Air gauge pressure must remain constant.

REMOVAL

FLHT/C Models — 1986 and Later (Figure 2-70)

NOTE

To remove air fork manifold (11) on 1984-1985 FLHT/C models follow next procedure.

1. Disconnect battery cables, negative cable first.
2. Remove radio following instructions given in this section.
3. Place shop towels or protective mats on front fender and fuel tank to protect paint.
4. Remove passing lamp bracket bolts and place bracket on front fender. Loosely install lower bolts to hold inner fairing in place.
5. Remove outer fairing following instructions in this section.

NOTE

If only anti-dive valve is being removed, the valve is now accessible and may be removed. See steps 4-7 in DISASSEMBLY, INSPECTION AND REPAIR, FLT Models for anti-dive valve removal instructions.

6. Remove handlebar riser nuts from underside of upper fork bracket, gently raise handlebar and on 1988 and later models disconnect air hose from handlebar.
7. Move handlebar to rear and place on fuel tank.
8. Remove bolts that hold ignition/fork lock assembly to upper fork bracket.
9. Disconnect leads from anti-dive valve.
10. On 1986-1987 models disconnect hose from anti-dive valve.
11. Remove banjo bolts (13).
12. Gently push top of inner fairing back toward fuel tank and remove air fork manifold (11).

FLT, 1984-1985 FLHT/C and FLHS (Figure 2-70)

1. Remove instrument panel.

CAUTION

Do not turn the instrument panel upside down; because, the damping oil in the fuel gauge will leak onto the face of the gauge and discolor it.

2. To remove air fork manifold (11) perform steps 6 and 7 of the FLHT/C removal procedure.
3. Remove banjo bolts (13), disconnect air hose from engine guard on early models and remove manifold (11).

NOTE

The anti-dive valve on FLT/C models is now accessible and may be removed as follows: Disconnect leads from valve and remove valve following steps 4-7 in DISASSEMBLY, INSPECTION AND REPAIR, FLT Models. On FLHT/C and FLHS the air manifold must be removed to gain access to anti-dive valve.

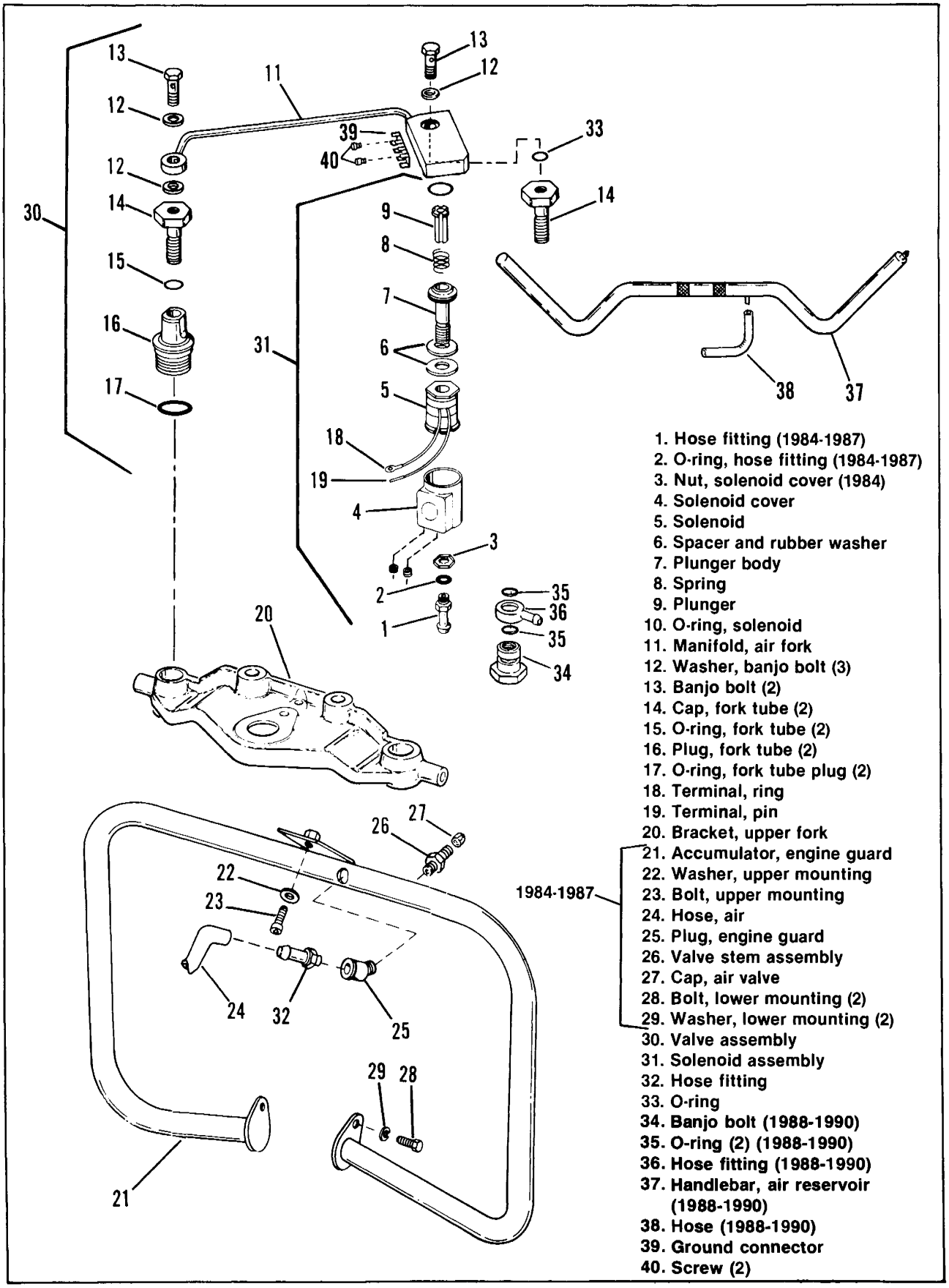


Figure 2-70. Front Fork Air Control — FLT Models

FXRD and FXRT — 1984 - 1987 (Figure 2-71)

1. Remove instruments from handlebar clamp.
2. Bleed the front fork air control system.
3. Remove bolts (1) and (2) and banjo bolts (13).
4. Remove cable strap (7) and clamp holding hose (26) to fork tube.
5. Remove the front fork air control system.

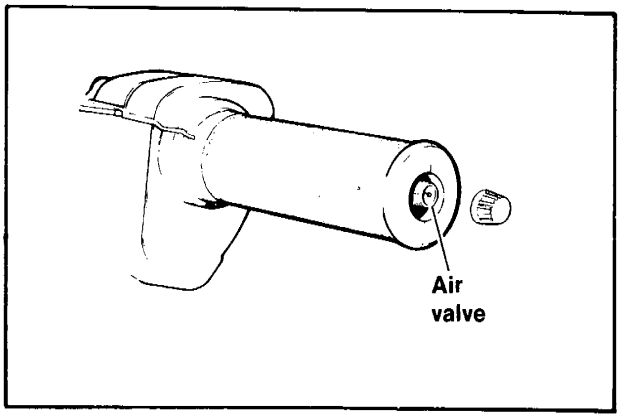
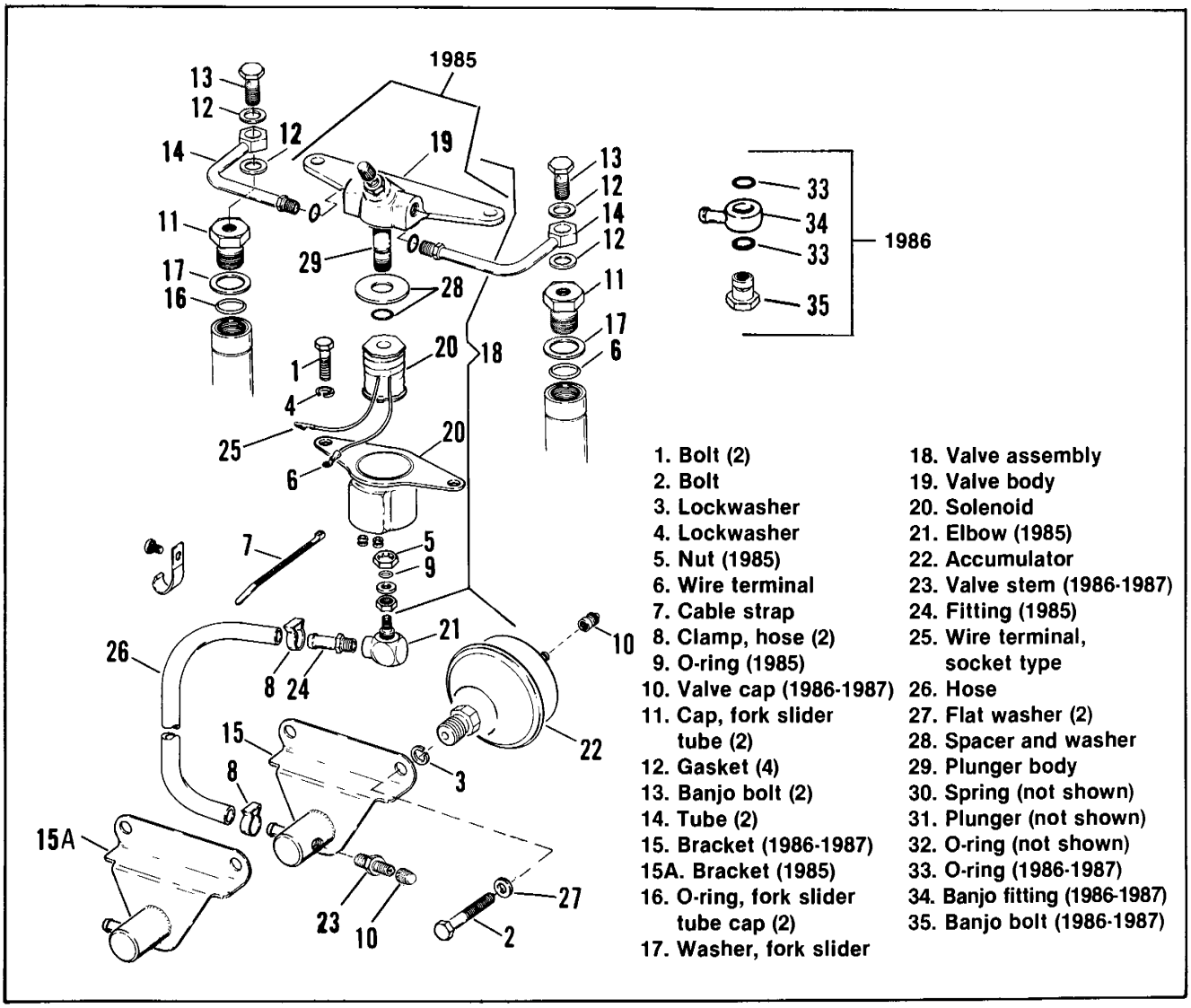


Figure 2-72. Air Suspension Valve

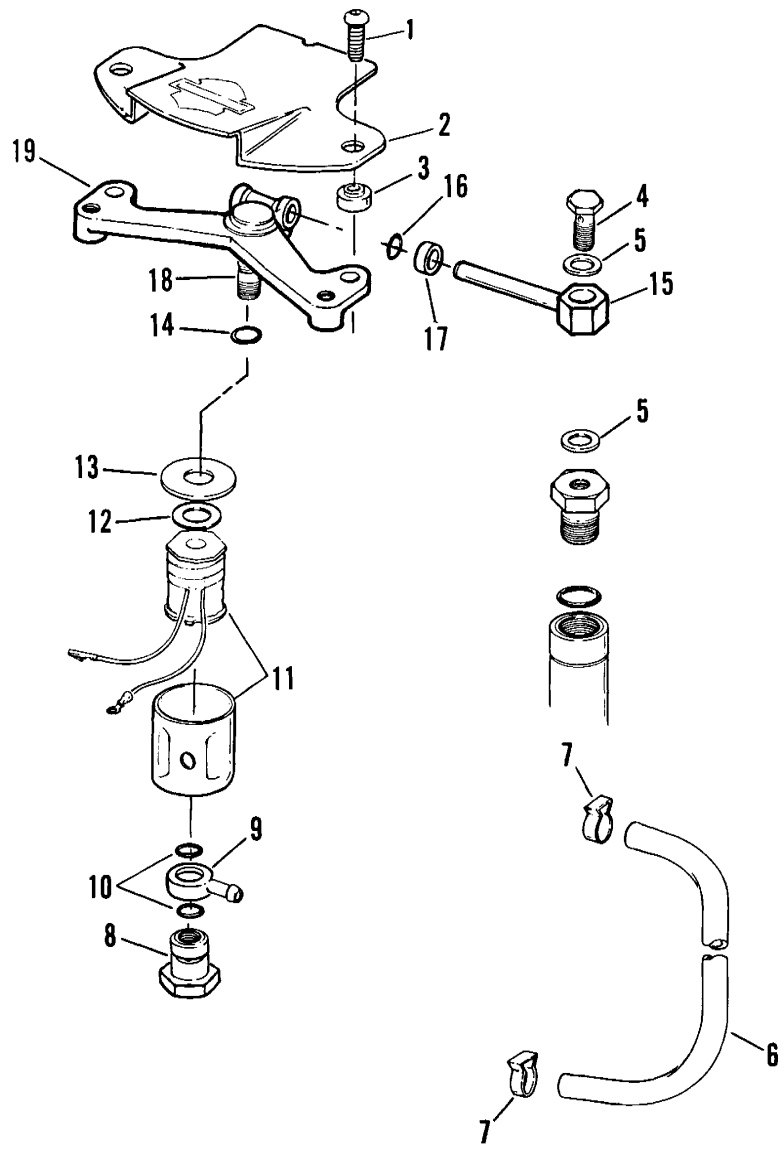
1988 - 1990 FXRT, FXRS-SP

1. See Figure 2-72. Bleed air from system by depressing or removing valve from left handlebar grip.
2. See Figure 2-73. On FXRT, remove screws (1), cover (2), and spacers (3).



1. Bolt (2)
2. Bolt
3. Lockwasher
4. Lockwasher
5. Nut (1985)
6. Wire terminal
7. Cable strap
8. Clamp, hose (2)
9. O-ring (1985)
10. Valve cap (1986-1987)
11. Cap, fork slider tube (2)
12. Gasket (4)
13. Banjo bolt (2)
14. Tube (2)
15. Bracket (1986-1987)
15A. Bracket (1985)
16. O-ring, fork slider tube cap (2)
17. Washer, fork slider
18. Valve assembly
19. Valve body
20. Solenoid
21. Elbow (1985)
22. Accumulator
23. Valve stem (1986-1987)
24. Fitting (1985)
25. Wire terminal, socket type
26. Hose
27. Flat washer (2)
28. Spacer and washer
29. Plunger body
30. Spring (not shown)
31. Plunger (not shown)
32. O-ring (not shown)
33. O-ring (1986-1987)
34. Banjo fitting (1986-1987)
35. Banjo bolt (1986-1987)

Figure 2-71. Front Fork Air Control — 1984-1987 FXRT, FXRD



1. Screw (2)
2. Cover — FXRT
3. Spacer — FXRT (2)
4. Banjo bolts (2)
5. Gasket (4)
6. Hose
7. Hose clamps (2)
8. Banjo bolt
9. Banjo fitting
10. O-rings (2)
11. Solenoid and case
12. Rubber washer
13. Washer
14. O-ring
15. Tubes (2)
16. O-ring (2)
17. Spacer sleeve
18. Plunger body
19. Manifold

Figure 2-73. Front Fork Air Control — 1988-1990 FXRT, FXRS-SP

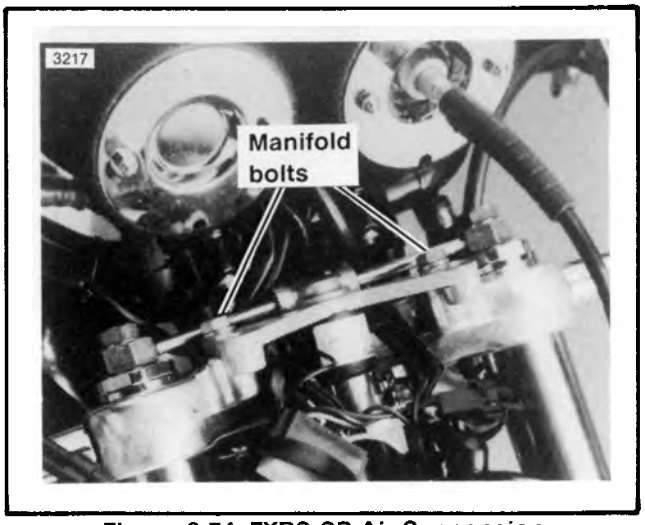


Figure 2-74. FXRS-SP Air Suspension

3. See Figure 2-74. On FXRS-SP remove headlamp bracket and manifold bolts.

4. See Figure 2-73. Remove banjo bolts (4), gaskets (5), and hose (6) from valve.

5. Disconnect solenoid leads and remove valve assembly.

DISASSEMBLY, INSPECTION AND REPAIR

FLT Models (Figure 2-70)

1. Check solenoid winding resistance by connecting an ohmmeter to the solenoid leads. Meter reading must be 10-20 ohms. Replace solenoid if any other reading is obtained.

2. Also check the solenoid for grounded windings by touching one lead of the ohmmeter to the solenoid case and the other lead to either solenoid lead. Meter reading must be infinity.

3. If the solenoid failed either step 1 or step 2 remove it as follows:

4. On 1984 - 1987 models, remove hose fitting (1) and O-ring (2). On 1988 models, remove banjo bolt (34), O-rings (35) and hose fitting (36).

5. Remove nut (3), if present, solenoid case (4), solenoid (5), spacer (6) and rubber washer.

6. Remove plunger body (7) using a face spanner wrench or put two narrow nuts on threads of plunger body, tighten them together and then with wrench on inner nut, unscrew plunger body.

NOTE

Plunger body (7) on 1985 and later models does not have holes for spanner wrench — instead a screwdriver slot is provided.

7. Remove spring (8), plunger (9) and O-ring (10).

1984 - 1987 FXRT, FXRD (Figure 2-71)

1. Check the solenoid winding following steps 1 and 2 of the FLT procedure.

2. If the solenoid failed either step 1 or step 2 checks, remove it as follows:

3. On 1985 and earlier models, remove hose fitting (21) nut, washer and O-ring (9). On 1986 models, remove banjo bolt (35), banjo fitting (34) and O-rings (33).

4. On 1985 and earlier models, remove nut (5). Solenoid case, bracket and solenoid (20) with spacer (28) can now be removed.

NOTE

To remove plunger body, follow steps 6 and 7 in the FLT DISASSEMBLY, INSPECTION AND REPAIR section.

1988 - 1990 FXRT, FXRS-SP (Figure 2-73)

1. Check the solenoid winding following steps 1 and 2 of the FLT procedure.

2. If the solenoid failed either step 1 or step 2 checks, remove it as follows.

3. Remove banjo bolt (8), banjo fitting (9) and O-rings (10).

4. Remove O-ring (14), solenoid case and solenoid (11), rubber washer (12) and washer (13).

NOTE

To remove plunger body (18), follow steps 6 & 7 in the FLT DISASSEMBLY, INSPECTION AND REPAIR section.

5. Remove tubes (15) and O-rings (16).

ASSEMBLY

FLT Models (Figure 2-70)

1. When reassembling the front fork air control replace all gaskets and O-rings to ensure system is air-tight. Copper washers will not seal if reused.

2. Place O-ring (10) in recess of air manifold (11).

3. Install spring (8) on plunger (9).

CAUTION

Install smaller diameter end of spring on plunger.

4. Insert plunger (9) and spring (8) into plunger body (7). Apply Loctite PIPE SEALANT WITH TEFLON to large threads on plunger body (7) and install in air manifold.

5. Tighten with face spanner, use "double-nut" method, or use screwdriver slot.

6. Install spacer and rubber washer (6), solenoid (5), solenoid case (4) and secure with nut (3), if present.

7. On 1984 - 1987 models, install O-ring (2) in groove above threads on plunger body (7). Install hose fitting (1) on plunger body (7).

8. On 1988 - 1989 models, install O-rings (35), banjo fitting (36) and banjo bolt (34).

9. Position banjo fitting so hose nipple faces forward.

10. Tighten banjo bolt (34) to 8 - 10 ft-lbs torque.

NOTE

See Figure 2-70. If ground connector (39) was removed, apply LOCTITE PIPE SEALANT WITH TEFLON on the threads of the rear mounting screw (40). The sealant will prevent a possible air leak at this location.

1984 - 1987 FXRT and FXRD (Figure 2-71)

1. When assembling the front fork air control use PIPE SEALANT WITH TEFLON on all pipe threads.

NOTE

On all pipe thread fittings, hand tighten and then apply two turns with a wrench to secure. All flare fitting nuts must be torqued to 200 in-lbs.

2. When assembling the front fork air control replace all gaskets and O-rings to ensure system is airtight.

3. Install plunger body as instructed in steps 2 through 5 in FLT ASSEMBLY procedure.

4. Install spacer (28) and solenoid (20). On 1985 and earlier models, install nut (5) on threaded end of valve body (19). On 1986 - 1987 models, place O-rings into banjo fitting (34) and place banjo fitting over threaded end of valve body (19). Secure by installing internal threaded banjo bolt (35) on the threaded end of valve body (19).

5. On 1985 and earlier models, install nut, washer and O-ring (9) on hose fitting (21). Install by threading fitting into internal threads of valve body (19).

1988 - 1990 FXRT, FXRS-SP (Figure 2-73)

1. Use new O-rings when assembling front fork air control to ensure system is airtight.

2. Install plunger body (18) following steps 2 through 5 in FLT procedure.

3. Install spacer (13), washer (12), solenoid and case (11) on plunger body (18).

4. Install O-ring (14) in groove above threads on plunger body (18).

5. Install banjo fitting (9) with new O-rings (10) above and below the fitting, on plunger body (18).

6. Install banjo bolt (8) to retain banjo fitting. Do not tighten.

7. See Figure 2-75. Banjo fitting must be positioned as shown. Tighten banjo bolt (8) to 8-10 ft-lbs torque.

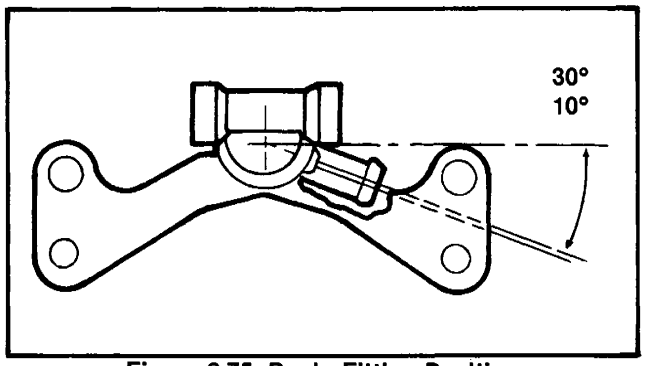


Figure 2-75. Banjo Fitting Position

8. See Figure 2-73. Install new O-rings (16) in manifold (19).

9. Slide tubes (15) into manifold (19).

CAUTION

Insert tubes (15) gently as air seal is made between taper on tube and O-ring. DO NOT ATTEMPT REMOVAL OF SPACER SLEEVES (17).

INSTALLATION

FLT Models (Figure 2-70)

1. Install new O-ring (33) in manifold (11) and apply some grease to hold it in position. Install valve assembly on forks and connect solenoid leads.

2. Install banjo bolts using new gaskets (12).

3. Tighten banjo bolts to 25-30 ft-lbs torque.

4. Connect hose to solenoid assembly.

5. Install handlebars, pressurize system and check for leaks. Install instrument panel, outer fairing, light bar and all parts removed to gain access to air control.

1984 - 1987 FXRT, FXRD (Figure 2-71)

1. Place front fork air control on forks and connect solenoid ground wire and hot wire to main harness.

NOTE

If the tubes (14) were replaced or removed for servicing, they must be installed properly to prevent leakage. Use new O-rings between flared tube ends and valve body. The flared end of the tubes must be squarely aligned and seated fully before tightening the fittings. Be sure the fitting nuts are torqued to 200 in-lbs.

2. Install banjo bolts (13) and tighten to 25-30 ft-lbs torque.

3. Place a flat washer (27) on each of the two bolts (2). Insert a lockwasher (3) between the bracket (15) and the lower fork bracket. Hold bracket (15) against the lockwashers with the holes aligned. Insert the bolts through the accumulator bracket and the lockwasher, then into the tapped hole in fork bracket. Tighten the bolts to a torque of 30 - 35 ft-lbs.

4. Install bolts (1) and tighten to 155-190 in-lbs torque.

5. Secure hose to fork and upper fork clamp with cable strap and clamp.

6. Refer to the air chart and service the front fork air control system. Check for leaks. Install instruments.

1988 - 1990 FXRT, FXRS-SP (Figure 2-73)

1. Place front fork air control on forks and connect solenoid ground wire and hot wire to main harness.

2. Install banjo bolts (13) and new gaskets (5) and tighten banjo bolts to 25-30 ft-lbs torque.

3. Install hose (6) on banjo fitting (9).

4. On FXRT, install spacers (3), cover (2) and screws (1).

5. On FXRS-SP install bolts shown in Figure 2-74 and install headlamp bracket.

6. Refer to the air chart and service the front fork air control system. Check for leaks.

7. Adjust headlamp beam following instructions in section 8.

FORK STEM AND BRACKET ASSEMBLY — FLT

ADJUSTMENT (Figure 2-68)

1. Place suitable blocking under frame to raise front wheel several inches off of floor.

2. Remove all accessory weight which could influence front end swing momentum. If clutch control cable impairs front end swing, disconnect it.

3. Move the front wheel to the extreme left. With the wheel at its maximum turning radius, let the wheel go and it will swing back and forth past center and finally come to rest near the center position. When the fork stem is adjusted properly, the wheel will swing past center and stop on the third swing.

4. If the number of swings past center is less or more than three times, loosen the triple clamp pinch bolts (1) and mover the rubber fork stop (23) a short distance up the slider tube. Loosen the fork stem nut (17) and insert a drill rod or drift pin into the notches of the bearing adjuster nut (19) under the fork bracket. Tighten the nut (19) to decrease the number of swings and loosen the nut to increase the number of swings.

NOTE

Fork stem nut (17) must be properly torqued when rechecking for proper swing.

5. Tighten triple clamp screws (1) to a torque of 25 ft-lbs. Tighten fork stem nut (17) to a torque of 35-40 ft-lbs. Bend locking tab against flat of fork stem nut.

6. Recheck "fork swing".

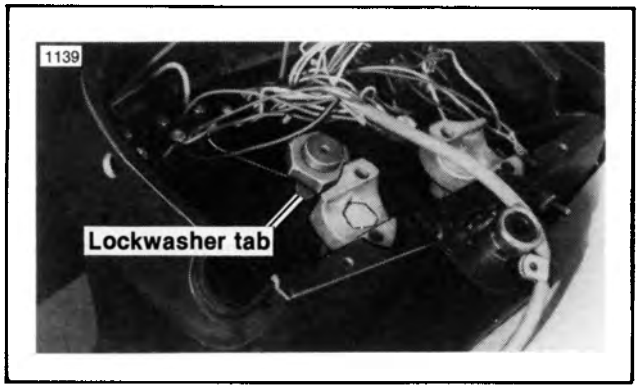


Figure 2-76. Fork Stem Nut

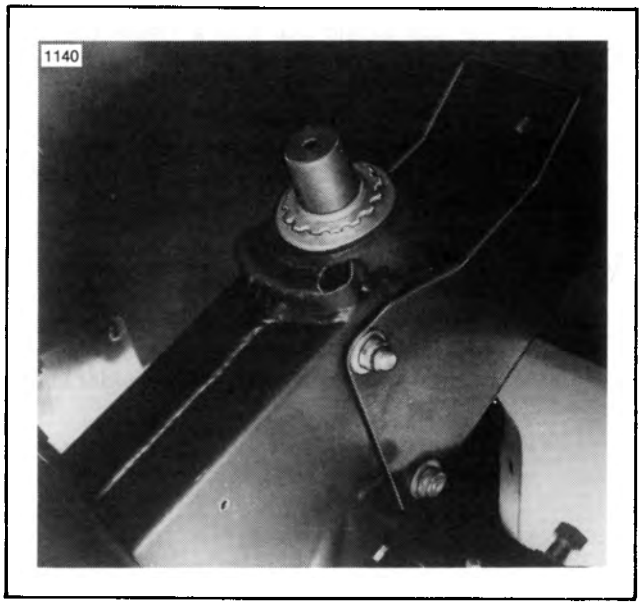


Figure 2-77. Upper Bracket Seat

REMOVAL

1. On 1986 and later FLHT/C Models, remove the light bar and outer fairing. On FLT/C Models, remove the instrument panel and handlebar.

2. Remove the front wheel, fork sides and air suspension as described in each respective REMOVAL procedure.

3. Remove the brake line from the lower fork bracket.

4. See Figure 2-76. Bend the tab away from the nut flat. Remove the nut and main circuit board.

5. See Figure 2-77. Remove the bearing adjuster and remove the fork stem assembly. See Figure 2-68. Remove the dust shield and bearing (20) from the top of the steering head.

CLEANING, INSPECTION AND REPAIR (Figure 2-68)

1. Check the bearing races (22) in the steering head. If they are pitted or grooved replace the bearings and the races.

2. Check the roughness of the roller bearings by turning them in the races. Replace the bearings if they don't move freely and smoothly.

NOTE

Always replace both races and bearings — even if one race and bearing appears good.

Removing Races

Drive the races (22) out of the frame using a drift. Tap evenly around the race to prevent damage to the bore in the frame.

Removing Bearing From Fork Stem

1. Chisel cage, that retains rollers, off bearing on fork stem.

2. Turn the stem (21) upside down while you heat the inner race. Race will expand and fall free.

ASSEMBLY (Figure 2-68)

1. Pack the new bearings with a high quality wheel bearing grease.

2. Install the dust shield (20). Use a sleeve that will contact only the inner race of the new bearing then press the bearing into place.

3. Grind down the outside circumference of one of the old races (22) so it fits loosely in the frame bore.

4. Gently tap the new races into place using the ground down race as a driver. Make sure you don't contact the tapered surface of the new race. Any marks here will damage the bearing. The race should be firmly seated against the shoulder in the bore. If it is not, the steering head adjustment will become loose affecting the vehicle's handling characteristics.

INSTALLATION (Figure 2-68)

1. Install the fork stem assembly (21) into the steering head. Install the bearings and dust shield into the top of the steering head. Install the bearing adjuster. Snug the adjuster down until bearing play is taken up and the fork stem turns freely in the steering head.

CAUTION

Overtightening the adjuster will cause the bearings to wear out excessively.

WARNING

An improperly adjusted fork stem nut may cause handling problems. See ADJUSTMENT.

2. See Figure 2-76. Install upper bracket. Install the circuit board so it registers. Install nut. Tighten nut to 35-40 ft-lbs torque. Bend the lockwasher tab against the nut flat.

3. Install the fork sides, air suspension instrument panel and handlebar.

4. Install the front wheel and bleed the front brake. Check fork swing under BEARING ADJUSTMENT.

FORK STEM AND BRACKET ASSEMBLY — FXR

ADJUSTMENT

1. Place suitable blocking under frame to raise front wheel several inches off of floor.

2. Remove all accessory weight, such as windshield, which could influence front end swing. If clutch control cable impairs front end swing, disconnect it.

3. Place a strip of masking tape over the tip of fender.

4. Install a pointer mounted to a floor stand. The pointer is positioned at the center of the fender with the front wheel pointed straight ahead.

5. Repeatedly nudge the fender, a short distance at a time, on one side, until the front end begins to "fall-away" by itself. Mark the point where it begins to "fall-away" on its own. Repeat this procedure in opposite direction.

6. Measure the distance between the two "fall-away" marks. This distance must be 1 to 2 inches for proper bearing adjustment.

7. If the distance is not correct an adjustment is required. See Figure 2-66. On 1984 - 1987 FXR models (excluding 1987 FXLR, FXRS Sport Edition) loosen the triple clamp pinch bolts (3) and the upper bracket clamp bolt (9). Loosen or tighten the fork stem nut (8) until the "fall-away" distance is 1 to 2 inches. See Figure 2-67. On 1987 FXLR, FXRS Sport Edition and all 1988 FXR models loosen the lower bracket pinch screws (2) and the fork stem clamp screw (11). Loosen or tighten the fork stem bolt (13) until the "fall-away" distance is 1 to 2 inches.

NOTE

If the "fall-away" point is more than 2 inches, loosen the fork stem nut and if it is less than 1 inch, tighten the fork stem nut.

8. See Figure 2-66. On 1984 - 1987 FXR models (excluding 1987 FXLR, FXRS Sport Edition), tighten lower triple clamp pinch bolts (3) to a torque of 30-35 ft-lbs. Tighten upper bracket pinch bolt (9) to a torque of 21-27 ft-lbs. See Figure 2-67. On 1987 FXLR, FXRS Sport Edition and all 1988-1990 FXR models, tighten fork stem clamp screw (11) to 25-30 ft-lbs torque. Tighten lower bracket pinch screws (2) to 25-30 ft-lbs torque.

9. Recheck "fall-away".

REMOVAL (Figure 2-66, 2-67)

1. On FXRT, FXRD and FXRS-SP remove front fork air control banjo bolts. Remove fork sides as described under front fork REMOVAL.

2. See Figure 2-66. On 1984 - 1987 FXR models (excluding 1987 FXLR, FXRS Sport Edition), remove fork stem nut (8) and loosen pinch screw (9). Lift handlebars from steering head with upper bracket (5) attached being careful not to pinch or kink control wires.

3. Remove upper bearing shield (10) and bearing cone (11). Slide fork stem and bracket (12) from frame.

4. See Figure 2-67. On 1987 FXLR, FXRS Sport and all 1988-1990 FXR models, remove bolt (13), washer (12) and loosen pinch bolt (11). Lift handlebars from steering head with upper bracket (9) attached. Be careful not to pinch or kink control cables.

5. Remove dust cap (8) and bearing (7). Slide fork stem and bracket (1) from frame.

CLEANING, INSPECTION AND REPAIR (Figure 2-66, 2-67)

Refer to CLEANING, INSPECTION AND REPAIR given for the FLT models for instructions on steering head bearings. Use Figures 2-66 and 2-67 to identify components.

INSTALLATION

1984 - 1987 FXR Models (Except 1987 FXLR, FXRS-SE)

1. See Figure 2-66. Insert fork stem and bracket (12) into steering head of frame. Install upper bearing cone (11) and dust shield (10).

2. Install upper bracket (5) with handlebars and replace stem nut (8). Tighten pinch screw (9) to 21-27 ft-lbs torque. Tighten stem nut (8) so forks have no noticeable shake and turn left and right freely.

NOTE

See Caution and Warning following next procedure.

1987 FXLR, FXRS-SE and All 1988-1990 Models

1. See Figure 2-67. Insert fork stem and bracket (1) into steering head of frame. Install bearing (7) and dust cap (8).

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

All FXR Models

CAUTION

Overtightening stem nut will cause the bearings to wear excessively.

WARNING

An improperly adjusted fork stem nut may cause handling problems.

1. Replace fork sides as described under FRONT FORK, INSTALLATION.

2. On FXRD, FXRT and FXRS-SP replace air control system banjo bolts following the applicable INSTALLATION procedure in this section.

REAR SWING ARM

REMOVAL

1. Remove the rear wheel and rear wheel sprocket housing. See the REAR WHEEL SPROCKET, REMOVAL procedure.
2. Perform steps 7 - 13 as described in the TRANSMISSION CASE, REMOVAL procedure in section 7.

DISASSEMBLY

1. See Figure 2-78. Pry the washer (2) and plastic ring (3) from one side of the swing arm.

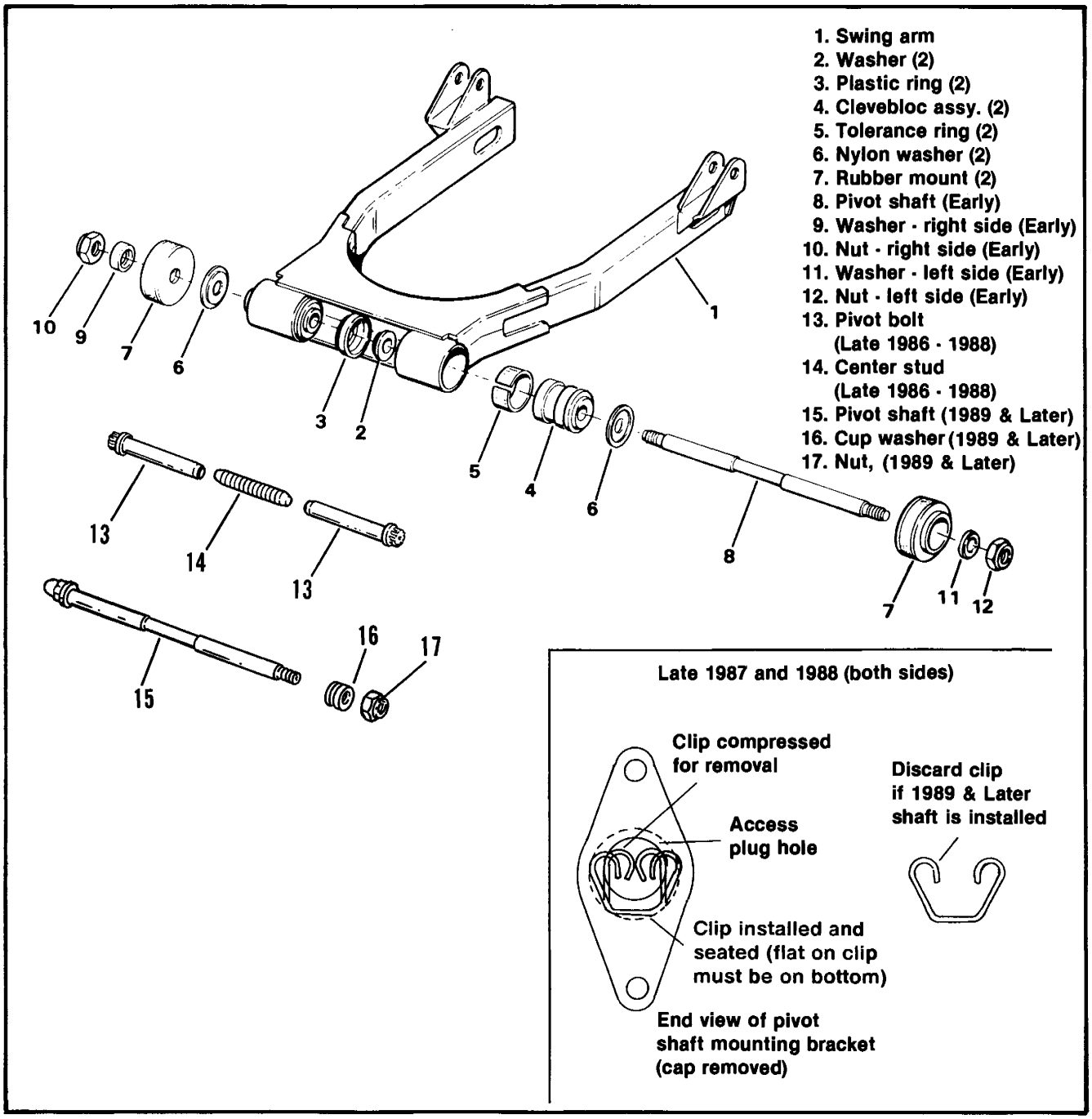


Figure 2-78. Rear Swing Arm

2. See Figure 2-79. Place the swing arm in an arbor or hydraulic press. Place the PRESS COLLAR, from the SWING ARM ASSEMBLY TOOL, Part No. HD-96200-80, on the outside diameter of the swing arm as shown.

3. Place a 1-1/4 in. socket on the clevebloc outside diameter. Use a long extension and press the clevebloc out of the swing arm.

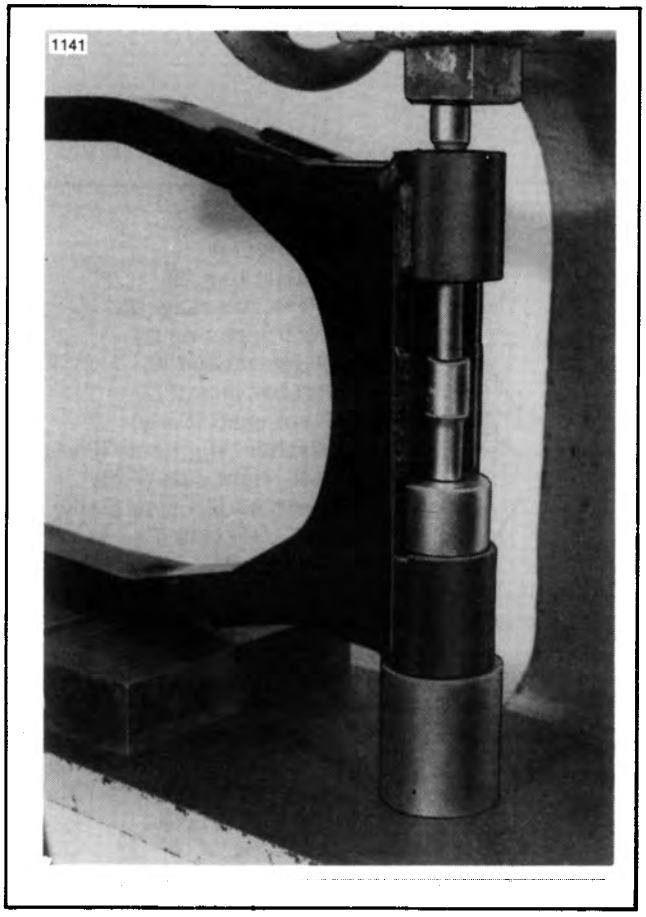


Figure 2-79. Pressing Out Clevebloc

NOTE

The clevebloc is a silicone filled bushing. Always press on the clevebloc outer sleeve. Never press directly on the clevebloc because any excessive force may break the seal and cause the silicone to leak out. Follow the assembly and installation instructions carefully. If clevebloc leaks it must be replaced.

4. Repeat Steps 1-3 for the other clevebloc.

ASSEMBLY

1. See Figure 2-80. Place a new tolerance ring (5, Figure 2-78) on one clevebloc and using the PRESS PLUG press the washer, plastic ring and clevebloc into one side of swing arm.

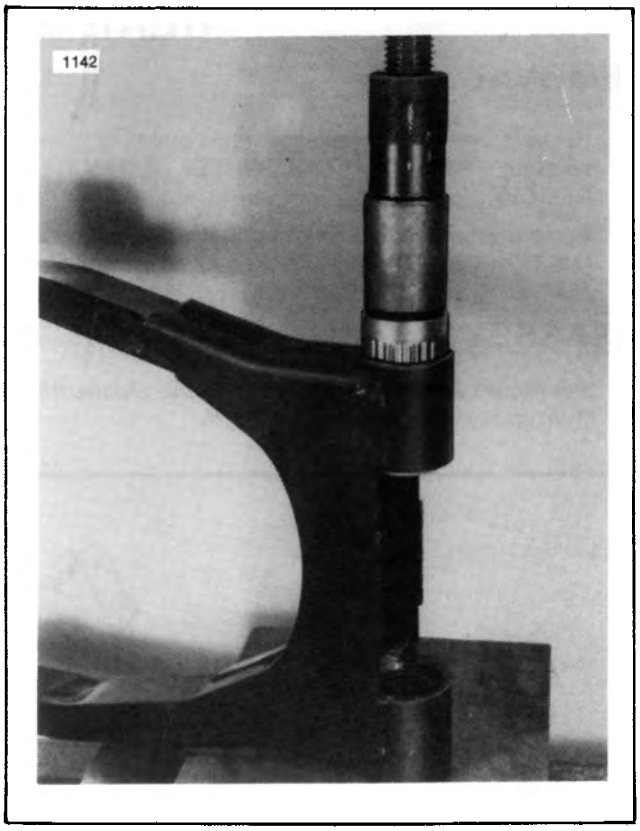


Figure 2-80. Pressing in Clevebloc

2. See Figure 2-81. The clevebloc should be pressed in so the stepped surface is flush with the mounting surface.

3. Repeat for the other side. Do not reuse tolerance ring, install a new one.

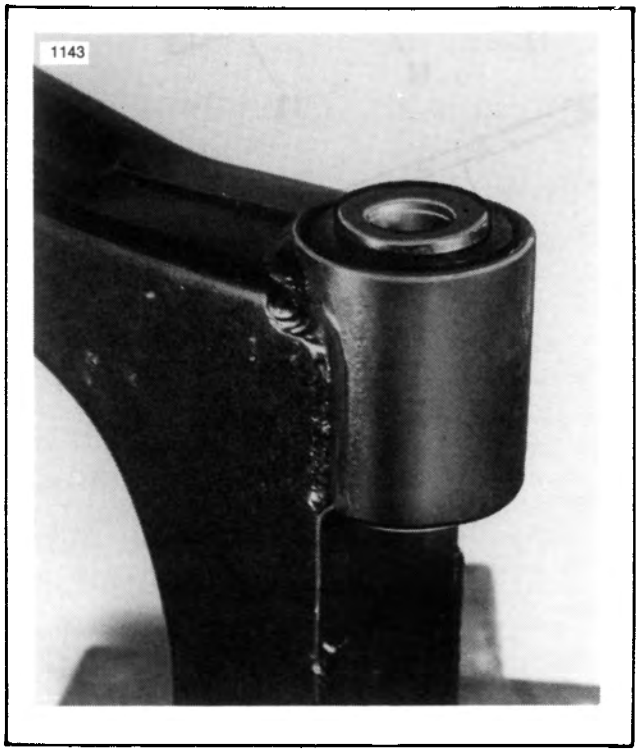


Figure 2-81. Clevebloc in Swing Arm

INSTALLATION

1. Place the rear swing arm in the motorcycle. Fasten it to the transmission case following Steps 2-5 under TRANSMISSION CASE, ASSEMBLY procedure. Install the rear wheel. See the REAR WHEEL INSTALLATION procedure.

2. Make all adjustments described in the REAR WHEEL and REAR CHAIN or REAR BELT sections.

NOTE

Check the pivot shaft nut or pivot bolt torque every 5,000 miles.

ENGINE FRONT RUBBER MOUNT

The engine front rubber mount should be inspected every 2500 miles. Be sure to examine carefully from the bottom of the motorcycle paying special attention to the area between the large flat metal washer and the bracket on the frame. Replace the mount if there are any signs of cracking or shearing of the rubber. Check front mount alignment. See VEHICLE ALIGNMENT earlier in this section.

REAR SHOCK ABSORBER — 1984

ADJUSTMENT

FLT, FXRS Models

The rear shock absorber springs can be adjusted to five positions to compensate for various loads. For heavy loads, the springs should be compressed. For lighter loads the springs should be extended. Use the following procedure to adjust the shocks.

1. Remove the saddlebags on FLT models.
2. See Figure 2-82. Using a SPANNER WRENCH, Part No. HD-94820-75, turn the shock absorber cam to the desired position. Repeat for the other shock so both are adjusted to the same level.

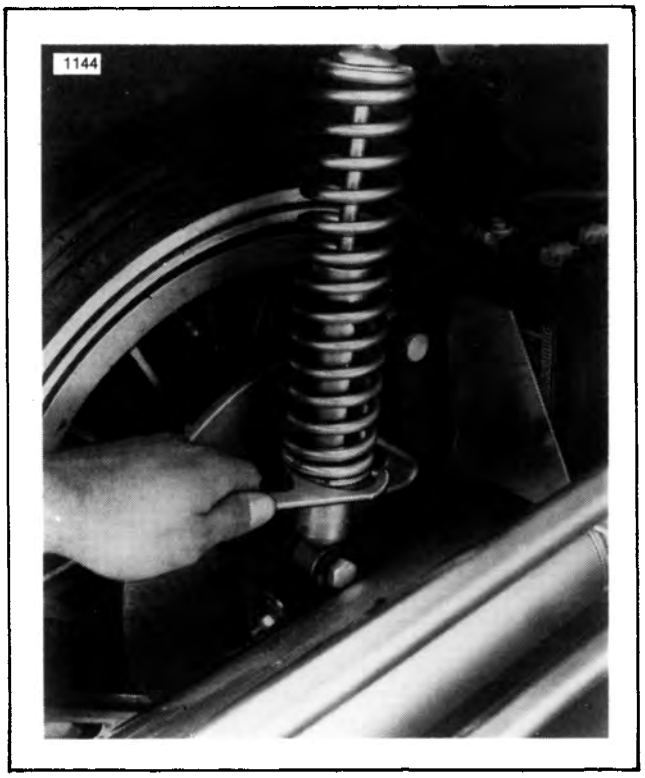


Figure 2-82. Adjusting the Rear Shock Absorber

NOTE

Always back off on the cam when releasing the spring tension for lighter adjustments.

FXRT Models

The rear suspension is adjusted by adding or removing air from the air valve located underneath the operator's seat. Refer to the chart for the correct air pressure.

The preferred pressure for personal riding comfort can be selected from the chart. Lower pressure gives a softer ride and higher pressure gives a firmer ride. Setting the pressure outside of the recommended range for loading will result in a reduction of available ride comfort. Pressures should be adjusted with the vehicle on the jiffy stand.

CAUTION

Air suspension components fill rapidly. When adding air to the front and rear suspension or accumulator, use a low pressure source such as a regulated pressure supply or a hand or foot operated pump, to prevent damage to air suspension components. AIR SUSPENSION PUMP AND GAUGE, Part No. HD-34633 is available at your Harley-Davidson dealer.

NOTE

Use a no-loss air gauge to accurately measure air pressure.

FXRT AIR SHOCK	
LOADING	**RECOMMENDED PRESSURES (PSI)**
Rider weight up to 150 lbs:	4 - 8
For each extra 25 lbs., add:	3
Passenger weight for each 50 lbs., add:	8
Luggage weight for each 10 lbs., add:	2
Maximum Pressures:	40

REMOVAL

FLT, FXRS Models

When removing the shocks for repair or replacement, remove and install one shock first, then the other. This will eliminate the need for raising the rear end of the motorcycle. If it is necessary to remove both shocks at once, place the motorcycle on a center stand with the rear wheel raised off the ground.

1. Remove the saddlebags from FLT models.
2. Remove the muffler on FLT models so the shock bottom mounting bolt can be removed.

NOTE

It may be necessary to remove rear muffler on FXR Models.

3. Remove the shock upper and lower mounting bolts and remove the shock.

FXRT (Figure 2-83)

When removing the air shocks for 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.

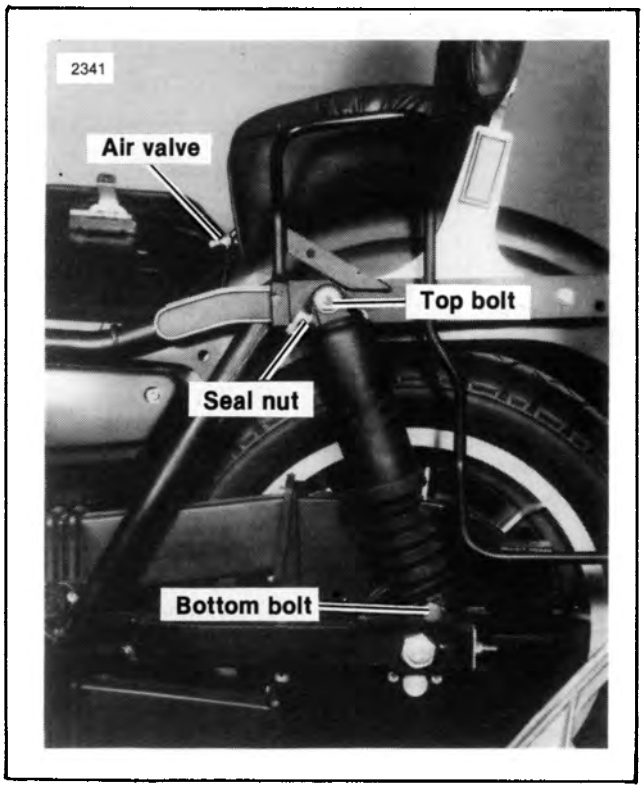


Figure 2-83. Rear Air Shock Absorber — FXRT

1. Remove the saddlebags.

2. Remove the air line at the compression fitting, the top mounting nut and the bottom mounting bolt. Remove the air shocks. The brass elbow and seal nut remain on the shock unless they require service.

DISASSEMBLY

1. See Figure 2-84. Place the shock, cam side down, in SHOCK COMPRESSOR tool, Part No. HD-97010-52A. Place an extra pressing block in the tool to help compress the shock.

2. Compress the shock and remove the spring seat (1, Figure 2-85).

3. See Figure 2-85. Remove the shock from the compressor tool and disassemble the spring (2), spring guide (3) and spring cam (4) from the shock (5).

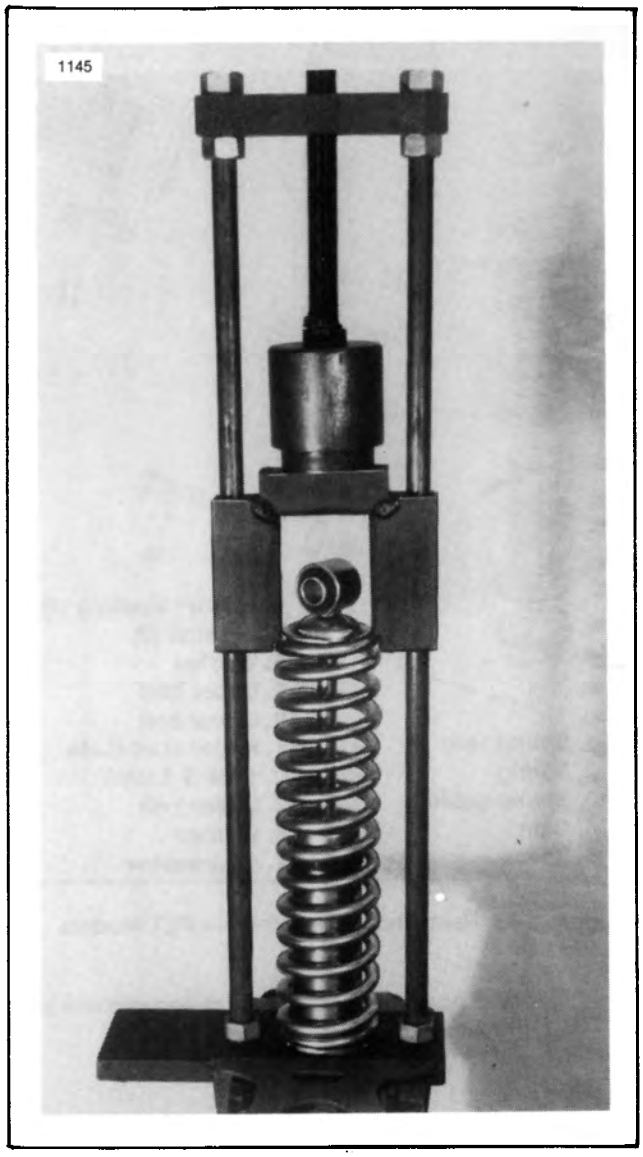


Figure 2-84. Disassembly Shock Absorbers

NOTE

FLT and FXRT air shocks are not repairable.

CLEANING, INSPECTION AND REPAIR

FLT, FXR Models (Figure 2-85, 2-86)

1. Examine the rubber bushings (6) and replace them if they are cracked or worn.

2. Examine the shock (5) 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 it is worn or leaking.

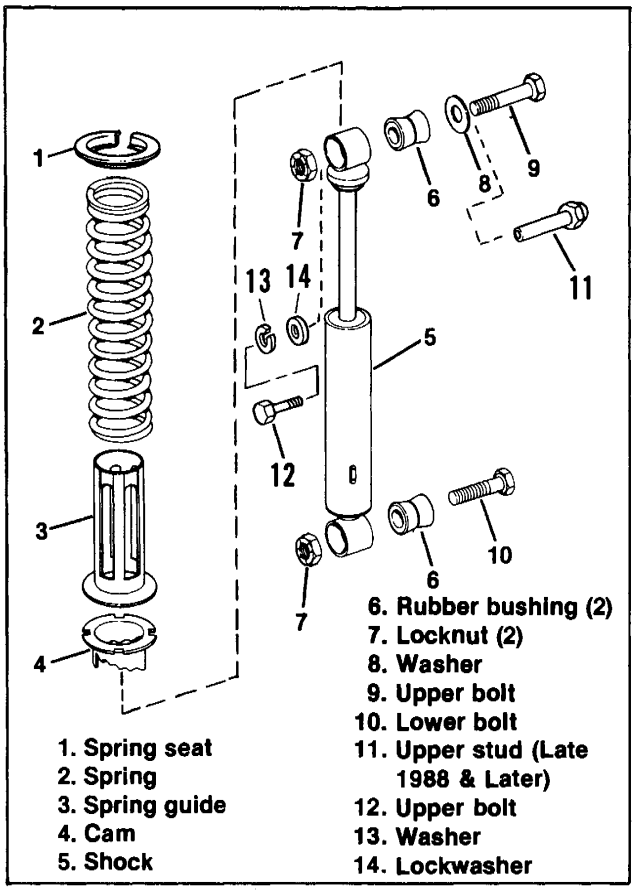


Figure 2-85. Rear Shock Absorber — FLT Models

3. Clean and examine all other parts and replace any that appear worn or damaged.

FXRT

1. Examine the shocks for leaks. The unit should not leak. The shock is a non-repairable item and must be replaced if it is worn or leaking.

2. Clean and examine all other parts of the air valve system and replace any that appear worn or damaged.

ASSEMBLY (Figures 2-85, 2-86)

1. Place the cam (4), spring guide (3) and spring (2) on the shock (5). The cam steps should face downward.

2. Place the assembly in the compressor tool and install the cover (13) and spring seat (1).

NOTE

If the brass elbow at the top of the shock was removed, apply a coat of PIPE SEALANT WITH TEFLON on the threads. Thread the elbow into the shock casing at least four turns. Then position the elbow with the open end straight down and lock in place by tightening the seal nut.

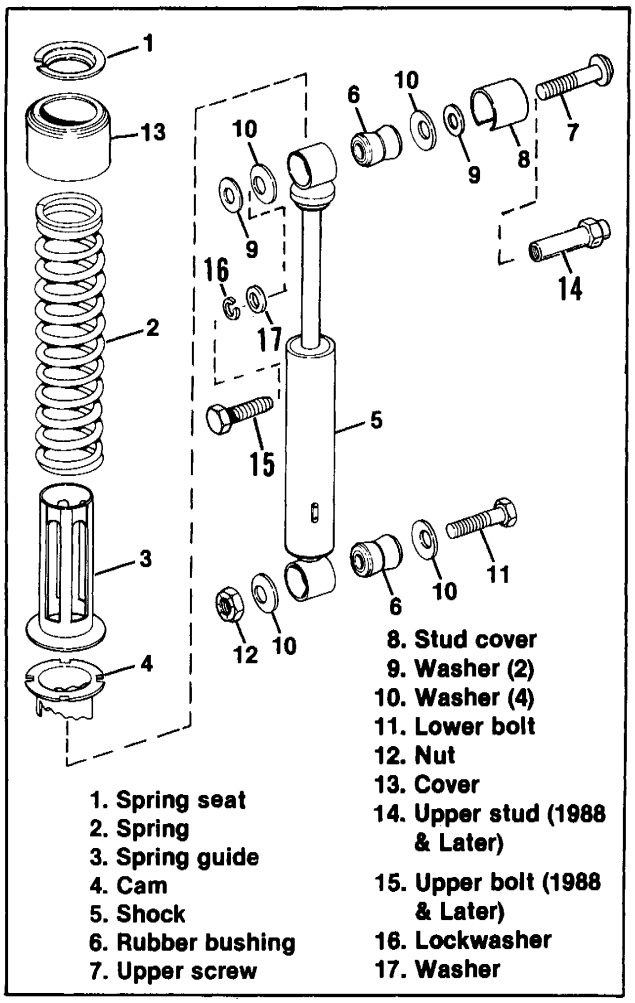


Figure 2-86. Rear Shock Absorber — FXR Models

INSTALLATION

FLT, FXRS Models

1. Fasten each shock to the frame and swing arm using the original bolts and locknuts. The larger bolt goes in the top mounting hole.

2. Adjust the shocks according to the ADJUSTMENT procedure. Install mufflers.

3. Install the saddlebags on FLT models.

FXRT

1. Fasten each shock to the frame and swing arm using the original mounting hardware.

2. Adjust the air shock according to the air pressure chart. Install mufflers.

3. Install the saddlebags following instruction under saddlebag—FXRT INSTALLATION in this section.

REAR SHOCK ABSORBER — 1985 AND LATER

ADJUSTMENT

FLT Models

See Figure 2-87. The rear air suspension is adjusted by adding or removing air from the air valve located on the left sidecover below the passenger seat. Refer to the decal for the correct air pressure. The following information is on this decal:

LOADING	FLT/FLHT, FLHS AIR SHOCK ABSORBERS RECOMMENDED PRESSURES (PSI)
RIDER	0
RIDER & PASSENGER	5
RIDER & PASSENGER & MAXIMUM RECOMMENDED LUGGAGE	10

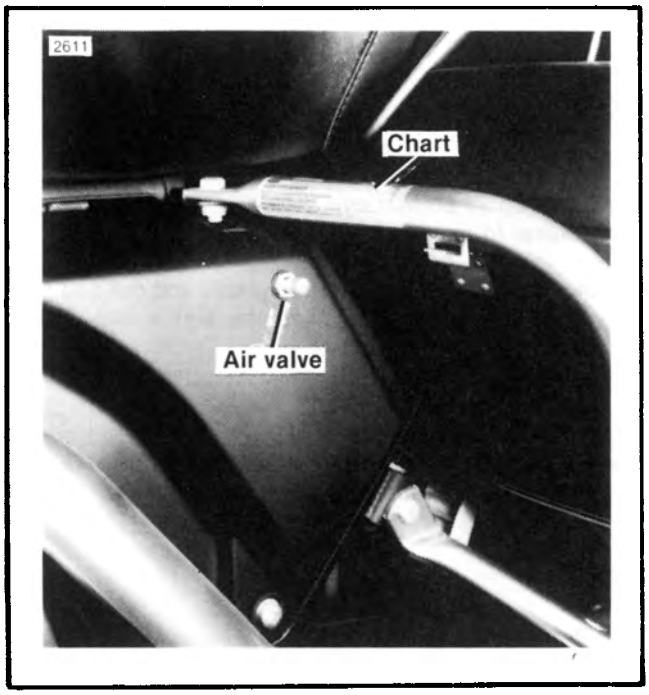


Figure 2-87. Rear Suspension Adjustment — FLT

NOTE

Recommended pressures may be adjusted for rider preference. Do not exceed 20 PSI.

CAUTION

Maximum air pressure should not be exceeded. All air components fill rapidly and we recommend low air line pressure be used to avoid damage to air components. Use AIR SUSPENSION PUMP AND GAUGE, Part No. HD-34633, available at your Harley-Davidson dealer. This will prevent damage to air suspension components.

FXR, FXRS Models

The rear shock absorber springs can be adjusted to five positions to compensate for various loads. For heavy loads, the springs should be compressed. For lighter loads, the spring should be extended.

See Figure 2-88. To adjust the rear shock absorber, turn spring adjusting cam to desired position with spanner wrench. Both spring adjusting cams must be adjusted to the same position. When returning to off-cam position, cams should be backed off in opposite direction.

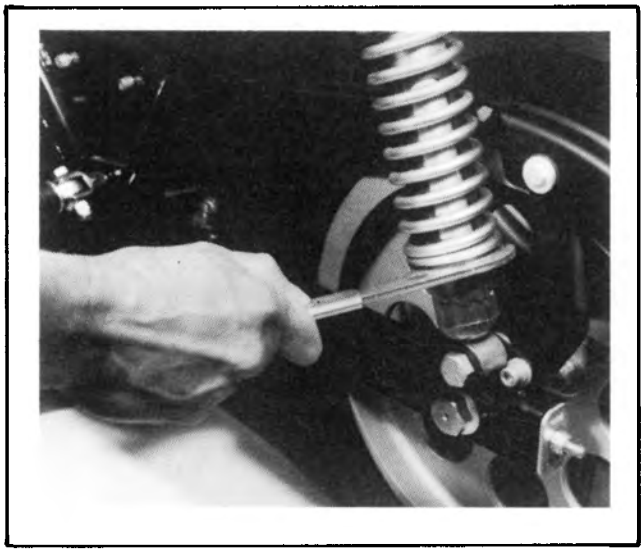


Figure 2-88. Rear Shock Absorber Spring Adjustment — FXR, FXRS

FXRT, FXRD Models

The FXRT utilizes a split rear shock absorber system. The left shock is a non-adjustable, self-leveling type. The right shock is an air adjustable type, similar to the FLT models.

See Figure 2-89. The right rear air suspension is adjusted by adding or removing air from the air valve located underneath the front of the right saddlebag.

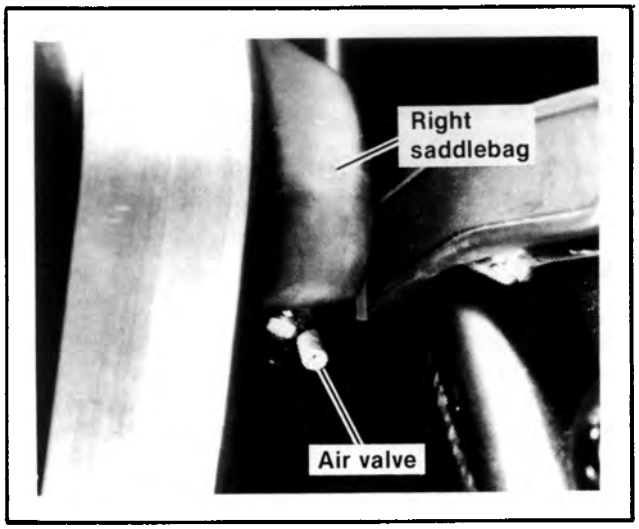


Figure 2-89. Rear Air Suspension Adjustment — FXRT, FXRD

Refer to the decal underneath the operator's seat for the correct air pressure. The following information is on this decal:

LOADING	FXRT, FXRD SHOCK RECOMMENDED PRESSURE (PSI)
Rider weight up to 150 lbs:	0 - 5
For each extra 25 lbs., add:	5
Passenger weight for each 50 lbs., add:	10
Luggage weight for each 10 lbs., add:	3
Maximum Pressures:	60

CAUTION

Maximum air pressure should not be exceeded. All air components fill rapidly and we recommend low air line pressure be used to avoid damage to air components. Use AIR SUSPENSION PUMP AND GAUGE, Part No. HD-34633, available at your Harley-Davidson dealer. This will prevent damage to air suspension componets.

NOTE

The left shock absorber does not require adjustment.

REMOVAL

When removing the shocks for repair or replacement, remove and install one shock first, then the other. This will eliminate the need for raising the rear end of the motorcycle. If it is necessary to remove both shocks at once, place the motorcycle on a center stand with the rear wheel raised off the ground.

FLT

1. Remove the saddlebags.
2. Remove the air line at the compression fitting, the top mounting nut and the bottom mounting bolt. Remove the air shocks. The brass elbow and seal nut remain on the shock unless they require service.

NOTE

See Figure 2-85. Late 1988 and later models are equipped with internally threaded stud (11) that mates with bolt (12).

FXRS

NOTE

The FXRS Sport Edition and the FXRT require rear muffler removal to remove rear shock.

Remove the shock lower mounting bolt and nut and the upper nut and washer. Remove the shock and upper spacer.

NOTE

See Figure 2-86. All 1988 and later FXR models use the two piece stud (14) and bolt (15) upper fastener.

FXRT

1. Remove the saddlebags.
2. Remove the shock lower mounting bolt and nut and the upper nut, lockwasher and flat washer.
3. Remove the shock.

DISASSEMBLY

NOTE

Air shocks are non-repairable items, except for the rubber mounting bushings. If the shock is leaking or damaged, it must be replaced as an assembly.

INSTALLATION

All Models (Figure 2-85, 2-86)

1. Fasten each shock to the frame and swing arm using the original fasteners.

2. Apply two or three drops of Loctite 242 (blue to threads of bottom bolt and tighten to 35-40 ft-lbs torque.

3. On early 1988 and earlier FLT's and 1984 - 1987 FXR's repeat step 2 for upper bolts.

4. On late 1988 and later FLT's and 1988 and later FXR's, apply 2 to 3 drops of Loctite 242 (blue) to bolt (12, Figure 2-85 or 15, Figure 2-86) and install bolts into internally threaded stud.

5. Tighten bolt and stud to 33-35 ft-lbs torque.

THROTTLE CONTROL

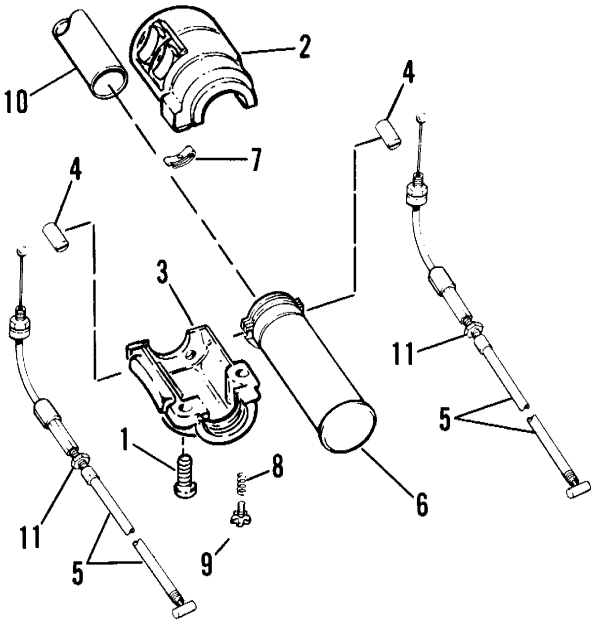
GENERAL (Figure 2-90)

The throttle controls on 1989 and later FLTC Ultra and FLTHC Ultra are covered under CRUISE CONTROL -ULTRA MODELS in Section 8.

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.

DISASSEMBLY (Figure 2-90)

1. Remove the two screws (1) and separate the upper clamp (2) from the lower clamp (3).



1. Screw (2)
2. Upper housing
3. Lower housing
4. Ferrule (2)
5. Control cable assembly (2)
6. Throttle grip
7. Friction spring
8. Spring
9. Adjusting screw
10. Handlebar
11. Adjusting nut (2)

Figure 2-90. Handlebar Throttle Control

NOTE

The switch assembly is part of the throttle clamp.

2. Unhook each ferrule (4) and cable (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), adjusting screw (9) and spring (8) from the lower clamp (3).

CLEANING, INSPECTION AND REPAIR (Figure 2-90)

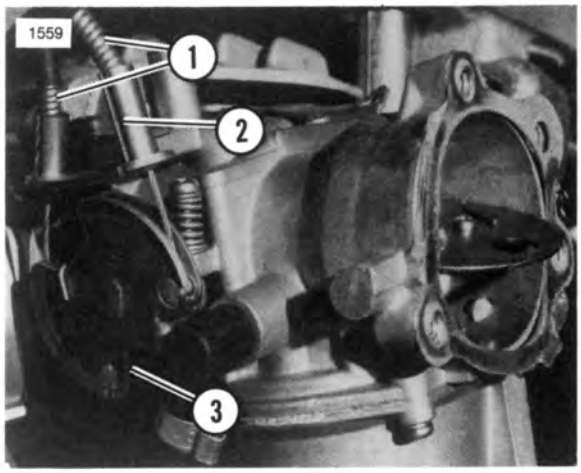
1. Clean all parts in a non-flammable cleaning solvent and blow dry with compressed air.

2. Replace the cables (5) if frayed, kinked or bent.

3. Put one or two drops of oil into the housing of each control cable.

ASSEMBLY (Figures 2-90, 2-91)

1. Apply a light coating of graphite to the handlebar and inside surface of the clamps (2 and 3).



1. Cable housing
2. Spring
3. Cam stop

Figure 2-91. Cable Installation

2. Attach the cable assemblies (5) to the lower clamp (3). The throttle cable has a 5/16 x 18 in. threaded adjuster and should be assembled to the right side of the throttle grip. The idle cable has a 1/4 x 20 in. threaded adjuster and should be assembled to the left side of the throttle grip. Install adjusting screw (9), spring (8) and friction spring 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.

WARNING

Do not overtighten the adjusting screw. Operation with the screw overtightened is not recommended because of the possible hazard involved when the engine will not return to idle position automatically in an emergency.

4. Fasten the upper clamp (2) to the lower clamp (3) using the screws (1). Tighten the screws to 12-16 in-lbs torque.

5. 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 x 20 in. threaded adjuster at the throttle end.

6. Install the throttle cable (2) into the other support sleeve on the carburetor. The throttle cable has a 5/16 x 18 in. threaded adjuster at the throttle end.

Routing — FLT (Figure 2-92), FLHT/C (Figure 2-93) and FLHS (Figure 2-94)

1. FLT throttle cables are routed between the brake line and handlebar and between instrument housing and fairing.

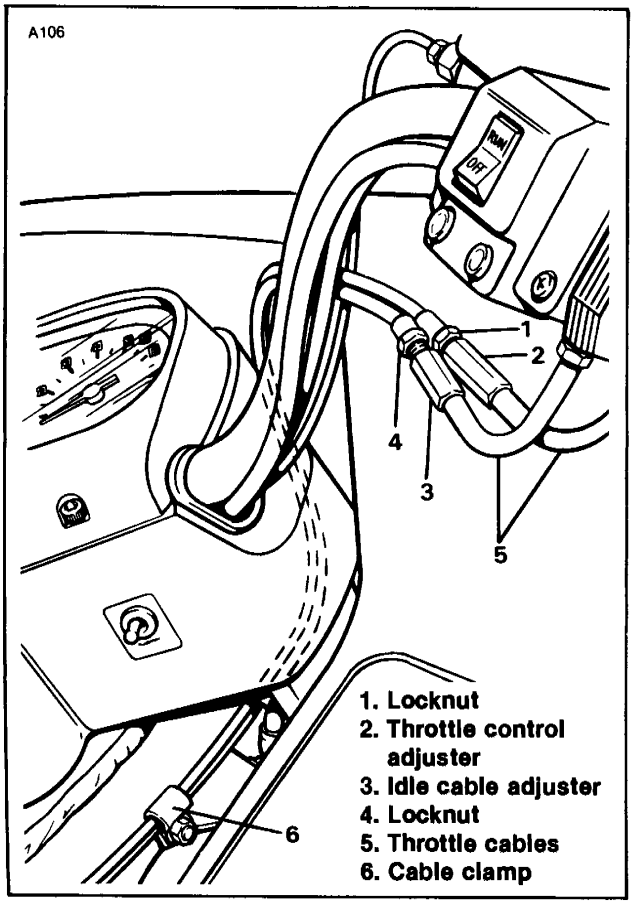


Figure 2-92. Throttle Cable Routing — FLT

2. 1984 and 1985 FLHT throttle cables are routed between the brake line and handlebar and through the hole in the headlamp housing. 1986 and later FLHT/C throttle cables are routed directly through the fairing, then looped back to the steering head.

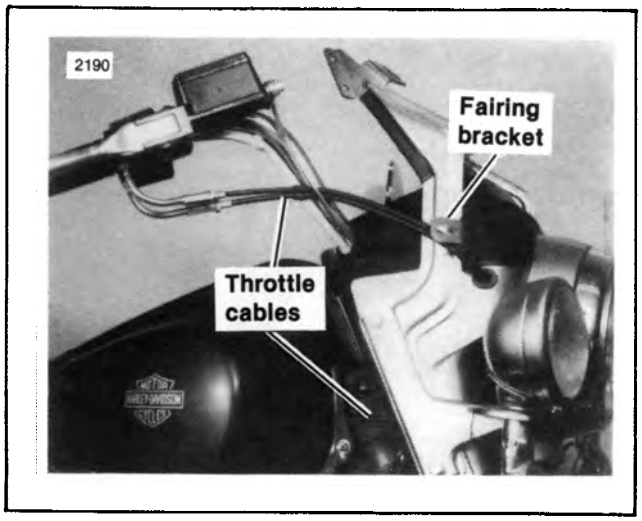


Figure 2-93. Throttle Cable Routing — FLHT

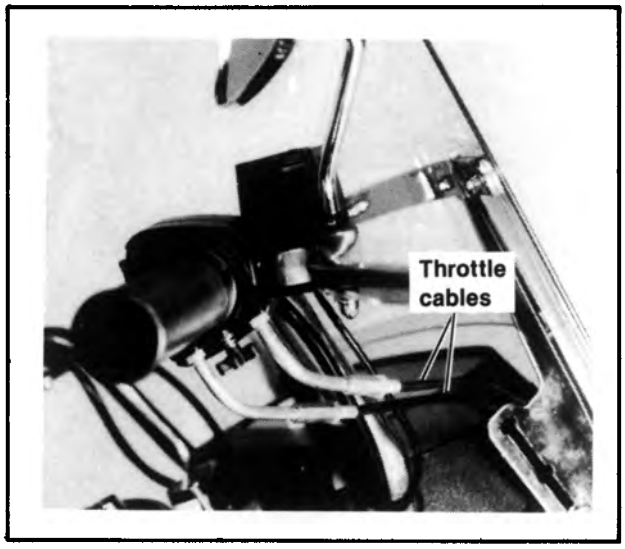


Figure 2-94. Throttle Cable Routing - FLHS

3. Throttle cables on FLHS must be routed forward between adjustable windshield bracket and instrument housing. The cables than are routed through a hole in headlight housing and down along right side of frame backbone. The final routing is the same as FLHTC and FLTC.

4. Throttle cables are fastened to front fork head with bolt, washer, clamp and locknut, and are routed along inner fuel tank housing to carburetor (see Figure 2-91).

NOTE

When turned by hand and then released the throttle grip must return to the closed or idle position and must open and close freely when front wheel is turned to the right or left fork stop. If throttle grip does not return to idle position freely, check adjusting screw tension and cables for short bends.

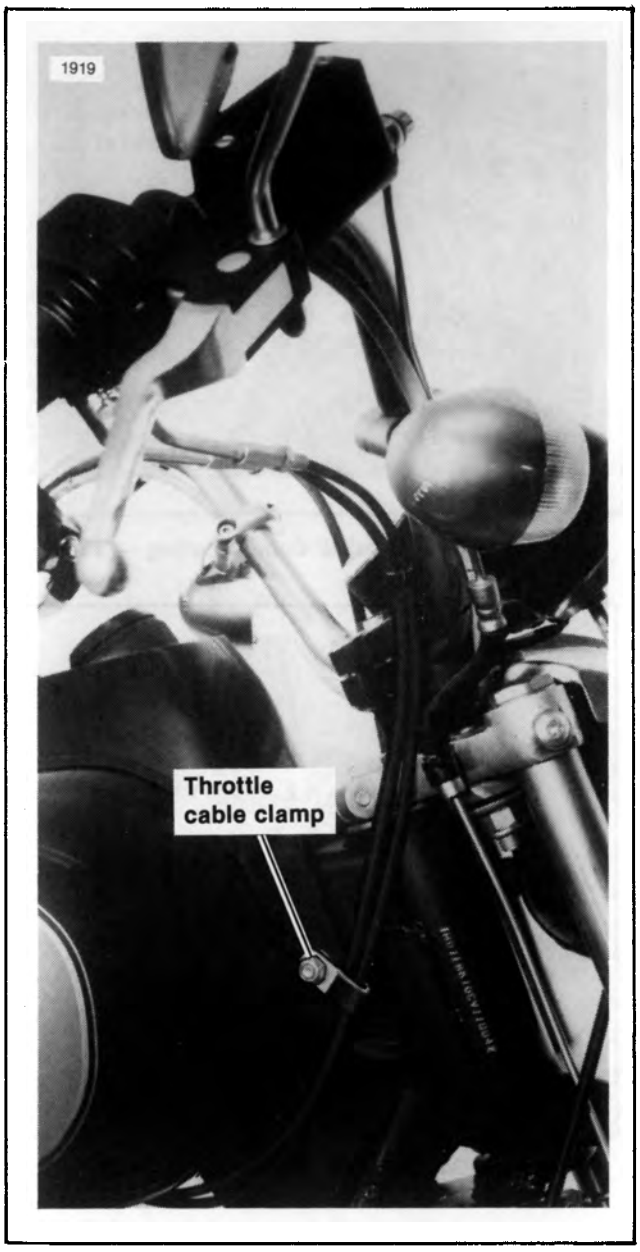


Figure 2-95. Throttle Cable Routing — FXR

Routing — FXR Models (Figure 2-95)

Throttle cables should be routed behind handlebars and under right side of tank. Be sure cable clamp is securely fastened to the fuel tank mounting bolt as shown. The FXRT and FXRD throttle cables must be routed forward of rear fairing braces.

CAUTION

Control cables must not pull tight when handlebars are turned to left and right fork stops. Also, be sure control cables and wires are clear of fork stops at steering head so they will not be pinched when fork is turned against stops.

ADJUSTMENT (Figure 2-92)

CAUTION

This adjustment is necessary to prevent excess stress and potential failure to the throttle cables.

NOTE

The throttle cable has a 5/16 x 18 in. threaded adjuster and is assembled to the right side of the throttle grip. The idle cable has a 1/4 x 20 in. threaded adjuster and is assembled to the left side 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 (2) counterclockwise until the throttle cam stop (3, Figure 2-91) just touches the stop boss on the carburetor. Tighten the locknut (1) against the throttle cable adjuster and release the throttle.

3. Turn the front wheel full right. Turn the idle cable adjuster (3) counterclockwise until the cable housing (1, Figure 2-91) just touches the spring (2, Figure 2-91) 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 the adjuster (3) clockwise to achieve the correct adjustment. Tighten the locknut (4) against the idle cable adjuster.

CLUTCH CONTROL

REMOVAL

1984 to 1986 Models

1. Remove clutch cable ball end from release arm as described in Steps 1 and 2 under CLUTCH CONTROL, ADJUSTMENT in Section 6 of this manual.

2. See Figure 2-96. Remove the clutch cable (1) and anchor pin (2) from the hand lever (3). To remove anchor pin, it will be necessary to remove the retaining ring (4) and pivot pin (5).

1987 and Later Models

1. See Figure 2-96. Remove the clutch cable (1 or 6) and anchor pin (2 or 7) from the hand lever (3). To remove anchor pin, it will be necessary to remove the retaining ring and pivot pin.

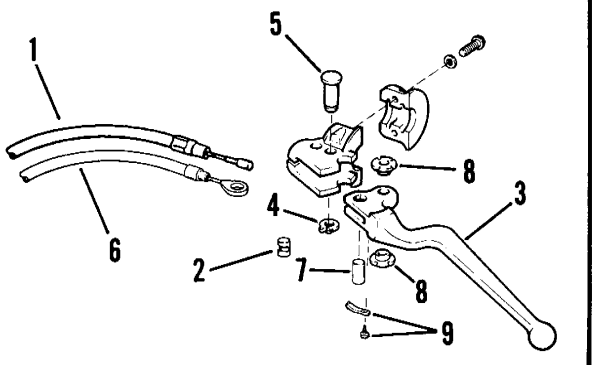
2. Drain transmission lubricant. Remove fill plug dipstick.

3. Loosen clutch adjuster so clutch cable is fully slack. See section 6, WET CLUTCH, ADJUSTMENT.

4. Remove transmission side cover.

5. See Figure 2-97. Note position of retaining ring opening. Retaining ring opening must be positioned in approximately the same location during assembly. Remove retaining ring (1).

6. Pull inner ramp (2) and coupling (3) out of side cover. Hold inner and outer ramps together to keep balls from falling free.



1. Clutch cable, 1984-1987
2. Anchor pin, 1984-1987
3. Handlever
4. Retaining ring
5. Pivot pin
6. Clutch cable, 1988-1990
7. Anchor pin, 1988-1990
8. Anchor pin bushing (2) 1984-1987
9. Anti-rattle spring and screw

Figure 2-96. Clutch Cable Installation

7. Rotate the inner ramp to a position which will allow the coupling to be disconnected from the inner ramp lever arm. Disconnect coupling (3) from inner ramp (2). Disconnect cable (4) from coupling (3).

8. Back out threaded cable fitting (5) from side cover.

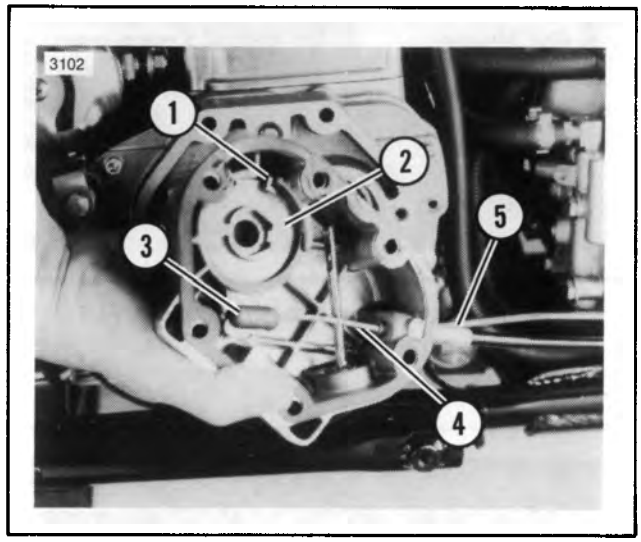


Figure 2-97. Clutch Cable Connection

INSTALLATION

1984 to 1986 Models

1. See Figure 2-96. Place a few drops of oil inside the cable housing. Wipe any dirt off anchor pin and plastic sleeves. Lube anchor pin with ANTI-SEIZE. Install the clutch cable and anchor pin to the clutch hand lever. The slot in the pin must face toward the handlebar. Install pivot pin through bracket and hand lever and secure with retaining ring.

2. See Figures 2-98, 2-99. On FLT models route the cable down the left side between instrument panel and fairing, through the cable guide on the engine. Keep cable behind highway bar and on left side of engine. Attach cable to cable clamp at crankcase (under horn). Install spring to protect cable from heat and chafing at rear cylinder. (See Figure 2-98.)

   The 1984 and 1985 FLHT cable routing is similar to the FLT; except, for cable guide on the fairing bracket as shown in Figure 2-99.

CAUTION

To prevent disconnected or broken wires do not force cable against any of the wires inside the fairing. The cable must be routed on the left side of gauges against the fairing.

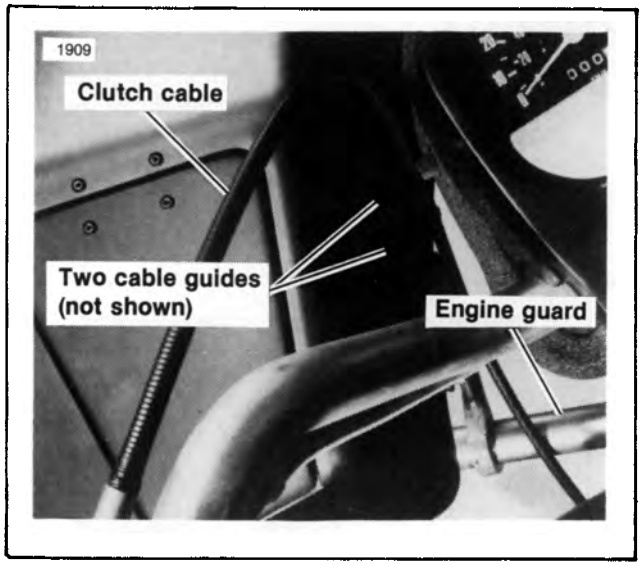


Figure 2-98. Clutch Cable Routing — FLT

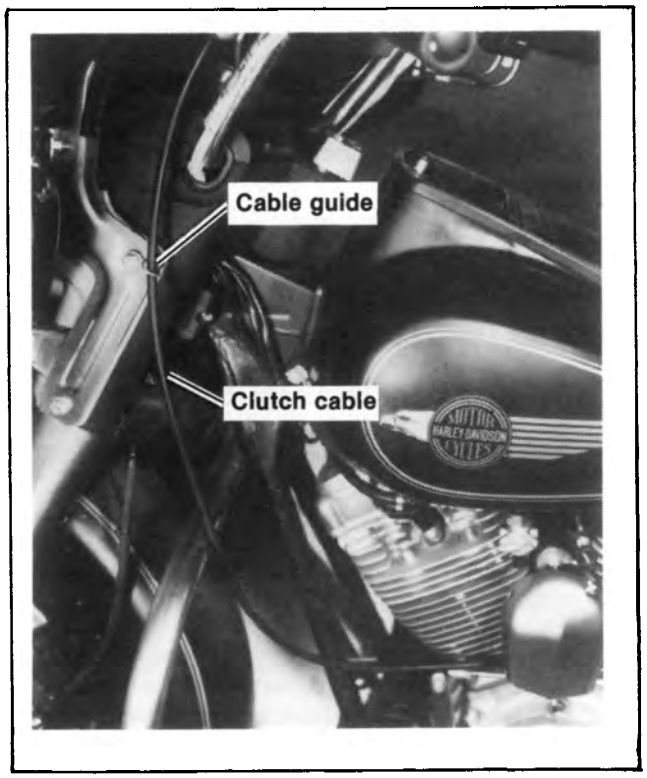


Figure 2-99. Clutch Cable Routing — 1984 FLHT

The 1986 FLHT/C clutch cable is routed forward through a rubber grommet in the fairing and looped back under the fairing to the left side of the engine.

On FXR models, the clutch cable should be routed in front of handlebars and clipped to the left front downtube as shown in Figure 2-100. Next, install cable in cable clamp on left side of crankcase and then to clutch release arm.

3. Insert clutch cable through the adjusting bracket on transmission cover and insert cable ferrule in release arm socket.

CAUTION

To prevent cable damage make sure clutch cable does not touch hot or moving parts.

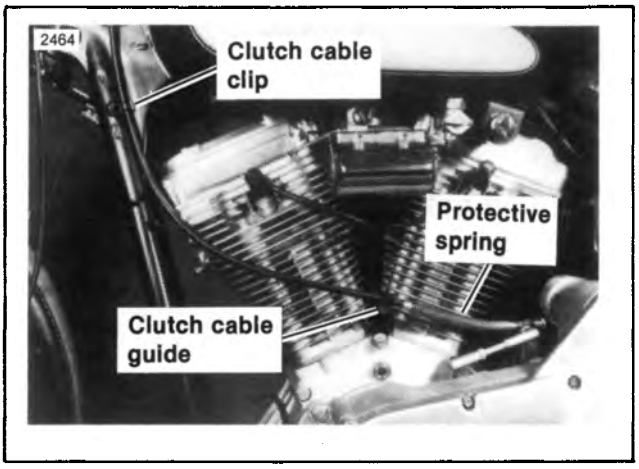


Figure 2-100. Clutch Cable Routing — FXR

1987 and Later Models

1. See Figure 2-97. Thread clutch cable fitting (5) into side cover. Do not tighten at this time.
2. Connect cable end (4) to coupling (3). Rotate ramps for best access and install coupling on inner ramp (2). Place ramp assembly in position in side cover.
3. Install retaining ring (1). Position retaining ring opening so it is located approximately over the outer ramp tang (the stop that prevents rotation).
4. Place new gasket on side cover. Position side cover on transmission case and thread in bolts. Tighten side cover bolts to 10-12 ft-lbs torque.
5. Tighten clutch cable fitting (5) to 3-5 ft-lbs torque.
6. Fill transmission and install filler plug oil gauge.
7. Cable passes through cable clip at exhaust pipe bracket and under timer cover. Lead cable to the back of right downtube to the front of left downtube. See Figure 2-101. Ty-wrap the cable to left downtube and lead cable up to clutch lever.
8. See Figure 2-102. On FLT models cable passes through cable clip under timer cover to the left side between engine and downtubes.
9. On FXRT bring cable up between fairing brace and left fork tube.

Figure 2-101. FXR Clutch Cable Routing — Left Side, 1987 and Later

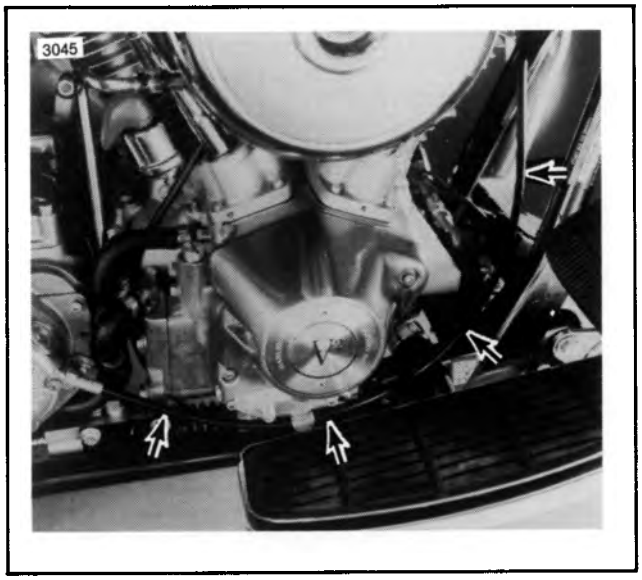


Figure 2-102. FLHT Cable Routing — Right Side, 1987 and Later

10. See Figure 2-103. On FLT lead cable through cable guide at left side of fairing.

Figure 2-103. Clutch Cable Routing — 1987 FLT and Later

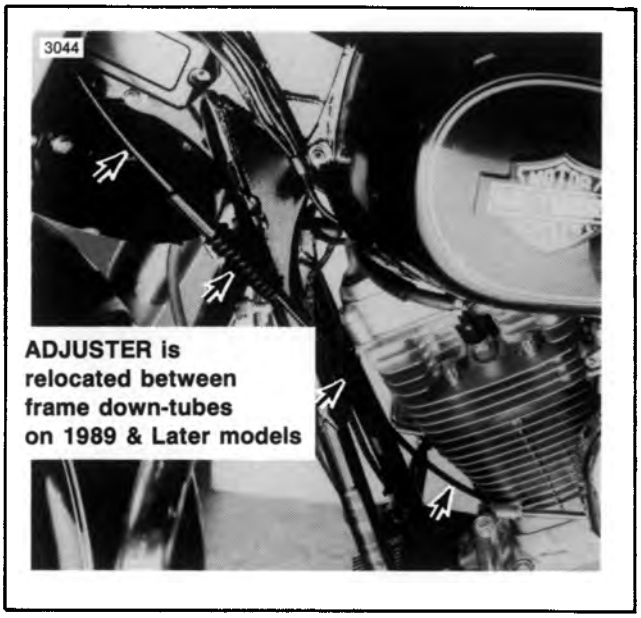


Figure 2-104. FLHT Clutch Cable Routing — Left Side, 1987 and Later

11. See Figure 2-104. On FLHT bring cable end up through grommet in fairing and ty-wrap cable to left fork side.

CAUTION

To prevent disconnected or broken wires do not force cable against wires inside fairing.

12. See Figure 2-105. The FLHS clutch cable routing is similar to the FLHTC except a bracket, attached with the upper-spotlight-bracket bolt, locates and guides the cable down forward of the front engine guard and behind front frame downtubes. The cable crosses to the right side of the engine and the final routing is identical to the FLHTC.

13. On all 1984 - 1987 models place a few drops of oil inside the cable housing. Wipe any dirt off anchor pin and plastic sleeves. Lube anchor pin with ANTI-SEIZE. Install the clutch cable and anchor pin to the clutch hand lever. The slot in the pin must face toward the handlebar. Install pivot pin through bracket and hand lever and secure with retaining ring.

14. See Figure 2-96. On 1988 and later models, anchor pin (7) does not require lubrication. Place a few drops of oil in side cable housing.

15. Insert anchor pin (7) through handle (3) and clutch cable end (6).

16. Place handle in bracket and install pivot pin (5) and retaining ring (4).

17. Adjust clutch cable. See section 6, WET CLUTCH, ADJUSTMENT.

Figure 2-105. Clutch Cable Routing — FLHS

INSTRUMENTS AND GAUGES

TROUBLESHOOTING (ALL MODELS)

Always refer to the applicable wiring diagram (at the rear of this manual) when troubleshooting instruments or gauges.

The following troubleshooting chart should be used to diagnose and locate the problem in malfunctioning or inoperative instruments or gauges.

See Figure 2-106 for wire connections at rear of gauges. Removal and installation of instruments and gauges is covered following this troubleshooting subsection.

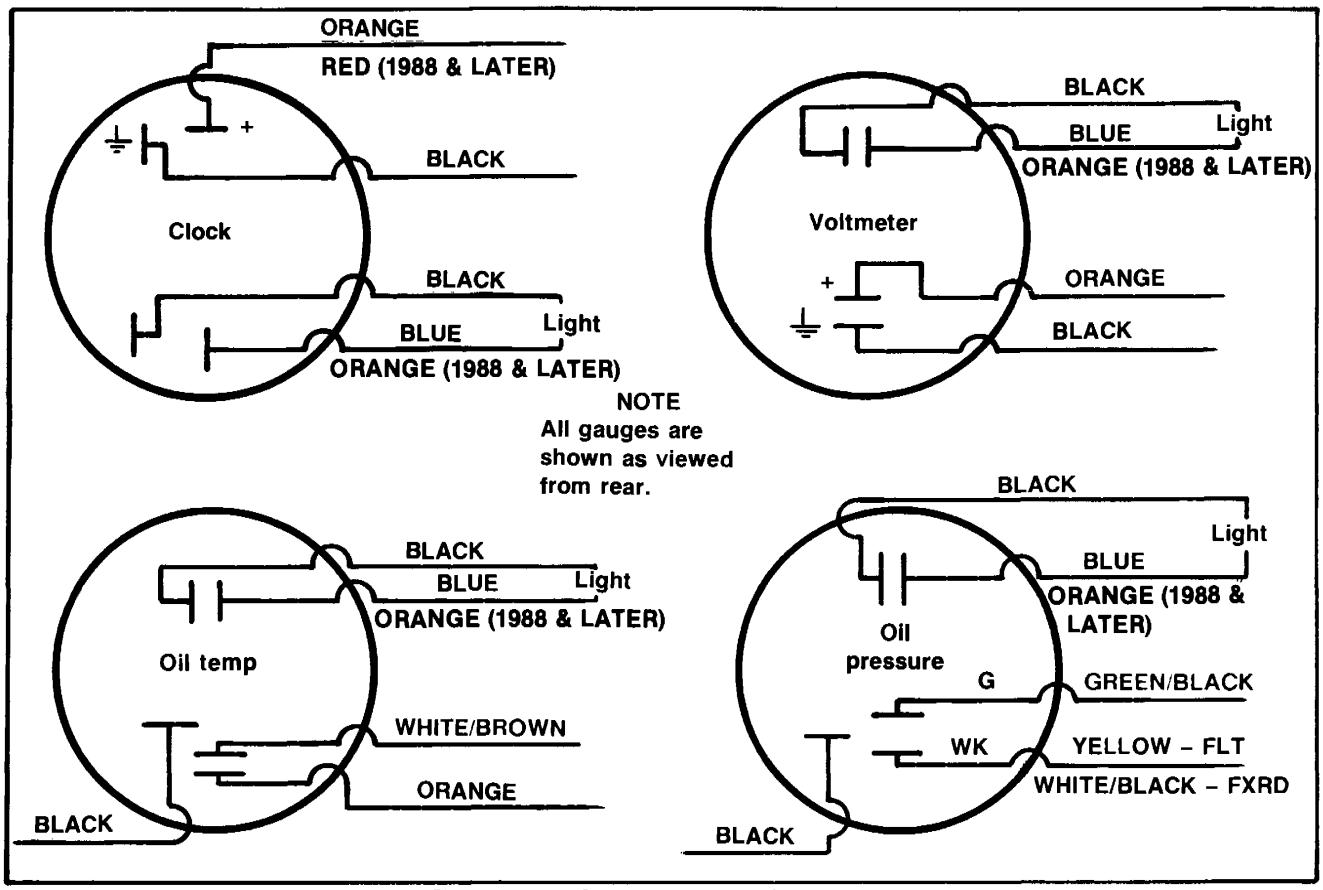


Figure 2-106 Connections for Gauges

Problem	Cause	Solution
FUEL GAUGE		
1. Gauge inoperative.	1.1 Sender/fuel tank not grounded.	1.1.1 See test procedure that follows this chart.
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.	1.2 Malfunction in gauge or sender.	1.2.1 See 1.1.1
	1.3 Broken or disconnected wire from ignition switch to fuel gauge.	1.3.1 See 1.1.1

Problem	Cause	Solution
OIL TEMPERATURE GAUGE		
2. No gauge reading.	2.1 Malfunction in gauge or sender	2.1.1 Remove wire from sender (oil tank drain plug) and ground wire to crankcase. Turn ignition switch ON. Gauge must read 300°. Remove sender wire from crankcase ground - gauge must read below 120°. If gauge readings were as specified above, replace oil drain plug sender.
	2.2 Broken or disconnected 12 vdc wire to gauge or burned-out gauge.	2.2.1 Verify 12 vdc is present on sender wire. If voltage is present, but gauge did not respond in 2.1.1 – replace gauge. If voltage is not present check for broken or disconnected wire or burned-out gauge.
OIL PRESSURE GAUGE AND INDICATOR LIGHT		**CAUTION** **Do not run engine except for test or ride motorcycle if OIL light stays on and gauge indicates no oil pressure.**
3. Oil Indicator light stays on with engine running above idle and/or gauge does not indicate pressure.	3.1 No oil pressure due to lack of oil or inoperative oil pump.	3.1.1 Check oil level and add oil if low. Restart engine and check that oil light goes off and gauge indicates pressure. If problem still exists, refer to OIL PUMP in section 3.
	3.2 Contacts in pressure sender not opening to shut-off light. Variable resistor in sender is shorted to ground.	3.2.1 Check that yellow lead on FLT or white/black lead on FXRD is connected to sender terminal WK. The green/black lead must be connected to terminal G. If gauge indicates pressure but oil light stays lit – disconnect wire from terminal WK and place one ohmmeter probe on WK terminal and other probe on crankcase. **CAUTION** **Make certain you have disconnected wire from terminal WK before checking with ohmmeter. The ohmmeter may be damaged if connected to 12 vdc.** Meter must read zero ohms. Start engine and run at a fast idle, meter must read infinity. Replace sender if above meter readings were not obtained. If oil light is functioning correctly, but gauge does not function correctly perform following: Remove lead from "G" terminal on sender. Turn ignition switch ON, gauge must read full scale 40 PSI on FXRD or 70 PSI on FLT models. Ground lead to crankcase, gauge must read zero. If above gauge readings were obtained replace sender. If gauge did not indicate above readings – replace gauge.

Problem	Cause	Solution
VOLTMETER AND CLOCK		
4. Meter or clock inoperative.	4.1 Broken or disconnected leads to meter or clock or open meter winding or clock mechanism.	4.1.1 Check that 12 vdc is present at "+" terminal on voltmeter with ignition switch ON. With ignition switch OFF check ground terminal for continuity to ground. On clock check that 12 vdc is present at "+" terminal with ignition switch On and OFF. Remove wire from ground terminal and check wire for continuity to ground. If 12 vdc is present and ground terminal or wire is grounded – replace meter or clock. If 12 vdc is not present trace wiring until disconnected or broken wire is found and repaired. If ground terminal or wire is not grounded refer to wiring diagram and repeat procedure given for 12 vdc lead.

Fuel Gauges

THEORY OF OPERATION

See Figure 2-107. With ignition switch on, the fuel gauge is connected to + 12 vdc. Current flows through the gauge and variable resistor in the fuel gauge sending unit to ground. The sending unit float controls the amount of resistance in the variable resistor.

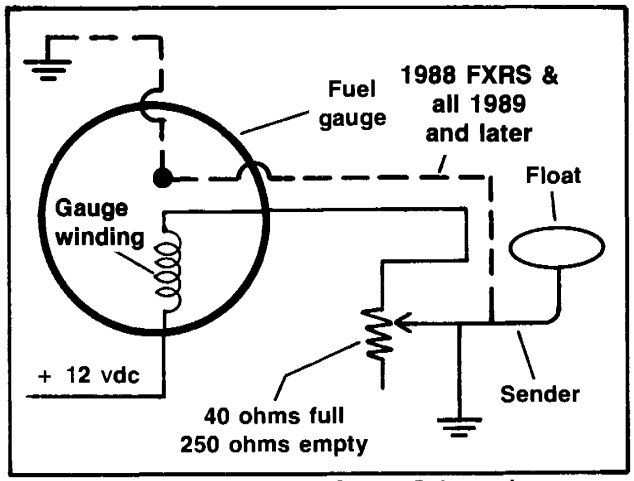


Figure 2-107. Fuel Gauge Schematic

FUEL GAUGE AND SENDER TEST

1. Ground wire from center terminal of fuel gauge sender at connector under seat.

2. Turn on ignition switch, fuel gauge must indicate FULL. If gauge indicated FULL, gauge is functioning correctly. Proceed to step 3. If gauge did not indicate FULL, proceed to step 4.

3. With Multi-Meter, Part No. HD-35500, set on the RXI scale, measure the resistance of the sending unit. Place one probe on center terminal and the other probe on a good ground. The meter must indicate approximately 40-250 ohms. If fuel tank is full the reading should be approximately 40 ohms. An empty tank should have a 250 ohm resistance. If a very high resistance or infinity is indicated on the meter, the sender may be "open" or not grounded. Check that sender and fuel tank are grounded by placing one probe of Multi-Meter on sender flange and the other probe on crankcase. Meter must indicate one ohm or less. Replace sender if one ohm or less was present. If a higher resistance is present, remove sender and check that sender gasket has a ground staple in it.

NOTE

Sender gaskets on 1988 and later FXRS's do not have a ground staple. All other model's sender gaskets have a ground staple. All 1989 and later models have a ground wire that connects the sender to ground.

Place one probe of Multi-Meter on unpainted surface of fuel tank and other probe to crankcase. Meter reading must be one ohm or less. Clean and tighten fuel tank mounting fasteners if a higher resistance is present. Verify that fuel tank is grounded, check that resistance of sending unit equals values given in Figure 2-107 and install sender using a new gasket.

4. If gauge did not indicate FULL, check with Multi-Meter, Part No. HD-35500 that 12 vdc is present on wire removed in step 1. If 12 vdc is not present check for broken or disconnected wire or an open winding in fuel gauge. Replace gauge is winding is open.

REMOVAL AND INSTALLATION, INSTRUMENTS

FLT/C — 1984 and LATER, FLHT/C — 1984 and 1985 (Figure 2-108)

Repair

The instruments are non-repairable and must be replaced if they are not working properly. Before replacing a faulty instrument, check to see if the connections are causing the malfunction. Lubricate speedometer cables with graphite grease every 5000 miles.

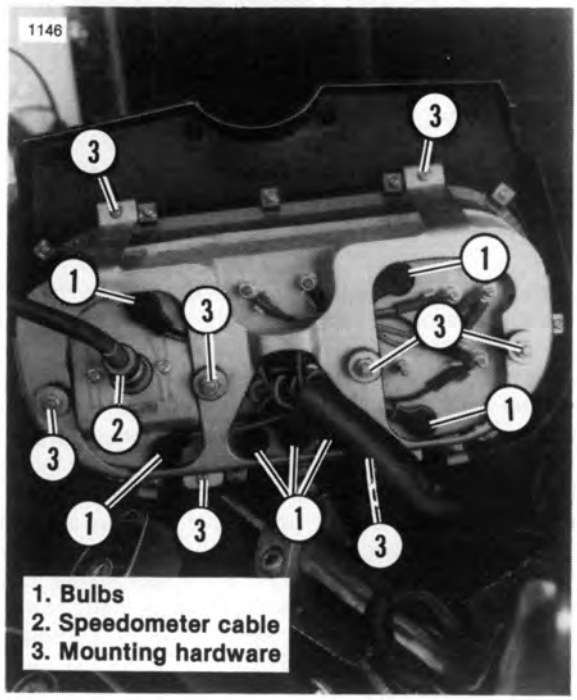


Figure 2-108. Instrument Panel — FLT

Replacing Bulbs

1. Remove the two screws from the instrument panel. Remove phillips head screw and pull the odometer trip knob out. Lift up the panel.

CAUTION

Do not turn instrument panel upside down. Damping oil in fuel gauge will leak onto and stain gauge face.

2. Replace any bulbs (1) that are burnt out. See section 8 for bulb charts.

REMOVAL

1. Remove the two screws from the instrument panel. Remove screw from end of speedometer reset knob. Pull the knob out and lift up the panel. Disconnect the speedometer cable (2) and disconnect wire harness.
2. Remove the bracket mounting hardware (3) and the mounting bracket.
3. Mark all wires for identification and then unplug them from the instrument panel.
4. Replace the malfunctioning instrument.

INSTALLATION

1. Plug all wires into their respective holes.
2. Install the bracket and mounting hardware (3). Install speedometer cable and plug in wire harness.
3. Fasten the instrument panel to the housing with the two screws. Install the trip reset knob.

Fuel Gauge Sending Unit

The fuel gauge sending unit is located next to the gas filler cap. Follow FXR procedure for its removal and installation.

FLHT/C MODELS — 1986 AND LATER, FLHS — 1987 AND LATER

Repair

The instruments are non-repairable and must be replaced if they are not working properly. Before replacing a faulty instrument, check to see if the connections are causing the malfunction. Lubricate cables with graphite grease every 5000 miles.

Replacing Bulbs (Figure 2-108)

1. Remove light bar and outer fairing. See FAIRING AND WINDSHIELD later in this section. The instrument panel and all the gauges are now fully accessible from the front of the inner fairing.
2. Replace any bulbs (1) that are burnt out.

Removal and Installation of Instruments (Figure 2-108)

1. Remove light bar and outer fairing. See FAIRING AND WINDSHIELD later in this section.

2. Disconnect all wire connectors from instrument housing. Remove four allen head screws mounting instrument panel to fairing. Remove round nut holding trip odometer knob to fairing. Disconnect the speedometer cable (2). Remove the panel from the motorcycle.

3. Remove the bracket mounting hardware (3) and the mounting bracket.

4. Mark all wires for identification and then unplug them from the instrument panel.

5. Replace the malfunctioning instrument.

6. Plug all wire connectors into their respective sockets.

7. Install the bracket and mounting hardware. Connect the speedometer.

8. Mount the instrument panel to the fairing with the four allen head screws. Connect wire connectors.

REPLACING GAUGES (Figures 2-109, 2-110)

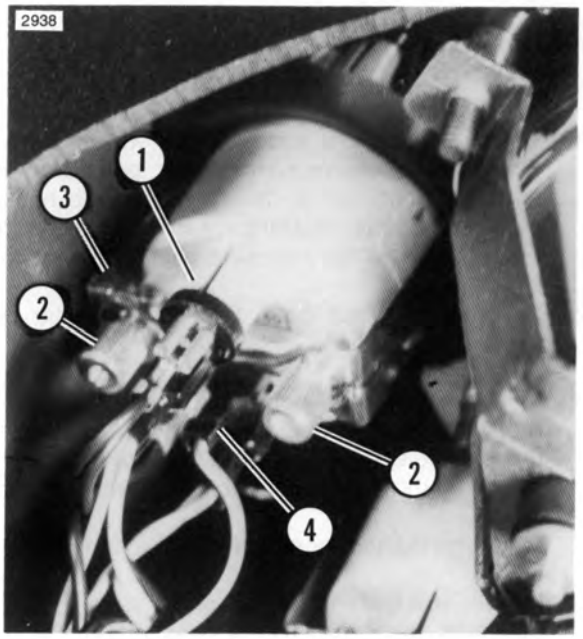
1. On FLHT/C vehicles, remove light bar and outer fairing. See FAIRING AND WINDSHIELD later in this section. On FLT/C vehicles, remove headlight bucket assembly. See Figure 2-106 for gauge lead locations.

   On FXR vehicles, gauges are accessible from backside of gauge panel.

2. Make a diagram of connector location according to color of wire. Disconnect spade connectors (4).

3. Remove the two clamp nuts (2) and clamp (3).

4. Remove gauge and insert new gauge. Install clamp (3) over mounting screws and secure with clamp nuts (2). Reconnect wire connectors following diagram.



1. Bulb
2. Clamp nut
3. Clamp
4. Spade Connector

Figure 2-109. Gauge Mounting

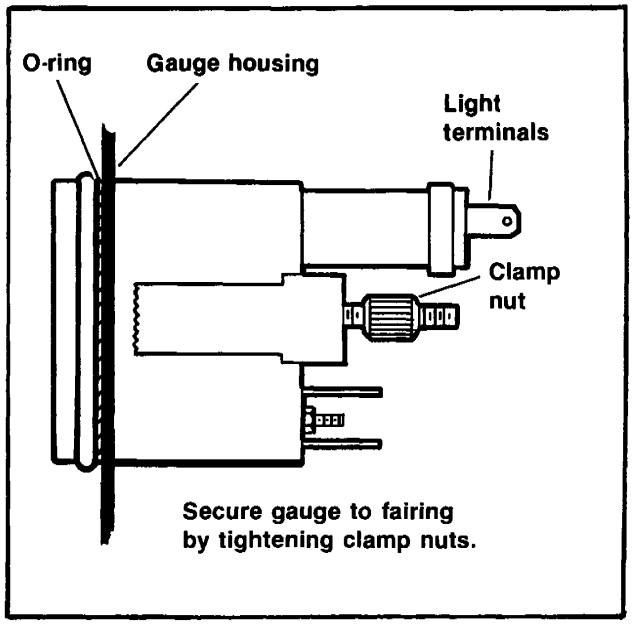


Figure 2-110. Gauge Assembly

Fuel Gauge Sending Unit

The fuel gauge sending unit is located next to the filler cap. See FUEL GAUGE later in this section.

REPLACING INSTRUMENTS

FXRS and FXRT — 1984 to 1985

1. Remove small nuts and lockwashers from rear of instrument. Remove screw in trip odometer knob and pull knob out of housing. Remove backing plate and rubber bushings. Lift instrument from bracket and pull bulb socket from instrument back.

2. Replace burnt out bulb. See section 8 for bulb charts.

3. If instrument is malfunctioning, it must be replaced since instruments are not repairable. Remove cable and wires making sure to mark their location on the instrument back. Remove instrument.

4. Install instrument connecting wires and cable.

5. Install instrument in bracket. Install rubber bushings, backing plate, lockwashers and nuts.

FXR

1. Remove trip odometer knob by turning knob in clockwise direction.

2. Remove the allen head screws attaching instrument panel to fuel tank. Lift panel off tank.

3. Disconnect speedometer cable and remove clamp nuts and clamp. Pull light socket and bulb out of speedometer housing. Replace bulb if burnt out.

4. Replace speedometer and insert bulb with socket into speedometer housing.

5. Position clamp over screws and install clamp nuts. Connect speedometer cable.

6. Position instrument panel on fuel tank with mounting holes aligned. Install three allen head screws.

7. Attach odometer knob by turning in counterclockwise direction.

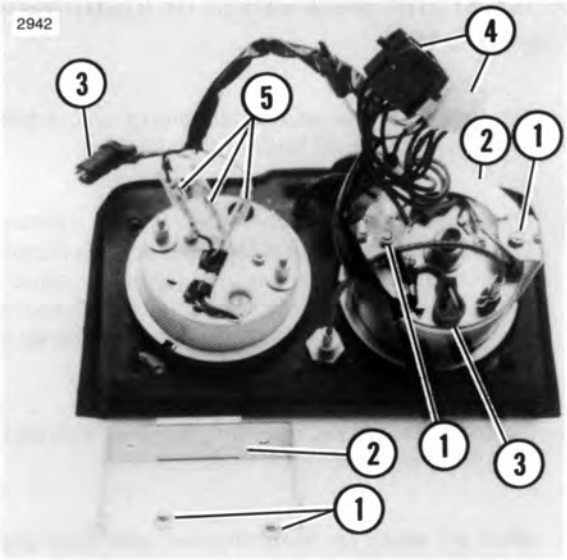
FXRD and FXRT — 1986 and Later (Figure 2-111)

1. Remove the four screws that attach the instrument panel to fairing.

2. Move instrument panel away from fairing and disconnect speedometer cable.

3. See Figure 2-111. Disconnect the two main connectors (4). Remove instrument panel.

4. Remove clamp nuts (1) and clamp (2). Pull light bulb and socket from instrument housing. Replace bulb if burnt out.



1. Clamp nut
2. Clamp
3. Light
4. Main connector
5. Instrument connector

Figure 2-111. Instrument Panel — FXRD, FXRT

5. Mark wires to be sure they will be connected to the proper connector on the new instrument.

6. Install new instrument in panel and join connectors (5). Insert bulb socket (3) into instrument housing.

7. Gather wire connectors (5) so they will be secured under clamp (2). Install clamp (2) and clamp nuts (1).

8. Connect speedometer cable and two main connectors (4). Position panel on fairing and secure with the four screws.

FXRS — 1988-1990

The speedometer and tachometer are mounted on the fuel tank.

1. Remove two screws that attach instrument console to fuel tank.

2. Lift console from fuel tank. Light bulbs may be replaced by pulling socket and bulb from either tachometer or speedometer.

3. If tachometer or speedometer are malfunctioning, they must be replaced since instruments are not repairable. Remove cable and wires making sure to mark their location on the instrument back. Remove instrument.

NOTE

Trip odometer knob has left-hand threads.

4. Install instrument in console and connect leads/cables.

5. Position instrument console on fuel tank and install screws.

FUEL GAUGE

REMOVAL

All FXR Models — Except 1988 - 1990 FXRS

WARNING

Gasoline is extremely flammable and highly explosive under certain conditions. Do not smoke or allow open flame or sparks anywhere in area when working on fuel gauge. Disconnect battery negative cable to avoid sparks near open gas tank.

1. Remove three screws holding fuel tank center panel in place. Remove fuel tank cap and center panel.
2. Burnt out bulb may be replaced from back of instrument.
3. If gauge is to be replaced, remove wires and mounting hardware from back of gauge.
4. Sending unit can be removed from fuel tank by removing the five screws securing it to the tank.

INSTALLATION

1. Install new sending unit making sure to use new gasket for proper sealing. The gasket must have a grounding staple.

NOTE

Check sending unit screws for proper sealing devices. Early models used washers — later models have screws with a bonded seal on underside of screw head. Replace washer or screws if needed.

2. Install new gauge and connect wires.
3. Install fuel tank center panel making sure gasket is in place around filler neck. Replace fuel tank cap.

1988 - 1990 FXRS

1. The fuel gauge is mounted in a simulated left fuel tank cap. Remove by gently pulling upward. Do not twist.
2. The light bulb may be replaced without further disassembly.
3. If gauge is to be replaced, remove wires from back of gauge.
4. Sending unit is located beneath gauge and can be removed from fuel tank by removing the five screws securing it to the tank.

INSTALLATION

1. Check seal on underside of five screws that secure sending unit to tank. Use new screws if seal is cracked or missing. Install new sending unit making sure to use new gasket for proper sealing.
2. Connect wires from gauge to sender.
3. Install gauge.

HANDLEBAR SWITCHES

GENERAL

The push-to-transmit (PTT) switch, located on the left handlebar, is covered in CB/INTERCOM section in Section 8. The "SET" switch located on the right handlebar is covered in Section 8 under CRUISE CONTROL -ULTRA MODELS.

The left handlebar switches include the headlamp HI-LO switch, horn, left turn signal switch and sound system equipped models also have a volume control. The right handlebar switches include the engine start and RUN-OFF switch, right turn signal switch and sound system equipped models also have a receiver/tape function control. The individual switches are non-repairable and must be replaced if they malfunction.

Service procedures are divided, the Sound System controls follow common handlebar switches.

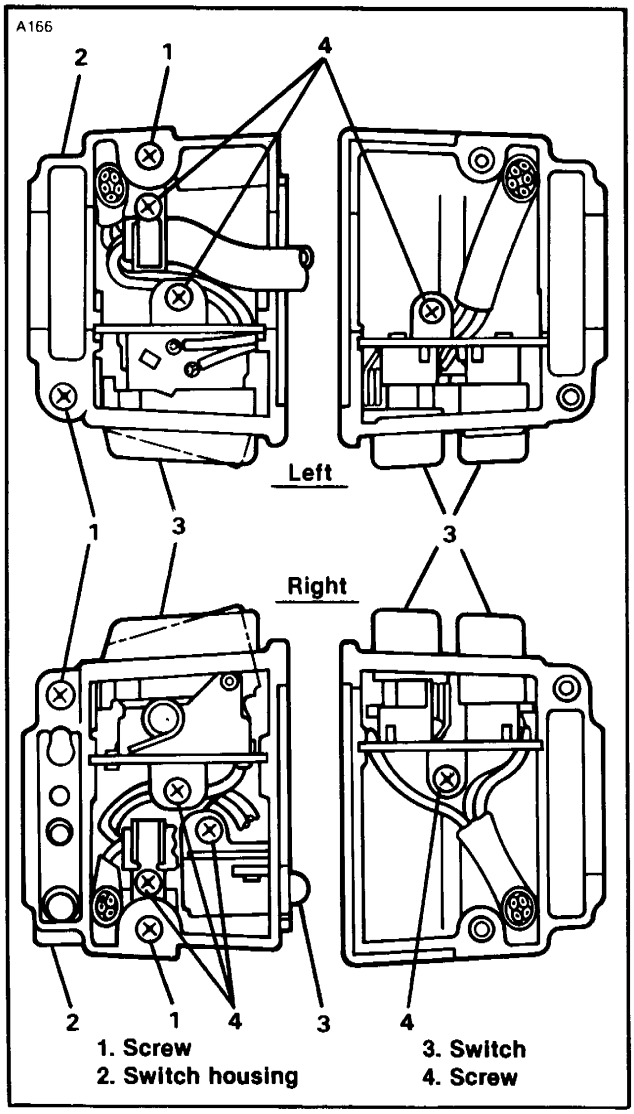


Figure 2-112. Handlebar Switch Assemblies

REMOVAL SWITCH ASSEMBLY WITHOUT SOUND SYSTEM CONTROLS (Figure 2-112)

1. Remove screws (1) from the switch housing (2).
2. To replace switch (3), remove screw (4).
3. Cut old switch wires at the switch.

INSTALLATION SWITCH ASSEMBLY WITHOUT SOUND SYSTEM CONTROLS (Figure 2-112)

1. Cut new switch wires 3/4 in. from switch.
2. Replace switch (3), screw (4) and screws (1).
3. Tighten screws (1) to 18-24 in-lbs torque.
4. Slip a piece of shrink tubing over each wire.
5. Solder wire ends together and shrink tubing over solder joint.

REMOVAL SWITCH ASSEMBLY WITH SOUND SYSTEM CONTROLS

Left Side

1. See Figure 2-113. Remove the two clamping screws and separate switch halves. Loosen set screw in bottom of knob (8) (if equipped) and remove knob. Remove left directional switch (5) and volume switch (2) by removing screws (6 and 4).
2. Cut old switch wires at the switch.

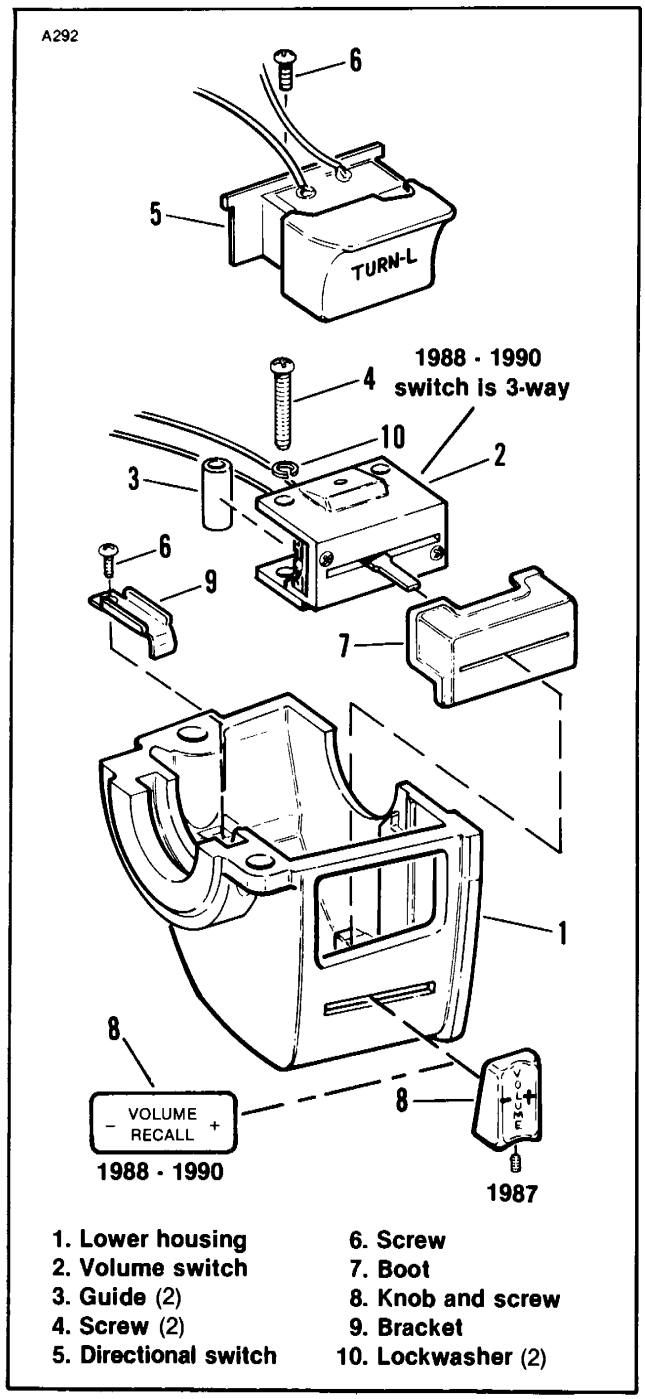
Right Hand

1. See Figure 2-114. Remove the two clamping screws and separate switch halves. Loosen setscrew in bottom of knob (10) (if equipped) and remove knob. Remove right directional switch (5), functional switch (3) and stoplight switch (2) by removing screws (6, 4 and 9).
2. Cut old switch wires at the switch.

INSTALLATION SWITCH ASSEMBLY WITH SOUND SYSTEM CONTROLS

Left Hand

1. See Figure 2-113. With volume control switch (2) in



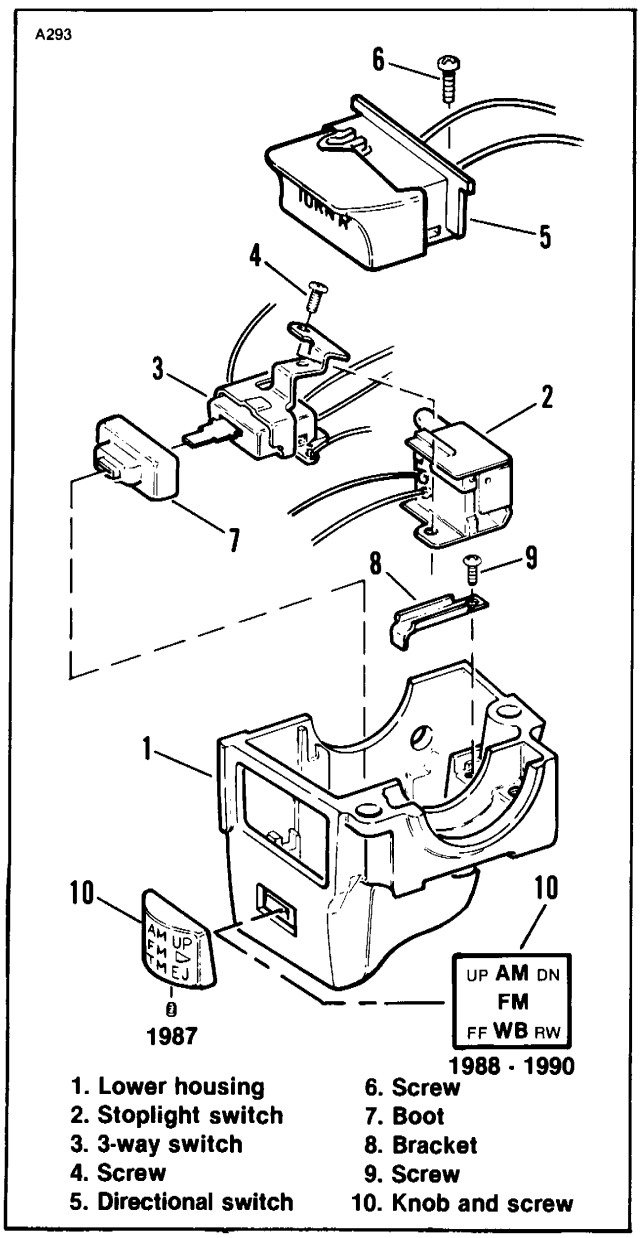
1. Lower housing
2. Volume switch
3. Guide (2)
4. Screw (2)
5. Directional switch
6. Screw
7. Boot
8. Knob and screw
9. Bracket
10. Lockwasher (2)

Figure 2-113. Left Lower Housing Assembly

hand, insert guides (3) between top and bottom edges of switch to line up with holes in both surfaces. Place rubber boot (7) over front of switch.

2. Set switch in place in bottom of housing (1) with boss on top side of unit. Attach with two No. 4-40 x 1 in. screws (4) and lockwashers (10).

3. Attach directional switch (5) to top of volume control unit with No. 4 x 1/4 in. self tapping screw (6).



1. Lower housing
2. Stoplight switch
3. 3-way switch
4. Screw
5. Directional switch
6. Screw
7. Boot
8. Bracket
9. Screw
10. Knob and screw

Figure 2-114. Right Lower Housing Assembly

4. Route volume control wires together with directional switch wires and position as noted in step 1 to exit right side of housing. Secure wires with bracket (9) and No. 4 x 1/4 in. self tapping screw (6).

5. Attach assembly to left handlebars with original socket head screws.

6. Press volume knob (8) onto switch lever and tighten setscrew (if equipped).

7. Solder wire ends together and shrink tubing over solder joint.

Right Side

1. See Figure 2-114. Insert 3-way functional switch (3) into new lower housing (1). Mounting tab on 3-way switch MUST be placed on top of brake light switch mounting tab (2) to prevent brake light switch from binding. Attach both units to housing with No. 4 x 1/4 in. self tapping screw (4).

2. Place directional switch (5) into opening in housing. Hole in mounting tab will line up with threaded hole in 3-way switch mounting tab. Attach unit with No. 4 x 1/4 in. screw (6).

3. Route wires to exit left side of lower housing. Secure with bracket (8) the same as in old housing.

4. Press knob (10 on function switch lever and tighten setscrew (if equipped).

5. Solder wire ends together and shrink tubing over solder joint.

6. Check operation of throttle control and brake light.

IGNITION/FORK LOCK ASSEMBLY — FLT MODELS

REMOVAL

WARNING

- **To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables (negative cable first) before performing any of the following procedures.**
- **DO NOT modify the ignition/light switch wiring to circumvent the automatic-on headlight feature. High visibility is an important safety consideration for motorcycle riders.**

1. Remove the two screws securing instrument panel. Remove the Phillips screw from trip knob using a #0 Phillips screwdriver. Pull the trip knob out and lift off panel.

2. See Figure 2-115. Disconnect the speedometer cable. Lift head up and out of the way. Disconnect the wiring connectors and remove assembly.

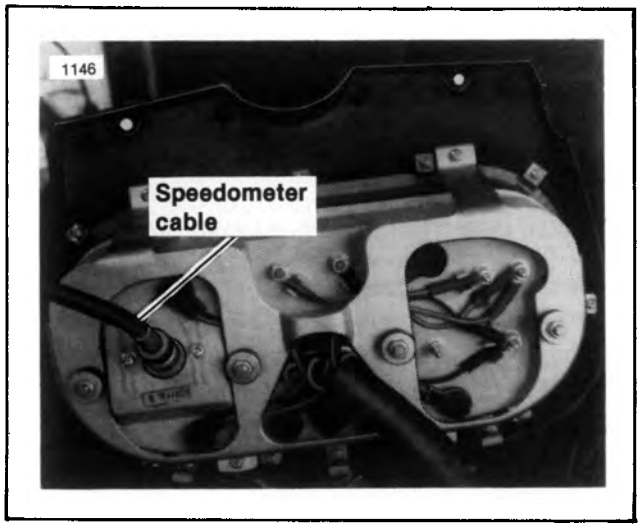


Figure 2-115. Speedometer Cable Location

NOTE

On 1986 and later FLHT/C Models, remove the inner and outer fairing. Disconnect the electrical wires and the fork lock linkage. The switch is free for removal once the switch knob, nut, collar and lockwasher are removed during the inner fairing removal procedure.

3. Remove locknuts that secure handlebar clamps. These are located under the instrument housing. Be very careful not to scratch the paint on the fuel tank while removing.

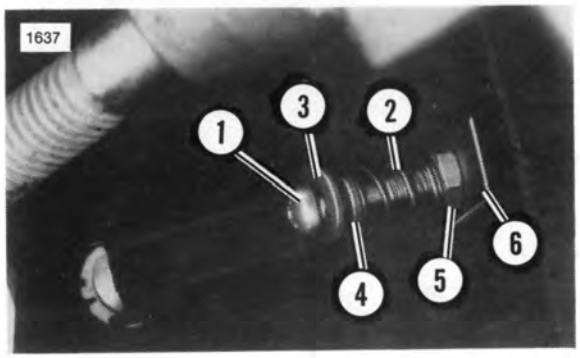
4. With the locknuts removed, lift the handlebar assembly up and out.

5. Remove the ignition switch tamper shield.

6. With needle nose pliers, remove the ignition switch knob by pulling on the ignition switch pin located underneath lip of instrument support housing. This will free the knob.

7. You should now be able to see inside the switch housing body.

8. See Figure 2-116. Remove fork lock adjusting screw (1), jamnut (5), spring (2) and washers (4 and 3).



1. Fork lock adjusting screw
2. Spring
3. Large washer
4. Small washer
5. Jamnut
6. Switch plunger

Figure 2-116. Lock Assembly

9. Remove four screws securing instrument panel support housing to upper and lower triple clamps. Move support housing to allow removal of switch.

10. Disconnect wires and remove ignition switch/fork lock housing (see Figure 2-117). First, remove ignition switch housing head nut and spacer from top. Then push down on threaded shaft of housing and pull out from beneath.

Figure 2-117. Ignition Switch Housing Head Nut

INSTALLATION

1. Connect the wiring, then install the new ignition switch into the instrument panel support housing.

2. See Figure 2-117. Tighten ignition switch housing head nut to 50 in-lbs torque. Hold switch pointing straight ahead while tightening to prevent it from rotating in the support housing.

3. Replace the support housing and install four mounting screws. Tighten to 144-168 in-lbs torque.

4. See Figure 2-118. Install onto adjusting screw the following parts in order given: large washer, small washer, spring and jamnut. Turn adjusting screw into switch plunger a few turns making sure fork lock lever slot is between large and small washers.

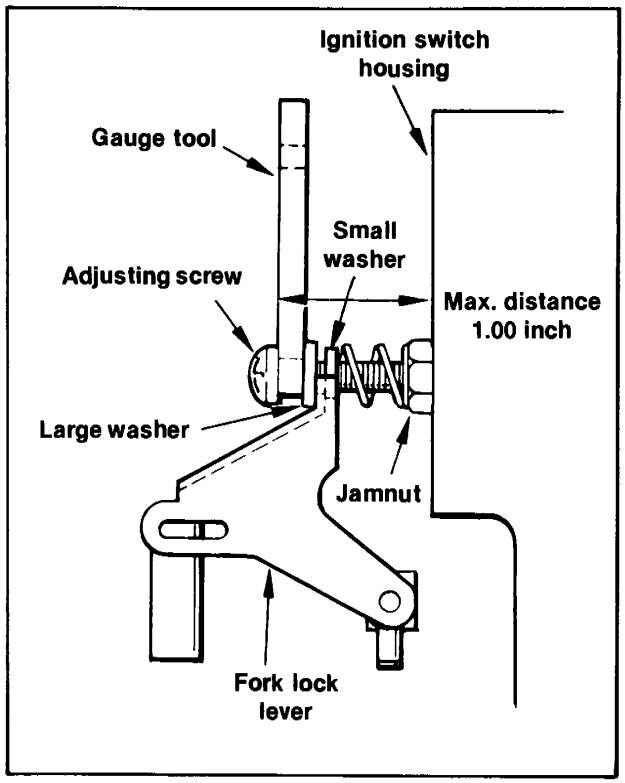


Figure 2-118. Fork Lock Adjustment

5. Position instrument mounting housing and wheel straight ahead.

6. Turn ignition switch to fork lock position.

7. Push the front fork lock lever assembly down until lock pin rests on the frame plate.

8. Insert special IGNITION FORK LOCK GAUGE, Part No. HD-96315-80, between the adjusting screw head and washer so slot in gauge rests on the screw shaft.

NOTE

The FORK LOCK GAUGE, Part No. HD-96315-80, is the recommended method for properly spacing the adjusting screw because the gauge rests on the screw shaft and prevents mispositioning the screw while tightening. The same spacing can be produced by placing two EQUAL pieces of metal - thickness 0.160 to 0.170 inch - on either side of the adjusting screw between the screw head and washer.

9. See Figure 2-118. Tighten screw until adjusting screw, large washer and gauge tool touch lever.

10. Measure distance between screw head and ignition switch plunger. This distance should not exceed 1 in.

11. When correct distance and alignment is achieved, apply Loctite STUD 'N BEARING MOUNT to inner threads of adjusting screw (1, Figure 2-116) and tighten jamnut (5, Figure 2-116) over STUD 'N BEARING MOUNT against the switch plunger (6).

CAUTION

Care must be taken to prevent movement of the adjusting screw while jamnut is tightened.

Check the entire assembly for freedom of movement and proper operation.

12. Install tamper shield.

13. Install handlebars.

14. Connect the speedometer cable (Figure 2-115) and replace instrument head in support housing. Connect wiring connectors. Make sure no wiring is crimped.

15. Install instrument panel head case and position it to fit between lips of grommet (Figure 2-119). Be careful not to scratch paint on housing during installation.

16. Install two instrument panel cover screws. Tighten to 75 in-lbs torque.

17. Recheck fork lock operation.

18. Install battery cables.

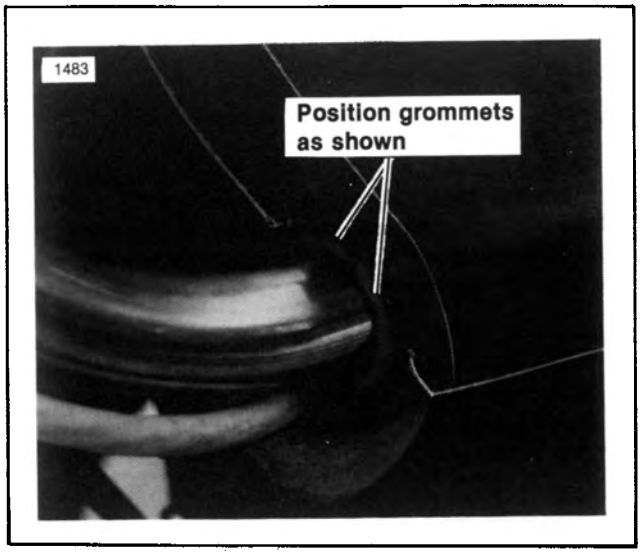
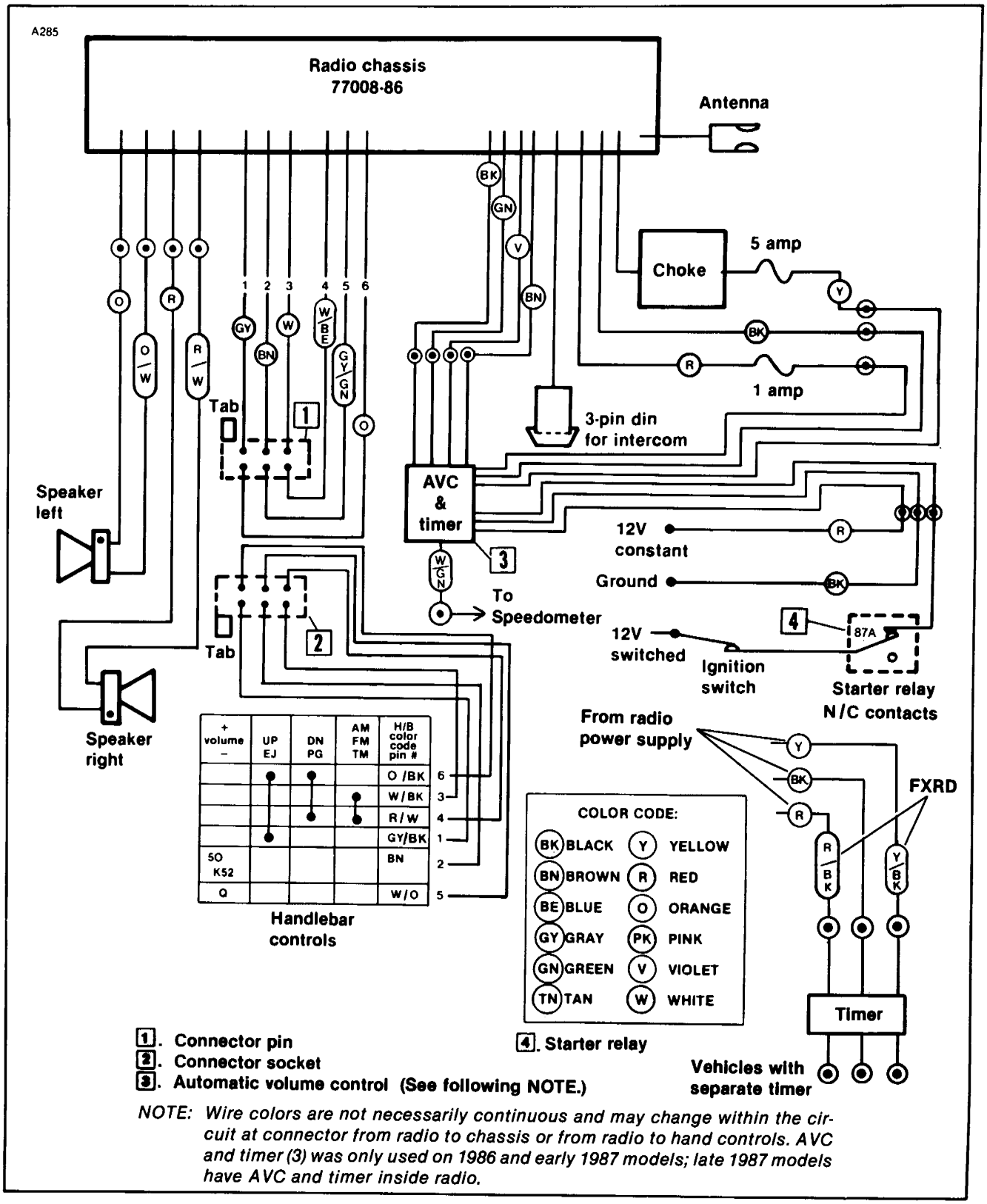


Figure 2-119. Handlebar Grommets

1986-1987 SOUND SYSTEM

TROUBLESHOOTING



NOTE: Wire colors are not necessarily continuous and may change within the circuit at connector from radio to chassis or from radio to hand controls. AVC and timer (3) was only used on 1986 and early 1987 models; late 1987 models have AVC and timer inside radio.

Figure 2-120. Wiring Diagram

Problem	Cause	Solution
1. No lights, No sound. Tape player inoperable.	1.1 Grounded handlebar switch	1.1.1 Refer to the test procedures under Handlebar Switches later in this bulletin.
		1.1.2 Tape or replace pinched wires. Replace any faulty switches.
	1.2 Fuse blown.	1.2.1 Check fuses. Replace blown fuse with fuse that is equally rated.
	1.3 Faulty starter relay (possibly caused by brake fluid contamination).	1.3.1 Replace starter relay (5).
	1.4 Faulty control panel or panel not fully engaged.	1.4.1 Check engagement without rubber hood.
		1.4.2 Substitute a known good control panel.
	1.5 Minimal or below control voltage limit.	1.5.1 Reset radio by turning ignition switch to OFF position and momentarily disconnecting battery. On FLTC models, turn ignition switch OFF and disconnect fairing twelve pin connector, if more convenient.
	1.6 No power.	1.6 1 Check battery, circuit breaker and wiring.
2. No switching at control panel and/or at handlebar controls.	2.1 Minimal or below control voltage limit.	2.1.1 Reset radio by momentarily disconnecting battery.
	2.2 Grounded handlebar switches.	2.2.1 Refer to Handlebar Switches later in this bulletin.
	2.3 Faulty control panel.	2.3.1 Replace with known good control panel.
3. Cover sticks. (FLTC/FLHTC)	3.1 Cover binding on hood.	3.1.1 Lubricate radio hood and radio cover with LUBRIPLATE 1200-2 grease, or equivalent. Lubricant should be applied at cover hinge points, along detent ridge of hood between the cover hinges and on both ends of the hood. The grease should be rubbed lightly on the rubber until it becomes clear.
		3.1.2 Check to be sure hood is not distorted due to overtightening of top mounting screws.
4. Cannot obtain full volume at either volume control slider	4.1 Low voltage.	4.1.1 Charge battery. Check current draw and charging system output. Reduce load at idle by turning off unnecessary accessories. If current draw is excessive, eliminate one or two accessories to reduce load.
	4.2 Water in speaker grilles.	4.2.1 Blow water out of speaker grilles with compressed air.
	4.3 Dirty volume slider on control panel.	4.3.1 Replace control panel or disassemble and clean slider.

Problem	Cause	Solution
5. No volume or intermittent volume.	5.1 Faulty AVC.	5.1.1 Check AVC (3) unit by disconnecting four pin connector. Attach a jumper wire, at pin connector half, between pins connected to brown and violet wires. If problem is corrected, replace AVC unit.
	5.2 Grounded volume control.	5.2.1 See 1.2
	5.3 Water in volume control	5.3.1 Dry switch housing with compressed air and spray slide control with WD-40 or equivalent.
	5.4 Dirty volume slider on control panel.	5.4.1 See 4.3.1.
6. Distortion or poor performance.	6.1 Bass and volume set too high.	6.1.1 Adjust bass and volume controls to median settings.
	6.2 FLT models, loose speakers.	6.2.1 Replace speednuts with nylock nuts. See Bulletin M-913.
	6.3 FLT models, bottom panel under caddy vibrating.	6.3.1 Install vibration pads under caddy. See Bulletin M-913.
	6.4 Incorrect speaker polarity.	6.4.1 Check if solid colored wire is on the speaker terminal with painted dot.
	6.5 Dirty volume slider on control panel.	6.5.1 See 4.3.1.
7. Poor reception on AM or FM. Tape unit plays satisfactorily.	7.1 Faulty starter relay (sometimes evidenced by erratic voltmeter).	7.1.1 Replace starter relay (5).
	7.2 Antenna cable or mast shorted to ground.	7.2.1 Replace antenna or cable. See Antenna Tests later in this bulletin.
	7.3 Water in radio chassis.	7.3.1 Allow three days to dry out chassis in warm dry environment.
	7.4 Low voltage.	7.4.1 Charge battery.
8. Lights out on control panel.	8.1 Control panel not fully engaged.	8.1.1 Remove control panel from hood and install panel. Observe lights, if OK, check if fairing (FLHTC) or hood is too thick. Reduce fairing thickness or tighten hood mounting screws more securely.
	8.2 Lights burned out in control panel.	Substitute a known good control panel.
9. Tape cartridge stuck.	9.1 Stuck tape release mechanism.	9.1.1 Push in slightly on tape cartridge to activate release mechanism. **CAUTION** **If tape is difficult to dislodge, do not force as damage to tape mechanism could result. Call Harley-Davidson Service Department for assistance.**

Problem	Cause	Solution
10. Tape ingested.	10.1 Capstan or pinch roller dirty.	10.1.1 Push EJT button. If tape doesn't eject, lightly push in on tape cartridge. If cartridge still does not eject, turn ignition and radio power OFF, then ON. Push cartridge in more firmly, but not hard. If tape is now fully taken in by drive unit, wait ten seconds, and press EJT button. If cartridge does not eject, remove nose piece and rotate visible gear below tape opening to the right until the tape is up and out. Clean cassette deck.
	10.2 Loosely wound tape in deck or tape left in door for extended period then inserted.	10.2.1 Slowly remove cassette cartridge and if the ribbon is wrapped around the internal workings gently pull on the ribbon so as to free it from the drive. If the ribbon breaks, call Harley-Davidson Service Department.
11. Radio makes a "flub, flub, flub" noise.	11.1 Low voltage.	11.1.1 Charge battery. Check current draw and charging system output. Reduce load at idle by turning OFF unnecessary accessories. If current draw is excessive, eliminate one or two accessories to reduce load.
12. Battery drained when motorcycle is not operated for one or two weeks.	12.1 Radio memory and clock constantly draw small amount of current.	12.1.1 Trickle charge, or disconnect battery occasionally, during periods that motorcycle remains idle more than four days.
13. Radio picks up engine noise. Noise (signal frequency) changes with engine R.P.M.	13.1 Poor antenna ground or antenna shorted to ground.	13.1.1 Check antenna ground following test procedures under Antenna Tests later in this bulletin.
	13.2 Loose spark plug wire or wires.	13.2.1 Clean coil tower and check ignition wire connections.
	13.3 Water in radio chassis.	13.3.1 Allow motorcycle to dry out in dry environment for three days.
	13.4 Weak signal (usually on AM or traffic monitor)	13.4.1 Normal. Automatic Gain Circuit in radio increases gain to "pull-in" weak signal, and also "pulls-in" ignition signal.

Handlebar Switches

INTERMITTENT POWER LOSS

Refer to Figure 2-120. The circuit from radio to function switch, through pin one, if grounded will start and stop radio. To isolate problem, disconnect connector halves (1) and (2).

If problem is eliminated, grounding is in circuit between pin connector (2) and function switch.

LOSS OF VOLUME

Refer to Figure 2-120. Circuit from radio to volume control, through pin five, if grounded will kill volume. To isolate problem, disconnect connector (1) and (2).

If problem is eliminated, grounding is in circuit between pin connector (2) and volume control.

SWITCH CONTACTS

1. Refer to Figure 2-120. Disconnect connector halves (1) and (2).
2. Refer to Figure 2-121, View A. With ohmmeter, place probes on pins (3) and (6), and push function switch straight inward. Meter should register zero ohms. A resistance reading significantly higher than zero indicates the switch contacts are not closing and the switch should be replaced. Release the switch control knob. The meter should now register infinite ohms. If the meter registers a reading other than infinite ohms, the contacts are not fully opening and the switch should be replaced.
3. Refer to Figure 2-121, View B and C. Place the meter probes on the pins and move the switch control knob in the direction shown. The meter should indicate zero ohms when moved to either side with the probes at appropriate connector pins. The meter should register infinite ohms when the switch knob is released.
4. Refer to Figure 2-122, View D. Place ohmmeter probes on connector pins (5) and (2), and move volume control knob to extreme left (when facing switch) or 'minus' side. Meter should register approximately two (2) ohms. Leave probes on pins (5) and (2), and move control knob to extreme right, or to 'plus' side. Meter should register 50,000 ohms. If meter readings vary significantly from the recommended readings, replace switch.

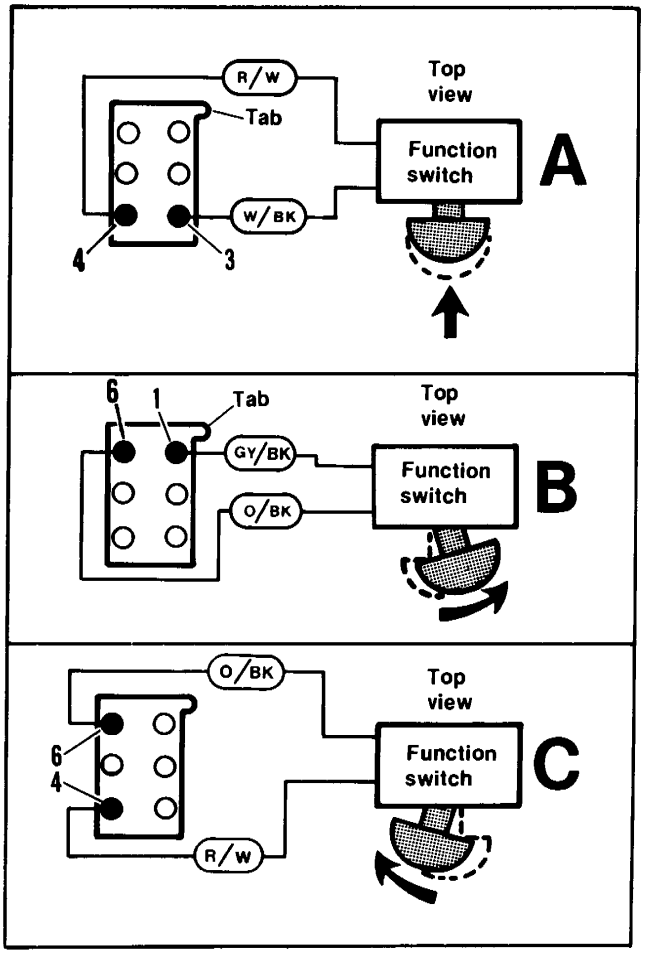


Figure 2-121. Function Switch Test

Transient Signal Voltage

Refer to Figure 2-120. Disconent connector halves (1) and (2). Connect voltmeter black lead to vehicle ground. Touch each pin of pin connector (2) with red probe and watch for an indication of voltage on meter. There should be no voltage present at any of the pins. If a voltage is present, this is an indication of current flow into the radio control circuit from source other than radio chassis.

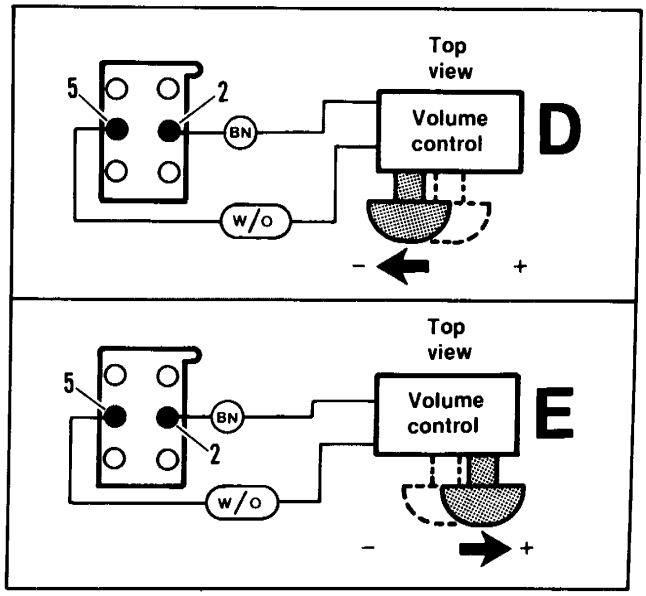


Figure 2-122. Volume Switch Test

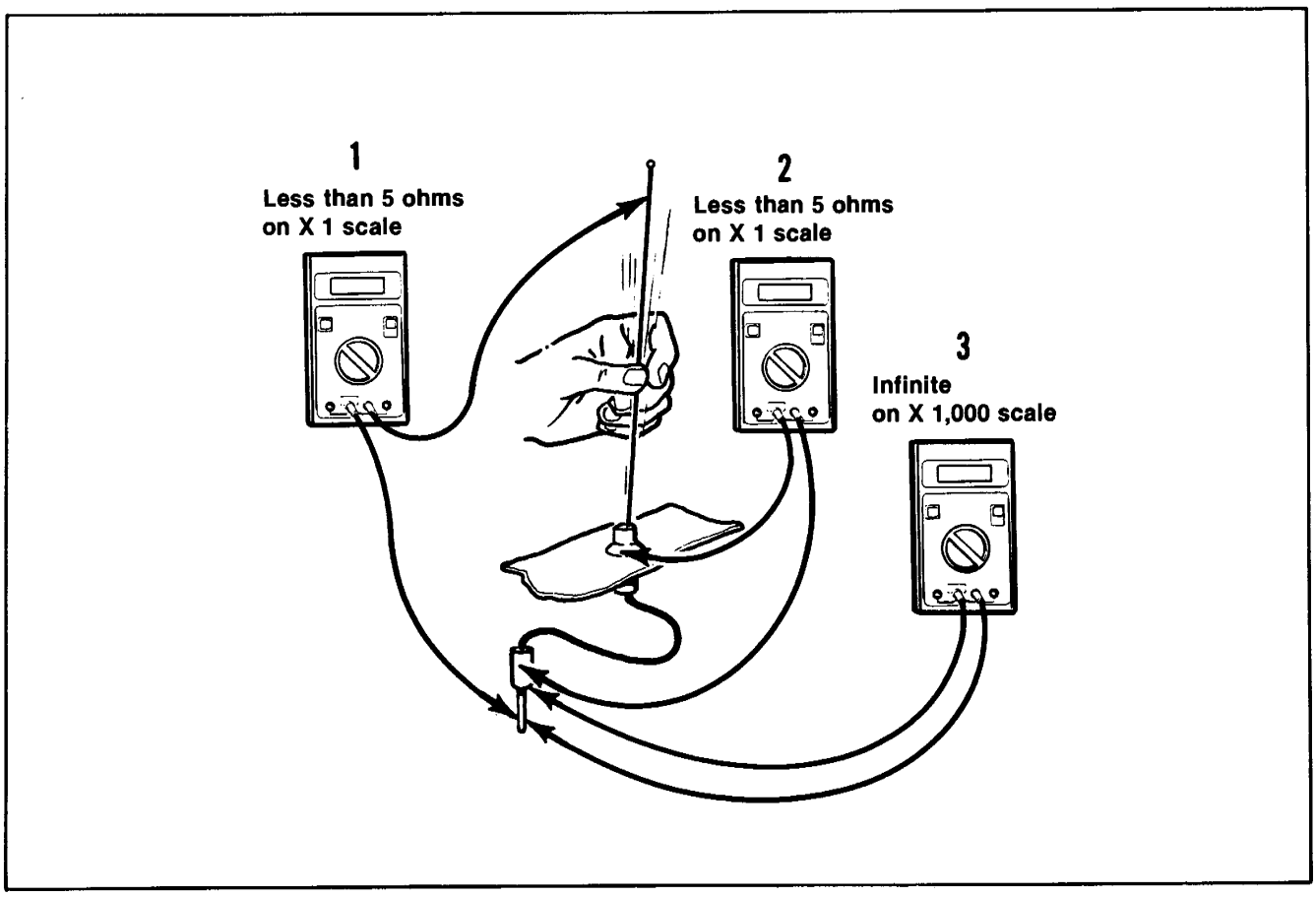


Figure 2-123. Antenna Test Hookup

Antenna Test (Figure 2-123)

A faulty antenna can cause poor reception. Check it in three steps after cleaning the mast. Step one: set your ohmmeter to the X 1 scale, and connect the leads as shown in the drawing. A reading of more than five ohms means you should replace the antenna or cable. If less than five ohms, proceed to Step 2. Using the same scale, connect the leads as shown. If the reading is greater than five ohms, replace the antenna or cable. If it's less than five ohms, proceed to Step 3. Set the meter to the X 1,000 scale, and connect the leads as shown. If the reading is not infinite, replace the antenna or cable. If replacement parts are necessary, retest after installation of new parts.

REMOVAL AND INSTALLATION

GENERAL

The electrical connections at the radio chassis are the same on all models. To free the radio chassis electrically, it will be necessary to separate the following connectors:

Automatic volume control (1986 and early 1987 models) (with or without timer) — Four pin connector

Power supply — Three pin connector

Handlebar controls — Six pin connector

Speaker — Four socket connector

Antenna — Single socket connector

WARNING

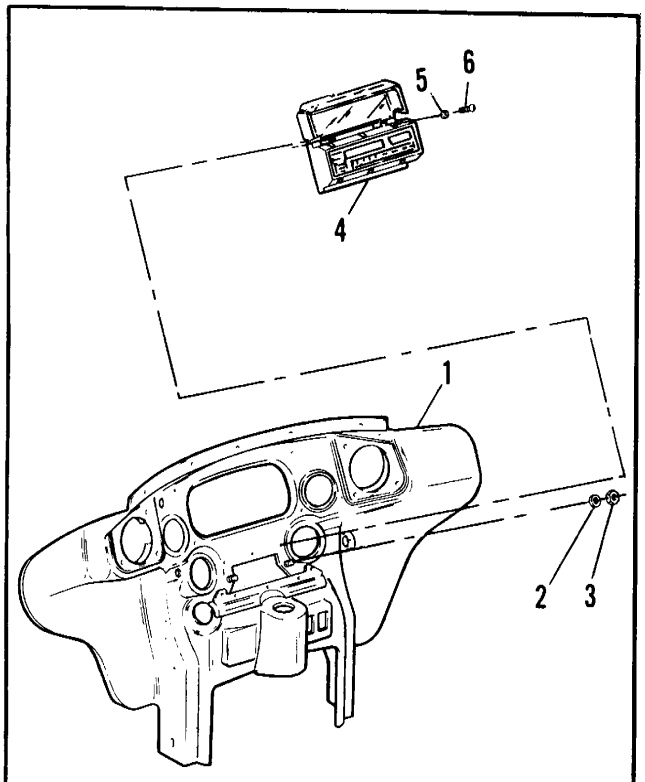
Turn the ignition switch to the OFF position and disconnect the negative lead from the battery before doing any electrical work on the sound system. When finished, connect the negative lead to the battery with the ignition switch in the OFF position. Failure to do so may cause irreversible damage to the radio and possible personal injury.

REMOVAL — FLHTC — 1986-1987

1. Place ignition switch in OFF position. Disconnect battery negative cable to avoid damaging sound system and possible personal injury.
2. Remove headlamp housing.
3. Remove outer fairing and windshield following procedure later in this section.
4. Cut ty-wraps holding automatic volume control and choke to crossbar at backside of fairing. Disconnect speedometer cable at instrument.
5. Move radio connectors from behind crossbars. Separate connector halves.
6. See Figure 2-124. Remove radio hood and control panel assembly (4).
7. Remove radio front stud nuts (3) and washers (2).
8. See Figure 2-125. Remove rear support screw (5) with lockwasher (4) and washer (3).
9. Loosen screws (6) and remove rear support (1).
10. Carefully remove radio chassis (9).

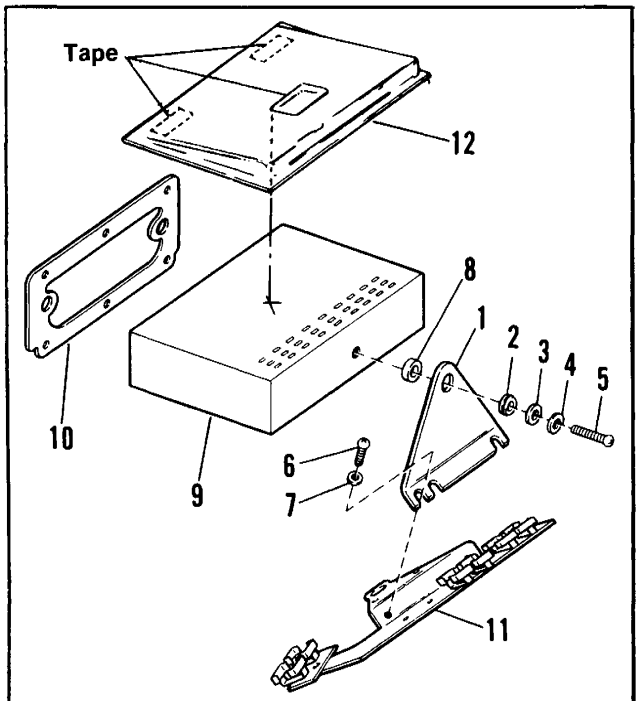
INSTALLATION — FLHTC 1986-1987

1. See Figure 2-125. Remove weather shield (12) from original radio chassis and remove old mounting tape. See Figure 2-126. Install new mounting tape Part No. 76301-86 in the three locations shown. Press weather shield into place on top of radio chassis.
2. See Figure 2-125. Place radio in position with front support studs extending through fairing. See Figure 2-124. Install washers (2) and nuts (3). Tighten nuts (3) finger tight only.
3. Position support (1) with slots around screws (6) and under washers (7). Loosely snug down screws (6).
4. Insert screw (5) through lockwasher (4), washer (3), grommet (2) and spacer (8). Thread and tighten screw (5) into threaded hole in back of radio (9). Tighten screws (6).
5. Join electrical connectors and connect speedometer cable. See Figure 2-124. Tighten nuts (3).



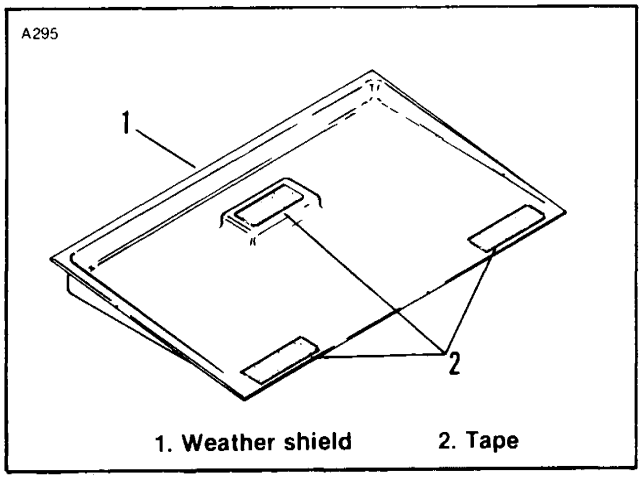
1. Fairing
2. Washer (2)
3. Nut (2)
4. Panel control assy.
5. Washer (6)
6. Screw (6)

Figure 2-124. Front Radio Mounting — 1986-1987 FLHTC



1. Bracket, radio - rear
2. Grommet
3. Washer, flat
4. Lockwasher
5. Screw
6. Screw (2)
7. Washer, flat (2)
8. Spacer
9. Radio
10. Bracket, radio - front
11. Bracket, circuit breaker
12. Weather shield

Figure 2-125. Rear Radio Mounting — 1986-1987 FLHTC



1. Weather shield
2. Tape

Figure 2-126. Mounting Tape on Weather Shield

6. Ty-wrap automatic volume control and choke to crossbrace at rear of fairing.

CAUTION

See Figure 2-124. Do not overtigthen mounting screws (6). Overtightening mounting screws will distort rubber hood and prevent the hinged cover from operating properly.

7. Install radio hood and control panel assembly (4) using screws (6) and washers (5).
8. Install outer fairing.
9. Install headlamp housing.
10. Check be be sure ignition is in OFF position and connect negative lead to battery.
11. Check headlamp adjustment following procedure in section 8.

REMOVAL — FLTC 1986-1987

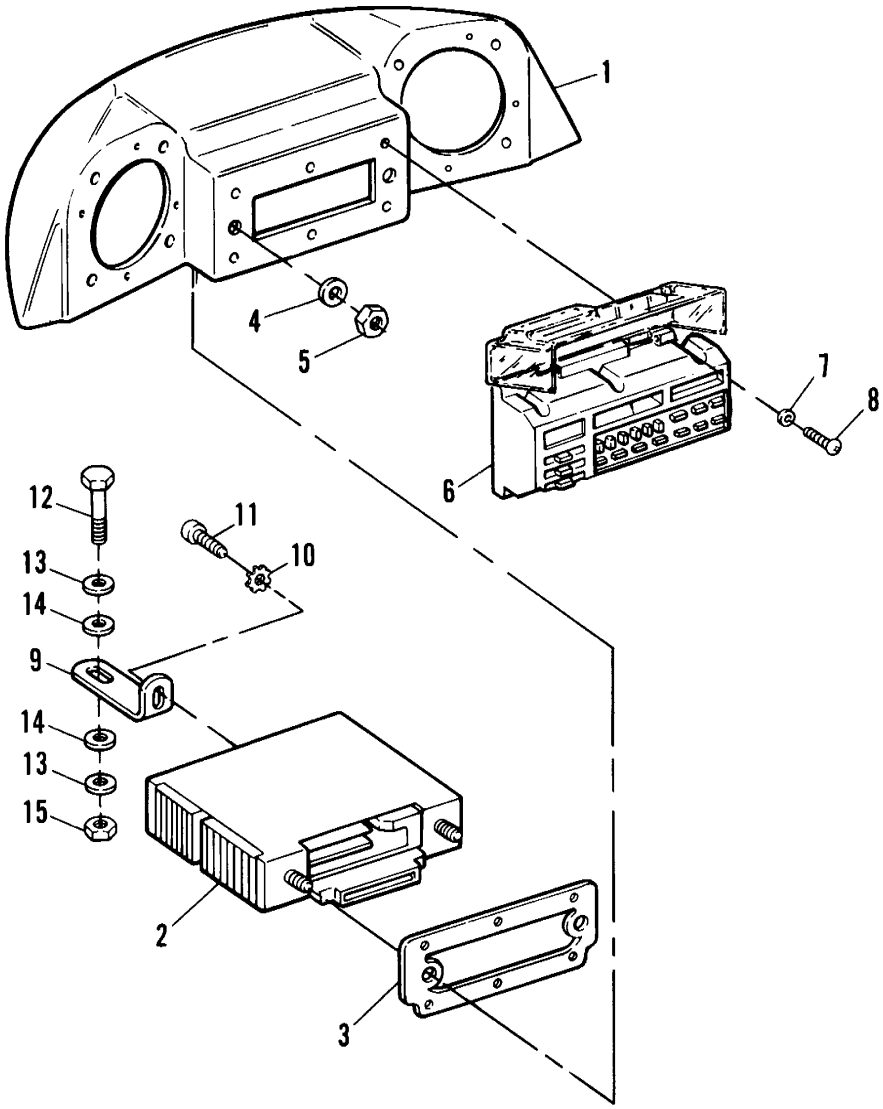
WARNING

Turn the ignition switch to the OFF position and disconnect the negative lead from the battery before doing any electrical work on the sound system. When finished, connect the negative lead to the battery with the ignition switch in the OFF position. Failure to do so may cause irreversible damage to the radio and possible personal injury.

1. Disconnect negative battery cable to avoid damaging sound system and possible personal injury.
2. Remove windshield. See procedure later in this section.
3. Remove headlamp housing. See section 8.
4. Working through headlamp opening separate antenna and electrical connectors that are accessible.
5. See Figure 2-127. Through headlamp opening remove the four nuts that attach the radio caddy (1) to top of fairing.
6. Lift caddy off of fairing and remove bottom panel from caddy.
7. Remove rear mounting bolt (12), washers (13), washers (14) and nut (15).
8. Remove screws (8) and washers (7). Pull control panel assembly (6) free of radio chassis.
9. Remove stud nuts (5) and washers (4).
10. Separate halves of remaining electrical connectors. Pry choke free of caddy. Slide radio chassis free of caddy.
11. Remove bracket (9), screw (11) and washer (10).

INSTALLATION — FLTC 1986-1987

1. See Figure 2-127. Attach bracket (9) to rear of radio using screw (11) and washer (10).



1. Caddy, radio
2. Radio
3. Bracket, radio mounting (front)
4. Washer, flat - 9mm (2)
5. Nut, 9mm (2)
6. Panel control assy.
7. Washer, black - locking (6)
8. Screw, #6-32 x 1 in. (6)
9. Bracket, radio caddy
10. Star washer
11. Screw, 6mm x 1-1/4 in.
12. Bolt, 1/4-20 x 1 in.
13. Washer
14. Washer, rubber
15. Locknut, 1/4 in.

Figure 2-127. Radio Mounting — 1986-1987 FLTC

2. Place radio mounting bracket (3) over radio chassis front mounting studs and position radio chassis inside caddy opening.

3. At front of caddy install washers (4) and nuts (5) on radio front mounting studs. At back of radio attach bracket (9) to caddy using bolt (12) washers (13) washers (14) and nut (15).

CAUTION

Do not over-tighten mounting fasteners or radio chassis will be distorted and stressed.

4. Apply adhesive to choke and mount to caddy. Join all electrical connectors that are accessible from inside caddy opening.

CAUTION

Do not overtighten mounting screws (8). Overtightening mounting screws will distort rubber hood (6) and prevent the hinged cover from operating properly.

5. Install control panel and hood assembly (6) with washers (7) and screws (8).

6. Install bottom panel then position radio caddy, with mounting studs through holes in top of fairing. Install washers and nuts on caddy mounting studs. Do not overtighten.

7. Working through headlamp opening, join remaining electrical connectors.

8. Install headlamp housing, see section 8, and windshield. See procedure later in this section.

9. Check to be sure ignition is in OFF position. Connect negative lead to battery.

10. Check headlamp adjustment following procedure in section 8.

REMOVAL — FXRD, 1986-1987 FXRT

WARNING

Turn the ignition switch to the OFF position and disconnect the negative lead from the battery before doing any electrical work on the sound system. When finished, connect the negative lead to the battery with the ignition switch in the OFF position. Failure to do so may cause irreversible damage to the radio and possible personal injury.

1. Place ignition switch in OFF position. Disconnect battery negative cable to avoid damaging sound system and possible personal injury.

2. Remove instrument cluster from top of fairing. Follow procedure earlier in this section.

3. Refer to Figure 2-120. Turn the handlebars to extreme left. Disconnect the six pin connector (remote handlebar controls) and remove connector from retainer.

4. Separate all electrical connectors that are accessible through instrument cluster opening.

5. See Figure 2-128. Remove screws (9), washers (8), radio hood (6) and control panel (4).

6. Remove nuts and washers (3).

7. If timer module is taped to top of radio remove at this time for additional clearance. If module is ty-wrapped to fairing leave module in place. If removal is too difficult with module ty-wrapped to fairing, cut ty-wraps and remove module.

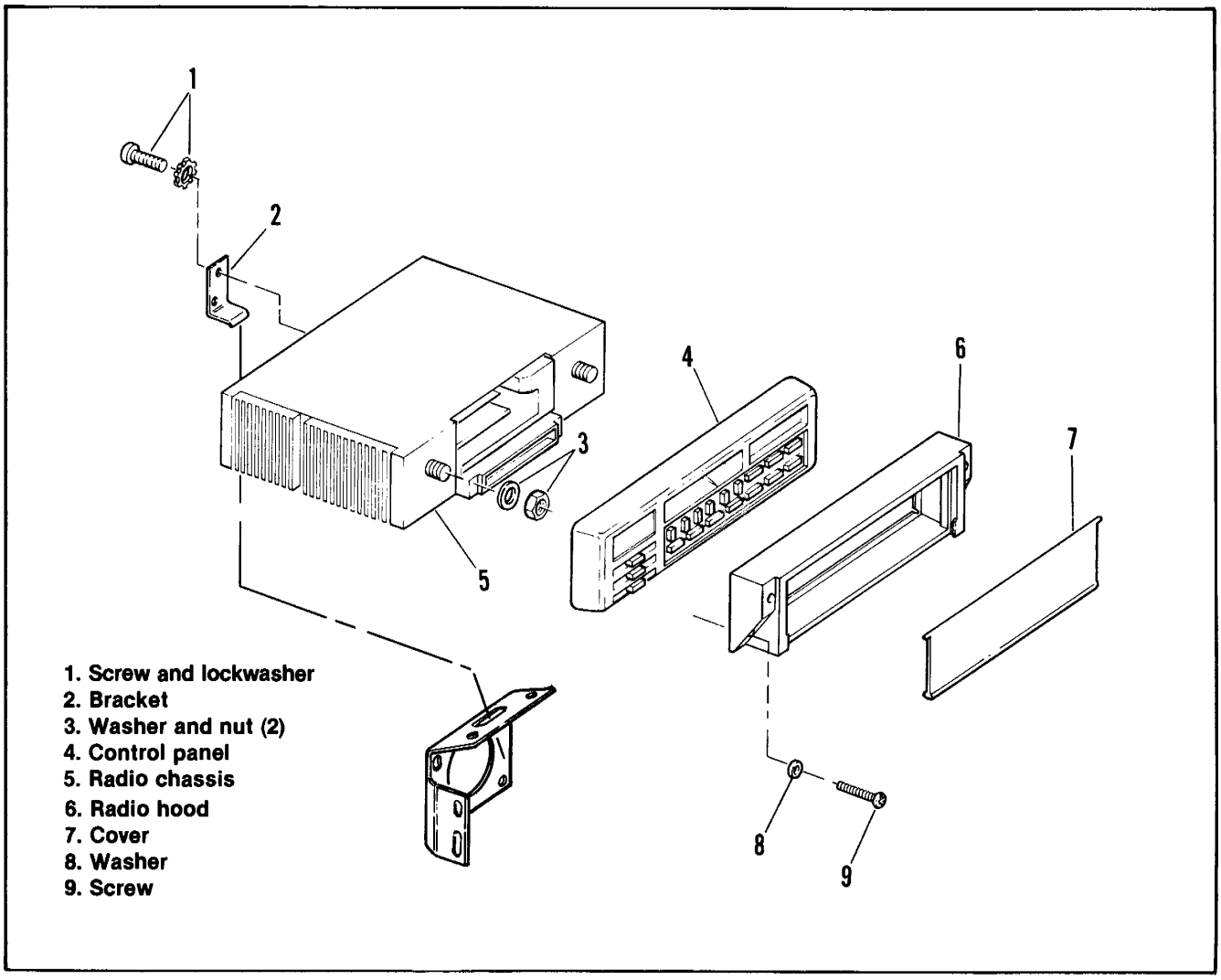


Figure 2-128. Radio Mounting — 1986-1987 FXRD/FXRT

8. Push radio chassis straight back a minimum of 1/2 in. to release bracket (2) from its mounting slot.

9. Lift radio upward and carefully work radio out through instrument opening as far as wiring permits. Separate remaining electrical connectors freeing radio.

10. Remove screw and washer (1) and bracket (2) from back of radio.

INSTALLATION — FXRD, 1986-1987 FXRT

1. See Figure 2-128. Install bracket (2) at back of radio using washer and screw (1).

2. Insert radio through instrument opening and join the electrical connectors that are accessible. Position radio back far enough for bracket (2) to enter retaining slot. Move radio forward so that studs at front of radio enter holes in fairing and bracket (2) slides into retaining slot.

3. Lift upward on back of radio. If radio lifts up the mounting bracket is not into the retaining slot. Refer to step 2.

4. Check to be certain the control panel connector is centered in the fairing window to insure control panel will seat fully when connnected. When radio is properly seated in rear retaining slot and the control panel connector is centered, install washer and nut (3) on front mounting studs.

5. Place new tape, Part No. 76301-86, on timer module and mount to top of radio. If module was ty-wrapped and removed, ty-wrap module to fairing in original location.

6. Mount six pin (remote handlebar controls) connector in retainer then join all electrical connectors.

7. Install control panel (4), radio hood (6), washers (8) and screws (9).

8. Install instrument cluster. Follow procedure earlier in this section.

9. Check to be sure ignition switch is in OFF position then reconnect negative battery lead.

CAUTION

Do not overtighten mounting screws (9). Overtightening mounting screws will distort rubber hood (6) and prevent cover (7) from operating properly.

SPEAKERS

The removal, testing and installation of speakers is covered in the following 1988 Sound System Procedure.

1988 – 1990 SOUND SYSTEM

TROUBLESHOOTING

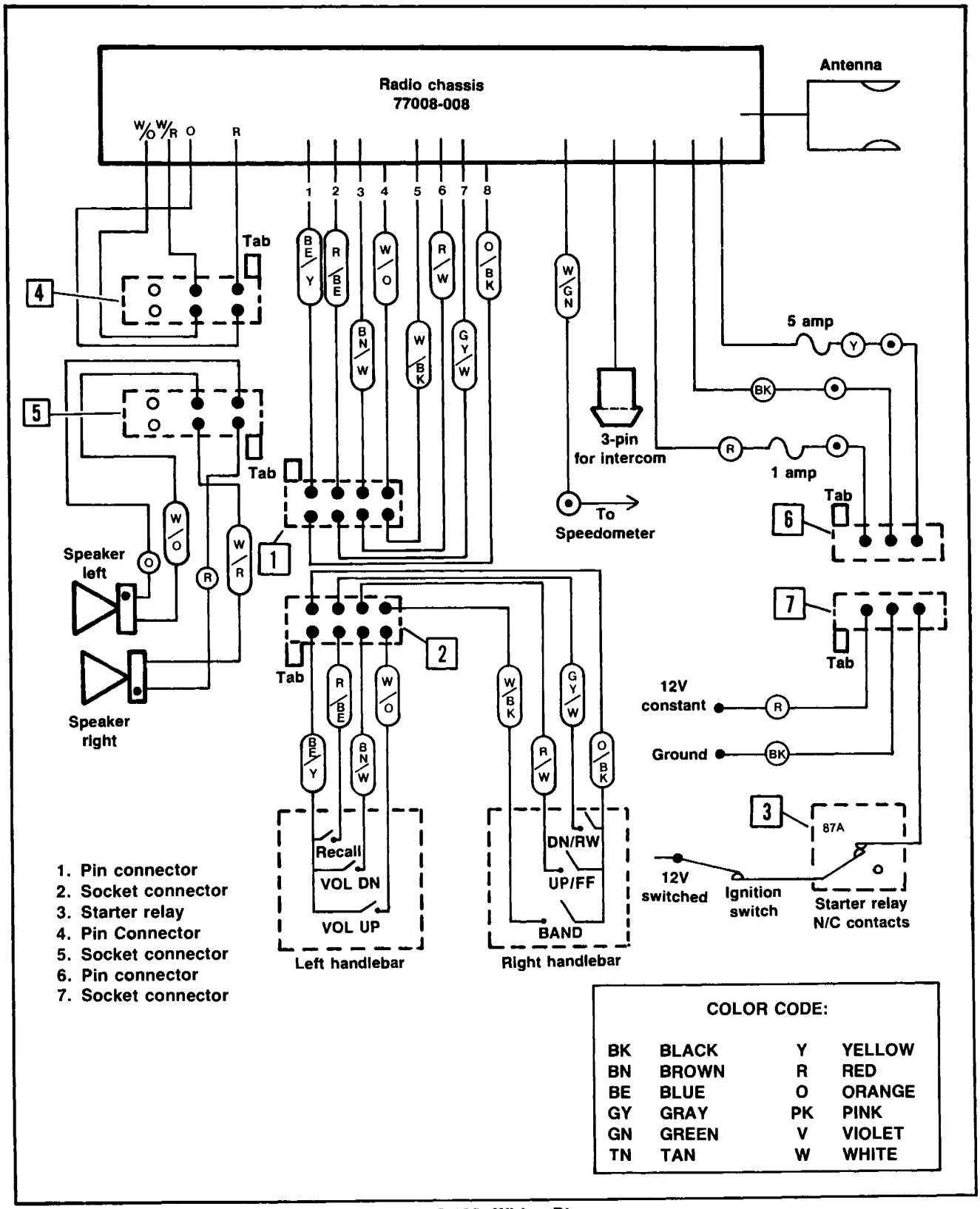


Figure 2-129. Wiring Diagram

Problem	Cause	Solution
1. No lights. No sound. Tape player inoperable.	1.1 Fuse blown.	1.1.1 Check fuses. Replace blown fuse with fuse that is equally rated.
	1.2 Faulty starter relay.	1.2.1 See Figure 2-129. Replace starter relay (3).
	1.3 Minimal or below control voltage limit.	1.3.1 Reset radio by turning ignition switch to OFF, then ON.
	1.4 No power.	1.4.1 Check battery, circuit breaker and wiring.
	1.5 Grounded handlebar switches.	1.5.1 See 2.2.1
2. No switching or erratic behavior at control panel and/or handlebar controls.	2.1 Minimal or below control voltage limit.	2.1.1 Reset radio by turning IGN OFF, then ON.
		2.1.2 Poor power or ground connections. Refer to wiring diagram and use multimeter to find source of problem.
	2.2 Grounded handlebar switches.	2.2.1 Refer to the test procedure under Handlebar Switches later in this section.
3. Cannot obtain full volume.	3.1 Low voltage.	3.1.1 Charge battery. Check current draw and charging system output. Reduce load at idle by turning off unnecessary accessories. If current draw is excessive, eliminate one or two accessories to reduce load.
	3.2 Water in speaker grilles.	3.2.1 Blow water out of speaker grilles with compressed air.
4. No volume, intermittent volume, or unresponsive volume switch.	4.1 Intermittent AVC lead.	4.1.1 Check that AVC line (single lead W/GN) from radio is connected to speedometer and reed switch is operating. See AVC test procedure given later in this section.
	4.2 Grounded handlebar switch.	4.2.1 See 2.1.2 and 2.2.1.
	4.3 Water in volume control.	4.3.1 Dry switch housing with compressed air.
5. Distortion or poor performance.	5.1 Bass and volume set too high.	5.1.1 Adjust bass and volume controls to median settings.
	5.2 Incorrect speaker polarity.	5.2.1 Check if solid colored wire is on the speaker terminal with painted dot.
	5.3 Speaker(s) not operating properly.	5.3.1 See test procedure later in this section.

Problem	Cause	Solution
6. Poor reception on AM or FM. Tape unit plays satisfactorily.	6.1 Faulty starter relay (sometimes evidenced by erratic voltmeter.	6.1.1 Replace starter relay (3).
	6.2 Antenna cable or mast shorted to ground.	6.2.1 Replace antenna or cable. See Antenna Tests later in this section.
	6.3 Water in radio chassis.	6.3.1 Allow three days to dry out chassis in warm dry environment.
	6.4 Low voltage.	6.4.1 Charge battery.
7. Tape ingested or tape cartridge stuck.	7.1 Radio not in tape mode.	7.1.1 Put radio in tape mode.
	7.2 Capstan or pinch roller dirty.	7.2.1 First try to eject. If unsuccessful, removal of lodged cassette should be attempted only if cassette is not completely seated. **CAUTION** **If cassette is seated, the radio must be returned to the radio manufacturer. The cassette can only be removed by removing tape deck from radio chassis. If cassette is not seated, removal can be attempted by pulling on cassette while carefully trying to lift cassette from bottom with a small screw driver. This must be performed very gently to avoid damage to cassette mechanism. If cassette is successfully removed, clean cassette deck thoroughly.**
	7.3 Loosely wound tape in deck or tape left in door for extended period then inserted.	7.3.1 If possible, eject cassette cartridge and if the ribbon is wrapped around the internal workings gently pull on the ribbon so as to free it from the drive. **CAUTION** **If tape is difficult to dislodge, do not force as damage to tape mechanism could result.**
8. Battery drained when motorcycle is not operated for extended periods.	8.1 Radio memory and clock circuits constantly draw small amount of current.	8.1.1 Trickle charge, or disconnect battery occasionally, during periods that motorcycle remains idle.
9. Radio picks up engine noise. Noise (signal frequency changes with engine R.P.M.	9.1 Poor antenna ground, antenna shorted to ground or bad cable.	9.1.1 Check antenna following test procedures under Antenna Tests in 1986-1987 Sound System section.
	9.2 Loose spark plug wire or wires.	9.2.1 Clean coil tower and check ignition wire connections.
	9.3 Water in radio chassis.	9.3.1 Allow motorcycle to dry out in dry environment for three days.
	9.4 Weak signal (usually AM)	9.4.1 Normal. Automatic Gain Circuit in radio increases gain to "pull-in" weak signal and also picks up ignition signal.

Handlebar Switches

HANDLEBAR CONTROLS INOPERABLE OR ABNORMAL OPERATION

Inoperable or abnormal operation of handlebar controls may be caused by grounds or shorts (to + 12 vdc). The following tabulations give symptoms and identify where in the circuitry a ground or short may exist. Refer to Figure 2-129 to determine the switch and lead connections.

NOTE

If any of these wires are grounded while radio POWER switch is OFF - the radio will not turn ON.

SYMPTOMS (With radio POWER ON)	GROUND ON WIRE (color code)
Mutes, beeps then unmutes upon initial grounding. Afterward pushing preset 1-4 causes mute, beep and unmute except preset 1. Other buttons inoperable.	R/BE or GY/W
Same, except PRESET-2 does nothing.	BN/W or R/W
Same, except PRESET-3 does nothing.	W/O or W/BK
Recall button functions like PRESET-1. DN button functions like PRESET-2. UP button functions like PRESET-3. Other buttons okay.	BE/Y
DN/RW button functions like PRESET-1. UP/FF button functions like PRESET-2. BAND button functions like PRESET-3. Other buttons okay.	O/BK

The following table describes symptoms that would result if + 12 vdc were shorted to the handlebar control wires.

SYMPTOM (with radio POWER ON)	SHORT TO 12 vdc AT WIRE
VOL. UP, VOL. DN, RECALL inop; all others okay.	BE/Y
RECALL, DN tune, PRESET-1, POWER inop; others okay.	R/BE
VOL. DN, PRESET-2, SE-SC, UP tune inop; others okay.	BN/W
VOL. UP, PRESET-3, DISPLAY, BAND inop; others okay.	W/O
Same as 4.	W/BK
Same as 3.	R/W
Same as 2.	GY/W
UP tune, DN tune, BAND inop; others okay.	O/BK

SWITCH CONTACTS

1. Refer to Figure 2-129. Disconnect connector halves (1) and (2).

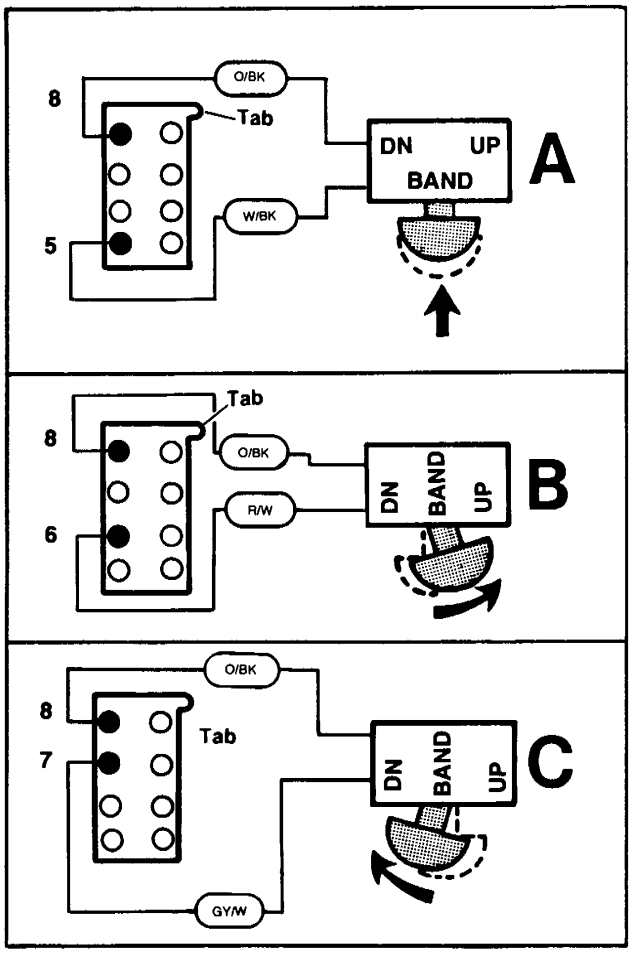


Figure 2-130. Function Switch Test

2. Refer to Figure 2-130, View A. With ohmmeter, place probes on pins (8) and (5) and push function switch straight inward. Meter should register zero ohms. A resistance reading significantly higher than zero indicates the switch contacts are not closing and the switch should be replaced. Release the switch control knob. The meter should now register infinite ohms. If the meter registers a reading other than infinite ohms, the contacts are not fully opening and the switch should be replaced.

3. Refer to Figure 2-130, View B and C. Place the meter probes on the pins and move the switch control knob in the direction shown. The meter should indicate zero ohms with the probes at appropriate connector pins. The meter should register infinite ohms when the switch knob is released.

4. Refer to Figure 2-131, View D. Place ohmmeter probes on connector pins (1) and (3), and move volume control knob to position shown (DN position). Meter should register approximately zero ohms. Leave probes on pins (1) and (3), and move control knob to UP position. Meter should register infinite ohms. If meter readings vary significantly from the recommended readings, replace switch.

5. Refer to Figure 2-131, View E. Place ohmmeter probes on connector pins (1) and (4), and move volume control knob to position shown (UP position). Meter should show approximately zero ohms. Leave probes on pins (1) and (4), and move control knob to DN position. Meter should read infinite ohms. Release knob (let it return to center position). The meter should still read infinite ohms. If meter readings vary significantly from these values, check wiring and switch.

6. Refer to Figure 2-131, View F. Place ohmmeter probes on connector pins (1) and (2), and push knob in as shown (RECALL position). Meter should show approximately zero ohms. Leave probes on pins (1) and (2), and release knob. Ohmmeter should show infinite ohms. If meter readings vary significantly from these values, check wiring and switch.

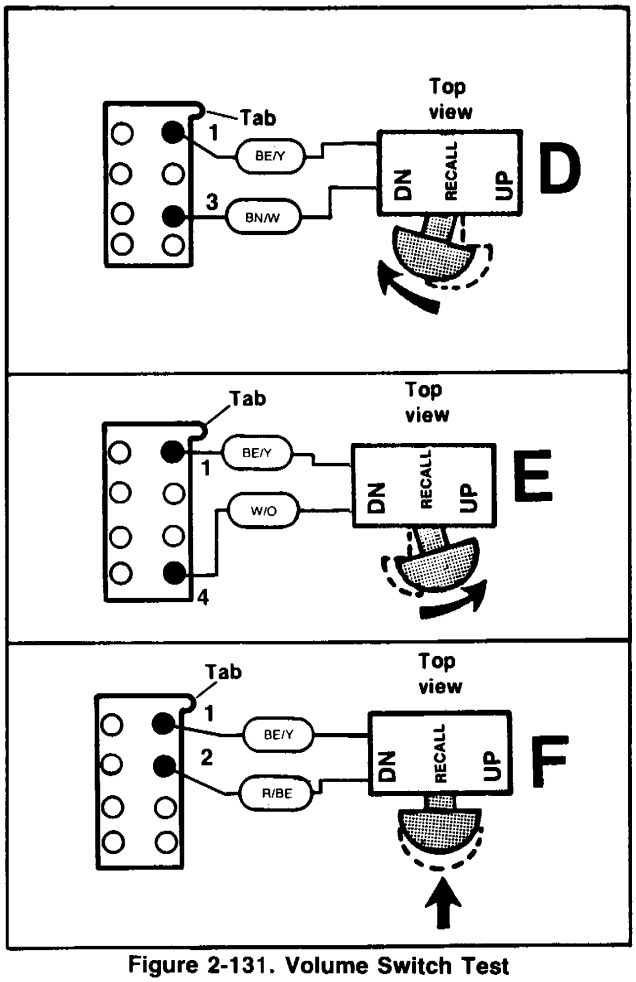


Figure 2-131. Volume Switch Test

Transient Signal Voltage

Refer to Figure 2-129. Disconnect connector halves (1) and (2). Connect voltmeter black lead to vehicle ground. Touch each pin of pin connector (1) with red probe and watch for an indication of voltage on meter. There should be no voltage present at any of the pins. If a voltage is present, this is an indicator of current flow into the radio control circuit from source other than radio chassis.

Automatic Volume Control (AVC)

If the Automatic Volume Control does not appear to be working, the problem may not be in the AVC. The AVC is triggered by a reed switch in the speedometer housing. Test reed switch and associated wiring as follows:

1. See Figure 2-132. Connect one lead of ohmmeter to W/GN wire that connects speedometer reed switch to radio. See Figure 2-129 if necessary.

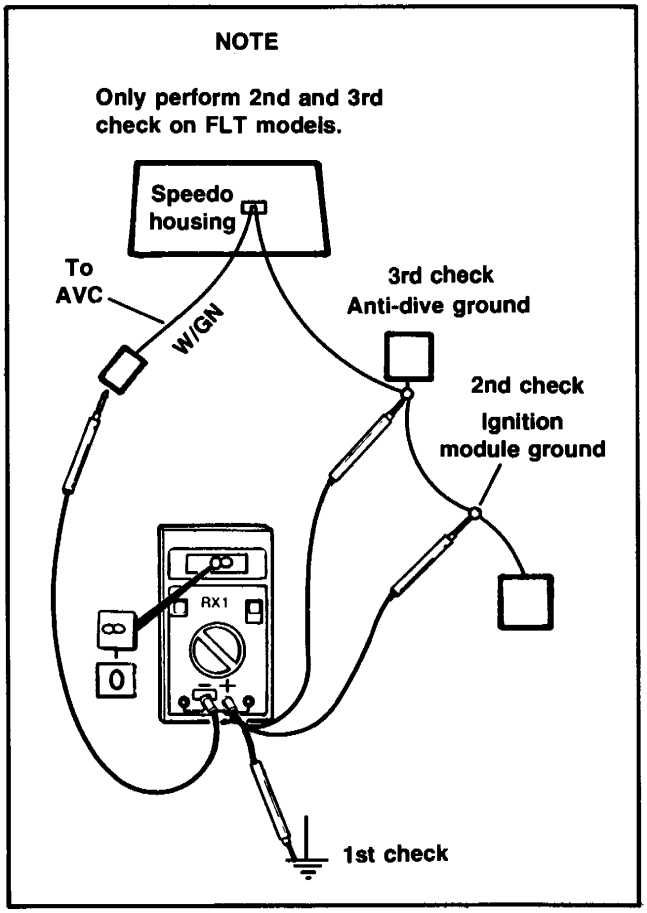


Figure 2-132. Reed Switch Test Connections

2. Connect other lead of ohmmeter to ground (crankcase).

3. Raise and block front wheel.

4. Rotate wheel and observe ohmmeter. The ohmmeter must fluctuate between zero ohms and infinity.

5. If ohmmeter does not fluctuate, either the reed switch is not operating or the other reed switch lead is not grounded.

NOTE

Only perform step 6 on FLTC or FLHTC models. On FXRT reed switch is grounded on instrument housing. A poor ground on FXRT models would cause the instruments to fail to illuminate.

6. Repeat step 4 with ohmmeter probe at ignition module ground and anti-dive valve ground.

7. If ohmmeter does not fluctuate at any of the three test locations and all ground connections are correct – replace reed switch.

GENERAL

The electrical connections at the radio chassis are the same on all models. To free the radio chassis electrically, it will be necessary to separate the following connectors:

Automatic volume control wire from speedometer – Single pin connector

Power supply – Three pin connector

Handlebar controls – Eight pin connector

Speaker – Six pin connector

Antenna – Single pin connector

Intercom (Ultra models) — Three pin DIN connector with single pin pigtail for ground connection.

WARNING

Turn the ignition switch to the OFF position and disconnect the negative lead from the battery before doing any electrical work on the sound system. When finished, connect the negative lead to the battery with the ignition switch in the OFF position. Failure to do so may cause irreversible damage to the radio and possible personal injury.

REMOVAL — FLHTC (Figure 2-133)

1. Place ignition switch in OFF position. Disconnect battery negative cable to avoid damaging sound system and possible personal injury.
2. Remove headlamp housing.
3. Reach through headlamp opening in fairing and disconnect (separate) the connectors listed under GENERAL above.

NOTE

Figure 2-133 shows additional parts in a removed or exploded view as an aid to inner fairing replacement or other associated repairs. Only remove the parts that are specified in this procedure.

4. Remove rear mount screw (1) and washer (2) by reaching through headlamp opening.
5. The front of the radio is held in position with two spring latches (3).

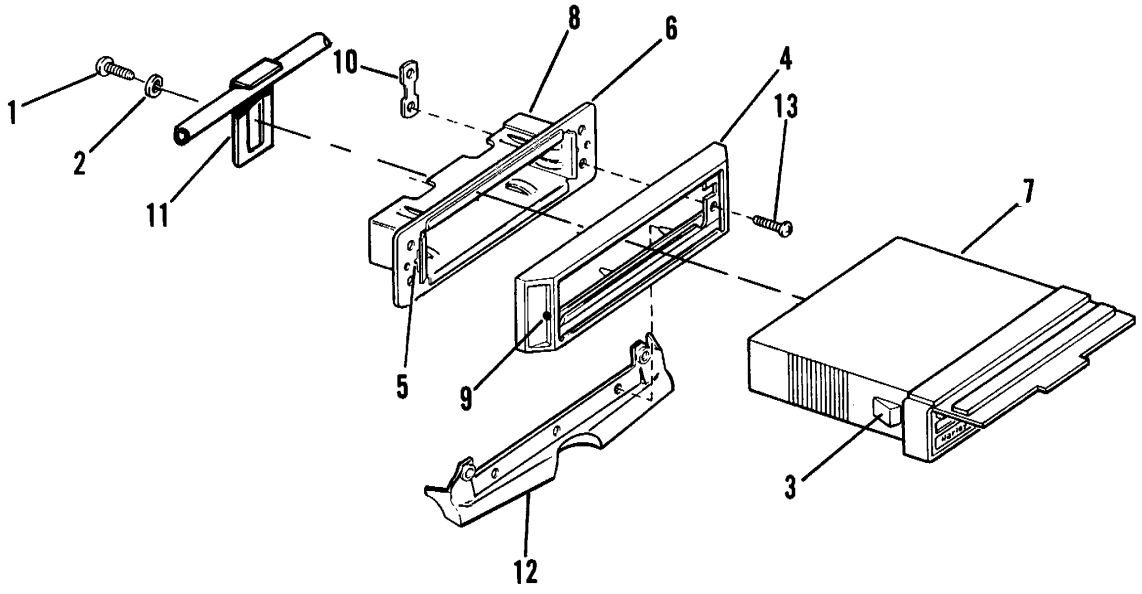
NOTE

Depress the left spring latch first following the directions in the following steps.

6. With a small Allen wrench (5/64 in.), pierce the radio seal (4) at the index dimple (9).
7. Hold Allen wrench at an angle so it enters the U-shaped notch (5). Press inward (toward radio) with wrench while gently pulling left side of radio outward until latch (3) is disengaged.
8. Repeat steps 6 and 7 to disengage right latch.

CAUTION

Radio should now be free – remove it gently while checking that all electrical connections have been disconnected.



1. Rear mount screw
2. Washer
3. Spring latch (2)
4. Seal
5. U-shaped notch
6. Mounting plate
7. Radio
8. Front bracket
9. Index dimple
10. Nut plate (2)
11. Fairing crossbrace
12. Handlebar cover
13. Screw (4)

Figure 2-133. Radio Mounting — FLHTC

INSTALLATION — FLHTC

NOTE

See Figure 2-134. Before installing radio, check that spring latches are positioned as shown. Loosen screws and move latches to position shown if required. Retighten screws.

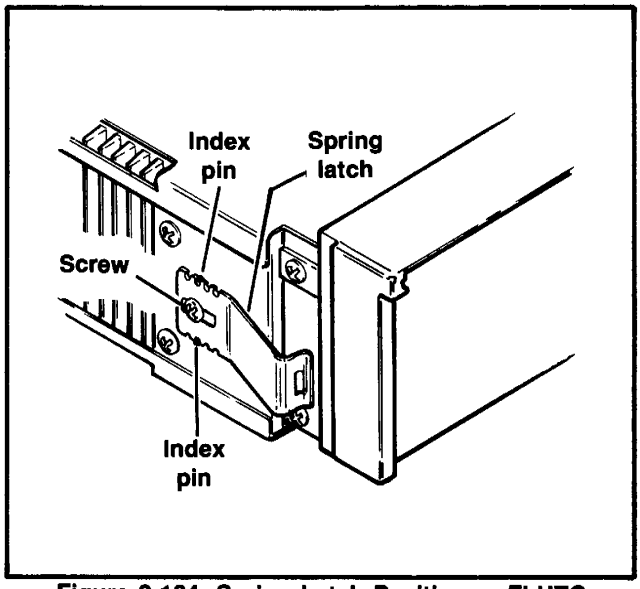


Figure 2-134. Spring Latch Position — FLHTC

1. See Figure 2-133. Carefully insert radio in front bracket (8). Make sure wires and connectors are not pinched or damaged while inserting the radio.

2. Use a thin wooden stick to lift edge of seal (4) so seal covers radio properly.

3. Press inward on radio to engage latches (3) in mounting plate (6) and front bracket (8).

4. Reaching through headlamp opening, connect all electrical connectors and install rear mount screw (1) and washer (2), making sure that radio chassis is not being stressed. On Ultra models, cover mating surface of DIN connector halves with two layers of black electrical tape.

5. Install headlamp housing.

6. Check to be sure ignition is in OFF position and connect negative lead to battery.

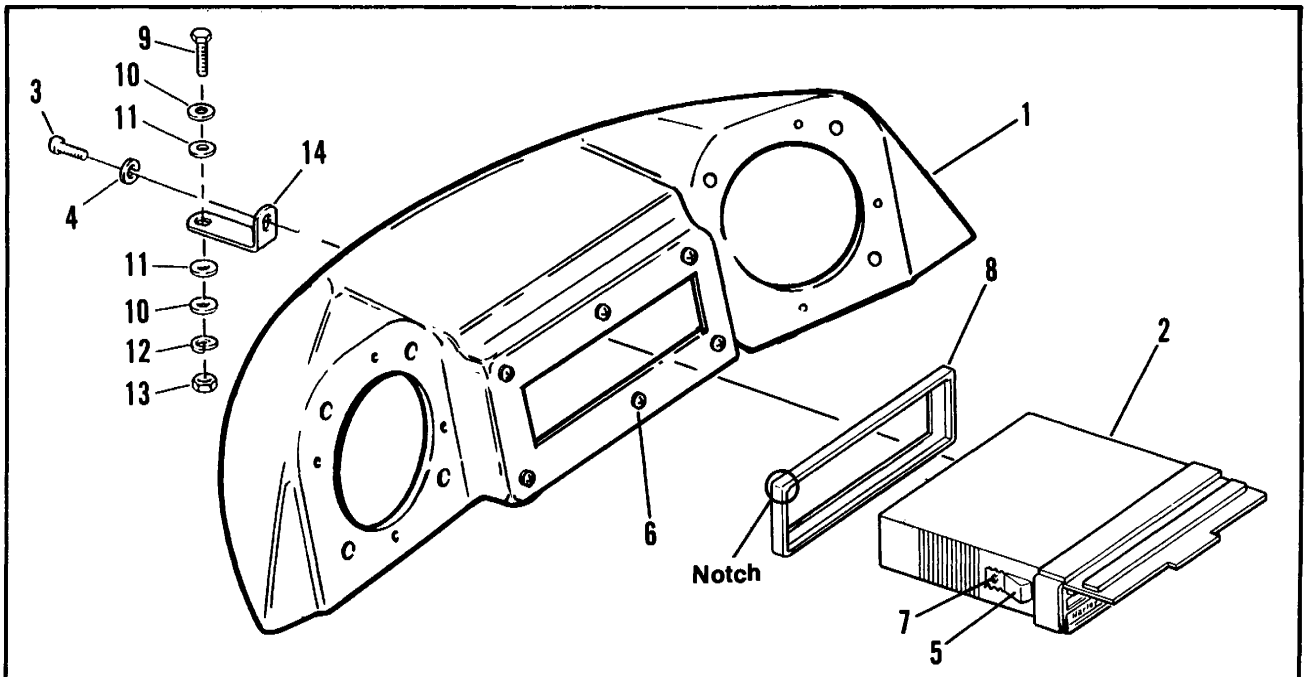
7. Check headlamp adjustment following procedure in section 8.

REMOVAL — FLTC (Figure 2-135)

WARNING

Turn the ignition switch to the OFF position and disconnect the negative lead from the battery before doing any electrical work on the sound system. When finished, connect the negative lead to the battery with the ignition switch in the OFF position. Failure to do so may cause irreversible damage to the radio and possible personal injury.

1. Disconnect negative battery cable to avoid damaging sound system and possible personal injury.
2. Remove windshield. See procedure later in this section.
3. Remove headlamp housing. See section 8.
4. Working through headlamp opening separate antenna and electrical connectors that are accessible.
5. See Figure 2-135. Through headlamp opening remove the four nuts that attach the radio caddy (1) to top of fairing.
6. Lift caddy off of fairing and remove bottom panel from caddy.
7. Remove bolt (9), nut (13) and washers (10, 11 and 12).
8. Depress spring latches (5) (one on each side of radio) and push radio out of its mount.
9. Remove rear mounting bolt (3) and washer (4) to remove bracket (14).



1. Caddy, radio
2. Radio
3. Rear mounting bolt
4. Washer
5. Spring latch
6. Radio mount screw (6)
7. Screw (2)
8. Seal
9. Bolt
10. Washer (2)
11. Rubber washer (2)
12. Lockwasher
13. Nut
14. Bracket, rear

Figure 2-135. Radio Mounting — FLTC

INSTALLATION — FLTC (Figure 2-135)

NOTE

Before installing radio, check that latches (5) are positioned toward rear of radio as far as possible. Loosen screw (7) and push latch to rear if required.

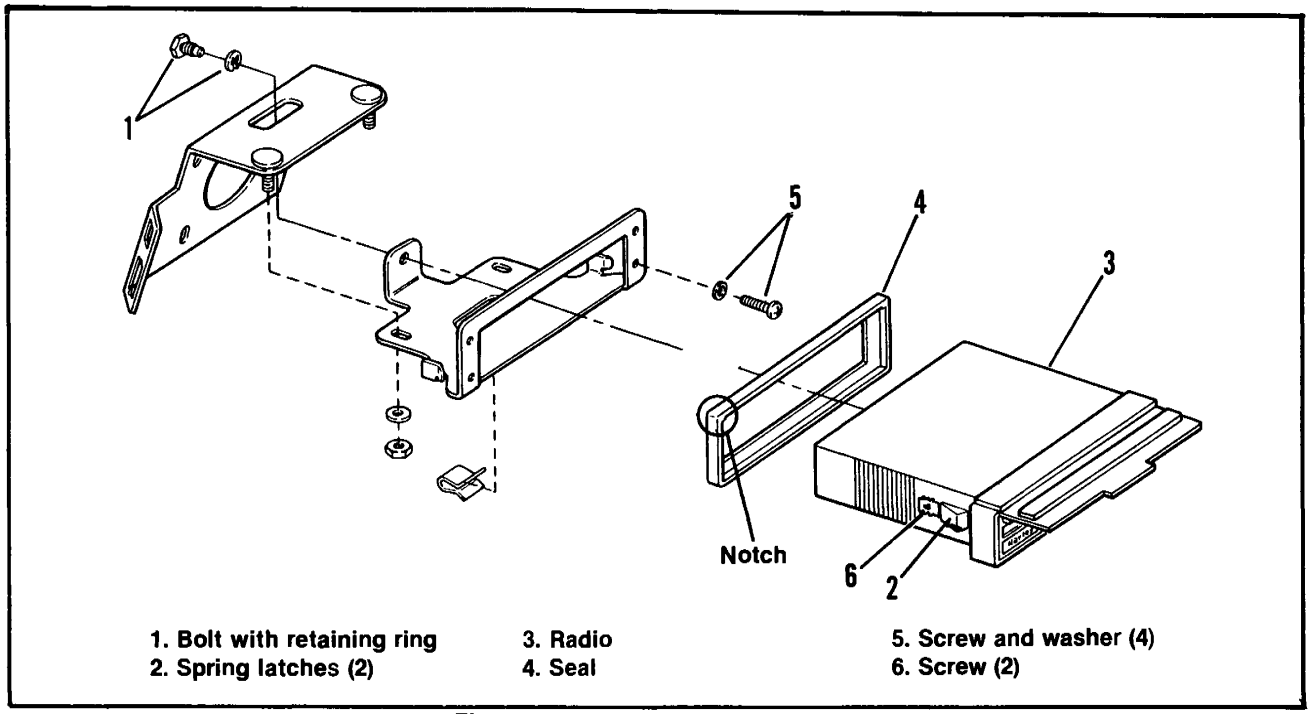
1. Install bracket (14) on radio with bolt (3) and washer (4).
2. Position seal (8) with notches up on radio and insert radio in caddy opening. Check that wires and connectors will not be pinched.
3. Gently press radio inward until spring latches (5) engage mounting bracket.
4. Secure bracket (14) to radio caddy with bolt (9), washers (10, 11 and 12) and nut 13. Make sure radio chassis is not being stressed or distorted.
5. Connect all electrical connectors.
6. Install bottom panel then position radio caddy, with mounting studs through holes in top of fairing. Install washers and nuts on caddy mounting studs.
7. Working through headlamp opening, join remaining electrical connectors. Cover mating surface of DIN connector halves with two layers of electrical tape on Ultra models.
8. Install headlamp housing, see Section 8, and windshield. See procedure later in this section.
9. Check to be sure ignition if in OFF position. Connect negative lead to battery.
10. Check headlamp adjustment following procedure in section 8.

REMOVAL — FXRT (Figure 2-136)

WARNING

Turn the ignition switch to the OFF position and disconnect the negative lead from the battery before doing any electrical work on the sound system. When finished, connect the negative lead to the battery with the ignition switch in the OFF position. Failure to do so may cause irreversible damage to the radio and possible personal injury.

1. Place ignition switch in OFF position. Disconnect battery negative cable to avoid damaging sound system and possible personal injury.
2. Remove instrument (speedometer and tachometer) cluster from top of fairing. Follow procedure given earlier in this section.
3. Separate all radio electrical connectors that are accessible through instrument cluster opening.
4. Reach through instrument cluster opening and with a short open-end 7/16 in. wrench remove rear radio mount bolt (1) and attached retaining ring. (The retaining ring serves as a captive washer.)
5. Depress spring latches (2) on both sides of radio and slide radio out of the mounting bracket.



1. Bolt with retaining ring
2. Spring latches (2)
3. Radio
4. Seal
5. Screw and washer (4)
6. Screw (2)

Figure 2-136. Radio Mounting — FXRT

INSTALLATION — FXRT (Figure 2-136)

NOTE

Before installing radio check that spring latches (2) are positioned all the way to the rear (opposite from front panel). If required loosen screws (6) and move latch to rear.

1. Check seal (4) – if torn replace with new seal.
2. Place seal (4) on radio and slide radio into mounting bracket. Press gently inward until spring latches engage in bracket.
3. Be careful radio wires and connectors are not pinched.
4. Reaching through instrument cluster opening, install bolt (1) to secure radio at rear and connect all radio connectors.
5. Install instrument cluster. Follow procedure earlier in this section.
6. Check to be sure ignition switch is in OFF position then reconnect negative battery lead.

SPEAKERS

If distortion or no sound output exists, remove the speaker(s) by performing the following. After speaker(s) are removed perform the speaker tests that follow Removal.

Removal

To remove speakers perform the applicable following procedure:

FLHTC

NOTE

Do not remove speaker grille cloth – speaker can only be removed from front side of inner fairing.

1. Remove outer fairing following instructions given later in this section.
2. Record location of speaker leads and remove them.
3. Remove three mounting screws from speaker and remove speaker.

FLTC

1. Remove radio caddy following instructions previously given in Radio Removal section.
2. Remove bottom cover from radio caddy.
3. Remove speaker grille. Speaker grille is retained with barbed fasteners at each corner. Remove by gently prying with thin bladed screwdriver at each corner.
4. Record location of speaker leads and remove them.
5. Remove four screws and nuts and remove speaker.

FXRT

The speakers on the FXRT may be removed from the rider-side or rear of the fairing.

1. Remove the speaker grille. The speaker grille is retained with barbed fasteners at top-inner corner and bottom-outer corner. Remove by gently prying at top-inner and bottom-outer corners with thin bladed screwdriver.
2. With a stiff wire or small diameter punch, push center pin of plastic rivets inward.
3. Grasp rivets and remove. Retain rivets as they are reusable.
4. Remove speaker outward enough so leads are visible, record location of leads and disconnect leads.

Cone Inspection

1. Check speaker cone for tears and warpage. If cone is torn or warped the speaker must be replaced.
2. Place four fingers on speaker cone and very gently press inward evenly on cone. The cone must move smoothly with no binding.
3. Release finger pressure. Cone must move outward smoothly. If cone does not move smoothly, the speaker must be replaced.

Impedance Check

With an ohmmeter set on the RXI range, measure the impedance of the speaker voice coil. Place probes of ohmmeter on speaker terminals and observe reading. The ohmmeter reading must be 3-5 ohms. Replace speaker if any other reading is observed.

Installation

Speaker installation is the reverse of removal with the following additional instructions:

ALL MODELS

Apply eight 1/2 in. long beads of latex caulk on mating surface of fairing or speaker. On FXRT apply caulk to back side of speaker.

FXRT

Mounting rivets may be reused if in good condition. Push center pin outward (opposite from split end) to decrease size of split end. After rivets are installed press center pin in to secure speaker.

SPEAKER GRILLES

FLHTC

If grille cloth was removed by mistake, apply Harley-Davidson Seal-All, silicone sealant or other adhesive and install.

FLTC, FXRT

Place barb fasteners over holes and press into place.

RADIO CONTROL PANEL COVER

Removal

1. Open cover to midpoint of its total travel.
2. Using a paper clip or stiff thin wire, depress pin on right end of hinge and move right end of cover outward. When edge of cover clears radio face pins may fly out. Use caution to avoid losing pins.

Installation

Same as removal; but make certain spring wound with thicker wire is placed on right side and pins are seated in their holes.

FRAME MOUNTED SEAT — FLT MODELS

REMOVAL

1. Remove the two rear seat bolts, washers and lockwashers securing the seat to the handrail.
2. Pull the seat up and back and lift seat off.

INSTALLATION

Install the seat by inserting the seat tabs located on the front of the seat into the frame cross member and fasten rear of seat to the handrail using two bolts, washers and lockwashers.

SEATS — FXR MODELS

Removal (Figure 2-137)

Hinged Seat

1. Lift seat up as shown. Remove lanyard from battery bracket bolt. Remove plastic sleeve from seat mounting pins and slide seat forward to remove from frame.

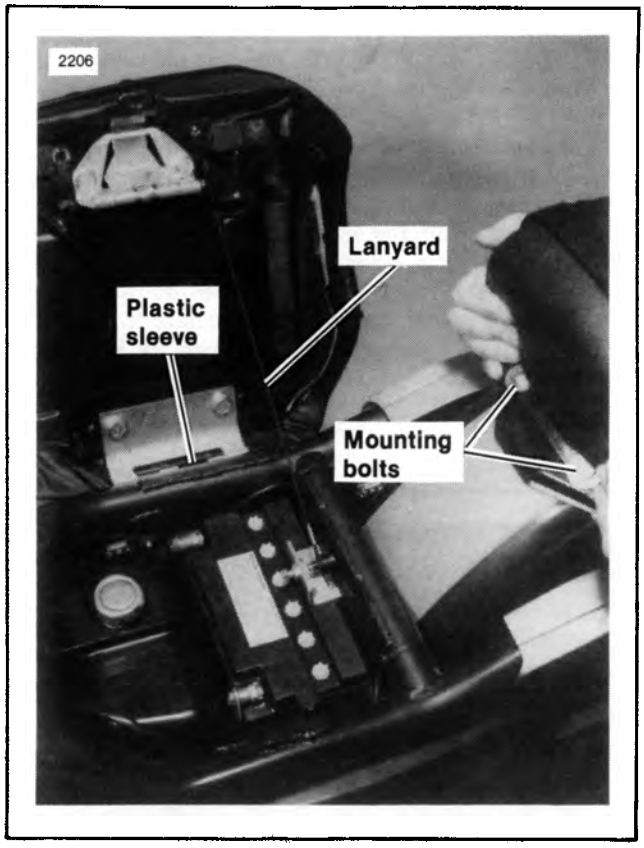


Figure 2-137. Seat Removal — FXR

2. Loosen passenger seat front bolts, remove rear bolt and slide passenger seat back and off fender. Models with sissy bars will require removal of two front bolts.

Fixed Seat

1. Remove screw at rear of fender pad, attaching seat to fender.

2. Pull seat back until seat is clear of mounting bracket on frame. Lift seat clear of motorcycle.

INSTALLATION

Hinged Seat

1. Secure passenger seat to fender with two bolts in front and one in rear.

2. Slide pins on seat bracket into holes on frame. Secure lanyard to battery bracket bolt, snap plastic sleeve on mounting pins and close seat.

Fixed Seat

1. Move seat forward so that retaining bar at front of seat slides under u-bracket on frame.

2. Secure seat to fender by installing screw, lockwasher and plastic washer at rear of fender pad. Be sure plastic washer is between fender and seat mounting bracket. Thread screw into weldnut at underside of fender.

SADDLEBAGS

GENERAL

The saddlebags and Tour-Pak on the FLT models are painted fiberglass. The FXRT saddlebags are painted ABS plastic. Wash and polish using a standard automotive detergent and wax to maintain the finish. The FXRS-CONV. saddlebags are leather and fabric.

SADDLEBAGS

Removal and Installation — FLT Models (Figure 2-138)

The saddlebags can be taken off the motorcycle by removing the cover, turning the 1/4 turn fasteners. Installation is the reverse of removal.

Saddlebags are equipped with latches. To remove saddlebag cover turn key to unlocked (horizontal) position. Unlatch rear latch. Lift cover slightly and pull to the rear to disengage the front latch.

Figure 2-138. Saddlebag Lock — FLT, FLHT

CAUTION

When replacing cover, be sure front latch is engaged in slot. Engage rear latch and lock saddlebag.

Removal and Installation — FXRT, FXRP (Figure 2-139)

The saddlebags can be removed by opening the saddlebag and removing the soft luggage bag and the four mounting bolts.

The saddlebags are installed by aligning the holes in the bag with the mounting holes in the support bracket. Secure the bag in position by installing the four bolts and flat washers at the four mounting locations from the inside of the bag. The larger flat washer is installed at the upper rear mounting location. The rubber washers isolate the bag from the vehicle and should be used on both sides of the saddlebag wall. Locknuts with lockwashers are hand tightened until all saddlebag hardware is in place, then tighten locknuts to 35 in-lbs torque. The same procedure is followed for both saddlebags. Make sure the soft inner luggage bags are in the saddlebags.

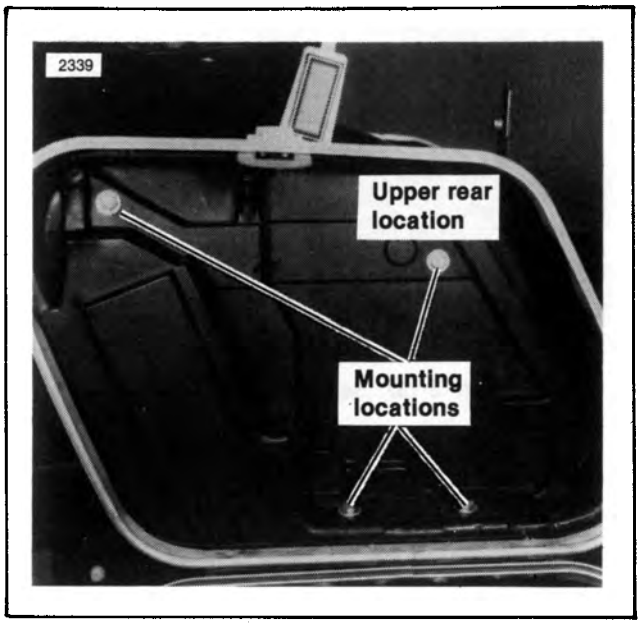


Figure 2-139. Saddlebag Mounting — FXRT

REMOVAL/INSTALLATION — FXRS-CONV.

See Figure 2-139A. The saddlebags are fixed at three points each at the rear of the motorcycle by three screws. These screws have large knobs for hand removal. The saddlebags have handles that tuck under the fender braces.

REMOVAL

1. Pull the saddlebag handle from under the fender brace.
2. Use the handle to support the saddlebag and unscrew the knobbed screws.
3. Insert the chrome plated caps in the fender brace sockets.

NOTE

The well nuts are designed to stay in place on the knobbed screws.

INSTALLATION

1. Remove the chrome plated caps from the fender brace sockets. Store in a safe place, such as the saddlebag pouch.
2. Put the saddlebag in position at the three support points.
3. Use the handle to support the saddlebag and screw the knobbed screws and well nuts into the brackets until they are snug.
4. Tuck the handles under the fender brackets.

WARNING

The saddlebag handles are not intended to serve as "grab handles" for the passenger. DO NOT allow them to be used as "grab handles".

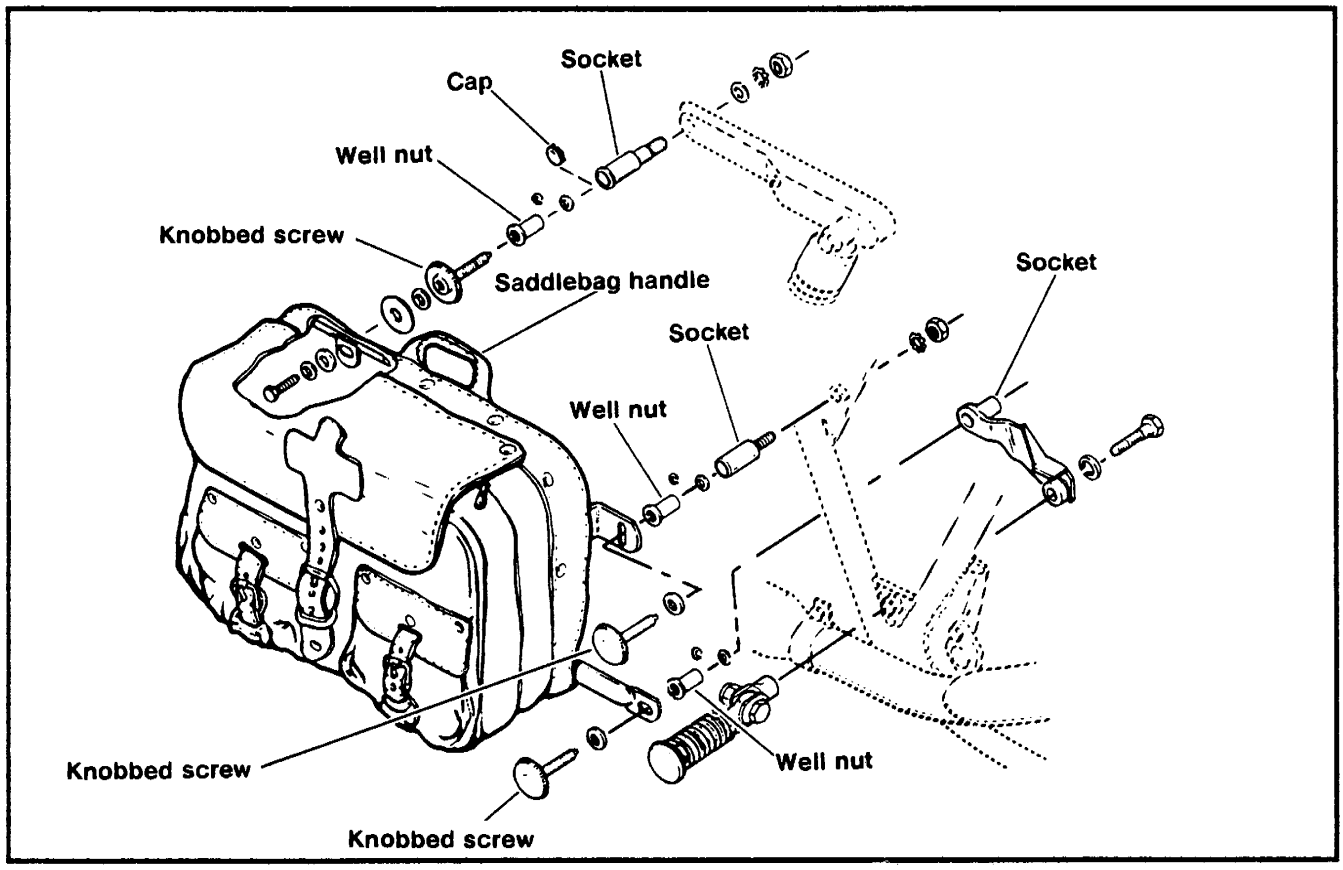


Figure 2-139A. FXRS-CONV. Saddlebag Details

TOUR-PAK

REMOVAL AND INSTALLATION (Figure 2-140)

All FLT Models — Except Ultras

The Tour-Pak is secured to the luggage rack with four bolt fasteners. Disconnect light plug and antenna cable, if applicable, lift up the rubber mat and remove the four nuts from under luggage rack. To replace the Tour-Pak, center it over the luggage rack and secure to luggage rack with the four bolts, nuts and washers. Reconnect wiring plug and antenna cable.

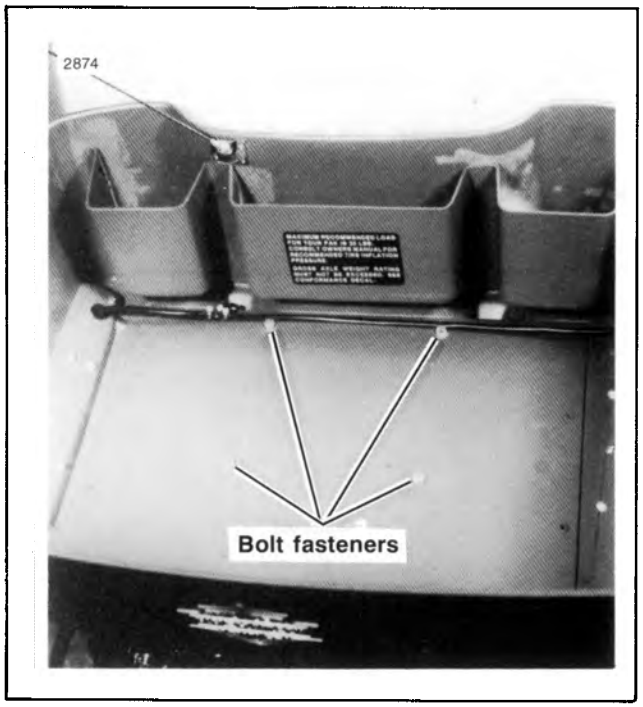


Figure 2-140. Tour-Pak Installation

Ultra Models (Figure 2-141)

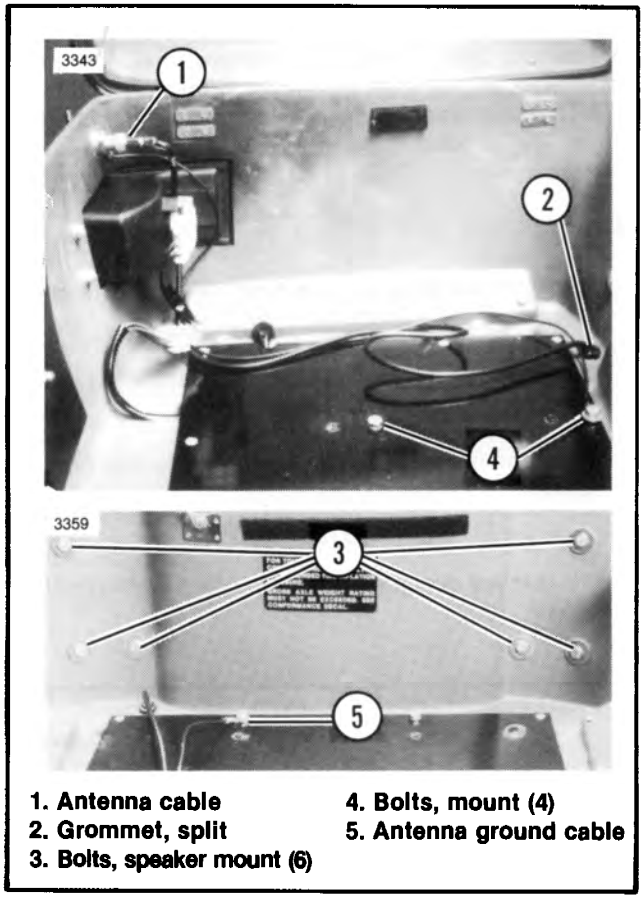
REMOVAL

1. Before removing Tour-Pak disconnect the antenna cable (1), remove grommet (2) and pull cable through hole in bottom of Tour-Pak.

2. Unplug the 3-pin connector (brake and taillight wires) on left side of luggage rack.

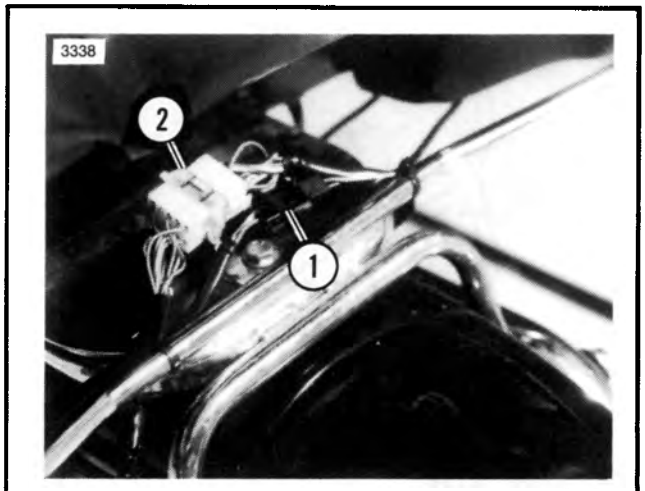
3. The two remaining harnesses are connected to the rear speakers. If your wish to remove speakers from the Tour-Pak, remove bolts (3) from each speaker and support speakers with string or wire.

4. See Figure 2-142. If speakers are to be left on Tour-Pak, remove seat and disconnect left speaker connector (1) and right speaker connector (2). Remove cable straps as required.



1. Antenna cable
2. Grommet, split
3. Bolts, speaker mount (6)
4. Bolts, mount (4)
5. Antenna ground cable

Figure 2-141. Ultra Tour-Pak



1. Left speaker connector
2. Right speaker and control connector

Figure 2-142. Ultra Speaker Wiring

5. Remove the four bolts (4) that attach Tour-Pak to luggage rack and Tour-Pak may be removed.

INSTALLATION

Reverse REMOVAL instructions to install the Tour-Pak. Make certain antenna and ground lead are firmly attached.

FAIRING AND WINDSHIELD — FLT

REMOVAL

1. Remove screws securing windshield to fairing and lift windshield from fairing.
2. Disconnect the wiring connector (two connectors — 1986-later FLT) from the back of the fairing.
3. See Figure 2-143. Remove the two screws that secure each clamp to the engine guard.

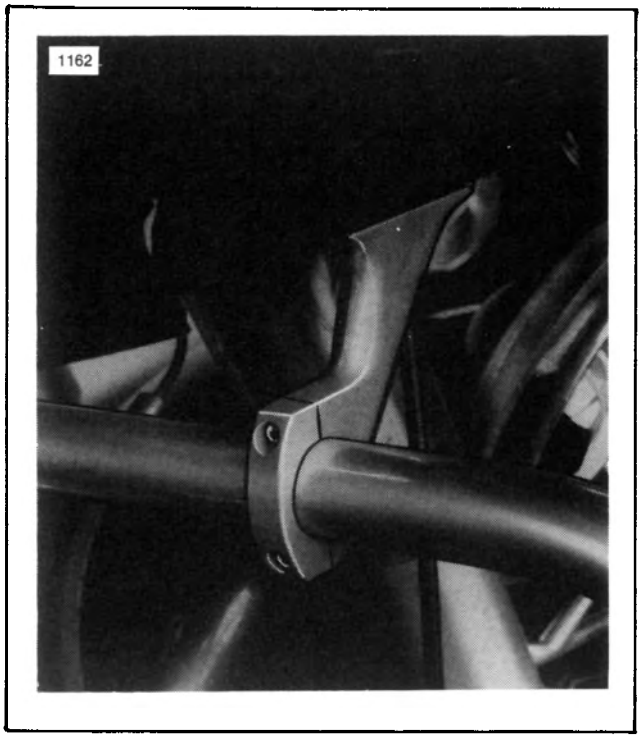


Figure 2-143. Fairing Clamps — FLT

NOTE

Front directional/running lights are mounted on fairing clamps on 1988 - 1989 models.

4. Remove the headlamp housing, see HEADLAMP HOUSING, REMOVAL in section 8.
5. See Figure 2-144. Remove the two bolts located behind the headlamp housing and remove the fairing.

INSTALLATION

1. See Figure 2-144. Install the two bolts behind the headlamp housing.
2. See Figure 2-143. Secure the clamps to the highway bar using the original screws.
3. Install the headlamp housing as described in the headlamp housing INSTALLATION procedure.

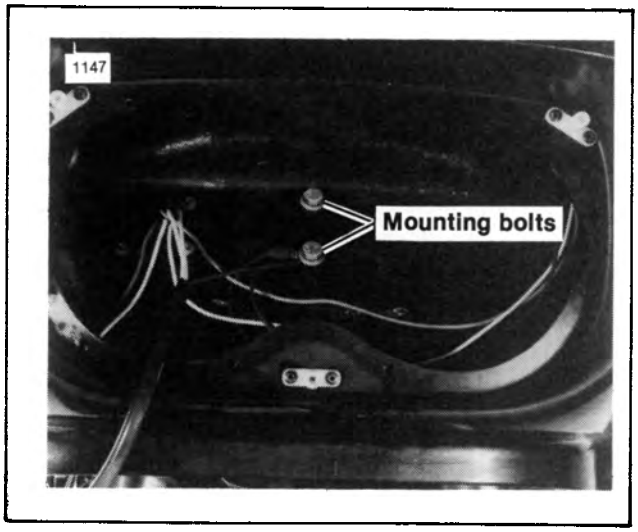
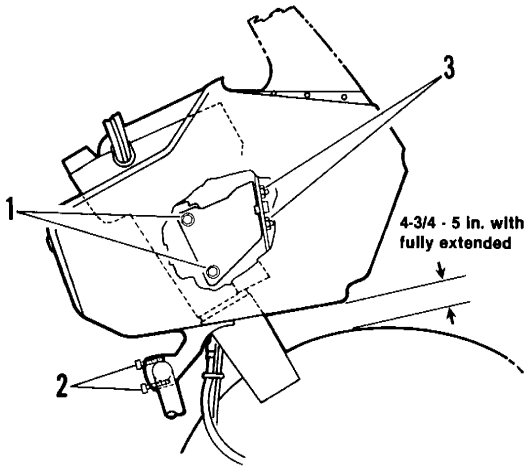


Figure 2-144. Fairing Mounting Bolts — FLT

4. Plug in the wiring connection.
5. With wellnuts installed in fairing holes, insert windshield into groove in fairing. Install screws and washers starting with center hole and working toward edges. Tighten screws to 4 in-lbs torque. Over-tightening could crack the fairing.
6. See Figure 2-145. Raise front wheel so forks are fully extended. Place blocking under frame.
7. Check clearance between fender and bottom of fairing.



1. Fairing bracket bolts (2)
2. Fairing clamp bolts (4)
3. Fairing mounting nuts (2)

Figure 2-145. Fairing Adjustment — FLT

8. Clearance must be 4 3/4-5 in. as shown in Figure 2-145.

9. If clearance is less than 4 3/4 in., loosen bolts (1) and slightly loosen (about one turn) bolts (2) on both fairing clamps.

10. Lift fairing at front until 4 3/4-5 in. clearance is obtained.

11. Tighten bolts (1) and (2).

12. Also check for throttle cable interference between instrument housing and fairing with front wheel turned fully to the left.

CAUTION

If clearance of 4 3/4 in. is not maintained, fender may be damaged if front wheel hits a bump.

FAIRING LOWERS AND GLOVE BOXES — FLT ULTRA

GENERAL

1. See Figure 2-146. The top of the fairing lowers and the early 1989 glove boxes are attached to tapped holes in the fairing clamps. Late 1989 and 1990 glove boxes are attached to fairing lowers with three screws and three well-nuts or crimp nuts. The bottom of the fairing lower attaches to the engine guard.

NOTE

For proper fit the inside face of the lower fairing clamps must be located 5-1/2 in. from frame as shown in Figure 2-146. Loosen clamp screws and move clamp to obtain the 5-1/2 in. dimension.

Figure 2-146. Upper Mount Location for Fairing Lowers

REMOVAL

Glove Box — Early 1989

1. See Figure 2-147. Remove screw (11), lockwasher (10), cable clamp (8) and spacer (9) holding clutch cable.

2. Remove screw (6), lockwasher (5) and flat washer (4). The glove box (2) may be removed.

3. Repeat step 2 to remove right glove box.

Glove Box — Late 1989-1990

1. See Figure 2-147. Remove two screws (12) and fairing lower cap (13).

2. Remove clutch cable clamp by performing step 1 in Early 1989 procedure above.

3. Remove three screws (15) and glove box may be removed.

4. Repeat steps 1-3 to remove right glove box.

Fairing Lowers

1. Remove clutch cable clamp by performing Step 1 of Early 1989 glove box procedure.

2. See Figure 2-147. Remove screw (6), lockwasher (5) and flat washer (4). (On early 1989 models, glove box and fairing lower are secured by screw (6).)

3. See Figure 2-152. Remove screw (6) and nut (9). Fairing lower can now be removed. Remove clamp (5) from engine guard if fairing lowers are not being re-installed.

4. Repeat steps 2 and 3 for right side.

NOTE

ON Late 1989 and 1990 models the glove boxes are attached to fairing lowers with three screws and do not have to be removed from lowers unless removal is required.

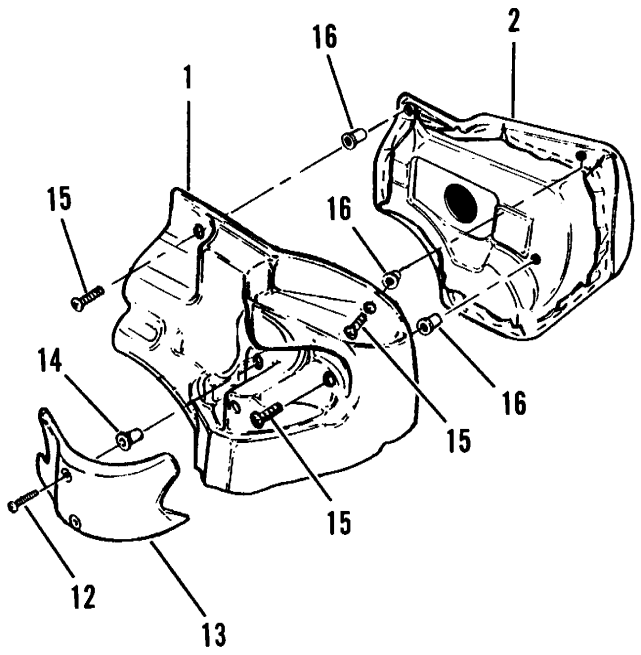
INSTALLATION

1. See Figure 2-147. Reverse the appropriate REMOVAL steps to install glove boxes and/or the fairing lowers.

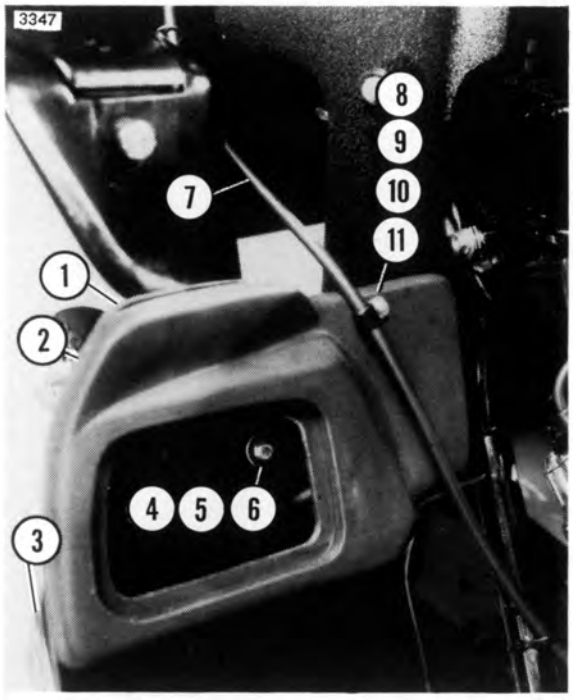
2. See Figure 2-152. Install clamp (5) on engine guard with tabs to rear.

3. Install bolt (6), washer (7), lockwasher (8) and nut (9) in locations shown. Tighten bolt (6), nut (9) to 12 ft-lbs torque.

4. Repeat steps 1-3 for other side.



LATE 1989 & 1990



EARLY 1989

1. Left fairing lower
2. Left glove box
3. Engine guard
4. Flat washer
5. Lockwasher
6. Screw, 1/4-20 x 3/4 in.
7. Clutch cable
8. Cable clamp
9. Spacer
10. Lockwasher
11. Screw
12. Screw (2)
13. Cap (2)
14. Well-nut® (2) (Early 1989) or crimp nut (2) (Late 1989 & 1990)
15. Screw (3)
16. Well-Nut® (3) (Early 1989) or crimp nut (3) (Late 1989 & 1990)

Figure 2-147 FLTC Ultra Fairing Lowers and Glove Box Mounting

FAIRING AND WINDSHIELD — 1984 to 1985 — FLHT

REMOVAL (Figure 2-148)

1. Remove two bolts, washers and locknuts securing windshield to brackets and remove windshield.

2. Remove four locknuts and washers securing fairing to mounting brackets and remove fairing.

INSTALLATION (Figure 2-148)

1. Place rubber washers then metal washers on fairing studs. Position fairing on brackets and secure with washers and locknuts.

2. Position windshield over upper or lower mounting holes in brackets and secure with bolts, washers and locknuts.

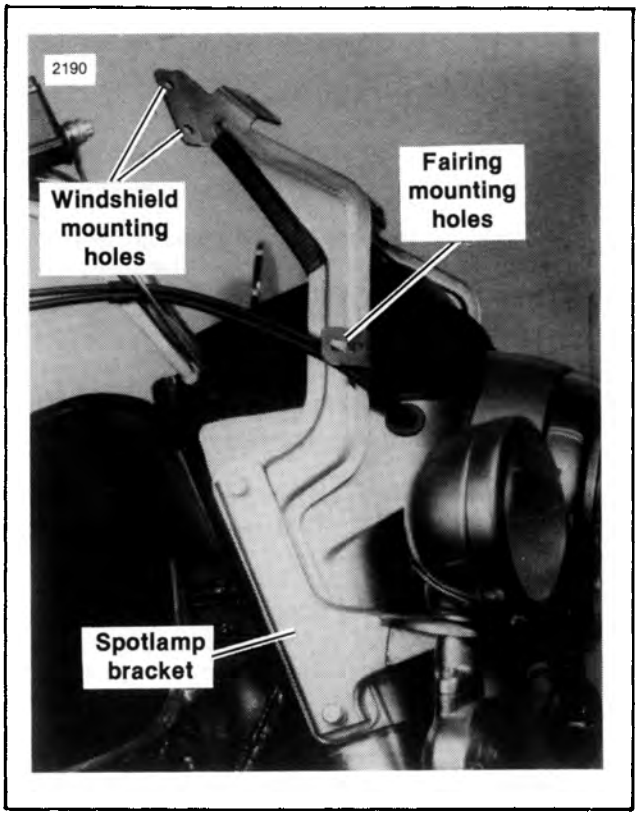


Figure 2-148. Windshield and Fairing Mounting Brackets — FLHT

FAIRING AND WINDSHIELD — 1986 AND LATER FLHT

REMOVAL

Outer Fairing (Figure 2-149)

1. Remove the bolts, nuts and washers that attach outer fairing to windshield and inner fairing.
2. Loosen the four bolts that attach light bracket and outer fairing to fork brackets. Remove the lower two bolts and leave the upper two bolts in position.
3. Lower light bracket to rest on fender.
4. Remove the screw holding the headlamp trim ring in place and remove the trim ring.
5. Remove the eight screws which attach the headlamp assembly to the outer fairing. Remove the headlamp assembly.
6. The outer fairing is attached to metal brackets by four studs, two at each side of headlight opening. Reach through the headlight opening and loosen the four locknuts on the four studs.
7. Remove the fairing by pulling straight forward freeing the studs of the slots in bracket.

NOTE

Most maintenance and repair procedures can be done by removing the outer fairing only. Do not remove the inner fairing unless required to do so.

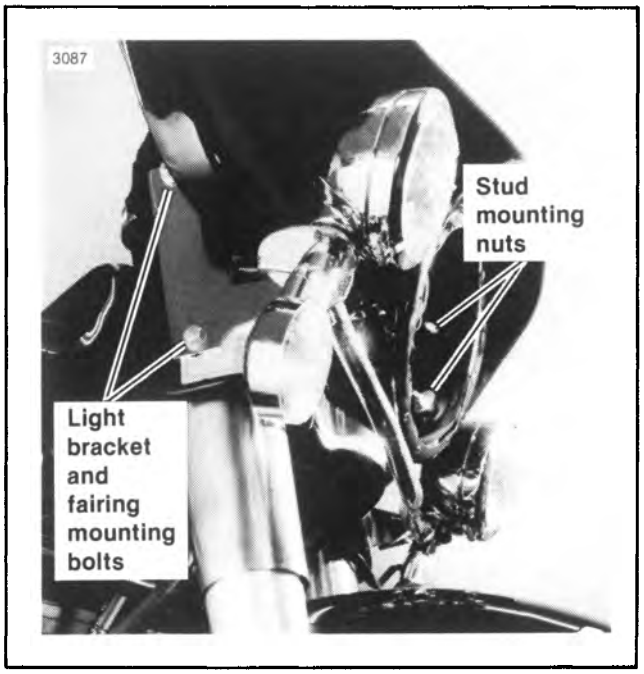
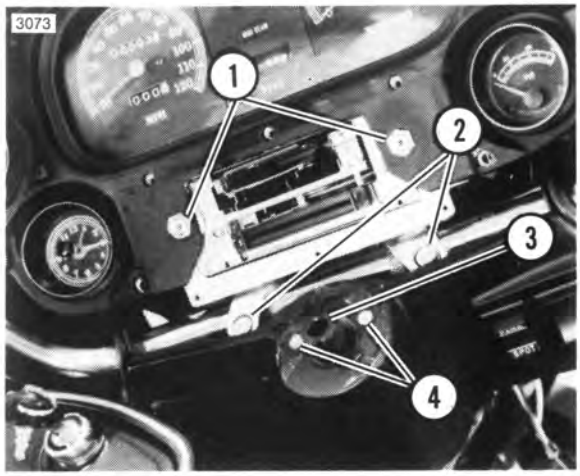


Figure 2-149. Outer Fairing Mounting — 1986 and Later

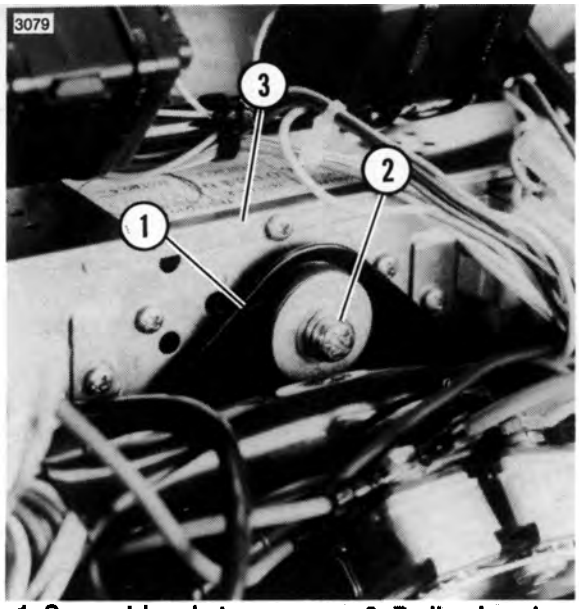
Inner Fairing

1. Disconnect speedometer cable at instrument panel. Disconnect gauge, instrument and radio connectors.
2. Disconnect throttle and clutch cables and route back through holes in inner fairing.
3. Remove the six screws attaching the radio faceplate and cover. Remove the faceplate and cover.
4. Remove the two allen head screws securing small fairing panel at top of handlebar.
5. See Figure 2-150. On 1986-1987 models, remove the two nuts (1) attaching the radio chassis to inner fairing. See Figure 2-151. Remove screw (2) securing the radio chassis to the rear support bracket. Loosen the support bracket mounting screws. Remove the rear support bracket and the radio chassis. For 1988 - 1989 models, see 1988 - 1989 Sound System for radio removal.
6. See Figure 2-150. Remove handlebar clamp screws (2) and remove handlebar.
7. Remove ignition switch knob by pulling pin at underside of switch bracket from front of inner fairing. Remove nut collar and lockwasher from threaded end of ignition switch.
8. Remove the ignition switch decal, then remove the two screws (4) which secure the inner fairing to switch bracket.
9. Remove the two bolts which secure the inner fairing to the upper fork bracket.



1. Radio stud nuts
2. Handlebar clamp screws
3. Ignition switch
4. Screws — inner fairing to switch bracket

Figure 2-150. Inner Fairing Mounting — 1986-1987



1. Support bracket
2. Screw — support bracket to radio chassis
3. Radio chassis

Figure 2-151. Radio Mounting Rear — 1986-1987

INSTALLATION

Inner Fairing

1. Insert throttle and clutch cables through fairing and position fairing over ignition switch. Snap the fairing support brackets over the bushings on the lower fork bracket.

2. See Figure 2-150. Install the two screws (4) securing the fairing to the ignition switch bracket. Be sure the screw heads are lower than the fairing surface. Install a new ignition switch decal.

3. Install lockwasher, collar and nut at top threaded end of ignition switch. Install ignition switch knob.

4. See Figure 2-149. Install the two bolts through inner fairing and thread into the upper fork bracket, but do not tighten.

5. See Figure 2-150. Place handlebar in the two clamps and install upper clamp bars and clamp screws (2) .

6. On 1986-1987 models, see Figure 2-150, 2-151. Position radio at support bracket and secure to fairing and rear support bracket by installing mounting hardware. On 1988 - 1989 models see 1988 - 1989 Sound System for radio installation.

CAUTION

Do not over-tighten radio mounting fasteners or radio chassis will be distorted and stressed.

7. Install small fairing panel above handlebar. Install the radio faceplate and cover with its six mounting screws.

8. Connect gauge, instrument and radio electrical connectors. Connect speedometer cable.

Outer Fairing

1. Position outer fairing over inner fairing with the four studs into the slots of support bracket. Install several bolts through outer fairing, windshield and inner fairing to hold in position.

2. See Figure 2-149. Tighten the nuts on the four studs securing the outer fairing to the metal support bracket. Be sure the fairing outer and inner are properly aligned at their edges.

3. Lift light bracket up and position so slots in bracket are around upper fork bracket bolts. Align the lower fork bracket mounting holes.

4. Install the two lower fairing mounting bolts through the light bracket, outer fairing, inner fairing and thread into the lower fork bracket.

5. Install remaining bolts, washers and nuts at top of fairing using drift pin to align holes where necessary.

6. Check rubber seal around inner fairing to be sure it is not pinched and seated properly.

7. Tighten four fairing mounting bolts to 12-14 ft-lbs torque.

FAIRING LOWERS AND GLOVE BOXES — FLHTC-ULTRA

REMOVAL

1. See Figure 2-152. Remove two screws (12) and fairing lower cap (11). Be careful not to lose two washers (13).

2. Remove nuts (4) and retainer (3). Remove U-bolt (2) through opening (door) of glove box. Glove box is now free and can be removed.

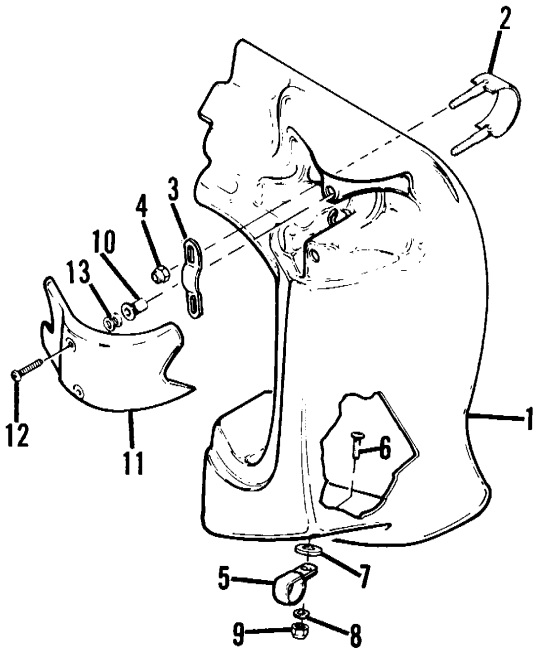
3. Remove screw (6) and nut (9). Fairing lower can now be removed. Remove clamp (5) from engine guard if fairing lowers are not being re-installed.

4. Repeat steps 1 - 3 for right side.

INSTALLATION

1. Reverse REMOVAL procedure.

2. Tighten bolt (6) and nut (9) to 12 ft-lbs torque and U-bolt nuts to 6 ft-lbs torque.



1. Left fairing lower
2. U-bolt (2)
3. Retainer (2)
4. Locknuts (4)
5. Clamp (2)
6. Screw (2)
7. Rubber washer (2)
8. Flat washer (2)
9. Locknut (2)
10. Well-Nut® (4) (Early 1989) or . . . Crimp nut (4) (Late 1989 & 1990)
11. Cap (2)
12. Screw (4)
13. Flat washer (8) (1989 only)

Figure 2-152. FLHTC-Ultra Fairing Lowers

FAIRING AND WINDSHIELD — FXRT, FXRD

REMOVAL (Figures 2-153, 2-154)

NOTE

On 1986-1989 models the speedometer cable must be disconnected from speedometer drive at front wheel. Disconnect cable by rotating cable counterclockwise to unscrew it from the drive. If present, slide rubber boot away from drive.

1. Remove the attaching hardware, at each side (right and left), where the fairing is attached to the upper fairing braces and the lower mounting support. Keep the attaching hardware separate so that the correct fasteners will be reinstalled at the proper locations.

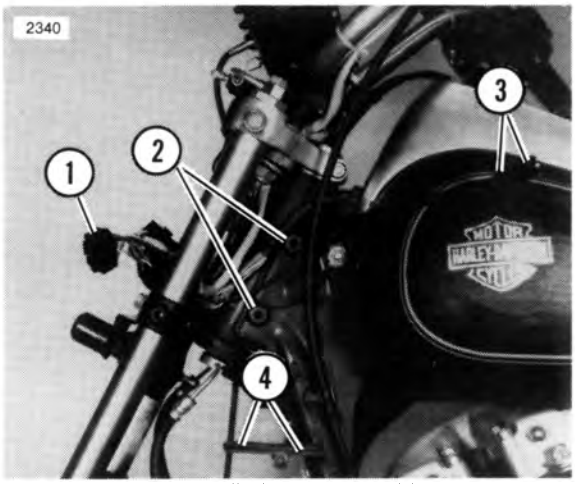
2. At the backside of the fork, at each side, remove the two bolts and lockwashers that secure that fairing bracket to the steering head.

3. Carefully remove the fairing a slight distance and diconnect the twelve pin connector.

4. Continue removing the fairing until it is clear of all the support mounting.

CAUTION

Do not kink speedometer cable by setting fairing on it. A bent or kinked cable will break after a short time.



1. 12 pin electrical connector
2. Fairing bracket mounting location
3. Fairing brace mount location
4. Fairing support mount location

Figure 2-153. Fairing Mounting Location — 1984, 1985

INSTALLATION

1984 to 1985 (Figure 2-153)

1. With the aid of a second person, position the fairing in approximate position and connect the twelve pin connector.

2. Move the fairing so that the bottom of the fairing is resting on the lower mounting support and the holes in the fairing bracket lugs are aligned with the threaded bushings in the steering head. The encased wiring harness must pass over the upper lug of the fairing bracket and the left hand side.

3. Place a 5/16 in. heavy lockwasher on each of the four 5/16 in. x 5/8 in. hex head bolts. Insert the bolts through the bracket holes in the frame and hand tighten.

4. Place a flat washer on two of the hex head 1/4 x 1 in. bolts. Place a nylon washer on each bolt and position next to the flat washer. Take two nylon washers and place one between the underside of the fairing and the top side of the lower mounting support at each hole in the mounting support. Insert the bolts from the top side of the fairing through the mounting holes in the fairing nylon washer and support. Thread a 1/4 in. locknut onto each bolt and tighten to 8 ft-lbs torque. Repeat the procedure at the opposite side.

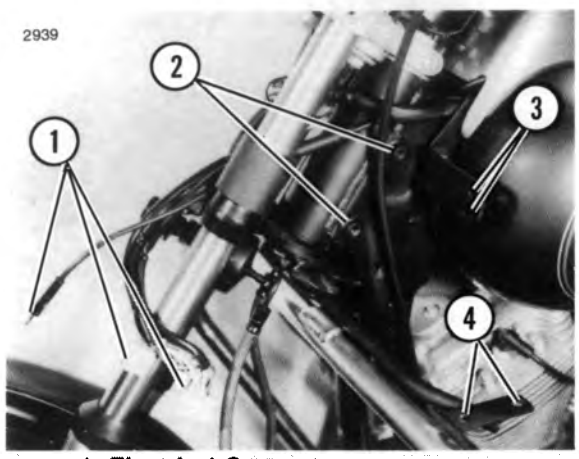
5. Tighten the four 5/16 x 5/8 in. hex head bolts at the center fairing bracket to 19 ft-lbs torque.

6. At one side align the two holes in the fairing brace with the two holes in the fairing, then insert two 1/4 x 3/4 in. black screws from the fairing side through the mating holes. Place a star lockwasher onto each bolt followed by a 1/4 in. hex head nut. Tighten each nut to 10 ft-lbs torque. Repeat this procedure at the opposite side.

1986 to 1990 (Figure 2-154)

1. With the aid of a second person, position the fairing in approximate position and connect the electrical connectors.

2. Move the fairing so that the bottom of the fairing is resting on the lower mounting support and the holes in the fairing bracket lugs are aligned with the threaded bushings in the steering head.



1. **Electrical Connectors**
2. **Fairing bracket mounting location**
3. **Fairing brace mounting location**
4. **Fairing support mounting location**

Figure 2-154. Fairing Mounting Location — 1986 and Later

3. Place a 5/16 in. heavy lockwasher on each of the four 5/16 x 5/8 in. hex head bolts. Insert the bolts through the bracket holes in the frame and hand tighten.

4. Place a plastic faced washer on each of the four phillips head screws with the metal side against the screw head. At each mounting hole insert a plastic faced washer between the bottom support bracket and the fairing with the plastic side toward the fairing. Insert the screws through the bracket, washer and fairing, and thread into the weld nuts at the topside of the fairing. Tighten each screw to 8 ft-lbs torque.

5. Tighten the four 5/16 x 5/8 in. hex head bolts at the center fairing bracket to 19 ft-lbs torque.

6. At each side, align the two holes in the upper fairing brace with the two holes in the fairing bracket. Insert two mounting bolts from the fairing side through the mounting holes. Thread a locknut onto each bolt and tighten to 10 ft-lbs torque.

7. On 1986 -1990 models connect speedometer cable to speedometer drive. Perform this by rotating the cable counterclockwise and then position cable in drive socket. The cable will "unwind" and thread into socket. Slide boot in position if boot is present.

Windshield Installation

1. Position windshield on fairing and loosely install windshield screws and washers.

CAUTION

Overtightening windshield screws will crack windshield.

2. Tighten windshield screws to 4 in-lbs torque. Start in middle and work to outside.

WINDSHIELD — FXRS-CONV.

WINDSHIELD REMOVAL/INSTALLATION

CAUTION

When removing or installing the windshield, protect the headlamp housing and bracket and front turn signals with rags to prevent scratches.

NOTE

There are socket head bolts (1) on the windshield brackets (2) that permit minor windshield adjustments.

Removal

See Figure 2-154A. The windshield brackets have a hinge and toggle design for quick and easy removal.

1. Loosen the toggles' socket head (toggle) bolts (3) enough to easily slip the toggle stops (4) out of their notches. Use the allen wrench provided.
2. Carefully support the windshield and unhinge the hinges (5) from the slider tubes. The toggle stops and bolts remain with the hinges.
3. Remove windshield assembly from the motorcycle.

Installation

NOTE

With practice, you will be able to install the windshield with the hinges in place. However, initially you may find it easier to install by removing the left side hinge assemblies, then installing them once the right side hinges are in place.

1. Place the windshield on the motorcycle's front fork and move the hinges (5) into position on the slider tube.

CAUTION

- **Be sure the lower part of the windshield is positioned BEHIND the front turn signals.**
- **Do not bend or damage front brake line.**

2. Close the hinges on the slider tubes.

NOTE

*The hinges will not close properly if you close them around a wiring harness or the clutch cable. Be sure they are closing **only** on the slider tubes.*

3. Slide the toggle stops (4) into their notches in the hinges, with the lip facing outward. As each hinge is fastened, tighten the toggle bolts (3) finger tight, to hold the windshield in position.
4. Check the position of the windshield. Carefully position the windshield so no part of the windshield touches any part of the motorcycle.

CAUTION

Tighten the toggle bolts with the supplied "key ring" allen wrench. DO NOT use a long handled allen wrench or over-tighten. Over-tightening could cause the toggle bolts to work loose. The hinges are designed to produce their maximum clamp load when the toggle bolts are snug.

5. Tighten the toggle bolts and socket head bolts.

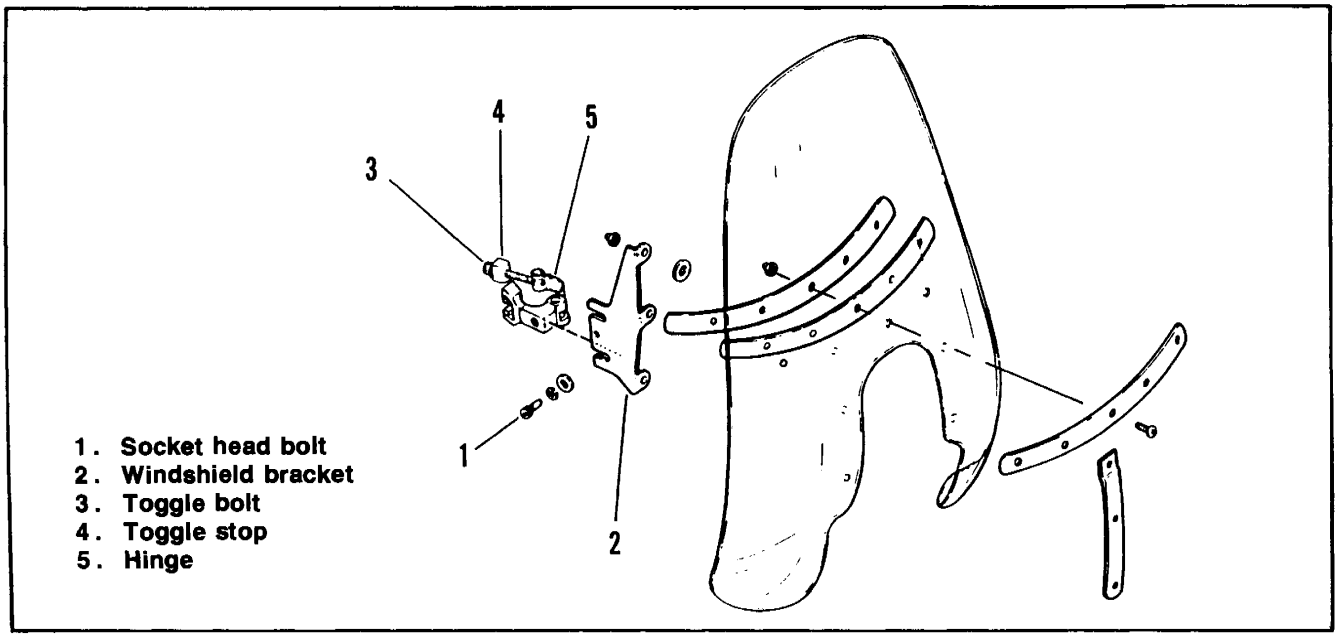


Figure 2-154A. FXRS-CON Windshield Details

WINDSHIELD — FLHS

REMOVAL

1. See Figure 2-154B.
2. Remove bolts (1), washers (2), lockwashers (3) and nuts (4).

INSTALLATION

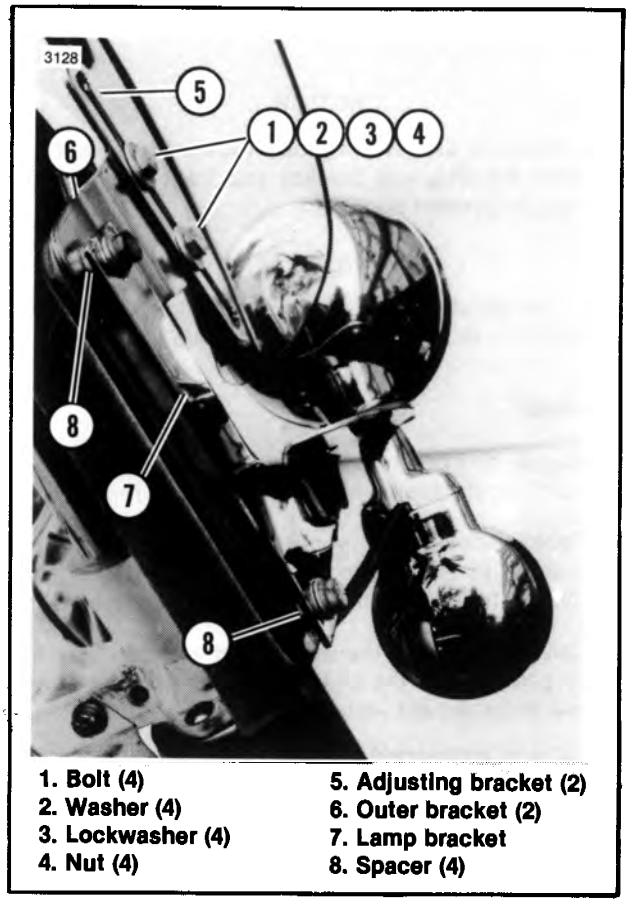
1. See Figure 2-154B. Align slots in windshield left and right side adjusting brackets (5) with holes in outer brackets (6).
2. Secure the windshield adjusting brackets to the outer brackets (6) with bolts, washers, lockwashers and nuts as shown.

NOTE

Adjust windshield height to suit the rider. The rider should see over the top of the windshield. Raise or lower windshield accordingly at adjusting bracket. If outer spotlight brackets (7) are removed, install spacers (8) between brackets (6) and (7).

CAUTION

Check that windshield is not touching headlamp nacelle. The lower edge of the lower window should "line-up" with the bottom of the instrument panel. If windshield touches nacelle, paint on nacelle will be damaged.



1. Bolt (4)
2. Washer (4)
3. Lockwasher (4)
4. Nut (4)
5. Adjusting bracket (2)
6. Outer bracket (2)
7. Lamp bracket
8. Spacer (4)

Figure 2-154B. Windshield Installation — FLHS

FRONT FENDER

REMOVAL

1. Disconnect speedometer cable.
2. Remove front wheel. (See WHEELS earlier in this section.)
3. On FLT Models, disconnect wire at fender light.
4. If applicable, bend bolt tabs back and remove the four fender mounting bolts.

INSTALLATION

1. Align fender mounting holes and install the four fender mounting bolts. Tighten fender mounting bolts to 16-20 ft-lbs torque on FLT Models and 10-14 ft-lbs torque on FXR Models.
2. If applicable, bend bolt tabs flush to bolt heads.
3. On FLT Models, connect front fender light wire.
4. Mount wheel. (See WHEELS earlier in this section.)
5. Reconnect speedometer cable.

REAR FENDER

REMOVAL

FLT Models

1. Place motorcycle on a center stand with the rear wheel raised off the ground.

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.

NOTE

Care should be taken throughout the removal and assembly procedure to avoid scratching or damaging parts.

2. Remove Tour-Pak and disconnect wiring plug. (See TOUR-PAK in this section.)

3. Remove saddlebags by turning 1/4 turn fasteners and disconnecting wiring plugs. (See SADDLEBAGS in this section.)

4. Remove seat.

5. Remove the upper shocks mounting hardware.

6. See Figure 2-155. Remove the 5/16-24 bolt and nut that secure the fender to the cross frame.

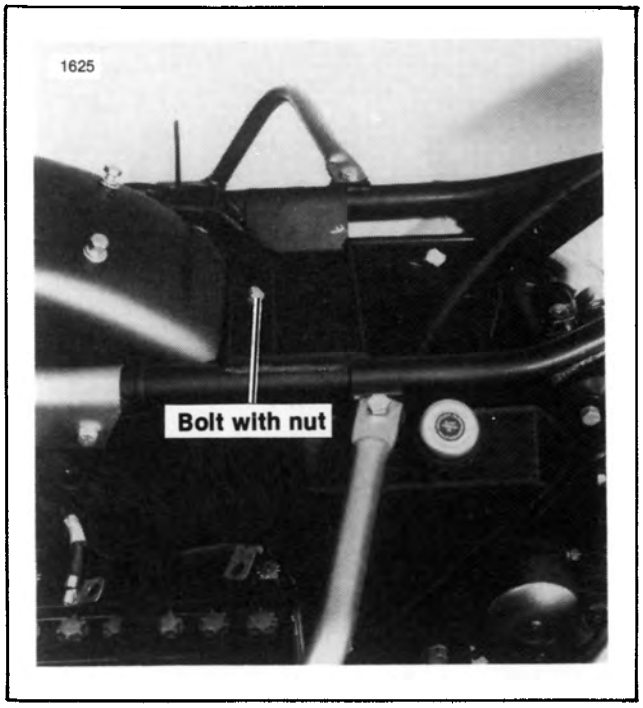
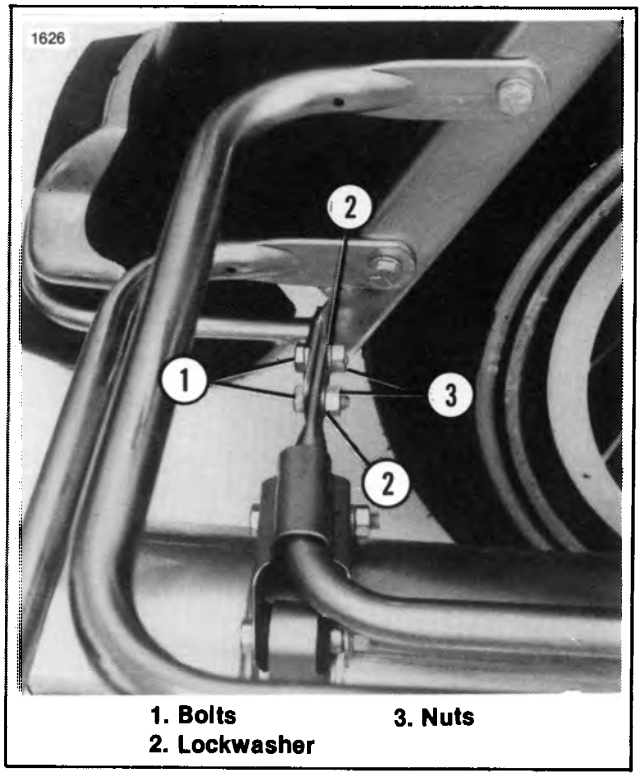


Figure 2-155. Rear Fender Mounting — FLT

7. See Figure 2-156. Remove the two 5/16-24 bolts, lockwasher and nuts that are used to fasten the lower saddlebag guard to the fender bumper.



1. Bolts **3. Nuts**
2. Lockwasher

Figure 2-156. Rear Fender Bumper Bolts — FLT

8. See Figure 2-157. Remove the two 5/16-24 x 1-1/2 bolts and locknuts securing fender brace to the fender.

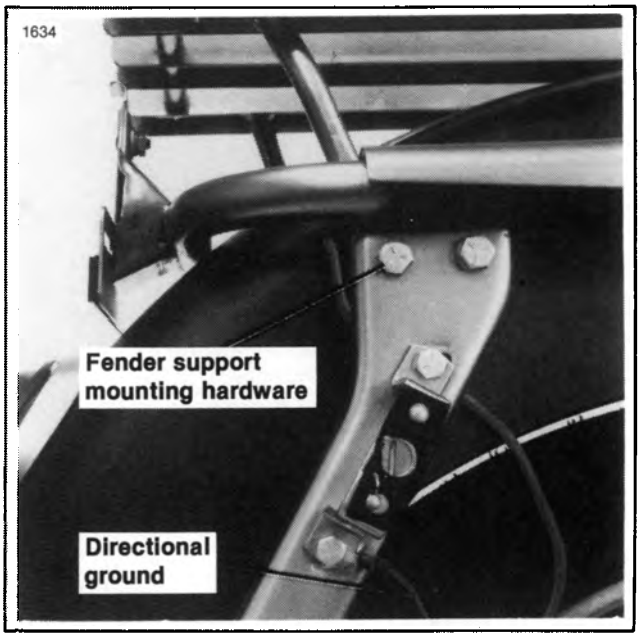


Figure 2-157. Fender Brace Bolts — FLT

9. Remove tail lamp and directional wires from terminal block and guide wires through fender hole.

10. Carefully remove fender.

FXR 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. See Figure 2-158. Remove the left side cover and disconnect taillight terminal block. Remove terminal block from mounting plate and remove two gray wires from terminal block using PIN TERMINAL TOOL, Part No. HD-97362-71, making sure to mark their location in block.

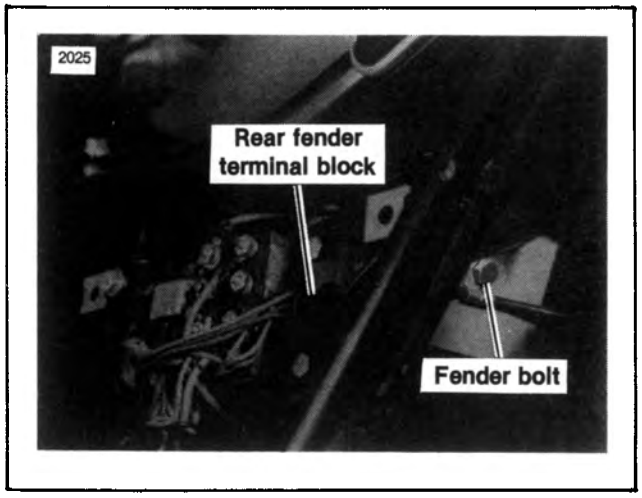


Figure 2-158. Rear Fender Bolt and Terminal Block — FXR

2. Place motorcycle on a center stand and raise rear wheel off the ground. Remove seat as described under SEAT, REMOVAL. Remove sissy bar if present.

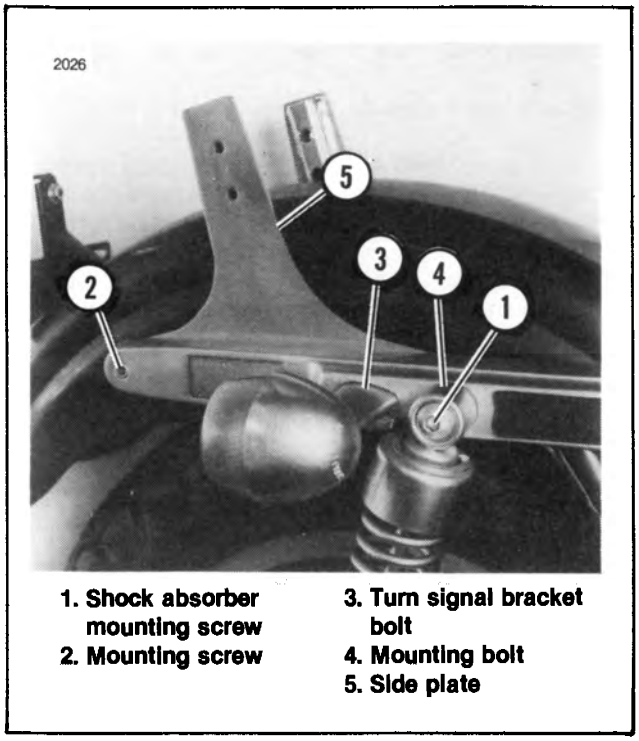
3. See Figure 2-159. Remove upper shock mounting screws (1) and drop wheel and swing arm down.

4. See Figure 2-158. Remove bolt securing front of fender to frame from under the fender.

5. See Figure 2-159. Remove rear fender mounting screws (2). Remove bolts securing turn signal brackets (3) to fender supports and pull wires through hole in fender and support.

6. Remove bolts (4) from under fender and carefully lift off fender and sissy bar side plates (5) if present.

7. See Figure 2-160. Remove and discard the two speed nuts securing taillight to fender. Remove three nuts securing license plate bracket to fender.



1. Shock absorber mounting screw
2. Mounting screw
3. Turn signal bracket bolt
4. Mounting bolt
5. Side plate

Figure 2-159. Rear Fender Removal — FXR

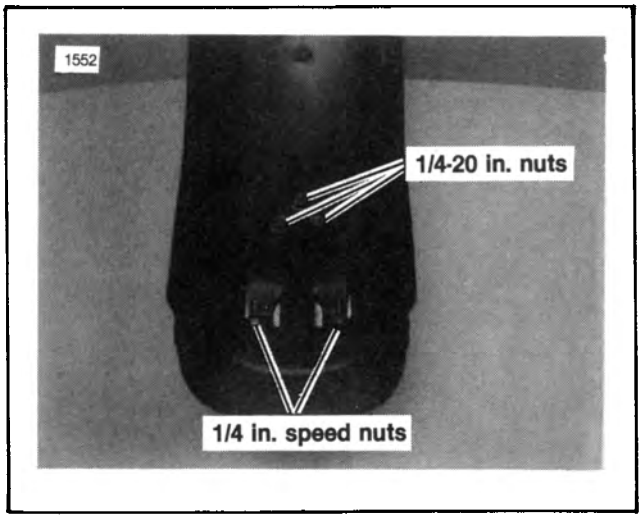


Figure 2-160. Taillamp and License Plate Bracket Removal — FXR

INSTALLATION

FLT Models

1. Guide wires through fender holes.

2. Install pins and sockets into plugs.

3. Connect taillamp wires to terminal block.

4. Reconnect battery cables (negative cable first), check directionals and taillamps for proper operation.

5. See Figure 2-155. Position fender and replace the front mounting bolt and nut. Tighten front mounting bolt to 19 ft-lbs torque.

6. Mount shock absorbers.

7. See Figure 2-157. Align fender and fender support and install the two 5/16-24 x 1-1/2 bolts and locknuts. Tighten fender bolts to 19 ft-lbs torque.

8. See Figure 2-156. Install the two bolts, lockwashers and nuts to secure the bumper bracket to the saddlebag guard. Tighten bumper bolts to 19 ft-lbs torque.

9. Install seat. (See SEAT earlier in section.)

10. Install saddlebags and connect directional wire plugs. (See earlier in section.)

11. Install Tour-Pak. (See earlier in section.)

FXR Models

1. See Figure 2-160. Secure license plate bracket to new fender with three screws and nuts. Tighten nuts to 6 ft-lbs torque.

2. See Figure 2-160. Install taillight to fender using new speed nuts. Route wires to front of fender securing under clips on fender.

3. See Figure 2-159. Place fender and side plates (5) in position and install mounting screw (2) and nuts. Install bolt in front of fender securing it to the frame.

4. See Figure 2-159. Install bolts (4). Insert turn signal lamp wires through hole in frame and install bolts and turn signal brackets (3). Route wires to front of fender securing under clips on fender.

5. See Figure 2-159. Install upper shock mounting screws (1) placing flat washer between fender support and shock absorber.

6. See Figure 2-158. Install gray wires in terminal block and install block into opening in plate. Plug in connector and replace side cover.

7. Replace seats as described under SEAT, INSTALLATION. Install sissy bar if present and reconnect battery cables.

ENGINE

IMPORTANT

Beginning with crankcase numbers 1589 221 007 (49 state & H-D-I) and 2089 221 007 (California) all 1340 cc engines have a one-piece forged right hand flywheel and pinion shaft. A replaceable inner race for the pinion shaft bearing allows fitting the pinion bearing with the proper clearance.

SPECIFICATIONS

GENERAL

Number of Cylinders	2
Type	4-cycle, 45°V
Horsepower	69hp @ 5000rpm
Torque	82 ft-lbs @ 3600rpm
Bore	3.498 in. (88.8mm)
Stroke	4.250 in. (108.0mm)
Piston Displacement	81.6 cu. in.- (1340cc)
Compression Ratio	8.5-1

VALVES

Fit in guide	
Exhaust	0.0015-0.0033 in.
Intake	0.0008-0.0026 in.
Seat width	0.040-0.062 in.
Stem protrusion from cylinder head boss	1.990-2.024 in.
Outer spring	
1.751-1.848 in.	(closed) 72-92 lbs.
1.282-1.378 in.	(open) 183-207 lbs.
free length	2.105-2.177 in.
Inner spring	
1.577-1.683 in.	(closed) 38-49 lbs.
1.107-1.213 in.	(open) 98-112 lbs.
free length	1.926-1.996 in.

ROCKER ARM

Shaft fit in bushing	(loose) 0.0005-0.002 in.
End clearance	0.003-0.013 in.
Bushing fit in rocker arm	(tight) 0.004-0.002 in.

ROCKER ARM SHAFT

Shaft fit in rocker cover	(loose) 0.0007-0.0022 in.

PISTON

Fit in cylinder	(loose) 0.00055-0.00165 in.
KSG piston (Late 85-90)	(loose) 0.00075-0.00175 in.
Compression ring gap	0.007-0.020 in.
Oil control ring rail gap (stock ring)	0.009-0.052 in.
Compression ring side clearance -	
Top	0.002-0.0045 in.
2nd	0.0016-0.0041 in.
Oil control ring side clearance	0.0016-0.0076 in.
Piston pin fit	(loose) 0.0002-0.0006 in.
KSG piston pin fit (Late 85-90)	(loose) 0.0001-0.0004 in.

CYLINDER HEAD

Valve guide in head	(tight) 0.0033-0.002 in.
Valve seat in head	(tight) 0.0045-0.0020 in.
Head gasket surface	(flatness) 0.006 in. total

CONNECTING ROD

Piston pin fit	(loose) 0.0003-0.0007 in.
Side play between flywheels	0.005-0.025 in.
Conn. Rod to crankpin	(loose) 0.0004-0.0017 in

TAPPETS

Guide fit in crankcase	(loose)0.000-0.004 in.
Fit in guide (loose)	(loose) 0.0008-0.002 in.

OIL PUMP PRESSURE

At normal operating temperature and engine speed of 2000 rpm, oil pressure should be 12-35 psi.

GEARCASE

Breather gear end play	(minimum) 0.001-0.011 in.
Cam gear shaft	(loose) 0.00075-0.00175 in.
Cam gear shaft in bearing	(loose) 0.0005-0.0025 in.
Cam gear end play	(loose) 0.001-0.050 in.
Oil pump drive shaft (crankcase bushing)	(loose) 0.0004-0.0025 in.

FLYWHEELS

Runout (flywheels at rim)	0.000-0.010 in.
Runout (shaft at flywheel)	0.000-0.002 in.
End play	0.001-0.005 in.

SPROCKET SHAFT BEARING

Cup fit in crankcase	(tight) 0.0032-0.0012 in.
Cone fit on shaft	(tight) 0.0015-0.0005 in.

PINION SHAFT BEARING

Roller bearing fit	(loose) 0.0002-0.0009 in.
Cover bushing fit	(loose) 0.001-0.0025 in.

IGNITION TIMING

Timer air gap	not adjustable
Ignition timing	
fully retarded	0° (TDC)
automatic advance	35° BTDC
Spark plug gap	0.038-0.043 in.

TORQUES

Sprocket/pin installed without hydraulic press	
Sprocket shaft nut	
Early 1985 and earlier	290-320 ft-lbs
Crank pin nut	180-210 ft-lbs
Pinion shaft nut	140-170 ft-lbs
Pinion gear nut	35-45 ft-lbs
Oil pump cover bolts	90-120 in-lbs
Tappet guide bolts	90-120 in-lbs
Rocker cover -	
5/16 in. bolts	15-18 ft-lbs
1/4 in. bolts	10-13 ft-lbs
Cylinder head bolts	See page 3-20
Upper engine mounting bracket nut	22-28 ft-lbs
Crankcase stud nut	15-19 ft-lbs
Crankcase bolt	15-19 ft-lbs
Gearcase cover screws	90-120 in-lbs
Timer screws (inner cover & sensor plate)	15-30 in-lbs
Tappet screen plug	90-120 in-lbs
Spark plug	18-22 ft-lbs

SERVICE WEAR LIMITS

GENERAL

Wear limits are given here as a guideline for measuring engine components that are not new. For new components or for measurements not given here, use measurements given under SPECIFICATIONS.

Replace if:

VALVES

Fit in guide - with seal	
Exhaust	Exceeds 0.0040 in.
Intake	Exceeds 0.0035 in.
Stem taper	Exceeds 0.0015 in.
Stem-face eccentricity	Exceeds 0.002 in.
Head margin	0.031 in.
Seat width	Exceeds 0.090 in.
Stem protrusion from cylinder head boss	Exceeds 2.034 in.

ROCKER ARM

Shaft fit in bushing	(loose) Exceeds 0.0035 in.
End clearance	Exceeds 0.025 in.

ROCKER ARM SHAFT

Shaft fit in rocker cover	(loose) Exceeds 0.0035 in.

PISTON

Fit in cylinder	(loose) Exceeds 0.0053 in.
Compression ring gap	Exceeds 0.030 in.
Oil control ring gap	Exceeds 0.065 in.
Compression ring side clearance	
Top ring	Exceeds 0.006 in.
2nd ring	Exceeds 0.006 in.
Oil control ring side clearance	Exceeds 0.008 in.
Piston pin fit	(loose) Exceeds 0.001 in.

CYLINDER HEAD

Valve guide in head	(tight) Less than 0.0020 in.
Valve seat in head	(tight) Less than 0.0020 in.
Head warpage	Exceeds 0.006 in.

CYLINDER

Taper	Exceeds 0.002 in.
Out of round	Exceeds 0.003 in.
Warpage (gasket surfaces)	
Top	0.006 in.
Base	0.008 in.
Bore:	
Standard	3.501 in.
0.005 Oversize (O.S.)	3.506 in.
0.010 O.S. Bore	3.511 in.
0.020 O.S. Bore	3.521 in.
0.030 O.S. Bore	3.531 in.

CONNECTING ROD

Piston pin fit	(loose) Exceeds 0.001 in.
Side play between flywheels	Exceeds 0.030 in.
Fit on crankpin	(loose) Exceeds 0.002 in.

TAPPETS

Fit in guide	(loose) Exceeds 0.003 in.
Roller fit	(loose) Exceeds 0.0015 in.
Roller end clearance	(loose) Exceeds 0.015 in.

GEARCASE

Breather gear end play	Exceeds 0.016 in.
Cam gear shaft in bushing	(loose) Exceeds 0.003 in.
Cam gear shaft in bearing	(loose) Exceeds 0.005 in.
Cam gear shaft end play -	
1987 and earlier	Exceeds 0.016 in.
1988 and later	Exceeds 0.050 in.
Oil pump drive shaft (crankcase bushing)	(loose) Exceeds 0.0035 in.

FLYWHEELS

Runout (flywheels at rim)	Exceeds 0.015 in.
Runout (shaft at flywheel)	Exceeds 0.003 in.
End play	Exceeds 0.006 in.
PINION SHAFT BEARINGS	
Cover bushing fit	(loose) Exceeds 0.0035 in.

GENERAL INFORMATION

DESCRIPTION

The engine is the V^2_{TM} Evolution Engine. It is a two-cylinder, four-cycle, air cooled, overhead-valve V-type. It has three major component assemblies: **cylinders, crankcase** and **gearcase.**

Cylinder assemblies include cylinder head, valves, rocker arm cover, rocker arms and piston. Cylinders mount on the crankcase in a 45° "V" with both connecting rods running on a single crank pin.

The up and down motion of the pistons in the cylinders is converted to circular motion in the **crankcase.** The multi-piece crankshaft consists of an off-center crankpin positioned between two counterweighted flywheels which rotate on two end shaft bearings (pinion shaft right side and sprocket shaft left side). The crankpin (big) end of the rear cylinder connecting rod is forked to fit around the single crankpin end of the front connecting rod, allowing a single connecting rod crankpin connection to the flywheels.

Flywheel rotation is clockwise when viewed from the right side of the engine. Using the front cylinder firing position as a starting point, the rear cylinder fires at 315 degrees rotation (360 degrees minus the 45 degrees between cylinders). The front cylinder fires in an additional 405 degrees rotation (360 degrees plus the 45 degrees between cylinders), completing the 720 degrees of flywheel rotation necessary for the four piston strokes.

The **gearcase** is located in the right side crankcase half and houses gears which operate and time the valves, and crankcase breather. The rotating crankcase breather relieves crankcase pressure produced by the downstroke of the pistons, and controls the flow of return oil in the lubrication system. Air exhausted from the crankcase by the breather is fed into the air cleaner assembly.

A single four-lobe gear 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 a non-compression stroke.

FUEL

Use a good quality leaded or unleaded gasoline (87 pump octane or higher).

CAUTION

Using gasolines that have alcohol additives (such as methanol) may cause failure of rubber components in the fuel system and/or internal engine damage.

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.

NOTE

When checking oil level on the FLT models, the motorcycle must be in an upright position off the side stand. On FXR models, check with motorcycle on side stand.

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. 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 oil at normal operating temperature. **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, seasonally or at 5000 mile intervals thereafter under normal service. If motorcycle is ridden hard, under dusty conditions or in cold weather, oil and filter should be changed more often. 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 or disconnect hose. 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.

NOTE

Step 4 applies to early 1984 models only, equipped with dry clutch.

4. Remove primary chaincase magnetic drain plug located under the clutch cover on the bottom of the chaincase. Clean plug and replace.

5. Remove oil filter.

CAUTION

MAKE SURE YOU USE THE PROPER oil filter for your application. Use of an improper oil filter could cause damage to the engine components.

6. 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.

7. With drain plug and filter tightened, install three (3)quarts (FXR) or four (4) quarts (FLT) of recommended grade oil determined from the following chart.

Harley-Davidson Type	Viscosity	Harley-Davidson Rating	Ambient Temperature (° F.)	Cold Weather Starts Below 50° F.
H.D. Multigrade	SAE20W50	HD 240	Above 20° to 100°	Excellent
H.D. Regular Heavy	SAE50	HD 240	Above 60° to 100°	Poor
H.D. Extra Heavy	SAE60	HD 240	Above 80° to 100°	Poor

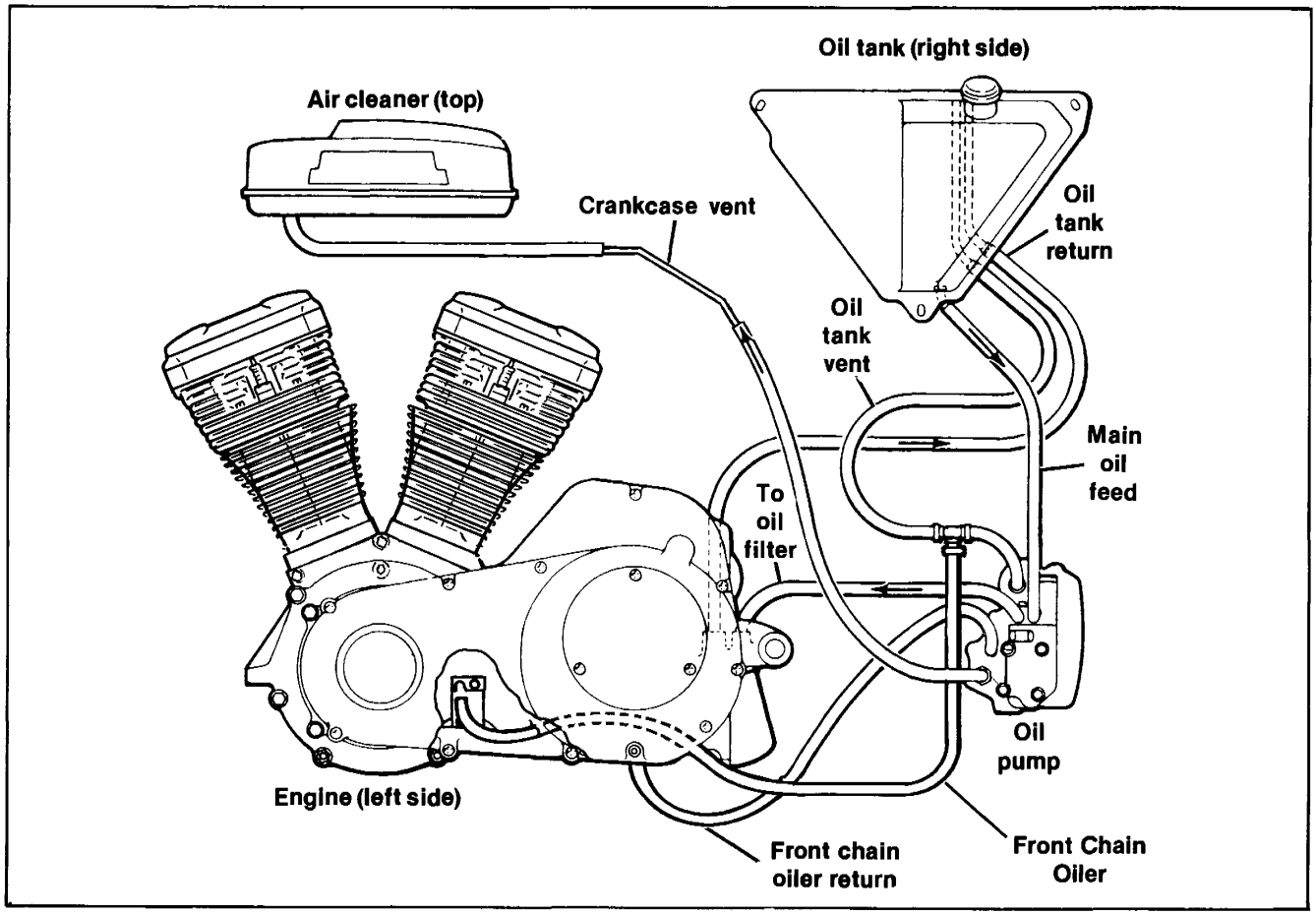


Figure 3-1. Oil Hose Routing — Early 1984

8. Start engine and carefully check for oil leaks around drain plug and oil filter.

9. Check oil level in tank and if necessary add oil to bring level to upper mark on dipstick or above the level of oil sight gauge. **Do not fill tank above this level. Tank needs some air space.**

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

Oil Hose Routing

Refer to either Figure 3-1 or Figure 3-2 for correct location of oil hoses.

Oil Pressure Signal Light

If the oil signal light fails to go off at speeds above idling, it is usually because of low or diluted oil supply or plugged lifter screen. In freezing weather 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. If no oil returns, shut off engine until trouble is located and corrected.

Operating oil pressure may be checked as follows:

1. Fill oil tank to proper level.

2. Disconnect oil pressure switch wire at top of switch and remove switch.

3. Install OIL PRESSURE GAUGE, Part No. HD-969212-52. Attach gauge to motorcycle and road run or simulate road running until engine is completely warm. A normal operating temperature is essential for accurate gauging. Oil pressure should be 12-35 psi at 2000 rpm with oil at normal operating temperature.

4. 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.

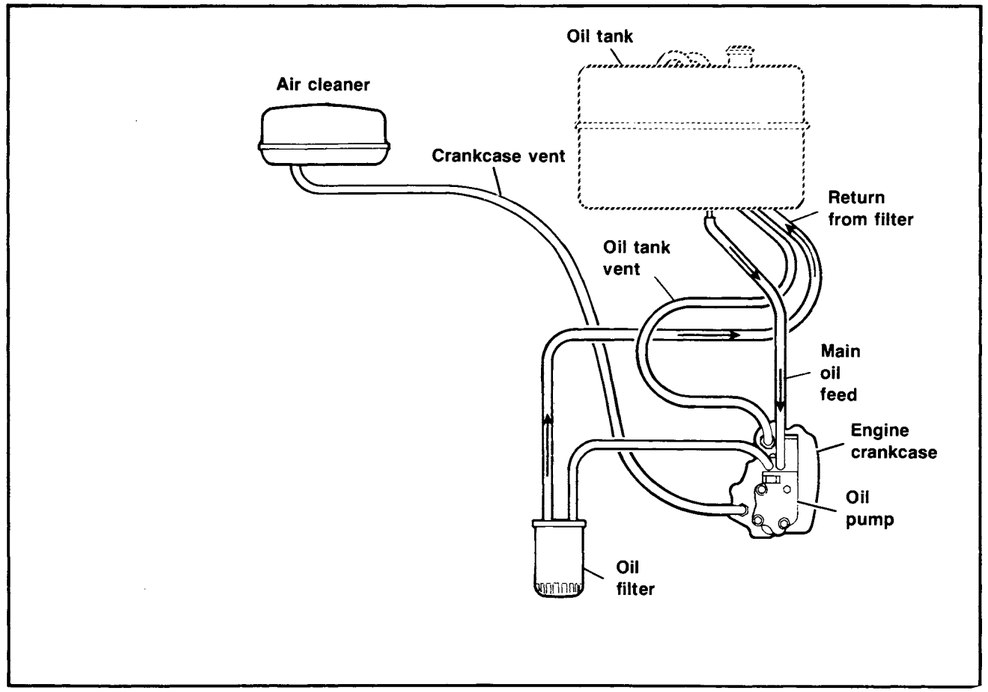
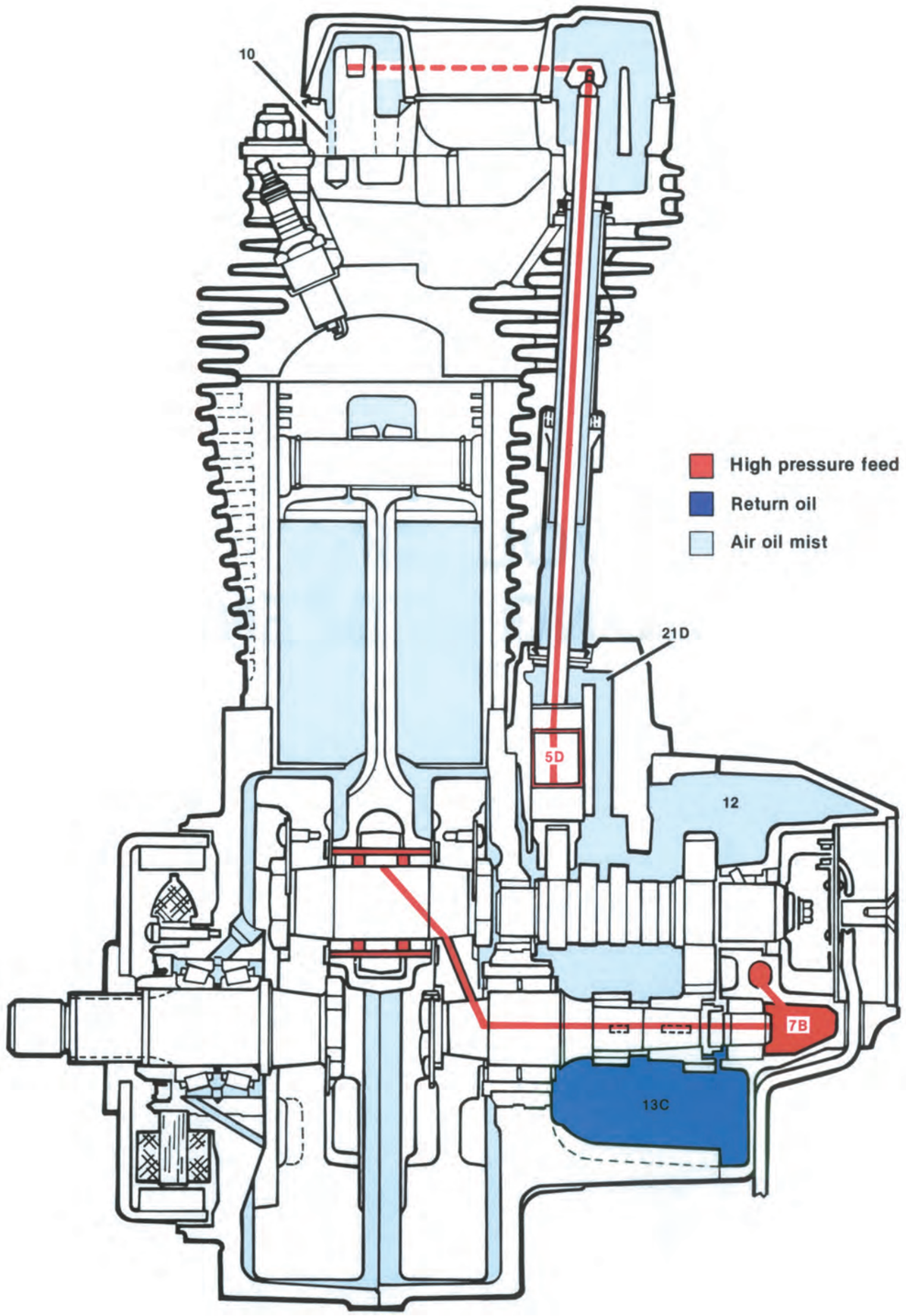
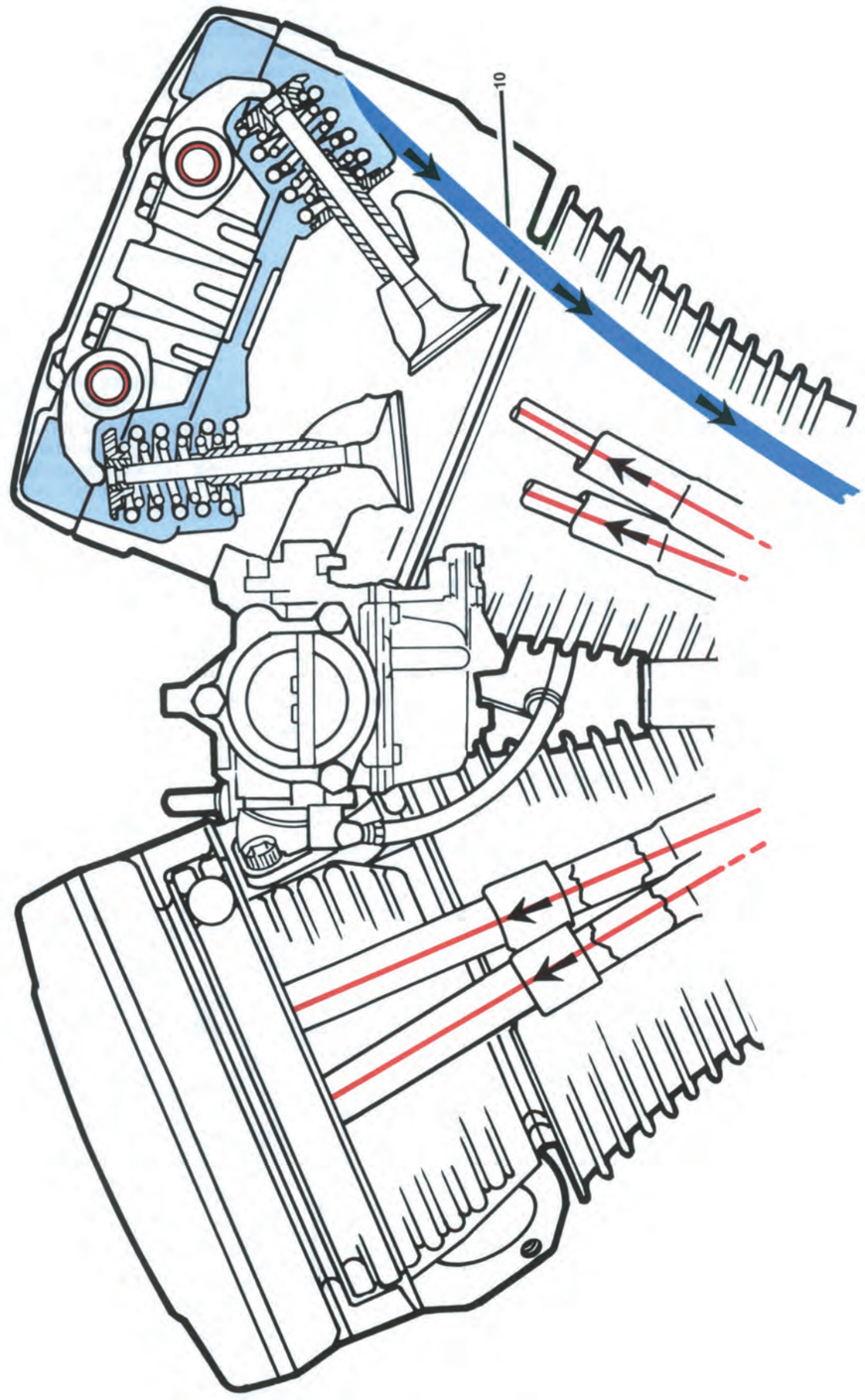
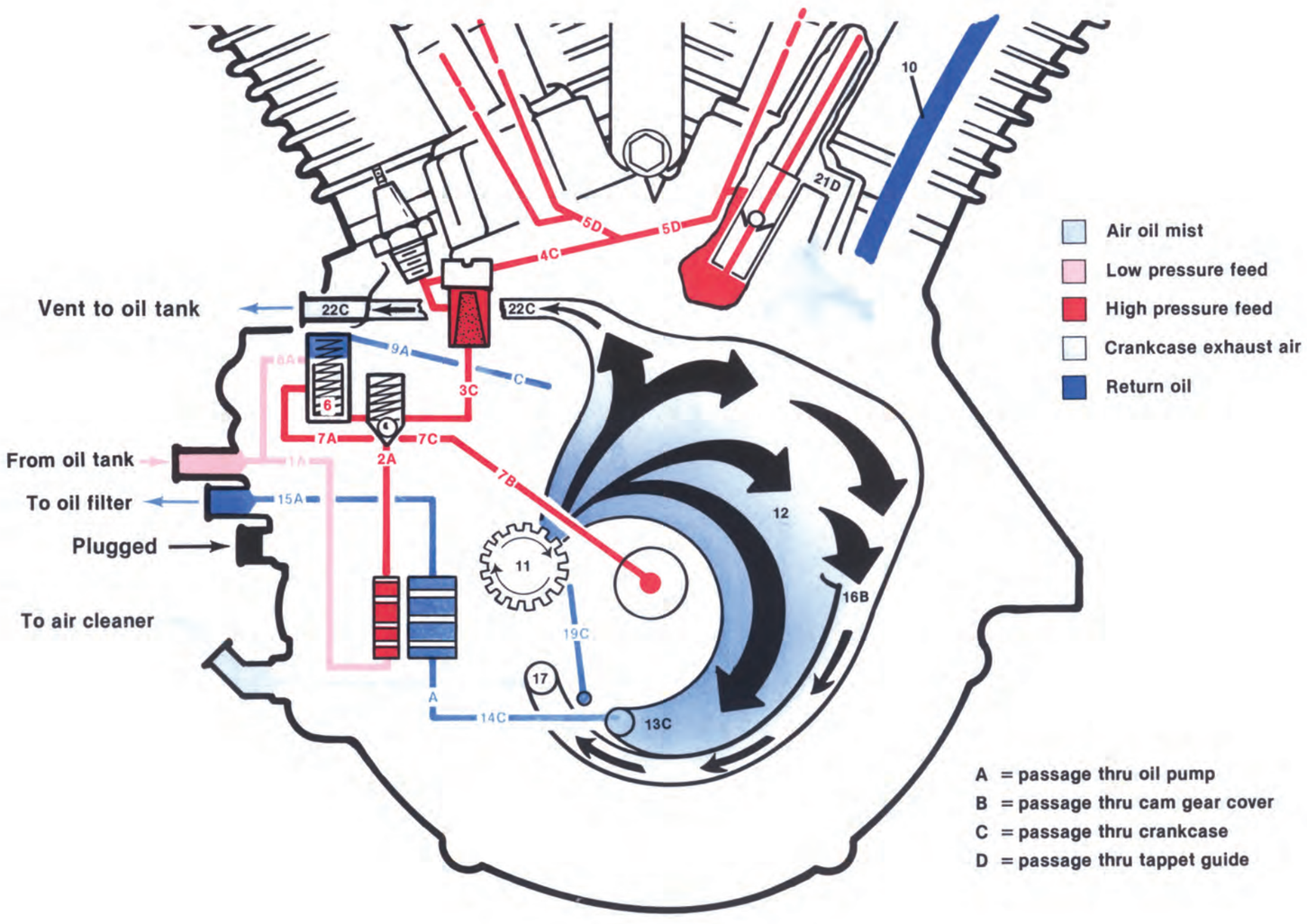


Figure 3-2. Oil Hose Routing-Late 1984 Through 1989

EVOLUTION OILING SYSTEM


10
21D
5D
12
7B
13C
High pressure feed
Return oil
Air oil mist


10



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 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 and scavenge oil from the flywheel compartment through the breather valve into the cam gear compartment.

The oil and air mixture exhausted through the breather valve is separated in the cam gear compartment (12). The oil falls to the bottom of the case (13C), flows to the passage in the crankcase (14C), is picked up by the scavenge gears in the oil pump and returned (15A) to the oil filter and tank. The air along with a light oil mist is routed around a baffle in the cam gear cover (16B) and through a passage in the cover. An additional baffle (17) is located in the breather trap to further separate the air/oil mist. The air continues through the crankcase passage (18C) and to the air cleaner. The oil drops to the bottom of the breather trap (19C) and on piston upstroke, vacuum pulls oil through a timed opening in the breather valve.

Positive cam gear compartment air pressure travels through tappet guide passage (21D) and push rod covers. This pressure helps to evacuate oil from the rocker area and into the cylinder drain holes (10).

A vent passage (22C) vents to the oil tank.

On the early 1984 models, during the piston upstroke, a timed opening in the breather valve draws oil from the primary chain housing (20C). This opening is plugged on late 1984 and later models with the wet clutch.

On early 1984 models, a vent passage (22 C) carries an air/oil mist to the primary chain oiler, and also vents to the oil tank. On late 1984 and later models, the vent passage (22C) vents to the oil tank only.

EVOLUTION
OILING SYSTEM

TROUBLESHOOTING

General

When an engine needs repair, it is not always possible to definitely determine beforehand whether the engine can be repaired by disassembling only cylinders and heads, 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 rocker box and cylinder head 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 Cylinder Leakdown Tester HD-35667. 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, exhaust pipe, head gasket and timing inspection hole. Air escaping through carburetor indicates leaking intake valve. Air escaping through exhaust pipe indicates leaking exhaust valve. Air escaping through timing inspection hole indicates leaking, worn or broken piston rings, worn piston and/or cylinder or leaking head gasket.

NOTE:
If air is escaping through valves check for correct pushrod length.

9. Repeat procedure on rear cylinder.

CAUTION

After installing spark plugs, make sure throttle plate is in the closed position before starting engine.

Diagnosing Smoking Engine Or High Oil Consumption — Early 1984 Only (Dry Clutch)

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:

— Oil return passages for clogging
— Guide seals
— Valve guide to valve stem clearance
— Gasket surface of both head and cylinder
— Cylinder head casting porosity allowing oil to drain into combustion chamber

Diagnosing Smoking Engine or High Oil Consumption Late 1984 and Later

Perform Compression or Cylinder Leakage Test as described previously. If further testing is needed, remove suspect head(s) and inspect the following:

— Valve guide seals
— Valve guide to valve stem clearance
— Gasket surface of both head and cylinder
— Oil return passages for clogging
— Cylinder head castings porosity allowing oil to drain into combustion chamber.

NOTES

1. If top of piston is covered with a uniform thickness of carbon — oil is entering combustion chamber through a cylinder head malfunction. See list preceding this note.

2. If top of piston has carbon formation at its center and a portion or all of the outside diameter of the piston top has no carbon formation — oil is entering combustion chamber past piston rings.

STRIPPING MOTORCYCLE FOR ENGINE REPAIR

REMOVING THE ENGINE

Use the following procedure to strip the motorcycle for either cylinder head or cylinder removal for repair with engine in chassis, or for engine removal for crankcase repair.

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 seat.
2. Drain fuel tank. Disconnect fuel line and remove gas tank.

WARNING

Gasoline is flammable and fumes are explosive. To avoid possible personal injury, drain gasoline in well ventilated area away from fire or flame. Drain gasoline into approved gasoline container only.

NOTE

Rocker box, tappet blocks or cam repair can be done at this time. This may require the removal of the front engine mounting plate (steps 12, 13, 14).

3. Remove upper cylinder head stabilizer from frame and cylinder head bracket. Do not loosen stabilizer jamnuts.
4. On FXR models remove ignition switch.
5. Remove spark plugs to prevent damaging them.
6. On FLT models remove lower attaching bolts from right side footboard.
7. Remove exhaust system.
8. Remove air cleaner cover, filter element and back plate.
9. Remove fuel and V.O.E.S. hoses from carburetor.
10. Disconnect throttle and choke cables from carburetor.
11. Loosen intake manifold clamps and remove carburetor and intake manifold assembly.
12. Remove large center bolt from front engine mount.
13. Remove bolt from outer end of front stabilizer.
14. Remove both front engine mount bolts and remove front engine mounting plate with stabilizer.

NOTE:

At this point the 3-piece rocker boxes, cylinder heads and cylinders can be removed from the crankcase. See CYLINDER HEAD and CYLINDER AND PISTON. To remove crankcase or complete engine assembly, continue stripping motorcycle as follows.

15. Remove left footboard and rear bracket (FLT) or footrest brackets (FXR).
16. Drain engine and primary chaincase lubricant.
17. On FXR models, remove shifter lever.
18. Remove primary housing cover.
19. Remove primary chain adjuster bolt and compensator nut.
20. Remove the four primary housing-to-engine mounting bolts, two are safety wired inside the housing.
21. Unplug charging system wires from engine crankcase. Unplug ignition wires.
22. Remove clutch cable from engine bracket.
23. Remove oil sending unit wire.
24. Label oil lines for reference and remove from oil pump and crankcase.
25. Remove the two rear engine mounting bolts.
26. On FXRT the front upper rocker box must be removed. Also remove the two bolts from the lower fairing support bracket.
27. Raise the right side of the fairing about an inch and support the fairing with blocks.
28. An alternate to step 26 and 27 is to remove the fairing.
29. Remove compensator as you remove the engine with hoist from right side of motorcycle.

INSTALLING ENGINE

1. Place engine in position on rear engine mount.

NOTE

Slide compensator onto sprocket shaft as engine is being set in place.

2. Install and hand tighten rear engine mounting bolts and washers through engine and mounting bracket and into nut plate.

3. Install front engine mount with stabilizer and hand tighten bolts, washers and nuts.

4. Install and hand tighten the two rear primary housing-to-engine mounting bolts (two bolts drilled for safety wire).

5. Loosely install front primary housing-to-engine mounting bolts.

6. Tighten primary housing-to-engine mounting bolts to 16-18 ft-lbs torque. Tighten rear engine mounting bolts to 35-38 ft-lbs torque.

7. Safety wire inside primary housing-to-engine mounting bolts.

8. Install primary chain compensator nut and adjuster bolt and adjust the chain.

9. Install primary cover and new gasket.

10. Plug in charging system and ignition wires.

11. Install oil lines to oil pump and crankcase. Use new hose clamps.

12. Install oil sending unit wire.

13. Install clutch cable to engine bracket.

14. Attach throttle and choke cables to carburetor.

15. Install carburetor and tighten clamps.

16. Install air cleaner.

CAUTION

The exhaust system will move due to oscillation of the rubber mounted engine. When assembling the exhaust pipe, be certain the exhaust pipe bracket has at least one inch of clearance at each side of the hanger mounted to the frame. If this clearance is not provided, the exhaust pipe will be damaged.

17. Install exhaust system.

18. Install left and right footboards or footrest brackets.

19. Install cylinder head stabilizer.

20. Install gas tank and connect fuel lines. Use new hose clamps.

21. Install seat.

22. Install new oil filter and refill engine and primary chaincase lubricant.

23. Install spark plugs and cables.

24. Tighten front engine mount and stabilizer bolt.

25. Check front engine mount for proper alignment as described in VEHICLE ALIGNMENT, section 2.

26. Connect battery cables, positive cable first.

CYLINDER HEAD

REMOVAL

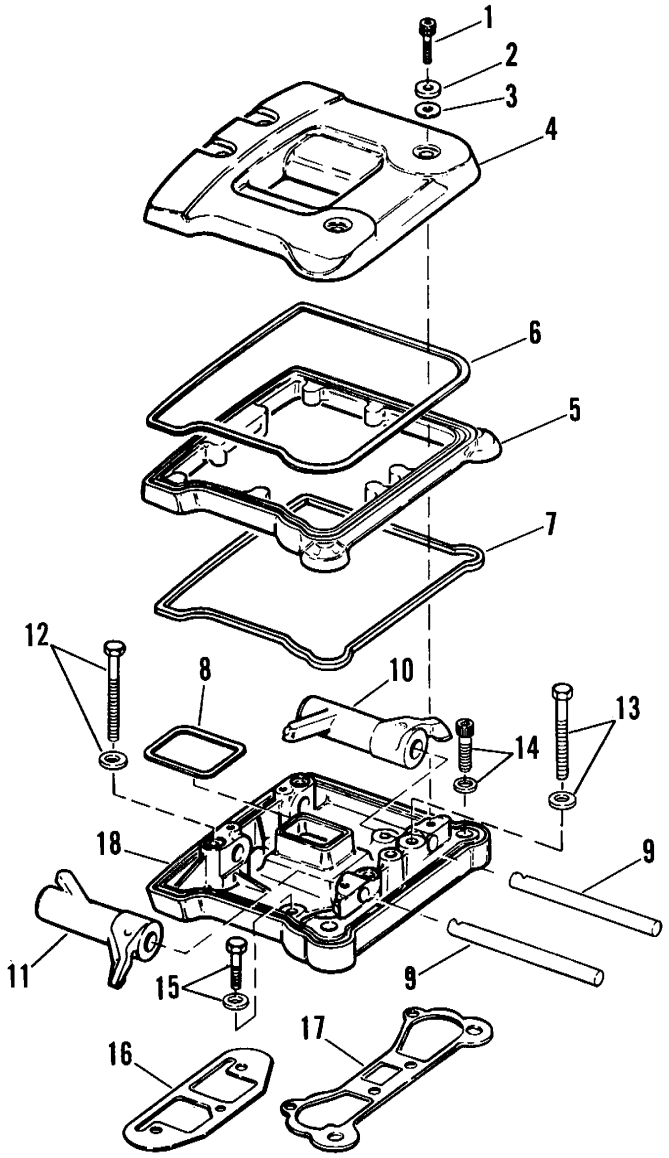
Before removing cylinder head assembly, strip motorcycle as described in STRIPPING MOTORCYCLE FOR ENGINE REPAIR. The rocker arm covers and internal components must be removed before removing heads.

1. See Figure 3-3. Remove bolts (1) with their washers (2) and fiber 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 gaskets (6, 7 and 8) and discard.
3. Rotate the engine so both valves are closed on the head being replaced.



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 3-3. Rocker Arm Cover

4. See Figures 3-3, 3-4. Remove the rocker arm retaining bolts (12) and washers nearest the rocker arm shafts at the push rod end.

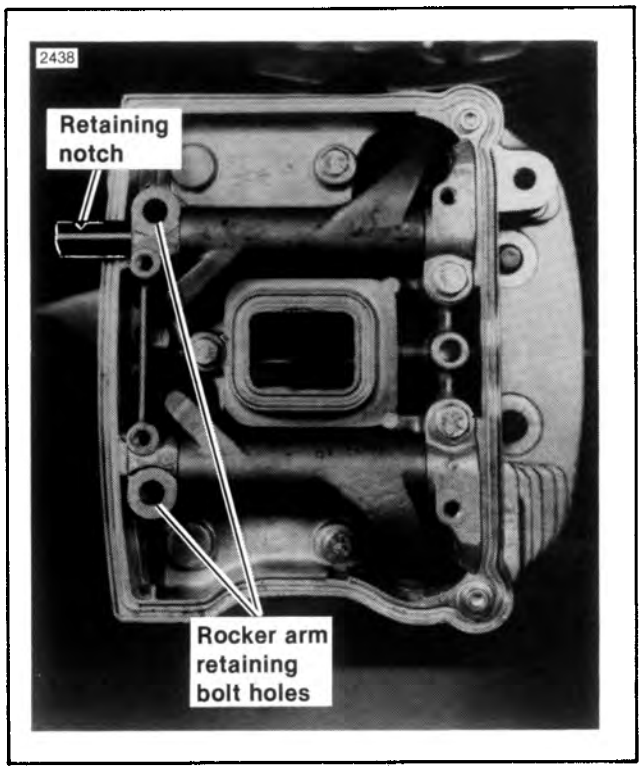


Figure 3-4. Removing Rocker Arm Shafts

NOTE

Remove lower racker boxes as an assembly, then diassemble if necessary.

5. Remove the rocker arm shafts by tapping them out with a hammer and soft metal punch.

CAUTION

Mark rocker arm shafts so they will be installed in their original positions. All valve train components must be reinstalled in their original positions.

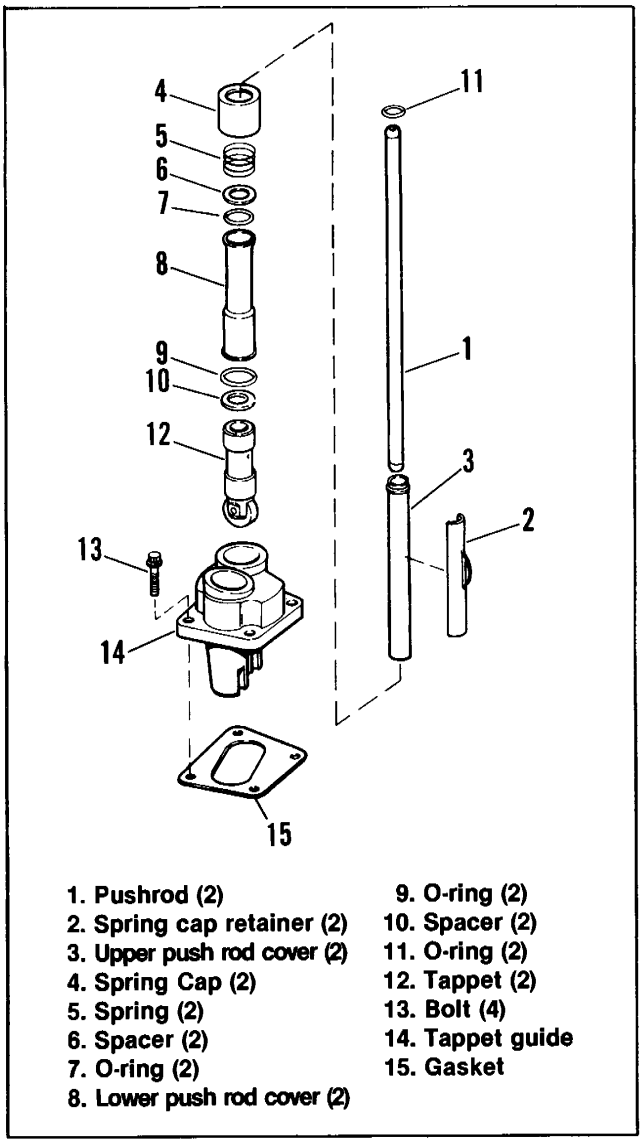
6. See Figure 3-3. Remove rocker arms (10 and 11) and mark them so they will be assembled in their original locations.

7. See Figure 3-5. Remove the push rods (1) and mark their location and orientation, top and bottom.

8. Remove spring cap retainers (2) on push rod covers and remove push rod covers and associated parts, (3 through 11).

9. See Figure 3-3. Remove the remaining fasteners (13, 14 and 15) holding the lower rocker arm cover (18) to the cylinder head.

10. Remove the lower rocker cover and gaskets (16 and 17).



1. Pushrod (2)
2. Spring cap retainer (2)
3. Upper push rod cover (2)
4. Spring Cap (2)
5. Spring (2)
6. Spacer (2)
7. O-ring (2)
8. Lower push rod cover (2)
9. O-ring (2)
10. Spacer (2)
11. O-ring (2)
12. Tappet (2)
13. Bolt (4)
14. Tappet guide
15. Gasket

Figure 3-5. Middle Valve Train Components

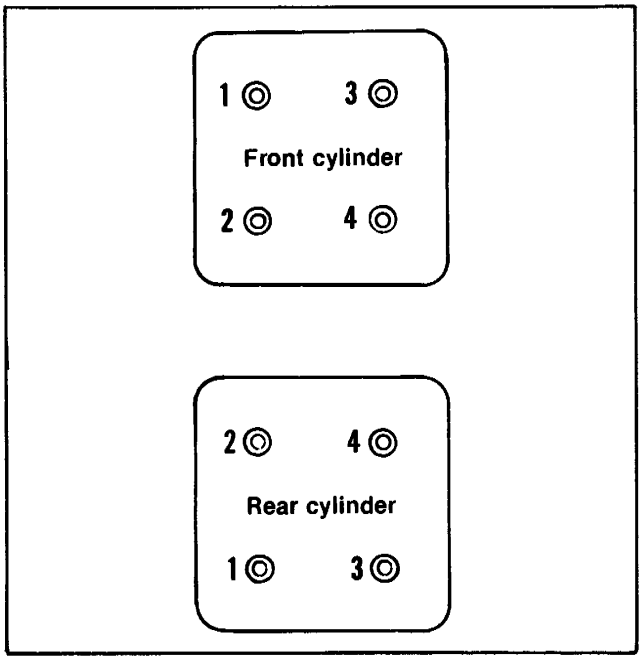


Figure 3-6. Head Bolt Loosening Pattern

11. See Figure 3-7. Loosen each head bolt (1) 1/8 turn following the cross pattern sequence shown in Figure 3-6.

CAUTION

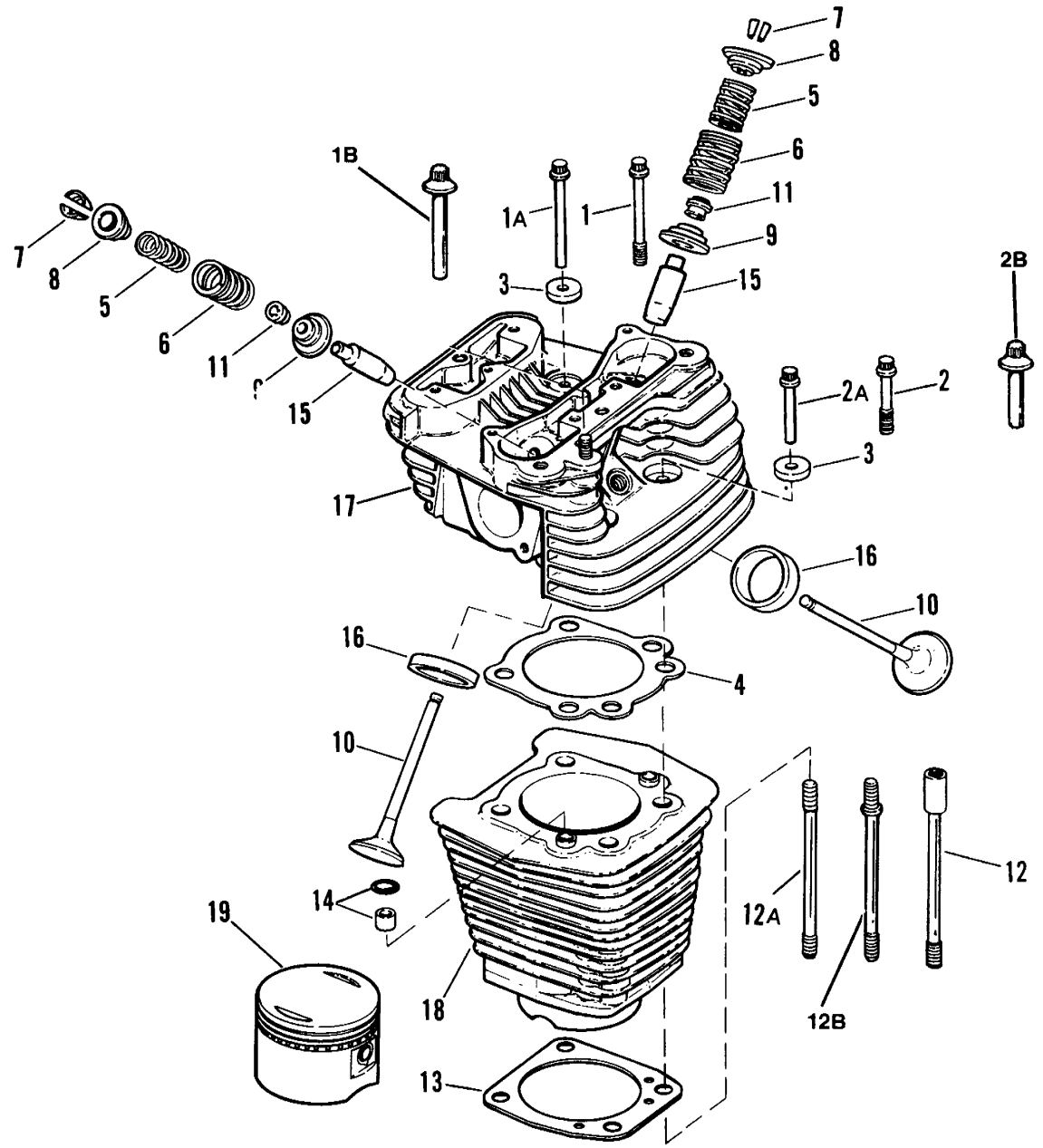
Loosen gradually to prevent distorting the head, cylinder and crankcase studs.

12. See Figure 3-6. Continue loosening in 1/8 turn increments until bolts are loose.
12. See Figure 3-7. Remove bolts (1) and thick washers (3).

NOTE

On 1988 and later engines, the thick washer is part of the bolt.

13. Remove cylinder head (17) and head gasket (4).
14. Repeat steps 1 thru 13 for the other head.



1. Head bolt, long (2) Early 1985
1A. Head bolt, long (2) Late 1985
1B. Head bolt, long (2) 1988
2. Head bolt, short (2) Early 1985
2A. Head bolt, short (2) Late 1985
2B. Head bolt, short (2) 1988
3. Head bolt washer (4) 1987 and earlier
4. Cylinder head gasket
5. Inner valve spring (2)
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) Early 1985
12A. Cylinder stud (4) Late 1985
12B. Cylinder stud (4) 1988
13. Cylinder base gasket
14. O-ring and insert (2)
15. Valve guide (2)
16. Valve seat (2)
17. Cylinder head
18. Cylinder
19. Piston

Figure 3-7. Cylinder Head, Cylinder and Piston — Exploded View

DISASSEMBLY

1. See Figures 3-7, 3-8. Compress valve springs (5 and 6) with VALVE SPRING COMPRESSOR, Part No. HD-34736B.

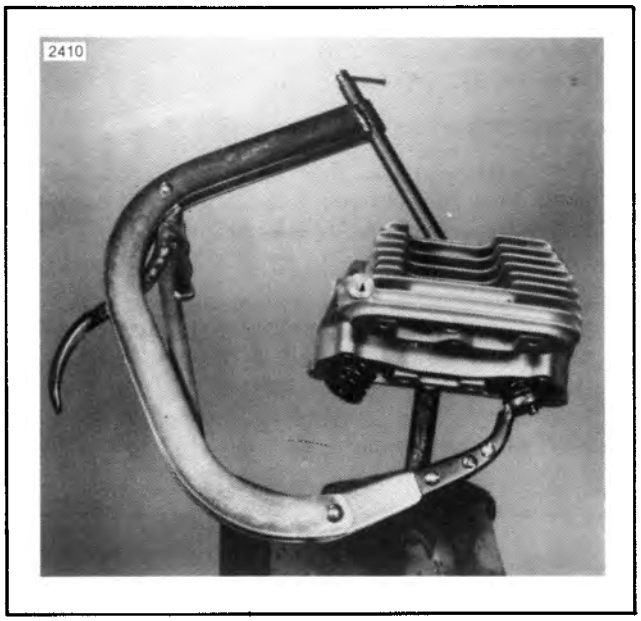


Figure 3-8. Compressing Valve Springs

2. See Figure 3-7. Remove keepers (7), upper collar (8), springs (5 and 6) and lower collar (9). Mark keepers so they will be reinstalled on the same valve.
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 through 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. 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.
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 0.035 in.
12. Valve heads should have a seating surface of 0.040 - 0.062 in. wide and should be free of pit marks and burn spots. Exhaust valves should contain carbon that is black or dark brown. White or light buff carbon indicates excessive heat and burning.
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-34571 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.

REPAIR

Rocker Arms and Bushings

1. To replace worn bushings, press them from the rocker arm one at a time. If bushing is difficult to remove, turn a 9/16-18 tap into bushing. From opposite side of rocker arm, press out bushing and tap.

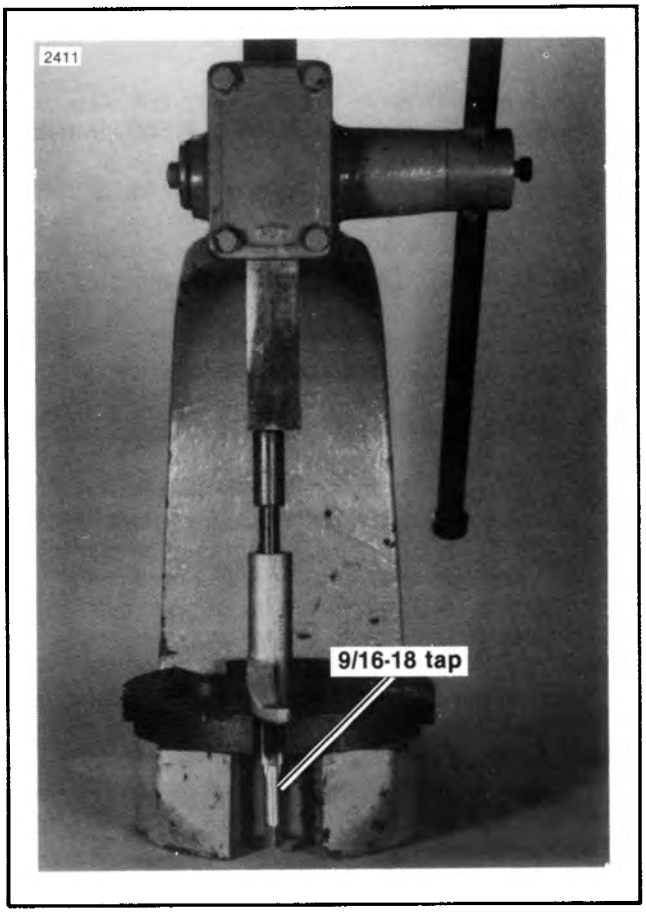


Figure 3-9. Removing Rocker Arm Bushing

2. Press replacement bushing into rocker arm, flush with arm end, and split portion of bushing towards top of arm.
3. Use the old bushing in the opposite end as a pilot and line ream the new bushing with Harley-Davidson ROCKER ARM BUSHING REAMER, Part No. HD-94804-57.

NOTE

Drive end of reamer is pilot. Be sure pilot end is in old bushing.

4. Repeat for other end of rocker arm, using new, reamed bushing as a guide.

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 limits, new parts must be installed.

Valve Stem Clearances and Service Limits

Valve	Valve Stem Clearance
Exhaust	0.0015 - 0.0040 in.
Intake	0.0008 - 0.0035 in.

1. Press shoulder-less guides toward combustion chamber using DRIVER HANDLE AND REMOVER, Part No. HD-34740.
2. Clean and measure valve guide bore in head.
3. The guide diameter should be 0.0020 - 0.0033 in. larger than bore in head. If it is not, select one of the following oversizes: intake and exhaust - 0.001, 0.002, and 0.003 in.
4. See Figure 3-10. Install shoulder-less guides using VALVE GUIDE INSTALLATION TOOL, Part No. HD-34731 and DRIVER HANDLE, Part No. HD-34740. Lube and press guide until the tool touches the machined surface surrounding the guide. At this point, you have reached the correct guide height.

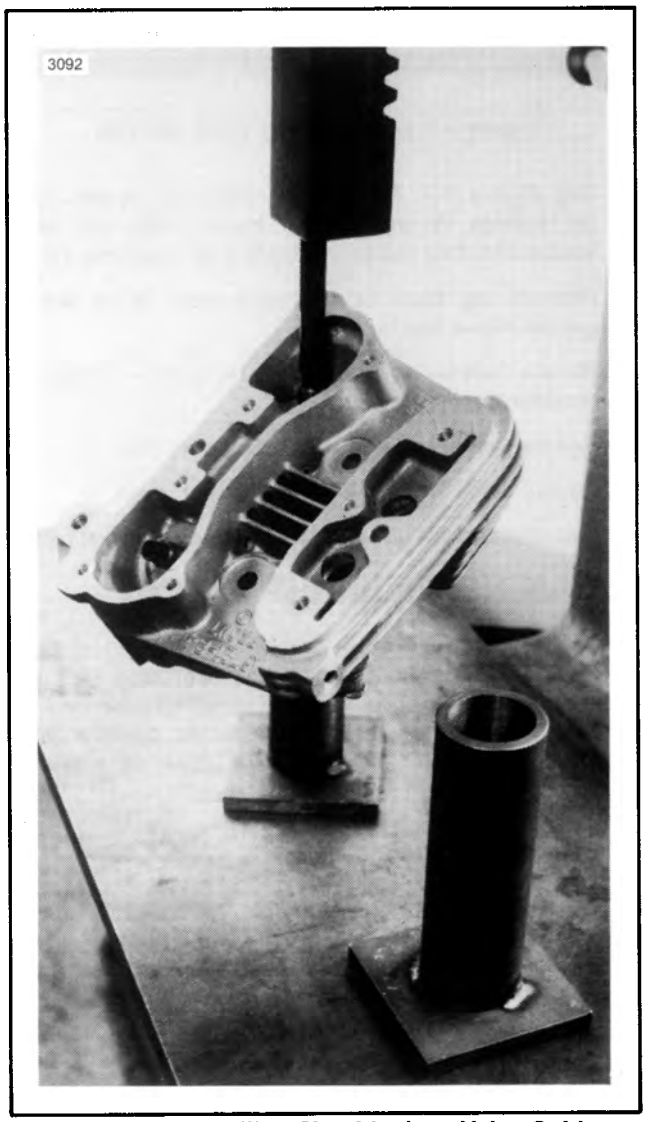


Figure 3-10. Installing Shoulder-less Valve Guides

5. The guides must be reamed to within 0.0005 - 0.0001 in. of finished size with VALVE GUIDE REAMER, Part No. HD-94810-80. Use liberal amounts of cutting oil to prevent reamer chatter.

Figure 3-11. Honing Valve Guides

6. See Figure 3-11. 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.

7. Clean guide bores with VALVE GUIDE BRUSH, Part No. HD- 34751 and hot soapy water after honing.

Valve Faces and Seats

After installing valve guides, valve seats must be refaced to true them with guides.

Valve face angle is 45° for both intake and exhaust valves, and if a valve refacing grinder is used, it must be adjusted exactly to this angle. It is important to not remove any more metal than is necessary to clean up and true valve face. If grinding leaves the edge of valve (the margin) less than 0.0313 in., install a new valve. A valve in this condition does not seat normally, will burn easily and may cause pre-ignition. There is also danger of cracking. Valves that do not clean up quickly are probably warped or too deeply pitted to be used. If end of valve stem shows uneven wear, replace the valve. After valves have been ground, they must be handled with care to prevent damage to the ground faces.

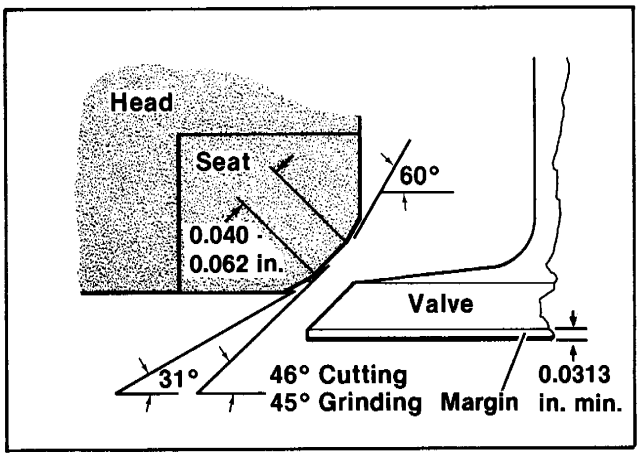


Figure 3-12. Valve Seat Angles

See Figure 3-12. 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.

Use a NEWAY VALVE SEAT CUTTER, Part No. 082454, to cut the seats. Always grind valves before cutting the seats.

1. Cut 46° valve seat angle first. Cut only enough to clean up the seat.

2. See Figure 3-12. Use bluing or magic marker and check the contact pattern on the valve face. It should be 0.040 - 0.062 in. wide and 2/3 the way towards the outside edge of the face.

3. If valve seat pattern is too wide and too close to stem side of valve face, cut 60° angle to narrow and move contact area away from stem side of valve. If pattern is too wide and too close to the edge of the valve face, cut 31° angle to narrow and move contact area away from margin.

4. If contact area is too narrow, use 46° valve cutter to increase width.

5. Check valve seat to be sure contact area is 0.040 - 0.062 in. and concentric.

6. See Figure 3-13. Measure the valve stem protrusion from the cylinder head to the top of the stem. If valve stem protrudes more than 2.034 in., the valve or seat must be replaced.

NOTE

Service replacement valves are available which are 0.030 in. shorter than the standard valve. If the valve stem protrudes beyond 2.034 in., but no more than 2.064 in., use the service replacement valve.

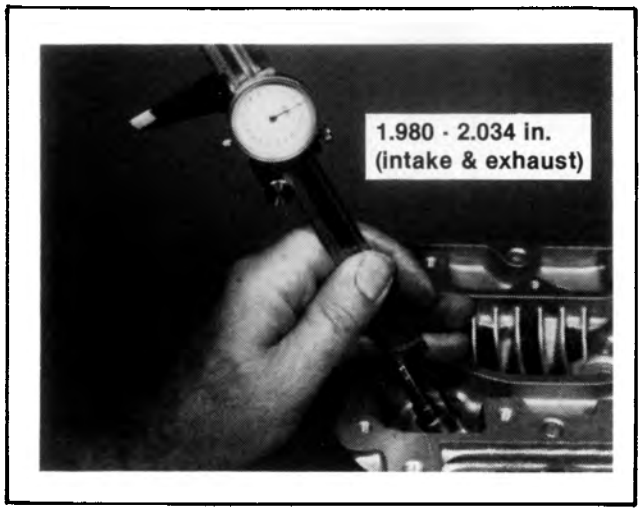


Figure 3-13. Measuring Valve Stem Protrusion

CAUTION

See Figure 3-14. Do not attempt to shorten valve by grinding on the end. The hardened case will be gone and the end will be mild steel. This will cause the end to wear rapidly. The shorter replacement valves are shortened in the stem body.

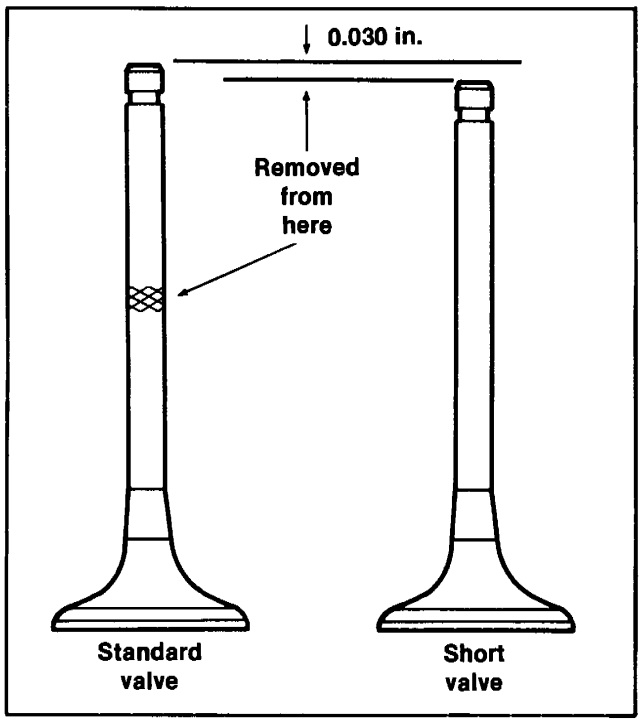


Figure 3-14. Shorter Replacement Valve

NOTE

Replacing a valve seat is a complex operation requiring special equipment. If the seat is loose or not sealed fully into the head, the seat will move and not transfer heat away from the valve properly. The seat surface must be flush with or below the head surface. See SPECIFICATIONS for valve seat to cylinder head fit.

To remove the old seat, lay a bead of weld material around the inside diameter of the seat. This will shrink the seat diameter and provide a surface for driving the seat out from the port side.

7. See Figure 3-13. If valve stem protrusion is within the proper range, the valves and seats are ready for lapping.
8. Apply a small amount of lapping compound to the valve face and rotate the valve against the seat using the VALVE LAPPING TOOL, Part No. HD-9655036A.

Lapping Valve Faces and Seats (Figure 3-15)

NOTE

If valve faces and seats have been smoothly and accurately refaced, very little lapping will be required to complete seating operation.

Figure 3-15. Lapping Valves

1. Apply a light coat of fine lapping compound to valve face, insert valve in guide and give it a few oscillations with VALVE LAPPING TOOL, Part No. HD-96550-36A.
2. Lift valve and rotate it about 1/3 of a turn.
3. Repeat lapping procedure as shown.
4. After full turn, remove valve, wash valve face and seat and dry with cloth that is immediately discarded so grinding compound cannot be transferred to engine parts.
5. If inspection shows an unbroken lapped finish of uniform width around both valve and seat, valve is well seated. If lapped finish is not complete, further lapping or grinding and lapping is necessary.

ASSEMBLY

1. Wash cylinder head and valves in warm soapy water to remove all lapping compound.
2. Scrub valve guide bores with VALVE GUIDE BRUSH, Part No. HD-34751 and hot soapy water.
3. Blow dry with compressed air.
4. Apply a liberal amount of engine oil to the valve stem.
5. Insert valve into guide.

CAUTION

Do not apply Loctite to inner portion of seal or top of guide.

6. See Figure 3-16. Apply a small amount of RC 620 Loctite (green) retaining compound to outside diameter of guide near the top of guide. Place a protective sleeve over the valve stem keeper grooves. Coat the sleeve with oil and place a new seal over the valve stem.

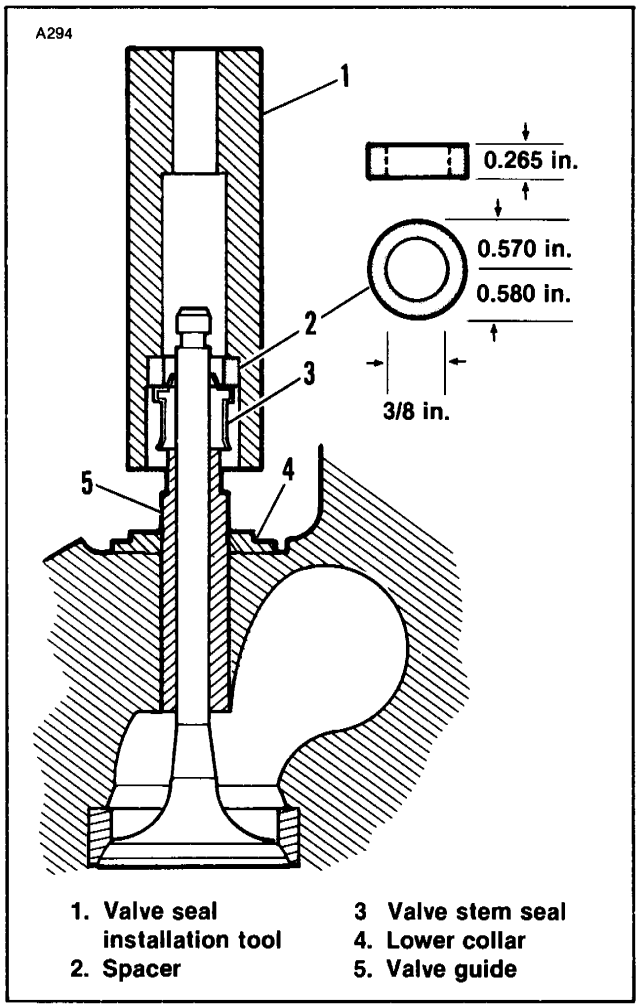


Figure 3-16. Valve Seal Installation with Spacer

7. See Figure 3-16. Install lower collar (4).

CAUTION

If the seal is installed without using the protective sleeve, the seal will be damaged.

8. Tap the seal (3) onto the guide (5) using the VALVE SEAL INSTALLATION TOOL (1) and spacer (2), Part No. HD-34643 and DRIVER HANDLE, Part No. HD-34740. The seal is completely installed when the tool (1) touches the lower collar (4).

CAUTION

Do not remove valve after seal is installed. Sharp edges on keeper groove will cut and ruin seal.

9. See Figure 3-7. Install valve springs (5 and 6), upper collar (8).
10. See Figures 3-8, 3-7. Compress springs (5 and 6) with VALVE SPRING COMPRESSOR, Part No. HD-34736.
11. See Figure 3-7. Insert keepers (7) into upper collar (8) making sure they engage groove in valve stem. The keeper gaps should be equally spaced.
12. Release and remove VALVE SPRING COMPRESSOR.
13. Gently tap the upper collar with a soft hammer to ensure keepers are fully seated.
14. Repeat steps 4 through 12 for the remaining valves.
15. Install the compliance fittings using a new gasket.

INSTALLATION

If only cylinder head work was needed, install cylinder head following these instructions. If further repair is required, go to the subject CYLINDER AND PISTON.

CAUTION

Install new O-rings over the cylinder dowels before installing the head gasket. Install the O-rings first to ensure alignment of the head gasket and prevent gasket leaks.

CAUTION

Late style cylinder head washers cannot be used with early style head screws.

1. See Figure 3-7. Make sure the stud (12) holes are clean and dry. Place new O-rings (14) on the cylinders and position the head gaskets on the inserts (14). Dip the head bolt threads and bottom face of head 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. See Figure 3-17. The procedure for tightening the head bolts is extremely critical; not only to prevent gasket leaks, but to prevent failure of the studs and distortion of the heads and cylinders.

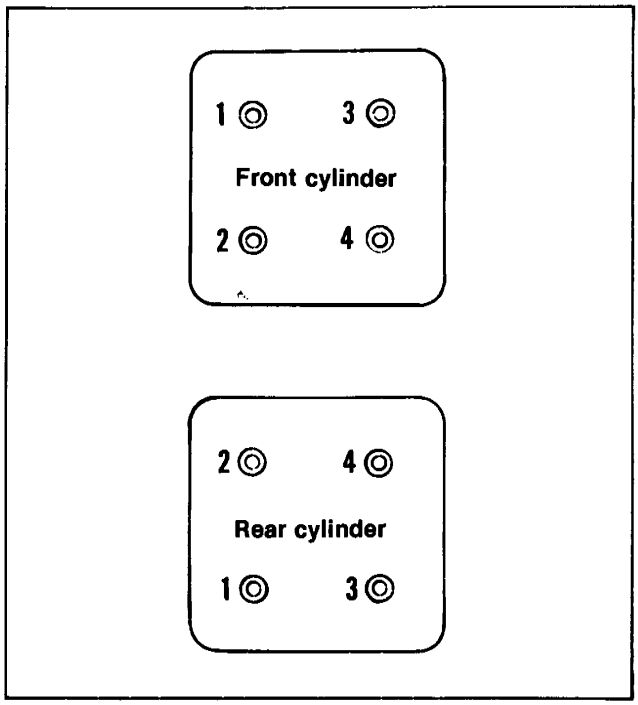


Figure 3-17. Torque Sequence

TORQUE SEQUENCE:

CAUTION

Be sure you thoroughly clean and lubricate the head bolts before tightening to the correct torque. Friction because of dirt or grime will cause the torque wrench readings to be incorrect. Clean and lubricate the threads with engine oil and screw the bolts onto the crankcase studs to be sure there is no friction.

a. See Figure 3-17. With a torque wrench, start at the head screw numbered "1" and tighten to 7 ft-lbs torque. Then tighten "2", "3" and "4", in order, to 7 - 9 ft-lbs torque.

b. Again, starting at the head screw numbered "1" and ending with "4" sequentially, tighten each screw to 12 - 14 ft-lbs torque.

c. See Figure 3-18. Mark a line on the cylinder head and a corresponding line on the head of the cylinder head screw as shown in View A. Following the same sequence 1, 2, 3, then 4, turn each head screw, one at a time one quarter turn (90°) using the marks as a guide. When marks are all positioned, as in View B, the procedure is completed.

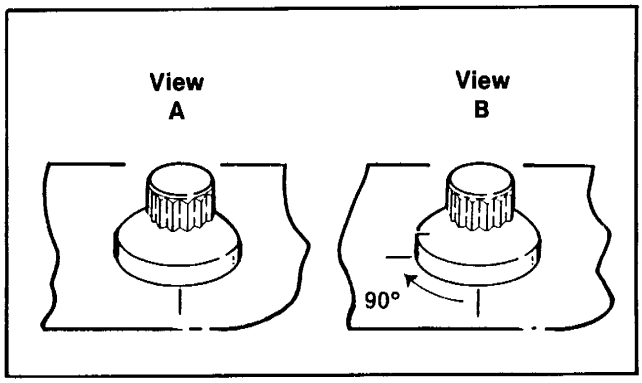


Figure 3-18. Tighten Head Bolts

3. See Figure 3-3. Install gaskets (16 and 17), with the bead facing up, and lower rocker cover (18). Secure with bolts and washers (13 and 15). Tighten bolts (13) to 15-18 ft-lbs torque and tighten the bolts (15) to 10-13 ft-lbs torque. Do not install the rocker arm shafts or rocker arms.

Push Rod Measurement and Gauging (Figure 3-19)

NOTE

- *Engineering research has shown that multiple length pushrods for each cam lobe and valve are not necessary for the engine to function correctly. Therefore only one length for each of four locations is currently available. See figure 3-19. Be sure to color match each pushrod to its correct valve and cam lobe; purple to rear exhaust, blue to rear intake, yellow to front intake and green to front exhaust.*

- *Perform the pushrod gauging procedure to determine that all measurements are within the correct range. An incorrect reading (outside the range shown in Figure 3-19) indicates that something in the valve train is wrong and must be corrected before finishing the procedure.*

1. Rotate camshaft so tappet is at its lowest point (on base circle of camshaft).

2. 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 cover 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 if the push rod length is correct.

7. If the pushrod length is outside the range given in the chart, check to see what is wrong, for example; incorrect valve or valve protrusion, valve seats worn beyond repair, two cylinder base gaskets, etc.

PUSHROD POSITION	COLOR CODE
REAR EXHAUST	PURPLE
REAR INTAKE	BLUE
FRONT INTAKE	YELLOW
FRONT EXHAUST	GREEN

Figure 3-19. Pushrod Color Code/Position

Installation - Push Rod

1. Remove the rocker arms and shafts.

2. Rotate the engine so that both lifters of the cylinder being serviced are on the base circle (lowest position) of the cam.

3. See Figure 3-3. Install push rod assemblies. Install gaskets (16, 17). Place lower rocker box assemblies (18) (with rocker arms and shafts) in position.

4. Slowly snug all rocker box fasteners in small increments (one at a time) in a cross pattern. This will bleed the lifters. Tighten the fasteners to the proper torque.

CAUTION

Do not turn engine over until push rods spin freely. Damage could occur to valve(s).

NOTE

If the original push rods are being installed, be sure you do not turn them end for end from their original position since they have worn into their mating components.

5. Install the middle (5) and top (4) rocker arm covers, using new gaskets and new fiber seals. The fiber seals must be under the steel washers. 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 crisscross pattern.

6. Install the carburetor, V.O.E.S. and ignition components.

CYLINDER AND PISTON

REMOVAL

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. Mark cylinder "front" or "rear". Remove the cylinder taking extreme care not to scratch or bend the studs or to scratch the pistons in any way. When lifting the cylinder, make sure the piston does not drop sideways striking the studs.

CAUTION

With cylinder removed, be careful not to bend the studs. The slightest bend could cause a stress riser and could lead to stud failure.

5. Install a 6 in. length of 0.500 in. inside diameter plastic or rubber hose over each stud. This not only protects the studs, but the pistons too.

WARNING

The next step covers removing the piston pin retaining rings. These rings are highly compressed in the ring groove and may "fly-out" with considerable force when pried out of the groove. Safety glasses or goggles must be worn while removing or installing retaining rings.

6. Insert a tinner's awl in the recessed area below the piston pin bore and pry out the piston pin retaining rings. To prevent the ring from flying-out, place your thumb over the retaining ring.

CAUTION

The piston pin retaining ring must not be reused.

NOTE

Since the piston pin is a loose fit in the piston, the pin will easily slide out. The pins have tapered ends to help seat the round retaining rings. For these reasons, piston pins from earlier engines must not be used in the V² engine.

Piston pin retaining ring grooves may become burred from the retaining rings. Use care when removing the piston pins.

7. See Figure 3-20. Mark the piston by marking an "F" or "R", for front or rear cylinder, on the piston pin boss as shown.

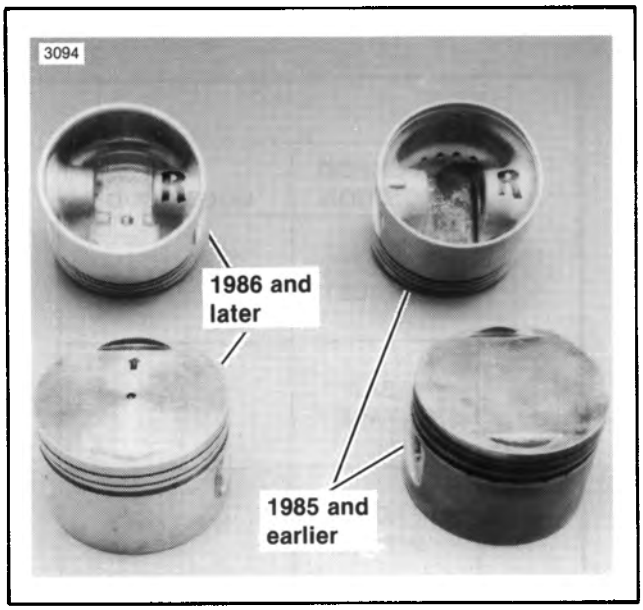


Figure 3-20. Piston Marking

CAUTION

Handle the piston with extreme care because the alloy used in these pistons is very hard. Any scratches, gouges or other marks on the piston could score the cylinder during engine operation.

CLEANING AND INSPECTION

1. Where carbon deposit is thick and hard, it is advisable to scrape carbon off. Use a carbon scraper. Be careful not to scrape piston.

2. Place the cylinders and piston in GUNK HYDRO-SEAL or other carbon and gum dissolving agent until deposits are soft.

3. Scrub piston dome and cylinder to remove deposits.

4. Wash all parts in solvent and blow dry with compressed air. Force air through return oil passage in cylinder.

5. If necessary, clean piston ring grooves with a piece of compression ring ground to a chisel shape.

6. Examine piston pin to see that it is not pitted or scored.

7. Check the piston pin bushing to see that it is not loose in connecting rod, grooved, pitted or scored. A piston pin, properly fitted, is a loose (0.00007-0.00041 in.) fit in piston and has 0.00027-0.00071 in. clearance in connecting rod upper bearing. If piston pin-to-bushing fit exceeds 0.001 in., replace worn parts. See REPAIR - Rod Bushings.

8. Make sure the piston pin retaining ring grooves are clean.

9. Examine piston and cylinder for cracks, burned spots, grooves and gouges. The cylinder will have four faint polish marks running the length of the bore near the stud holes. These marks are usually 0.375 in. wide and appear as the engine accumulates running time. They are normal and require no attention.

10. Check rods for 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.

REPAIR

Cylinder

1. Check the gasket surfaces for flatness. The top of head gasket surface must be flat within 0.006 in. and the base gasket surface must be flat within 0.008 in. Check the above surfaces by laying a straightedge across the surface and then try to insert the proper feeler gauge between the straightedge and the gasket surface.

2. If one or both of the above surfaces do not meet the flatness requirements, the cylinder and piston must be replaced.

3. See Figure 3-21. Before measuring the cylinder, be sure the gasket surfaces are free of burrs and install a head and base gasket and the CYLINDER TORQUE PLATE, Part No. HD-33446. Tighten the bolts using correct torque procedure. See CYLINDER HEADS, TORQUE procedure.This will simulate engine operating conditions. Your measurements will vary as much as 0.001 in. if you don't use the torque plates.

4. Take cylinder bore measurement in the ring path, starting about 0.500 in. from the top of the cylinder measuring from front to rear and then side to side. Record readings.

5. Repeat measurement at center and bottom ring path. Record readings. This process will determine if cylinder is out-of-round or "egged" and will also show any cylinder taper or bulge.

6. If cylinders are not scuffed or scored and are not worn beyond service limits, it is not necessary to rebore oversize.

7. If cylinders show wear beyond service limits, they should be rebored and/or honed to next standard oversize and refitted with corresponding pistons and rings.

NOTE

A standard piston may be fitted to a standard bore if only minor honing is required and bore is within SERVICE WEAR LIMITS.

1988 and later 49 state models require piston with valve pockets

Figure 3-21. Measuring Cylinder Bore

Boring and Honing Cylinder

1. The cylinder must be bored with gaskets and torque plates attached. Bore the cylinder to 0.003 in. under the desired finished size.

2. Hone the cylinder to its finished size using 280 grit rigid hone. To break a glaze, use a 240 grit flexible ball hone. Honing must be done with the torque plates attached. All honing must be done from the bottom (crankcase) end of the cylinder. Work for a 60° crosshatch pattern.

NOTE

Improper crosshatch pattern or too fine a hone will result in insufficient oil retention and possible piston seizure and/or oil consumption.

3. Final cylinder bore sizes, after honing are as follows:

Standard bore	3.4980 in ± 0.0002 in.
0.005 Oversize (O.S.) bore	3.5030 in ± 0.0002 in.
0.010 (O.S.) bore	3.5080 in ±0.0002 in.
0.020 (O.S.) bore	3.5180 in ± 0.0002 in.
0.030 O.S. bore	3.5280 in ± 0.0002 in.

Piston

Because of their complex shape, the pistons cannot be accurately measured with standard measuring instruments.

The pistons have the typical eliptical shape when viewed from the top. However, they also are barrel shaped when viewed from the side. This barrel shape is not symmetrical. In addition, the piston bore is offset.

Any damage to the piston will change its shape, which will lead to problems.

Fitting Cylinder to Piston

Since pistons cannot be accurately measured with standard measuring instruments, the bore sizes given in step 3 under Boring and Honing Cylinder must be observed. Example: a 0.005 in. oversize piston will have the proper clearance with a bore size of 3.5030 in. ± 0.0002 in.

Fitting Piston Rings

Piston rings are of two types: compression and oil control ring. The two compression rings are positioned in the two upper piston ring grooves. The dot on the second compression ring must face upward because it is a reverse-twist ring and aids in oil control. Ring sets are available to fit standard and oversize pistons.

1. See Figure 3-22. Check the end gap of both oil rings and the compression rings. Use the top of the piston to square the ring in the bore.
2. See SERVICE WEAR LIMITS for end gap dimensions for standard bore. Gap dimensions do not apply to oversize rings. Do not file rings to obtain proper gap. Replace rings if ring gap is incorrect.
3. See Figure 3-23. Apply engine oil to the piston grooves. Install the new rings on the piston making sure the dot on the second compression ring is facing up. Stagger the ring gaps.

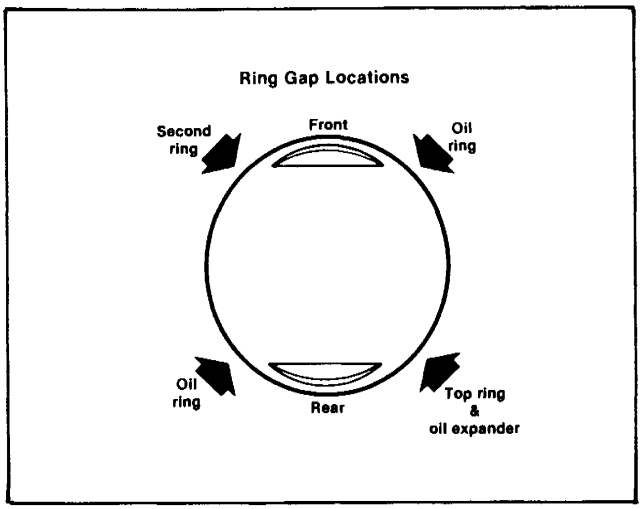


Figure 3-23. Positioning Ring Gaps

4. See Figure 3-24. 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.

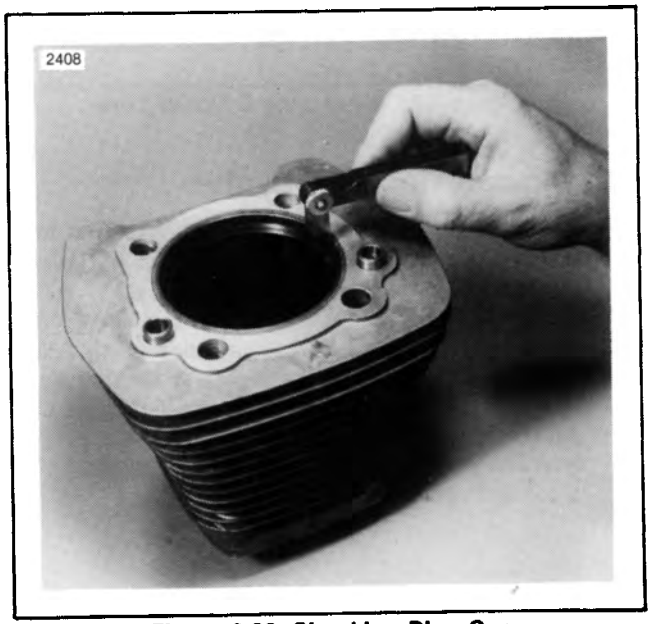


Figure 3-22. Checking Ring Gap

Figure 3-24. Measuring Ring Side Clearance

Rod Bushings (Figure 3-25)

If the piston pin to rod bushing clearance is greater than 0.001 in., replace the rod bushing.

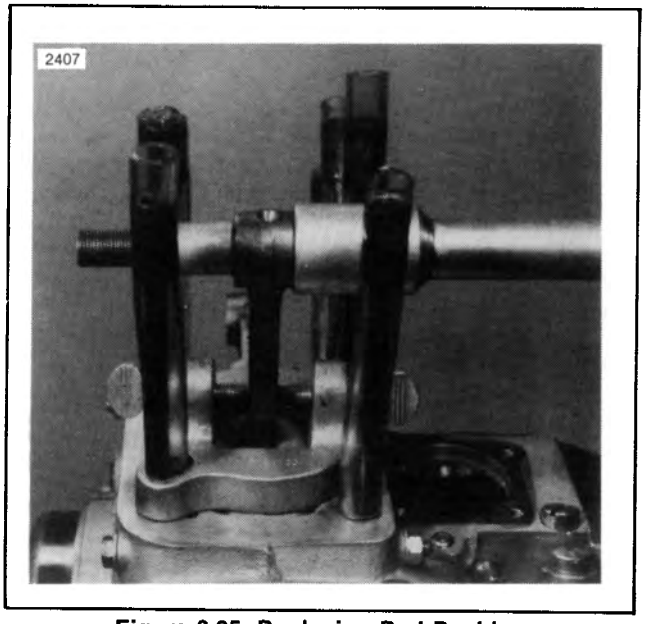


Figure 3-25. Replacing Rod Bushing

NOTE

To replace bushing, use Harley-Davidson PISTON PIN BUSHING TOOL, Part No. HD-95970-32A and CONNECTING ROD CLAMPING TOOL, Part No. HD-95952-33.

CAUTION

Place rag over crankcase opening to keep chips and shavings out of crankcase.

1. See Figure 3-25. 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 hoses over the studs wedging them inside the holes in the tool.

2. Press out the old bushing and install new bushing. Drill the bushing oil hole, using the rod oil hole as a guide. Remove sharp edges and thoroughly clean hole.

3. Ream new bushing to 0.0005 in. undersize using SPIRAL EXPANSION REAMER, Part No. HD-94800-26. Finish clearance using WRIST PIN BUSHING HONE, Part No. HD-35102. Drive hone with an electric drill and work for a crosshatch pattern of approximately 60°. Lubricate hone with honing oil.

4. Clean bushing bore with cleaning solvent.

Connecting Rods

CAUTION

DO NOT ATTEMPT TO STRAIGHTEN CONNECTING RODS. If there is evidence of bent rods, they must be replaced. Straightening rods by bending will damage the bearing on the crankpin and the piston pin bushing.

ASSEMBLY

1. See Figure 3-20. Install the pistons. Be sure they are properly oriented front to back. The raised nub or cast-in arrow on the piston pin boss must go to the left (sprocket shaft) side. Install the piston pin retaining rings with the PISTON PIN RETAINING RING INSTALLER, Part No. HD-34623. Be sure the ring groove is clean and that the ring is fully seated in the groove with the gap away from the slot at the bottom.
2. See Figure 3-23. Be sure the piston ring end gaps are properly positioned.
3. Lubricate cylinder walls, pistons, pins and rod bushings with engine oil.
4. Turn engine until crankpin is at top center.
5. See Figure 3-26. Compress the piston rings using PISTON RING COMPRESSOR, Part No. HD-96333-51B.

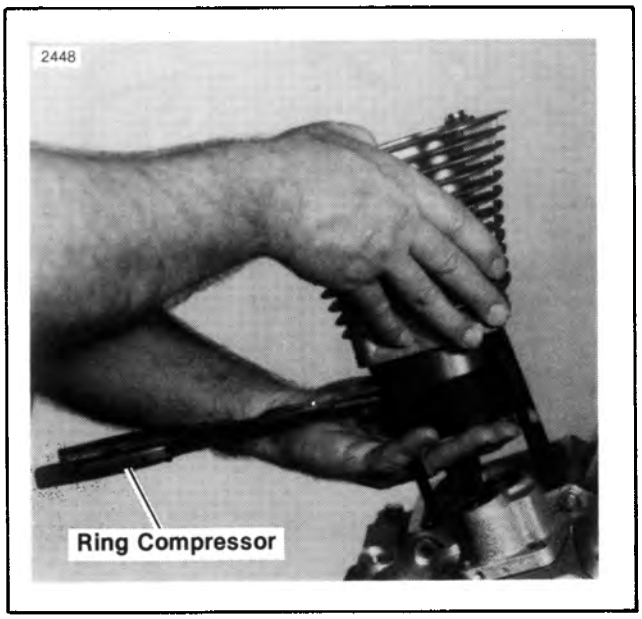


Figure 3-26. Slipping Cylinder Over Piston

6. Remove cylinder stud sleeves and install a new cylinder base gasket. Use a small amount of grease to hold the gasket in place. Be sure the pistons do not bump the studs or crankcase.
7. Support the piston with one hand while sliding the cylinder on with the other.
8. Remove piston ring compressor.
9. Assemble cylinder heads as explained in CYLINDER HEADS, ASSEMBLY.

OIL PUMP

GENERAL

The oil feed pump and scavenger (oil return) pump are gear type pumps housed in one pump body and located on rear of gearcase on right side of motorcycle. The feed pump incorporates an automatic relief valve that routes surplus oil (above the amount needed to lubricate the engine) directly back to the feed section of the pump. A check valve is located ahead of the pressure regulating valve to prevent oil draining from tank when engine is not running.

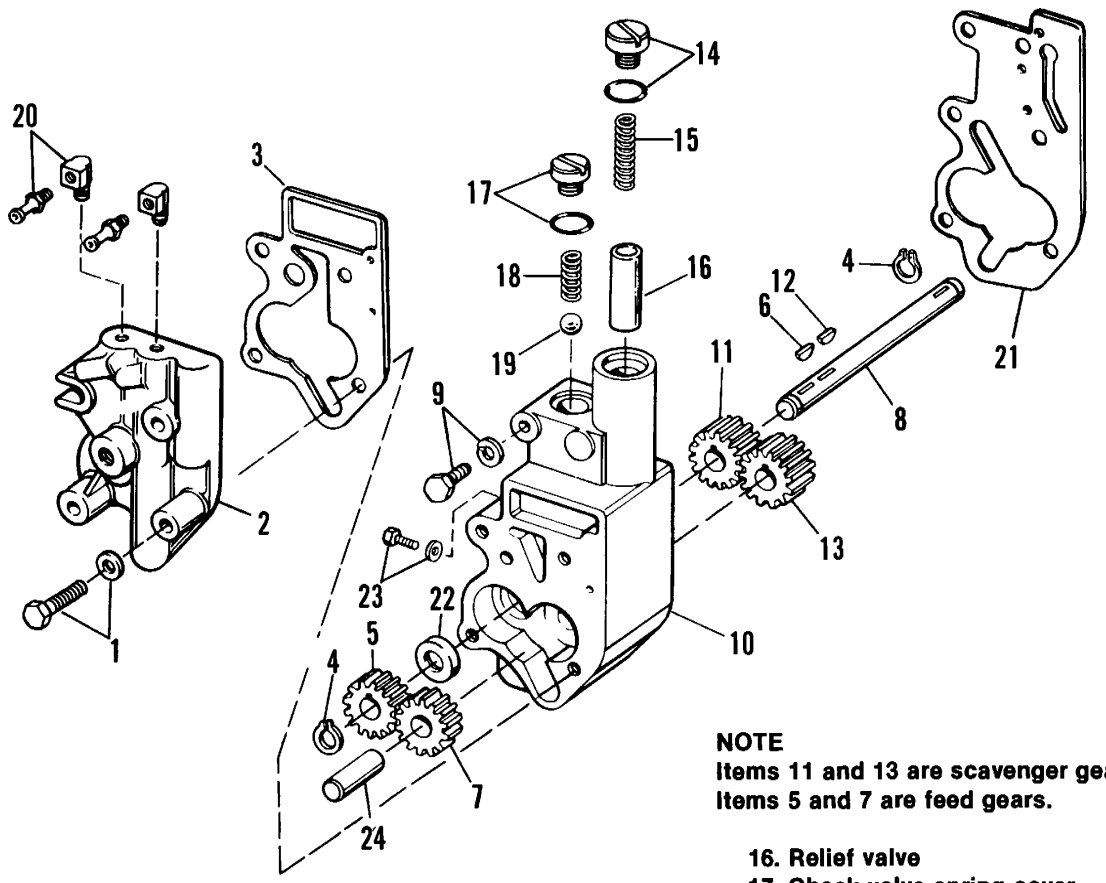
TROUBLESHOOTING

Under normal operating conditions, the pump is a trouble free unit. The most common trouble with pump operation is the introduction of a metal or hard carbon chip into the pump. If either gets between the gear teeth, it is possible to shear a key, fracture a gear or break off a gear tooth.

If oil fails to return to the tank, check the scavenger pump gear drive shaft key. When the engine receives no lubrication (oil remains in tank), the drive shaft key on the feed pump drive gear may be sheared. Both conditions together could be caused by a sheared oil pump (gearcase) drive gear key. In cold weather slush ice formed from moisture condensation in oil may block oil passages and cause any of above troubles.

DISASSEMBLY (Figure 3-27)

The oil pump may be disassembled, piece-by-piece without removing gearcase cover, with engine in chassis as follows:



NOTE
Items 11 and 13 are scavenger gears.
Items 5 and 7 are feed gears.

1. Cover bolt 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 3-27. Oil Pump

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(s) must be removed with the pump body.
3. Remove oil pump cover (2) and gasket (3).
4. Remove lock ring (4), drive gear (5), gear key (6) and idler gear (7).

CAUTION

Do not allow drive shaft (8) to be pushed into gearcase because key could fall out of shaft into gearcase requiring the gear cover to be removed.

5. Remove the oil pump body mounting hardware (9) and slip pump body (10) off drive gear shaft (8).
6. Remove drive gear (11), key (12) and idler gear (13).
7. Remove relief valve plug and O-ring (14) from pump body and remove relief valve spring (15), and valve (16).
8. Remove check valve spring cover screw and O-ring (17), valve spring (18) and ball (19).
9. Oil pump elbows (20) may be turned out of pump cover to facilitate cleaning.

CLEANING, INSPECTION AND REPAIR (Figure 3-27)

1. Thoroughly clean all parts in cleaning solvent and blow pump body passages clear with compressed air.
2. Inspect valves and valve seats for pitting and wear.
3. Replace pump having worn or damaged valve seat.
4. Inspect keys and keyways.
5. Inspect scavenger and feed pump gear teeth for gouging or cracking caused by foreign materials going through pump.
6. Lay a straightedge across the feed gears with the gears installed in the pump body. With a feeler gauge, check clearance between straightedge and pump body. Gears should extend above the pump body 0.003 - 0.004 in.
7. Repeat above check on scavenger gears. If gears do not extend 0.003 - 0.004 in. above pump body, the oil pump must be replaced.

ASSEMBLY (Figure 3-27)

NOTE

Do not mix gears and keys. Replace in original location. Oil pump gaskets must not be reused. Use only original Harley-Davidson gaskets (gasket thickness is important for proper pump operation). Lock rings are often damaged when removed. Use new lock rings and be sure they are seated securely in the groove.

1. Install oil pump elbows and nipples (20).
2. Install check valve ball (19), valve spring (18) and cover screw and O-ring (17).
3. Install relief valve (16), spring (15), and plug and gasket (14). Tighten plug to 80-110 in-lbs torque.
4. Install key (12) and drive gear (11) on drive shaft (8).
5. Install idler gear (13) on idler gear shaft from back side of oil pump body (10).
6. Place new gasket (21) on gearcase and install pump body (10) with top inside pump cover bolt and tighten mounting hardware (9) to a torque of 60-85 in-lbs.
7. Install a new drive shaft seal (22) in the pump body with the lip facing toward the feed gears. Install key (6) and drive gear (5). Secure drive gear (5) with new lock ring (4).
8. Install idler gear (7).
9. Install a new cover gasket (3) and oil pump cover (2) with bolts and lockwashers (1). Tighten hardware evenly to 90-120 in-lbs torque.
10. Retighten top bolts to a torque of 90-110 in-lbs.

CAUTION

Do not overtighten mounting bolts and nuts. Overtightening will eliminate pump gear side clearance which may cause the pump to seize up, damaging pump and engine parts.

NOTE

If pump is repositioned to eliminate binding, retighten top and cover bolts to a torque of 115-120 in-lbs using ONLY a hand torque wrench.

11. See Figure 3-28. 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.

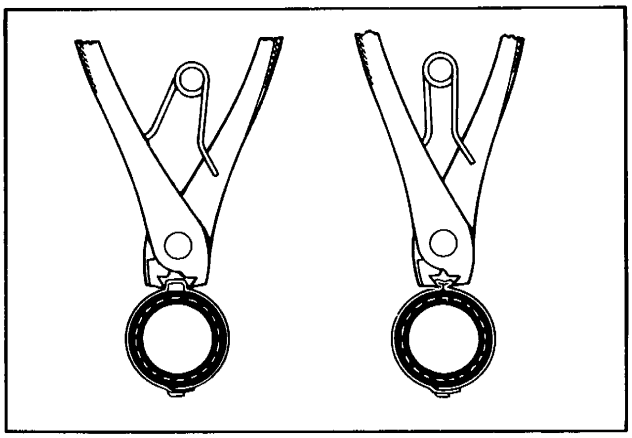


Figure 3-28. Hose Clamp Connection

VALVE TAPPETS AND GUIDES

GENERAL

The tappet assembly consists of tappet and roller. The tappet and roller, under compression force from the valve springs, follow the surface of the revolving cam. The up and-down motion produced is transmitted to the valve by the push rod and rocker arm. The tappet contains a piston or plunger and cylinder, plus a check valve, which allows the unit to pump itself full of engine oil to take up play in the valve train.

When tappets are functioning properly, the assembly operates with minimal tappet clearance. The units automatically compensate for heat expansion to maintain a no-clearance condition.

It is normal for tappets to click when engine is started after standing for some time. Tappets have a definite leak down rate which permits the oil in the tappets to escape. This is necessary to allow units to compensate for various expansion conditions of parts and still maintain correct-clearance operation. Tappets are functioning properly if they become quiet after a few minutes of engine operation.

REMOVAL/DISASSEMBLY

1. If engine cylinder head is not disassembled, rotate engine until both valves are closed.
2. Remove upper and middle rocker covers, rocker arm shafts, lower rocker covers, push rods and push rod covers following the REMOVAL procedure of the CYLINDER HEAD subject.
3. Remove the bolts holding the tappet guide to the crankcase.
4. See Figure 3-29. To remove the tappets and guides together, fashion a U-shaped wire from a large paper clip. Insert the ends into the tappets and tilt the guide and tappets out together.

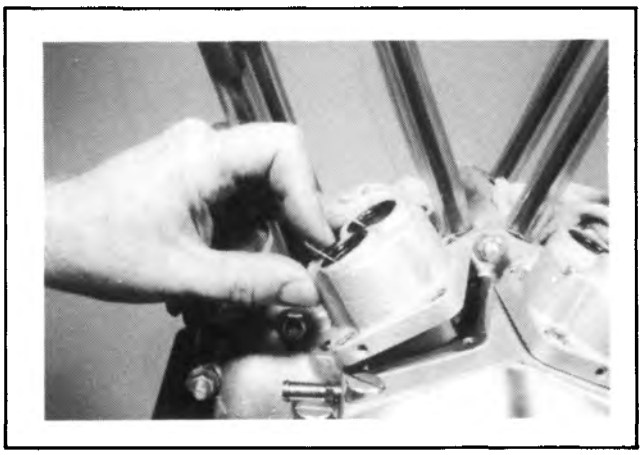


Figure 3-29. Removing Tappet & Guide Assembly

5. Mark tappets and guides so they will be assembled in their original locations.

CLEANING AND INSPECTION

1. Wash all parts, except tappet and roller assembly and gaskets, in grease solvent.
2. Inspect the tappets, rollers and guide bores for damage. Measure the guide bores and tappet diameters and check the clearance with the SERVICE WEAR LIMITS. Replace the tappet, the guide or both if clearance is excessive.
3. Clean the roller with an oil free aerosol cleaning solvent or contact cleaner. Measure the roller radial clearance and side play. Replace the tappets if the rollers are damaged or if clearances are excessive.
4. If you suspect there might be dirt in the tappet or internal parts are malfunctioning, replace the tappet.
5. Tappets should be soaked in clean engine oil and kept covered until assembly.

ASSEMBLY (Figure 3-30)

1. Install the tappets and guides using the wire clip to hold the tappets in the guide. The orientation of the oil hole in the side of the tappet does not affect tappet performance.

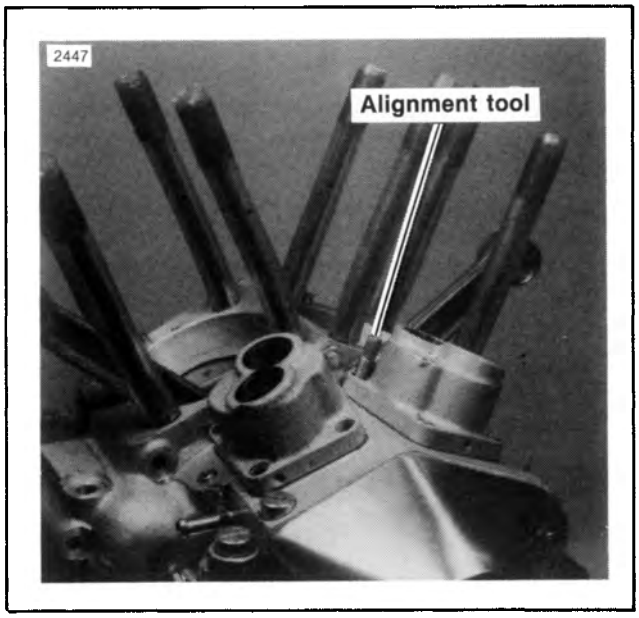


Figure 3-30. Tappet Guide Alignment

2. Insert the TAPPET GUIDE ALIGNMENT TOOL, Part No. HD-33443, in the screw hole nearest the tappet oil feed hole and install and tighten the other three screws.
3. Remove the tool and install the fourth screw.
4. Repeat the above procedure for the other tappet guide. Install TAPPET GUIDE ALIGNMENT TOOL in the hole closest to oil feed hole.
5. After tappets and guides are installed, check push rod length following the procedure given in the CYLINDER HEAD subject.
6. Install push rods following the procedure given in Installation, Push Rods.

GEARCASE COVER AND TIMING GEARS

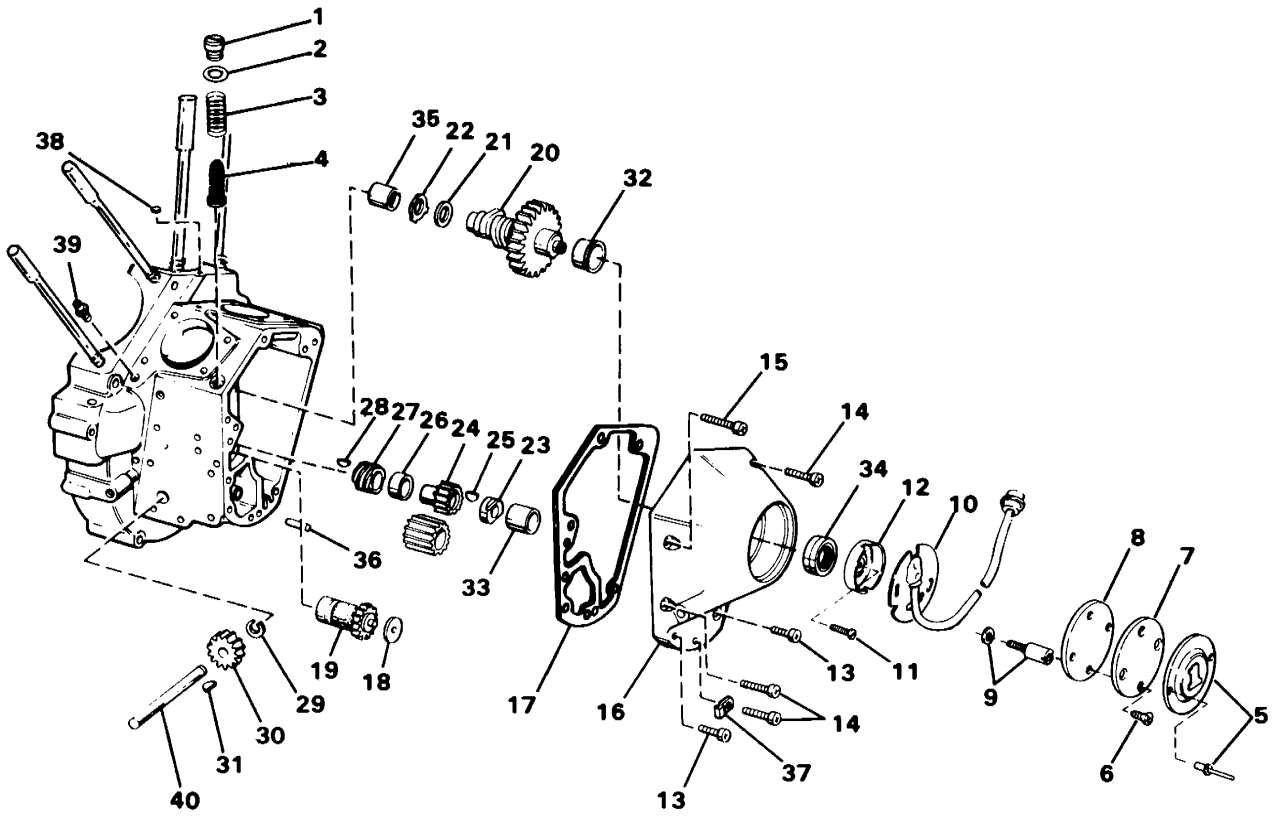
GENERAL

The gearcase, located on the right side of the engine crankcase, contains a series of gears which transmit engine power to the cam shaft and ignition timer, crankcase breather and oil pump. The gearcase is lubricated with engine oil through the breather valve from the engine crankcase.

Shafts run in bushings except the crankcase side of the cam shaft which operates in a needle roller bearing.

DISASSEMBLY

1. Remove rocker box assemblies. See CYLINDER HEADS.
2. See Figure 3-31. Remove tappet oil screen cap (1), O-ring (2), screen spring (3) and screen (4). If necessary, drill out two cover rivets and remove outer cover.
3. Remove two ignition sensor cover screws (6), cover (7) and gasket (8).



1. Oil screen cap
2. O-ring
3. Oil screen spring
4. Oil screen
5. Outer cover and rivets (2)
6. Inner cover screw (2)
7. Inner cover
8. Gasket
9. Sensor plate screw and lockwasher (2)
10. Sensor plate
11. Rotor screw
12. Rotor
13. Gear cover screw (2)
14. Gear cover screw (3)
15. Gear cover screw (1)
16. Gear cover
17. Gear cover gasket
18. Breather gear washer
19. Breather gear
20. Cam gear
21. Cam gear spacing washer, 1987 and earlier
22. Cam gear thrust washer
23. Gear shaft nut
24. Pinion gear
25. Pinion gear key 1989 and earlier
26. Pinion gear spacer
27. Oil pump pinion shaft gear
28. Oil pump/pinion 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 bushing
34. Camshaft oil seal
35. Camshaft needle bearing
36. Cover dowel pin (2)
37. Wire clip
38. Crankcase plug
39. Oil pressure switch
40. Oil pump shaft

Figure 3-31. Gearcase

4. Remove sensor plate screws and lockwashers (9).
5. Disconnect sensor plate wires at connection so that sensor plate may be moved out on the way.
6. Remove screw (11) and rotor (12).
7. Remove gearcase cover screws (13, 14 and 15).
8. Tap gearcase cover with soft face mallet to loosen and remove gear cover (16) and gearcase cover gasket (17).
9. Remove breather valve spacing washer (18) and breather gear (19).
10. Remove cam gear and camshaft (20), spacing washer (21) and thrust washer (22).
11. Remove pinion gear shaft nut (23) which has a left hand thread. Use PINION SHAFT NUT SOCKET, Part No. HD-94555-55A.
12. See Figure 3-32. Pull pinion gear using PINION GEAR PULLER AND INSTALLER, Part No. HD96830-51A. Tool has lefthand threads.

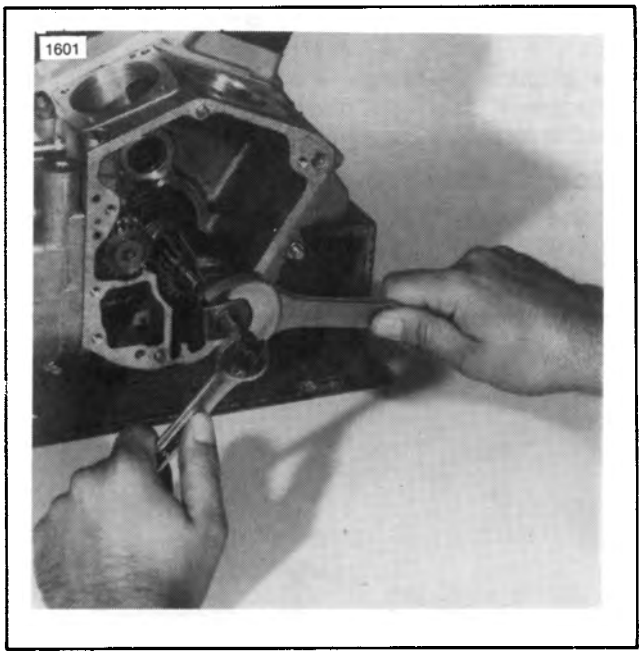


Figure 3-32. Pulling Pinion Gear

NOTE

1990 models use a single key (28) for both pinion gear and oil pump gear.

13. Remove key (25), gear shaft pinion spacer (26), oil pump pinion shaft gear (27) and key (28).
14. Use a LOCK RING PLIERS such as Snap-On No. PR129A and, if necessary, remove oil pump drive gear shaft lock ring (29), drive gear (30) and drive gear key (31).
15. If necessary, remove oil pump bolts and washers and remove oil pump from gearcase. See OIL PUMP, DISASSEMBLY.

CLEANING, INSPECTION AND REPAIR

1. Wash and air dry all parts. Wash inside of case. If crankcase is to be disassembled, wash parts after complete disassembly. If it is not to be disassembled, be careful to get not to get grease or solvent into crankcase when washing gearcase.
2. See Figure 3-31. If removed, inspect oil screen (4) carefully to be sure mesh is open. Fill screen with oil and watch for complete and even flow of oil through screen. Replace plugged or partially plugged screen.
3. Inspect cam gear and pinion gear bushings (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 WEAR LIMIT shown in ENGINE, SPECIFICATIONS, install new bushings.
4. Measure the small end of the cam shaft at the bearing surface and again near the cam lobes. If the shaft is worn more than 0.003 in. or is damaged in any way, replace both the cam and the needle bearing (35). See steps 8 and 9.
5. Replace the cam if any of the lobes are damaged or worn more than 0.006 in. Measure the lobes on a new cam for comparison. Be sure you use an Evolution engine cam. Since the lift and profile on the cam lobes differs from earlier engines, cams must not be interchanged.
6. Replace cam gear oil seal (34).

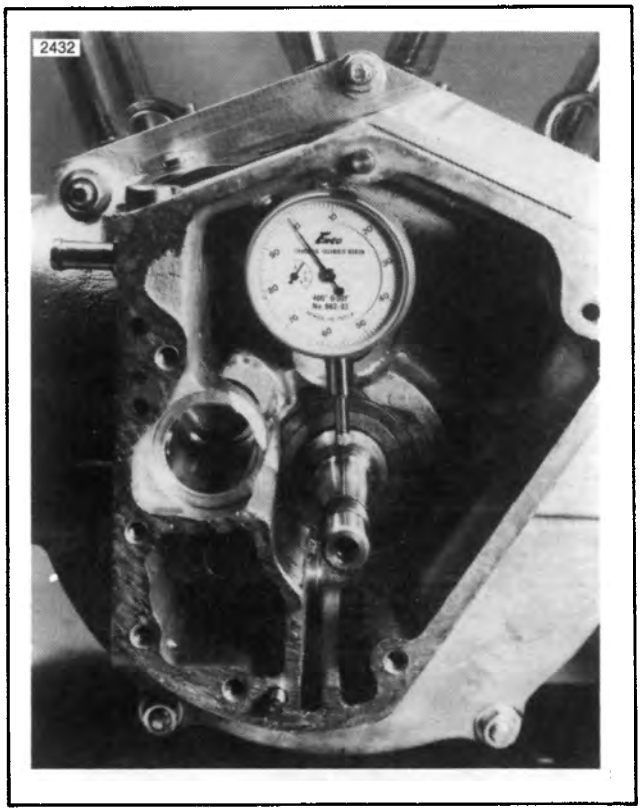


Figure 3-33. Checking Pinion Shaft Bearing

7. See Figure 3-33. Clean the pinion shaft bearing with contact cleaner and check the bearing clearance with a dial indicator. Mount the indicator with the probe perpendicular to the shaft and as close to the bearing as possible. If the clearance exceeds 0.002 in., the bearing must be refitted. See Truing and Sizing, Pinion Shaft Bearing in the CRANKCASE subject.

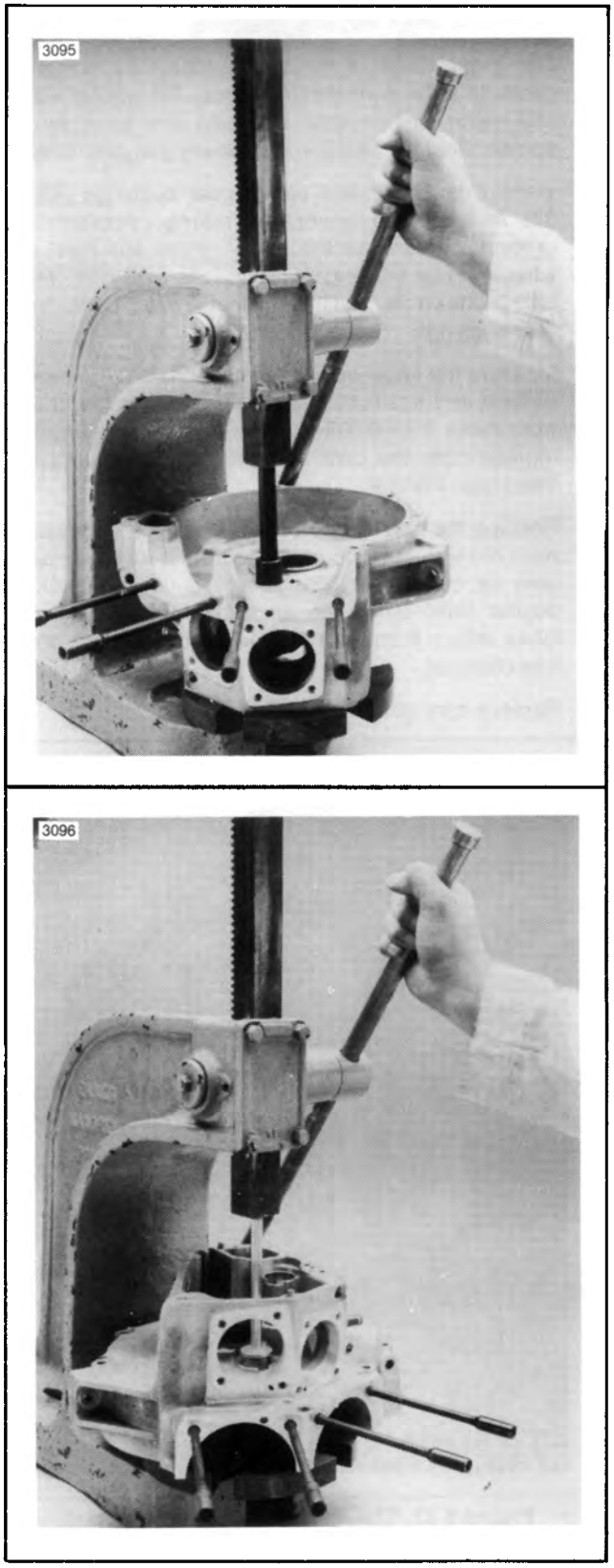


Figure 3-34. Removing and Installing Cam Gear Needle Bearing

8. See Figure 3-31. Inspect needle bearing (35) for wear and broken or gouged bearings. If end of cam shaft shows any appreciable wear (0.003 in. or more), needle bearing is probably worn to a point where replacement of bearing and cam shaft are advisable.

9. See Figure 3-34. Needle bearing can be removed and installed in crankcase without disassembling crankcase using PULLER TOOL, Part No. HD-95760-69. Press needle bearing into crankcase with NEEDLE BEARING TOOL, Part No. HD-97272-60. Press only from heavier end having the manufacturer's name. Pressing from opposite end will crush roller race and bind rollers. Pinion shaft main roller bearing may be replaced only when crankcase is disassembled, see CRANKCASE, DISASSEMBLY.

10. Inspect gears for wear. Assemble pinion and cam gears to respective positions in gearcase. Omit cam gear end spacer for the purpose of checking gear mesh. Attach cover with at least three cover screws. Mesh is correct when no play between gears can be felt and cam gear can be moved back and forth along shaft axis with slight drag.

Gearcase Cover Bushings

NOTE

The original bushings are not pinned, but the replacement bushings must be pinned to prevent possible rotation in the cover.

PINION GEAR SHAFT BUSHING

1. See Figure 3-35. To remove old bushing, use PULLER TOOL, Part No. HD-95760-69 with a 0.500 in. collet.

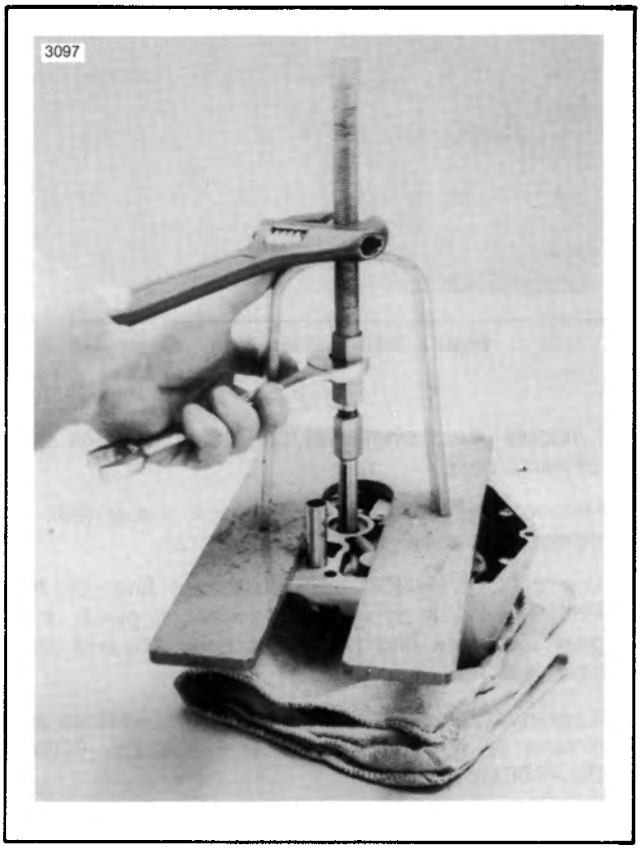


Figure 3-35. Removing Cover Bushing

2. Align the flat on the new bushing with the oil hole in the cover bore.

3. Using an arbor press, press in the new bushing only until the top of the bushing is flush with the boss in the cover.

4. See Figure 3-36. Locate and center punch dowel pin location 0.125 in. or more from oil hole in cover. Drill No. 31 hole 0.188 in. deep. Press in bushing until it bottoms on shoulder in cover boss hole. Continue drilling dowel pin hole to depth of 0.281 in. from top of bushing. Drive in new dowel pin no more than 0.020 in. below the bushing face and carefully peen edges of hole to lock in place.

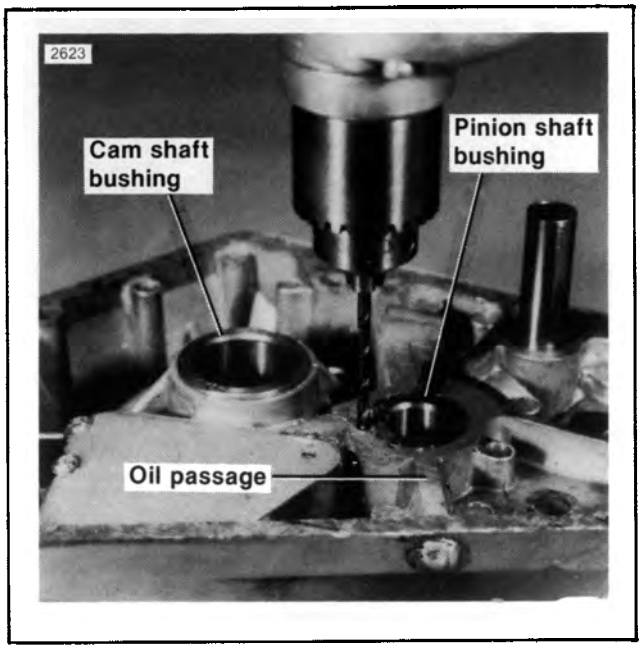


Figure 3-36. Pinning Gearcase Cover Bushings

5. Ream bushing. See procedure following CAM SHAFT BUSHING.

CAM SHAFT BUSHING

1. To remove old bushing, use PULLER TOOL, Part No. HD-95760- 69 with a 0.125 in. collet.

2. Press in the new bushing until the shoulder is tight against the boss in the cover.

3. See Figure 3-36. Center punch and drill No. 31 hole exactly 0.281 in. deep. Drive in new dowel pin and peen bushing edges over dowel to secure it. Pin must be no more than 0.020 in. below the bushing surface.

4. Drill lubrication oil hole through wall of bushing with 0.156 in. drill using oil hole in bushing boss as a drill guide.

REAM GEARCASE COVER BUSHINGS

NOTE

Pinion shaft and camshaft bushings must be line reamed to remove burrs and irregularities from hole and to ensure perfect alignment. If crankcase is not disassembled, use another right crankcase side. Fasten cover in place with at least three screws.

1. See Figure 3-37. To ream pinion shaft bushing, insert reamer pilot in right crankcase roller race. Insert 0.563 in. PINION SHAFT COVER BUSHING REAMER, Part No. HD-94805-57, through pilot and push into cover bushing until it bottoms, then give reamer one complete turn to size bushing. Rotate reamer the same direction (clockwise) during extraction.

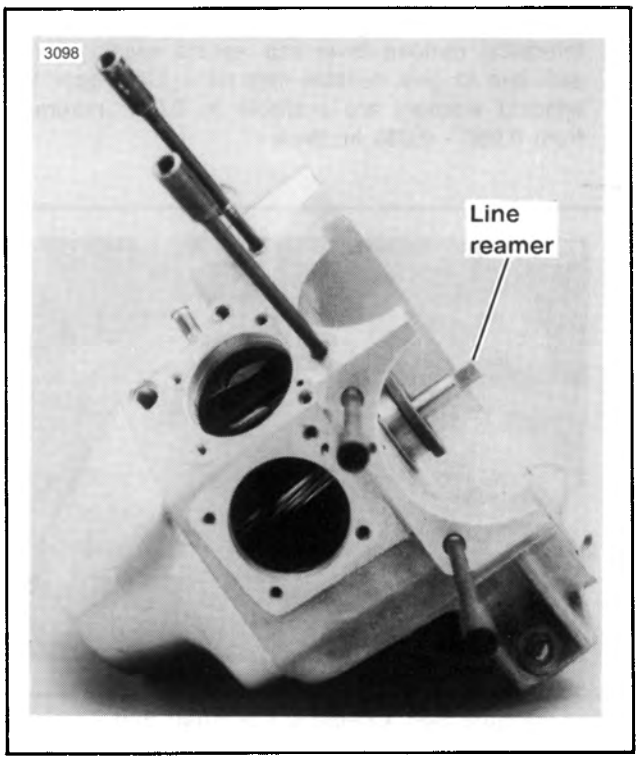


Figure 3-37. Line Reamer in Cover Bushing

2. To ream cam gear cover bushing, use a 1 in. expansion reamer and ream to 1.003 - 1.002 in. diameter.

ASSEMBLY

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 - 0.016 in. is correct. If end play exceeds maximum, insert thicker spacer. A range of breather valve and gear spacer washers are available.

NOTE

1988 cam gear shaft end play is 0.001 to 0.050 in. 1988 cam gear shafts do not use a spacer.

2. See Figure 3-38. Establish proper cam gear shaft end play as follows: Install thrust washer, spacing washer and cam shaft gear. Position cover gasket and secure cover with at least four screws. Measure cam gear end play between cam gear shaft and thrust washer with thickness gauge through tappet guide hole in gearcase. 1987 and earlier end play should be 0.001 - 0.016 in. If measurement is under or over tolerance, remove cover and replace spacing washer with one to give suitable clearance. Cam gear shaft spacing washers are available in 0.005 increments from 0.050 - 0.095 in. thick.

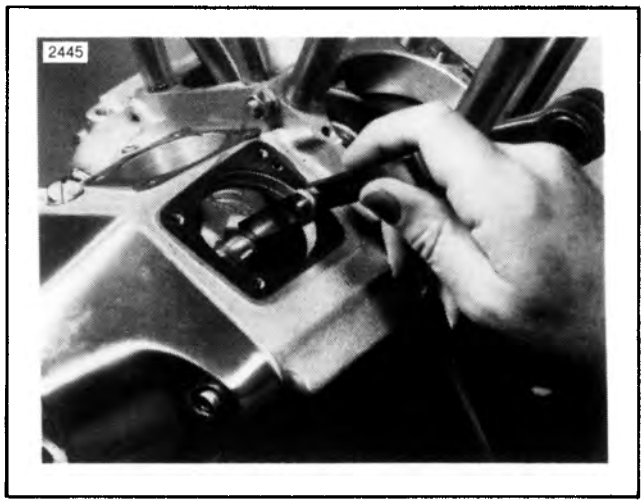


Figure 3-38. Checking Camshaft End Play

3. See Figure 3-31. On Early 1985 models, be 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. Be sure that gear shaft pinion spacer (26) has noticeable end play.

NOTE

Late 1985 and later model gear is chamfered on both sides and requires a larger diameter spacer between it and pinion gear.

4. See Figure 3-39. Breather, cam and pinion gears have timing marks which must be aligned or matched. Rotate gear train and note if it revolves freely. Binding indicates gears are meshing too tightly.

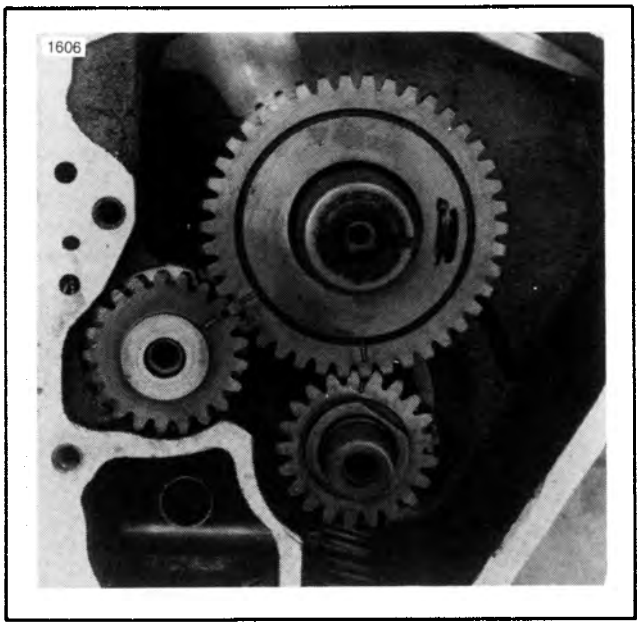


Figure 3-39. Timing Gears with Marks Aligned

NOTE

See Figure 3-31. On Late 1985 models and service parts, the oil pump gear (27) is chamfered on both ends. A larger diameter spacer (26) is used between the oil pump gear and pinion gear (24).

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-like noise or gear whine may result. See the following chart. If a matched set of gears produces a severe gear whine, the next smaller pinion gear may be used to obtain proper gear clearance. If a lifter type noise is present, the next larger pinion gear may be used. The proper gear clearance will give a very slight gear whine when engine is hot.

5. Position new cover gasket and secure cover with all cover screws. Tighten screws to 90-120 in-lbs torque.
6. After securing cover, pour about 1/4 pint of engine oil through tappet guide hole over gears to provide initial lubrication.
7. Assemble remainder of gearcase and ignition timer. See IGNITION SYSTEM, section 8.
8. Install rocker box assemblies. See CYLINDER HEADS.

CAM/PINION GEAR COLOR CODE CHART

COLOR CODE	PINION GEAR		CAM GEAR	
	NOTE	**1989 & earlier models (matched sets)**		
	• *Use 0.105 in. pins to measure.*			
	• *1989 & earlier cam gears have one groove on face.*			
	Part no.	**Size (in.)**		**Size (in.)**
ORANGE	24040-78	1.4756/1.4751	*NOTE*	2.7324/2.7334
WHITE	24041-78	1.4751/1.4745	*Check parts*	2.7334/2.7344
YELLOW	24042-78	1.4745/1.4737	*catalog for*	2.7344/2.7354
RED	24043-78	1.4737/1.4729	*cam and pin-*	2.7354/2.7364
BLUE	24044-78	1.4729/1.4721	*ion sets part*	2.7364/2.7374
GREEN	24045-78	1.4721/1.4715	*numbers.*	2.7374/2.7384
BLACK	24046-78	1.4715/1.4710		*2.7384/2.7394*
	NOTE	**1990 models (matched sets)**		
	• *Use 0.108 in. pins to measure.*			
	• *1990 cam gears have two grooves on face.*			
	Part no.	**Size (in.)**		**Size (in.)**
ORANGE	24040-90	1.4853/1.4850	*NOTE*	2.7472/2.7476
WHITE	24041-90	1.4849/1.4846	*Check parts*	2.7477/2.7481
YELLOW	24042-90	1.4845/1.4842	*catalog for*	2.7482/2.7486
RED	24043-90	1.4841/1.4838	*cam and pin-*	2.7487/2.7491
BLUE	24044-90	1.4837/1.4834	*ion sets part*	2.7492/2.7496
GREEN	24045-90	1.4833/1.4830	*numbers.*	2.7497/2.7501
BLACK	24046-90	1.4829/1.4826		2.7502/2.7506

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.

ADJUSTMENT – Flywheel End Play (Figure 3-40)

1. After engine has been removed from chassis, securely fasten it to a stand and workbench.

2. Remove gearcase cover and fasten dial indicator to gear side crankcase with indicator stem on end of gearshaft.

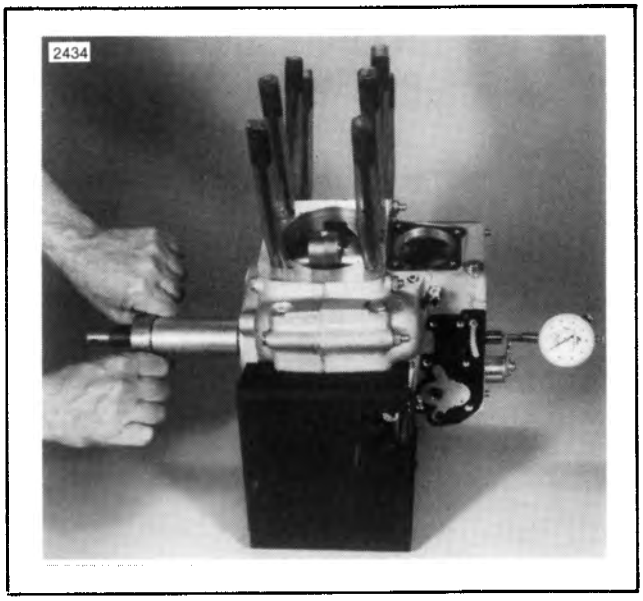


Figure 3-40. Checking Flywheel End Play

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 0.001 - 0.005 in., the bearing inner spacer (10, Figure 3-42) must be replaced. Choose spacer from the chart. A thinner spacer will result in less end play.

Bearing Inner Spacers Chart

Bearing Inner Spacers (10, Figure 3-42)	
PART NO.	**SIZE**
9120	0.0925/0.0915
9121	0.0945/0.0935
9122	0.0965/0.0955
9123	0.0985/0.0975
9124	0.1005/0.0995
9125	0.1025/0.1015
9126	0.1045/0.1035
9127	0.1065/0.1055
9128	0.1085/0.1075
9129	0.1105/0.1095
9130	0.1125/0.1115
9131	0.1145/0.1135
9132	0.1165/0.1155
9133	0.1185/0.1175
9134	0.1205/0.1195

DISASSEMBLY

1. Remove cylinder heads as described in CYLINDER HEAD, REMOVAL.

2. Remove cylinders as described in CYLINDER AND PISTON, REMOVAL.

CAUTION

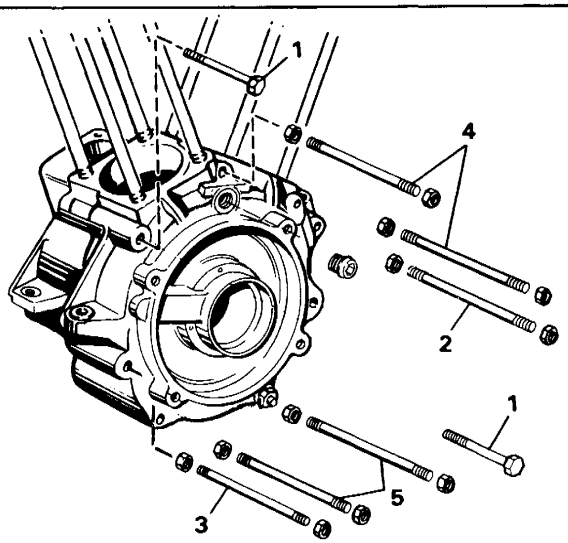
After removing cylinders, install 0.500 in. inside diameter plastic or rubber hose over the cylinder studs. Never lift or move the crankcase by grasping the cylinder studs.

3. Remove gearcase parts as described in GEARCASE, DISASSEMBLY. Check flywheel end play as described previously.

4. See Figure 3-41. Remove crankcase bolts and studs (1 through 5). It is necessary to remove only one stud nut and slip stud and other nut out opposite side of crankcase.

NOTE

The top center stud (4) and left and right bottom studs (5) are fitted to the crankcase holes for proper crankcase alignment. Mark these studs so they can be installed in their original location.



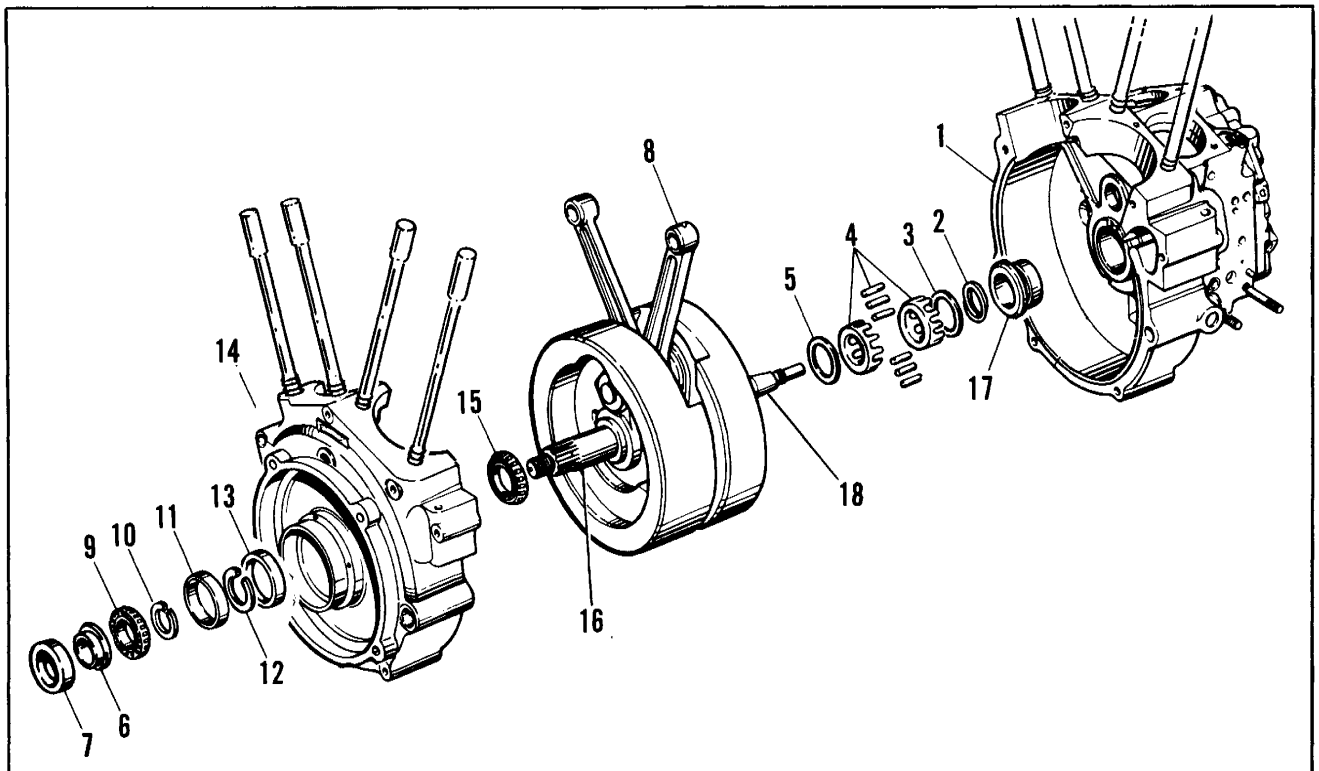
1. **Crankcase stud bolt, 3/8 x 3-1/4 in. (2)**
2. **Crankcase stud, 5/16 x 5 in. (right center)**
3. **Crankcase stud, 5/16 x 6 in. (left center)**
4. **Crankcase stud, 5/16 x 5-7/16 In. (2) (top and top right)**
5. **Crankcase stud, 11/32 x 5-13/16 in. (2) (left and right bottom)**

Figure 3-41. Crankcase Studs — Exploded View

5. See Figure 3-42. Position crankcase with gearcase (right) side up. Tap crankcase with soft face mallet to loosen right half. Lift right crankcase half (1) off pinion shaft main bearings (4). Remove 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. See Figure 3-43. Mount flywheel and left case assembly on press table supporting case on parallel bars 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. See Figure 3-44. If left main bearing is to be replaced, press out bearing races (11 and 13, Figure 3-42) 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 3-45. Starting at this free end, push ring out of bearing bore.



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 lock ring**
13. **Bearing outer race**
14. **Left crankcase half**
15. **Sprocket bearing half**
16. **Sprocket shaft**
17. **Pinion shaft bearing race**
18. **Pinion shaft**

NOTE: Keep parts 9, 11, 12, 13 and 15 as a set. Do not transpose or interchange parts.

Figure 3-42. Crankcase - Exploded View

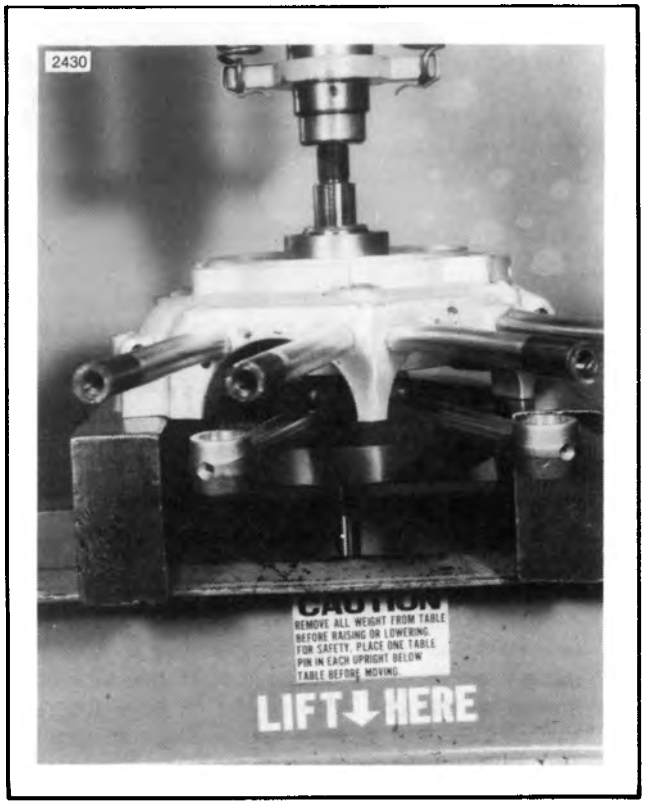


Figure 3-43. Pressing Flywheels Out of Crankcase

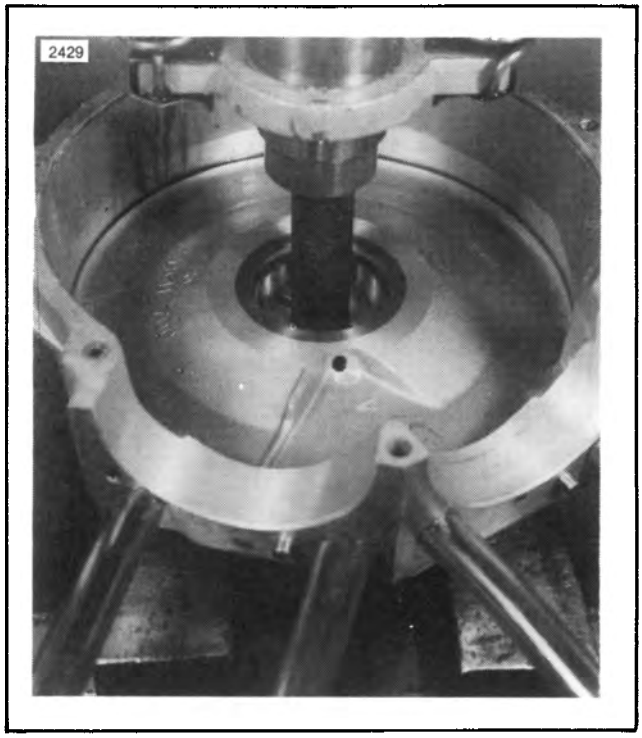


Figure 3-44. Removing Left Crankcase Bearing Races

INSTALLATION

Cylinder studs - Early 1985

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.

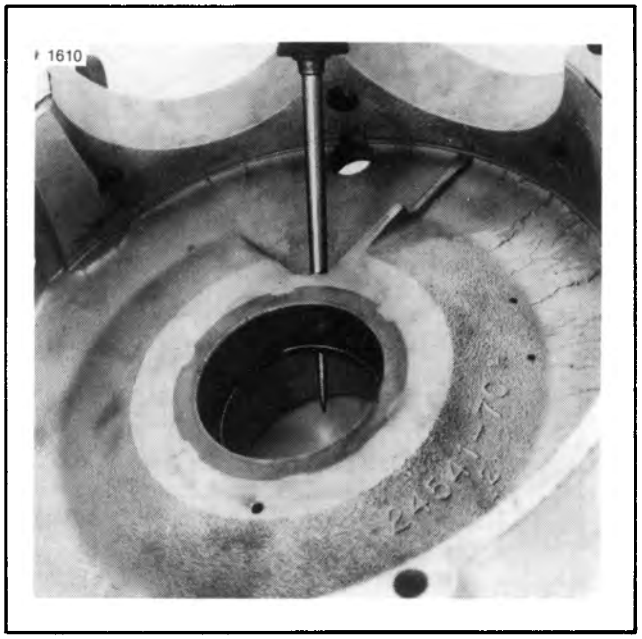


Figure 3-45. Removing Lock Ring

3. See Figure 3-46. 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 because they will bend the stud.

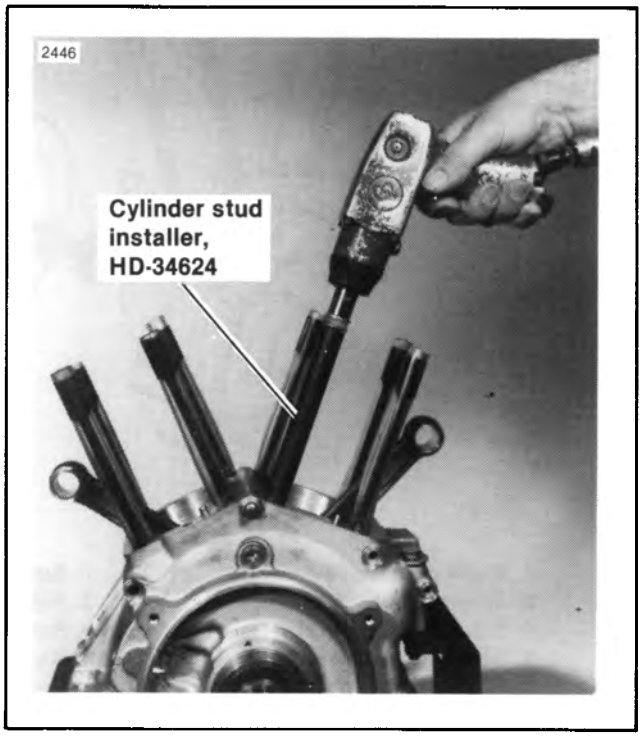


Figure 3-46. Installing Cylinder Studs — Early 1985

4. A properly installed stud should extend 5.670-5.770 in. above the base gasket surface and must be straight. The CYLINDER STUD INSTALLER tool is designed to preset the stud height.

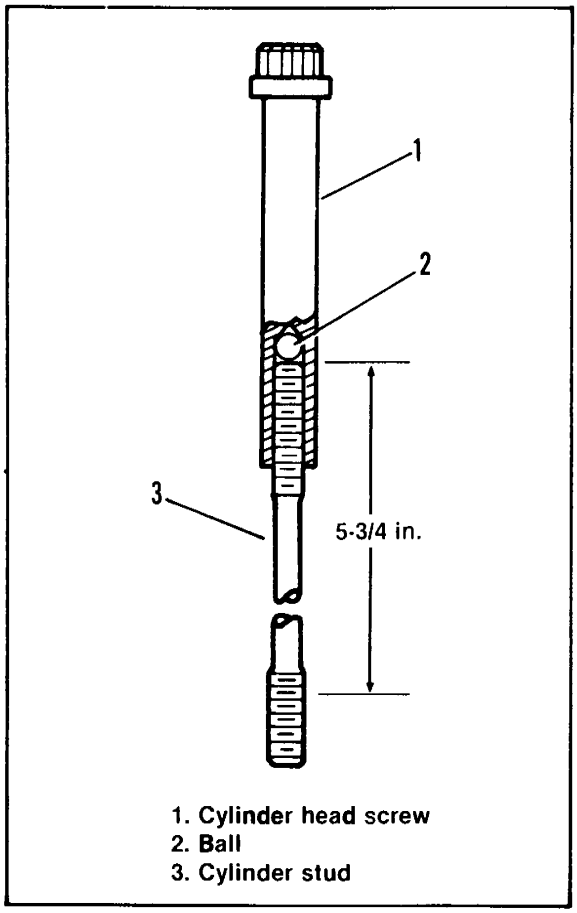
Cylinder Studs - Late 1985

CAUTION

Cylinder studs that are bent, scratched or broken must be replaced.

1. Measure 5.750 in. from the top of the stud toward the bottom of the stud. Paint a line on the threads to indicate the 5.750 in. measurement. This painted area will be used as a reference during installation.

2. See Figure 3-47. Place 0.313 in. DIAMETER BALL, Part No. 8860, from the XL clutch release mechanism into the head bolt recess. Thread the stud into the head bolt until the stud bottoms on the ball.



1. Cylinder head screw
2. Ball
3. Cylinder stud

Figure 3-47. Cylinder Stud and Head Bolt Late 1985

3. Clean the threads in the crankcase. Threads on new studs must have an interference fit in the crankcase threaded holes. Apply Loctite STUD 'N BEARING MOUNT on the stud threads.

4. See Figure 3-46. Use an air or electric impact wrench and install the stud threads to the depth of the painted line. Do not use a ratchet or breaker bar because they will bend the stud.

5. Pack clean shop towels into the crankcase openings to prevent the ball from falling into the flywheel compartment when removing the head bolt.

6. Verify that installed stud has a depth of 5.670-5.770 in. above the base gasket surface.

NOTE

Refer to ASSEMBLY following FLYWHEELS for additional crankcase installation procedures.

See Figure 3-48. 1987 1/2 cylinder studs are installed as described above. The stud shoulder must be installed up.

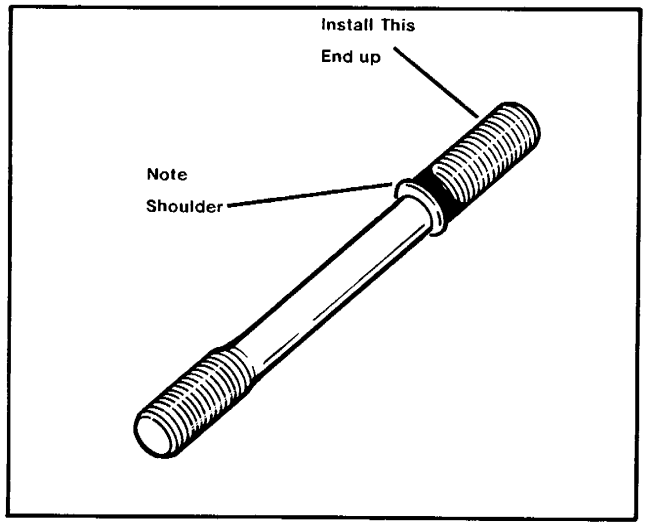


Figure 3-48. 1987 1/2 Cylinder Stud

FLYWHEELS

DISASSEMBLY

1. See Figure 3-50. If flywheels are to be disassembled, place a FLYWHEEL REBUILDING JIG, Part No. HD-34813 in a vise. Insert pinion shaft into fixture and install WEDGE ATTACHMENT, Part No. HD-95637-46 and GENERAL PURPOSE CLAW PULLER, Part No. HD-95635-46 over sprocket shaft bearing. Turn forcing screw to remove bearing. Keep bearings in a set with proper bearing outer races.

NOTE

On the late 1985 one-piece flywheel and sprocket shaft, the inner bearing will be destroyed during removal and must be replaced.

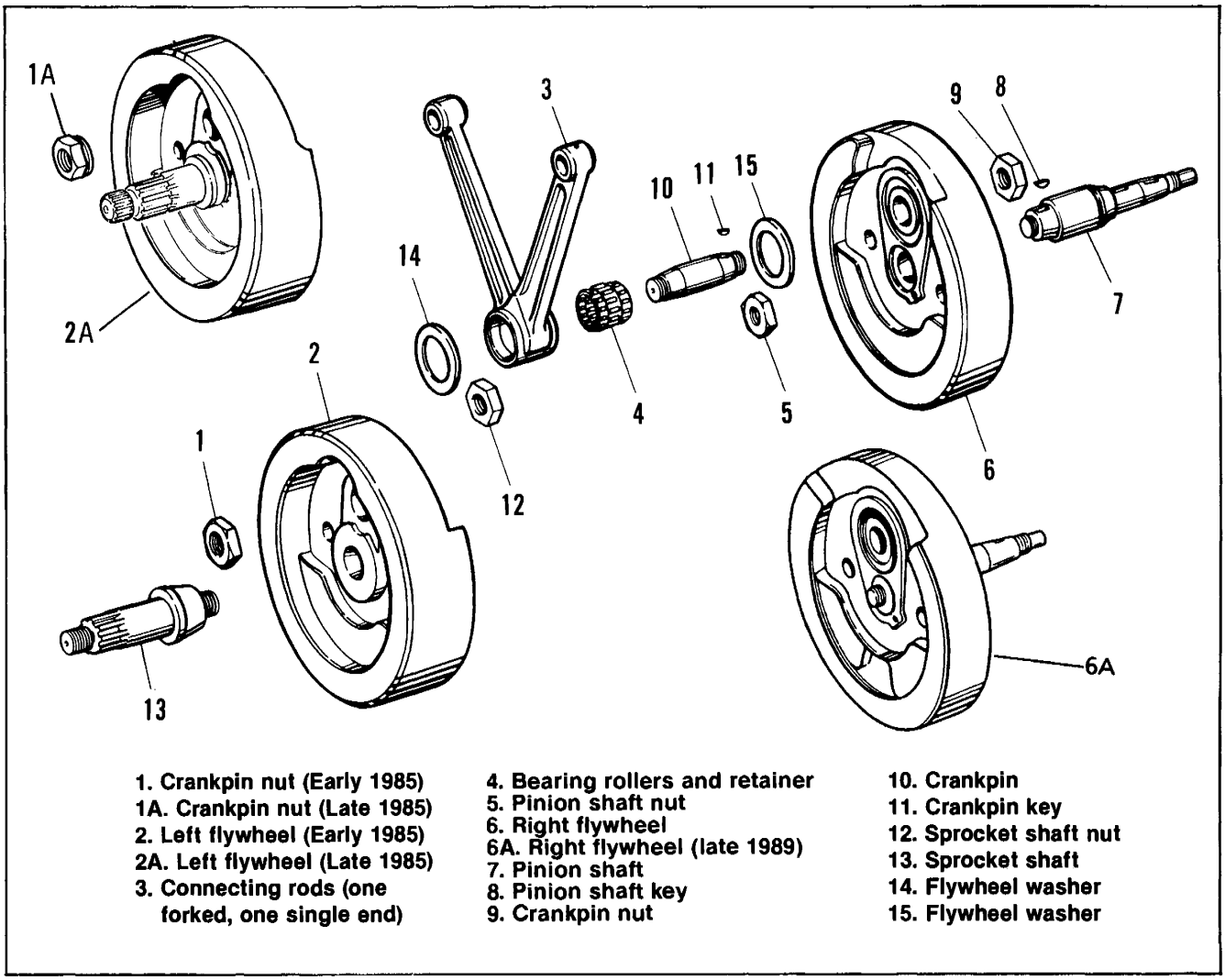
2. See Figure 3-51. Remove flywheel assembly from fixture and insert pinion shaft end into the fixture. Remove crankpin nut. To loosen flywheel, strike left flywheel rim with soft metal mallet at 90 degrees to crankpin.

3. See Figure 3-49. Remove left flywheel and gear shaft assembly. Remove crankpin key (11).

4. Hold down bearing assembly with a short length of pipe or tubing so connecting rods (3) may be slipped off bearings. Remove bearings (4). Hold together in set until bearings are washed and refitted to crankpin.

5. Using 1-5/8 in. socket, SNAP-ON Part No. S6202, remove sprocket shaft nut (12). On early 1985 models, press the sprocket shaft (13) out of flywheel. On late 1985 and later models, the sprocket shaft is an integral part of the flywheel.

6. Turn flywheel over in fixture and remove crankpin nut (1). Press crankpin out of flywheel.



1. Crankpin nut (Early 1985)
1A. Crankpin nut (Late 1985)
2. Left flywheel (Early 1985)
2A. Left flywheel (Late 1985)
3. Connecting rods (one forked, one single end)
4. Bearing rollers and retainer
5. Pinion shaft nut
6. Right flywheel
6A. Right flywheel (late 1989)
7. Pinion shaft
8. Pinion shaft key
9. Crankpin nut
10. Crankpin
11. Crankpin key
12. Sprocket shaft nut
13. Sprocket shaft
14. Flywheel washer
15. Flywheel washer

Figure 3-49. Flywheel Assembly

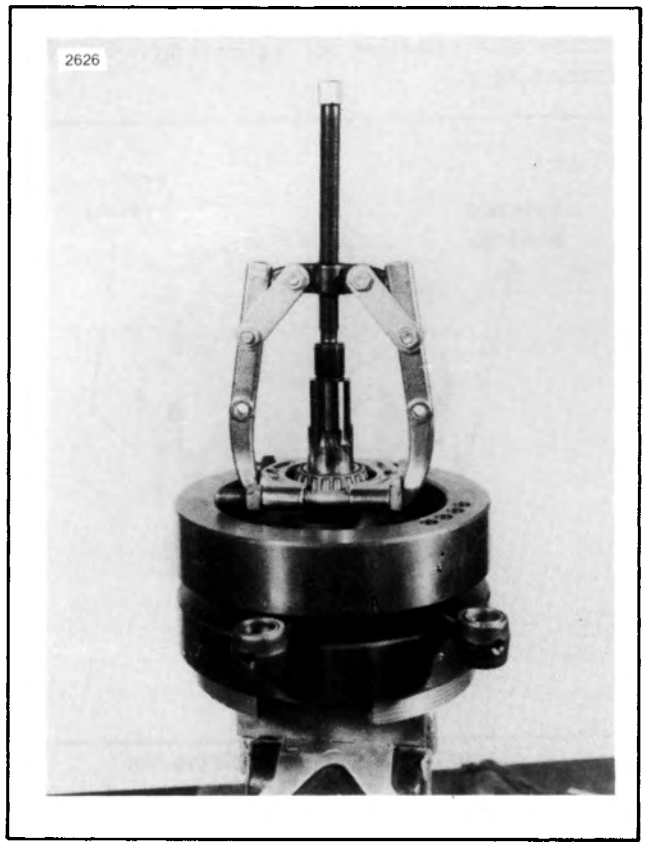


Figure 3-50. Pulling Bearing from Sprocket Shaft

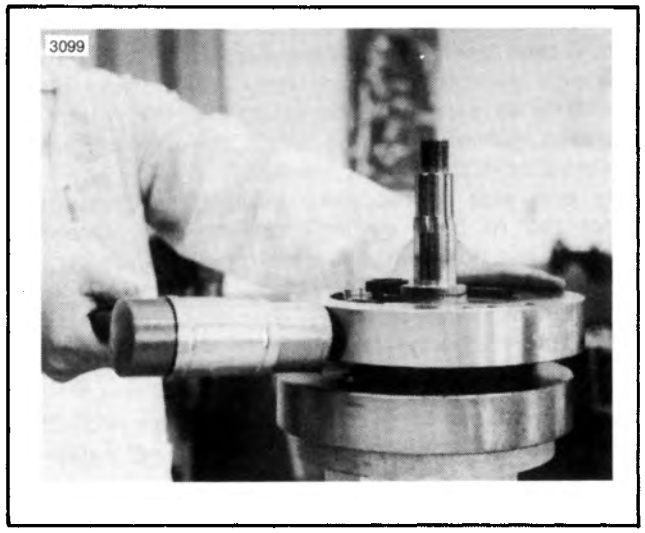


Figure 3-51. Loosen Flywheels

7. Place pinion shaft and flywheel in fixture and remove pinion shaft nut (5). Press the pinion shaft (7) out of flywheel and remove key (8) from shaft.

CLEANING AND INSPECTION (Figure 3-49)

1. Wash all parts in grease solvent and blow dry with compressed air. Examine crankpin for wear, grooving and pitting. If the surface is at all worn, replace with new pin. Examine flywheel washers (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. See Figure 3-42. Examine pinion shaft and right crankcase bearing race (17) 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.

NOTE

If bearings were removed from a one-piece flywheel, they must be replaced.

REPAIR

Flywheel Washers

Replace worn flywheel washers as follows:

1. Washer is a close fit in flywheel recess and is secured originally by punching flywheel metal tight against the washer at several points. It is usually necessary to drill a small hole (0.125 in. or smaller) through the washer. Turn a self-tapping screw into the hole to force the washer out.

2. Before installing new washer, scrape outer edge of washer recess where metal was punched against it so new washer may seat fully against recess bottom. If washer does not seat fully, forked rod will not have necessary clearance for side play.

3. Stake the new washers in place in four equally spaced locations using a center punch. Punch marks should be 0.045 in. deep and 0.050 in. away from the edge of the washer.

Lapping Connecting Rod Races

1. See Figure 3-52. Connecting rod lower races that are likely to clean up within the range of oversize bearing rollers and are otherwise in serviceable condition, should be trued and sized up with CONNECTING ROD LAPPING ARBOR, Part No. HD-96740-36.

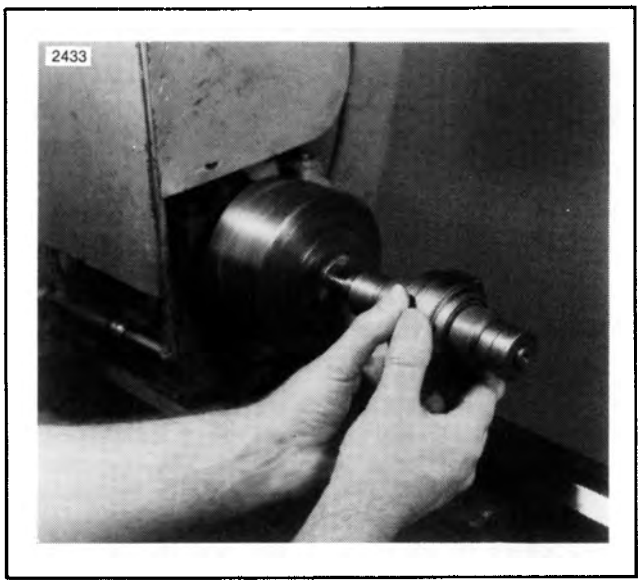


Figure 3-52. Lapping Connecting Rod

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 rods, work rod back and forth the full length of the lap holding rod as near race end as possible. Lap rods individually.

3. When rods are lapped true and all traces of pit marks or grooving are cleaned up, wash rods in warm soapy water and blow dry. Surface should have a soft velvety appearance and be free of shiny spots. Rod lower races must be round to within 0.0002 in.

Replacing Rod Bearings

NOTE

See Figure 3-53. The 1987 connecting rod bearing set consists of three packaged bearings. The new bearing sets will retrofit earlier models, but there is another method of using these bearings.

The bearing set packages are color coded with either a red or blue identification. This color coding is used by the bearing manufacturer only. The color coding DOES NOT indicate size selection for connecting rod bearing replacement.

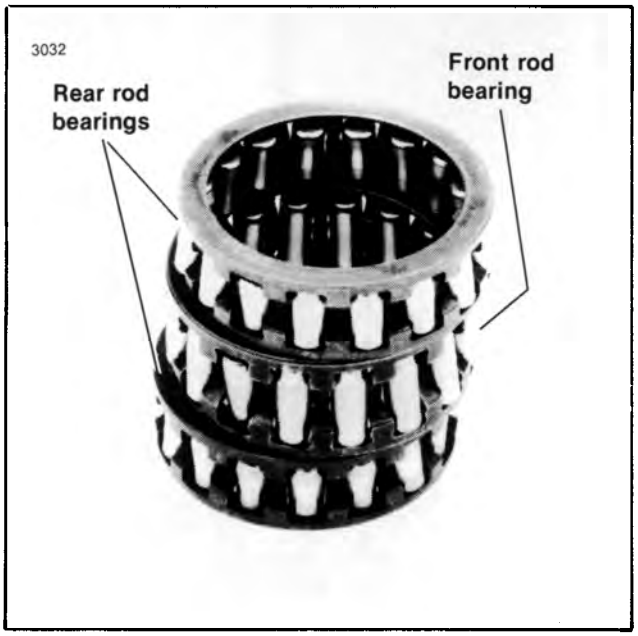


Figure 3-53. Crank Pin Bearing Set

CAUTION

Either a red or a blue coded bearing set may be used. DO NOT intermix bearings from a red and a blue bearing set because this will cause excessive loading on one bearing resulting in premature bearing failure.
The bearings consist of rollers retained in steel cages. The wide bearing (male/front rod) retains the rollers both internally and externally. The two narrow bearings (female/rear rod) only retain the rollers internally so care must be taken that the rollers do not drop out of the cage when the bearing set is removed from the plastic sleeve.
Only one size replacement bearing set (standard, either red or blue coding) will be sold. Oversize bearings are not available. Bearing clearance or fit is controlled by the connecting rod race inside diameters and the crank pin diameter. Two oversize crank pins are be available.

NOTE

Measure end play between connecting rod and thrust washer, not between connecting rod bearing cage and thrust washer.

CAUTION

Because of the extremely small tolerances involved, all measurements must be made as accurately as possible. Fitting bearings tighter than recommended may result in bearing seizure and damage when heat expands the parts. Excessive clearance will result in a noisy bearing.

All fitting and checking must be made with bearings, rods and crank pin clean and free of oil.

Establishing Proper Bearing Clearance

Oversized crank pins are used in the rod bearing to establish connecting rod clearance on crank pin.

See Figure 3-53. Oversize (OS) crank pins are available in two oversizes: 0.0010 and 0.0020 in. OS crank pins will have a blue or a red dot painted on their ends. A blue dot indicates 0.0010 in. OS, a red dot indicates 0.0020 in. OS. Standard size crank pins will not be marked.

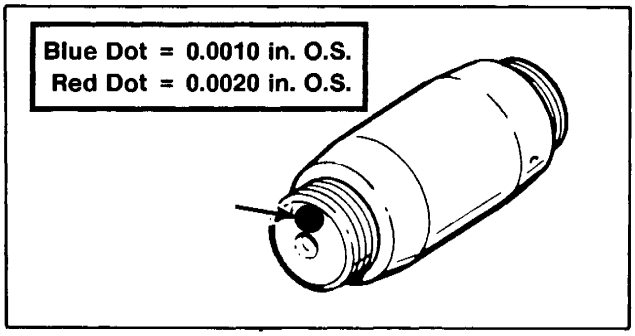


Figure 3-54. Oversize Crank Pin Identification

1. See Figure 3-55. To properly fit the rod bearings, measure inside diameter (ID) of lapped connecting rod races with a dial bore gauge that has 0.0001 in. graduations. Measure the ID at four places as shown. Record the four measurements.

See Replacing Rod Bearing Outer Races If any race ID exceeds Service Wear Limit of 1.6270 in., replace races or connecting rod set. If race ID measurements are less than 1. 6270 in., continue procedure as follows:

2. Compare the measurement recorded in step 1 with the ranges given in Race Diameter and Crank Pin Size Table. If the four measurements taken in each race differ, use the smallest measurement.

Race Diameter and Crankpin Size Table

CONNECTING ROD RACE ID REQUIRED	CRANK PIN REQUIRED
1.6245 – 1.6250	Standard
1.6255 – 1.6260	0.0010 in. oversize
1.6265 – 1.6270	0.0020 in. oversize
Greater than 1.6270	Service wear limit exceeded. Replace races or rods.

NOTE

Front and rear rod race ID must be within the same tolerance range given in table. The following example will illustrate the procedure necessary if the lapped connecting rod races on both rods are not in the same range.

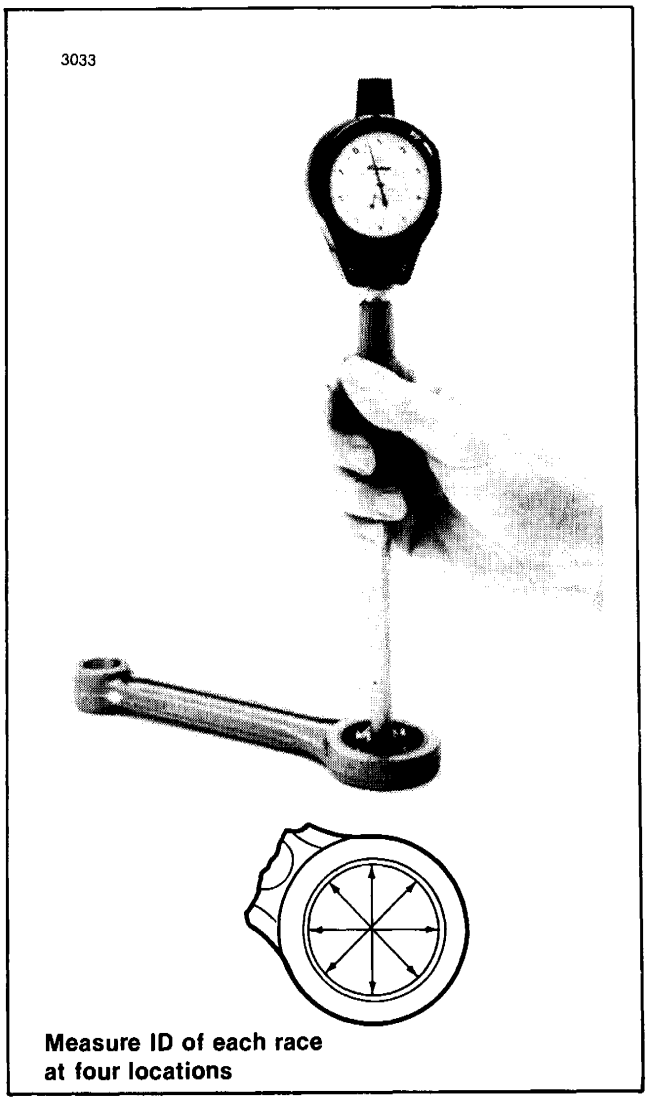


Figure 3-55. Measuring Connecting Rod Race Inside Diameters

Example: Assign the following values to the measurements taken in step 1.

Front connecting rod race diameter: 1.6255 in.
Rear connecting rod race diameter: 1.6250 in.

For the above measurements the table specifies that the front connecting rod would require a 0.0010 in. oversize crank pin, while the rear connecting rod could use the standard sized crank pin. The rear connecting rod races must be lapped so they have the same ID (within 0. 0002 in.) as the front rod.

3. Before assembling the flywheel assembly, with a new crank pin bearing set and 0.0010 in. oversize crank pin, recheck connecting rods as follows:

CAUTION

After the appropriate connecting rod race ID range specified in Race Diameter and Crank Pin Table has been achieved, verify that the following specifications are also met:

CONNECTING ROD	SPECIFICATIONS
Rear	Difference in ID of two races must not exceed 0.0001 in.
Front and rear	Difference in ID of races in front and rear connecting rods must not exceed 0.0002 in.
Front and rear	Races must be round within 0.00025 in. (Difference between largest and smallest ID measurement in any race must not exceed 0.00025 in.)

NOTE

Always use new bearings and crank pin after resizing (lapping) connecting rods to ensure proper running clearance.

Replacing Rod Bearing Outer Races

FRONT ROD

1. See Figure 3-56. Make a plug and sleeve to the dimensions shown.

CAUTION

Be sure the sleeve fully supports the outside of the conn. rod or the rod will be damaged beyond repair.

2. Use plug and sleeve with the Kent-Moore Universal Driver and and your shop press. Press the outer race out of the conn. rod, into the sleeve.

REAR ROD

NOTE

To remove the rear rod races, position the plug ***between*** *the the two races and press out.*

3. Press out first one race, then turn the rod over and press out the opposite race.

CAUTION

Be sure the chamfer in the race faces in the direction the race is being pressed.

4. Press new races into the rods until they bottom on the table.

NOTE

The race outside edge should be flush with the outside surface of the rod.

Manufactured Tools for Pressing
Conn Rod Bearing And Pinion Outer Races

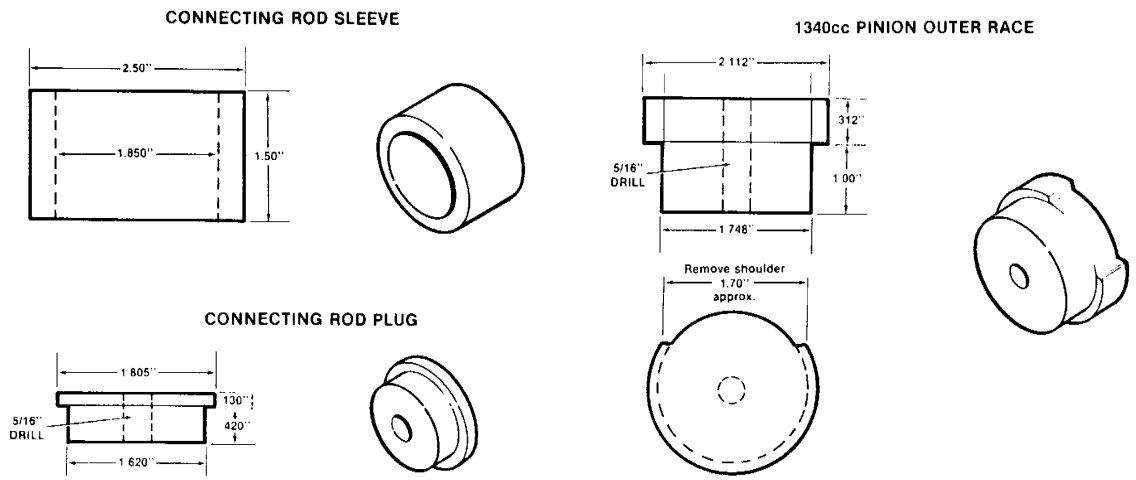


Figure 3-56. Manufactured Tools

ASSEMBLY (Figure 3-49)

After correct connecting rod bearing fit has been attained. Clean and assemble parts as follows:

1. Before assembly, all flywheel components must be perfectly clean and dry. Use a non-petroleum based solvent such as Loctite CLEANING SOLVENT or electrical contact cleaner.

2. On early 1985 flywheels, assemble the sprocket shaft (13) and left flywheel half (2) and apply two drops of Loctite RETAINING COMPOUND to the threads and two more drops to the face of the nut (12).

- Do not put Loctite on the shaft tapers.

- Late 1985 and later left flywheels are one piece flywheels.

- Late 1989 and later right flywheels are one piece flywheels. See One-Piece Pinion Shaft and Flywheel.

3. Tighten the nut (12) to 290 - 320 ft-lbs torque.

4. Assemble the pinion shaft (7) and right flywheel half (6) in a similar manner. Tighten the nut (5) to 140 - 170 ft-lbs torque.

5. Assemble the crankpin to the right flywheel. Again, place two drops of Loctite on the threads and face of the nut. Tighten the crankpin nut to 180 - 210 ft-lbs torque.

6. Check to be sure oil passages through pinion shaft, right flywheel and crankpin are clear by blowing compressed air into hole in end of pinion shaft.

7. Position right flywheel assembly in flywheel fixture, crankpin up.

8. See Figure 3-57. Install the rods and bearings on the crankpin using a thin film of petroleum jelly to retain the rollers. Never use a stiff, high temperature grease on the roller bearings. The forked rod is for the rear cylinder and the offset reinforcement on the front rod faces forward. If the front rod is turned 180° it will interfere with the rear rod.

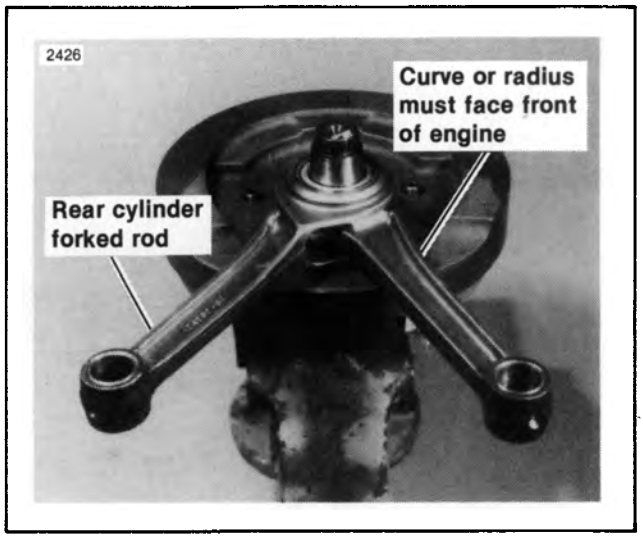


Figure 3-57. Connecting Rod Location

9. Install the left flywheel and shaft on the crankpin and apply Loctite to the threads and face of the nut.

10. See Figure 3-58. Place flywheel assembly in FLYWHEEL ASSEMBLY JIG, Part No. 34813. Tighten crankpin nut to a preliminary torque of 180 ft-lbs.

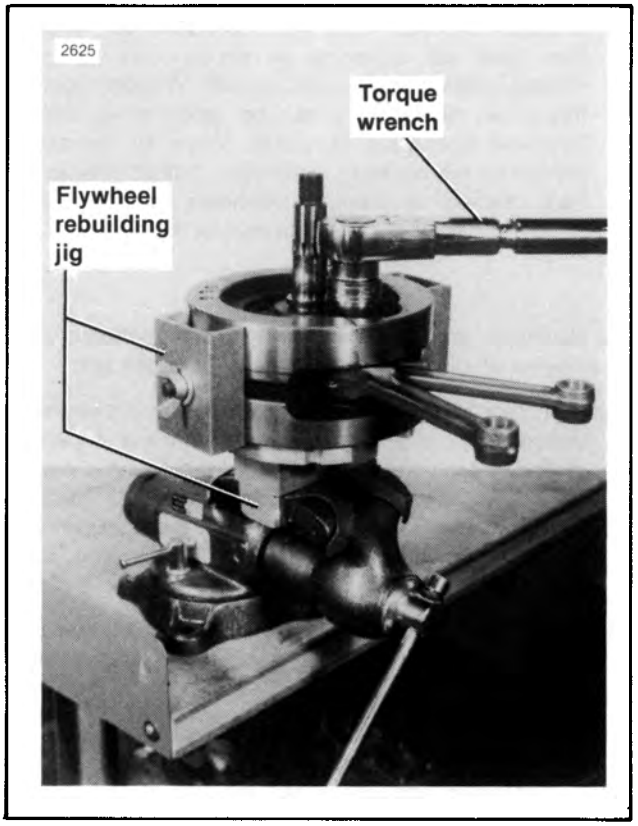


Figure 3-58. Assembling Flywheel

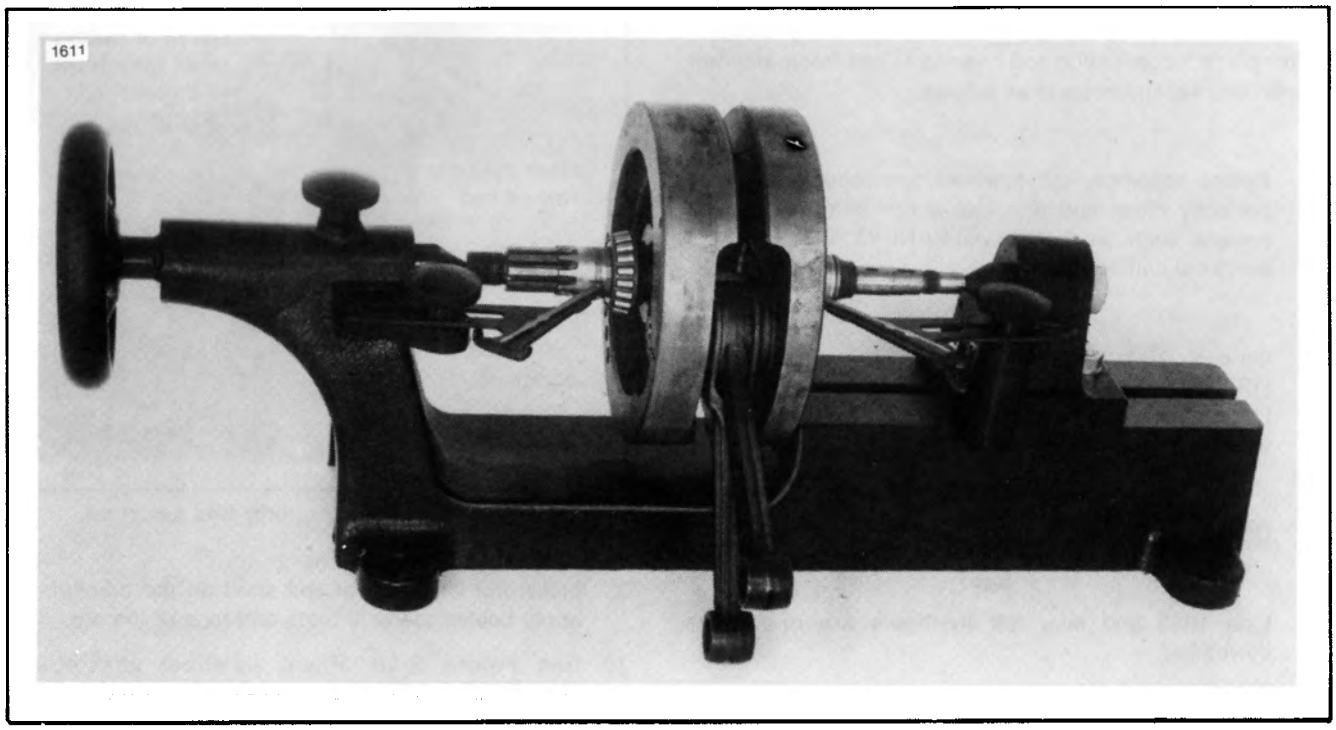


Figure 3-59. Flywheels on Truing Stand

11. See Figure 3-59. When nut is tightened to 180 ft-bs torque, install flywheel assembly in FLYWHEEL TRUING STAND, Part No. HD-96650-80. Tighten, then back off, adjusting so centers are snug but wheels rotate under weight of rods. 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 set.

12. Turn flywheels slowly and observe the movement of indicator pointers. Movement toward flywheels indicates high points of shafts. Find highest point of each shaft and chalk-mark flywheel rims at those points. Chalk marks must be parallel to pointers. Remove flywheel from truing stand and make corrections as stated in step 13.

13. See Figure 3-60. Flywheel may be out of true three ways, A, B, and C, or a combination of two of the three ways.

    a. When wheels are both out of true as described in "A", tighten C-clamp on rims or wheels opposite crankpin and lightly tap the rim at the crankpin with lead or copper mallet.

    b. When wheels are both out of true as indicated in "B", install a screw-type wedge between the wheels opposite the crankpin and lightly tap the rims near the crankpins with a mallet.

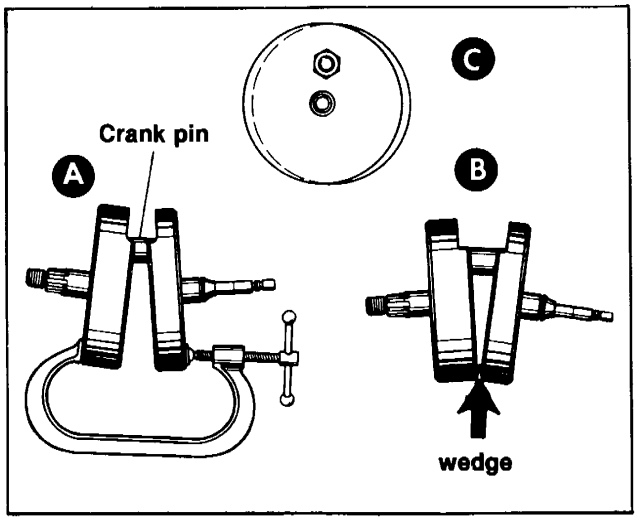


Figure 3-60. Types of Flywheel Misalignment

    c. When wheels are out of true as indicated in "C", strike the rim of the wheel a firm blow at about 90 degrees from crankpin on high side.

    d. When wheels are out of true in a combination of any of conditions shown, correct C first, tapping rim of offending wheel only, and then correct condition A or B.

NOTE

The number of blows required and how hard they should be struck depends on how far shafts are out of true and how tight nuts are drawn. Always remove the flywheels from the stand and strike the flywheel rim only at 90° to the crankpin. Use only a soft metal mallet. Never strike wheels a hard blow near crankpin. This could result in a broken crankpin.

14. 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.).

15. If it is impossible to true wheels, check for a dirty, damaged or enlarged tapered hole, or a sprocket or pinion shaft worn out of round at surface where indicator reading is being taken.

16. See Figure 3-59. Check connecting rod side play with thickness gauge. If it is greater than tolerance shown in engine SPECIFICATIONS, tighten crank pin nuts until within, but not exceeding torque limits. Insufficient play between rods and flywheel face is caused by one of the following conditions:

    a. Flywheel and crank pin assembled with oil on tapers and nuts over-tightened. Disassemble, clean, reassemble.

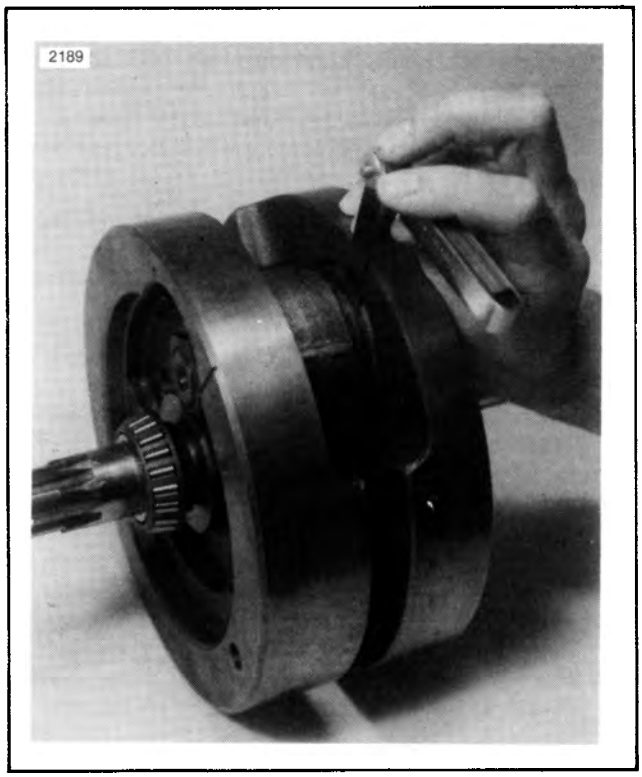


Figure 3-61. Check Connecting Rod Side Play

    b. New flywheel washers installed and not fully seated. Disassemble, inspect, replace deepest seating flywheel or exchange crankpin. As last resort, grind down width of forked rod.

    c. Tapered hole(s) enlarged as a result of having been taken apart several times. Replace flywheel(s).

After rod side play is checked and adjusted and crank pin nut tightened to specified torque, again recheck wheel trueness on truing stand. Correct any runout as above.

17. See Figure 3-58. When wheels are true, place flywheel in FLYWHEEL ASSEMBLY JIG, Part No. 34813 and using a torque wrench, tighten crank pin nuts to 210 ft-lbs final torque. Recheck for truing and runout, and if either is not within specification, repeat truing procedure.

Truing and Sizing Pinion Shaft Main Bearing Race

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.

See Figure 3-42. A race that is worn beyond limits of oversize bearings must be replaced. To remove bearing race, heat case to 275°-300° F. Heating expands case and makes it possible to remove bearing race using less force. See Figure 3-56. Make up a plug as shown. Press worn race (17) out and new race in. New race must be lapped slightly to true and align with left case bearing, and to attain a size compatible with roller sizes available.

Lapping Engine Main Bearing Races (Figure 3-62)

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.

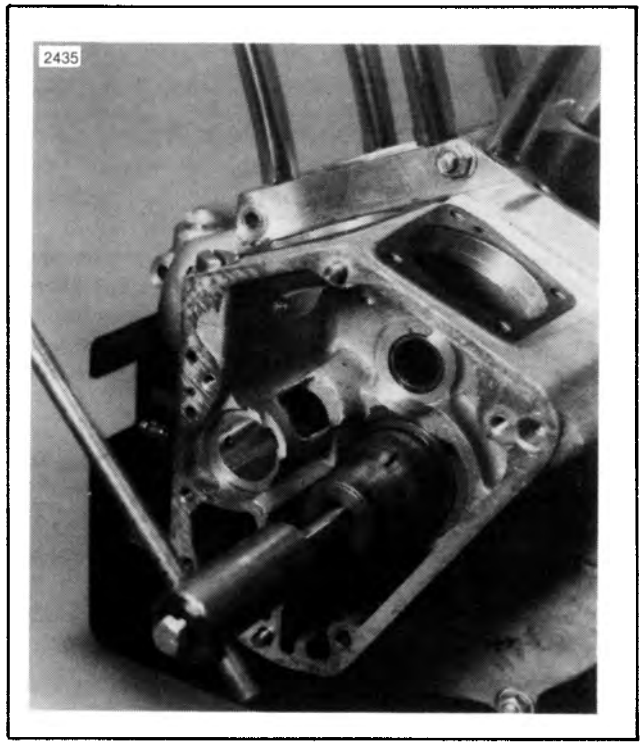


Figure 3-62. Lapping Pinion Shaft Main Bearing Race

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 0.156 in. rod as spanner until arbor begins to drag. Do not adjust arbor snug in bushing or bushing will "bell," a condition where hole is larger at ends than it is in the center.

4. Withdraw arbor far enough to coat lightly with 220 grit lapping compound. Do not apply a heavy coat. Reposition lap in bushing and turn handle at moderate hand speed. Work lap back and forth in bushing as it is revolved to avoid grooving and tapering.

5. At frequent intervals, remove lap from crankcase, wash and inspect bushing. Lapping is completed when entire bushing surface has a dull, satin finish rather than a glossy, smooth appearance. If necessary, flush off lap in cleaning solvent, air dry and apply fresh, light coat of fine lapping compound.

Fitting Sprocket Bearing

If flywheel end play is within tolerance and if tapered roller bearings and races pass visual check and have no apparent wear, the same set may be reinstalled. 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.

Replacing Pinion Shaft Bearings

CAUTION

Because of the extremely small tolerances involved, all measurements must be made as accurately as possible. Fitting bearings tighter than recommended may result in bearing seizure and damage when heat expands the parts. Excessive clearance will result in a noisy bearing.

All fitting and checking must be made with bearings, crankcase and pinion shaft clean and free of oil.

1. Inspect pinion shaft roller surface and crankcase bore race (17), Figure 3-42 for wear or damage. If roller surface and bore are clean and undamaged, go to step 3.

2. If crankcase bore race (17, Figure 3-42) or pinion shaft roller surface, or both, are scored, worn or damaged, you must:

   A. Lap the crankcase bore race (17), Figure 3-42 and pinion shaft roller surface until they are smoothly finished and replace the old bearings with new, oversize bearings.

   OR:

   B. Lap the crankcase bore and replace the old pinion shaft and bearings with a new pinion shaft and bearings.

   OR:

   C. Both crankcase bore and pinion shaft are too badly damaged to be reused. Replace crankcase race (17), Figure 3-42 and pinion shaft.

   OR:

   D. Pinion shaft is good and crankcase bore is damaged beyond reuse. Replace crankcase race (17), Figure 3-42. Replace old bearing with a new bearing that will fit both crankcase race and shaft.

3. If crankcase bore and pinion shaft roller surface are undamaged, or can be lapped for reuse, measure both carefully. Read the Pinion Shaft Bearing Chart and select the bearing set that will fit both dimensions correctly.

Example: If the bore measures 1.7509 in. and the shaft measures 1.2500 in., use a BLUE bearing set. This will fit a class two (2) crankcase and the shaft (GREEN).

NOTE

On new crankcases the class code is stamped below the right side bore. The pinion shaft color code is on the unground taper. The bearing color code is on the wrapper and carton.

4. If the crankcase bore is damaged and the pinion shaft is not, lap the crankcase bore until it is clean and smooth. Measure the bore and pinion shaft carefully. Read the chart. You must determine if the new bore size will allow you to use the existing pinion shaft with a bearing set within the range shown on the chart.

Example 1: The shaft is a standard size 1.2498 in. (GREEN) and the bore cleaned up at 1.7513 in. (class 3 crankcase). The chart indicates that a RED bearing set is correct for this range.

Example 2: The shaft is a standard size of 1.2502 in. (WHITE) , but the crankcase bore cleaned up at 1.7531 in. (class 3, O.S.). The chart indicates that the existing shaft is now undersize for the bore. To properly fit the new bore size you will have to use a 0.002 in. oversize (O.S.) shaft (1 RED), with a RED bearing set.

5. If you successfully lap the bore, but the shaft is damaged beyond reuse, see Example 2 above. Replace the shaft and bearing set with parts suitable for the bore size.

Pinion Shaft Bearing Chart

BORE SIZE (In.)	BEARING SETS (Color Coded to Shaft and Bore)					
1.7531 - 1.7533					Red (3)	Blue (3)
1.7529 - 1.7531					Blue (2)	White (2)
1.7527 - 1.7529					White (1)	Green (1)
1.7521 - 1.7523			Red (3)	Blue (3)		
1.7519 - 1.7521			Blue (2)	White (2)		
1.7517 - 1.7519			White (1)	Green (1)		
1.7511 - 1.7513	Red (3)	Blue (3) ←(Crankcase class code)				
1.7509 - 1.7511	Blue (2)	White (2)				
1.7507 - 1.7509	White (1)	Green (1)				
Color Code Shaft (In.)	Green 1.2498 - 1.2500	White 1.2500 - 1.2502 STD.	1 Blue 1.2508 - 1.2510	2 Blue 1.2510 - 1.2512 0.001 O.S.	1 Red 1.2518 - 1.2520	2 Red 1.2520 - 1.2522 0.002 O.S.

6. If the crankcase race (17), Figure 3-42 must be replaced, you will have to match the other components to the crankcase bore.

NOTE

If the crankcase is not damaged and the bore is outside the O.S. limits shown on the chart, replace the race (17), Figure 3-42, as explained in Truing and Sizing Pinion Shaft Main Bearing Race and Lapping Engine Main Bearing Races earlier in this section. Replace other components as explained.

7. If all components, crankcase race, shaft, bearings are damaged beyond repair, replace them all using standard size components.

ASSEMBLY (Figure 3-42)

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. See Figure 3-63. Position flywheel assembly, sprocket shaft up, in flywheel fixture. Press bearing (15, Figure 3-42) 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. 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.

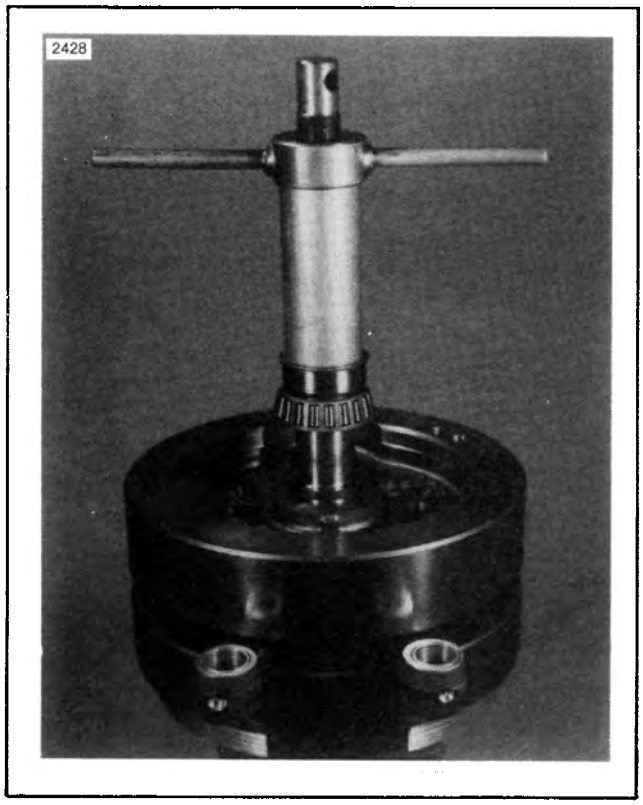


Figure 3-63. Pressing Bearing on Sprocket Shaft

4. See Figure 3-63. Install the bearing inner spacer (10, Figure 3-42) and tool sleeve and press bearing against flange on flywheel using the tool

5. Slip crankcase half, with outer race parts installed, over shaft. Slip bearing over tool screw, small end down toward inner spacer. Position tool sleeve and press bearings tightly together. Bearings must be tight against the bearing inner spacer to provide correct bearing clearance.

6. See Figure 3-42. 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, CRANKCASE SEALANT, Part No. HD-99650-81 or 3M #800 to mating surfaces.

7. See Figure 3-41. 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 15-19 ft-lbs torque. Tighten nuts on bolts to 15-19 ft-lbs torque.

8. See Figure 3-40. Check exact amount of flywheel end play with dial indicator as directed at the beginning of this section to determine if within specified limits.

9. See Figure 3-42. Install spacer (6). Press seal (7) into crankcase with lip toward flywheels on dry clutch models. On wet clutch models, lip should be away from 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.

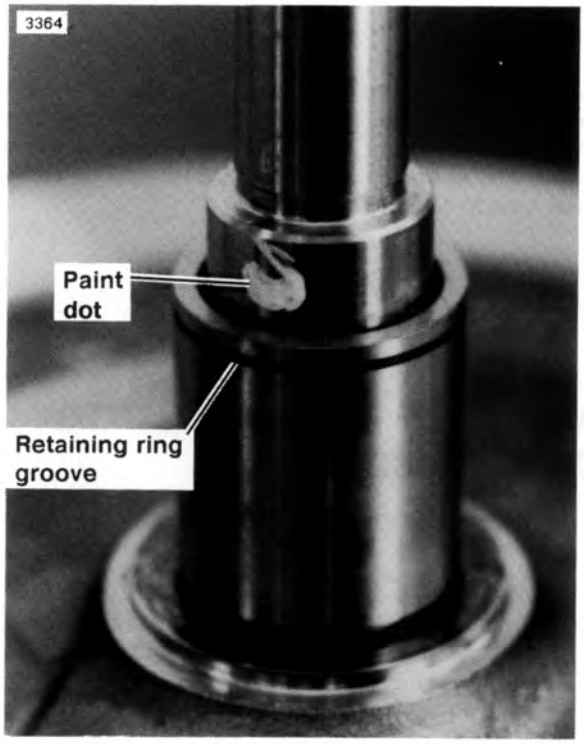
ONE-PIECE PINION SHAFT/FLYWHEEL – 1989 & LATER

FITTING PINION SHAFT BEARINGS

The same bearing sets are used with the one-piece flywheel that were used with the two-piece shaft and flywheel. Instead of shafts with oversized journals, the one-piece flywheel uses a pressed-on inner race that can be replaced and ground to the outside diameter (O.D.) needed for proper bearing fit.

FACTORY INNER RACE SIZE CODE

See Figure 3-64. A paint dot, located next to the inner race and in-line with the crankpin identifies the Class or O.D. of the inner race. See chart in Figure 3-64.



RACE O.D. (in.)	CLASS	IDENTIFICATION*
1.2502-1.2500	A	White
1.2500-1.2498	B	Green
*Paint dot		

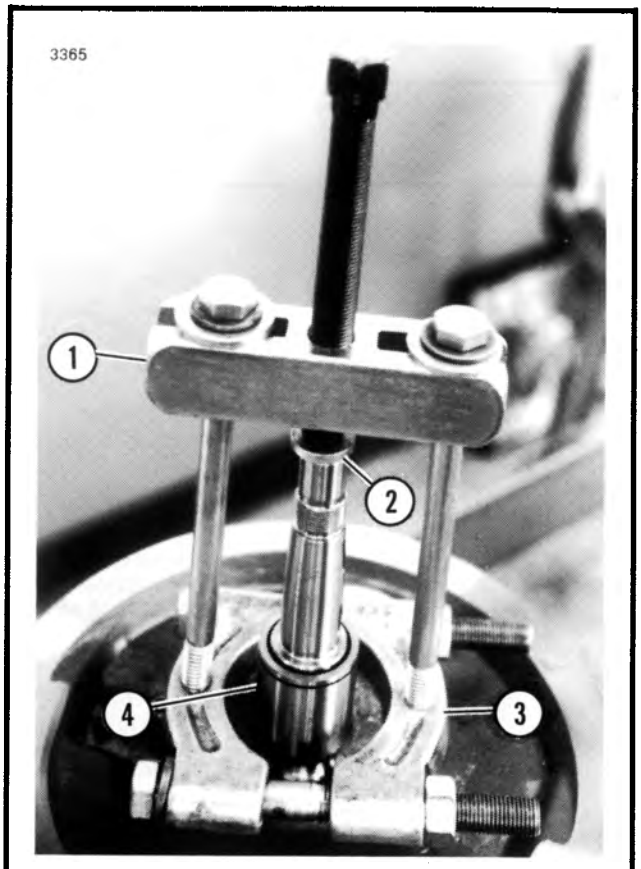
Figure 3-64. Factory Inner Race Sizes

REMOVING/INSTALLING RACE

CAUTION

To prevent damage to the pinion shaft center (and bearing journal) always use a shaft protector between the puller forcing screw and shaft when pulling pinion gear or bearing inner race. Exercise care with shaft protectors that have centering projections that could damage the shaft center or flare the end of the shaft. If a shaft protector is not available, breather gear washers H-D Part No. 25320-79 through 25328-79 may be used as shaft protectors.

1. See Figure 3-65. Remove inner race (4) with tools shown. Apply heat to race to aid removal.
2. See Figure 3-66. Press new race (1) on pinion shaft to the dimension shown. Figure 3-67 shows an installation tool that will locate the inner race properly when tool is "bottomed" on flywheel.

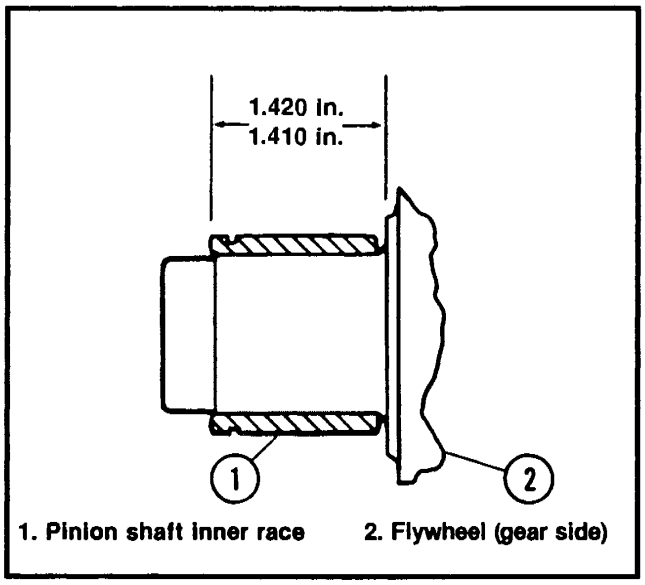


1. Puller HD-97292-61
2. Shaft protector HD-95652-43A or Washer 25324-79
3. Bearing separator, Snap-on® Tools stock no. CJ950 or equivalent
4. Inner race

Figure 3-65. Pulling Pinion Shaft Inner Race

CAUTION

Be certain retaining ring groove end of inner race is away from flywheel.



1. Pinion shaft inner race 2. Flywheel (gear side)

Figure 3-66. Inner Race Location

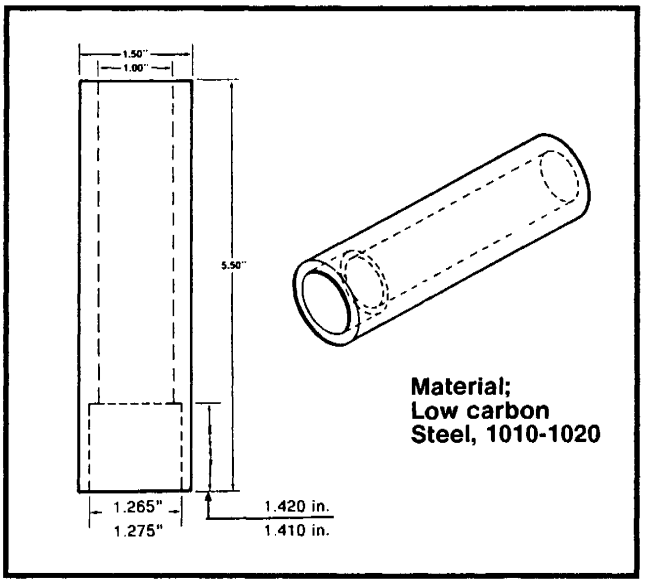


Figure 3-67. Inner Race Installation Tool

GRIND RACE

1. See **Pinion Shaft Bearing Chart** in **Lapping Engine Main Bearing Races.**
2. Find the BORE SIZE that was measured in the pinion outer race.
3. The new inner race must be ground, by a competent machinist, to O.D. dimension range given in bottom row of **Pinion Shaft Bearing Chart** for the finished lapped I.D. of the outer race. The finished inner race must meet these specifications:

Roundness:	within 0.0002 in.
Taper:	within 0.0002 in.
Surface finish:	16 RMS

NOTE

Have machinist grind inner race to center or middle of required O.D. range. This will prevent grinding inner race undersize and gives a more easily achieved tolerance range. For example, if BORE SIZE is 1.7518 in., grind inner race to 1.2510.

ASSEMBLE FLYWHEELS INTO CRANKCASE

1. Follow the same procedure as for 2-piece pinion/flywheel, but do not install pinion bearing set until after you have performed step 7 in ASSEMBLY.
2. Lubricate pinion shaft bearings with engine oil. Slip bearings on pinion shaft and into outer race in right crankcase. Install new retaining ring in groove of pinion shaft bearing inner race.

FUEL SYSTEM

SUBJECT **PAGE NO.**

SPECIFICATIONS

JET SIZES — 1984-1989

	FLT Models (early 1984)	FLT Models (late 1984-1986)	FLT Models (1987)
Main jet ..	No. 165	No. 175	No. 170
Slow jet ..	No. 50	No. 50	No. 50

	FXR Models (1984-1985)	FXR Models (1986)	FXR Models (1987)
Main jet ..	No. 160	No. 170	No. 165
Slow jet ..	No. 50	No. 50	No. 50

	FLT & FXR Models (1988-1989)	FLT & FXR Calif. Models (1988-1989)
Main jet	No. 165	No. 140
Slow jet	No. 52	No. 42

1990 CVH CARBURETOR JET SIZES

	FLT & FXR Models	FLT & FXR Calif. Models
Main jet	No. 185	No. 165
Slow jet	No. 45	No. 42

CAPACITY (U.S. GAL.)

	FLT	FXR
Fuel Tank		
Total	5.0	4.2
Reserve	0.7	0.4

TORQUES

FLT Models

1984-1989

Carburetor mounting nuts or bolts .....15-17 ft-lbs
Compliance fitting mounting bolts .....40-60 in-lbs
Compliance fitting hose clamps .....15-20 in-lbs

1990

Manifold to cylinder head bolts and nuts .....6-10 ft-lbs

AIR CLEANER
MOUNTING NUTS OR BOLTS — 1984-1985

Air cleaner bracket bolts (to cylinder heads) .....13-17 ft-lbs
(to backplate).....10-15 ft-lbs
Air cleaner backplate (to carburetor).....75-80 in-lbs
Air cleaner cover screws .....12-17 ft-lbs

AIR CLEANER MOUNTING BOLTS — 1986-1990

Air cleaner backplate screws
(to cylinder heads and bracket) .....10-12 ft-lbs
(to carburetor) .....3-5 ft-lbs
Air cleaner cover screws .....3-5 ft-lbs

FXR Models

1984-1989

Carburetor mounting bolts .....15-17 ft-lbs
Compliance fitting mounting bolts .....40-60 in-lbs
Compliance fitting hose clamps .....15-20 in-lbs

1990

Manifold to cylinder head bolts and nuts .....6-10 ft-lbs

AIR CLEANER
MOUNTING NUTS OR BOLTS — 1984-1985

Air cleaner bracket bolts (to cylinder heads) .13-17 ft-lbs
Air cleaner backplate (to bracket and carburetor).....7-10 ft-lbs
Backplate bottom bolt .....13-17 ft-lbs
Air cleaner cover screws .....12-17 ft-lbs

AIR CLEANER MOUNTING BOLTS — 1986-1990

Air cleaner backplate screws
(to cylinder heads and bracket) .....10-12 ft-lbs
(to carburetor) .....3-5 ft-lbs
Air cleaner cover screws .....3-5 ft-lbs

CARBURETOR 1984-1989

GENERAL (Figure 4-1)

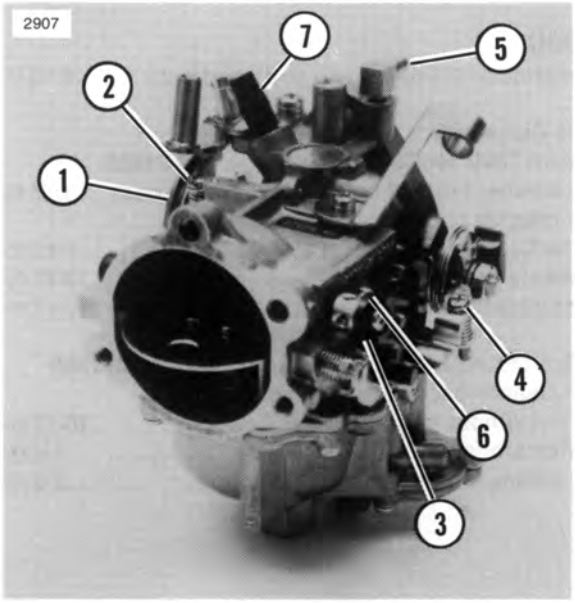
The carburetor is a horizontal, gravity fed type with a float operated inlet valve, an accelerating pump, a throttle stop screw for idle speed adjustment, and choke system with a high idle speed adjustment.

The carburetor has been specifically designed to control exhaust emissions. All jets are fixed. The idle mixture has been preset at the factory and 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.

A high altitude carburetor modification may be required to improve carburetion at altitudes over 4000 feet above sea level. Where there is evidence of over-richness causing loss of smooth combustion, stumbling upon acceleration or other driveability problems at high altitudes, see your Harley-Davidson dealer for this modification.

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 to over-lean fuel mixture.



1. Throttle lever
2. Thottle stop screw
3. Fast idle cam
4. Fast idle adjusting screw
5. V.O.E.S. vacuum nipple
6. Choke cable screw
7. Evap. vacuum nipple — California only

Figure 4-1. Carburetor

OPERATION

Choke (Figure 4-2)

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. See Figure 4-2. In the first position, choke knob all the way in, the choke plate is fully open and the engine operates at low idle speed.

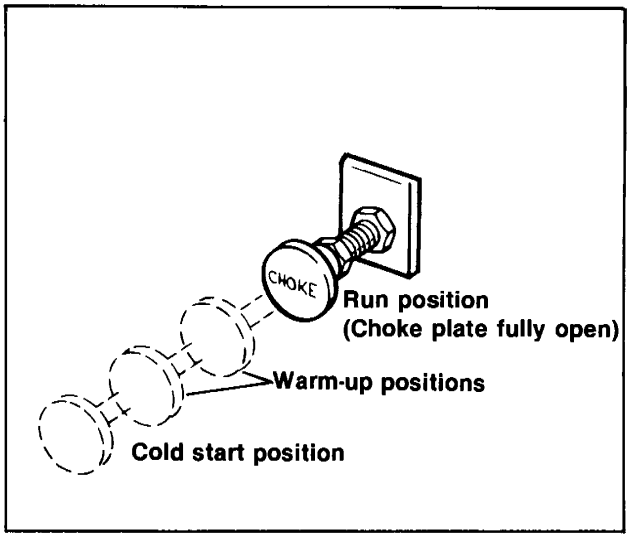


Figure 4-2. Setting the Choke

2. 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.

3. Adjust choke for best idle during warm-up.

Fuel Supply System (Figure 4-3)

Gasoline from the fuel 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 predetermined by float level setting.

Idle Circuit (Figure 4-4)

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 venturi almost entirely through the idle port where it is metered by the idle mixture screw.

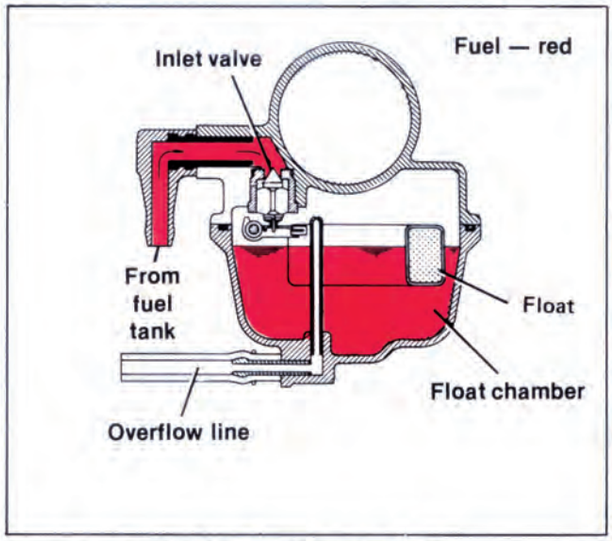


Figure 4-3. Fuel Supply System

As the throttle valve opens slightly the mixture also flows through the idle transfer ports as they become uncovered by the throttle valve.

Mid-Range Circuit (Figure 4-5)

As the throttle valve opens the air/fuel mixture from the slow jet is drawn into the venturi through the idle transfer ports. When the throttle valve uncovers the mid range port, raw fuel from the float chamber is also drawn into the engine.

High Speed Circuit (Figure 4-6)

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 4-7)

The accelerating pump system uses sudden throttle openings (rapid accelerations) to quickly inject raw 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 raw fuel past a check valve into the venturi. The check valve prevents backflow during this stroke. A spring then returns diaphragm to its original position and a new supply of fuel flows in under the diaphragm from the float chamber for the next acceleration.

NOTE

See Figures 4-8, 4-9 to locate and identify carburetor body passages.

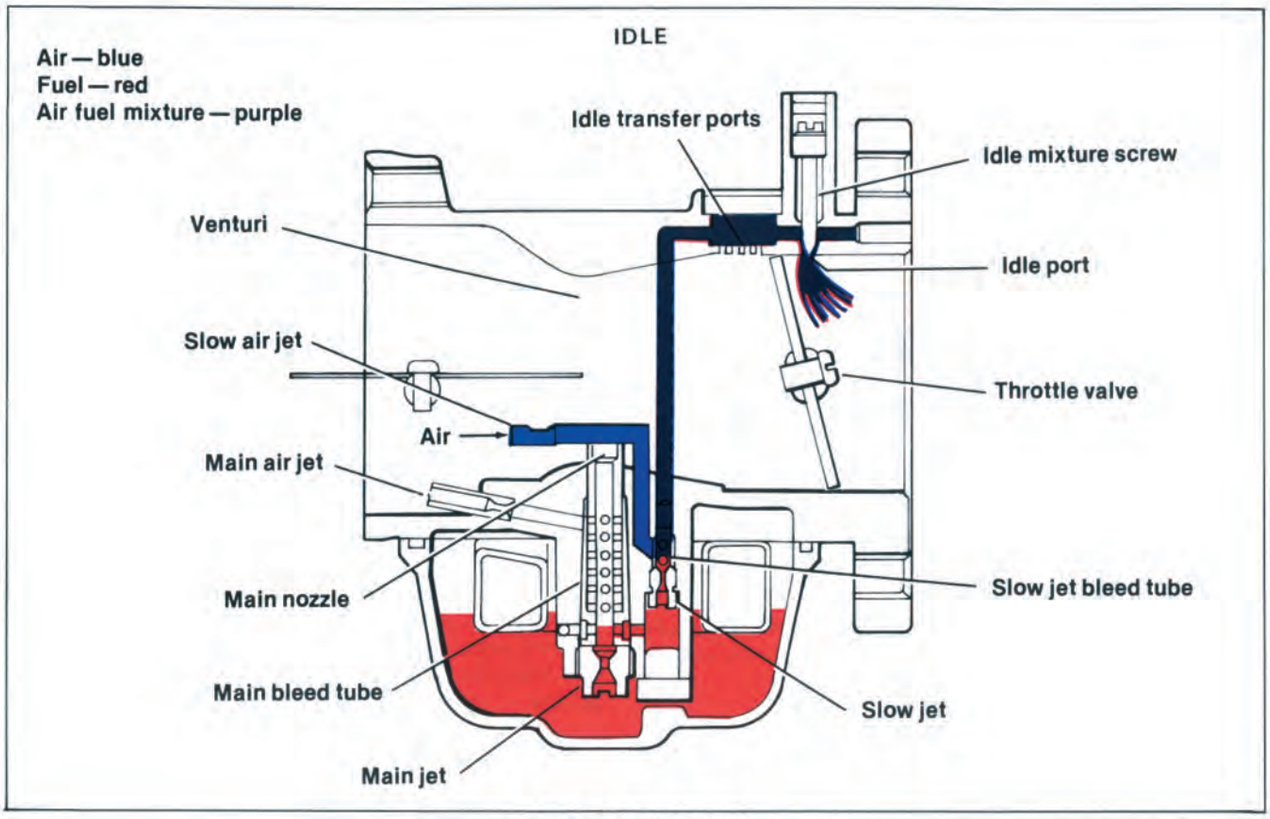


Figure 4-4. Idle Circuit

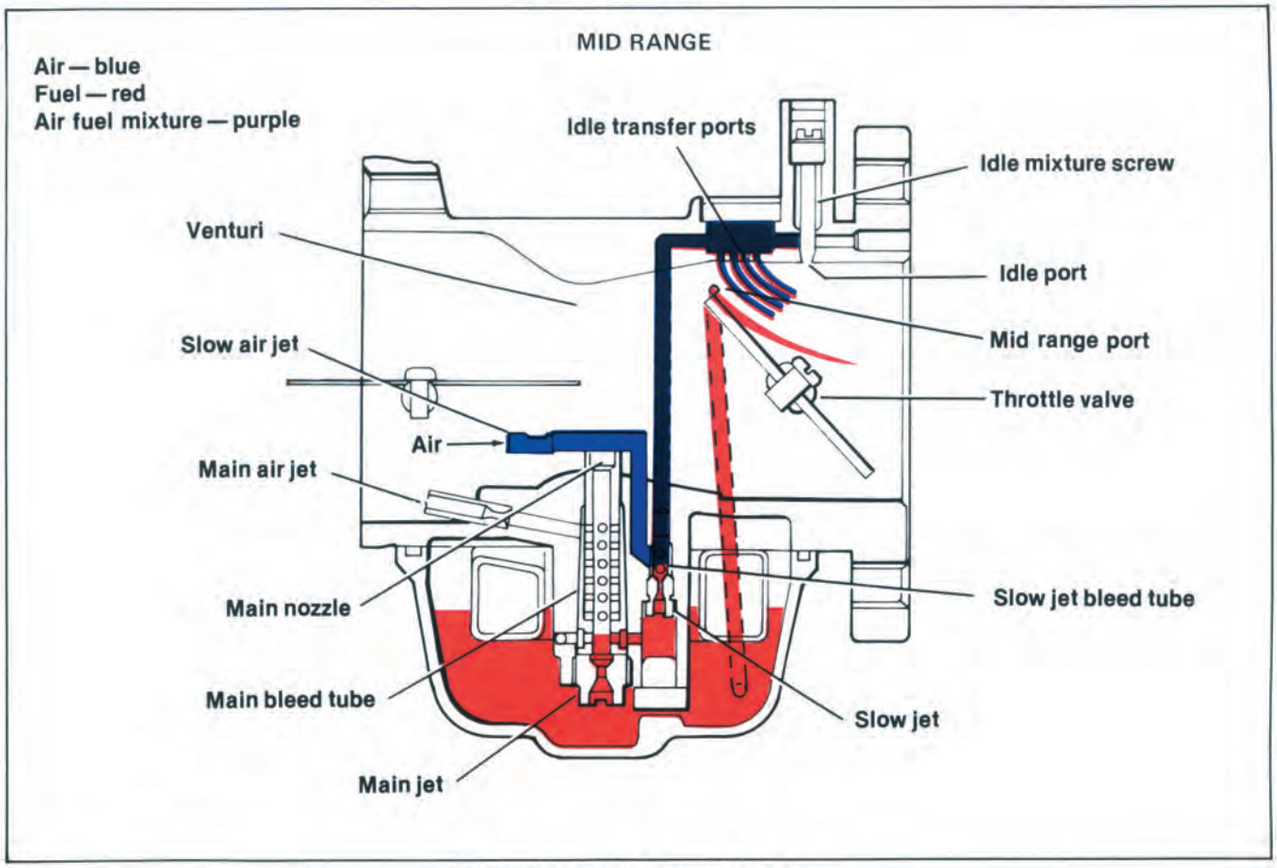


Figure 4-5. Mid-Range Circuit

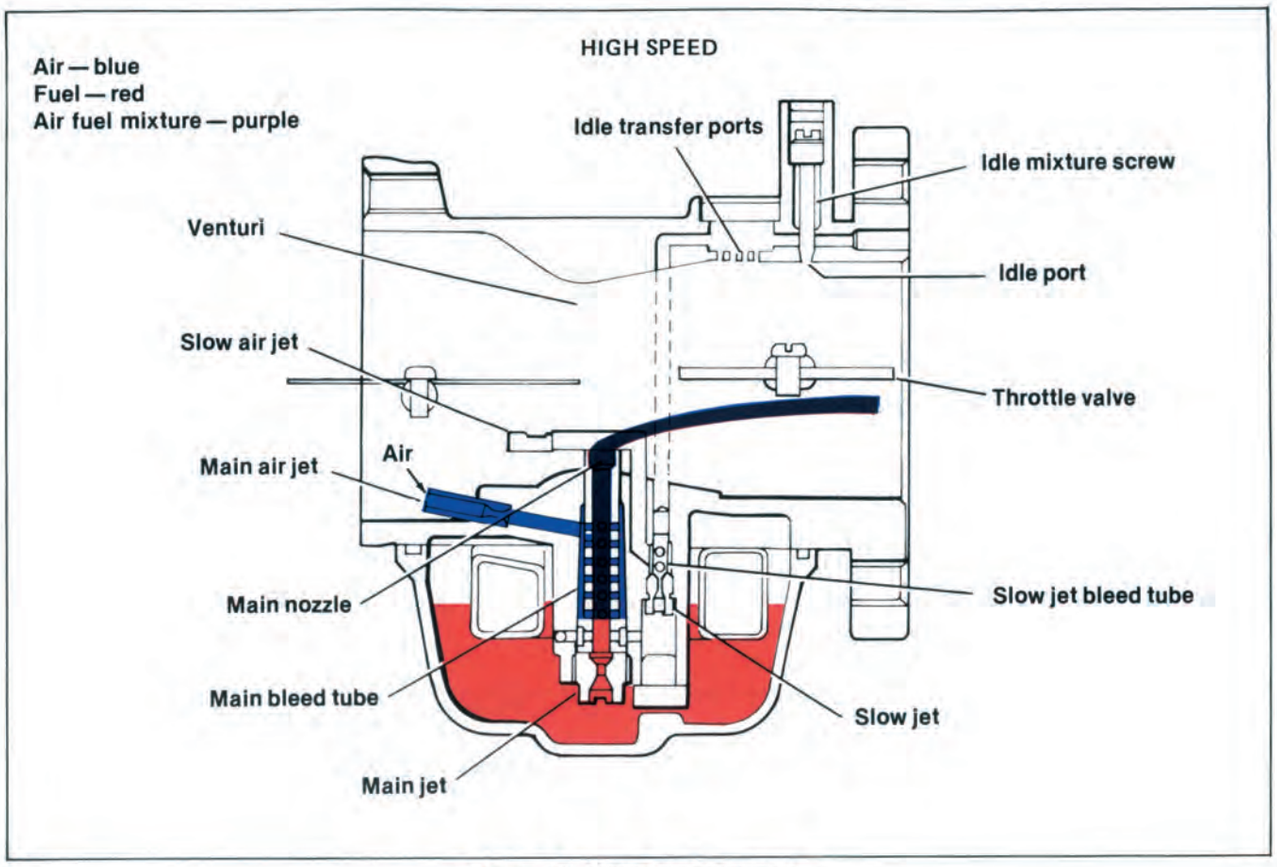


Figure 4-6. High Speed Circuit

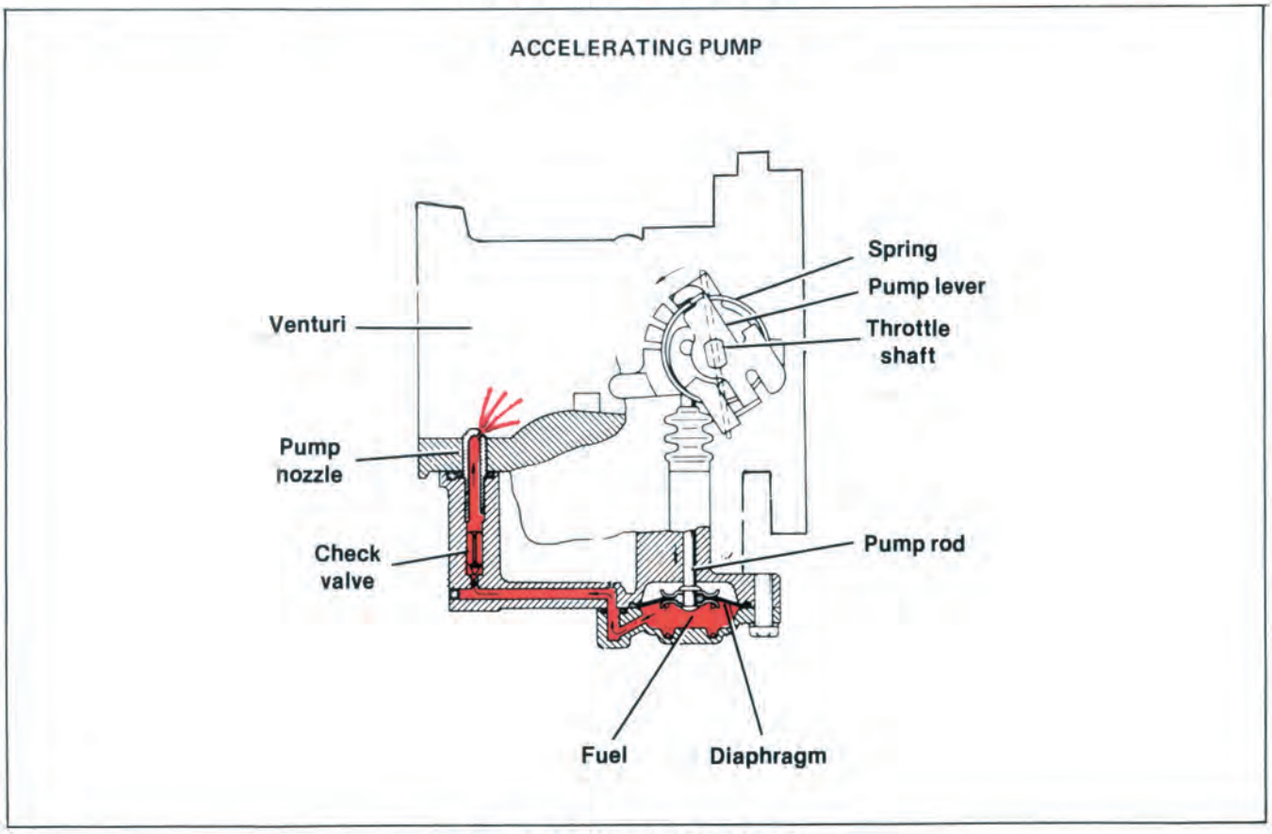


Figure 4-7. Accelerating Pump

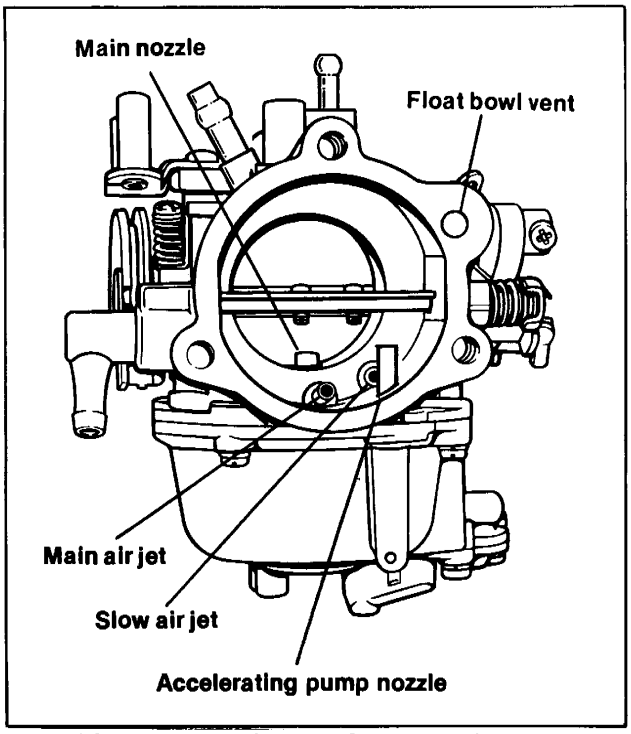


Figure 4-8. Air Cleaner Side of Carburetor

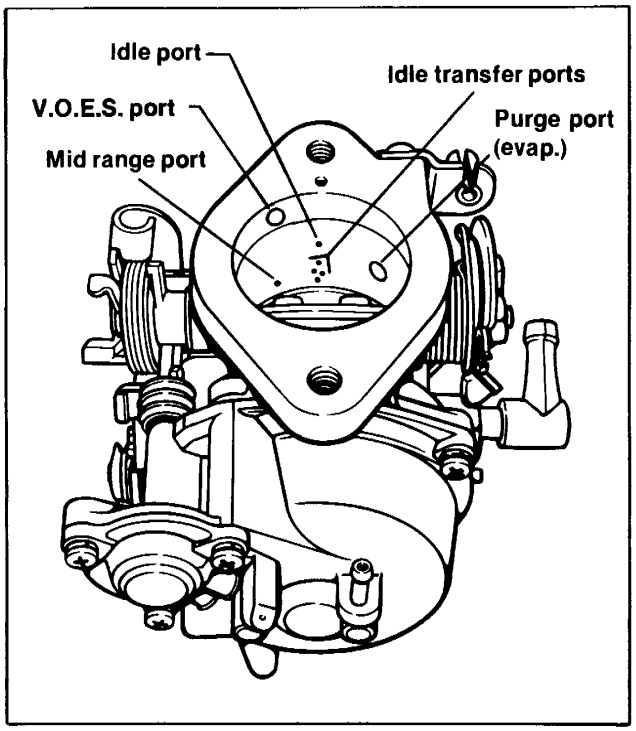


Figure 4-9. Engine Side of Carburetor

ADJUSTMENTS

Before adjusting carburetor be certain the IGNITION SYSTEM, Section 8, is functioning properly and that the ignition timing is correct.

Slow Idle

NOTE

Vehicle must be in an upright position.

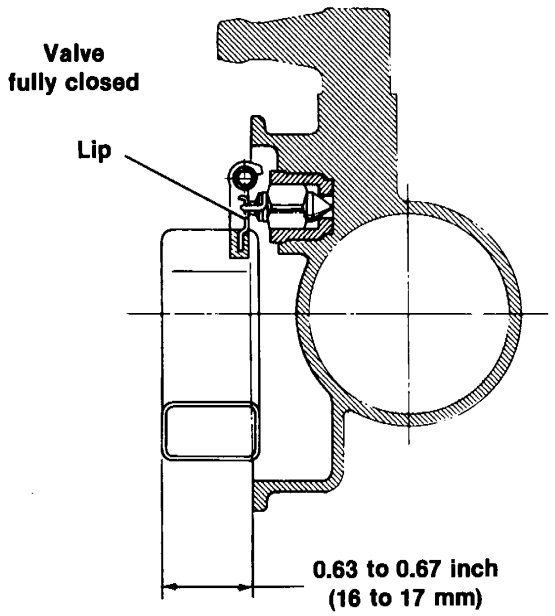
With the engine at normal operating temperature and the choke knob all the way in (choke fully open), adjust the throttle stop screw (Figure 4-1) so the engine idles at 900-950 rpm for 1984-1987 models. Set idle to 1000-1050 rpm for 1988 models.

Fast Idle

1. Bring engine up to normal operating temperature.
2. Remove air cleaner following procedure given in this section.
3. See Figure 4-1. Loosen choke cable screw.
4. Set choke to the second position (first detent from full open position).
5. Turn the fast idle adjusting screw in or out to set the fast idle at 1500 rpm.
6. Readjust choke cable.
7. Install air cleaner.

Float Level

1. Remove the carburetor following procedure under REMOVAL.
2. Remove the float bowl as described under CARBURETOR DISASSEMBLY.
3. See Figure 4-10. Hold carburetor on its side so that the float will be suspended, from the float pin, in a vertical position. Use a dial caliper 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 this section.



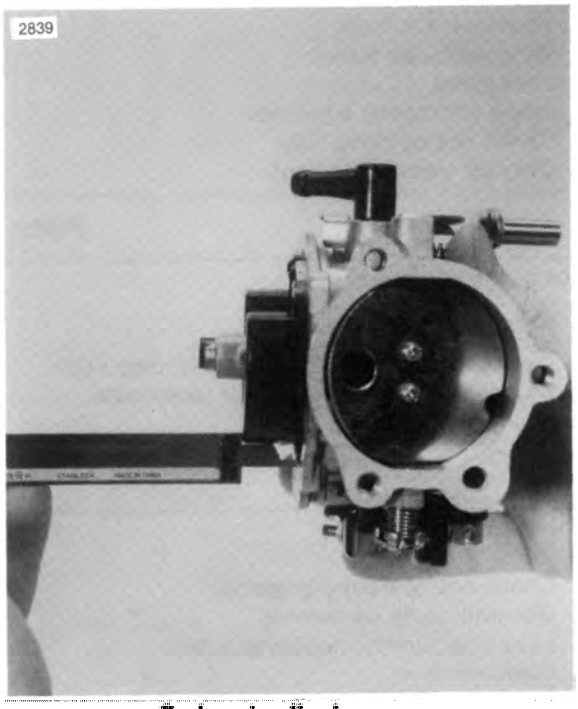


Figure 4-10. Float Adjustment

TROUBLESHOOTING (Figure 4-12)

Overflow	
Check for:	Remedy:
1. Worn inlet valve (18) or dirty inlet valve seat.	1. Replace valve (18) or clean valve seat.
2. Improper fuel level in float chamber (26).	2. Adjust float (20) 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 and 32).	6. Tighten screws (31 and 32).
7. Deformed float (20).	7. Replace float (20).
8. Pressurized fuel tank.	8. Relieve pressure - check fuel filler cap.
Poor Idling	
Check for:	Remedy:
1. Fuel filler cap not venting.	1. Replace fuel filler cap.
2. Idling improperly adjusted.	2. Adjust idle speed.
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.
Poor Fuel Economy	
Check for:	Remedy:
1. Fuel filler cap not venting.	1. Replace fuel filler cap.
2. Fuel level too high.	2. Adjust level of float (20).
3. Clogged bleed tubes.	3. Clean.
4. Loose jets.	4. Tighten.
5. Idling improperly adjusted.	5. Adjust idle speed.
6. Choke not opening fully.	6. Inspect choke and choke wire and adjust or replace.
7. Dirty air cleaner element.	7. Clean.
Poor Acceleration	
Check for:	Remedy:
1. Clogged accelerating system.	1. Clean.
2. Damaged accelerating pump diaphragm (28).	2. Replace diaphragm (28).
3. Clogged low speed jet (22) or bleed tube.	3. Clean.
4. Fuel level too low.	4. Adjust level of float (20).
Hard Starting	
Check for:	Remedy:
1. Choke 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.

Poor Performance On Road

Check for:	Remedy:
1. Fuel filler cap not venting.	1. Replace fuel filler cap.
2. Idling improperly adjusted.	2. Adjust idle.
3. Fuel overflow.	3. Inspect float (20) and fuel valve (18) and adjust or replace.
4. Main jet (23) loosened.	4. Inspect main jet (23) and tighten.
5. Air leak in intake system.	5. Check air cleaner backing plate and manifold mounting.
6. Dirty or clogged carburetor or air cleaner.	6. Clean

Poor High Speed Performance

Check for:	Remedy:
1. Fuel filler cap not venting.	1. Replace fuel filler cap.
2. Loose main jet (23).	2. Inspect main jet and tighten.
3. Improper fuel level in float chamber.	4. Adjust float (20) mounting tabs for correct fuel level.
4. Dirt lodged in strainer in fuel tank.	4. Clean strainer.
5. Clogged main jet (23) or main jet air passage.	5. 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. Fuel filler cap not venting.	1. Replace fuel filler cap.
2. Clogged fuel line.	2. Clean.
3. Dirty fuel tank.	3. Clean.
4. Air leaking into system.	4. Check mounting nuts for tightness or replace insulator (17).
5. Accelerating pump not working.	5. Repair.
6. Clogged fuel strainer in fuel tank.	6. Clean strainer.
7. Generally dirty carburetor.	7. Disassemble and clean.

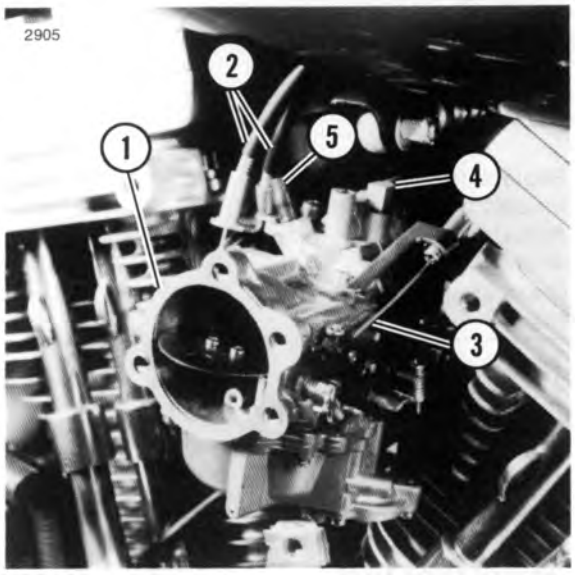
Loss of Power (Air Insufficient)

Check for:	Remedy:
1. Dirty air cleaner element.	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 (22 and 23).

REMOVAL

1. Remove the air cleaner and backplate. See AIR CLEANER REMOVAL later in this section.

2. See Figure 4-11. Turn the fuel valve off. Disconnect the fuel and V.O.E.S. hoses (1 and 4), throttle cables (2) and choke cable (3) from the carburetor. Disconnect evap hose (California models) or remove cap (5).



1. Fuel hose
2. Throttle cable
3. Choke cable
4. V.O.E.S. hose
5. Evap. hose - Calif. only
Cap - all except Calif.

Figure 4-11. Carburetor Mounting

3. Remove the two bolts and lockwashers that fasten the carburetor to the manifold. Remove the carburetor and insulator block.

DISASSEMBLY (Figure 4-12)

Accelerating Pump

Remove two screws (31), one long screw (32), the housing (30), spring (29) and diaphragm (28). Remove the O-ring (27) from the housing (30).

Float Chamber

1. Remove 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 accelerating pump rod (7) from the rocker arm (39).

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), throttle lever or high idle cam assembly (14) and 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 4-12)

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.

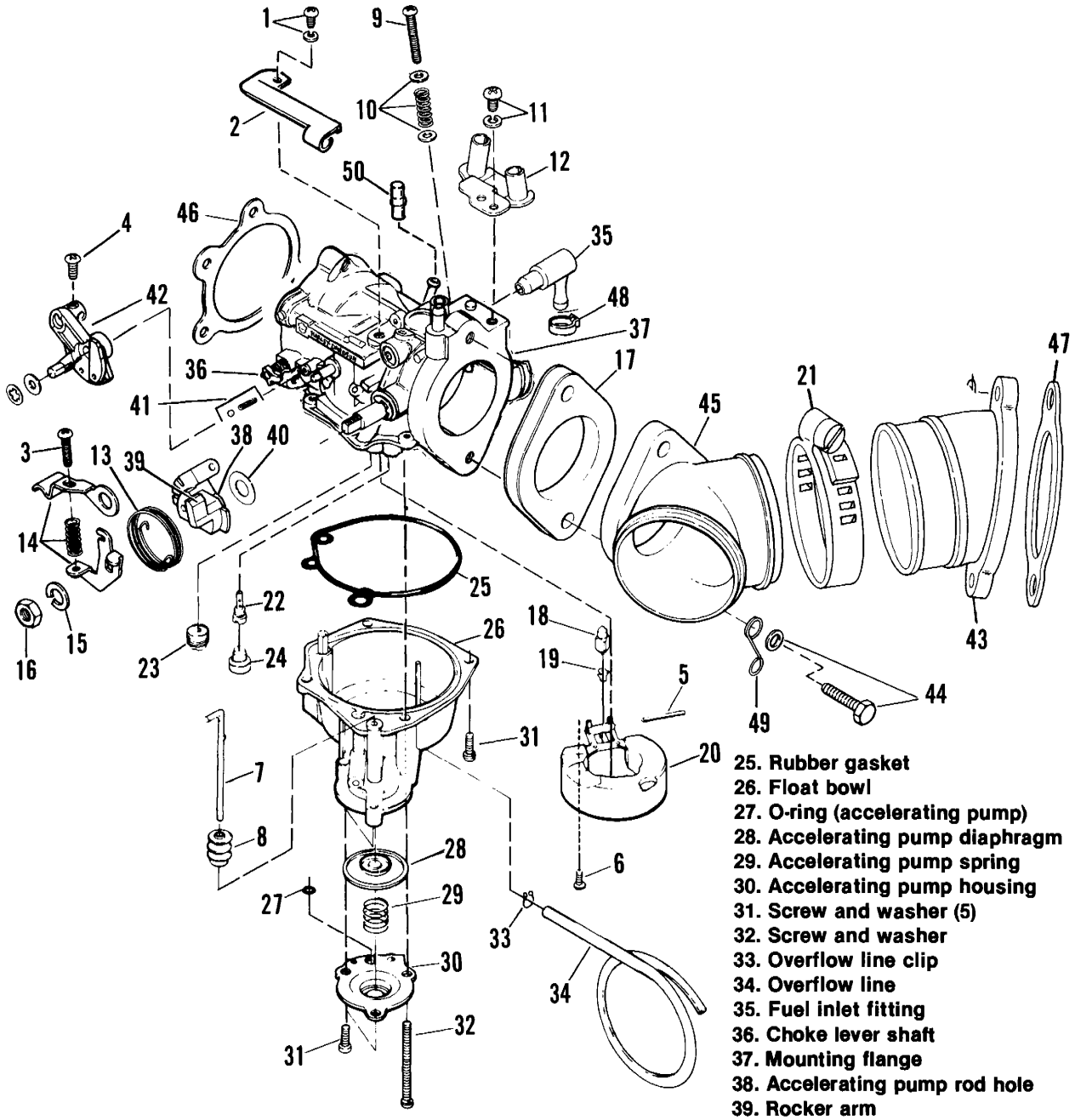
3. Replace the float if it is cracked or damaged.

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.



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. Clamp
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. Choke lever shaft
37. Mounting flange
38. Accelerating pump rod hole
39. Rocker arm
40. Washer
41. Choke detent ball and spring
42. Fast idle cam
43. Compliance fitting
44. Mounting bolts and lockwasher (2)
45. Intake manifold
46. Gasket
47. Gasket
48. Clamp (2)
49. Cable guide
50. Cap (evap. purge port)

Figure 4-12. Carburetor

ASSEMBLY (Figure 4-12)

Carburetor Body

1. Install the brackets (2 and 12) using the two screws (1 and 11).

2. Install the spring (13), throttle lever or 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) and install the accelerator pump rod (7) on the rocker arm (39).

2. Install the inlet valve (18) and clip (19) on the float (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 4-12)

1. Fasten the carburetor and insulator block to intake manifold using the lockwashers and bolts (44). Tighten the bolts alternately to 10-14 ft-lbs torque.

2. See Figure 4-11. Connect the fuel and V.O.E.S. hoses (1 and 4), throttle cables (2) and choke cable (3) to the carburetor. Connect evap. hose (California models) or install cap (5).

   Adjust throttle and choke cables. See ADJUSTMENTS in Section 2

3. Run float bowl vent line (34) down between engine and transmission.

4. Adjust slow and fast idle. See ADJUSTMENTS.

5. Install the air cleaner and backplate. See AIR CLEANER in this section.

CARBURETOR - 1990

GENERAL (Figure 4-13)

The carburetor is a constant velocity, gravity fed type with a float operated inlet valve, a variable venturi, a throttle stop screw for idle speed adjustment and a fuel enrichment system for starting.

Idle and transfer ports provide a balanced fuel mixture during the transition period from stop to mid-range. A vacuum piston controls venturi opening.

The carburetor is specifically designed to control exhaust emissions. All jets are fixed. The idle mixture has been pre-set at the factory.

The idle mixture screw is recessed in the carburetor casting. The opening is sealed with a plug because it is intended that the idle mixture be non-adjustable.

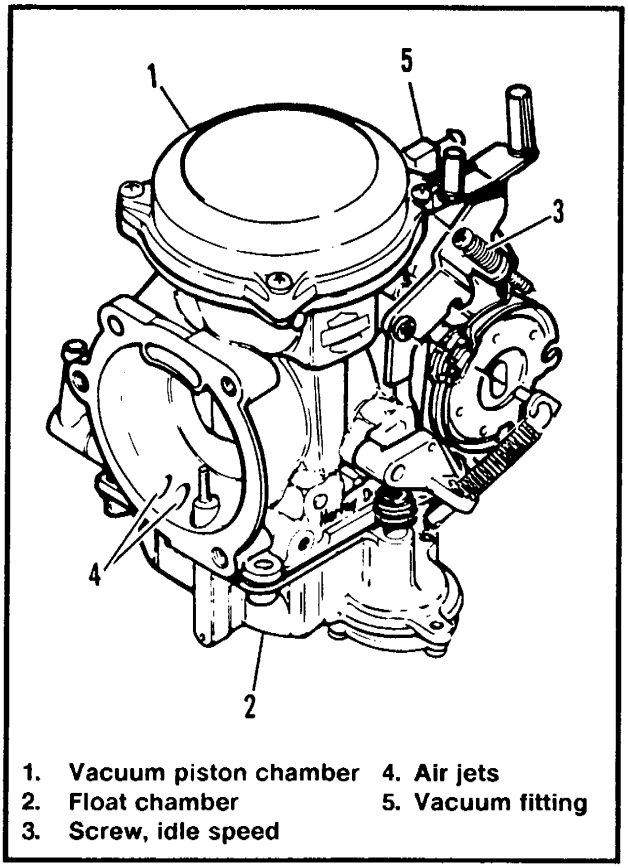
NOTE

Adjusting mixture setting by procedures other than specified in this section may be in violation of Federal or State regulations.

This system partially compensates for changes in the mixture that are normally caused by changes in altitude. Because atmospheric pressures drop as altitude increases, The pressure difference in the upper and lower chambers is reduced, which provides less fuel to the engine.

The carburetor has a drain for emptying the float chamber during seasonal or extended periods of storage.

The carburetor is equipped with an accelerator pump. The accelerator pump system uses sudden throttle openings (rapid accelerations) to quickly inject raw fuel into carburetor venturi to provide extra fuel for smooth acceleration.



1. **Vacuum piston chamber**
2. **Float chamber**
3. **Screw, idle speed**
4. **Air jets**
5. **Vacuum fitting**

Figure 4-13. CVH Carburetor

TROUBLESHOOTING (Figure 4-24)

OVERFLOW

Check for:	Remedy:
1. Damaged or non-venting fuel tank cap.	1. Replace cap.
2. Loose float bowl screws.	2. Tighten screws.
3. Damaged float bowl O-ring.	3. Replace O-ring
4. Damaged or leaking float assembly.	4. Replace float assembly
5. Particle contamination in inlet fitting cavity.	5. Clean and clear cavity and fuel supply tract
6. Worn or dirty inlet valve or seat.	6. Clean or replace valve and clean seat.
7. Improper fuel level in float bowl.	7. Adjust float tab for correct fuel level.
8. Misaligned float halves.	8. Align and adjust float level.

POOR IDLING

Check for:	Remedy:
1. Idle speed improperly adjusted.	1. Adjust operating idle speed.
2. Inlet system air leak	2. Correct as required.
3. Loose low speed jet	3. Tighten jet.
4. Plugged low speed jet	4. Clean contaminants and clear passages.
5. Contaminated or plugged low speed system.	6. Adjust, clean, or replace.
6. Enrichener valve not seated or leaking.	7. Repair
7. Leaking accelerator pump	

POOR FUEL ECONOMY

Check for:	Remedy:
1. Excess use of enrichment system.	1. Limit system use.
2. Enrichener valve not seated or leaking.	2. Adjust, clean or replace.
3. Dirty air cleaner element.	3. Clean or replace as required.
4. Damaged or non-venting fuel tank cap.	4. Replace cap.
5. High speed riding style.	5. Modify riding habits.
6. Idle speed improperly adjusted.	6. Adjust operating idle speed.
7. Loose jets.	7.Tighten jets.
8. Fuel level too high.	8. Adjust float level.
9. plugged or restricted bowl vent.	9. Clean and clear passages.
10. Worn or damaged needle or needle jet.	10. Replace needle or needle jet.
11. Vacuum piston assembly malfunction.	11. See Vacuum Piston troubleshooting.
12. Plugged air jets or passages.	12. Clean and clear passages.
13. Excessive accelerator pump output	13. Replace accelerator pump nozzle

POOR ACCELERATION

Check for:	Remedy:
1. Throttle cables misaligned.	1. Adjust throttle cables.
2. Inlet system air leak.	2. Correct as required.
3. Damaged or non-venting fuel tank cap.	3. Replace cap.
4. Restricted fuel supply passages.	4. Correct and clear restriction.
5. Plugged bowl vent or overflow.	5. Clean and clear passages.
6. Enrichener valve not seated or leaking.	6. Adjust, clean or replace.
7. Worn or damaged needle or needle jet.	7. Replace assembly.
8. Vacuum piston malfunction.	8. See Vacuum Piston troubleshooting.
9. Plugged jets or passages.	9. Clean and clear as required.
10. Fuel level (float chamber) too low.	10. Adjust float level.
11. Accelerator pump leaking or no output	11. Repair as necessary

Hard Starting

Check for:	Remedy:
1. Enrichener system plugged, not properly functioning or improperly operated.	1. Clean adjust, replace or read Owner's Manual
2. Inlet system air leak.	2. Correct as required.
3. Restricted fuel supply.	3. Correct fuel supply or passages.
4. Fuel overflow.	4. See Overflow Troubleshooting.
5. Plugged slow jet or passages.	5. Clean and clear jet or passages.

Poor Performance on Road

Check for:	Remedy:
1. Idle speed improperly adjusted.	1. Adjust operating idle speed.
2. Inlet system air leak.	2. Correct as required.
3. Damaged or non-venting fuel tank cap.	3. Replace cap.
4. Dirty or damaged air cleaner element.	4. Clean or replace.
5. Enrichener valve not seated or leaking.	5. Adjust, clean or replace.
6. Restricted fuel supply tract.	6. Correct and clear restriction.
7. Plugged bowl vent or overflow.	7. Clean and clear passages.
8. Loose or plugged fuel and air jets or passages.	8. Clean, clear and correct as required.
9. Worn or damaged needle or needle jet.	9. Replace assembly.
10. Vacuum piston assembly malfunction.	10. See Vacuum Piston Troubleshooting.
11. Accelerator pump inoperative.	11. Repair as required.

POOR HIGH SPEED PERFORMANCE

Check for:	Remedy:
1. Inlet system air leak.	1. Clean or replace.
2. Enrichener valve not seated or leaking.	2. Adjust, clean or replace.
3. Damaged or non-venting fuel tank cap.	3. Replace cap.
4. Restricted fuel supply tract.	4. Correct and clean restriction.
5. Dirty or damaged air cleaner element.	5. Clean or replace.
6. Plugged bowl, vent or overflow.	6. Clean and clear passages.
7. Worn or damaged needle or needle jet,	7. Replace assembly.
8. Vacuum piston assembly malfunction.	8. See Vacuum Piston Troubleshooting.
9. Loose or plugged main jets or passages.	9. Tighten, clean, clear as required.
10. Improper fuel level.	10. Adjust float level.
11. Accelerator pump inoperative	11. Repair as required

VACUUM PISTON ASSEMBLY TROUBLESHOOTING

PISTON DOES NOT RAISE PROPERLY	
Check for:	**Remedy:**
1. Enrichener valve open, not seated or leaking.	1. Adjust, clean or replace.
2. Piston atmosphere vent blocked.	2. Clear vent.
3. Diaphragm cap loose, damaged or leaking.	3. Tighten or replace cap.
4. Spring binding.	4. Correct or replace spring.
5. Diaphragm pinched at lip groove.	5. Reposition diaphragm lip.
6. Torn diaphragm.	6. Replace piston diaphragm assembly.
7. Piston binding.	7. Clean piston slides and body or replace piston.
8. Piston vacuum passage plugged.	8. Clean and clear passage.
PISTON DOES NOT CLOSE PROPERLY	
Check for:	**Remedy:**
1. Spring damaged.	1. Replace spring.
2. Piston binding.	2. Clean piston slides and body or replace piston.
3. Piston diaphragm ring dirty or damaged.	3. Clean or replace piston.

OPERATION

Enrichener (Figure 4-14)

The enrichener knob, under the left side fuel tank, controls opening and closing the enrichener circuit in the carburetor. The enrichener knob can be adjusted to any position, from full-in to full-out.

COOL ENGINE

BE SURE THROTTLE IS CLOSED. Pull enrichener knob fully out. Turn the ignition switch on and press starter switch to operate the electric starter.

The vehicle should be allowed to warm up for 15-30 seconds before being driven. Initial warm-up periods longer than 30 seconds are not recommended.

CAUTION

You must pay close attention to a C. V. carburetor equipped vehicle's warm up time. Both excessive use and insufficient use of the enrichener may cause poor performance, erratic idle, poor fuel economy and spark plug fouling.

Outside Temperature Less than 50°

1. After initial 15-30 second warm-up, ride for 5 minutes or 3 miles with enrichener knob in full out position.
2. After 5 minutes or 3 miles, push the enrichener knob in $^1/_2$ way. Ride 2 minutes or 2 miles.
3. After 2 minutes or 2 miles, push the enrichener knob fully in.

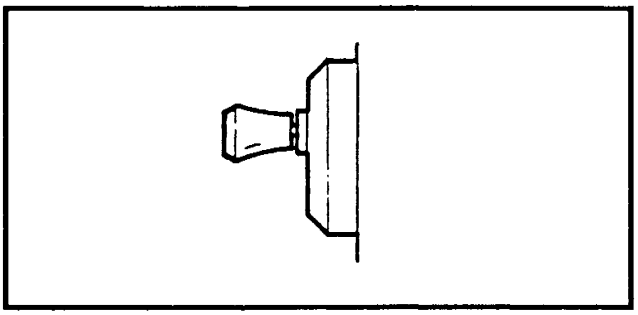


Figure 4-14. Enrichener Knob Fully In

Outside Temperature Greater than 50° F.

1. After initial 15-30 second warm-up, ride for 3 minutes or 2 miles with enrichener knob in full out position.
2. After 3 minutes or 2 miles, push the enrichener knob in $^1/_2$ way. Ride 2 minutes or 2 miles.
3. After 2 minutes or 2 miles, push the enrichener knob fully in.

WARM OR HOT ENGINE

Open throttle 1/8-1/4. Turn on ignition switch and operate electric starter. See Figure 4-14. DO NOT USE ENRICHENER.

Fuel Supply System (Figure 4-15)

Fuel from the fuel tank passes through the inlet valve into the float chamber. The fuel entering the chamber causes the float to rise until it shuts off the fuel valve, stopping flow at a level pre-determined by float level setting.

The float chamber is vented to atmosphere through an air passage opening in the air cleaner mounting flange.

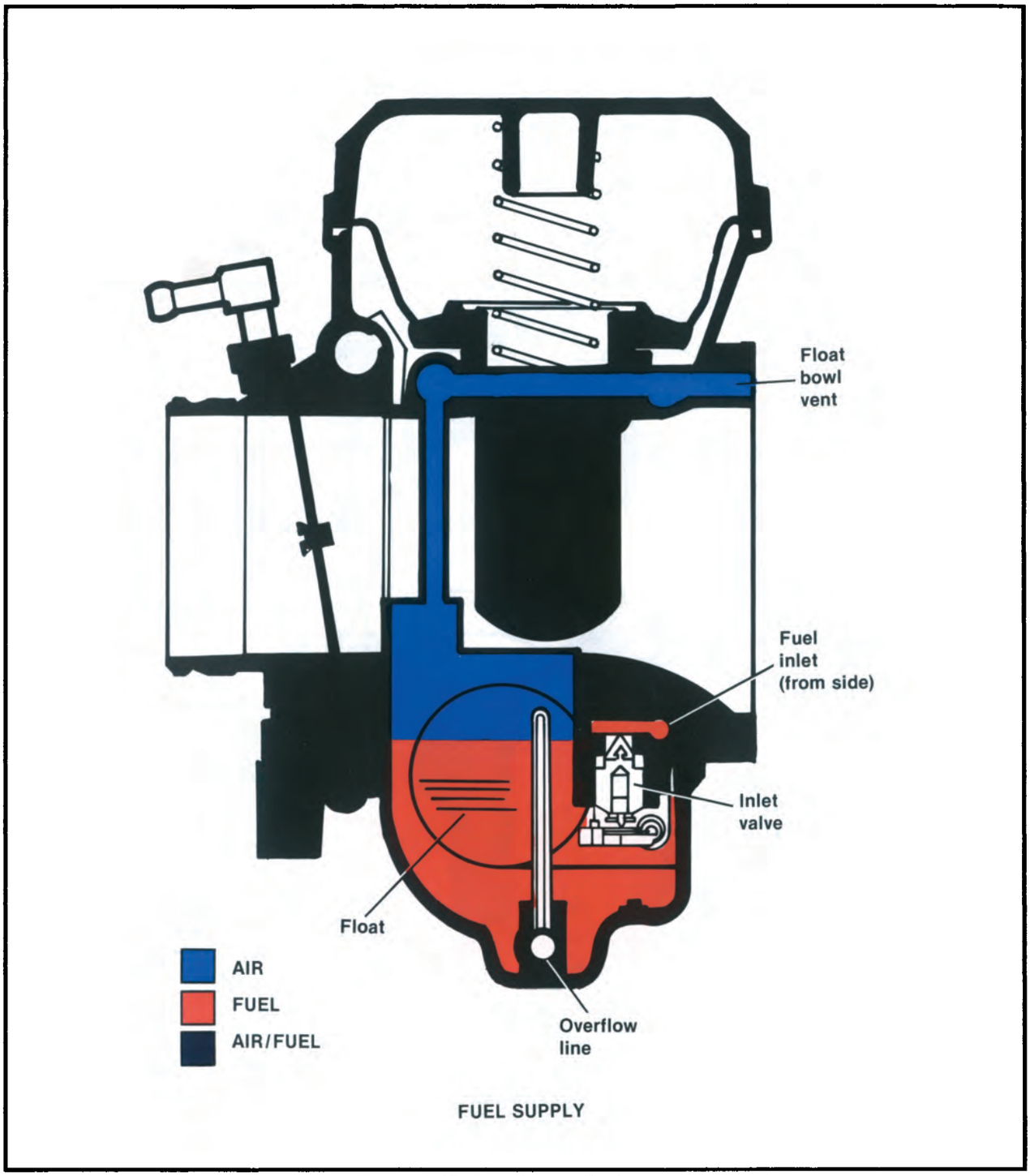


Figure 4-15. Fuel Supply System

Starter System (Figure 4-16)

The starting circuit consists of a cable actuated starter valve and converging fuel and air passages in the carburetor body.

Fuel metered through the enrichener jet is directed upward through a passage to the valve chamber. The starter valve opens the fuel passage to the carburetor venturi (vacuum side) when the enrichener knob is pulled outward. Air from an opening in the carburetor inlet is directed to the valve chamber, where it mixes with incoming fuel.

Low pressure, (vacuum) created by the downward stroke of the engine pistons, causes the higher pressure in the float chamber to force the fuel/air mixture through the fuel/air outlet passage in the carburetor venturi.

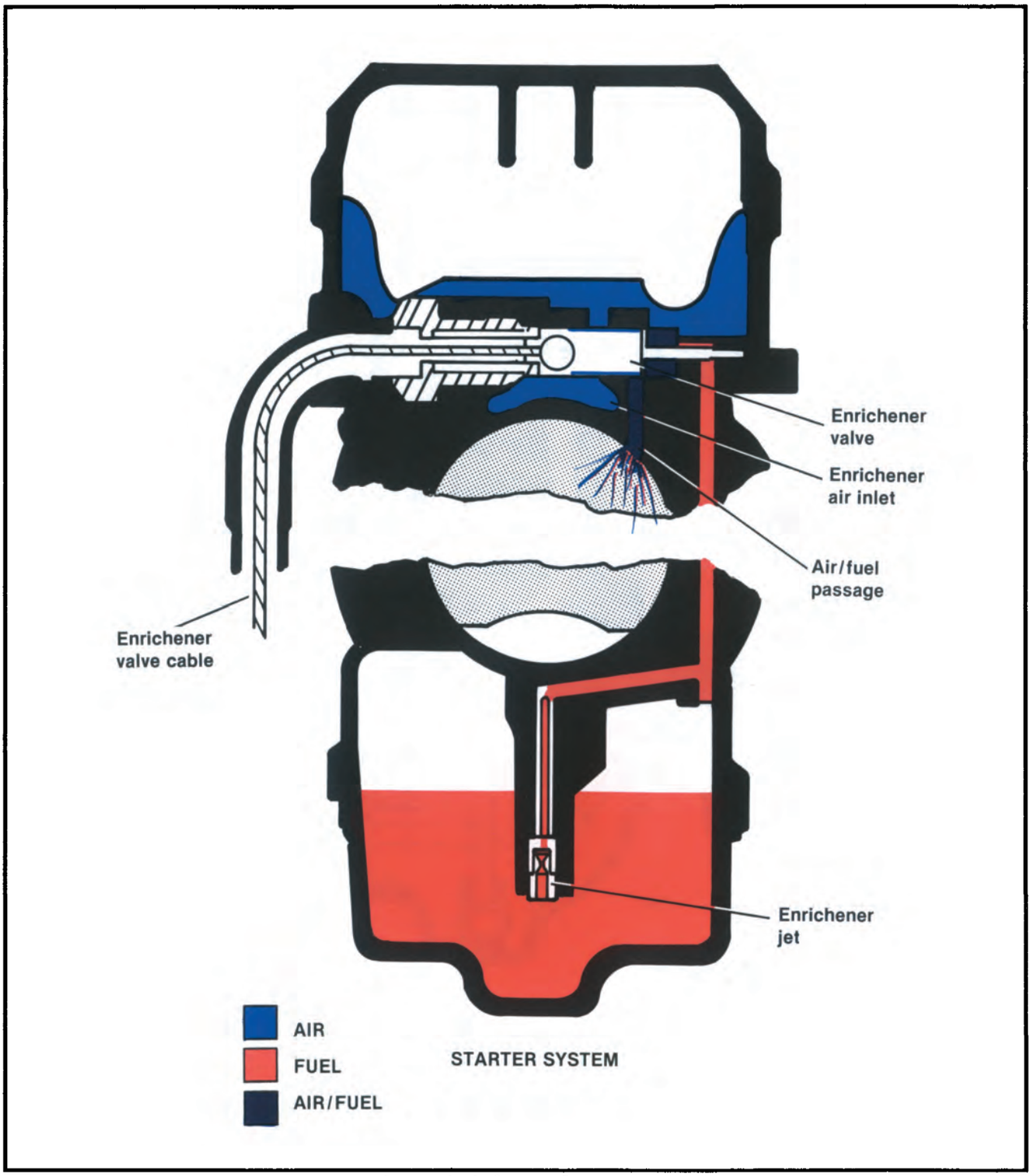


Figure 4-16. Starter System

Idle and Low Speed Circuit (Figure 4-17)

At idle, with the throttle plate closed and the air stream cut off, idle speed is maintained by fuel metered through the slow jet. Air from the slow air jet mixes with the fuel and is delivered to the idle port at the vacuum side of the throttle plate. At low speed as the throttle plate is cracked open the transfer ports are exposed to the vacuum side of the throttle plate and additional fuel is directed to the barrel of the carburetor. With the throttle plate cracked open a quantity of fuel also enters the air stream from the needle jet. The idle and transfer ports supply additional fuel to the carburetor barrel to assist during the transition period from idle to mid range.

The venturi opening is reduced by the low position of the vacuum piston. This enables initial air stream velocities to be higher than normally attainable with fixed venturi carburetors. The higher air stream velocities provide greater quantities of fuel necessary for good acceleration.

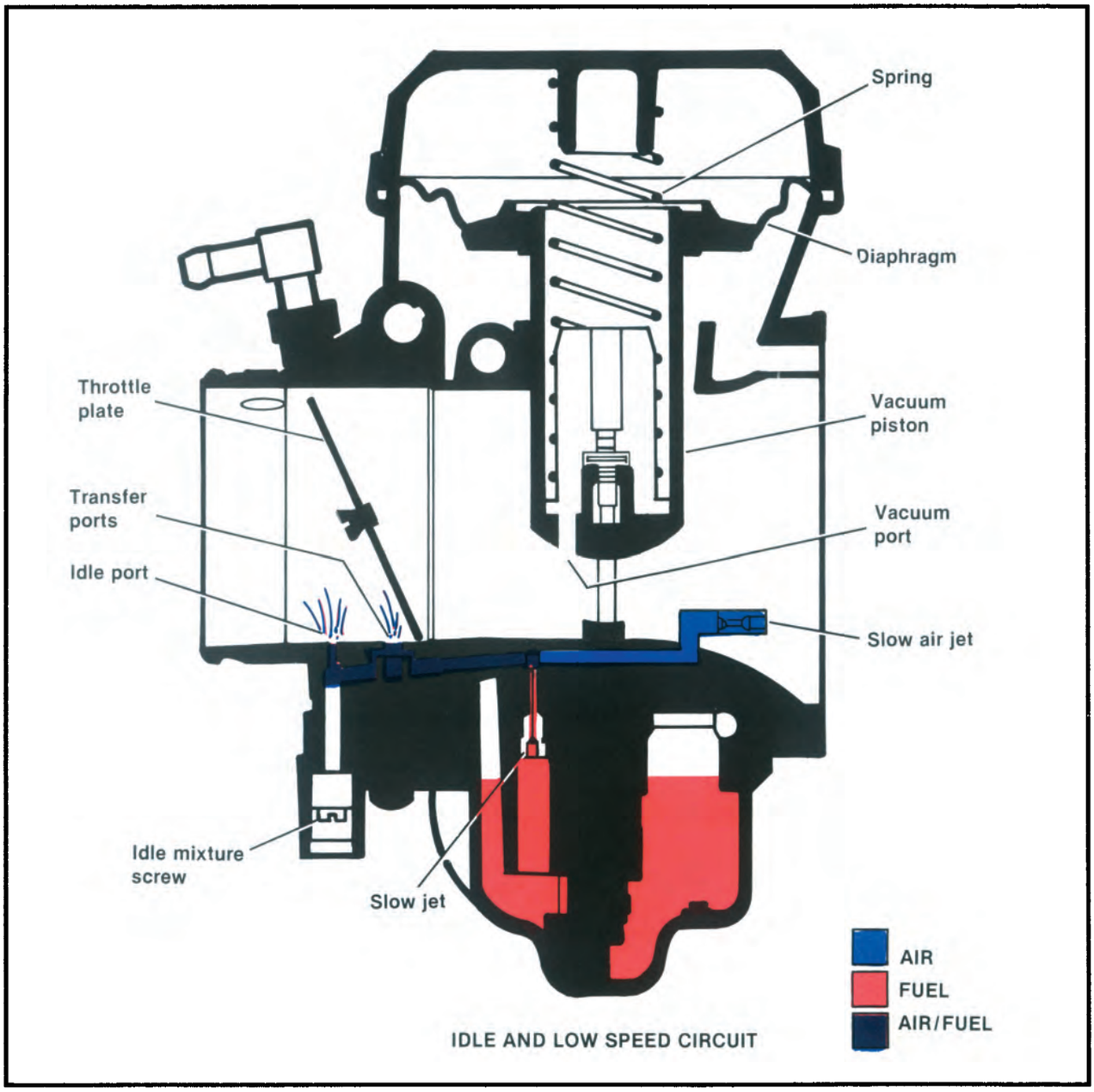


Figure 4-17. Idle and Low Speed Circuit

MidRange Slide Position and Fuel Discharge (Figure 4-18)

As the throttle plate is opened, air flow increases through the carburetor and the pressure drop in the venturi near the needle jet increases.

The low pressure in the venturi travels through the vacuum port in the vacuum piston to the chamber above the diaphragm. The chamber beneath the diaphragm is vented to atmospheric pressure by a passage from the chamber to the carburetor inlet. The higher pressure at the underside of the diaphragm overcomes spring pressure and moves the vacuum piston upward in proportion to the pressure difference between chambers.

The tapered needle moves upward with the vacuum piston, opening the needle jet. The higher pressure in the float chamber forces fuel into the needle jet passage. Air at atmospheric pressure from the main air jet is forced through the main bleed tube openings and mixes with the fuel. The fuel/air mixture is then delivered through the needle jet into the air stream.

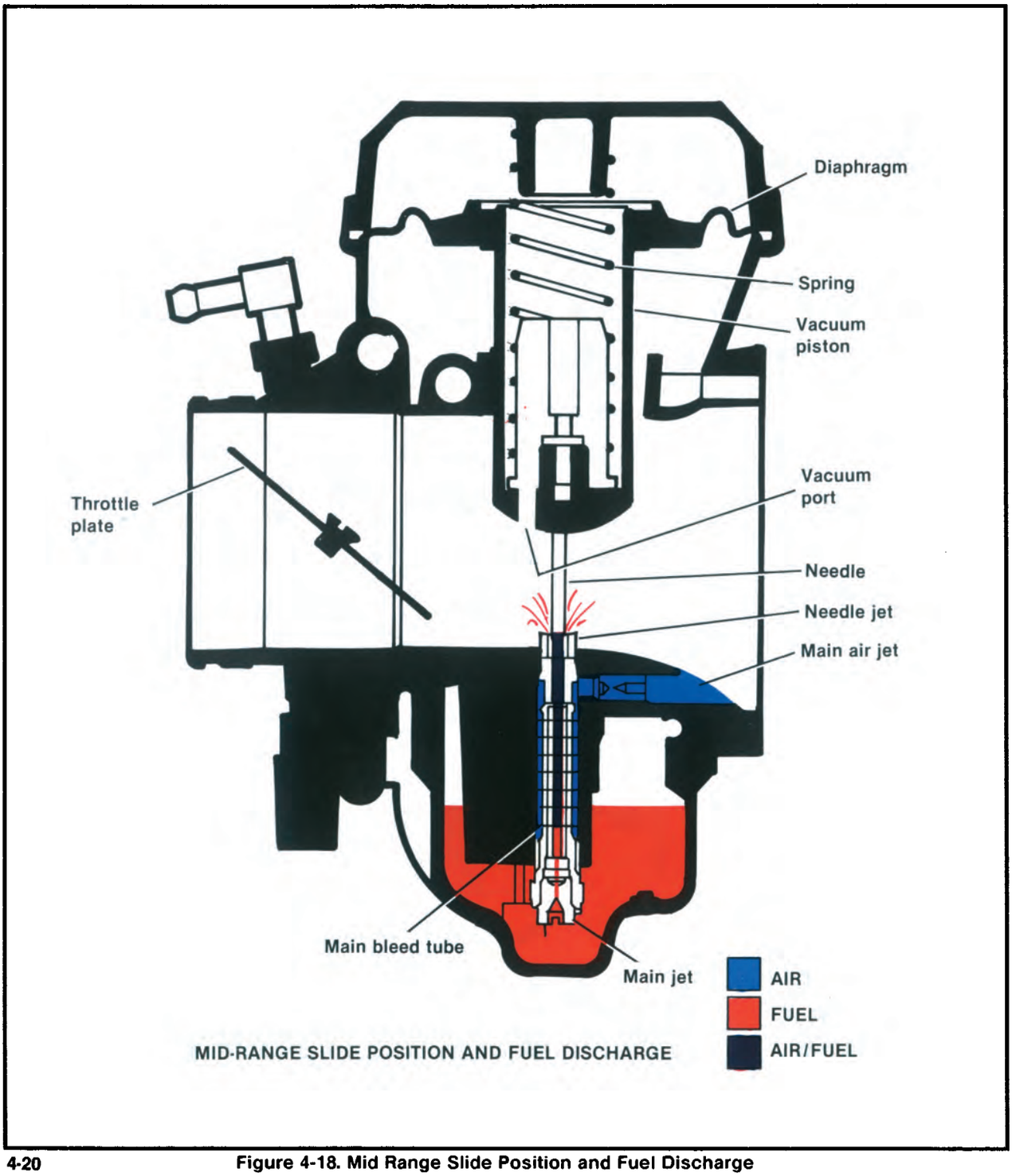


Figure 4-18. Mid Range Slide Position and Fuel Discharge

High Speed Circuit Slide Position and Fuel Discharge (Figure 4-19)

As the throttle plate is opened, the pressure difference between the chambers above and below the diaphragm increases and the vacuum piston moves further upward.

The venturi opening increases and the needle is lifted further out of the the needle jet. The quantity of fuel and the volume of air are simultaneously increased and metered to the proportions of engine demand by the variable venturi and needle lift. With the vacuum piston fully upward, the venturi opening is fully enlarged and the needle jet opening exposure to the air stream is at its maximum. Air and fuel supplies are now available in quantities sufficient to meet all engine demands.

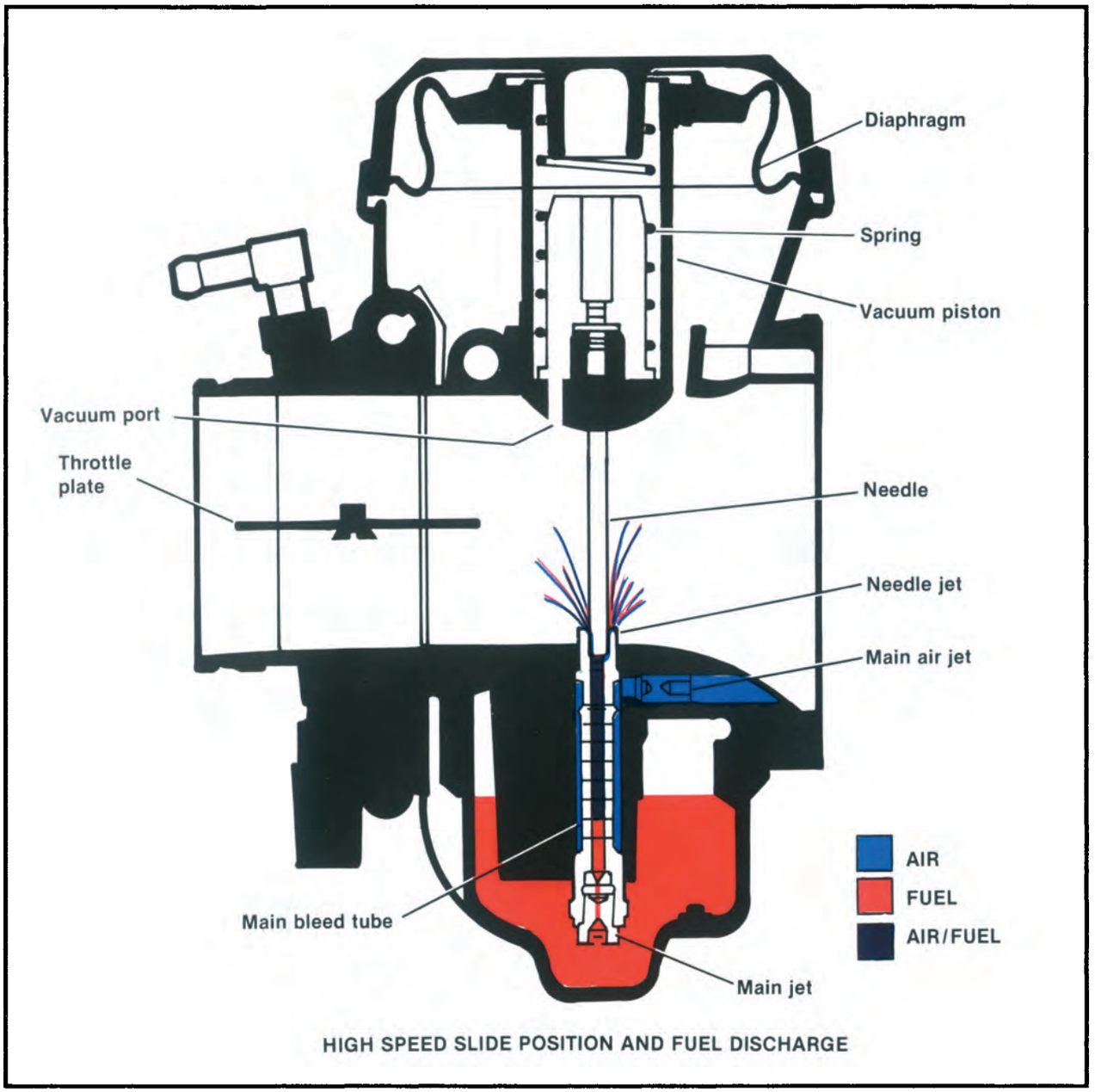


Figure 4-19. High Speed Circuit Slide Position and Fuel Discharge

Accelerator Pump System (Figure 4-20)

The accelerator pump system uses sudden throttle openings (rapid accelerations) to quickly inject fuel into carburetor venturi to provide extra fuel for smooth acceleration. This fuel also assists engine operation during cold engine warm-up when the enrichener is turned off prematurely.

Rapid throttle action during the first third of throttle travel, pushes the pump rod down, flexing a diaphragm. This flexing action forces fuel past a check valve into the venturi. The check valve prevents backflow during this stroke. A spring then returns diaphragm to its original position and a new supply of fuel flows in under the diaphragm from the float chamber for the next acceleration.

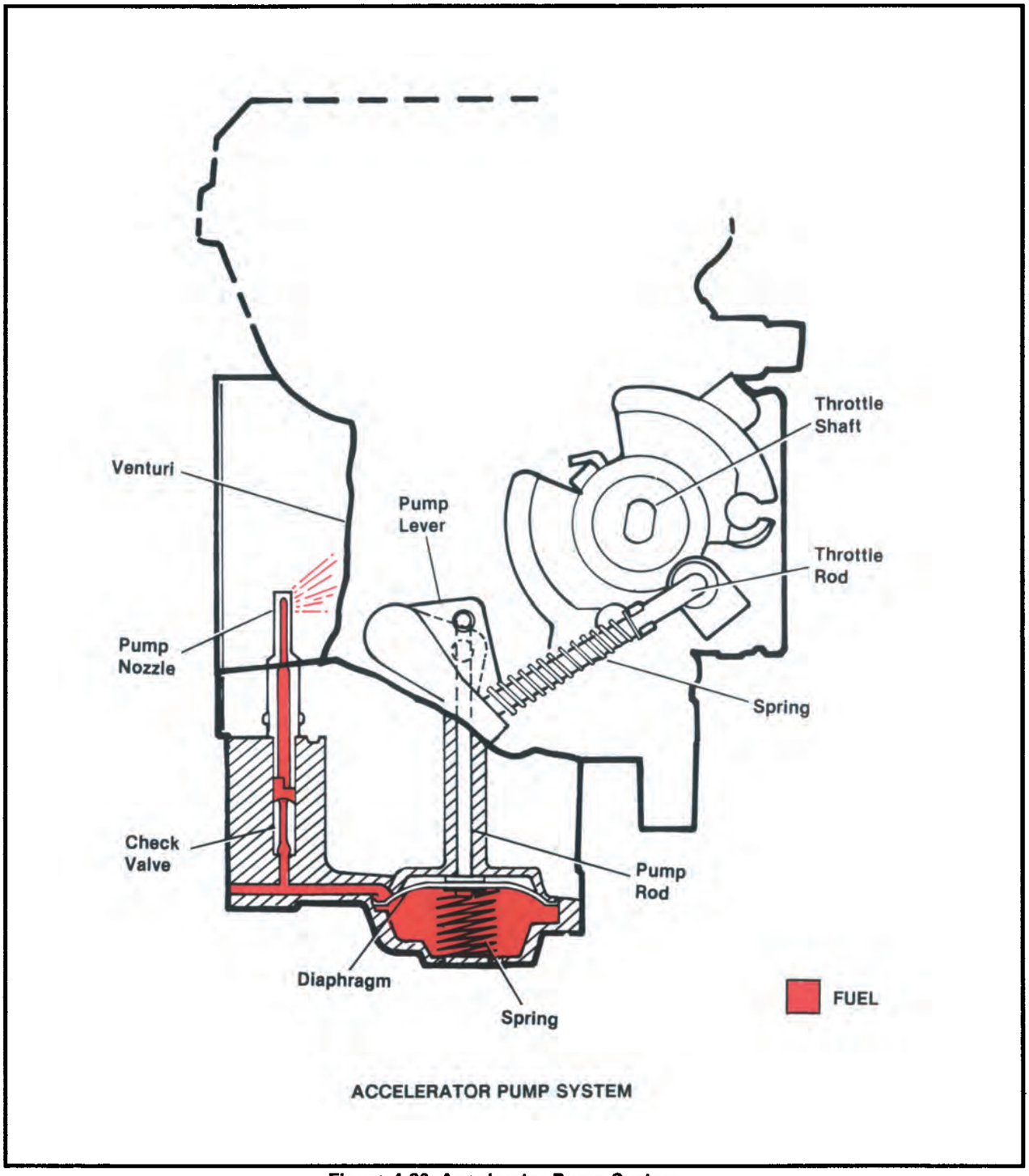


Figure 4-20. Accelerator Pump System

ADJUSTMENTS

Slow Idle

With the engine at normal operating temperature and the enrichener all the way in (enrichener valve closed) adjust the throttle stop screw so the engine idles at 1000 rpm.

NOTE

Use a test tachometer, connected to negative ignition coil terminal to measure engine rpm on models without tachometers.

Enrichener Control

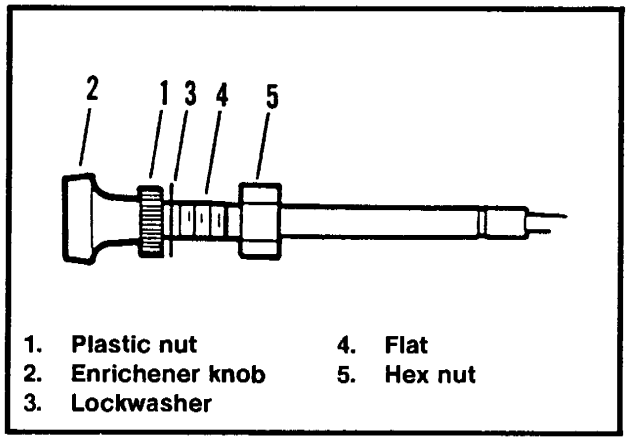
See Figure 4-21. Check fuel enrichener operation. The fuel enrichener knob should open, remain open and then close without binding. The knurled plastic nut next to the enrichener knob controls the ease or difficulty with which the cable slides within the cable conduit.

If adjustment is needed:

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

CAUTION

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



1. **Plastic nut**
2. **Enrichener knob**
3. **Lockwasher**
4. **Flat**
5. **Hex nut**

Figure 4-21. Fuel Enrichener Control

Float Level

1. Remove the carburetor as described under REMOVAL.
2. See Figure 4-24. Remove screws and washers (18). Remove float bowl.

NOTE

Before float adjustment check that float halves are properly aligned and at equal height. Carefully bend to realign, if necessary.

3. See Figure 4-48. Use a vernier or dial caliper depth gauge to measure from the carburetor flange face to the perimeter of the float. Be careful not to push on float while measuring.
4. If measurement is not within 0.725-0.730 in., carefully bend tab to position float at proper level.
5. See Figure 4-24. Position the float bowl on carburetor body. Install screws and washers (18).
6. Install carburetor as described under INSTALLATION.

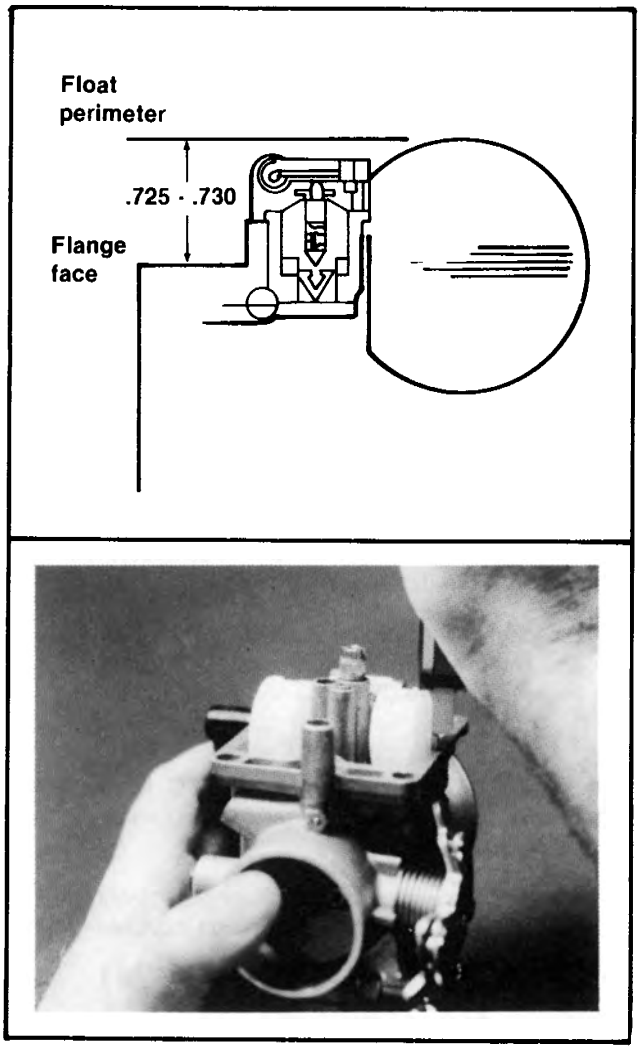


Figure 4-22. Float Adjustment

OPERATION CHECK - VACUUM PISTON

Opening Malfunction

WARNING

While observing piston slide movement be sure to maintain a safe distance from the carburetor and wear suitable eye protection. An unexpected engine backfire could cause serious burns or eye injury.

1. With air cleaner cover off and engine running, partially open and close throttle control several times to see if vacuum piston has upward movement. If piston does not rise, see Vacuum Piston Troubleshooting.
2. With engine not running, lift vacuum piston with finger. Feel whether piston lifts fully and smoothly or whether it binds.

Closing Malfunction

1. With engine not running, lift vacuum piston to full open position, then release. See if piston slides downward smoothly and fully to stop.
2. Observe position of piston slide at its lowest downward point. Lower edge of slide should rest at horizontal groove at lower end of slide track. See Vacuum Piston Troubleshooting if any problems are observed.

REMOVAL

WARNING

Gasoline is extremely flammable and highly explosive under certain conditions. Do not smoke or allow open flame or sparks anywhere in the area when refueling or servicing the fuel system.

1. Turn the fuel supply valve off.
2. See Figure 23. Disconnect the fuel line (1). Remove the fuel tank. See FUEL TANK in this section.
3. Remove the air cleaner and backplate. See AIR CLEANER in this section.
4. Disconnect the throttle cables (2). See Figures 4-24, and remove enrichener cable (19, 20, 21). Remove enrichener valve (22) and spring (23).

NOTE

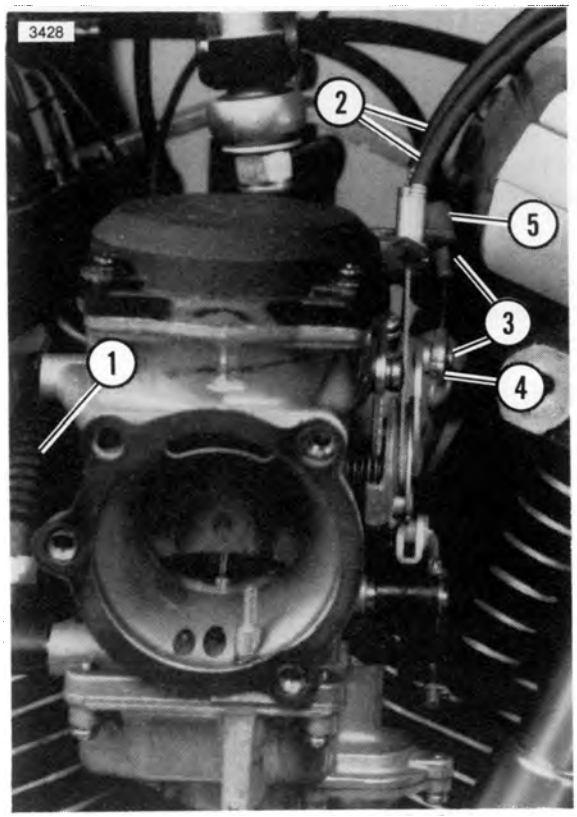
See Figure 23. On FLTC AND FLHTC Ultra models, remove two C-rings (3), washer (4) and remove cruise control servo cable (5).

5. Remove vacuum hose (7) from the carburetor. Pull carburetor free of seal ring (33) and manifold (34).

DISASSEMBLY (Figure 4-24)

Vacuum Piston Chamber

1. Remove screws (26, 25) and bracket (24)
2. Remove three screws and washers (2). Remove cover (1) and spring (3).



1. Fuel line
2. Throttle cables
3. C-rings (2)
4. Washer
5. Servo cable (Ultras only)

Figure 4-23. CVH Carburetor Cables

3. Lift out vacuum piston (4) with needle (6) and spring seat (5). Remove loose parts from vacuum piston.

Carburetor Body

1. Remove screws and washers (18). Remove float bowl assembly (38).
2. Remove pin (14), float (15) and valve (13).
3. Unscrew main jet (11) and needle jet holder (10). Needle jet (9) is now free to be removed from bottom end of passage.
4. Insert thin bladed screw driver into slow jet passage and turn out slow jet (12).

Accelerator Pump

Remove three screws (49), lockwashers (48), accelerator pump housing (42), spring (43) and diaphragm (44). Remove O-ring (45) from housing (42).

CLEANING, INSPECTION AND REPAIR (Figure 4-24)

Vacuum Piston Components

1. Hold vacuum piston up to strong light. Examine diaphragm at top of vacuum piston (4) for evidence of pinching, holes or tears. Replace if damaged.

2. Examine vacuum passage through bottom of piston (4). Clean passage if restricted.
3. Examine spring (3) for stretching, crimping or any distortion or damage. Replace if damaged.
4. Examine slide on sides of piston (4) to be sure surface is smooth and clean. Clean or buff out any rough surfaces.
5. Examine needle (6) for evidence of bending or damage. Examine tip of needle for grooves. Needle should be straight and surface of taper smooth and even.

Carburetor Body Components

1. Check float bowl O-ring (16) for any distortion or damage. Replace if sealing surfaces are damaged.
2. Examine inlet valve (13) and inlet valve seat. Clean with carburetor cleaner. Replace if seating surfaces are damaged.
3. Clean slow jet (12) with carburetor cleaner. Check to be sure all orifices are open.
4. Check enrichener valve (22). Be sure needle guide is clean, straight and undamaged. Check seat surface and spring (23) for wear or damage. Replace if damaged.
5. Check enrichener valve chamber. Clean with carburetor cleaner. Check that all passages are open and free of obstruction.
6. Clean needle jet (9). Replace if damaged.
7. Clean all internal fuel/air passages and jets. Check that all passages and jets are open and free of obstruction.
8. Check needle jet holder (10). Clean bleed tube orifices. Replace holder if damaged.
9. Check float (15) for cracks or other leaks. Replace if damaged.
10. Clean main jet (11) with carburetor cleaner and inspect for damage. Replace if damaged.

Accelerator Pump

1. Inspect the accelerator pump diaphragm (44) for holes, cracks or deformation. Replace as necessary.
2. Replace the pump rod (51) if it is bent and replace the boot (50) if it is cracked
3. Check o-ring (17) on accelerator pump nozzle (40) Replace if damaged.

ASSEMBLY (Figure 4-24)

Vacuum Piston Chamber

1. Place needle (6) through center hole in vacuum piston (4). Place spring seat (5) over top of needle.
2. Insert vacuum piston into carburetor body. The slides on the piston are off-center and the piston will fit into the slide track grooves only one way. If piston does not fit, rotate it 180 degrees.
3. Check to be sure diaphragm is seated evenly into groove at top of carburetor body.
4. Place spring (3) over spring seat (5) and carefully lower top (1). Keep spring straight while lowering top.
5. After top is seated, hold top while lifting up on vacuum piston. Piston should rise to top smoothly. If piston movement is restricted, spring is cocked. Lift up on top and lower carefully, keeping spring coils straight.
6. Once top is installed correctly, install screws and washers (2). Place bracket (24) in position with idle screw resting on top of throttle cam stop. Install body screw and washer (26) first, then top screw (25), to prevent bending bracket or throttle cam.

Carburetor Body

NOTE

FLT models have a bracket (24a) designed to accomodate the cruise control servo motor cable.

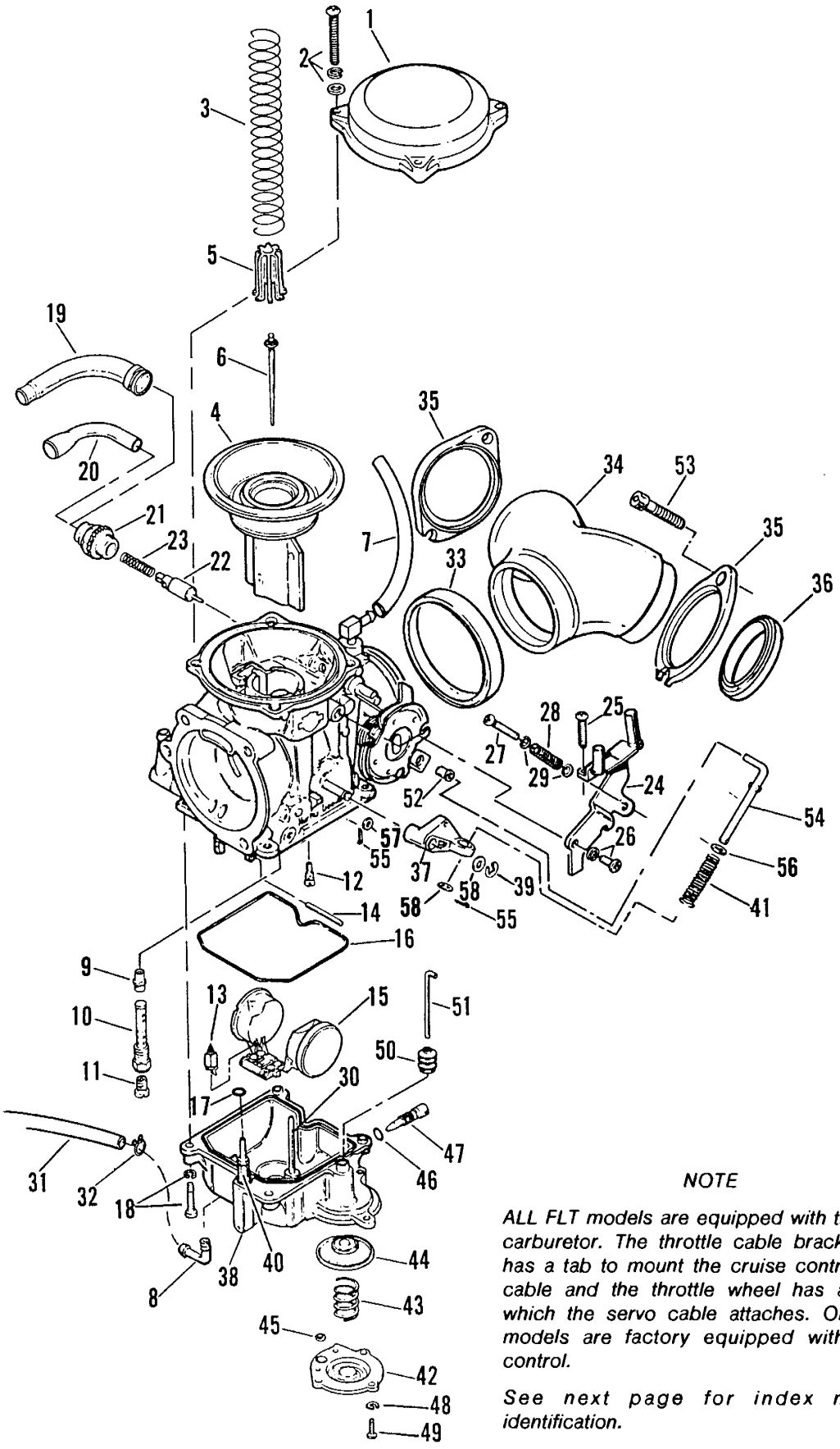
CAUTION

Slow fuel jets from fixed venturi carburetors look the same as the slow jet of the CVH carburetor, however the air bleed hole sizes are different on fixed venturi carburetors and they must not be installed on CVH carburetors.

1. Screw slow jet (12) into slow jet passage with narrow bladed screwdriver.
2. Turn carburetor upside down. Place needle Jet (9) in main jet passage with needle passing through center hole. Be sure end of jet with larger opening and chamfered surface enters passage first.
3. Insert needle jet holder (10) into main jet passage with needle inserted into center of holder. Thread holder into passage and tighten. Thread main jet (11) into tapped hole in holder (10) and tighten.
4. Place float assembly (15) into position with fuel valve (13) inserted into valve seat and pivot arm aligned with holes in mounting posts at bottom of carburetor body. Insert pin (14) through float pivot arm and float mounting posts.
5. Place float bowl over float and onto carburetor body flange. Bowl will only fit in one position. Install screws and washers (18) and tighten.

Accelerator Pump

Install diaphragm (44), spring (43), O-ring (45) and housing (42). Secure with three screws (49) and lockwashers (48).



NOTE

ALL FLT models are equipped with the same carburetor. The throttle cable bracket (24a) has a tab to mount the cruise control servo cable and the throttle wheel has a pin to which the servo cable attaches. Only Ultra models are factory equipped with cruise control.

See next page for index number identification.

Figure 4-24. Carburetor

1. Top
2. Screw and washer (3)
3. Spring
4. Vacuum piston
5. Spring seat
6. Jet needle
7. Vacuum hose (VOES)
8. Fuel overflow fitting
9. Needle jet
10. Needle jet holder
11. Main jet
12. Slow jet
13. Fuel valve with clip
14. Pin
15. Float
16. O-ring
17. O-ring
18. Screw and washer (4)
19. Cable guide
20. Starter cap
21. Cable sealing cap
22. Enrichener valve
23. Spring
24. Bracket, throttle cable (FXR)
24a. Bracket, throttle cable (FLT, not shown)
25. Screw (throttle cable bracket)
26. Screw (throttle cable bracket)
27. Screw (idle speed adjust)
28. Spring
29. Washer (2)
30. Pipe overflow
31. Rubber tube
32. Clip, tube
33. Seal ring
34. Manifold
35. Flange (2)
36. Seal, intake manifold (2)
37. Lever
38. Float bowl
39. E-clip
40. Accelerator pump nozzle
41. Spring
42. Pump housing
43. Spring
44. Diaphragm
45. O-ring
46. O-ring
47. Drain screw
48. Washer
49. Screw (3)
50. Boot
51. Rod
52. Collar
53. Screw (4)
54. Rod
55. Cotter pin (2)
56. Washer
57. Washer
58. Washer

Figure 4-24. Carburetor (cont'd)

INSTALLATION (Figure 4-25)

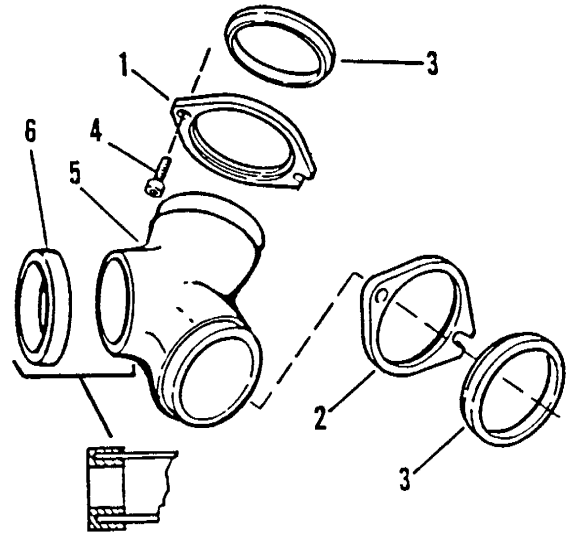
NOTE

If manifold has been removed, begin at step 1. If only carburetor is being installed, begin at NOTE following step 4.

1. See Figure 4-25. Place flanges (1) and (2) onto aluminum manifold (5).
2. Place intake manifold seals (3) onto each spigot of manifold with chamfered edge against flanges (1) and (2).
3. Place channel of seal ring (6) over inlet end of manifold.
4. Position manifold (5) against intake ports of cylinder head with slotted hole in flanges (1) and (2) at lower holes in cylinder heads. Insert Allen screws (4) through manifold flanges (1) and (2) and loosely thread into tapped holes in cylinder head.

NOTE

The fit between the carburetor and the seal ring is tight. For ease of installation it is recommended that the mating surfaces, carburetor body and seal ring be lubricated prior to assembly to reduce surface friction. Use liquid dish soap or tire mounting lube for this purpose.



1. Mounting flange, rear
2. Mounting flange, front
3. Seal, intake manifold
4. Screw (4)
5. Intake manifold
6. Seal ring, carburetor

Figure 4-25. Manifold Assembly

5. Lubricate only the inside surface of seal ring (6) that will be in contact with the carburetor. Also apply a light coat of lubricant to the spigot of the carburetor body. Push carburetor body into seal ring (6).

6. Connect VOES hose.

NOTE

In step 7 the air cleaner backplate is attached to the carburetor and cylinder heads to align the manifold. Make certain screws (4), Figure 4-25, are loose before performing step 7.

7. See Figure 4-29. Install air cleaner backplate following procedure **"INSTALLATION (Figure 4-29)"** steps 1 through 7 in this section.

8. See Figure 4-25. Tighten the socket head bolts (4) to 6–10 ft-lbs torque.

NOTE

If fuel tank has not been removed, tighten screws (4) using a 1/4 in. Bondhus balldriver, Snap-on FABL8, and remove backplate to gain access only if required.

9. Connect throttle cables. See Figure 4-24. Install enrichener valve (22) and spring (23). Connect enrichener cable (19, 20, 21).

10. Route the float bowl overflow line between rear cylinder push rods, then down between engine oil pump cover and crankcase.

11. If removed, install fuel tank. See FUEL TANK in this section. Connect fuel line to carburetor with new clamp.

AIR CLEANER
1984 - 1985

GENERAL (Figures 4-26 and 4-27)

The air cleaner contains a plastic foam element that traps airborne dust and dirt to keep it from entering the carburetor and engine.

Remove the air cleaner cover and service the filter every 5000 miles, or more often if the motorcycle is run in a dusty environment.

NOTE

The sides of the element must be clamped between the backing plate and air cleaner cover. Replace elements that have tears, folds or do not fit the screen.

REMOVAL

FLT Models (Figure 4-26)

1. Remove the three screws (1) and washers (2). Remove the air cleaner cover (3), baffle plate (4) and element (5).
2. Bend lock tabs on ring (7) away from bolts (6).
3. Remove bolts (6) and locktab ring (7).
4. Remove bolt (8) from bottom of backplate.
5. Remove backplate (9) and gasket (10).
6. Remove hose (11) from locking plate.

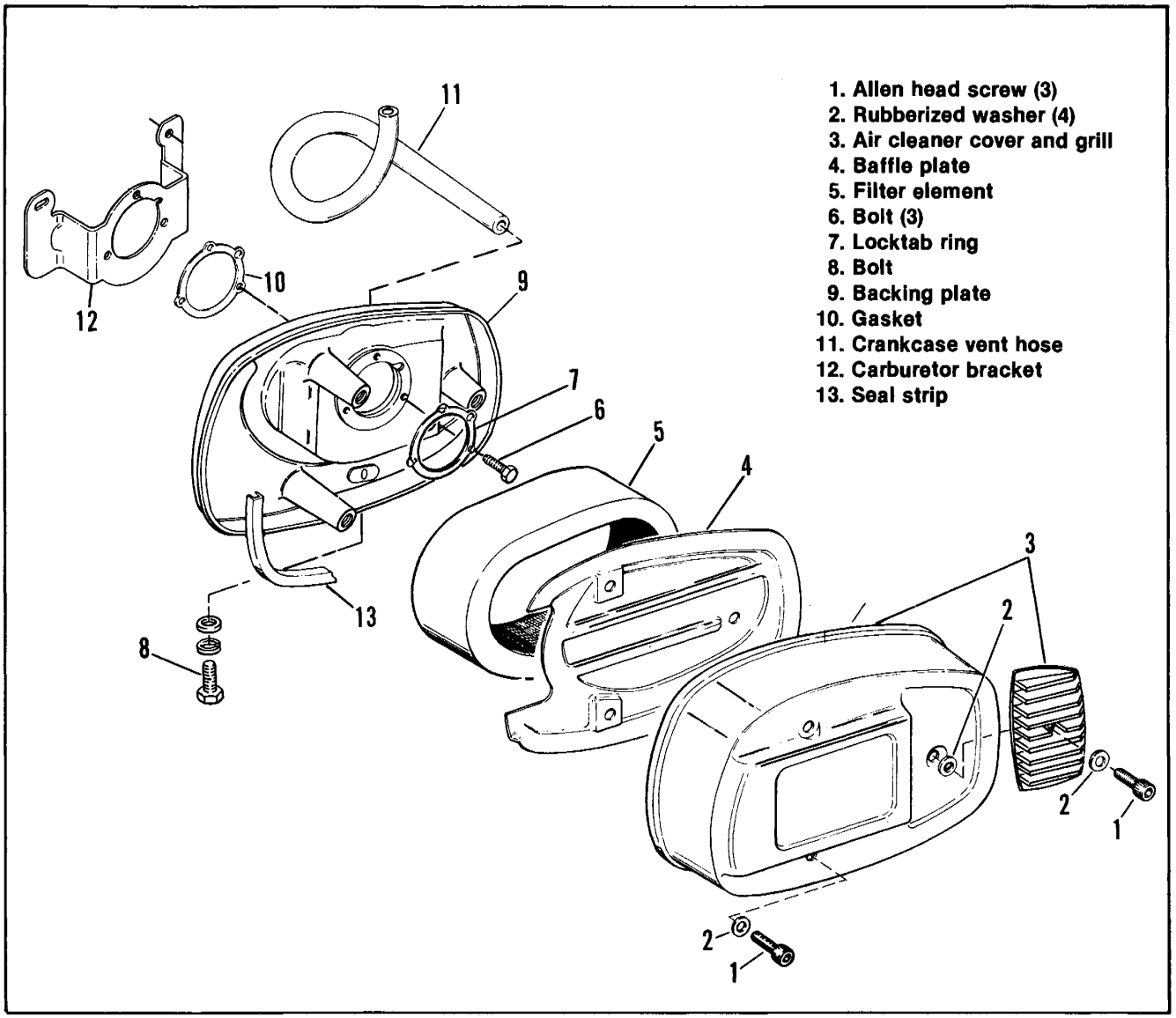


Figure 4-26. Air Cleaner — 1984, 1985 FLT

FXR Models (Figure 4-27)

1. Remove cap screw (1) and cover (3).
2. Remove element (4).
3. Bend tabs of ring (7) away from screws (5).
4. Remove screws (5) from the tapped holes in the carburetor flange.
5. Remove screw (6) with washer (10) and nut (11). Lift the backplate free of the carburetor and carefully remove the gasket. Disconnect the vent hose from the oil transfer tube (12).

CLEANING, INSPECTION AND REPAIR

FLT Models

NOTE

The filter should be cleaned and reoiled 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.

1. Remove the foam element from the wire mesh core and clean it with soap and hot water.
2. Allow the element to dry. Evenly apply 1-1/2 tablespoons of engine oil with an atomizer or by direct application into the filter element.

FXR Models (Figure 4-27)

NOTE

The filter should be cleaned and reoiled 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.

1. Remove the foam element from the wire mesh core and clean it with soap and hot water.
2. Allow the element to dry. Evenly apply 1-1/2 tablespoons of engine oil with an atomizer or work that amount of oil in to the filter. Squeeze out excess oil. Install element over the screen and place into the air cleaner backplate (8).

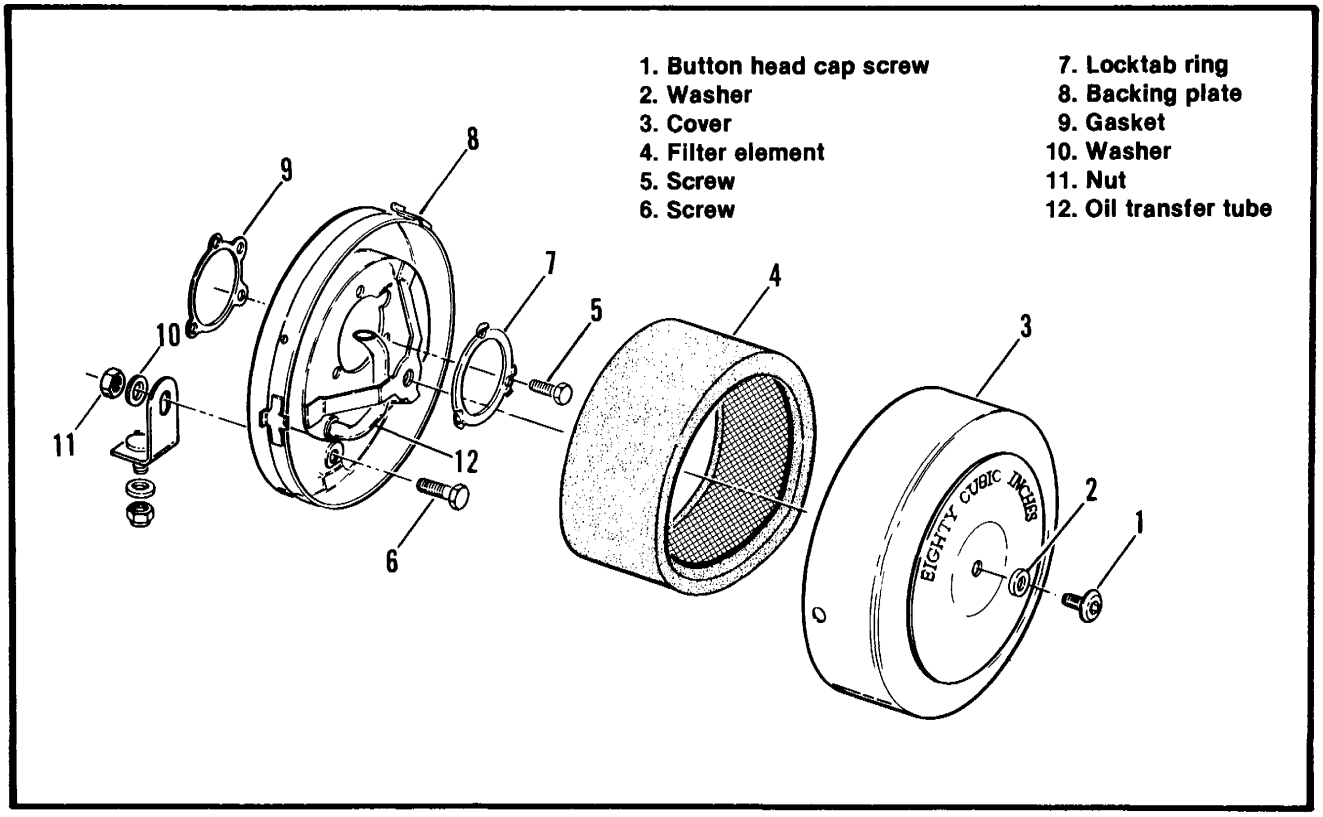


Figure 4-27. Air Cleaner — 1984, 1985 FXR

INSTALLATION

FLT Models (Figure 4-26)

1. Connect the hose (11) to the backplate (9). Install the gasket (10 and backplate to the carburetor bracket (12) using the three screws (6). Tighten the bolts to 7-10 ft-lbs torque. Bend one tab on the locktab ring (7) against each nut flat.

2. Install bolt (8) in bottom of backplate.

3. Install the element (5) and seal strip (13) so the opening in the seal is to the top. Install the baffle plate (4) and cover and grill (3). Secure it with the four washers (2) and screws (1).

FXR Models (Figure 4-27)

1. Inspect gasket (9) and replace if damaged. Hold gasket (9) on carburetor bracket and position backplate (8) against the gasket. Install locktab ring (7) and screws (4) through the backplate and bracket into the tapped holes in the carburetor flange. Tighten screws to 7-10 ft-lbs torque. Bend tabs to hold screws. Connect crankcase vent hose to tube (12).

2. Insert bolt (6) through backplate (8) and engine bracket. Place washer (10) on bolt followed by nut (11). Tighten bolt to 13-17 ft-lbs torque.

3. Install element over the screen and place into the air cleaner backplate.

4. Place cover (3) in position over backplate (8). Insert button head cap screw (1) through cover (3) and thread into the tapped hole at the center of the backplate. Tighten the screw to 12-17 ft-lbs torque.

AIR CLEANER — 1986 - 1989

GENERAL (Figure 4-28)

The air cleaner contains a plastic foam element that traps airborne dust and dirt to keep it from entering the carbuetor and engine.

Remove the air cleaner cover and service the filter every 5000 miles, or more often if the motorcycle is run in a dusty environment.

NOTE

The sides of the element must be clamped between the backing plate and air cleaner cover. Replace elements that have tears, folds or do not fit the screen.

REMOVAL

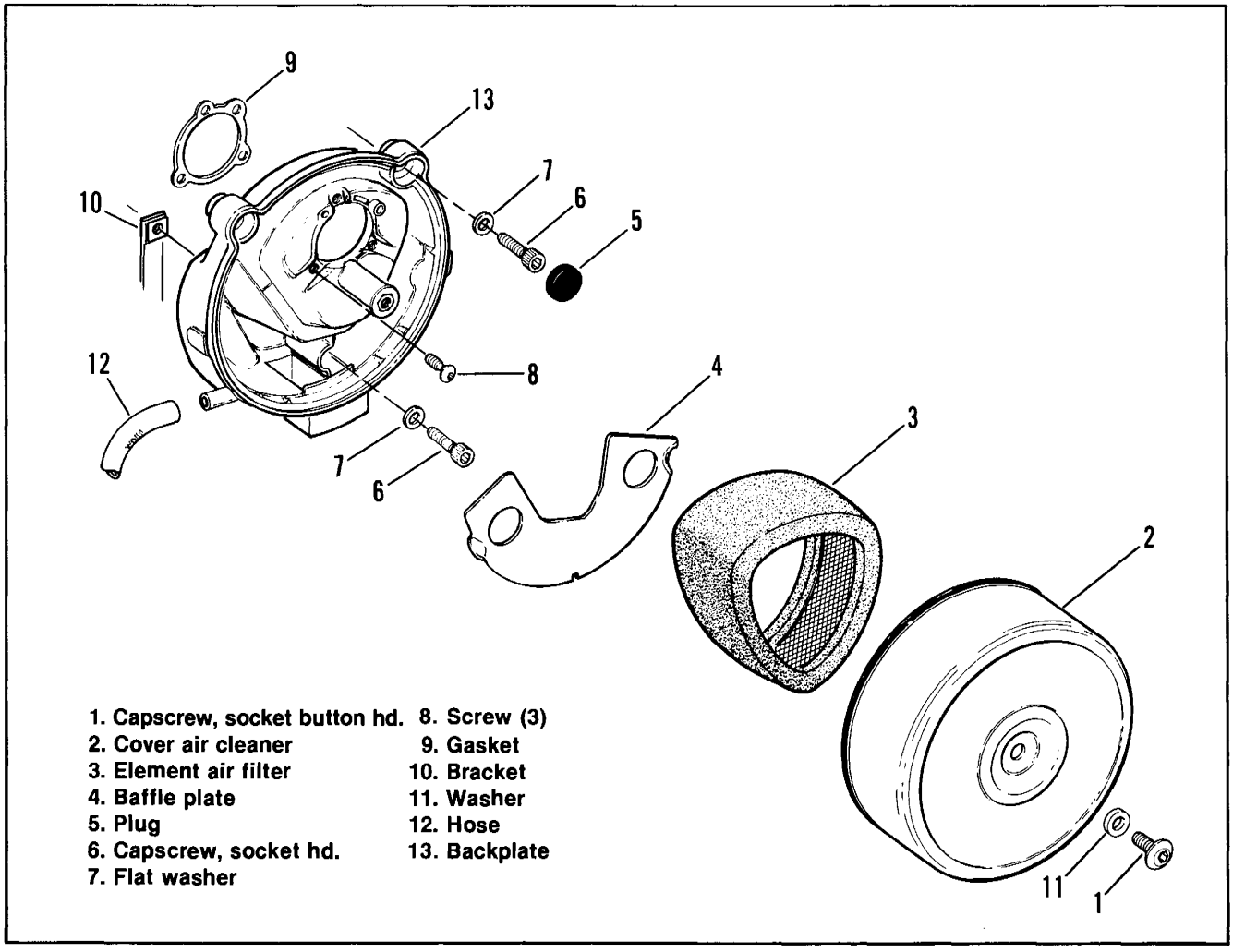
1. Remove cap screw (1) and washer (11).
2. Remove cover (2), baffle (4) and element (3).
3. Pry out plugs (5) and remove the three screws (6).
4. Disconnect hose (12) at backplate.

CAUTION

Do not let the captive screws (8) threads catch the backplate threads when removing the backplate or backplate and/or carburetor will become damaged.

5. Back out screws (8), in sequence, a couple of turns at a time while pulling the backplate away from carburetor.

Continue this procedure until screws are clear, then remove backplate.



1. Capscrew, socket button hd.
2. Cover air cleaner
3. Element air filter
4. Baffle plate
5. Plug
6. Capscrew, socket hd.
7. Flat washer
8. Screw (3)
9. Gasket
10. Bracket
11. Washer
12. Hose
13. Backplate

Figure 4-28. Air Cleaner

CLEANING, INSPECTION AND REPAIR

1. Remove the foam element from the wire mesh core and clean it with soap and hot water.

2. Allow the element to dry. Evenly apply 1-1/2 tablespoons of engine oil with an atomizer or by direct application into the filter element. Squeeze out excess oil. Install element over the screen and place into the air cleaner backplate (13). Install baffle (4) in bottom of backplate.

INSTALLATION (Figure 4-28)

1. Check each screw (8) to be sure the threaded portion of the screws are not threaded into backplate threaded insert.

2. Position backplate (13) next to carburetor and install the crankcase breather hose. Start each captive screw (8) into threaded holes in carburetor flange.

3. By hand, turn each captive bolt a couple of turns in sequence, until the backplate is drawn to a loose fit next to the carburetor flange.

4. Insert one screw (6) with washer (7) through lower backplate mounting hole and turn into the bracket to a loose fit.

5. Insert one screw (6) with washer (7) into each upper backplate mounting hole and thread loosely into the threaded hole in each cylinder head.

6. Tighten screws (8) to 3-5 ft-lbs torque.

7. Tighten screws (6) to 10-12 ft-lbs torque.

8. Install rubber plug over screws (6) at two upper mounting holes.

AIR CLEANER - 1990

REMOVAL (Figure 4-29)

1. Remove screw (1) and washer (10).
2. Remove cover (2), element (3) and baffle (4).

NOTE

If filter is being removed for cleaning, proceed to Step 1, CLEANING, INSPECTION AND REPAIR.

3. Pry out plugs (5) and remove two screws (6) and washers (7).
4. Disconnect crankcase breather hose (11) at backplate (12).
5. Back out screws (8), in sequence, a couple of turns at a time while pulling the backplate away from the carburetor.

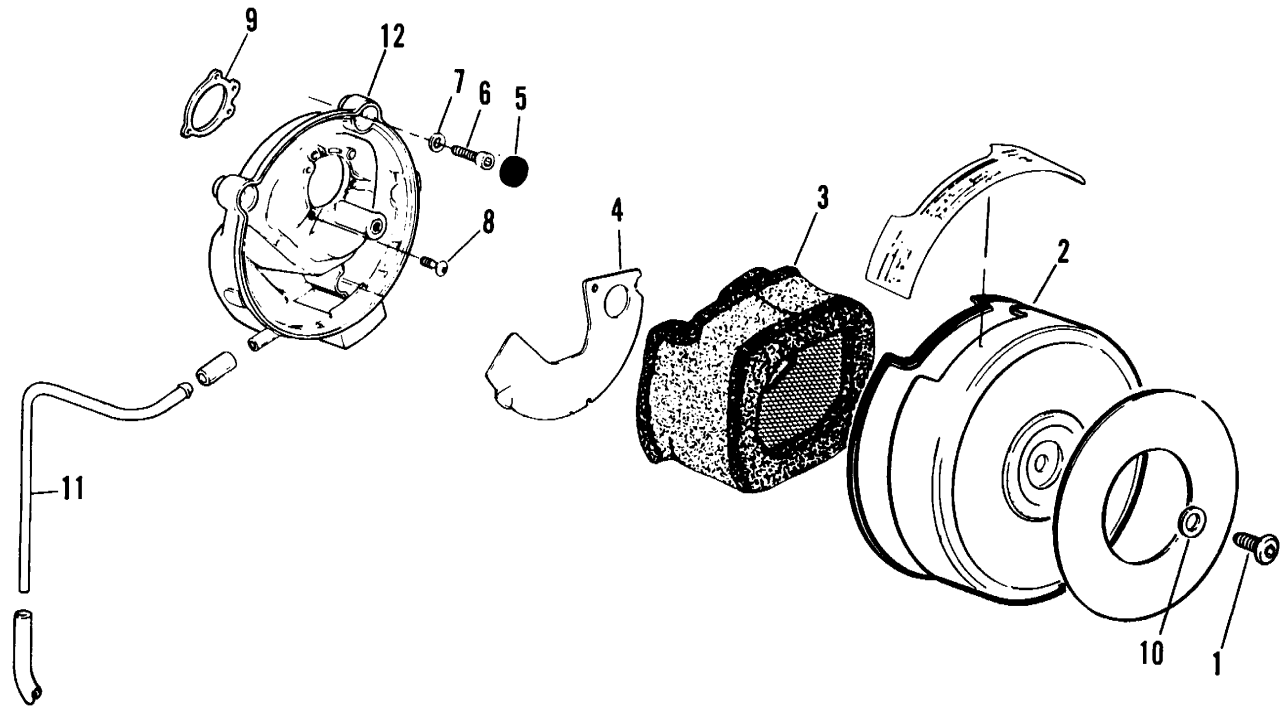
CAUTION

Do not let the captive bolt thread catch the backplate threads when removing the backplate or backplate will become damaged.

Continue this procedure until screws are clear, then remove backplate (12) and gasket (9).

CLEANING, INSPECTION AND REPAIR

1. Remove the foam element from the wire mesh core and clean it with soap and water.



1. **Air cleaner cover screw**
2. **Air cleaner cover**
3. **Filter element**
4. **Baffle**
5. **Plug (2)**
6. **Socket head capscrew (2)**
7. **Washer (2)**
8. **Captive screw (3)**
9. **Gasket**
10. **Washer**
11. **Crankcase breather tube**
12. **Backplate**

Figure 4-29. Air Cleaner - 1990

2. Allow the element to dry. Evenly apply 1 1/2 tablespoons of engine oil with an atomizer or by direct application into the filter element. Squeeze out excess oil. Install element over the screen and place into the air cleaner backplate (12).

INSTALLATION (Figure 4-29)

1. Check each screw (8) to be sure they are not threaded into backplate threaded insert.
2. Position backplate (12) and gasket (9) next to carburetor and install the crankcase breather tube (11). Start each captive screw (8) into threaded holes in carburetor flange.
3. By hand, turn each captive screw a couple of turns in sequence, until the backplate (12) is drawn to a loose fit next to the carburetor flange.
4. Insert one screw (6) with washer (7) into each upper backplate mounting hole and thread loosely into the threaded hole in each cylinder head.
5. Tighten screws (8) to 3-5 ft-lbs torque.
6. Tighten screws (6) to 10-12 ft-lbs torque.
7. Install plug(s) (5) over screws (6) at two upper mounting holes.
8. Place filter element (3) in position. Place cover (2) over filter and install screw (1) and washer (10). Tighten air cleaner cover screw to 3-5 ft-lbs.

FUEL SUPPLY VALVE

GENERAL (Figure 4-30)

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.

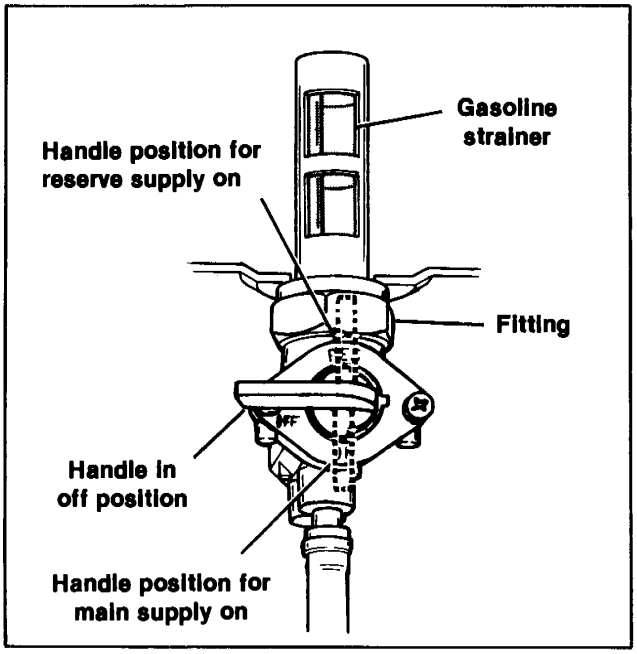


Figure 4-30. Fuel Supply Valve

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 valve. Drain the gasoline into a proper, clean container using a piece of fuel hose connected to the valve.

2. Turn the fitting and remove the valve assembly.

CLEANING, INSPECTION AND REPAIR

1. Clean or replace the filter strainer located on top of the valve, inside of fuel tank.

2. Flush the tank to remove all dirt.

INSTALLATION

1. Coat the valve threads with Loctite PIPE SEALANT WITH TEFLON, and tighten fitting.

2. Connect the hose to the valve using new clamp.

FUEL TANK

GENERAL

The fuel tank is a one-piece welded tank.

The tank interior is treated to resist rusting. However, if the motorcycle is to be stored for a long period of time, the tank should be drained and the interior treated with a one-to-one oil/fuel mixture or a commercially available fuel tank rust preventative. This will protect the tank during storage.

NOTE

To be sure the filler cap is securely fastened to the tank, on FXR models, turn the cap until at least three clicks are heard.

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.

WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect battery (negative cable first) before performing any of the following procedures.

FLT Models

1988 AND EARLIER

1. Turn fuel supply valve to OFF position.
2. Remove the fuel hose at the valve. Drain the fuel into a suitable, clean container using a piece of fuel hose connected to the valve.
3. Remove all hoses from each side of the tank.
4. Remove the two bolts located underneath the rear of the seat and remove the seat. Remove the seat bracket and plastic frame cover.
5. Unplug wire to fuel gauge (under frame cover).
6. Remove the rear fuel tank mounting screws and lockwashers. Remove the front mounting bolt, washer, lockwasher and nuts.
7. If fuel tank is to be replaced, remove tank trim and fuel sending unit for use in the new tank.

1989

1. Perform steps 1 through 3 given for 1988 AND EARLIER.
2. Remove both saddlebag covers and remove bolts securing rear of seat.
3. Pull seat to rear to disengage seat from front mounting tab.
4. See Figure 4-31. Remove three screws (1) securing console. Remove fuel tank cap and gently lift console upward and set console on frame behind fuel tank.
5. Remove bolt that secures front of fuel tank to frame and two screws (2) ahead of seat.

CAUTION

Do not remove nut that holds yellow wire to center of fuel gauge sender. Float will drop down into tank. See step 6.

6. Unplug wires connected to fuel gauge sender at connector (4).
7. If fuel tank is being replaced, remove fuel gauge sending unit for use in new tank.

FXR Models (Except FXLR, 1988 & 1989 FXRS)

1. Turn fuel supply valve handle to the OFF position.
2. Remove the fuel hose at the valve. Drain the fuel into a suitable, clean container using a piece of fuel hose connected to the valve.
3. Remove all hoses from each side of the tank.
4. Remove the three fuel tank center panel screws and gas cap.
5. Carefully lift up on center panel and disconnect: the fuel gauge wire at the sending unit, the ground wire and the twelve volt power supply wire from the main wire harness. On vehicles with a fuel tank console mounted speedometer, disconnect the speedometer twelve volt power supply wire and the ground wire to the speedometer light. Disconnect the speedometer cable.
6. Remove the front tank mounting locknut, washer, and internal tooth washer. Disconnect the fuel gauge ground wire which is clipped to fuel tank under panel. Pull the mounting bolt and washer out, and remove the fuel tank center panel.

7. Open the seat.

8. Remove the rear tank mounting bolts, lockwashers and washers.

CAUTION

When removing the fuel tank, care must be given to the wiring harness which is located between the fuel tank and frame.

9. Carefully lift up on the fuel tank and remove.

10. Remove sending unit if tank is to be replaced.

FXLR

The FXLR fuel tank does not have a center instrument panel or fuel gauge. Remove tank following FXR Models instructions; but ignore those instructions covering center panel and fuel gauge.

FXRS — 1988-1990

The FXRS has the speedometer and tachometer mounted on the fuel tank. The fuel gauge is contained in a simulated filler cap on the left side of the fuel tank. The fuel gauge sender is located beneath the fuel gauge.

1. To remove tank, perform steps 1-3 of FXR Models procedure.

2. Remove the two screws retaining the instrument panel. Carefully lift panel and disconnect speedometer cable and electrical leads.

3. Remove the front fuel tank mounting bolt.

4. Perform steps 7-10 of FXR Models procedure.

CLEANING, INSPECTION AND REPAIR

WARNING

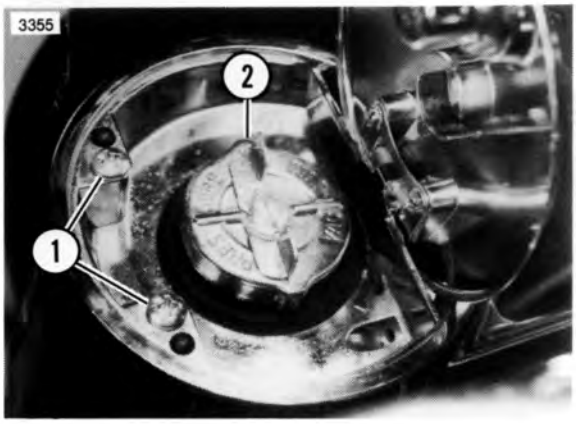
If all traces of fuel are not purged, an open flame may result in a tank explosion. Extreme caution should be taken when repairing tanks.

WARNING

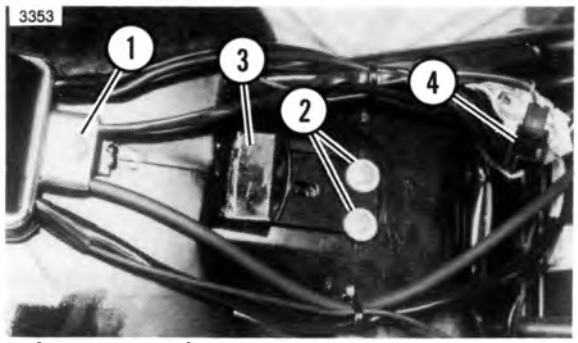
Use only non-ferrous (non-sparking) metal balls, such as lead pellets, to loosen deposits. Metal balls, such as steel ball bearings, could produce a spark igniting the fumes in the tank. The resulting flames or explosion could cause personal injury.

1. Remove fuel gauge sending unit from the fuel tank on models so equipped. 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, non-ferrous metallic balls or pellets may be added to the tank to assist in loosening deposits.

2. Flush fuel tank thoroughly after cleaning and allow it to air dry.



1. Screw, console (2) 2. Fuel tank cap



1. Screw, console
2. Screw, fuel tank
3. Seat tab
4. Fuel gauge connector

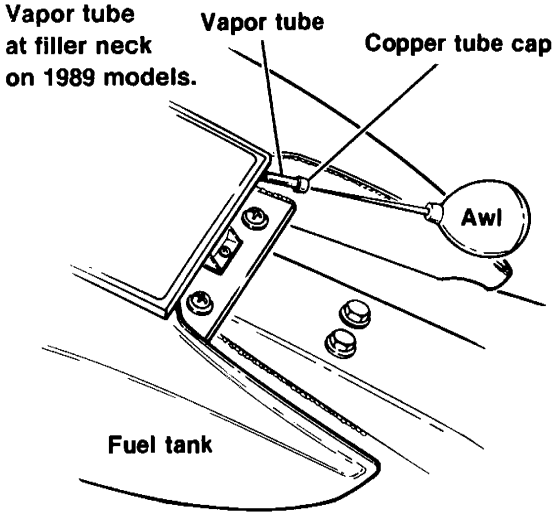


Figure 4-31. FLT Fuel Tank

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 fuel 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.

INSTALLATION

NOTE

When replacing a fuel tank on 1985 and later FLT and FXR models equipped with a California Evaporative Emissions Control System, you must pierce or drill a 0.03 - 0.06 in. diameter hole in the vapor tube cap. See Figures 4-17, 4-18. Use a sharp awl and light hammer to pierce cap or center punch cap and drill through cap with a 1/16 in. drill. Use compressed air to blow chips from tank.

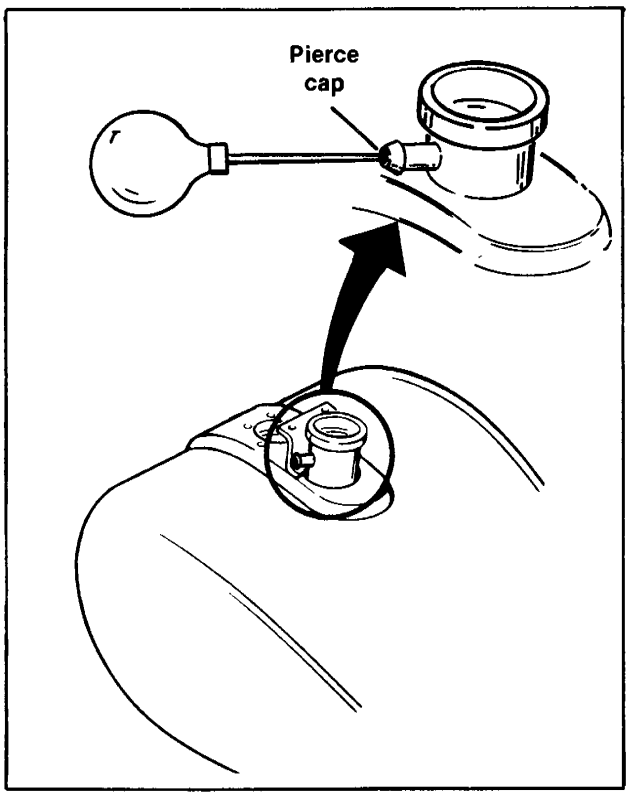


Figure 4-32. Piercing Cap on 1985 and Later FXR Models (Except FXLR and 1988 FXRS) with EVAP System

NOTE

Vapor tube on FXLR and 1988 and 1989 FXRS is located on right front of fuel tank.

CAUTION

When piercing or drilling hole in vapor tube cap, exercise caution to avoid damaging fuel tank. If hole is drilled, blow all metal chips from inside of fuel tank with compressed air.

FLT Models

1988 AND EARLIER

1. Place the tank on the motorcycle and fasten with front mounting bolt, washer, lockwasher and nut.
2. Replace trim and sending unit, if removed.
3. Fasten the rear of the tank using the two screws and lockwasher.
4. Connect the fuel hoses to the tank using new clamps. Route the drain hose from the rear of the tank down behind the rear swing arm.
5. Connect fuel gauge wire.
6. Install the plastic frame cover and seat.
7. Connect battery cables (positive first). Check for leaks.

1989 AND LATER (Figure 4-31)

1. Place the tank on the motorcycle and fasten with front mounting bolt, washer, lockwasher and nut.
2. Replace sending unit, if removed.

NOTE

Connect leads to sending unit before installing unit on tank.

3. Fasten the rear of the tank using the two screws and lockwasher.
4. Install console.
5. Connect the fuel hose to the tank using new clamps.
6. Connect fuel gauge wire connector (4).
7. Install the seat.
8. Connect battery cable (positive first). Check for leaks.

FXR Models (Except FXLR, 1988 & 1989 FXRS)

1. Carefully position fuel tank, making sure wiring harness does not bind between tank and frame.
2. Install sending unit, if removed.
3. Install front mounting bolt, throttle cable clamp, washer, internal tooth lockwasher, washer, and locknut.
4. Install the rear tank mounting bolts, lockwashers and washers. Close the seat. See SEAT INSTALLATION, Section 2.
5. Place the center panel console in position, then connect: the fuel gauge wire at the sending unit, the ground wire and the twelve volt power supply wire from the main wire harness. On vehicles with a fuel tank console mounted speedometer, connect the speedometer twelve volt power supply wire and the ground wire to the speedometer light. Connect speedometer cable.
6. Install the center panel and filler neck gasket and the three screws.
7. Connect the fuel hoses to the tank using new hose clamps.
8. Connect battery cables (positive first).
9. Add fuel and check for leaks.

FXLR

Install fuel tank following the instructions given for FXR Models; but, ignore the instructions that cover instrument console or fuel gauge.

FXRS — 1988-1989

1. Install the fuel tank following instructions in steps 1 - 4 of FXR Models.
2. Install new gasket and sending unit, if removed.
3. Place speedometer/tachometer panel on fuel tank and connect speedometer cable and electrical leads.
4. Install two screws to retain panel to fuel tank.
5. Perform steps 7 - 9 of FXR Models procedure.

EVAPORATIVE EMISSIONS CONTROL
1985 CALIFORNIA MODELS ONLY — FLT

GENERAL (Figure 4-33)

All 1985 model year Harley-Davidson motorcycles sold in the state of California are equipped with an evaporative emission control system. This system is designed to meet the CARB regulations in effect at the time of manufacture.

The system is virtually maintenance free. All that should be required is periodic inspection to be sure hoses are properly routed and not kinked or blocked and that all fittings are secure. Mounting hardware should also be checked for tightness.

The purpose of the evaporative emissions system is to prevent fuel hydrocarbon vapors from escaping into the atmosphere. When the engine is not running, any pressurized build-up of hydrocarbon vapors are directed through the vapor valve and stored in the charcoal canister. At engine start-up, a vacuum line from the carburetor will purge or draw off the vapors in the canister and direct them to the engine combustion chambers. The vapor valve prevents gasoline from escaping through the vapor vent when the vehicle is tipped at an abnormal angle. A large diameter hose purges the canister with fresh air from the air cleaner through the air cleaner backing plate.

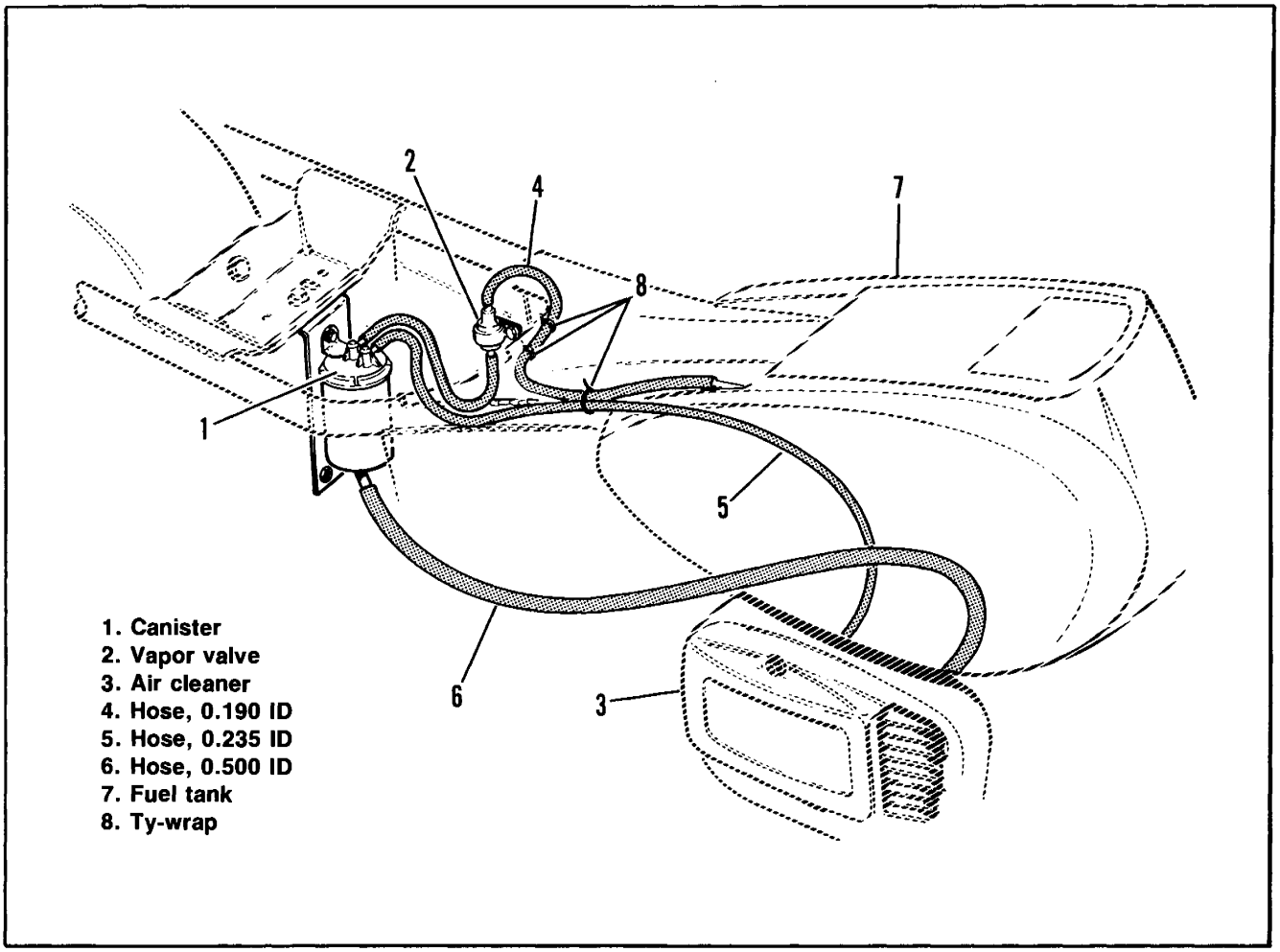


Figure 4-33. Evap. System

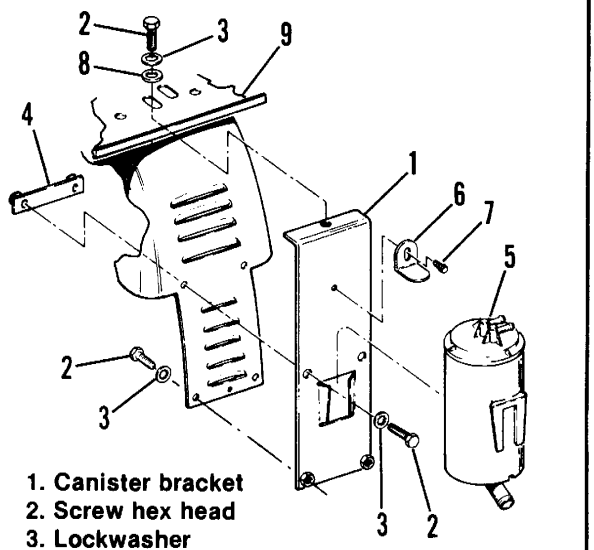
INSTALLATION

Canister (Figure 4-34)

The canister is mounted so that holes in bracket align with holes in frame (9) and the holes in fender.

CAUTION

Be certain to mount the canister in the location specified. The canister must be mounted below the carburetor for the system to be operational.



1. Canister bracket
2. Screw hex head
3. Lockwasher
4. Bracket assembly
5. Canister
6. Hold down bracket
7. Screw, self-tapping
8. Washer
9. Frame

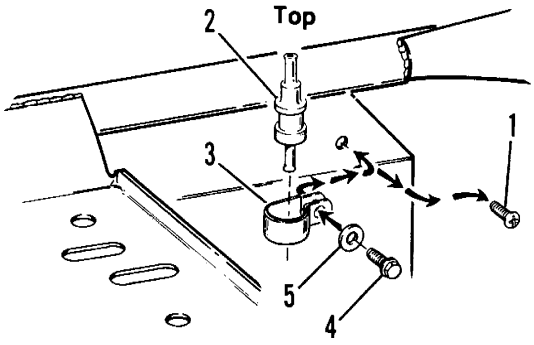
Figure 4-34. Canister Mounting

Vapor Valve (Figure 4-35)

The vapor valve is mounted in compartment under seat.

CAUTION

The vapor valve must be maintained in an upright attitude and the proper end (long fitting) must be at the top or excessive fuel tank pressures may occur.



1. Screw, Phillips head
2. Vapor valve
3. Bracket
4. Screw
5. Washer

Figure 4-35. Vapor Valve Mounting

Hose Routing (Figure 4-33)

1. Take small diameter 0.190 ID hose (4) and push one end over fitting at top of canister labeled "tank". Direct hose to bottom of vapor valve, leaving a generous loop in hose. Push free end of hose over lower fitting on vapor valve (2).

2. Take small diameter hose and push one end over top fitting on vapor valve (2). Lead hose around top from opening under seat and ty-wrap hose to adjacent cable at two points as shown in Figure 4-16. Extend hose along right frame member to tank hose nipple. Push free end of hose over tank nipple.

3. Take 0.235 ID hose (5) and push one end over fitting at top of canister labeled "carb". Lead hose along right side of frame next to hose (4) and ty-wrap the two hoses (5) and (4) together. Bring hose down to carburetor purge fitting.

4. Push free end of hose over carburetor purge fitting.

5. Take large diameter 0.500 ID pre-formed hose and push one end over fitting at bottom of canister. Bring hose under horizontal frame member, over starter housing, under exhaust pipe and up to air cleaner. Connect free end of hose to the fitting installed at air cleaner.

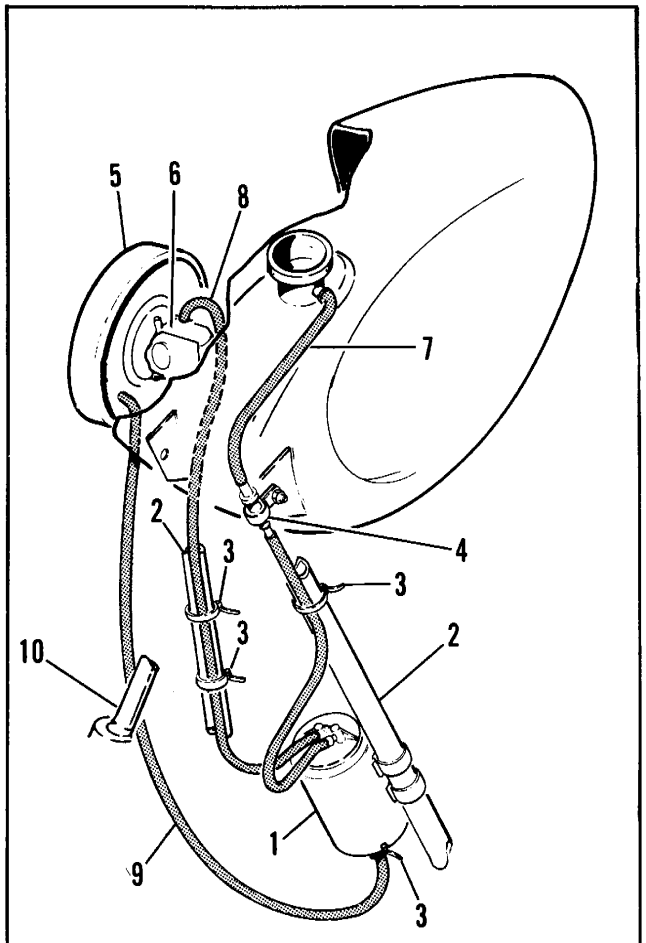
EVAPORATIVE EMISSIONS CONTROL
1985 CALIFORNIA MODELS ONLY — FXR

GENERAL (Figure 4-36)

All 1985 model year Harley-Davidson motorcycles sold in the state of California are equipped with an evaporative emission control system. This system is designed to meet the CARB regulations in effect at the time of manufacture.

The system is virtually maintenance free. All that should be required is periodic inspection to be sure hoses are properly routed and not kinked or blocked and that all fittings are secure. Mounting hardware should also be checked for tightness.

The purpose of the evaporative emissions system is to prevent fuel hydrocarbon vapors from escaping into the atmosphere. When the engine is not running, any pressurized build-up of hydrocarbon vapors are directed through the vapor valve and stored in the charcoal canister. At engine start-up, a vacuum line from the carburetor will purge or draw off the vapors in the canister and direct them to the engine combustion chambers. The vapor valve prevents gasoline from escaping through the vapor vent when the vehicle is tipped at an abnormal angle. A large diameter hose purges the canister with fresh air from the air cleaner through the air cleaner backing plate.



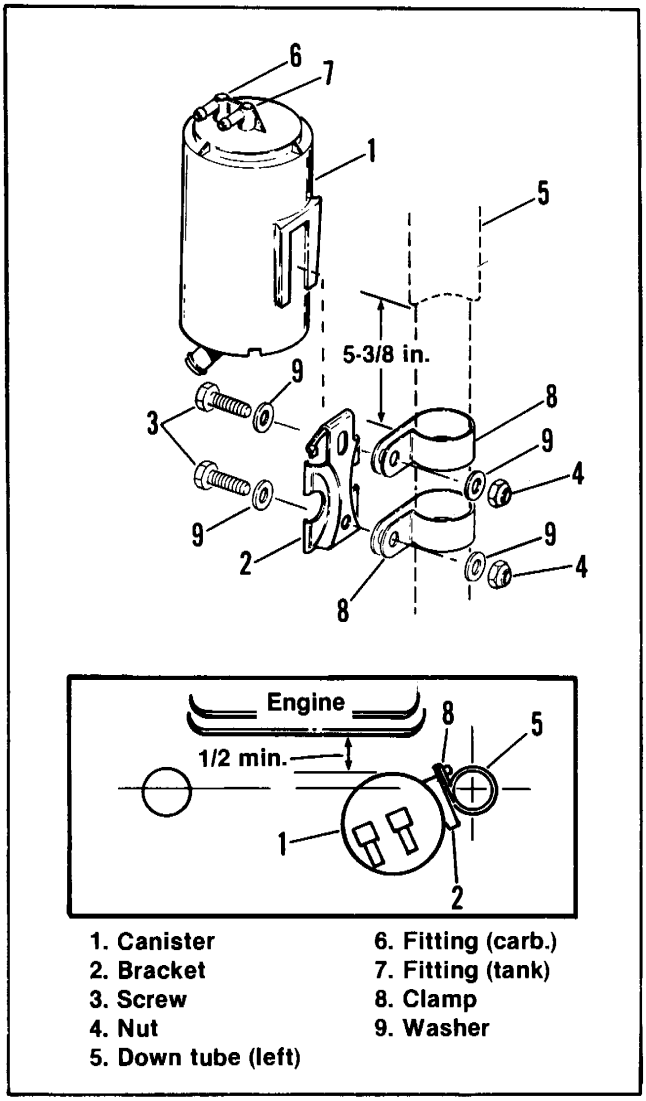
1. Canister
2. Frame downtube
3. Ty-wrap
4. Vapor valve
5. Air cleaner
6. Carburetor
7. Hose, 0.190 ID
8. Hose, 0.235 ID
9. Hose, 0.500 ID
10. Pushrod cover

Figure 4-36. Evap. System

INSTALLATION

Canister (Figure 4-37)

The canister is mounted into bracket (2) and mounting clamps (8) on downtube (5) so canister is a minimum of 1/2 in. from engine as shown.



1. Canister
2. Bracket
3. Screw
4. Nut
5. Down tube (left)
6. Fitting (carb.)
7. Fitting (tank)
8. Clamp
9. Washer

Figure 4-37. Canister Mounting

Vapor Valve (Figure 4-38)

The vapor valve is mounted in clamp (2) with valve right side up (longer fitting upward) as shown in Figure 4-38.

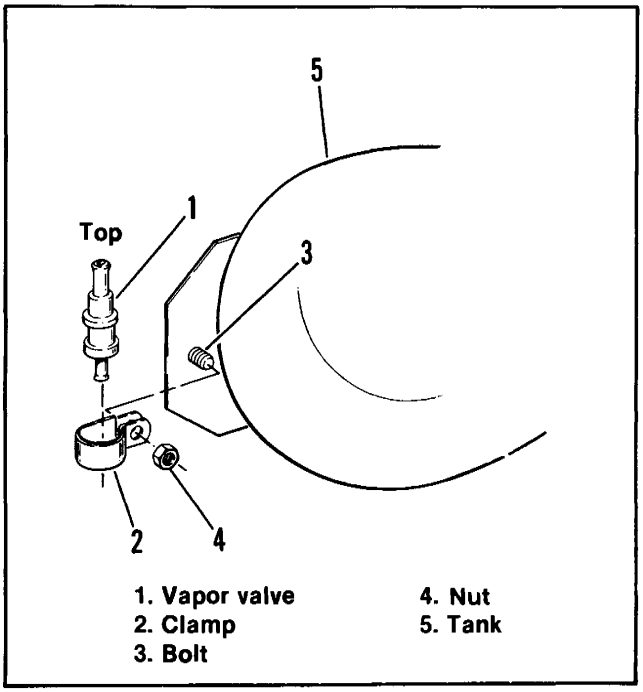


Figure 4-38. Vapor Valve Mounting

Hose Routing (Figure 4-36, 4-39)

1. Take small 0.190 ID hose (7) and push one end over fitting at top of canister labeled "tank". Lead hose to left downtube and secure with ty-wrap (3). Bring hose up to the bottom of the vapor valve. Push free end of hose over lower fitting on vapor valve.

2. Take small diameter hose and push one end over top fitting on vapor valve. Bring hose up along tank to vent fitting in tank filler neck and cut to length. Push free end of hose over vent tube fitting.

3. Take 0.235 ID hose (8) and push hose through center cavity under gas tank. Bring hose around rear of carburetor, between throttle cables and onto purge fitting. Bring free end of hose down right frame tube to fitting on top of canister labeled "carb". Cut hose to length and push hose on fitting. Secure hose to frame with two ty-wraps.

4. See Figure 4-39. Take large diameter pre-formed hose and push end with short bend over fitting installed at back of air cleaner. Route hose between engine push rod and cylinder to canister as shown.

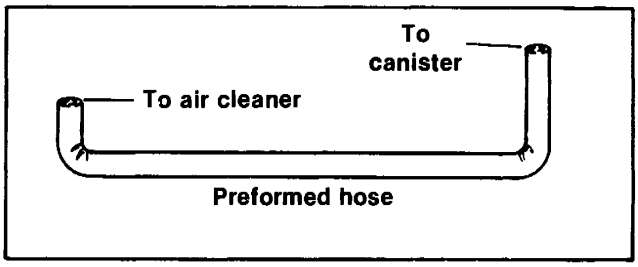


Figure 4-39. Preformed Hose Connections

FLT MODELS EVAPORATIVE EMISSIONS CONTROL KIT 1986, 1987 CALIFORNIA MODELS ONLY

GENERAL

This kit is for 1986 and 1987 FLT model motorcycles sold in the state of California.

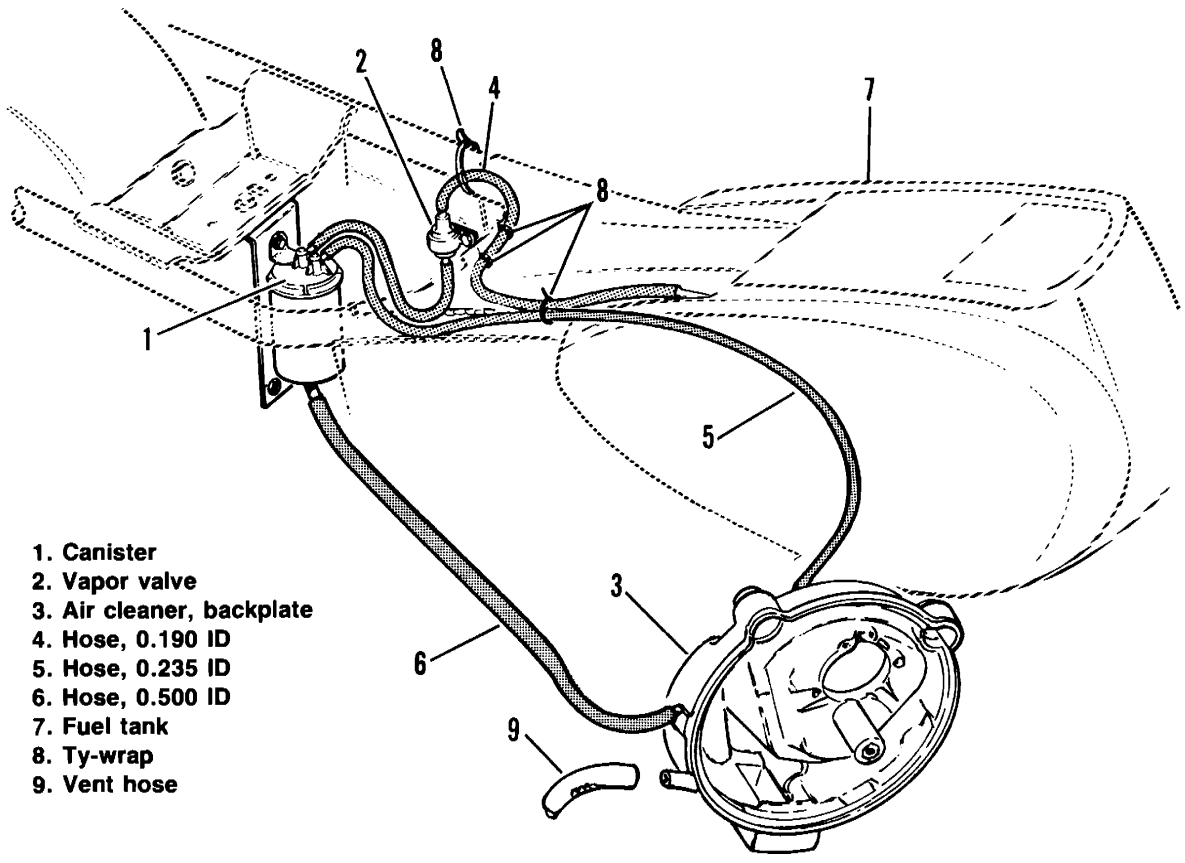
It is the responsibility of Harley-Davidson, Inc., to supply a complete and approved evaporative emissions control system with each vehicle sold in the state of California.

It is the responsibility of Harley-Davidson dealers, whose dealerships are in the state of California, to ensure that the evaporative emissions system as furnished with each vehicle, is installed correctly. Therefore, it is of utmost importance that all specified parts in the kit are installed and all procedures carried out, as covered in these instructions, for the system to be properly operative.

INSTALLATION

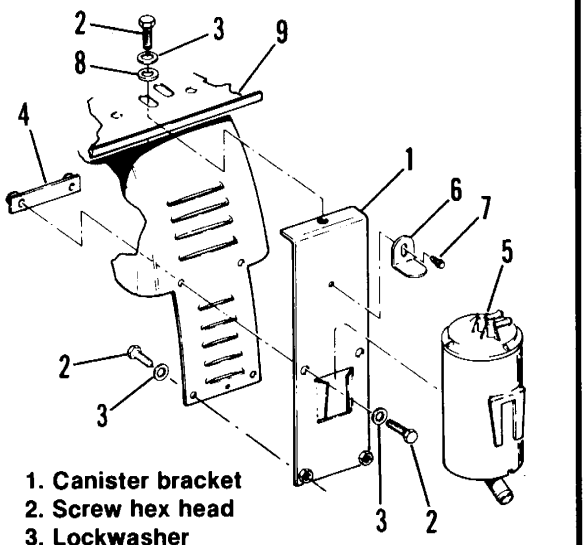
1. See Figure 4-41. Position canister bracket (1) so that holes in bracket align with holes in frame (9) and the holes in fender.

2. Place lockwasher (3) followed by washer (8) on screw (2). Insert screw (2) through frame (9) and thread into the nut welded to underside of canister bracket flange. Place two lockwashers (3) on two screws (2). Insert screws (2) through upper holes in bracket (1) and fender, then thread into nut plate (4). Place two lockwashers (3) on remaining two screws (2). Insert screw (2) through lower holes at backside of fender and thread into nut welded to front of canister bracket (1). Tighten all nuts and bolts securely.



1. Canister
2. Vapor valve
3. Air cleaner, backplate
4. Hose, 0.190 ID
5. Hose, 0.235 ID
6. Hose, 0.500 ID
7. Fuel tank
8. Ty-wrap
9. Vent hose

Figure 4-40. Evap. System



1. Canister bracket
2. Screw hex head
3. Lockwasher
4. Bracket assembly
5. Canister
6. Hold down bracket
7. Screw, self-tapping
8. Washer
9. Frame

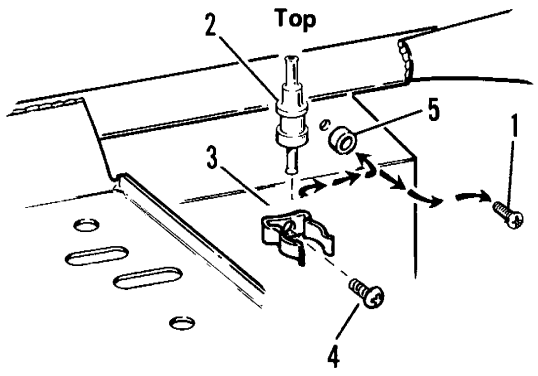
Figure 4-41. Canister Mounting

3. Place canister (5), with top hose fittings pointing left, into canister bracket (1). Align slotted hole in hold down bracket (6) with center hole in canister bracket (1). Move bracket (6) against top of canister (5), then insert screw (7) through bracket (6) and thread into hole in canister bracket.

4. See Figure 4-42. Remove the front reservoir mounting screw (1) from inside compartment under seat and discard. Position two spacers (5) and bracket (3) over hole and secure with screw (4). Press vapor valve (2) into bracket (3) making sure long fitting end of valve is "up" and center groove on valve seats firmly in bracket.

CAUTION

The vapor valve must be maintained in an upright attitude and the proper end (long fitting) must be at the top or excessive fuel tank pressures may occur.



1. Screw, Phillips head
2. Vapor valve
3. Bracket
4. Screw
5. Spacer (2)

Figure 4-42. Vapor Valve Mounting

HOSE ROUTING

1. See Figure 4-40. Take small diameter-0.190 I.D. hose (4) and push one end over fitting at top of canister labeled "tank". Direct hose to bottom of vapor valve, leaving a generous loop in hose, then cut to length. Push free end of hose over lower fitting on vapor valve (2).

2. Take remaining portion of small diameter hose and push one end over top fitting on vapor valve (2). Lead hose around top from opening under seat and ty-wrap hose to adjacent cable at two points as shown in Figure 4-40. Extend hose along right frame member to tank hose nipple. Cut hose to length. Push free end of hose over tank nipple.

3. Take 0.235 I.D. hose (5) and push one end over fitting at top of canister labeled "carb". Lead hose along right side of frame next to hose (4) and ty-wrap the two hoses (5) and (4) together. Bring hose down to carburetor purge fitting. Cut hose to length.

4. Push free end of hose over carburetor purge fitting.

5. Take large diameter 0.500 I.D. pre-formed hose and push one end over fitting at bottom of canister. Bring hose under horizontal frame member, over starter housing, under exhaust pipe and up to air cleaner backplate location.

FLT MODELS EVAPORATIVE EMISSIONS CONTROL SYSTEM 1988-1990 CALIFORNIA MODELS ONLY

DESCRIPTION (Figure 4-43)

The purpose of the evaporative emissions (EVAP) system is to prevent fuel hydrocarbon vapors from escaping into the atmosphere. When the engine is not running, any build-up of hydrocarbon vapors are directed through the vapor valve and stored in the charcoal canister. At engine start-up a vacuum line from the carburetor will purge or draw off the vapors in the canister and direct them to the engine combustion chambers. The vapor valve prevents fuel from escaping through the vapor vent when the vehicle is tipped at an abnormal angle. A large diameter hose purges the canister with fresh air from the air cleaner through the air cleaner backplate.

The reed valves seal the air cleaner backplate when the engine is not running. The vacuum operated valve (VOV) seals the float bowl overflow when the engine is not running.

WARNING

Make certain hoses do not contact hot exhaust or engine parts. Hoses contain flammable vapors that could be ignited if hose was melted.

TROUBLESHOOTING

The EVAP system has been designed to operate with a minimum of maintenance. Check that all hoses are properly connected, are not pinched or kinked and are routed properly.

Reed Valves (Figure 4-44)

When servicing the air cleaner check that the top and bottom reeds are not cracked or broken. If reeds are cracked or broken, replace them. See REMOVAL and INSTALLATION in this section.

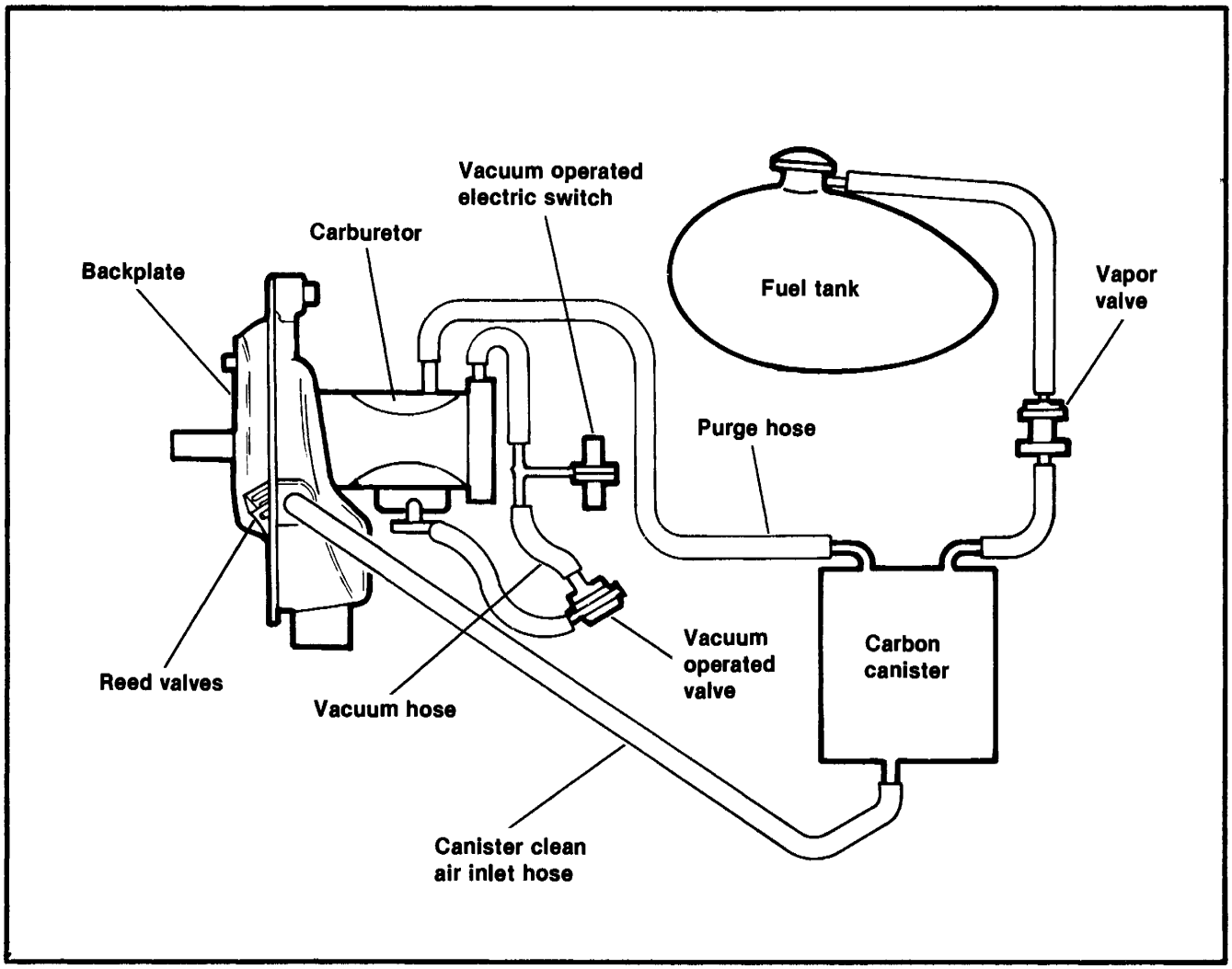


Figure 4-43. 1988 Schematic — California Evaporative Emissions Control System

Vacuum Operated Valve (VOV)

1. Failure of the diaphragm in the VOV would result in a vacuum leak. Also the mixture would be lean at high engine speed.

2. See Figure 4-45. To check for a leaking diaphragm and proper valve action in VOV, attach hose of VACUUM PUMP, Part No. HD-23738 to (A) on VOV as shown.

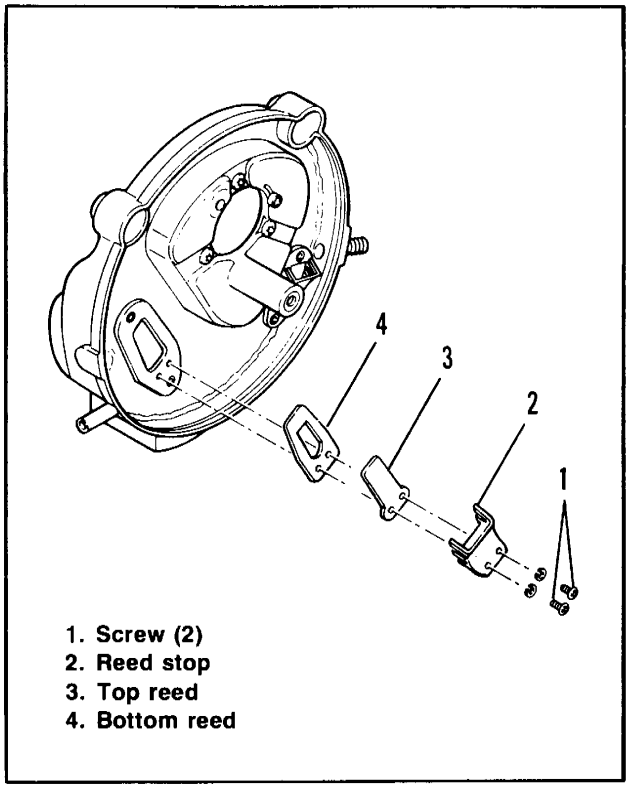
3. Apply a vacuum of 1 - 2 in. of mercury.

4. Vacuum gauge reading should remain steady. If vacuum reading decreases rapidly, diaphragm is leaking.

5. With vacuum applied, blow into hose (B). Valve must be open and allow air passage to atmosphere at (C).

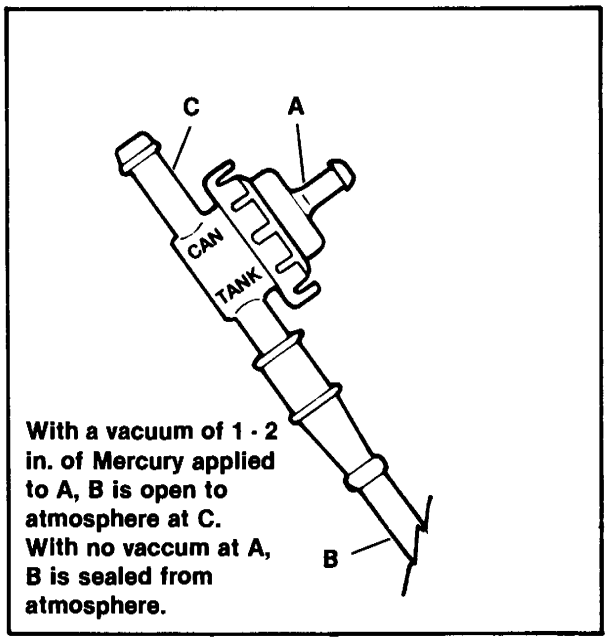
6. With no vacuum applied, valve must be closed, that is air cannot pass from B to C.

7. If a leaking diaphragm or a malfunctioning valve was found, replace the VOV.



1. Screw (2)
2. Reed stop
3. Top reed
4. Bottom reed

Figure 4-44. Reed Valves



With a vacuum of 1 - 2 in. of Mercury applied to A, B is open to atmosphere at C. With no vaccum at A, B is sealed from atmosphere.

Figure 4-45. Vacuum Operated Valve

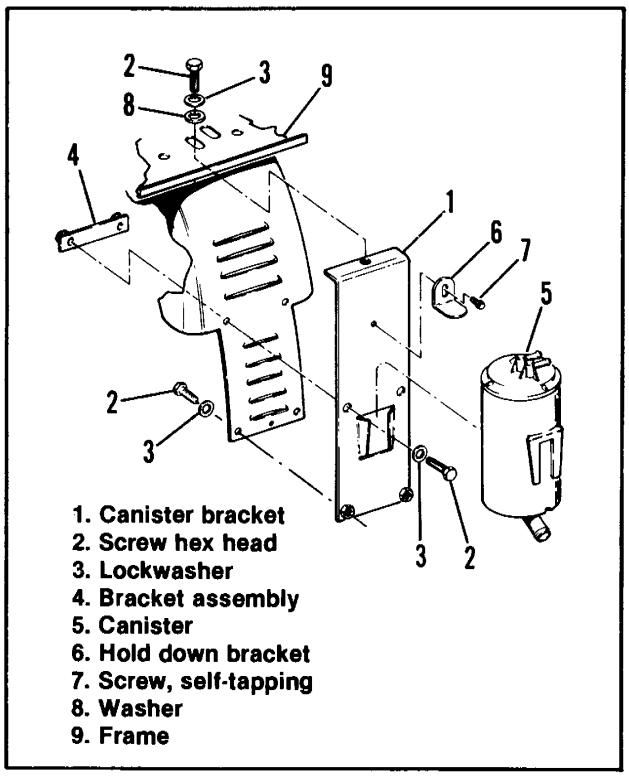
REMOVAL AND INSTALLATION

Canister (Figure 4-46)

The canister is mounted so that holes in bracket align with holes in frame (9) and the holes in fender.

CAUTION

Be certain to mount the canister in the location specified. The canister must be mounted below the carburetor for the system to be operational.



1. Canister bracket
2. Screw hex head
3. Lockwasher
4. Bracket assembly
5. Canister
6. Hold down bracket
7. Screw, self-tapping
8. Washer
9. Frame

Figure 4-46. Canister Mounting

Vapor Valve (Figure 4-47)

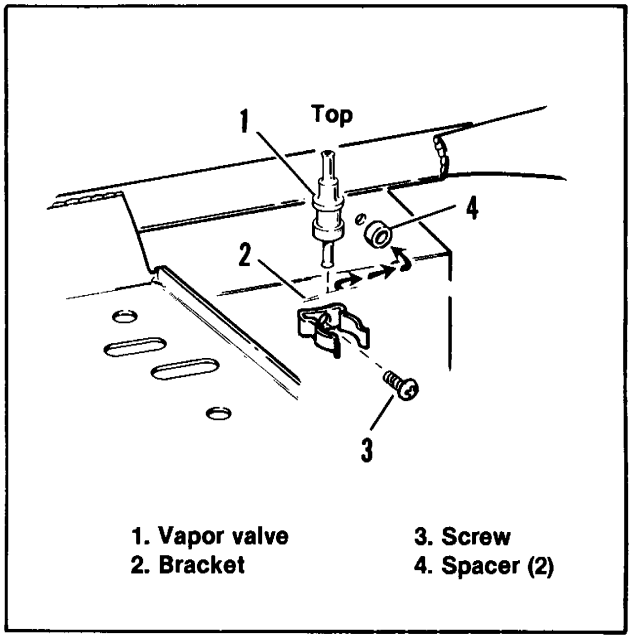
The vapor valve is mounted in compartment under seat.

CAUTION

The vapor valve must be maintained in an upright attitude and the proper end (long fitting) must be at the top or excessive fuel tank pressures may occur.

Reed Valves (Figure 4-44)

1. Reeds in reed valves may be replaced without removing backplate.
2. Remove screws (1), reed stop (2), top reed (3) and bottom reed (4).
3. Reed installation is the reverse of removal. Tighten screws (1) to 4 - 6 in-lbs torque.



1. Vapor valve
2. Bracket
3. Screw
4. Spacer (2)

Figure 4-47. Vapor Valve Mounting

Vacuum Operated Valve (VOV)

See HOSE ROUTING for Removal and Installation of VOV. The VOV is sold as an assembly including all connecting hoses and tee.

HOSE ROUTING

VOV

1988 AND 1989
See Figure 4-48 for VOV hose routing.

1990
See Figure 4-49 for VOV hose routing.

Canister Hoses (Figure 4-50)

CANISTER-TO-VAPOR-VALVE HOSE

The canister-to-vapor-valve hose (1) connects the "TANK" nipple (2) on the canister to the bottom nipple of the vapor valve (3).

VAPOR-VALVE-TO-FUEL-TANK HOSE

The vapor-valve-to-fuel-tank hose (4) connects the top nipple of the vapor valve (3) to the fuel tank vapor tube.

CANISTER-TO-CARBURETOR HOSE

The canister-to-carburetor hose (5) connects the "CARB" nipple (6) on the canister to the carburetor. See Figure 4-51 for final hose routing and carburetor connection on 1988-1989 models. See Figure 4-49 for 1990 models.

CANISTER-TO-AIR-CLEANER-BACKPLATE HOSE

See Figure 4-52. The canister-to-air-cleaner-backplate hose connects the bottom nipple on canister to the air cleaner backplate. This is a preformed hose. Connect the hose end with the single bend to the canister. Route the backplate end of hose down through the frame, over the transmission and behind the rear exhaust pipe. Install a cable strap (loosely) at the location shown in Figure 4-52 to prevent hose from contacting rear exhaust pipe. On 1990 canister-to-air-cleaner, backplate hose connects to rear of backplate and no cable strap is needed.

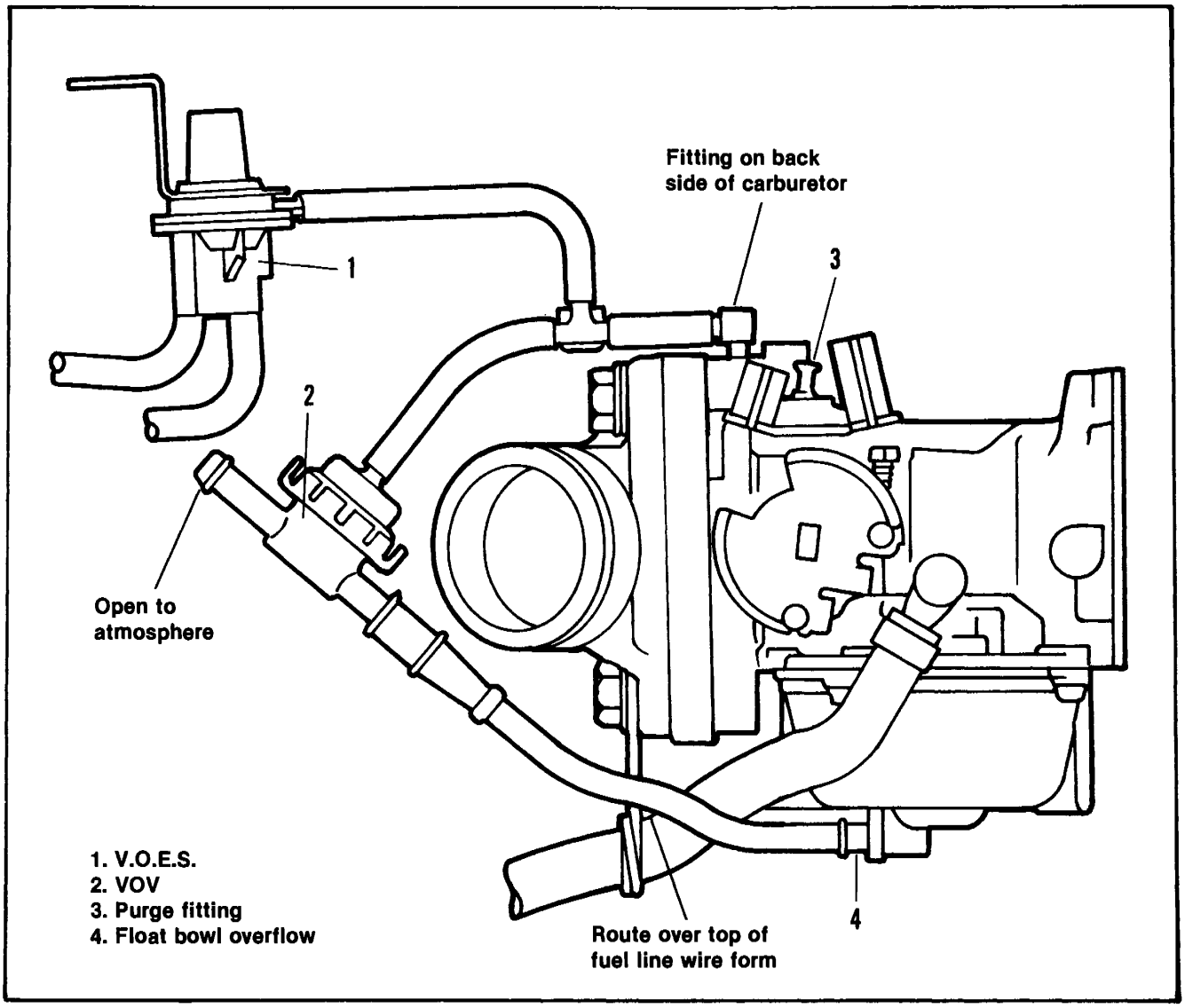


Figure 4-48. Hose Routing — 1988, 1989

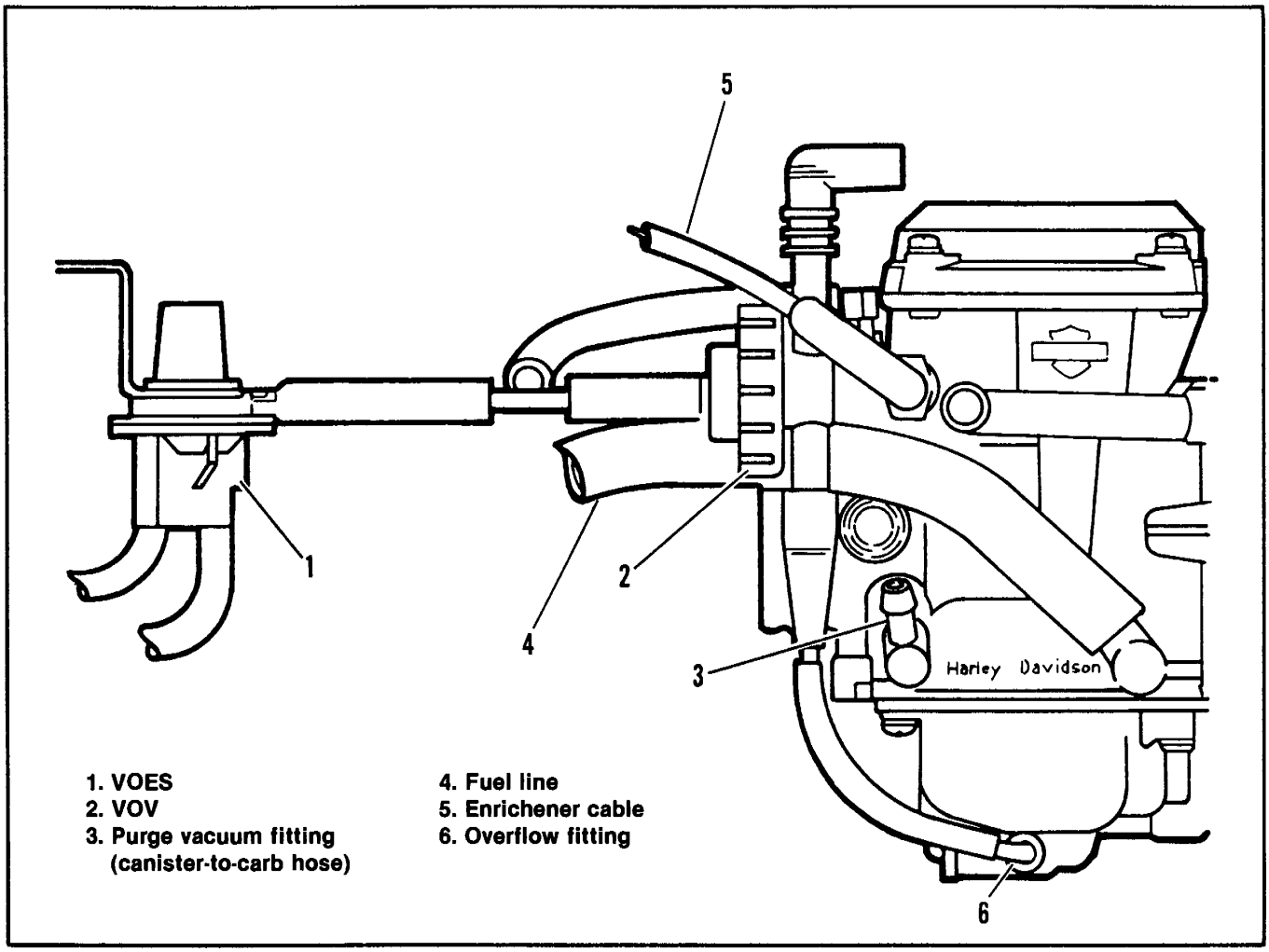
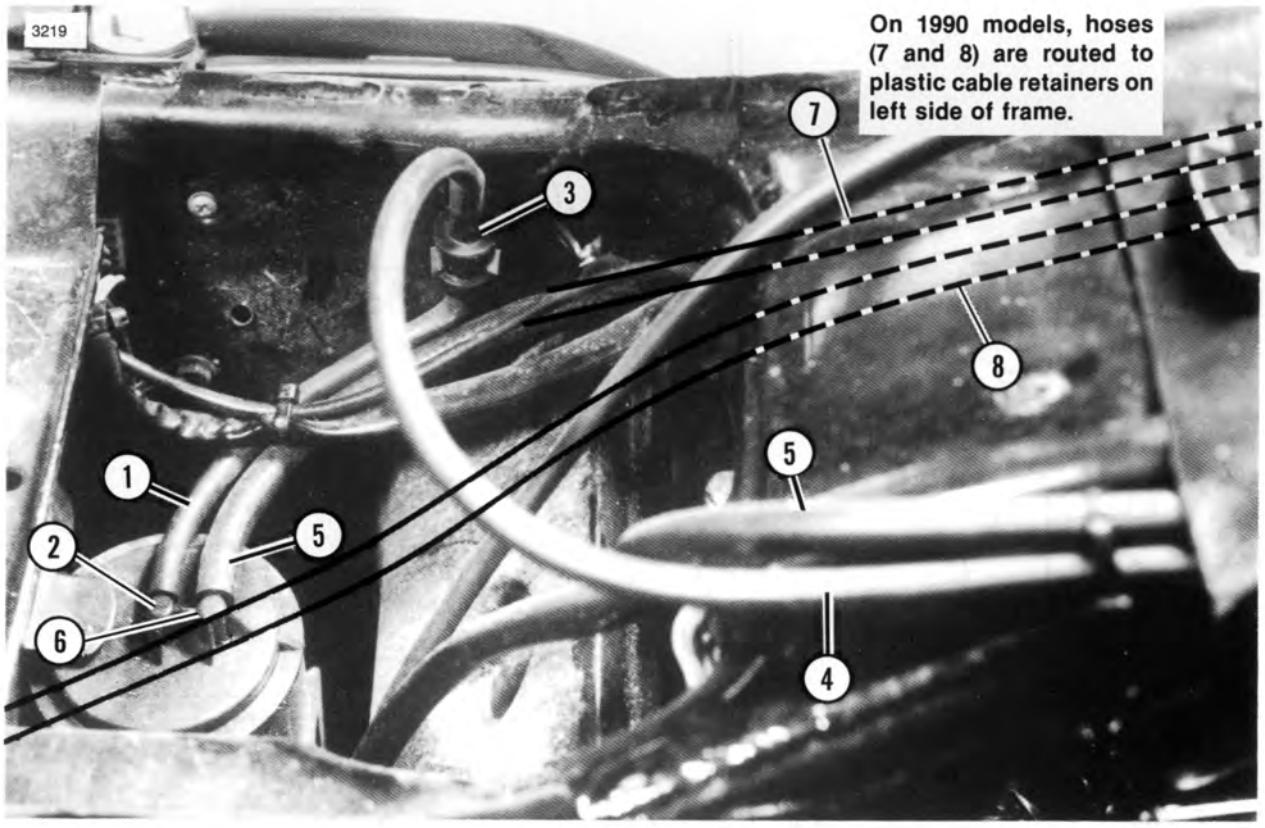
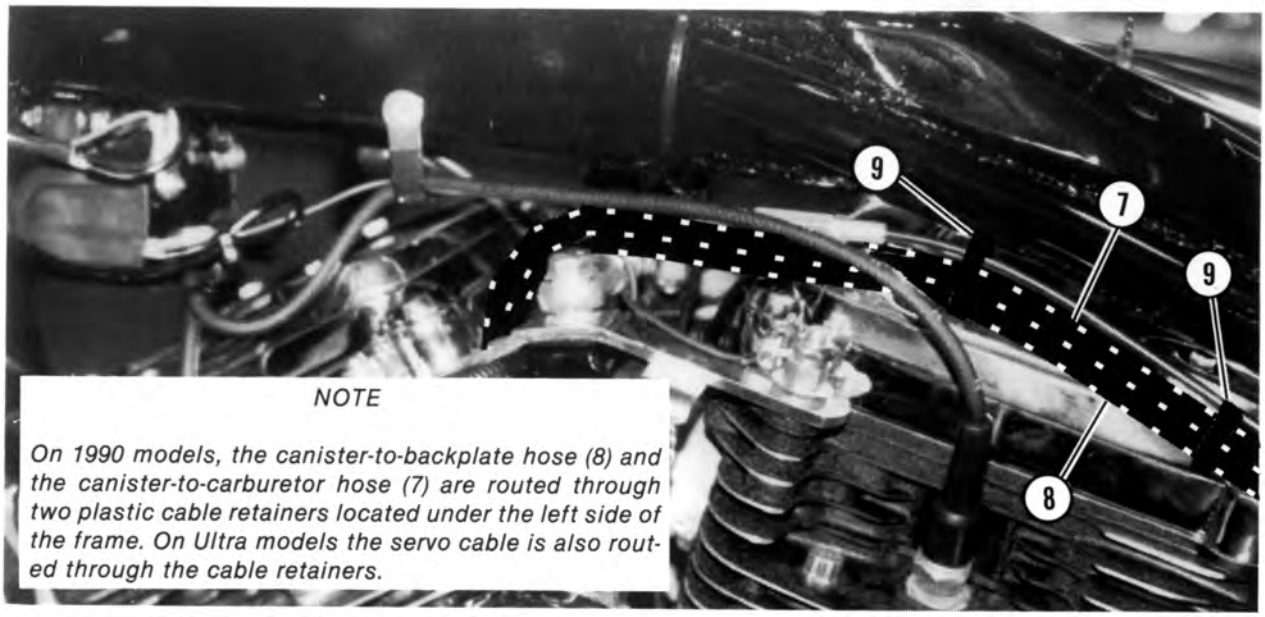


Figure 4-49. Hose Routing — 1990





NOTE

On 1990 models, the canister-to-backplate hose (8) and the canister-to-carburetor hose (7) are routed through two plastic cable retainers located under the left side of the frame. On Ultra models the servo cable is also routed through the cable retainers.

1. Canister-to-vapor-valve hose
2. TANK canister nipple
3. Vapor valve
4. Vapor-valve-to-fuel-tank hose
5. Canister-to-carburetor hose (1988)
6. CARB canister nipple
7. Canister-to-carburetor hose (1989 - 1990)
8. Canister-to-backplate hose (1990 routing)
9. Plastic cable retainer (2)

Figure 4-50. Hose Routing From Canister

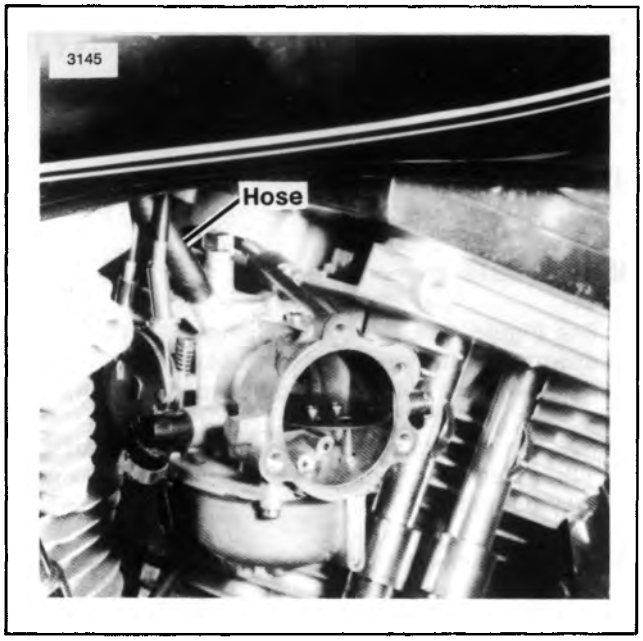


Figure 4-51. Canister-To-Carburetor Hose

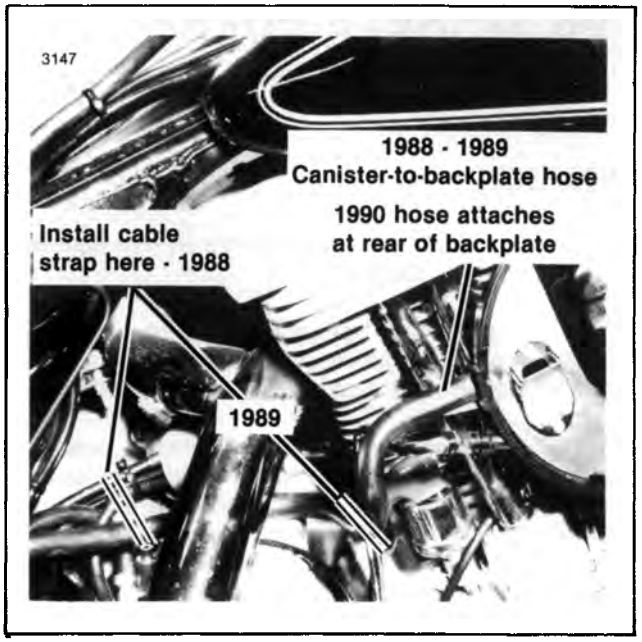


Figure 4-52. Air Cleaner Backplate Hose Connection

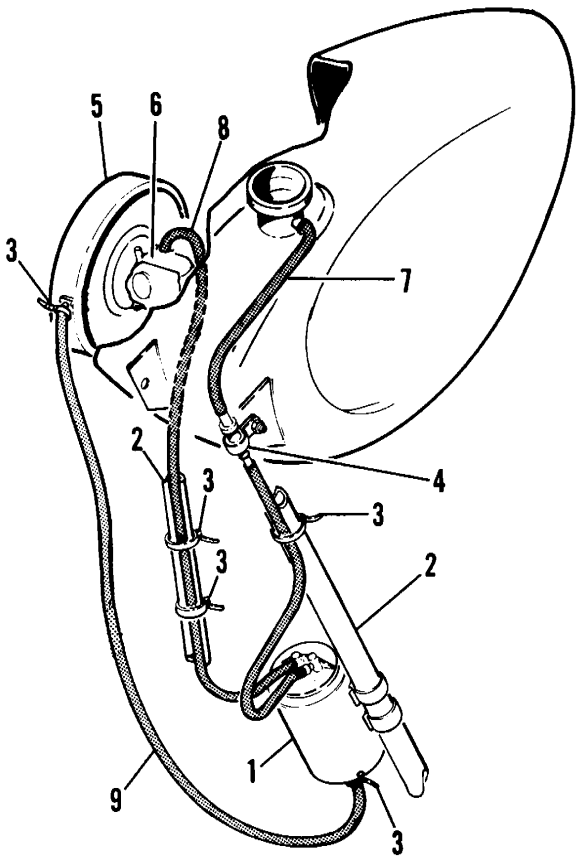
FXR MODELS EVAPORATIVE EMISSIONS CONTROL KIT 1986, 1987 CALIFORNIA MODELS ONLY

GENERAL

This kit is for 1986 and 1987 FXR model motorcycles sold in the state of California.

It is the responsibility of Harley-Davidson, Inc., to supply a complete and approved evaporative emissions control system with each vehicle sold in the state of California.

It is the responsibility of Harley-Davidson dealers, whose dealerships are in the state of California, to ensure that the evaporative emissions system as furnished with each vehicle, is installed correctly. Therefore, it is of utmost importance that all specified parts in the kit are installed and all procedures carried out, as covered in these instructions, for the system to be properly operative.



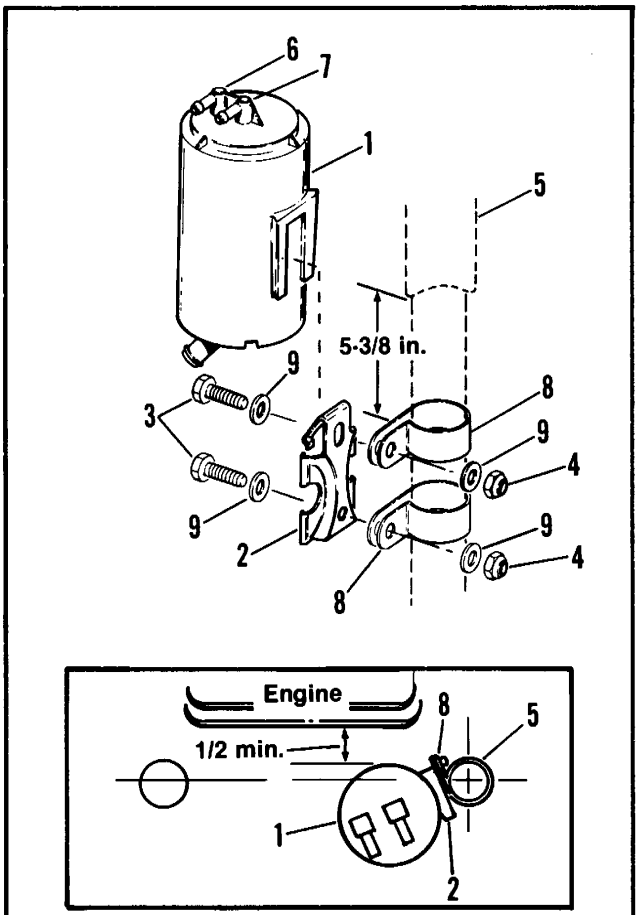
1. Canister
2. Frame downtube
3. Ty-wrap
4. Vapor valve
5. Air cleaner
6. Carburetor
7. Hose, .190 ID
8. Hose, .235 ID
9. Hose, .500 ID

Figure 4-53. Evap. System

INSTALLATION

1986 Models

1. See Figure 4-54. Place two clamps (8) around left downtube with the top clamp approximately 5-3/8 in. down from steering head stamping as shown.
2. Position bracket (2) against clamps (8) and attach with screws (3), washers (9) and nuts (4). Do not fully tighten.
3. Insert canister (1) into bracket (2). If canister is loose, compress bracket sides slightly with channel lock pliers to tighten.
4. Rotate canister and mounting clamps so that canister is minimum of 1/2 in. from engine as shown.



1. Canister
2. Bracket
3. Screw
4. Nut
5. Down tube (left)
6. Fitting (carb.)
7. Fitting (tank)
8. Clamp
9. Washer

Figure 4-54. Canister Mounting

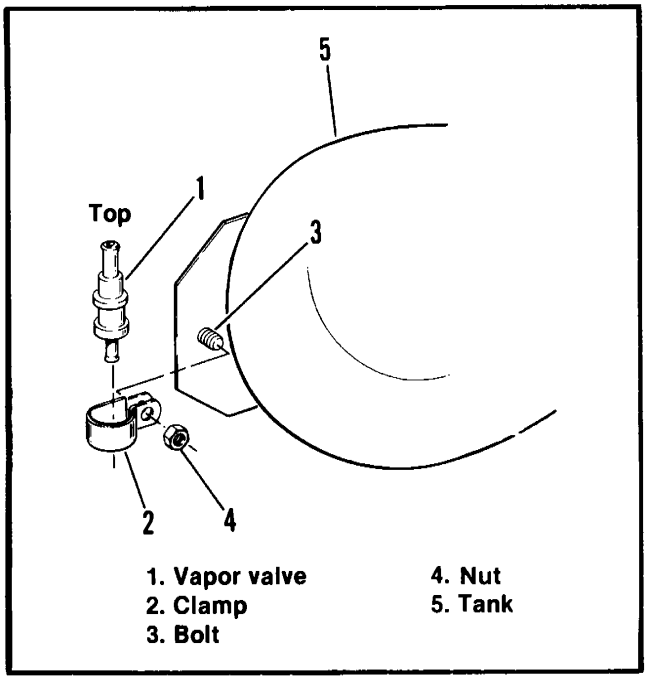


Figure 4-55. Flow Valve Mounting

Tighten mounting hardware securely. Secure canister in bracket by bending retaining tabs toward canister.

5. See Figure 4-55. Remove nut (4) from tank mounting bolt (3).

6. Place valve (1) in clamp being sure valve is right side up (longer fitting upward) as shown in Figure 4-55.

CAUTION

The vapor valve must be installed in the correct orientation and vertical position with the longer fitting upward to be operative.

7. Position clamp (2) over bolt (3), thread on and tighten nut (4) securely while keeping valve vertical.

1987 Models

1. See Figure 4-54. Place two clamps (8) around left downtube with the top clamp approximately 5-3/8 in. down from steering head stamping as shown.

2. Position bracket (2) against clamps (8) and attach with screws (3), washers (9) and nuts (4). Do not fully tighten.

3. Insert canister (1) into bracket (2). If canister is loose, compress bracket sides slightly with channel lock pliers to tighten.

4. Rotate canister and mounting clamps so that canister is minimum of 1/2 in. from engine as shown. Tighten mounting hardware securely. Secure canister in bracket by bending retaining tabs toward canister.

5. See Figure 4-55. On FXR, FXRS/SE, FXLR, remove nut (4) from tank mounting bolt (3).

6. On FXRT models, remove bolt from bottom frame mounted fairing bracket.

7. Place valve (1) in clamp (2) being sure valve is right side up (longer fitting upward) as shown.

CAUTION

The vapor valve must be installed in the correct orientation and vertical position with the longer fitting upward to be operative.

8. On FXR, FXRS/SE, FXLR models, position clamp (2) over bolt (3), thread on and tighten nut (4) securely while keeping valve vertical.

9. On FXRT thread bolt into clamp. With clamp on, use bolt to reattach fairing bracket securely while keeping valve vertical.

HOSE ROUTING

1986 Models

1. See Figure 4-53. Take small 0.190 ID hose (7) and push one end over fitting at top of canister labeled "tank". Lead hose to left downtube and secure with ty-wrap (3). Bring hose up to the bottom of the vapor valve and cut to length. Push free end of hose over lower fitting on vapor valve.

2. Take remaining portion of small diameter hose and push one end over top fitting on vapor valve. Bring hose up along tank to vent fitting in tank filler neck and cut to length. Push free end of hose over vent tube fitting.

3. Take 0.235 ID hose (8) and push hose through center cavity under fuel tank. Bring hose around rear of carburetor, between throttle cables and onto purge fitting. Bring free end of hose down right frame tube to fitting on top of canister labeled "carb". Cut hose to length and push hose on fitting. Secure hose to frame with two ty-wraps.

4. See Figure 4-56. Take large diameter pre-formed hose and push end with short bend over fitting in-

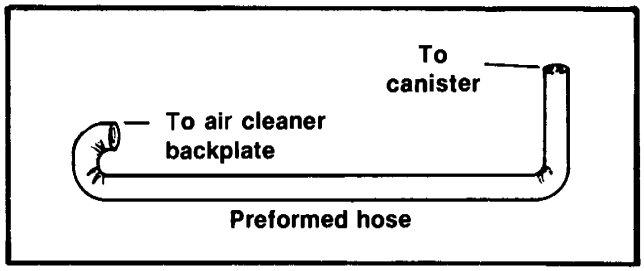


Figure 4-56. Preformed Hose Connections

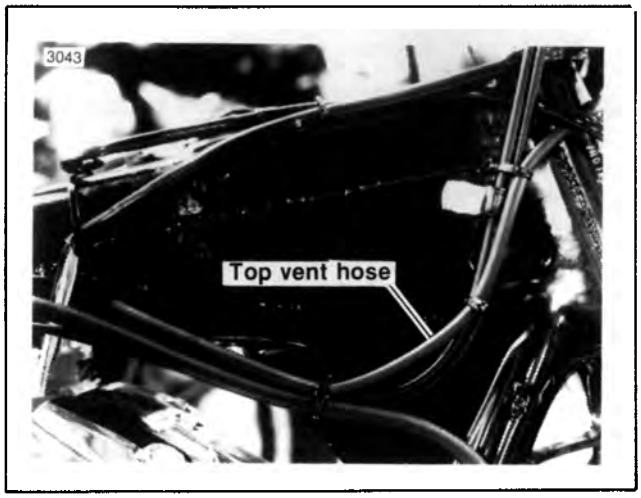


Figure 4-57. Top Vent Hose Routing — FXR

stalled at front of air cleaner backplate. Route hose outside push rod cover and down to canister as shown in Figure 4-53. Connect end of hose with long leg to the fitting at bottom of canister. Secure hose to canister with ty-wrap. Do not cut hose. Be sure regulator wires do not contact hose or canister.

1987 Models

1. See Figure 4-53. Take small 0.190 I.D. hose (7) and push one end over fitting at top of canister labeled "tank". Lead hose to left downtube and secure with ty-wrap (3). Bring hose up to bottom of the vapor valve and cut to length. Push free end of hose over lower fitting on vapor valve.

   Routing of top vapor valve hose on FXLR is different than other FXR models.

   A. On FXR, FXRS/SE models, take remaining portion of small diameter hose and push one end over top fitting on vapor valve. Bring hose up along tank to vent fitting in tank filler neck and cut to length. Push free end of hose over vent tube fitting.

   B. See Figure 4-57. On FXLR models, push one end of remaining portion of small diameter hose over top fitting on vapor valve. Route hose around front of steering head, along frame to vent fitting in bottom of fuel tank. Ty-wrap hose to throttle cables in two places. Third ty-wrap closest to vent fitting includes two throttle cables and two evap. kit hoses. Make sure both throttle cables work freely after securing with ty-wrap.

2. Take remaining porition of small diameter hose and push one end over top fitting on vapor valve.

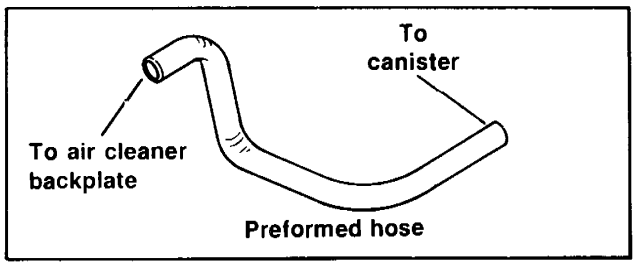


Figure 4-58. Preformed Hose Connections

   Bring hose up along tank to vent fitting in tank filler neck and cut to length. Push free end of hose over vent tube fitting.

3. Take 0.235 I.D. hose (8) and push hose through center cavity under fuel tank. Bring hose around rear of carburetor, between throttle cables and onto purge fitting. Bring free end of hose down right frame tube to fitting on top of canister labeled "carb". Cut hose to length and push hose on fitting. Secure hose to frame with two ty-wraps.

4. See Figure 4-58. Take large diameter pre-formed hose and push end with short bend over fitting installed at front of air cleaner backplate. Secure with ty-wrap. Route hose outside push rod cover and down to canister. Connect end of hose with long leg to the fitting at bottom of canister. Secure hose to canister with ty-wrap. Do not cut hose. Be sure regulator wires do not contact hose or canister. Bottom canister fitting should not swivel.

5. Actuate throttle control lever to be sure there is no interference with carburetor linkage and evap. hoses.

6. Place element in backplate and install baffle plate in bottom of backplate.

7. Position cover on backplate and secure with washer and screw.

8. Tighten screw to 3-5 ft-lbs torque.

9. Install new emission label over existing emission label on frame downtube. Clean area with solvent to assure proper adhesion. Do not cover any part of the V.I.N. label that is below the emission label.

10. Reinstall fuel tank console.

11. Remove rag from fuel filler neck.

12. Install fuel filler cap.

13. Inspect all hose routings for pinching or interference. Obstructed hoses may affect vehicle performance.

14. Road test vehicle.

FXR MODELS EVAPORATIVE EMISSIONS CONTROL SYSTEM — 1988-1990 CALIFORNIA MODELS ONLY

DESCRIPTION (Figure 4-59)

The purpose of the evaporative emissions (EVAP) system is to prevent fuel hydrocarbon vapors from escaping into the atmosphere. When the engine is not running, any build-up of hydrocarbon vapors are directed through the vapor valve and stored in the charcoal canister. At engine start-up a vacuum line from the carburetor will purge or draw off the vapors in the canister and direct them to the engine combustion chambers. The vapor valve prevents fuel from escaping through the vapor vent when the vehicle is tipped at an abnormal angle. A large diameter hose purges the canister with fresh air from the air cleaner through the air cleaner backplate.

The reed valves seal the air cleaner backplate when the engine is not running. The vacuum operated vacuum valve (VOV) seals the float bowl overflow when the engine is not running. See Figure 4-49 for VOV hose routing and connections for 1990 models.

WARNING

Make certain hoses do not contact hot exhaust or engine parts. Hoses contain flammable vapors that could be ignited if hose was melted.

TROUBLESHOOTING

Refer to 1988-1990 FLT procedures.

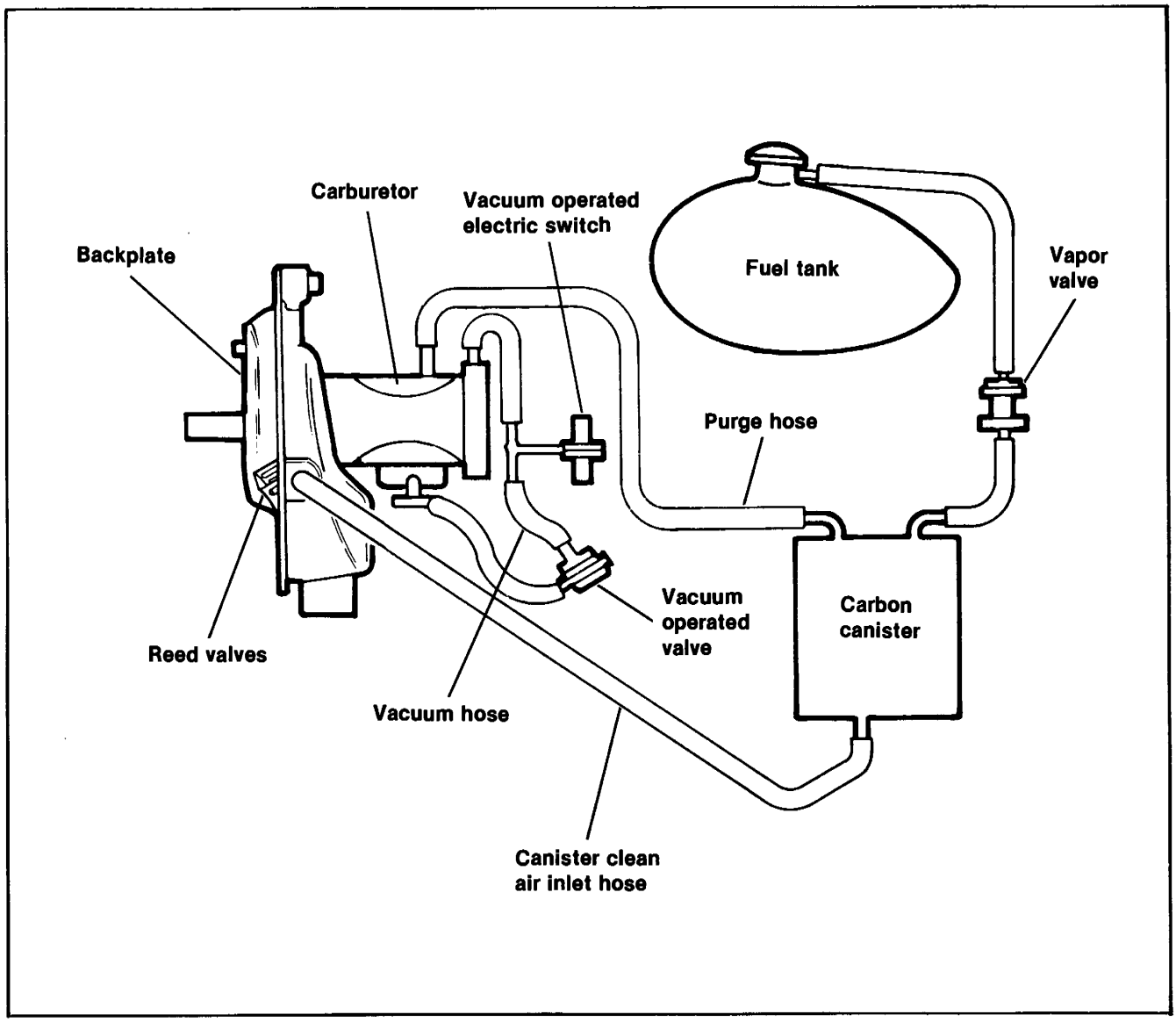


Figure 4-59. 1988 Schematic — California Evaporative Emissions Control System

REMOVAL AND INSTALLATION

Canister Bracket and Canister

1. See Figure 4-60. The lower canister bracket clamp must be 3.5 in. above the stabilizer bracket. The bracket must be located 30° inward from a horizontal line that is parallel to the left side of the motorcycle.

2. See Figure 4-61. The canister must be inserted in bracket with nipples facing engine.

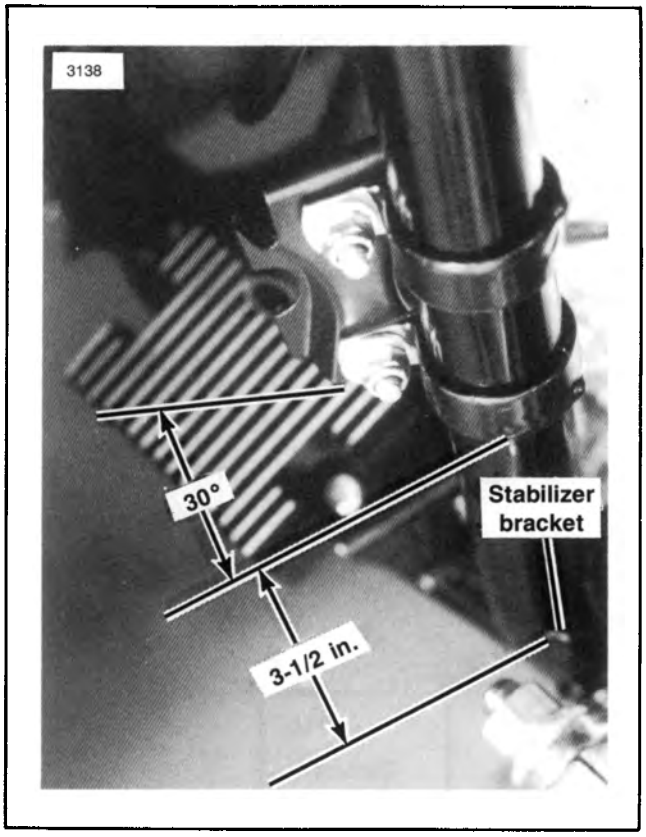
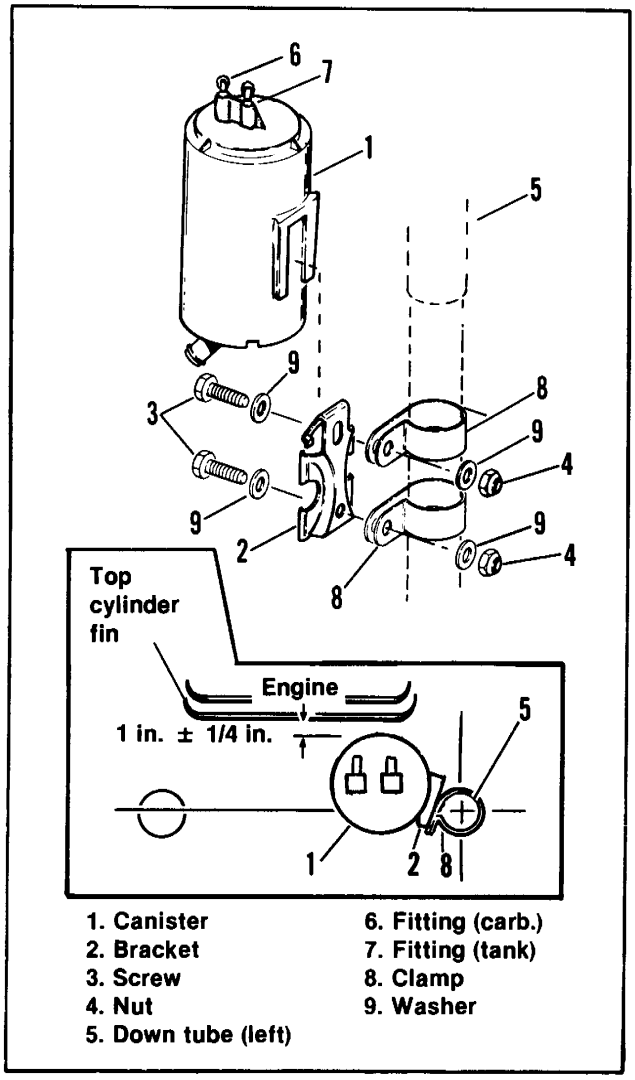


Figure 4-60. Canister Bracket Location



1. Canister
2. Bracket
3. Screw
4. Nut
5. Down tube (left)
6. Fitting (carb.)
7. Fitting (tank)
8. Clamp
9. Washer

Figure 4-61. Canister Mounting

WARNING

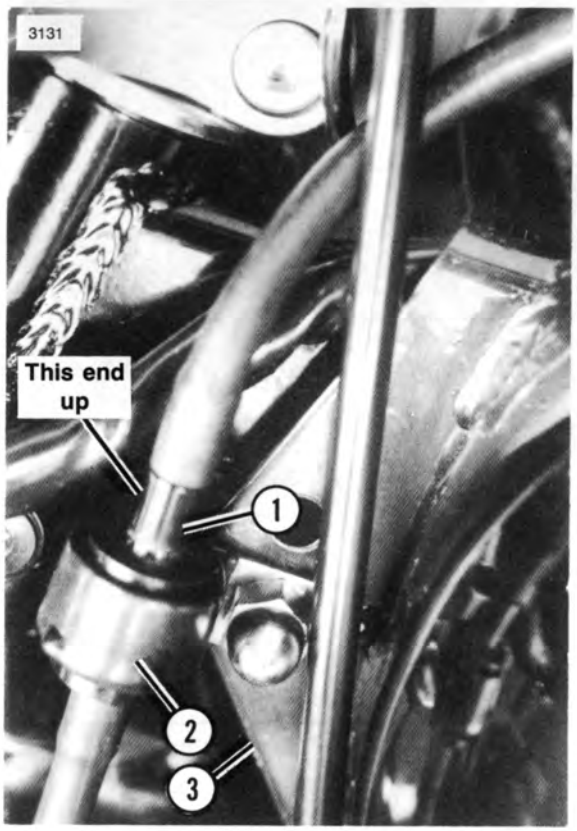
Canister must fit bracket securely. Bend bracket tabs that hold canister if required. A loose fitting canister could detach from bracket, hoses contact hot exhaust pipe and cause fire hazard and injury.

3. Check that 3/4 - 1¼ in. clearance exists between canister and front cylinder.

Vapor Valve Mounting

FXR, FXRS-SP MODELS

See Figure 4-62. Mount vapor valve as shown.



1. Valve
2. Clamp
3. Left fuel tank bracket

Figure 4-62. Vapor Valve Location — FXR, FXRS/SP, FXRS-CONV

FXLR, FXRS

See Figure 4-63. Mount vapor valve to right frame downtube as shown.

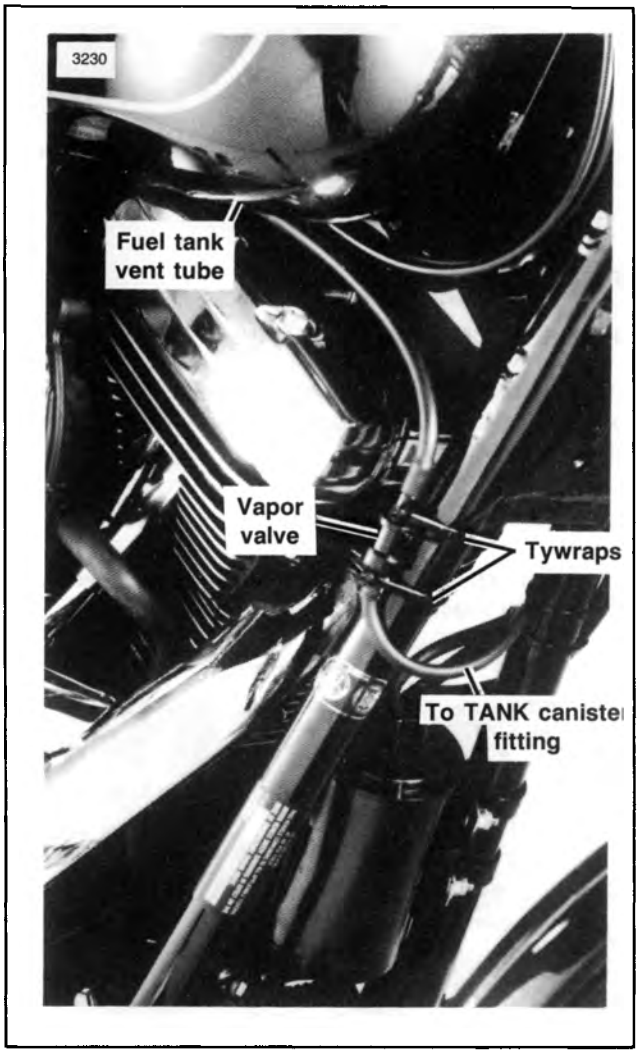


Figure 4-63. Vapor Valve Location — FXLR, 1988 FXRS

FXRT

See Figure 4-64. Mount vapor valve clamp with top bolt of left, upper fairing bracket.

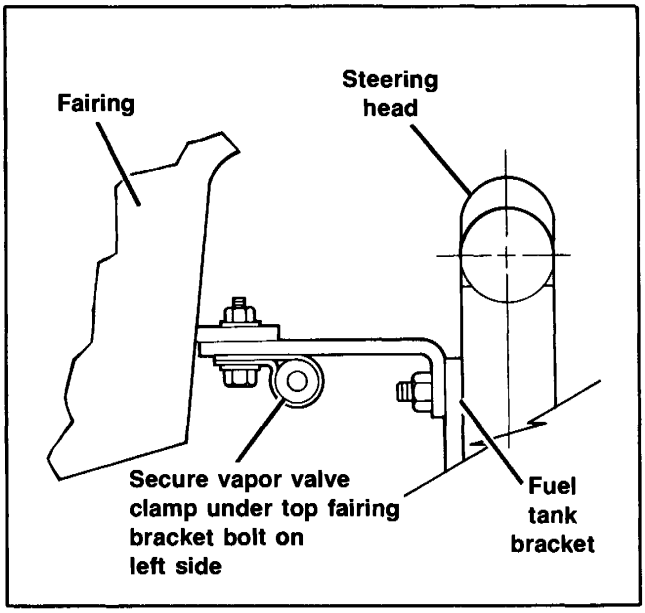


Figure 4-64. FXRT Vapor Valve Mounting (Top View)

HOSE ROUTING

VOV

See Figure 4-48 of FLT section for VOV hose routing on 1988-1989 models and Figure 4-49 for 1990 models.

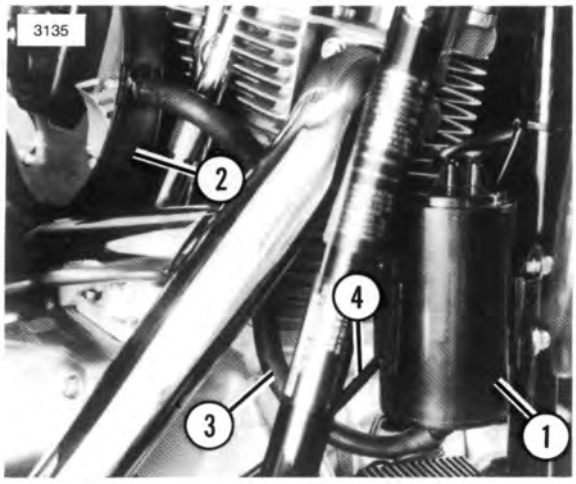
Canister Hoses

CANISTER-TO-AIR-CLEANER-BACKPLATE HOSE

See Figure 4-65. Canister-to-air-cleaner-backplate hose (3) connects the bottom nipple on canister to the air cleaner backplate.

WARNING

Position hose (3) behind clutch cable and make certain hose does not touch front exhaust pipe.



1. Canister
2. Air cleaner backplate
3. Canister-to-air-cleaner-backplate hose
4. Clutch cable

Figure 4-65. Canister-To-Air-Cleaner-Backplate Hose

VAPOR-VALVE-TO-FUEL-TANK HOSE (Figure 4-66)

The vapor-valve-to-fuel-tank hose (1) connects the top nipple of the vapor valve (4) to the fuel tank vapor tube.

NOTE

On FXRT, FXLR and FXRS the vapor valve location is different from that shown in Figure 4-66. FXRT hose is routed on left side of steering head as shown in Figure 4-66. The hoses on FXLR and FXRS are routed as shown in Figure 4-63.

1. Vapor-valve-to-fuel-tank hose
2. Canister-to-vapor-valve hose
3. Canister-to-carburetor hose
4. Vapor valve

Figure 4-66. Hose Routing

CANISTER-TO-VAPOR-VALVE HOSE

The canister-to-vapor-valve hose connects the "TANK" nipple on the canister to the bottom nipple of the vapor valve (4). See Figure 4-66. On FXR, FXRS-CONV and FXRS-SP hose (2) is routed from "TANK" nipple on canister to bottom of vapor valve. On FXRT hose (2) is routed to vapor valve mounted on left top fairing bracket. See Figure 4-63. On FXLR and FXRS the hose is routed to vapor valve mounted on right downtube.

CANISTER-TO-CARBURETOR HOSE (Figure 4-67)

The canister-to-carburetor hose connects the "CARB" nipple on the canister to the carburetor. See Figure 4-51 for final hose routing and carburetor connection. Install cable straps (ty-wraps) as shown in Figure 4-67.

On 1990 models, the canister-to-carburetor hose connects to fitting (3), Figure 4-49.

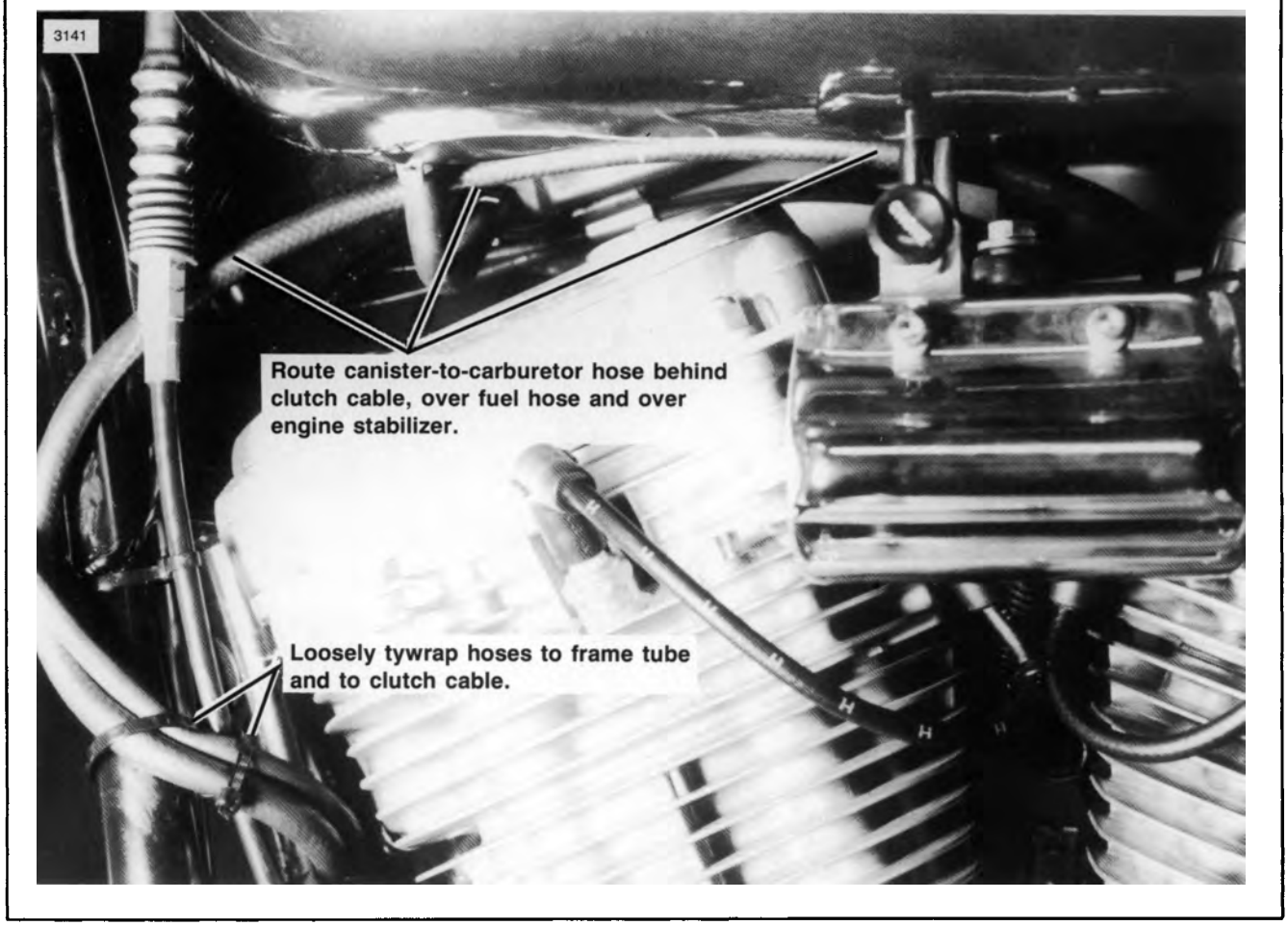


Figure 4-52 Canister-To-Carburetor Hose

NOTES

ELECTRIC STARTER

SUBJECT **PAGE NO.**

ELECTRIC STARTER SYSTEM — 1984-1988

SPECIFICATIONS

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

TORQUES

Thru-bolts	20-25 in-lbs
Thru-bolt nuts	20-25 in-lbs
Cable terminal nut	65-80 in-lbs
Rubber mount nut	6 ft-lbs
Starter bracket to transmission stud nut	13-16 ft-lbs

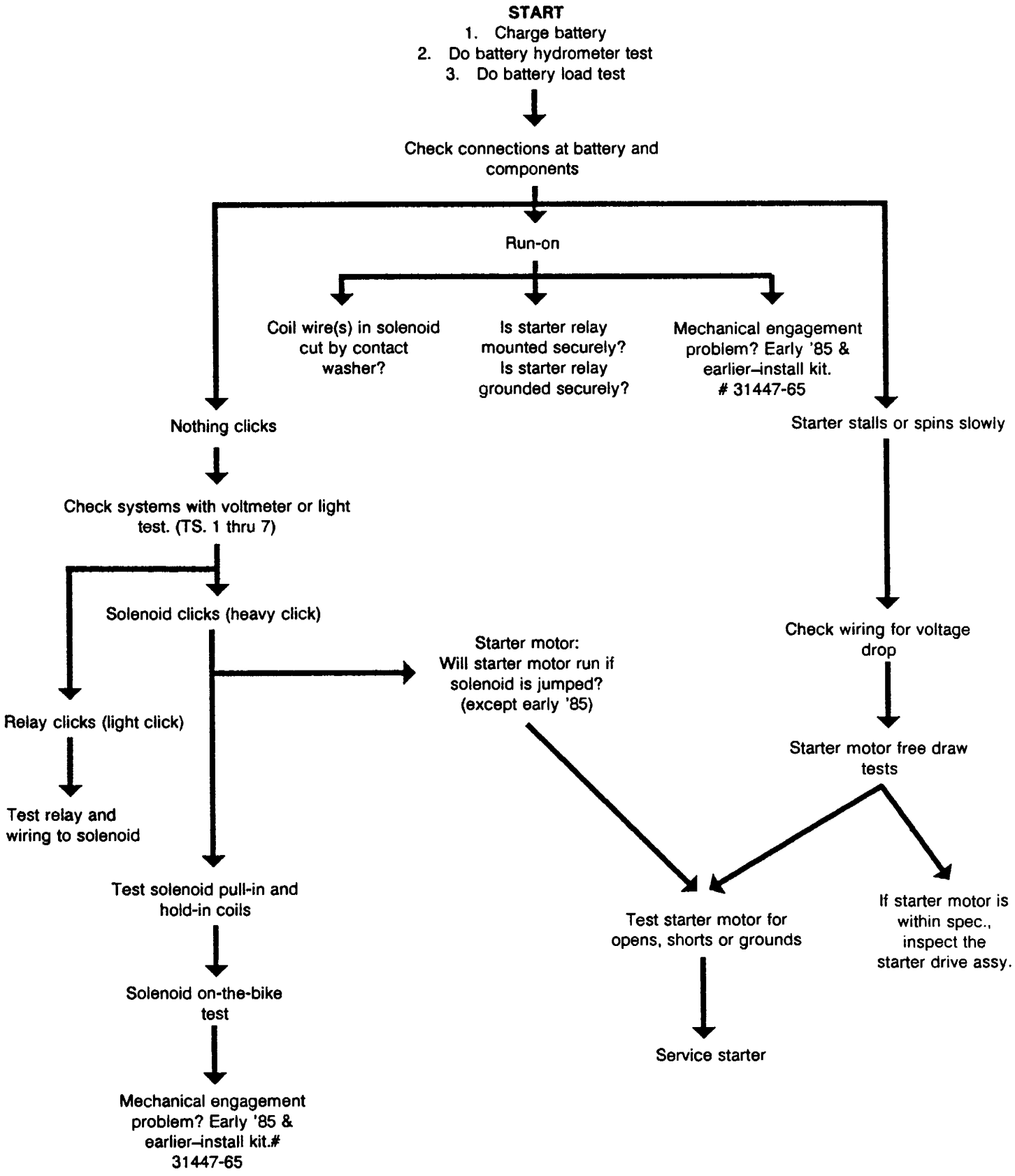
GENERAL

The starter motor is a 12-volt, 4-pole drive motor. The starter engages the clutch ring gear through a starter drive and a reduction gear unit. Battery current is directed to the starter motor through the starter relay and starter solenoid. The relay is energized by the starter button on the handlebar.

NOTE

Never operate the starter motor continuously for more than thirty 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.

STARTING SYSTEM DIAGNOSIS



TROUBLESHOOTING

Early 1985

NOTE

It is normal to have some starter stall when cranking the 1340cc engine, particularly when the engine is hot.

Heavy oil will cause the engine to turn over harder. If the engine is in good condition and the starter motor fails to operate properly, the following checks should be made before removing the starter for inspection.

These tests can be performed only with a battery in good condition. Be sure battery is good.

Test results must read within 1/2 volt of battery voltage. Each test point will help locate defective parts and loose or broken connections. Use wiring diagrams in back of this manual for ease of locating test points.

With a voltmeter and starter switch depressed, check voltage at the following locations:

NOTHING CLICKS

1. Check voltage between small terminal and base (ground) of starter relay.

   Low voltage indicates bad connection. Check for failed wiring, bad connections at small terminal, relay base (ground), or starter switch. Proper voltage indicates damaged relay.

2. Starter switch.

   Low voltage indicates failed wiring, starter switch (output side) or damaged stop switch (input side).

3. Engine stop switch

   Low voltage on input side indicates bad connection from ignition switch. Low voltage on output side indicates damaged switch.

4. Ignition circuit breaker.

   Low voltage at input side (copper stud) indicates bad connection from ignition switch. Low voltage at output side indicates faulty ignition circuit breaker.

5. Ignition terminal of ignition switch.

   Low voltage indicates a damaged switch.

6. Battery terminal on ignition switch.

   Low voltage indicates bad connection from main circuit breaker.

7. Main circuit breaker.

Low voltage at input indicates bad wire or connections from the battery. Low voltage at output indicates faulty main circuit breaker.

RELAY CLICKS

1. Battery cable terminal of starter relay.

   Low voltage indicates bad connection from battery.

2. Solenoid cable terminal of starter relay.

   Low voltage indicates damaged starter relay.

3. Long, large terminal of starter solenoid.

   Low voltage indicates poor connection from starter relay.

4. Small terminal of starter solenoid.

   Low voltage indicates bad connection of jumper wire from long, large terminal (early 1985).

SOLENOID

1. Short, large terminal at solenoid.

   Low voltage indicates bad internal connection at starter solenoid or starter drive linkage problems.

2. Starter motor.

   Low voltage indicates bad connection from solenoid.

Late 1985 and Later

NOTHING CLICKS

With a voltmeter and starter switch depressed, check voltage at the following locations:

1. On starter relay, place black meter lead on ground terminal (No. 85 on FXR models or No. 86 on FLT models). Red meter lead is connected to No. 86 terminal on FXR models or No. 85 on FLT models.
   Low voltage indicates bad connection. Check for failed wiring, bad connections to ground or starter switch. Proper voltage indicates damaged relay.

2. Starter switch.

   Low voltage indicates failed wiring, starter switch (output side) or damaged stop switch (input side).

3. Engine stop switch.

   Low voltage on input side indicates bad connection from ignition switch. Low voltage on output side indicates failed switch.

4. Ignition circuit breaker.

   Low voltage at input side (copper stud) indicates bad connection from ignition switch. Low voltage at output side indicates faulty ignition circuit breaker.

5. Ignition terminal of ignition switch.

   Low voltage indicates a failed switch.

6. Battery terminal on ignition switch.

   Low voltage indicates bad connection from main circuit breaker.

7. Main circuit breaker.

   Low voltage at input indicates bad wire or connections from the battery. Low voltage at output indicates faulty main circuit breaker.

RELAY CLICKS

1. No. 30 terminal of starter relay.

   Low voltage at No.30 terminal indicates bad connections from main circuit breaker or grounds.

2. No. 87 terminal.

   Low voltage indicates failed relay.

3. Small terminal at solenoid.

   Low voltage indicates bad connection from relay.

SOLENOID CLICKS

1. Long, large terminal at solenoid.

   Low voltage indicates bad connection from the battery.

2. Short, large terminal at solenoid.

   Low voltage indicates faulty solenoid or starter drive linkage problems.

3. Starter motor wire.

   Low voltage indicates bad connection from solenoid.

STARTER MOTOR — 1984-1988

TESTING

Starter Free Draw Test (Figure 5-1)

These tests can be performed only with a battery in good condition. Be sure battery is good.

NOTE

Ten (10) seconds is enough time to take measurements without damaging starter.

Starter draw should be checked "on-the-bike" with an induction ammeter before disconnecting the battery.

NOTE

The starter motor and drive will run when the jumper cable is connected to the short solenoid stud; but, the engine will not be cranked since the solenoid is not actuated.

1. Use a short, heavy jumper cable and connect it to battery positive terminal first, then to short heavy solenoid stud. Put induction ammeter on jumper cable. Measure the draw as you turn the starter.
2. Write down the result. If draw is 75 amps or less, starter motor and drive are good and no further testing is required. If current draw is greater than 75 amps continue at step 3.
3. Remove starter motor. See REMOVAL, starter motor.
4. Bench test starter. Use jumper cables to run starter and check current draw with induction ammeter.
   - Compare results.
5. If bench test result is considerably more than 40 -50 amps, service the starter motor.

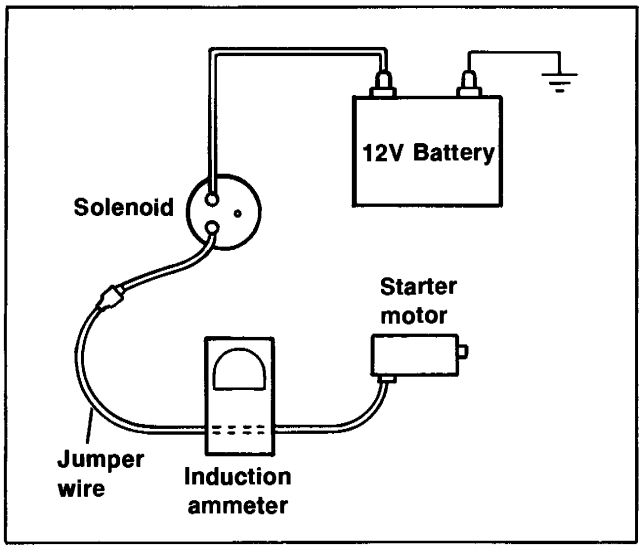


Figure 5-1. Testing Starter Draw

6. If bench test is within specifications, but ammeter "on-the-bike" test shows considerably more than 75 amps, it indicates a mechanical problem in the starter drive.

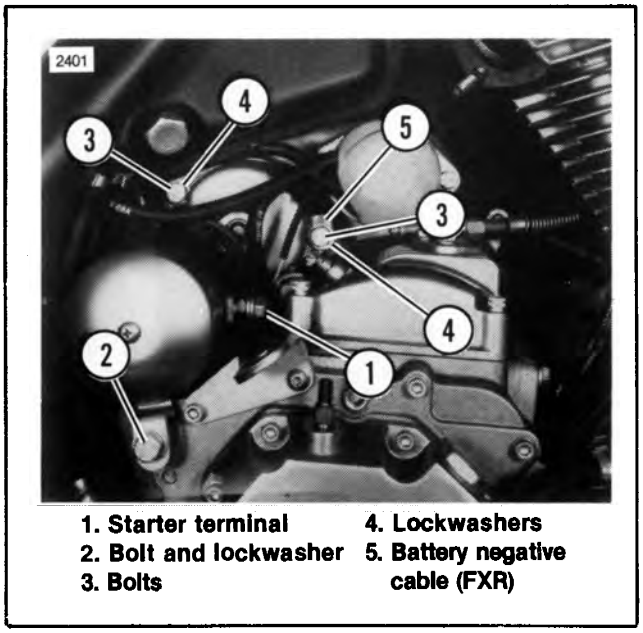
REMOVAL (Figure 5-2)

WARNING

Disconnect the battery cables (negative cable first) to prevent accidental start-up of vehicle and possible personal injury.

Starter Motor and Housing

1. Disconnect solenoid cable from the starter terminal.
2. Remove bolt and lockwasher (2) that fastens starter to transmission side door.
3. Remove the stud nuts or bolts (3), lockwasher or washers (4) and the battery negative cable (5) (FLT models upper stud, FXR models lower stud). Remove the starter and drive gear housing as an assembly. Drive gear can then be removed for inspection.



1. Starter terminal
2. Bolt and lockwasher
3. Bolts
4. Lockwashers
5. Battery negative cable (FXR)

Figure 5-2. Removing the Starter

Starter Motor

1. Disconnect solenoid cable from starter terminal (1).
2. Remove the bolt and washer (2) that fastens starter bracket.
3. See Figure 5-3. Remove starter thru-bolts (8).
4. Grasp starter by front and rear covers to prevent it from coming apart and remove starter.

DISASSEMBLY (Figure 5-3)

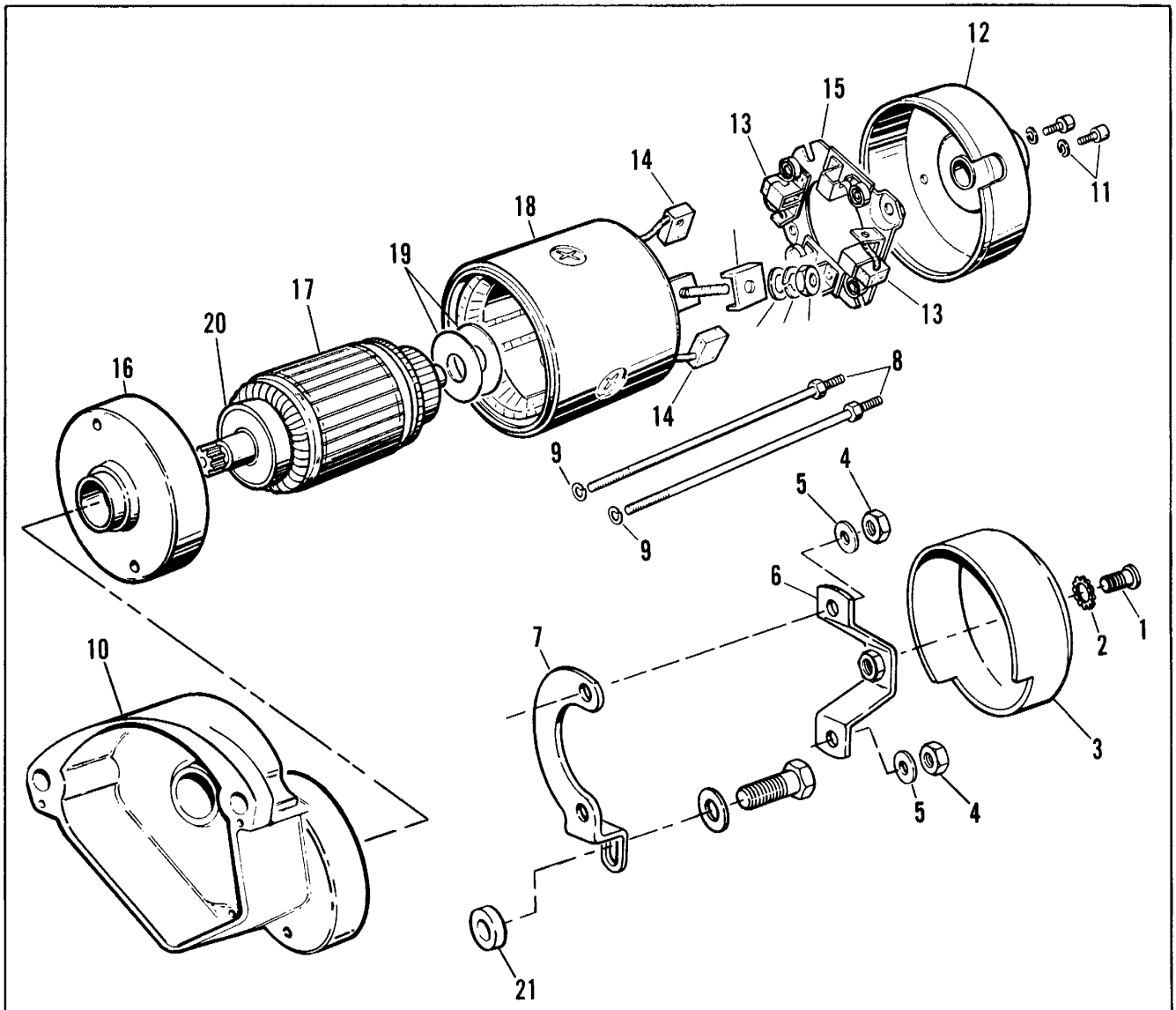
1. Remove screw (1) and lockwasher (2) that fastens decorative cover (3) to starter.
2. Remove decorative cover (3), nuts (4), washers (5) and brackets (6 and 7).
3. Remove thru bolts (8) and lockwashers (9).
4. Remove housing (10). Remove rear cover screws and lockwashers (11).
5. Remove rear cover (12).
6. Use a wire hook to pull up on brush springs and remove brushes (13 and 14) from brush holder assembly (15).
7. Remove front cover (16) and pull armature (17) from frame (18).
8. Note position and quantity of thrust washer (s) (19) and remove from armature (17) or rear cover (12).

CLEANING, INSPECTION AND REPAIR

Frame and Field Assembly

The frame and field assembly should be tested for grounded and open fields using an ohmmeter.

1. See Figure 5-4. Check for a grounded field coil with an ohmmeter set at the (RX1) resistance times one scale. Touch one probe to the field frame and the other probe to each of the field brushes in turn. There should be no continuity, infinite ohms. If there is any ohm reading at either brush, the field coil is grounded to the frame and the field frame assembly must be replaced.
2. See Figure 5-5. To test for an open field coil, touch one ohmmeter probe to the starter terminal and the other probe to each of the field brushes in turn. There should be continuity, zero ohms at both test points. Any ohm reading other than zero indicates an open circuit and the field frame must be replaced.



1. Screw
2. Lockwasher
3. Decorative cover
4. Nuts (2)
5. Washers (2)
6. Cover bracket
7. Mounting bracket
8. Thru bolts (2)
9. Lockwasher (2)
10. Starter shaft housing
11. Screw and lockwasher (2)
12. Rear cover
13. Brushes (2)
14. Brushes, field (2)
15. Brush holder
16. Front cover
17. Armature
18. Frame
19. Thrust washer (s)
20. Bearing
21. Spacer

Figure 5-3. Starter Motor

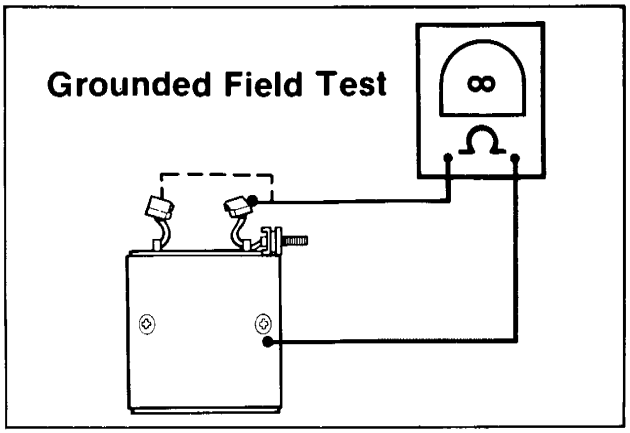


Figure 5-4. Grounded Field Test

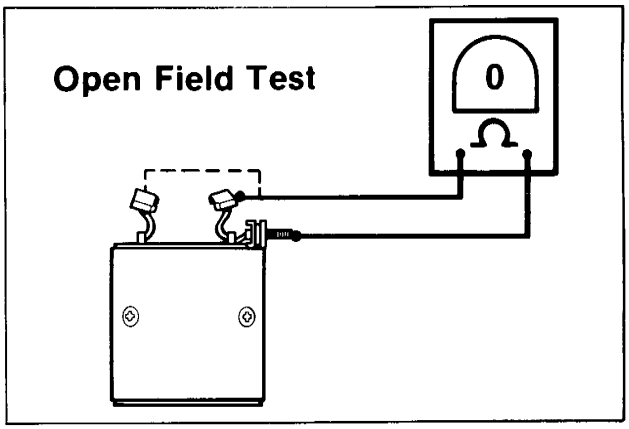


Figure 5-5. Open Field Test

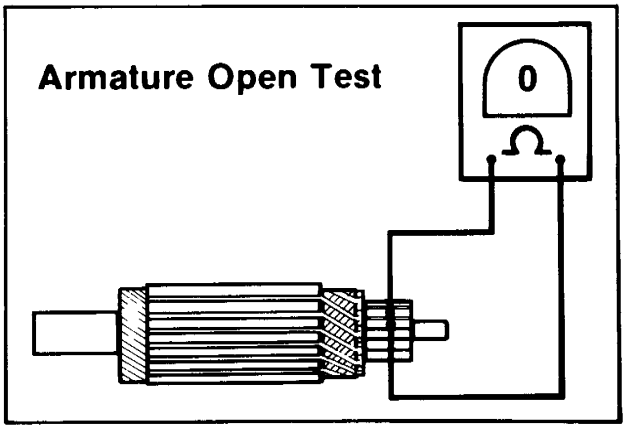


Figure 5-6. Testing for Open Armature

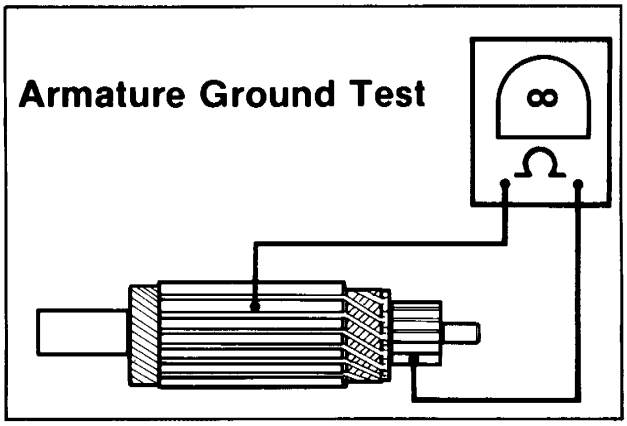


Figure 5-7. Testing for Grounded Armature

Armature

1. If the commutator is dirty use crocus cloth and contact cleaner to clean it.

2. Armatures should be tested for open or grounded circuits using an ohmmeter.

3. See Figure 5-6. 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 parts 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 5-7. 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. See Figure 5-8. Test the armature for short circuits using an armature growler. Place the armature on the growler and turn it on.

7. Hold a thin steel strip or hacksaw blade over the armature core, parallel to the armature shaft, 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 or out of round, it may be turned down in a lathe. If the commutator is out of round due to burned bars, 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 using a thin hacksaw blade. See Figure 5-9. After undercutting, lightly sand the commutator with crocus cloth to remove any burrs.

NOTE

Do not use sandpaper to remove commutator burrs. Sand particles may become embedded in commutator segments and cause rapid brush wear.

10. Inspect the bearing (20, Figure 5-3). If it is worn or loose, replace it.

11. Inspect the bushing in the commutator end cover (12, Figure 5-3) 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.

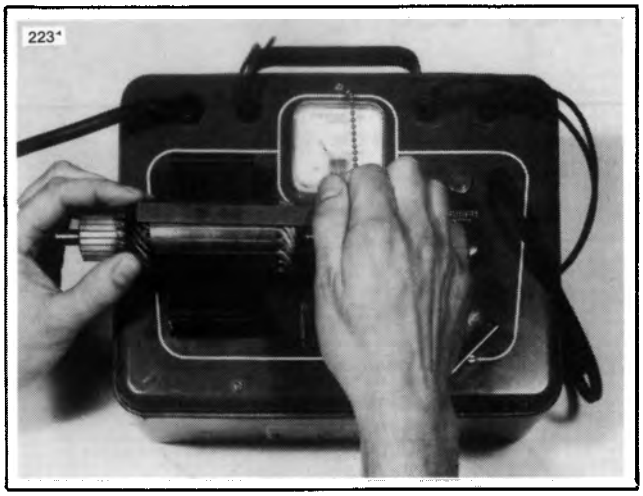


Figure 5-8. Testing for Shorted Armature

Brushes

The brushes should be replaced if they are worn close to 7/16 in. minimum. The Harley-Davidson Part No. for brushes are as follows:

Part No. 31575-73, Field coil mounted (2 required)
Part No. 31582-72, Brush holder mounted (2 required)

Always replace brushes in sets of four.

To replace brushes, heat, unsolder and remove old brushes. Solder the new brushes in place.

ASSEMBLY (Figure 5-3)

1. Install armature (17) into frame (18). Install front cover (16).
2. Install brush holder (15) in frame (18).
3. Use a wire hook to pull brush springs up and install brushes (13 and 14).
4. Install thrust washer(s) (19) on armature (17) shaft.
5. Install rear cover (12), thru bolts (8) and lockwashers (9).
6. Secure brush plate assembly (15) to rear cover (12) with screws and lockwashers (11).
7. Assembly starter to starter shaft housing (10) with terminal to the front. Tighten thru bolts (8) to 20-25 in-lbs torque.

INSTALLATION

1. Place the drive gear (12, Figure 5-17) on the drive shaft and install the starter motor assembly on the primary chaincase.
2. See Figure 5-2. Install the battery negative cable (5) on the left mounting stud on FLT models or the right side on FXR models. Fasten the starter with the original lockwashers (4) and nuts (3) or bolts. Tighten nuts or bolts to 10-12 ft-lbs torque.
3. See Figure 5-3. Install brackets (6 and 7) and secure with washers (5) and nuts (4). Tighten nuts to 20-25 in-lbs torque.
4. Install solenoid cable to starter terminal. Tighten starter terminal nut to 65-80 in-lbs torque.
5. See Figure 5-2. Install bolt (2) that fastens mounting bracket to transmission side door.
6. Install decorative cover.

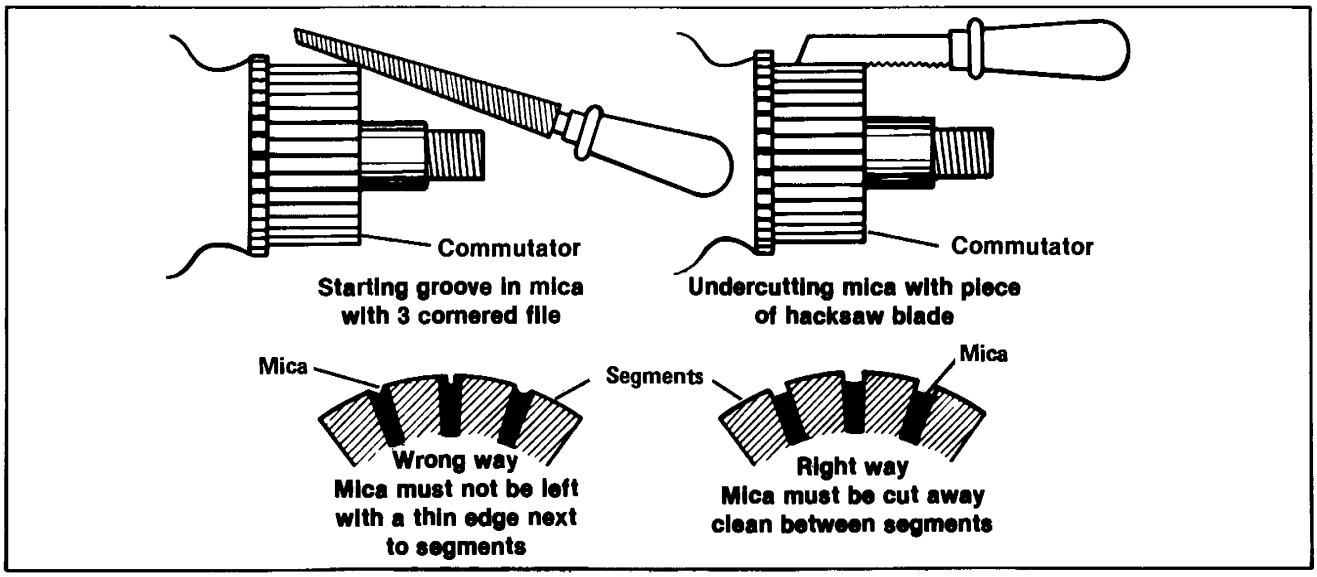


Figure 5-9. Undercutting the Mica Separators

SOLENOID — 1984-1988

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.

ON VEHICLE TESTING

It is not necessary to remove the solenoid to perform the following tests:

WARNING

Disconnect the battery cables (negative cable first) to prevent accidental start-up of vehicle and possible personal injury.

1. See Figure 5-10, 5-11 or 5-12. Disconnect the cable from the short, large stud and the wire from the small terminal.

2. See Figure 5-13. With an ohmmeter, check the pull-in coil between the small terminal and the short large terminal. There should be continuity, less than one ohm resistance. No meter reading or infinity indicates a broken or open circuit in the pull-in coil and the solenoid must be replaced.

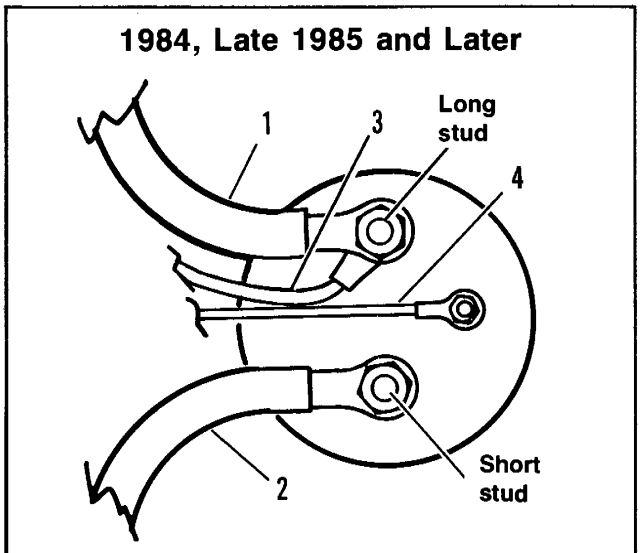


Figure 5-10. Solenoid Connections - FLT Models

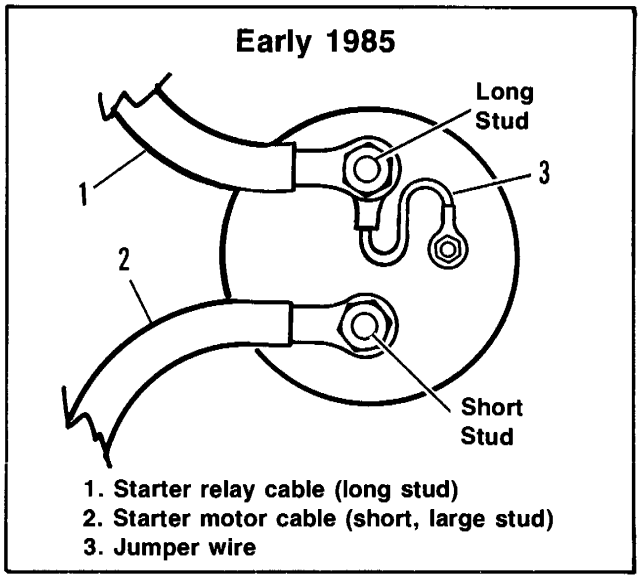


Figure 5-11. Solenoid Connections - All models

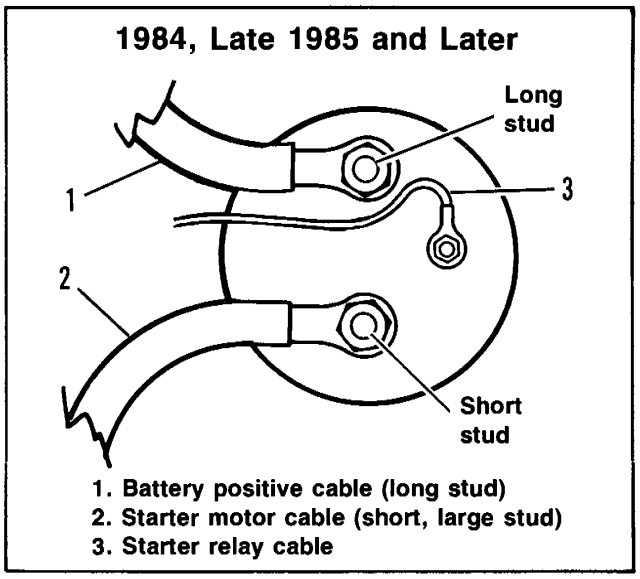


Figure 5-12. Solenoid Connections - FXR Models

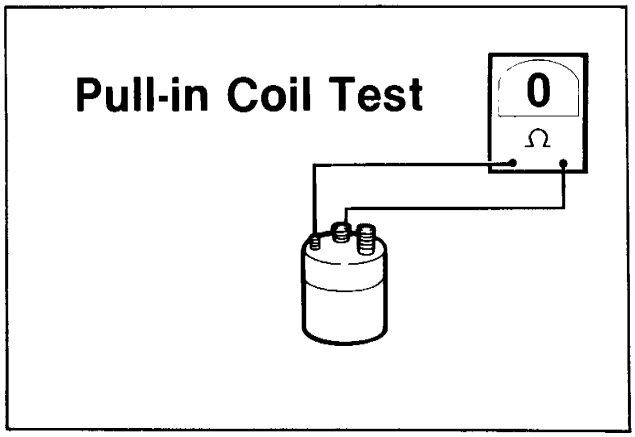


Figure 5-13. Pull-in Coil Test

3. See Figure 5-14. Check the hold-in coil between the small terminal and the solenoid case, again there must be continuity, a reading of less than one ohm. Replace the solenoid if any other meter reading is obtained.

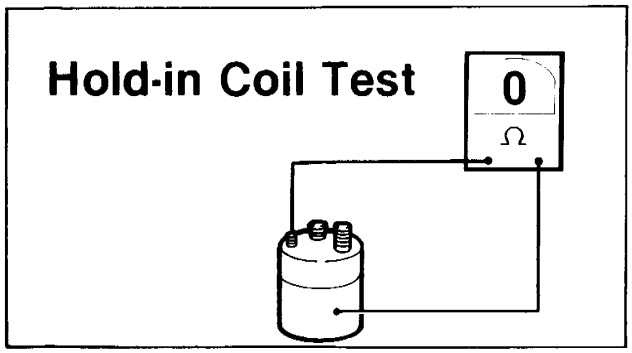


Figure 5-14. Hold-in Coil Test

4. See Figure 5-14A. Connect the leads from a 12 volt battery to the small terminal and the short, large terminal. The solenoid should engage with a click.

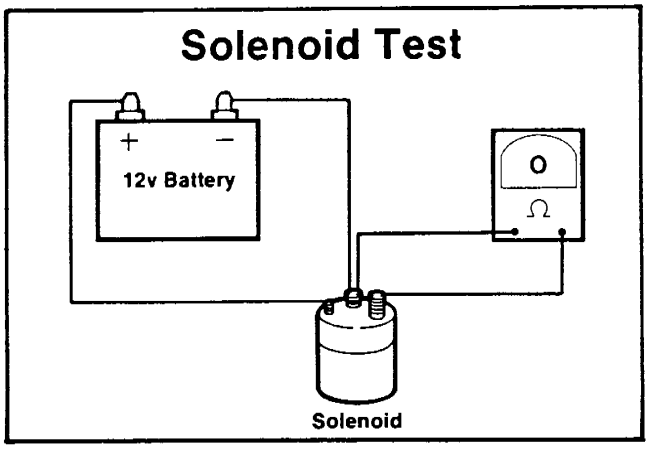


Figure 5-14A. Testing Solenoid Contacts

5. Check for continuity between the two large terminals. A good solenoid will have continuity. A bad solenoid will not.

NOTE

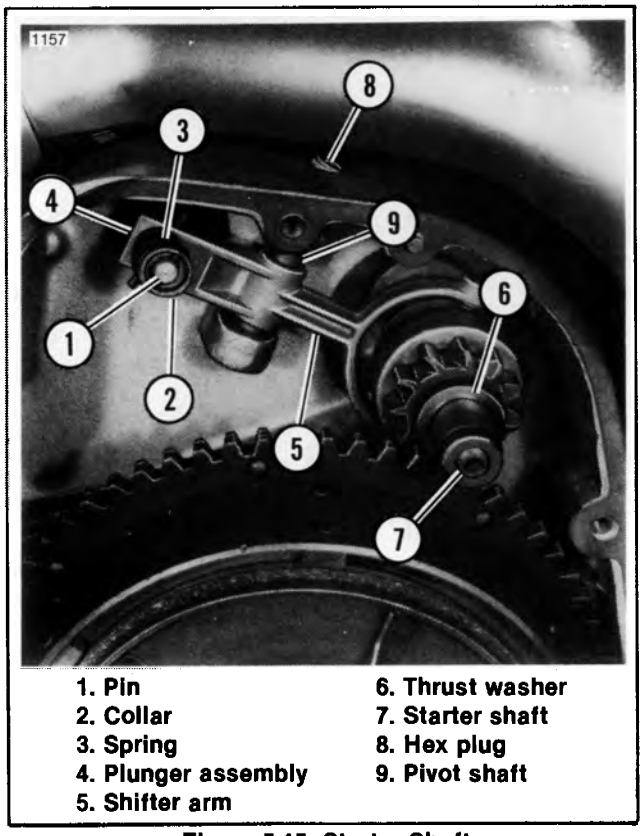
This test can be performed off the motorcycle if a 31435-65B plunger assembly is used.

REMOVAL

1. See Figure 5-10, 5-11 or 5-12. Remove the nuts and disconnect the wires and cables from the solenoid terminals.

2. Remove the mounting bolts and lockwashers. Remove the solenoid along with the spring and gasket (18 and 19, Figure 5-16).

To remove the plunger, continue with Steps 3 and 4.



1. Pin
2. Collar
3. Spring
4. Plunger assembly
5. Shifter arm
6. Thrust washer
7. Starter shaft
8. Hex plug
9. Pivot shaft

Figure 5-15. Starter Shaft

NOTE

On Late 1984 and later models equipped with the primary drive "wet clutch", the lubricant must be drained from the primary chaincase prior to Step 3. See PRIMARY CHAINCASE, Section 6, for procedure.

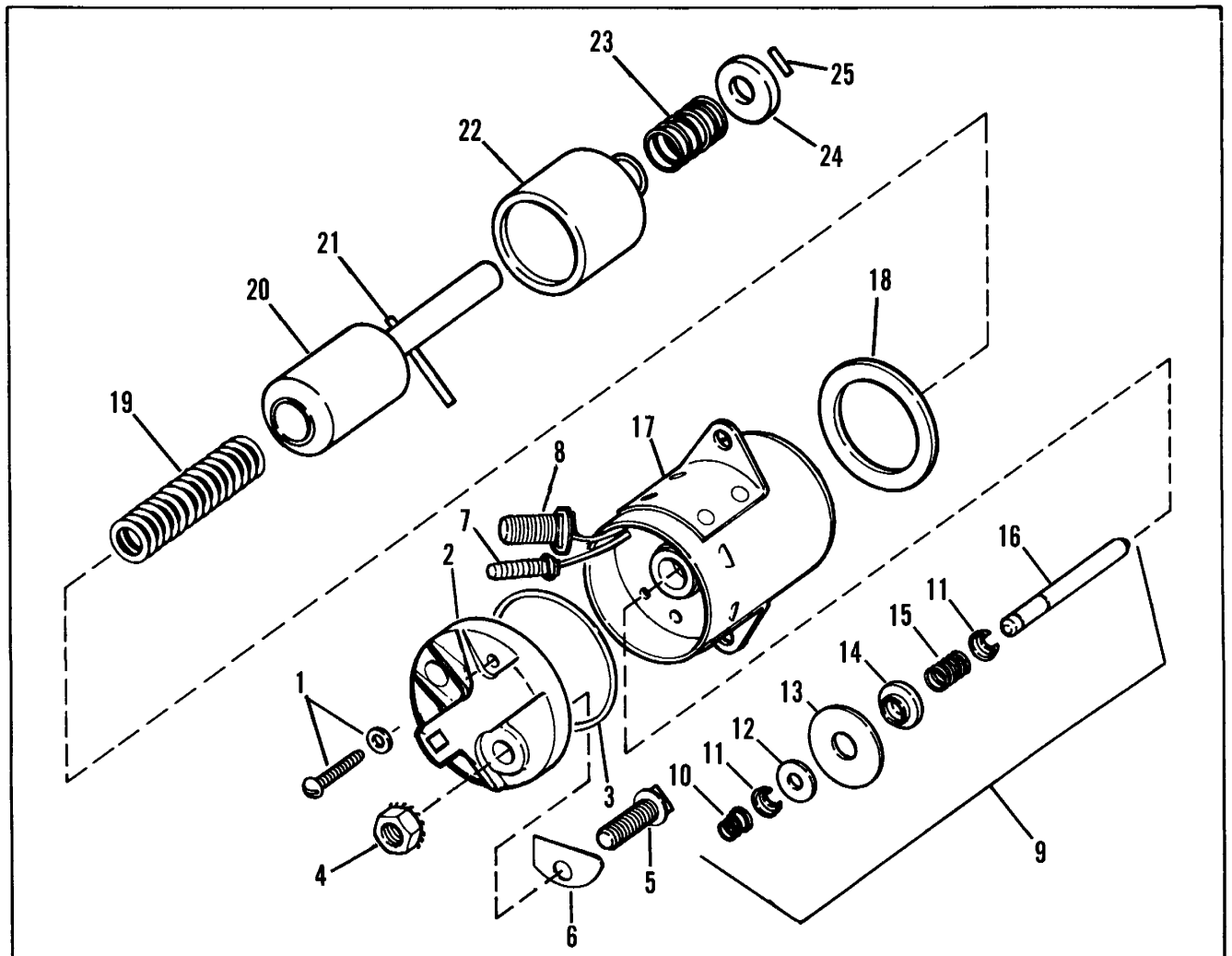
3. Remove the primary chaincase cover.

4. See Figure 5-15. Remove the pin (1), collar (2) and spring (3). Pull the plunger assembly (4) out from the right side of the motorcycle.

DISASSEMBLY (Figure 5-16)

1. Remove nuts and gaskets from the small terminal (7) and the short, large terminal (8). (Terminals (8) and (7) have wires attached and will not come off with cover.) Remove the two cover mounting screws and washers (1), raise the cover (2) and remove the gasket (3).

2. 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) and collar (11) from the plunger (16).



1. Screw and washer (2)
2. Cover
3. Gasket
4. Nut and gasket (3)
5. Stud
6. Plate
7. Stud
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. Gasket
19. Spring
20. Plunger (outer)
21. Pin (large)
22. Sleeve
23. Spring
24. Collar
25. Pin (small)

Figure 5-16. Solenoid — Exploded View

CLEANING, INSPECTION AND REPAIR (Figure 5-16)

1. If the copper washer (13) is grooved or burnt on one side, turn it around on the plunger. This will double the life of the washer.

2. Replace the cover (2) and gasket (3) if cracked or broken.

ASSEMBLY (Figure 5-16)

1. Lightly coat parts 11 through 17, except copper washer (13), with a high temperature grease such as LUBRIPLATE 110. Install the collar (11), large spring (15), seat (14), copper washer (13), plastic washer (12), collar (11) and small spring (10) onto the plunger (16). Insert the plunger assembly into the solenoid housing (17).

2. Install the gasket (3) and cover (2) over the terminals and inner plunger assembly and fasten with screws (1). Install nuts and gaskets on terminals.

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.

3. Install the gasket and spring (18 and 19, Figure 5-16) and solenoid. Secure the solenoid using the original lockwashers and bolts.

4. See Figure 5-10, 5-11 or 5-12. Connect the cables and wires to the solenoid terminals as shown in the appropriate illustration. Secure wire or cables with terminal nuts.

INSTALLATION

1. See Figure 5-15. Place the plunger (4) into the primary chain housing so the plunger shaft protrudes through the shifter arm (5). Install the spring (3), collar (2) and pin (1).

2. Install the primary chain cover.

NOTE

On Late 1984 models and later with the "wet clutch", fill chaincase with PRIMARY CHAINCASE LUBRICANT. Fill to bottom of clutch inspection cover opening.

3. Reconnect battery cables, positive cable first.

NOTE

Step 4 applies to Early 1984 models without "wet clutch".

4. After reassembly, chain housing must be airtight. Check using Vacuum Gauge, Part No. HD-96950-68. Remove one of the 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 twenty-five inches water vacuum or more at 1500 rpm. Perform check with vent hose to primary chain case pinched closed with a pliers. A lower reading indicates an air leak into chain housing either at solenoid gasket, starter shaft, hoses, O-ring or seals.

STARTER SHAFT 1984 - 1988

REMOVAL (Figure 5-17)

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.

NOTE

On Late 1984 and later models equipped with the primary drive "wet clutch", the lubricant must be drained from the primary chaincase prior to Step 1. See PRIMARY CHAINCASE, Section 6, for procedure.

1. Remove the primary chaincase cover.
2. Remove starter shaft housing and starter motor as described under STARTER MOTOR, REMOVAL.

NOTE

If clutch shell is removed, removing the starter and housing is not required. If clutch shell is not removed, perform Steps 4 and 5 before Step 3.

3. Remove the thrust washer (2) and pull the starter shaft (8) out.

If it is necessary to remove the shifter arm (11) continue with Steps 4 and 5.

4. Remove the solenoid. See SOLENOID, REMOVAL.
5. Remove the hex plug (9), shaft (10) and shifter arm (11).

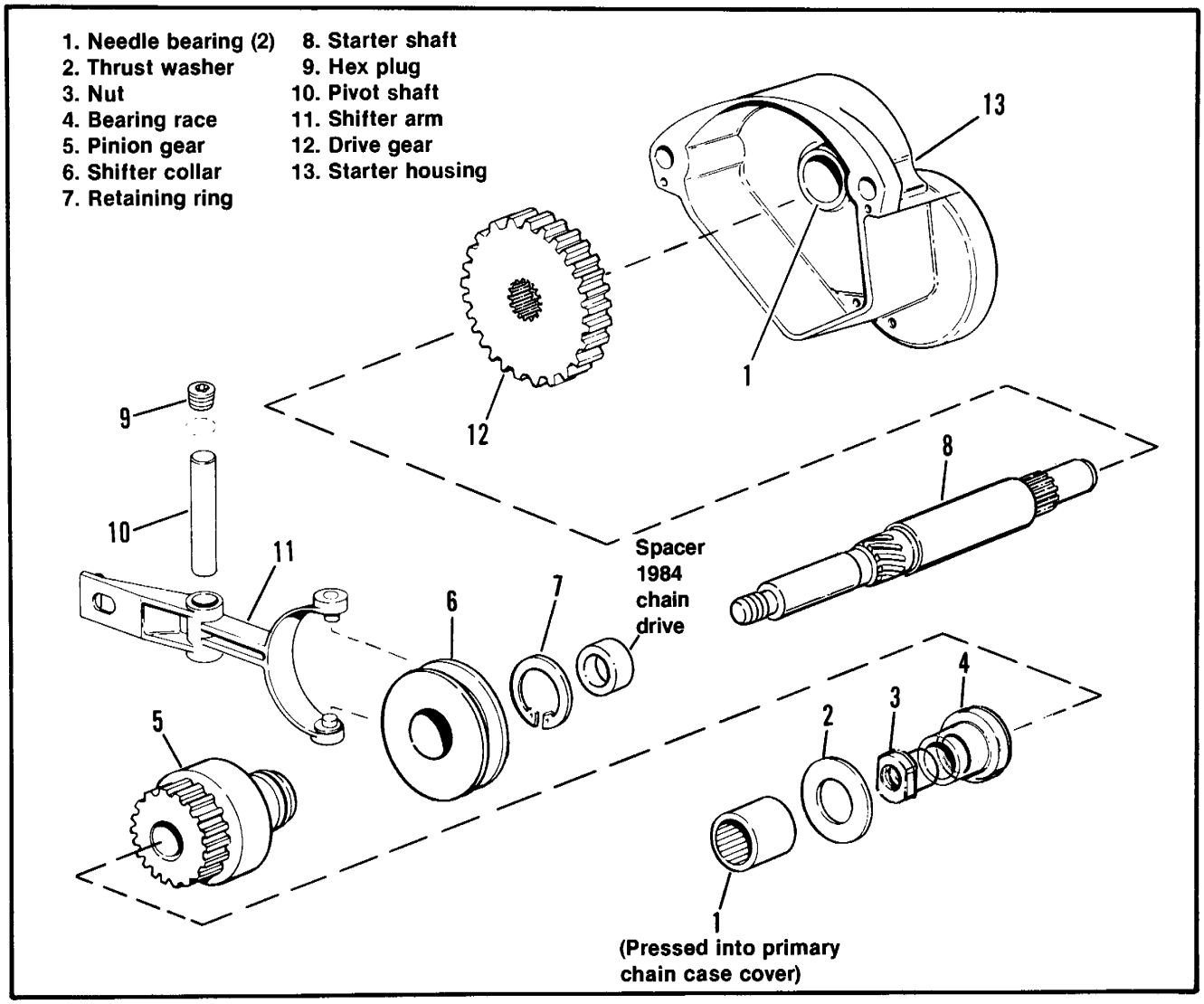


Figure 5-17. Starter Shaft

DISASSEMBLY (Figure 5-17)

1. Remove the nut (3) and bearing race (4). Nut has left hand thread.
2. Remove the pinion gear (5) and collar (6). To separate these two pieces, remove the retaining ring (7).
3. Remove the spacer (1984 chain drive vehicles).

CLEANING, INSPECTION AND REPAIR

1. Check the pinion gear teeth and replace the gear if the teeth are rounded or damaged. Also check overrunning clutch. Pinion gear must turn in one direction only.
2. Check the bearings in the primary cover and starter housing. Replace the needle bearings if they are pitted.
3. Pack bearings with grease (LUBRIPLATE).

ASSEMBLY (Figure 5-17)

1. Install the spacer on the shaft (1984 chain drive vehicles).
2. Fasten the collar (6) to the gear (5) using the retaining ring (7). Apply a light coating of grease (LUBRIPLATE) on the splines of the shaft.
3. Slide the assembly on the shaft with the retaining ring facing the spacer.
4. Install the bearing race (4) so the lip rests against the pinion gear. Install the nut (3) and tighten it securely.

INSTALLATION (Figure 5-17)

1. Install the starter shaft assembly (8) and thrust washer (2).
2. If the shifter arm was removed, lightly grease pivot shaft with LUBRIPLATE and then install the arm (11), pivot shaft (10) and hex plug (9).
3. Install the solenoid. See SOLENOID, INSTALLATION procedure.
4. Install the starter shaft housing and starter motor following procedure under STARTER MOTOR, INSTALLATION.
5. Install primary chaincase cover. See SOLENOID, INSTALLATION for procedure.

STARTER RELAY

GENERAL

The starter relay is located behind the right side cover on FXR models and later 1986 and later FLT models. The starter relay is located under the seat on 1984 through early 1986 FLT models. The relay is a non-repairable part and must be replaced if it is faulty.

NOTE

Before removing relay, check for possible bad ground connection between relay housing and electrical panel; also electrical panel and frame. Check with ohmmeter for continuity. Zero ohms on meter would indicate a good connection.

TESTING

Early 1985 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 right side cover on FXR models, or remove seat on FLT's.

2. See Figures 5-18, 5-19. Disconnect wires and remove the starter relay.

3. See Figure 5-20. Connect a fully charged battery and an ohmmeter to the relay as shown. With relay contacts closed and ohmmeter on "RX1" scale, the contact resistance must be less than one ohm.

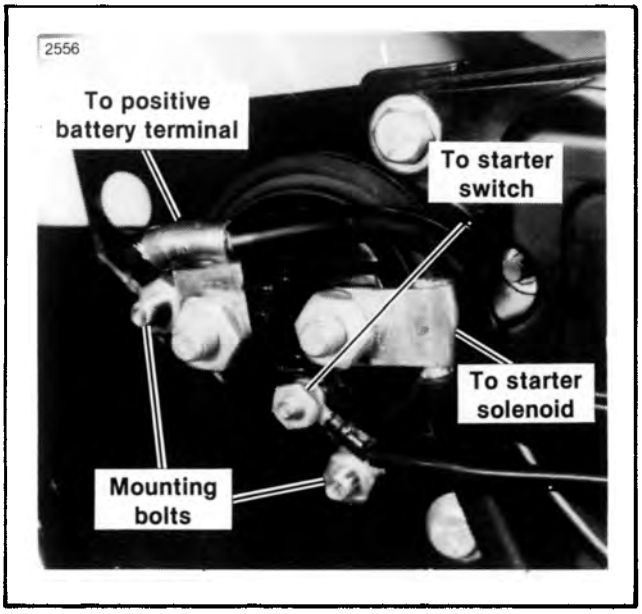
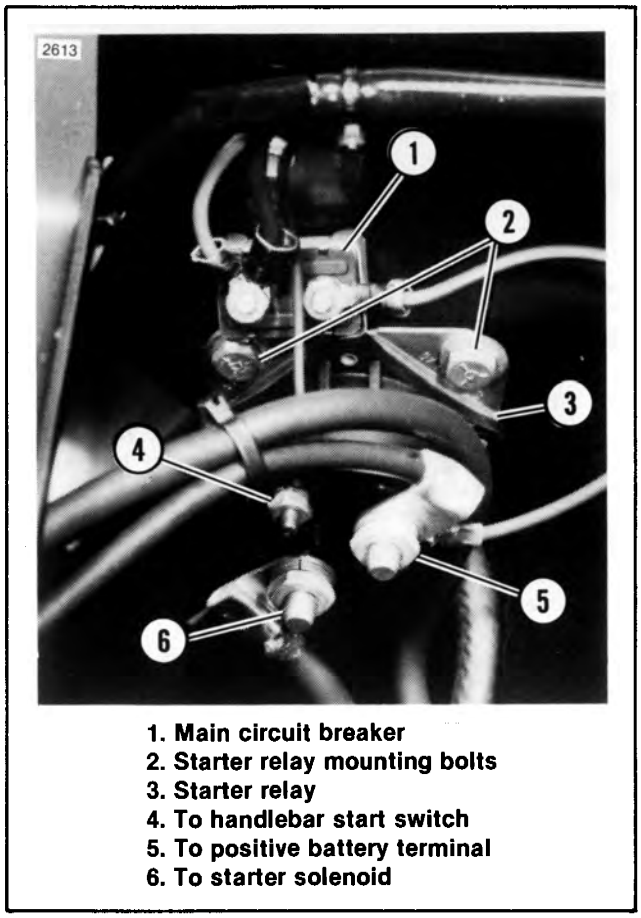


Figure 5-18. Starter Relay Mounting and Connections Early 1985 — FXR (Right Side Cover Removed)



1. Main circuit breaker
2. Starter relay mounting bolts
3. Starter relay
4. To handlebar start switch
5. To positive battery terminal
6. To starter solenoid

Figure 5-19. Starter Relay Mounting and Connections Early 1985 — FLT (Seat Removed)

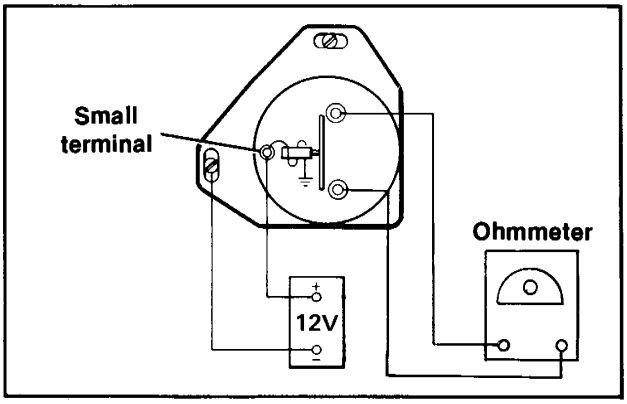


Figure 5-20. Starter Relay Test Circuit — Early 1985

INSTALLATION

Early 1985 Models

1. If the starter relay failed the above tests, install a new relay and connect the wires as shown in either Figure 5-18 (FXR) or Figure 5-19 (FLT).

2. Install right side cover on FXR, or seat on FLT.

3. Reconnect battery, positive cable first.

TESTING

1984, Late 1985 and Later Models

1. Remove the right side cover on FXR models and on late 1986 and later FLT models. Remove the seat on 1984 and early 1986 FLT models.

2. See Figure 5-21, 5-22 or 5-23. Before removing the starter relay, unplug the connector and substitute a new relay or perform the following test.

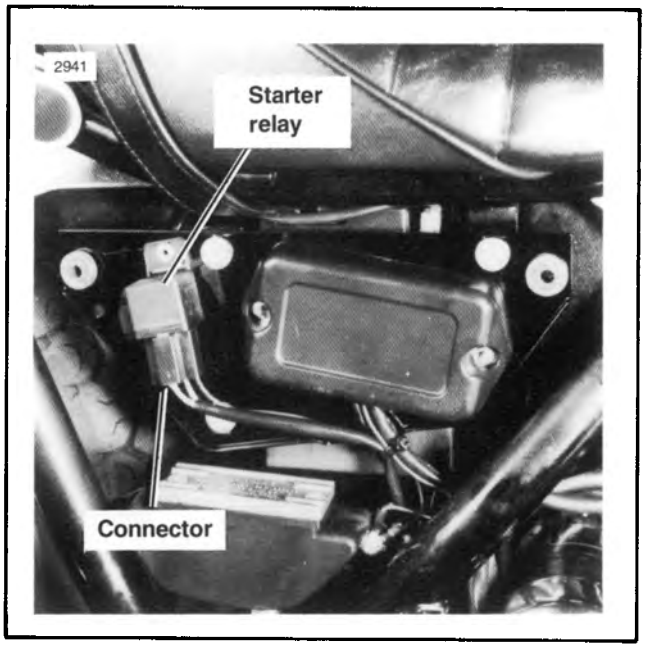


Figure 5-21. (Right Side Cover Removed). Starter Relay Location FXR — Models

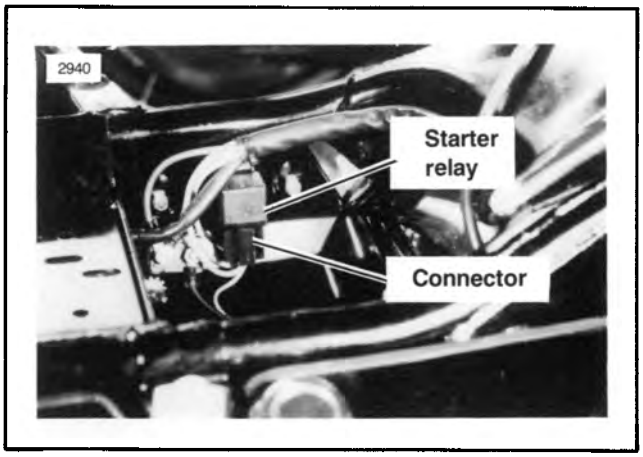


Figure 5-22. Starter Relay Location — 1984, Late 1985 and Early 1986 FLT Models

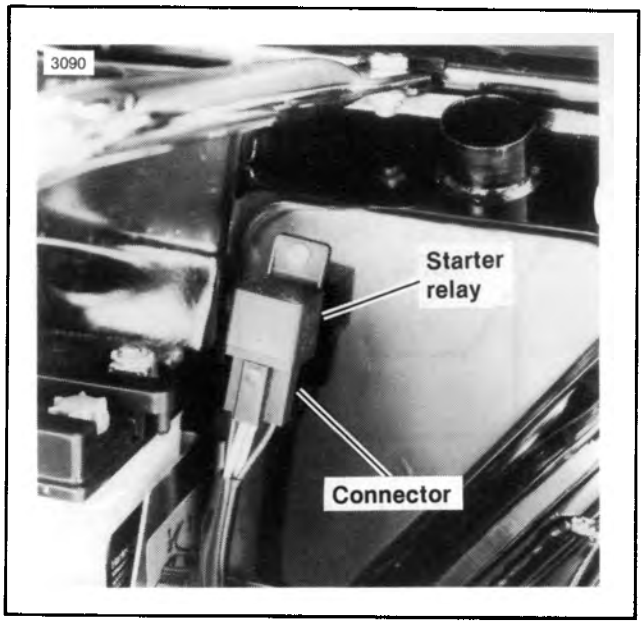


Figure 5-23. Starter Relay Location — Late 1986 and Later FLT Models (Right Side Cover Removed)

3. See Figure 5-24, Test 1. Check for continuity between terminals 85 and 86. If continuity does not exist - replace relay. If continuity is present, continue at step 4.

4. See Figure 5-24. Connect the battery leads to terminals 86 and 85 to energize the relay. Check for continuity between terminals 30 and 87. A good relay will show continuity (continuity tester lamp on or a zero ohm reading on the ohmmeter). A defective relay will not have continuity and should be replaced.

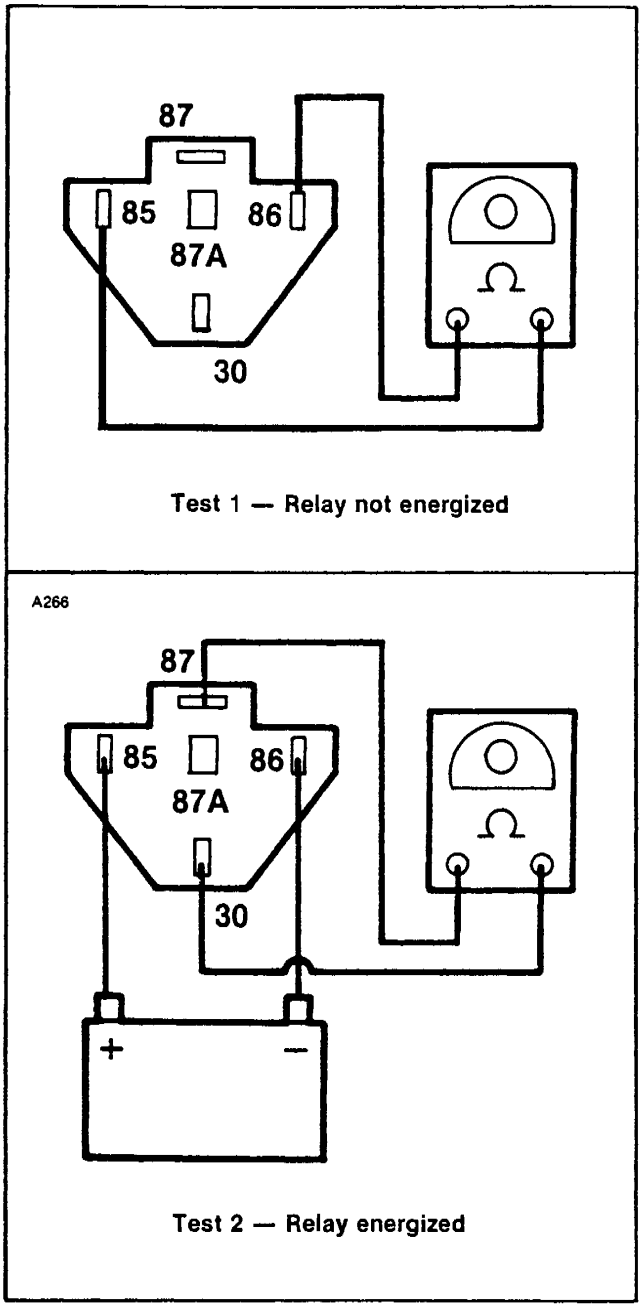


Figure 5-24. Starter Relay Tests

REMOVAL AND INSTALLATION

1984, Late 1985 and Later Models

1. If either of the above tests indicated a faulty relay, replace the relay. On all vehicles except late 1986 and later FLT models, the relay is attached by a pop rivet. On 1986 and later FLT models, the relay is attached with a screw.

2. Install the right side cover or seat.

SPECIFICATIONS – 1989 - 1990

STARTER

Free speed	3000 rpm (min.) @ 11.5 V
Free current	90 amp (max.) @ 11.5V
Stall current	400 amp (max.) @ 2.5 V
Stall torque	8.7 ft-lbs @ 2.5 V

SERVICE WEAR LIMITS

Brush length minimum	0.354 in.
Commutator diameter minimum	1.141 in.(min.)

TORQUES

Thru-bolts	20-25	in-lbs
Cable terminal nuts	65-80	in-lbs
Starter mounting bolts	13-20	ft-lbs
Jackshaft bolt	7-9	ft-lbs

STARTER SYSTEM-1989 & 1990

GENERAL

The starter is made up of an armature, field winding assembly, solenoid, drive assembly, idle gear, and drive housing.

The starter motor torque is increased through gear reduction. The gear reduction consists of the drive pinion on the armature, an idle gear, and a clutch gear in the drive housing. The idle gear is supported by rollers and the clutch gear is part of the overrunning clutch/drive assembly.

The overrunning clutch is the part which engages and drives the clutch ring gear. It also prevents the starter from overrunning. The field windings are connected in series with the armature through brushes and commutator segments.

Starter Relay

The starter relay is a non-repairable part and must be replaced if it malfunctions.

Operation (Figure 5-25)

When the starter switch is pushed the starter relay is activated and battery current flows into the pull-in winding and also into the hold-in winding to ground. The magnetic forces of the pull-in and hold-in windings, in the solenoid, pull the plunger and cause it to shift to the left, so that the pinion gear is engaged with the clutch ring gear. At the same time, the main solenoid contacts are closed and battery current flows directly through the field windings to the armature, and to ground. Simultaneously, the pull-in winding is opened. The current continues flowing through the hold-in winding, keeping the main solenoid contacts closed. At this point the starter begins to crank the engine. After the engine has started, the pinion gear turns freely on the pinion shaft through the action of the overrunning clutch which prevents overrunning of the armature caused by the rotation of the clutch ring gear.

When the starter switch is released, the current of the hold-in winding is fed through the main solenoid contacts and the direction of the current in the pull-in winding is reversed. The solenoid plunger is returned to its original position by the return spring, disengaging the pinion gear from the clutch ring gear.

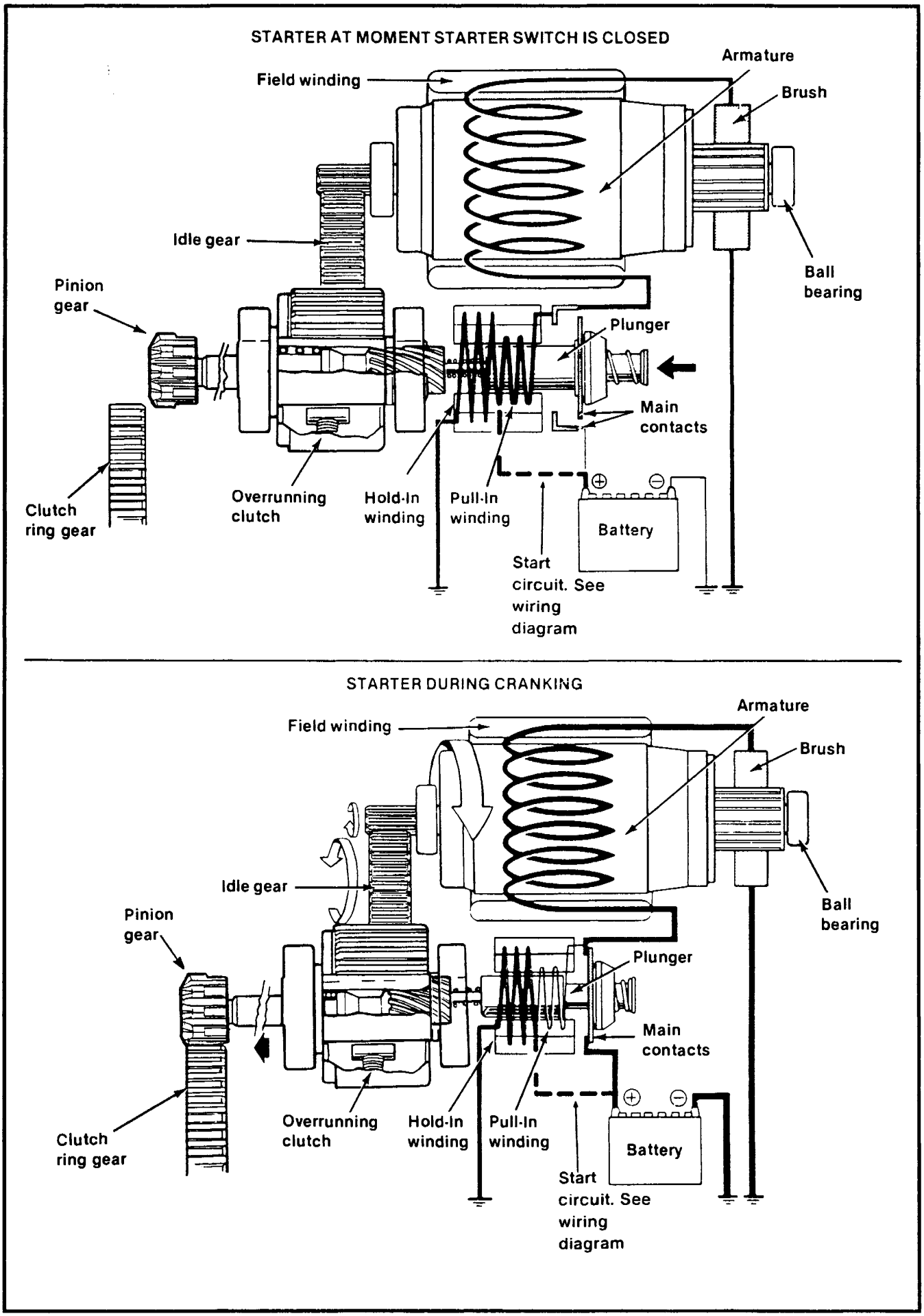


Figure 5-25. Starter Operation

TROUBLESHOOTING

PROBLEM	SOURCE OF TROUBLE	PROBABLE CAUSE	SOLUTION
1. Starter does not run, or runs at considerably low speeds.	1.1 Battery	1.1.1 Voltage drop due to discharged battery	1.1.1 Charge battery
		1.1.2 Poor contact condition of battery terminal(s)	1.1.2 Clean and retighten
		1.1.3 Bad battery	1.1.3 Replace battery.
	1.2 Wiring	1.2.1 Disconnection between starter switch and solenoid terminal	1.2.1 Repair or replace wire
	1.3 Starter switch or starter relay	1.3.1 Poor contact condition or poor connection	1.3.1 Replace
	1.4 Solenoid	1.4.1 Poor contact condition caused by burnt contact	1.4.1 Polish contact surface or replace solenoid assembly
		1.4.2 Contact plate removed	1.4.2 Repair
		1.4.3 Pull-in winding open or short-circuited	1.4.3 Replace solenoid assembly
		1.4.4 Hold-in winding open	1.4.4 Replace solenoid assembly
	1.5 Starting motor	1.5.1 Poor contact condition of brushes	1.5.1 Check brush spring tension
		1.5.2 Commutator burnt	1.5.2 Correct on lathe or replace
		1.5.3 Commutator high mica	1.5.3 Correct by undercutting
		1.5.4 Field winding grounded	1.5.4 Replace
		1.5.5 Armature winding grounded or short-circuited	1.5.5 Replace
		1.5.6 Reduction gears damaged	1.5.6 Replace
		1,5,7 Insufficient brush spring tension	1.5.7 Replace
		1.5.8 Disconnected lead wire between solenoid and field windings	1.5.8 Repair or replace lead wire
		1.5.9 Ball bearing sticks	1.5.9 Replace bearing
	1.6 Starter jackshaft	1.6.1 Jackshaft binding.	1.6.1 Remove jackshaft bolt, apply Loctite ® 242 to threads on bolt, install and tighten to 3-5 ft-lbs of torque.

PROBLEM	SOURCE OF TROUBLE	PROBABLE CAUSE	SOLUTION
2. Pinion does not engage with ring gear while starter is running or engine cannot be cranked	2.1 Battery	2.1.1 Voltage drop due to discharged battery	2.1.1 Charge battery
		2.1.2 Bad battery.	2.1.2 Replace battery
		2.1.3 Poor contact condition of battery terminal(s)	2.1.3 Clean and retighten
	2.2 Wiring	2.2.1 Disconnection between starter switch and solenoid terminal	2.2.1 Repair or replace wire
	2.3 Overrunning clutch	2.3.1 Overrunning clutch malfunction (rollers or compression spring)	2.3.1 Replace overrunning clutch
		2.3.2 Pinion teeth worn out	2.3.2 Replace overrunning clutch
		2.3.3 Pinion does not run in overrunning direction	2.3.3 Replace overrunning clutch
		2.3.4 Poor sliding condition of spline teeth	2.3.4 Remove foreign materials, dirt, or replace overrunning clutch
		2.3.5 Reduction gears damaged	2.3.5 Replace overrunning clutch and idle gear
3. Starter does not stop running	3.1 Solenoid	3.1.1 Return spring worn	3.1.1 Replace solenoid
		3.1.2 Coil layer shorted	3.1.2 Replace solenoid
		3.1.3 Contact plate melted and stuck	3.1.3 Replace solenoid
	3.2 Ring gear	3.2.1 Worn out teeth	Replace ring gear (clutch shell)
	3.3 Starting switch or starter relay	3.3.1 Unopened contacts	3.3.1 Replace starting switch or starter relay
		3.3.2 Poor returning	3.3.1 Replace starting switch or starter relay

TESTING

On-Motorcycle Tests

Before removing starter perform the following tests:

STARTER RELAY

See TESTING in STARTER RELAY section.

STARTER CURRENT DRAW TEST (Figure 5-26)

Starter current draw should be checked with an induction ammeter before disconnecting the battery.

1. Make sure the transmission is in neutral. Disconnect the spark plug wires from spark plug terminals.
2. Clamp induction ammeter over the positive battery cable.
3. With the ignition ON, turn engine over by pressing starter switch while taking a reading on the ammeter. Disregard initial high currect reading which is normal during time the engine is first turned over.
4. If starter current draw exceeds 150 amperes, a problem may exist in the starter motor or starter drive and the starter must be removed and tested further. See REMOVAL.

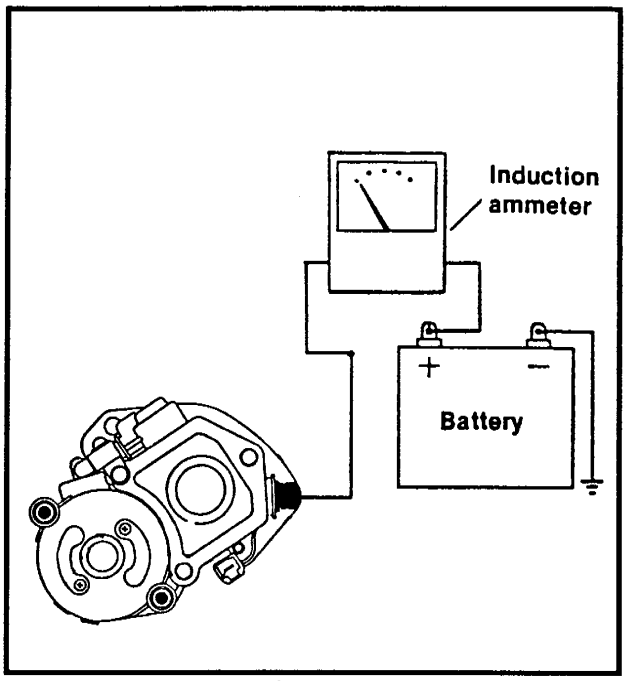


Figure 5-26. Starter Draw Test

STARTER – 1989 - 1990

REMOVAL

WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables (negative cable first) before performing any of the following procedures.

1. Remove primary chaincase cover. See PRIMARY CHAINCASE, REMOVAL, in Section 6.
2. See Figure 5-45. Hold pinion gear (6) in place and remove jackshaft bolt (1) and lockplate (2).
3. Remove acorn nuts and chrome end cover if so equipped.
4. See Figure 5-27. Remove the two starter mounting allen head bolts and washers.
5. Disconnect positive battery lead and solenoid wire from starter.
6. Remove starter from right side of motorcycle.

NOTE

Jackshaft-to-starter shaft coupling (11 in Figure 5-45) is a loose fit and could come off with starter or stay on jackshaft. The coupling on 1990 models is directional; i. e., the coupling end having the counterbore must face the jackshaft. If it comes off with starter put it back on the jackshaft. This will ease assembly later on.

TESTING ASSEMBLED STARTER

Starter Solenoid

NOTE

Do not disassemble solenoid. Before testing, disconnect field wire from terminal C shown in Figure 5-28.

Figure 5-27. Starter Mounting

CAUTION

Each test should be performed for only 3 to 5 seconds to prevent damage to solenoid. These tests, Solenoid Pull-In, Hold-In and Return must be performed in that order and consecutively.

Solenoid Pull-In (Figure 5-28)

See Figure 5-28. Connect test leads from 12 volt battery as shown. The starter shaft should pull in strongly if the solenoid is working properly. If shaft does not pull in, solenoid should be replaced.

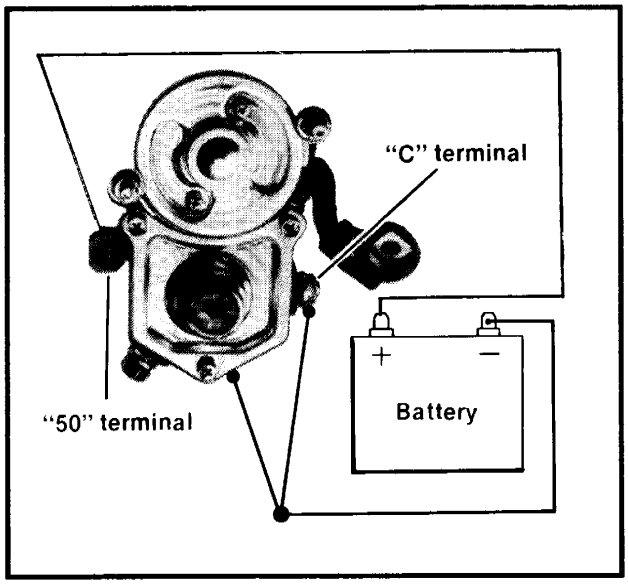


Figure 5-28. Pull-In Test

Solenoid Hold-In (Figure 5-29)

Use same setup as Pull-In Test and disconnect test lead from "C" terminal. If shaft remains in pull-in position, the solenoid is working properly. If shaft does not remain in pull-in position the solenoid should be replaced.

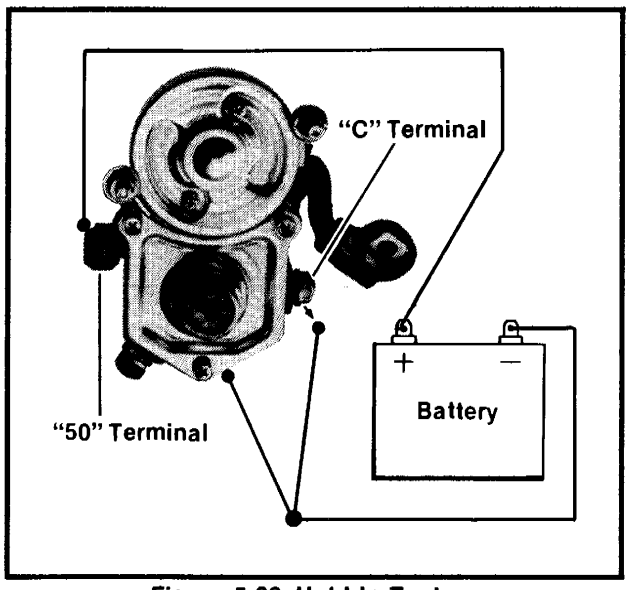


Figure 5-29. Hold-In Test

Solenoid Return (Figure 5-30)

Connect test leads from 12 volt battery as shown. Disconnect the "50" terminal test lead. If shaft returns to its original position, the solenoid is working properly. If the shaft does not return to its original position the solenoid should be replaced.

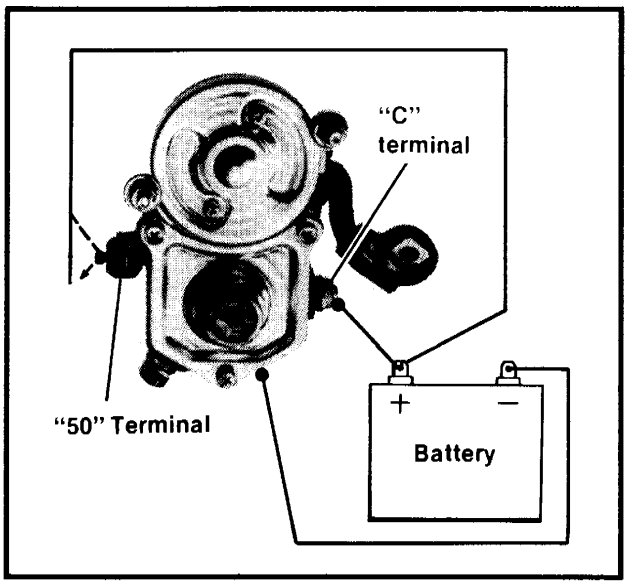


Figure 5-30. Return Test

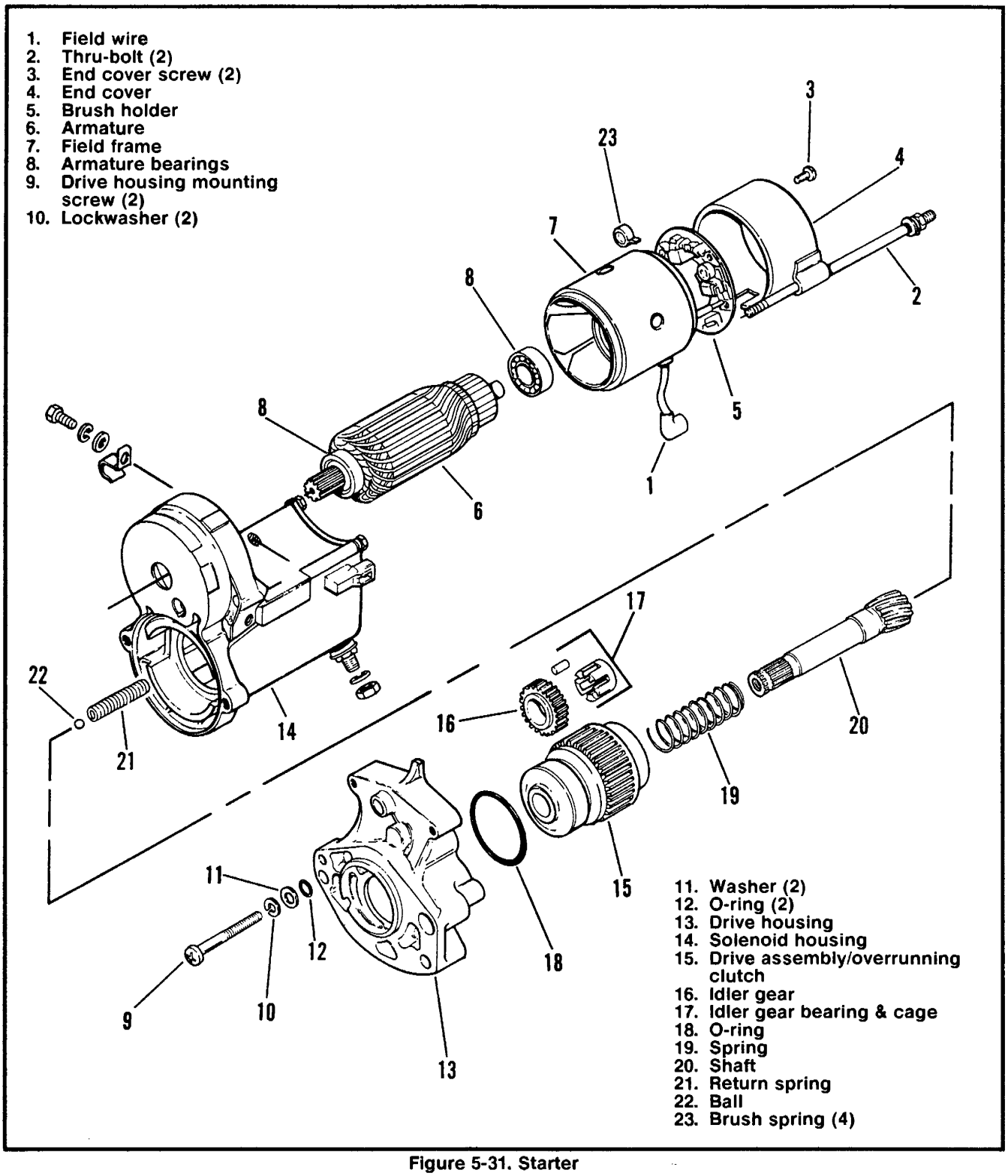


Figure 5-31. Starter

DISASSEMBLY, INSPECTION AND REPAIR

1. See Figures 5-31, 5-32. Disconnect field wire (1).

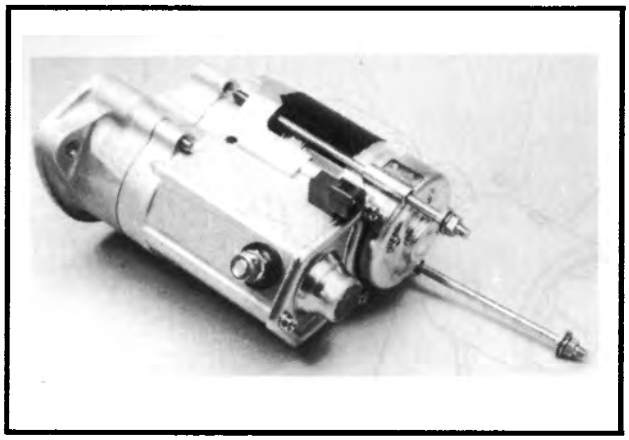


Figure 5-32. Remove Thru-Bolts

2. See Figures 5-31,5-33. Remove thru-bolts (2).

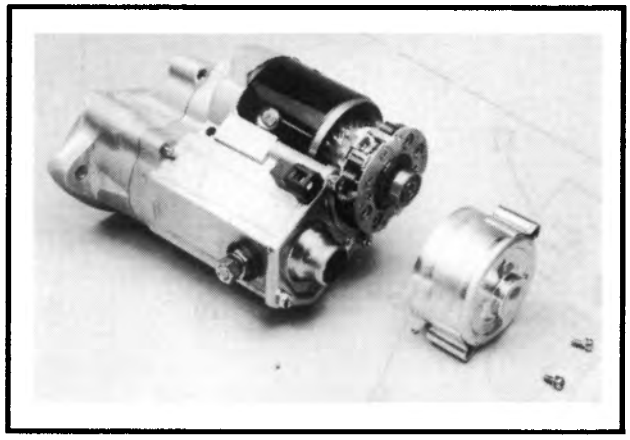


Figure 5-33. Remove End Cover

3. See Figures 5-31, 5-33. Remove the two cover screws and cover.
4. See Figure 5-34. Move brush springs out of the way and lift field coil brushes out of brush holder. Remove brush holder.

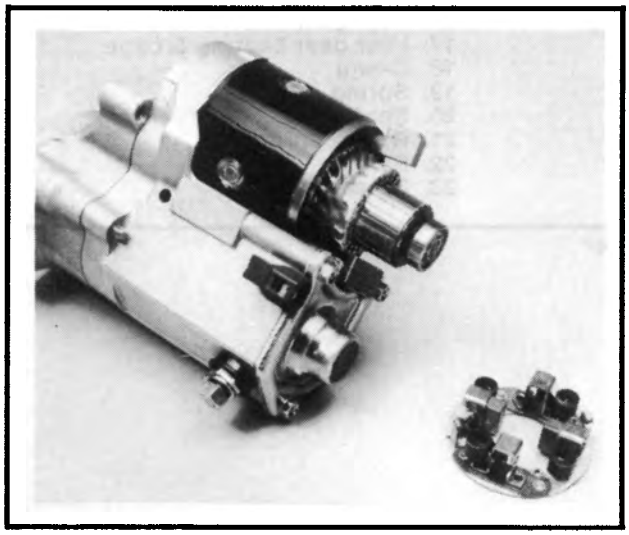


Figure 5-34. Remove Brush Holder

5. Check brush length. Brushes less than 0.354 in. long should be replaced.

NOTE

Replace brushes in sets of four only.

6. See Figure 5-31. Remove armature (6) and field frame (7).
7. Place armature in lathe or truing stand and check runout of commutator. Commutators with more than 0.002 in. of runout should be replaced or machined on a lathe. Commutators should be replaced when diameter is less than 1.141 in.
8. Check depth of mica on commutator. If undercut is less than 0.008 in., use an undercutting machine to undercut the mica to 1/32 in. deep. The slots should then be cleaned to remove any dirt or copper dust.
9. See Figure 5-35. If an undercutting machine is not available, undercutting can be done satisfactorily

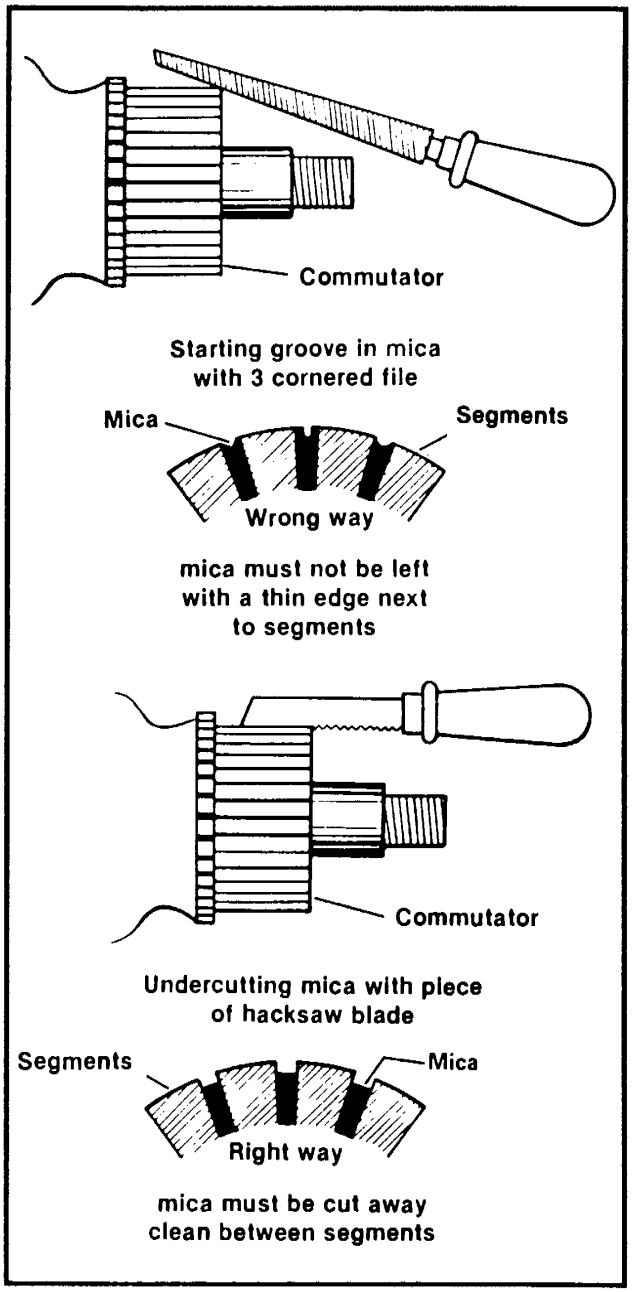


Figure 5-35. Undercutting the Mica Separators

using a thin hacksaw blade. After undercutting, lightly sand the armature with crocus cloth to remove any burrs.

10. See Figure 5-36. Check for SHORTED ARMATURE with a growler. Place armature on growler. Hold a thin steel strip (hacksaw blade) against armature core and slowly turn armature. A shorted armature will cause the steel strip to vibrate and be attracted to the core. Shorted armatures should be replaced.

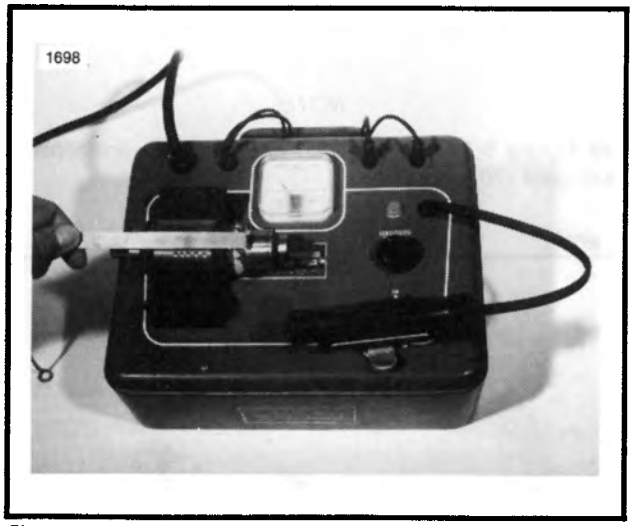


Figure 5-36. Shorted Armature Test Using Growler

11. See Figure 5-37. Check for a GROUNDED ARMATURE with an ohmmeter or continuity tester. Touch one probe to any commutator segment, and the other probe to the armature core. There should be no continuity (infinite ohms). If there is any continuity the armature is grounded and should be replaced.

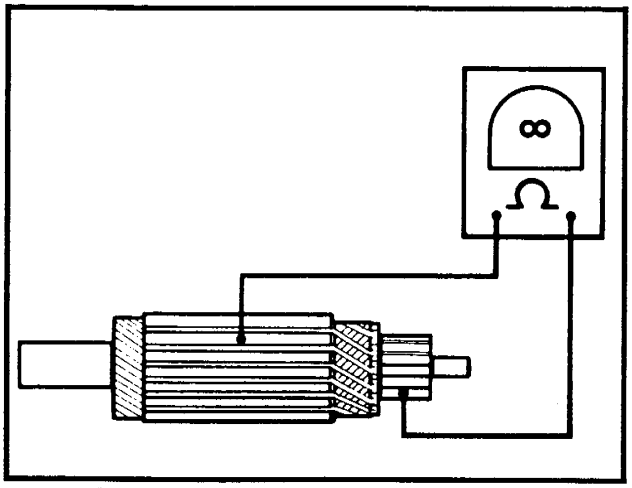


Figure 5-37. Grounded Armature Test

12. See Figure 5-38. Check for OPEN ARMATURE with an ohmmeter or continuity tester. Check for continuity between all commutator segments. There should be continuity (0 ohms) at all test points. No continuity at any test point indicates armature is open and should be replaced.

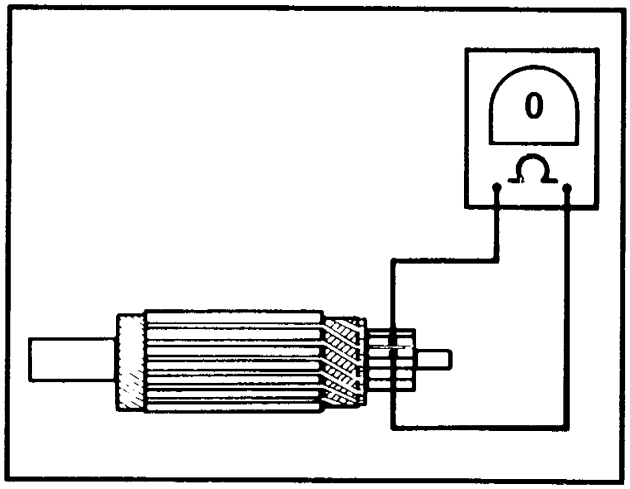


Figure 5-38. Armature Open Test

13. See Figure 5-39. Check for GROUNDED FIELD WINDING with an ohmmeter or continuity tester. Touch one probe to the frame, and the other probe to each of the brushes attached to the field winding. There should be no continuity (infinite ohms). If there is any continuity at either brush, the field winding(s) are grounded and the field frame should be replaced.

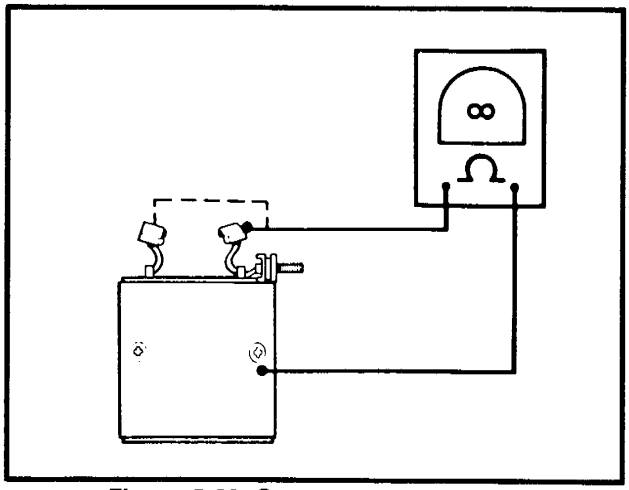


Figure 5-39. Grounded Field Test

14. See Figure 5-40. Check for OPEN FIELD WINDING with an ohmmeter or continuity tester. Touch one probe to the field wire, and the other probe to each of the brushes attached to the field coils. There should be continuity. If there is no continuity at either brush, the field winding(s) are open and the field frame should be replaced.

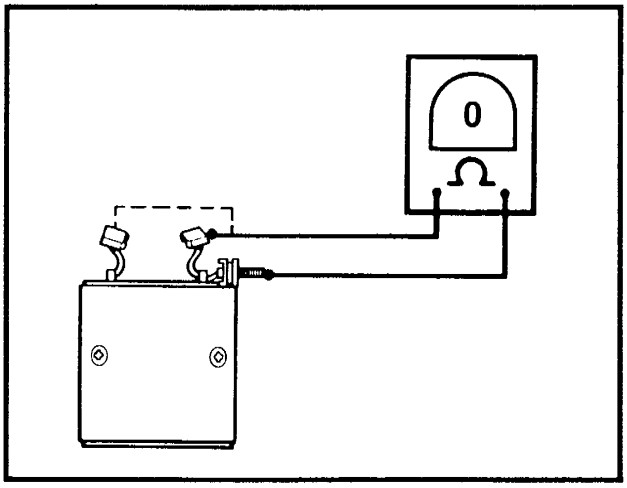
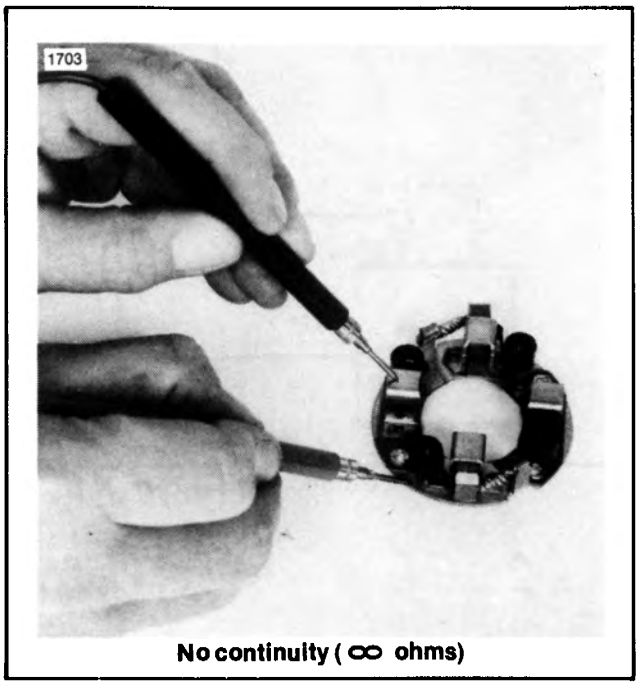


Figure 5-40. Open Field Test

15. See Figure 5-41. Test BRUSH HOLDER INSTALLATION with an ohmmeter or continuity tester. Touch one probe to holder plate and the other probe to each of the positive (insulated) brush holders. There should be no continuity (infinite ohms). If there is continuity at either brush holder, the brush holder assembly should be replaced.



No continuity (∞ ohms)

Figure 5-41. Brush Holder Insulation Test

16. Check armature bearings (8, Figure 5-31) and replace if necessary.

17. See Figures 5-31 and 5-42. Remove the two drive housing mounting screws (9) lockwashers. (10) and washers (11) and O-rings (12). Remove drive housing (13) from solenoid housing (14).

NOTE

See Figure 5-31. Spring (21) and ball (22) are loose in shaft gear (20) end.

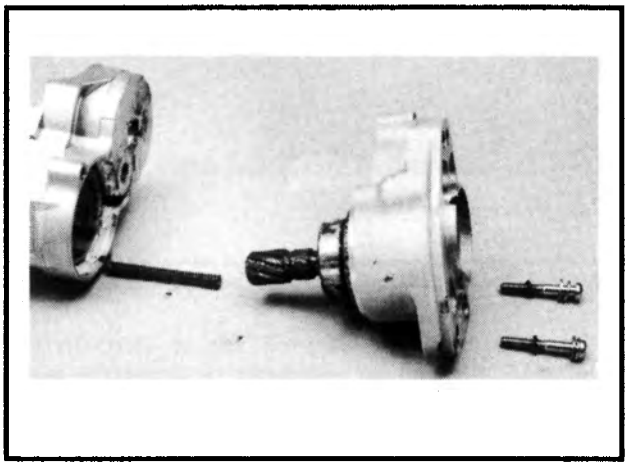


Figure 5-42. Remove Drive Housing

18. See Figure 5-31. Remove drive (15), idler gear (16) and idler gear bearing (17) from drive housing (13). O-ring (18) is in groove in drive housing.

19. See Figures 5-31 5-43. Remove spring (19) and shaft (20).

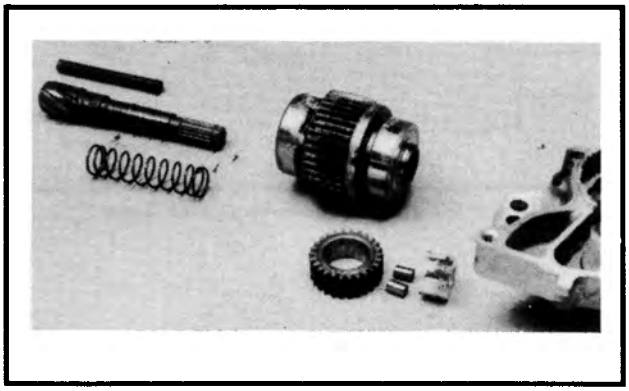


Figure 5-43 Drive Assembly

ASSEMBLY

1. See Figure 5-31. Clean, inspect and lubricate drive assembly components. Lubricate parts with high temperature grease such as LUBRIPLATE 110.

2. When installing drive assembly components, open end of idler bearing cage (17) faces toward solenoid.

3. When installing drive housing (13) to solenoid housing (14) use new O-rings (12). Be sure to install return spring (21) and ball (22).

4. Lubricate armature bearings (8) with high temperature grease such as LUBRIPLATE 110. Install armature (6) and frame (7) to solenoid housing (14).

5. Replace brush springs (23), if necessary.

6. Install brushes and brush holder (5).

7. Install end cover (4) with screws (3).

8. Install bolts (2).

9. Connect field wire (1) to terminal and tighten terminal nut to 65-80 in-lbs torque.

INSTALLATION

NOTE

See Figure 5-45. Lubricate splines inside coupling (11) with Locktite® Anti-seize. Be sure jackshaft coupling engages starter shaft. On 1990 models, coupling end with counterbore must face jackshaft.

1. Install starter from right side of motorcycle.

2. Install positive battery cable and solenoid wire to solenoid.

3. See Figure 5-27. Install the two starter mounting bolts and washers. Tighten mounting bolts to 13-20 ft-lbs torque. **Battery negative cable is connected to the front bolt on FXR's and the rear bolt on FLT's.**

NOTE

Be sure the lockplate protrusion is sticking into the keyway.

5. See Figure 5-45 for 1989 models. Install jackshaft lockplate (2), O-ring (3) and bolt (1). Hold pinion gear in place and tighten bolt to 7-9 ft-lbs torque. Bend lockplate tab against flat on bolt head.

6. See Figure 5-47 for 1990 models and follow ASSEMBLY/INSTALLATION procedure given for STARTER JACKSHAFT-1990.

7. Install primary chaincase cover. See PRIMARY CHAINCASE in section 6.

8. Fill primary chaincase with lubricant as described in section 6, WET CLUTCH LUBRICATION.

9. Install chrome end cover and acorn nuts, if applicable.

10. Connect battery cables, positive cable first.

STARTER JACKSHAFT - 1989

REMOVAL/DISASSEMBLY (Figures 5-44 and 5-45)

1. Remove primary cover. See DRIVE, Section 6.
2. Remove clutch. See DRIVE, Section 6.
3. Hold pinion gear in place and remove jackshaft bolt (1), lockplate (2) and O-ring (3).
3. Remove jackshaft from inner primary as an assembly.
4. Remove sleeve (4).

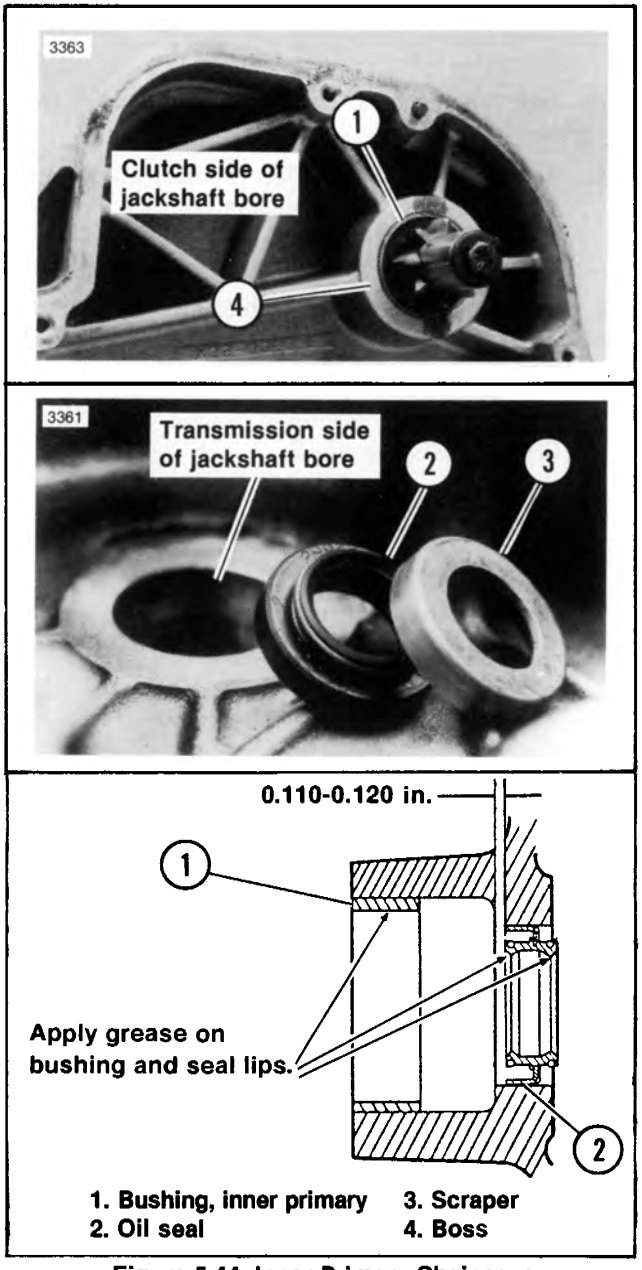


Figure 5-44. Inner Primary Chaincase

NOTE

Key (5) may come out with the sleeve.

5. Remove pinion gear (6) from jackshaft (7).
6. Remove coupling (8) and spring (9). Spring (9) and retaining ring (10) are inside coupling (8). Replace retaining ring if necessary.
7. If coupling (11) did not come off with jackshaft assembly, remove it from the starter shaft. Replace retaining ring (12) in groove inside coupling (11) if it was removed.
8. See Figure 5-44. Check bushing (1), seal (2) and scraper (3). Seal (2) and scraper (3) are on back side of primary chaincase (toward transmission).
9. If worn or damaged, remove bushing (1) and press new bushing into bore so it is flush to 0.010 in. below boss (4).
10. If seal (2) must be replaced, drive seal and scraper (3) out of primary chaincase. Discard seal and scraper.
11. Install a new seal (2) to the dimension shown in Figure 5-44. Scraper (3) is no longer needed.
12. Also check the primary cover bushing. If worn or damaged, replace the bushing, pressing it into the bore until it is flush to 0.030 in. below the surrounding boss.

ASSEMBLY/INSTALLATION

CAUTION

Make sure coupling (8) is installed with the end that is closest to the retaining ring facing the starter. If coupling is reversed, it will contact the inner primary and pinion will not engage ring gear.

1. Install coupling (8) and retaining ring (10) on jackshaft (7). Place spring (9) inside coupling.
2. Install pinion gear (6), sleeve (4) and key (5) on shaft.

3. Place lockplate (2) and and O-ring (3) on bolt (1). Install bolt in shaft.

CAUTION

Be sure the lockplate tab is in the keyway. This will prevent the key sliding out of the keyway and hold lockplate in place.

4. Place coupling (11) on shaft and slide jackshaft assembly into position in inner primary.
5. Screw the jackshaft bolt (1) into the starter shaft.
6. Hold the pinion gear in position and tighten the bolt to 7-9 ft-lbs torque.
7. Bend locking tab against bolt head.
8. Install clutch. See DRIVE, Section 6.
9. Install primary cover. See DRIVE, Section 6.

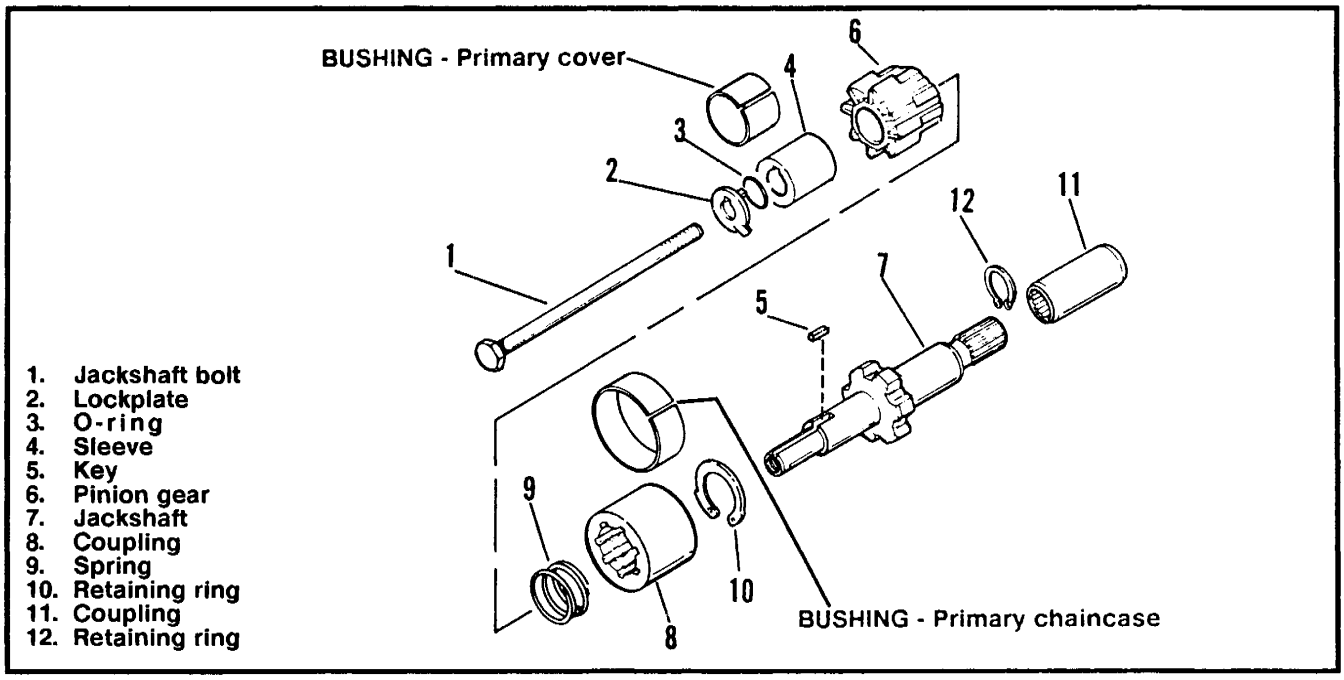


Figure 5-45. Jackshaft

STARTER JACKSHAFT - 1990

REMOVAL/DISASSEMBLY (Figures 5-46 and 5-47)

NOTE

- *The parts of the 1990 jackshaft assembly are NOT interchangeable with the 1989 assembly.*
- *The 1990 jackshaft assembly CAN be used in 1989 vehicles, but ONLY as an assembly.*
- *If you use the 1990 jackshaft assembly in an 1989 primary chaincase, the scraper must be removed and a new oil seal driven into the inner primary to a depth of 0.110 - 0.120 in. See Figure 5-44.*

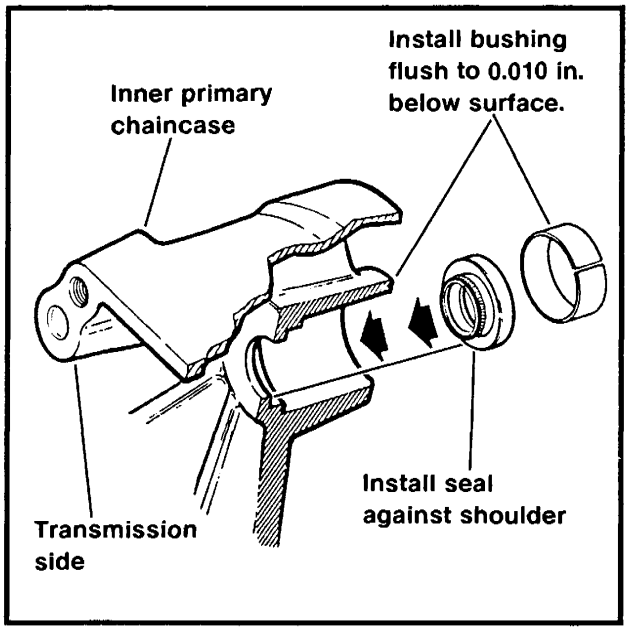
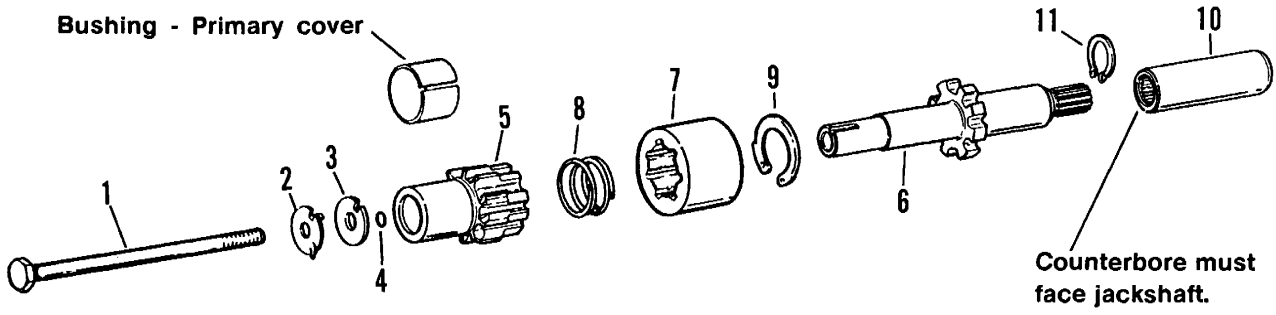


Figure 5-46. Primary Chaincase Jackshaft Bore

- *The 1989 and 1990 inner primary chaincases are NOT interchangeable.*
- *The 1990 inner primary and 1990 jackshaft can be used together on 1989 vehicles.*

1. Remove primary cover. See DRIVE, Section 6.
2. Remove clutch. See DRIVE, Section 6
3. Hold pinion gear in place and remove jackshaft bolt (1), lockplate (2), thrust washer (3) and O-ring (4).
4. Remove jackshaft from inner primary as an assembly.
5. Remove pinion gear (5) from jackshaft (6).
6. Remove coupling (7) and spring (8). Spring (8) and retaining ring (9) are inside coupling (7). Replace retaining ring if necessary.
7. If coupling (10) did not come off with jackshaft assembly, remove it from the starter shaft. Replace retaining ring (11) if necessary.
8. See Figure 5-46. If oil seal / bushing are worn or damaged, remove them and install new parts as shown.
9. Also check the primary cover bushing that supports the outer end of the jackshaft. If worn or damaged, replace the bushing, pressing it into the bore until it is flush to 0.030 in. below the surrounding boss.



1. Jackshaft bolt
2. Lockplate
3. Thrust washer
4. O-ring
5. Pinion gear
6. Jackshaft
7. Coupling
8. Spring
9. Retaining ring
10. Coupling
11. Retaining ring

Figure 5-47. 1990 Jackshaft

ASSEMBLY/INSTALLATION

1. Install coupling (7) and retaining ring (9) on jackshaft (6). Place spring (8) inside coupling.

CAUTION

Make sure coupling (7) is installed with the end that is closest to the retaining ring facing the starter. If coupling is reversed, it will contact the inner primary and pinion will not engage ring gear.

2. Install pinion gear (5) on shaft.

3. Place lockplate (2), thrust washer (3) and O-ring (4) on bolt (1). Install bolt in shaft.

NOTE

The 1990 coupling (10) is longer than the 1989 coupling and the retaining ring (11) groove is no longer centered. It is offset towards one end of the coupling. When you install the coupling, be sure the end with the COUNTERBORE goes toward the jackshaft.

4. Install retaining ring (11) if removed and place coupling (10) on shaft. Slide jackshaft assembly into position in inner primary.

CAUTION

Be sure the lockplate tab is in the keyway. This will hold lockplate and thrust washer in place.

5. Align lockplate tab and thrust washer slot with jackshaft keyway. Screw the jackshaft bolt into the starter shaft.

6. Hold the pinion gear in position and tighten the bolt to 7-9 ft-lbs torque.

7. Bend locking tab against bolt head.

CAUTION

Make certain lockplate tab does not extend beyond outside diameter of pinion gear journal. Jackshaft will jam and primary cover bushing may be damaged if tab touches primary bushing when starter drive is engaged.

8. Install clutch. See DRIVE, Section 6.

9. Install primary cover. See DRIVE, Section 6.

NOTES

SUBJECT **PAGE NO.**

SPECIFICATIONS

GENERAL

Overall Gear Ratios

Overall gear ratios indicate the number of engine revolutions required to drive the rear wheel one revolution.

	1985, & LATER	1984	
	ALL	FXRS	FLT FXRT
1st	10.93	11.58	10.90
2nd	7.46	7.90	7.44
3rd	5.40	5.72	5.38
4th	4.15	4.40	4.14
5th	3.37	3.57	3.37

CHAINS AND BELTS

Adjustments

Primary Chain:
- Cold Engine ..... 5/8-7/8 in. slack
- Hot Engine ..... 3/8-5/8 in. slack

Rear Chain - 1984 and 1986 ..... 1/2 in. slack
Rear Belt - 1985 and later ..... 5/16-3/8 in. deflection — 10 lbs force

Lubrication — FLT/FXR Models

Rear Chain (enclosed) ..... Harley-Davidson Motorcycle Oil Regular Heavy or Extra Heavy
Rear Chain (open) ..... Harley-Davidson CHAIN LUBE PLUS, Part No. 99865-81 Harley-Davidson CHAIN SPRAY, Part No. 99870-58
Primary Chain (Late 1984 and later) .... Harley-Davidson PRIMARY CHAINCASE LUBRICANT, Part No. 99887-84 Late 1984-1989: 44-48 ozs. 1990: 38-44 ozs.

SPROCKETS

Sprocket	No. of teeth
Engine	24
Clutch	37
Transmission	
Chain	22
Belt	32
Rear Wheel	
Chain — Enclosed	48
— Open	51
Belt	70

CLUTCH

Early 1984

Type ..... Dry, multiple disc
Capacity ..... 206 ft-lbs torque
Spring pressure (total) ..... 315 lbs.
Spring adjustment 1-1/32-7/8 in. from spring collar edge
Spring free length ..... 1-47/64-1-45/64 in.
Spring rate (1-1/4 in.) ..... 38-30 lbs.
Friction disc lining thickness ..... 1/32 in. min.
Friction disc warpage ..... 0.000-0.010 in.
Steel disc warpage ..... 0.000-0.010 in.
Clutch screw adjustment ..... 1/4 turn loose from lightly seated
Clutch lever free play ..... 1/16 in.

Late 1984-1989

Type ..... Wet-multiple disc
Capacity ..... 200 ft-lbs torque
Spring pressure ..... 330 lbs engaged
Clutch lever free play ..... 1/8 - 3/16 in.
Clutch screw adjustment ..... 3/4 turn loose from lightly seated

1990

Type ..... Wet-multiple disc
Clutch lever free play ..... 1/16 - 1/8 in.
Clutch screw adjustment ..... 1/2 - 3/4 turn loose from lightly seated

PRIMARY CHAINCASE — EARLY 1984 (DRY CLUTCH)

Vacuum (with vent hoses pinched closed) ..... 25 in. of water min. @ 1500 rpm

TORQUES

Clutch cable bracket screws (1984 - 1986) ..... 6-8 ft-lbs
Primary chaincase cover screws ..... 7-9 ft-lbs
Clutch release arm nut (1984 - 1986) ..... 8-10 ft-lbs
All 1/4 in. fasteners ..... 7-9 ft-lbs
Starter drive to primary chaincase bolts/studs 10-12 ft-lbs
Compensating sprocket nut ..... 80-100 ft-lbs
Primary chaincase to engine bolts ..... 16-18 ft-lbs
Transmission sprocket nut ..... 110-120 ft-lbs
Rear chain rubber boots mounting screws (1984) . 3-4 ft-lbs
Clutch release rod adjusting locknut ..... 6-10 ft-lbs
Clutch hub nut
- Dry clutch ..... 50-60 ft-lbs
- Wet clutch - 1989 and earlier ..... 50-60 ft-lbs
- 1990 ..... 70-80 ft-lbs

PRIMARY CHAIN AND SPROCKETS

GENERAL

Inspect the chain periodically for cracked, broken or badly worn links. Primary chain adjustment must be checked every 5000 miles. As chains stretch and wear they run tighter at one spot than another. Always adjust free movement at the tightest spot in the chain to allow specified play midway between sprockets. Do not adjust tighter. Running chains too tight will result in excessive wear.

There are two sprockets inside the primary chaincase: The engine compensating sprocket and the clutch sprocket.

ADJUSTMENT (Figure 6-1)

Primary chain tension is adjusted by a shoe located in the primary chaincase. 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:

1. Remove the adjusting shoe cover from the primary chaincase cover. On FXR remove shifter lever.
2. Loosen the center bolt or nut a maximum of two turns and move the shoe assembly up or down to obtain the specified free play.
3. Align the face slots of the fixed and sliding adjuster plates then tighten the center bolt or nut.
4. Install the cover.

NOTE

Cover gasket must be replaced whenever cover is removed.

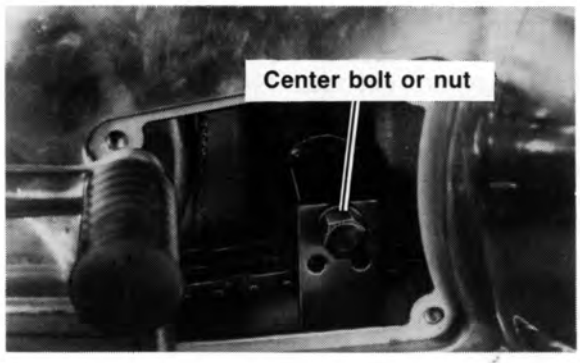
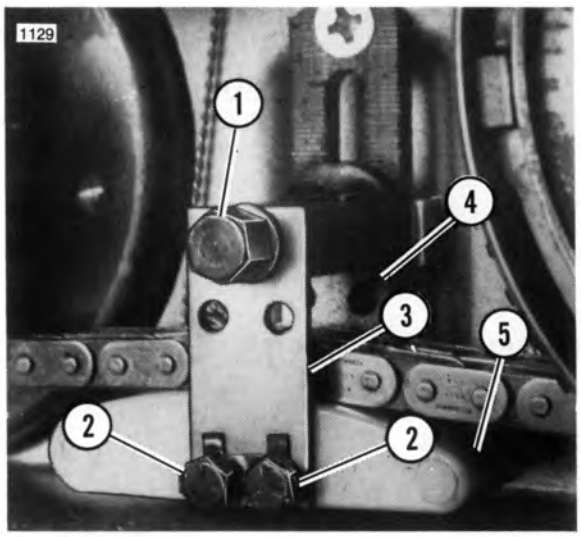


Figure 6-1. Adjusting Primary Chain

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. Center bolt or nut
2. Mounting bolt (2)
3. Outer plate
4. Support bracket
5. Adjusting shoe

Figure 6-2. Adjusting Shoe Mounting

1. Remove the left footrest bracket and shifter lever on FXR models or footboard and rear bracket on FLT models. Remove primary chaicase cover.
2. Remove the center bolt or nut (1) and two bottom bolts (2). Remove the adjusting shoe and replace it.

LUBRICATION

Early 1984 — Dry Clutch

A fixed amount of oil is supplied through an oil line running from the gearcase to the primary chaincase. Oil drops on the chain from the oil outlet in the support bracket 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 5000 miles, check to see that oil comes out of the oil outlet. If oil mist does not come out of the outlet, check for restriction in the oil hose and the oil outlet.

Late 1984 and Later — Wet Clutch

The primary chain is lubricated by the lubricant in the primary chaincase.

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. On "wet" clutch models, drain primary chaincase lubricant.
2. Remove primary chain following procedure under clutch DISASSEMBLY given later in this section.
3. See Figure 6-3. Disassemble components of compensating sprocket.

CLEANING, INSPECTION AND REPAIR

1. Inspect compensating sprocket components for wear and damage. Replace damaged or broken parts.

NOTE

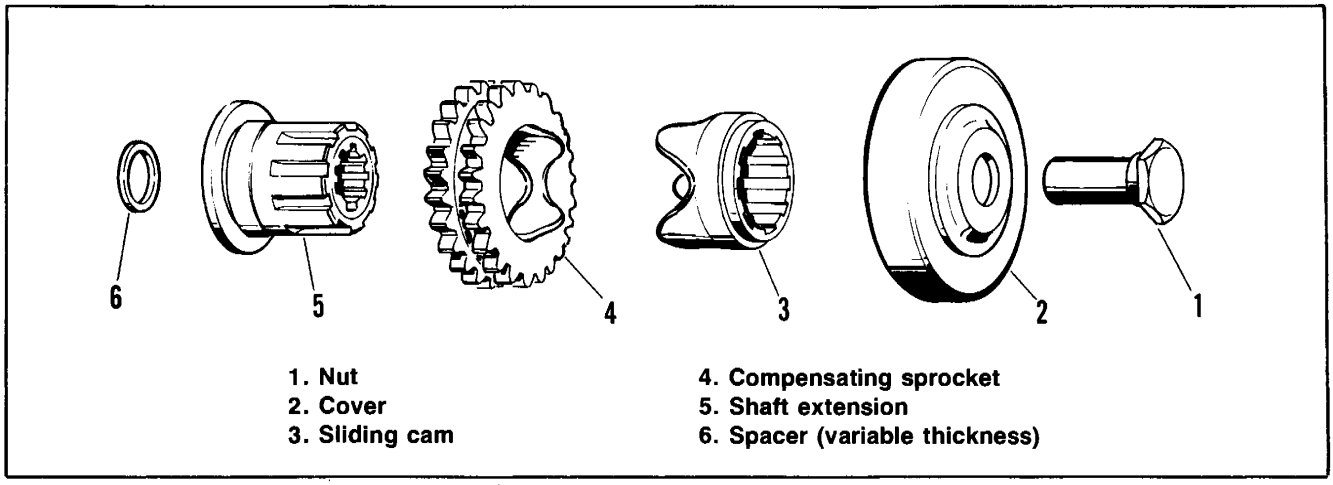
Lubrication of cam lobes is not required on "wet" clutch models because there is ample lubrication within the primary chaincase.

2. See Figure 6-3. On "dry" clutch models apply grease to cam lobes (3 and 4).
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 dry clutch shell bearing surface. If it is grooved or pitted, replace the clutch shell.

Sprocket Alignment

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. With the primary chaincase cover removed, check to be certain the primary chain tension is properly adjusted. See ADJUSTEMENT at the beginning of this section.
2. Push the primary chain inward as far as it will go at both the engine compensating and clutch sprockets.
3. Place a straightedge vertically across the primary chaincase cover gasket surface near the engine compensating sprocket.



1. Nut
2. Cover
3. Sliding cam
4. Compensating sprocket
5. Shaft extension
6. Spacer (variable thickness)

Figure 6-3. Compensating Sprocket

4. See Figure 6-4. With a dial caliper, measure the distance from the straightedge to the chain link sideplates. Measure as close to the engine compensating sprocket as possible. Record this measurement.

Figure 6-4. Checking Chain Alignment

5. Repeat the measuring procedure at the clutch sprockets.

6. See Figure 6-5. The difference between the two measurements must be within 0.030 in. for proper primary chain alignment. A difference greater than 0.030 in. indicates a variable thickness spacer should be removed or installed on the engine sprocket shaft just before the shaft extension.

SHIM THICKNESS	
0.010 in.	0.030 in.
0.020 in.	0.060 in.

Figure 6-5. Compensating Sprocket Shims

ASSEMBLY

Assemble both sprockets, chain and chain adjuster as an assembly following procedure under CLUTCH, ASSEMBLY. Make sure correct spacer (6, Figure 6-3) is used.

CAUTION

The Print-O-Seal gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed.

REAR CHAIN AND SPROCKETS — 1984 AND 1986

ADJUSTMENT (Figures 6-6, 6-7)

1. Loosen locknut (7) and caliper and/or bolt (1) on FLT/FXRT models. Loosen axle nut (2) on right side.

2. With the motorcycle upright and one rider sitting on it, turn the adjusting nuts (4) on both sides of the rear wheel to move the axle. Turn the adjusting nuts an equal amount of turns to keep the rear wheel in alignment.

NOTE

Rear axle must remain parallel with swing arm pivot shaft. See REAR WHEEL ALIGNMENT PROCEDURE in Section 2.

3. A properly adjusted chain should have 1/2" free up and down movement halfway between the transmission sprocket and the rear wheel sprocket. Check the rear wheel alignment. Wheel must run centrally in the swing arm. See REAR WHEEL ALIGNMENT PROCEDURE in section 2.

4. Tighten the axle nut (2) to 60-65 ft-lbs torque and, on FLT models, tighten the rear brake anchor bolt (1) to a point where the rubber plug in the center of the bolt is just starting to compress. Tighten the locknut to 20 ft-lbs torque.

NOTE

Once the chain adjusters have reached their limit and proper chain adjustment can no longer be achieved, replace the chain.

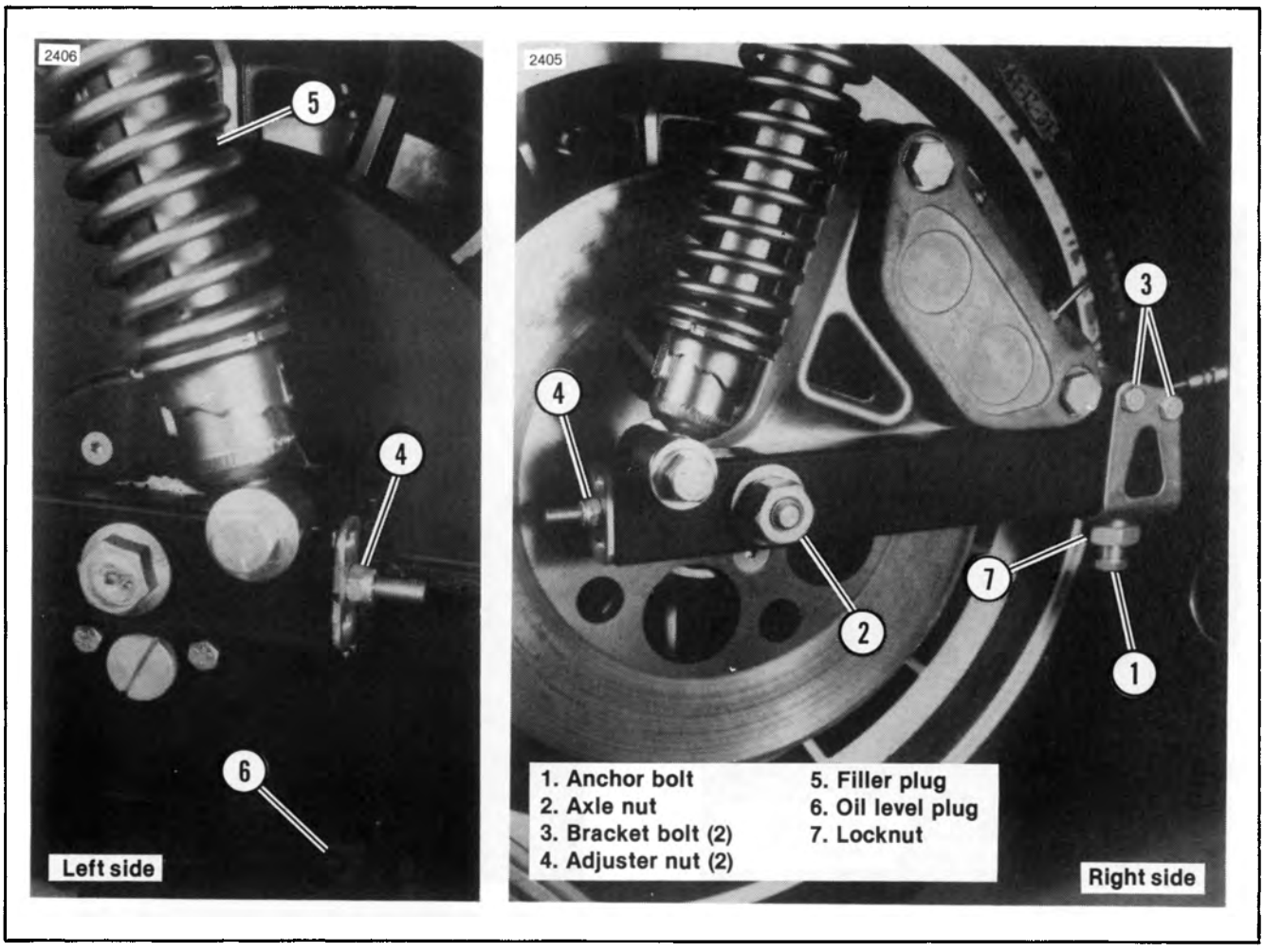


Figure 6-6. Rear Chain Adjustment and Lubrication — 1984 FLT/FLHT/FXRT

LUBRICATION —

Enclosed Chain (Figure 6-6)

The rear chain is an enclosed unit. The housing should have sufficient oil to lubricate the chain. Use Harley-Davidson Motorcycle Oil Regular Heavy or Extra Heavy.

CAUTION

Do not use transmission lubricant in the chain housing. Some types are not compatible with the chain boots and oil seals.

1. To fill the housing, remove the filler plug (5) and oil level plug (6).

2. With the motorcycle upright, pour oil into the filler hole until it starts to run out of the oil level hole. Install the two plugs.

Open Chain

NORMAL CONDITIONS

Brush dirt off chain and lubricate as required with Harley-Davidson CHAIN LUBE PLUS, or CHAIN SPRAY, if available; if not available, use engine oil. Apply at room temperature to chain side plates and rollers.

All working parts of the chain should be thoroughly lubricated. Wipe off surplus lubricant.

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.

CAUTION

Late 1984 FXRS and 1986 FXR models are equipped with O-ring chains. Do not soak or immerse these chains in solvent. Clean external surfaces with a rag dampened with kerosene. Then lubricate as instructed.

2. Soak and wash the chain thoroughly in a pan of solvent such as kerosene.

3. Remove chain from solvent and blow it dry with compressed 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.

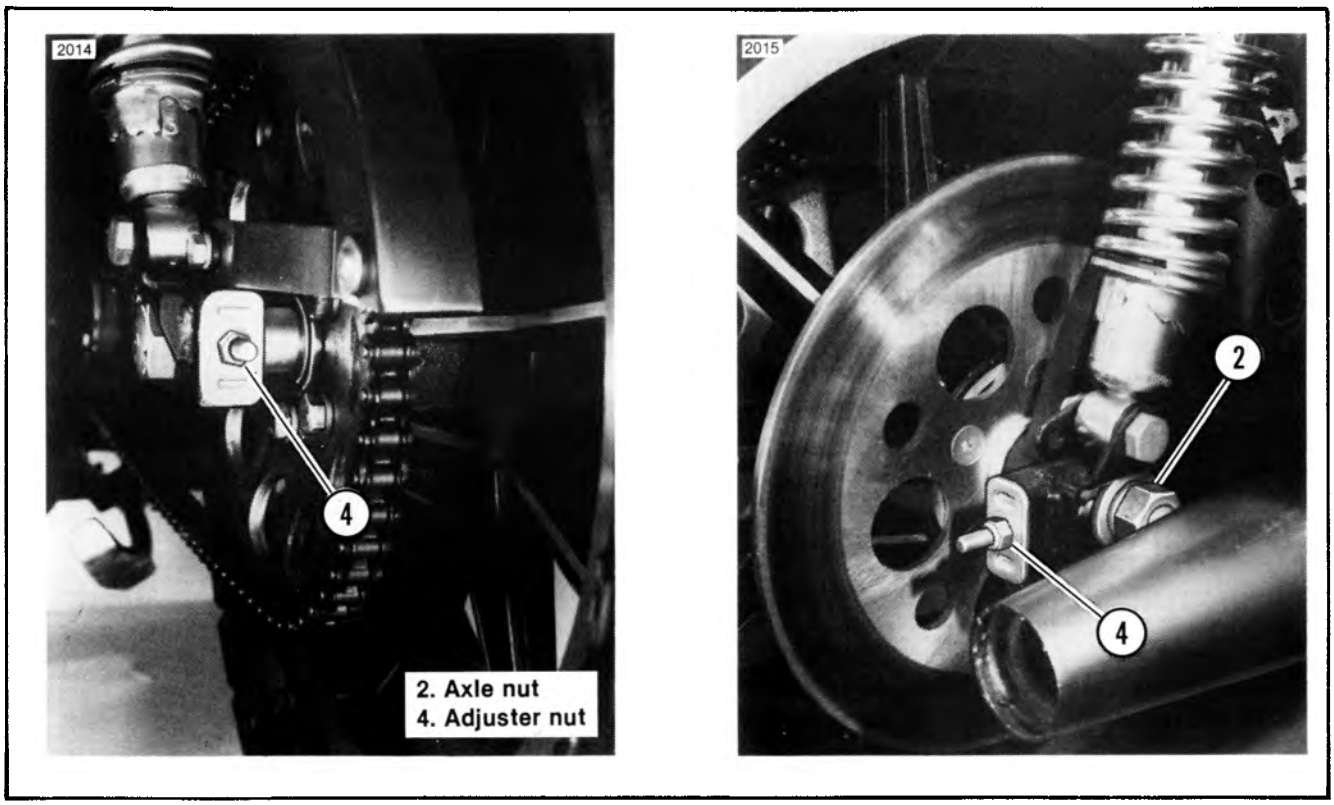


Figure 6-7. Rear Chain Adjustment — 1984 FXRS and 1986 FXR

Be sure clip is correctly and securely locked on pin ends with open end trailing direction of chain travel. See Figure 6-8.

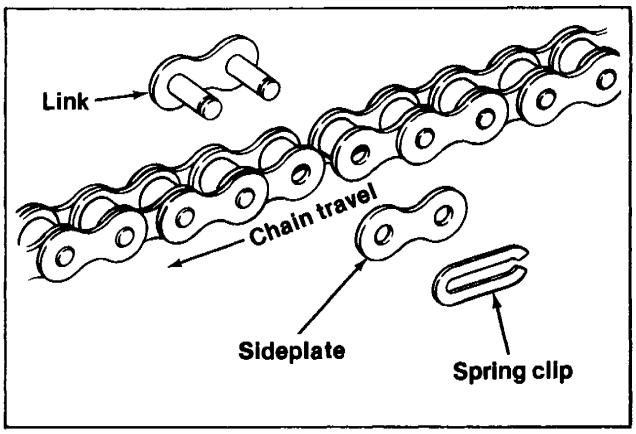


Figure 6-8. Chain Connecting Link

ASSEMBLY

Assemble both sprockets, chain and chain adjuster as an assembly following procedure under CLUTCH ASSEMBLY. Make sure correct spacer (6, Figure 6-3) is used.

CAUTION

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed.

REMOVING AND INSTALLING REAR CHAIN (Figure 6-8)

1. Support the motorcycle with the rear wheel raised. Disconnect the bottom rear chain boot from the chain housing on FLT/FXRT models.
2. Loosen axle and adjusters, then slide rear wheel forward. Locate and remove the spring clip on the chain connecting link.
3. Using CHAIN BREAKING TOOL, Part No. HD-95021-29A, press the connecting link from the side plate.
4. 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.
5. Disconnect the old chain from the new chain.
6. Using CHAIN ASSEMBLY TOOL, Part No. HD-95020-66, 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. Adjust chain and properly torque axle nuts.

TRANSMISSION SPROCKET

Removal

1. Remove primary chain and case as described under PRIMARY CHAINCASE, DISASSEMBLY later in this section.
2. Remove lock screw from sprocket. Apply rear brake and remove the sprocket nut using SPROCKET NUT WRENCH, Part No. HD-94660-37A. **Nut has a left hand thread.**
3. Disconnect rear chain as described earlier and remove the transmission sprocket 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, apply a drop of 242 blue Loctite to threads and install nut finger tight. Nut has left hand threads.
2. Install rear chain as described earlier making sure spring slip open end trails the direction of chain travel.
3. Apply rear brake and tighten sprocket nut to 110-120 ft-lbs torque. See ASSEMBLING MAIN DRIVE GEAR in section 7 for nut locking procedure.
4. Install primary chain and case as described under PRIMARY CHAINCASE, ASSEMBLY later in this section.

SECONDARY DRIVE BELT AND SPROCKETS — 1985 AND LATER

GENERAL

The secondary belt inner tooth surface has a thin coating of polyethylene 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 2500 miles thereafter (See Figure 6-9). When 10 lbs of force is applied with BELT TENSION GAUGE, Part No. HD-35381 at the midpoint of the belt's bottom strand, deflection should equal 5/16-3/8 in. Belt tension is checked with the rear wheel on the ground and one rider sitting on the motorcycle.

NOTE

On 1989 models the rear axle has a hole for a cotter pin to secure the castle axle nut.

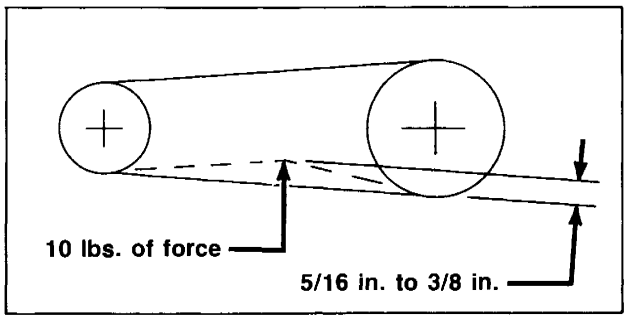


Figure 6-9. Belt Tension

FLT Models

1. See Figure 6-10. Remove cotter pin (4) if present. Loosen the axle nut (1). Loosen the brake anchor nut (1985 only) (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. Torque axle nuts to 60-65 ft-lbs or if 1989 model proceed to steps 2 and 3, then check wheel alignment. Check wheel alignment. See WHEEL ALIGNMENT, section 2.

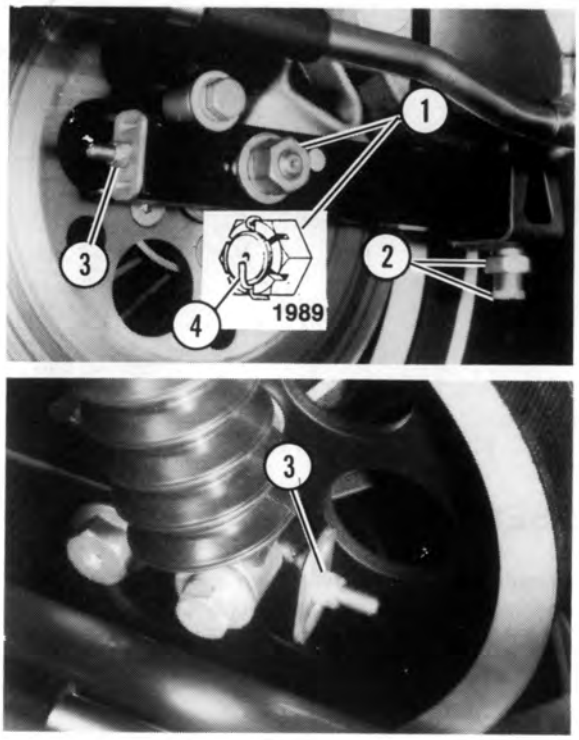
2. On 1989 models tighten the axle nut (1) to 60 ft-lbs torque and check if new cotter pin can be inserted. If required, tighten nut further to align axle hole and nut slot - do not exceed 65 ft-lbs torque.

3. Install cotter pin (4) as shown.

FXR Models

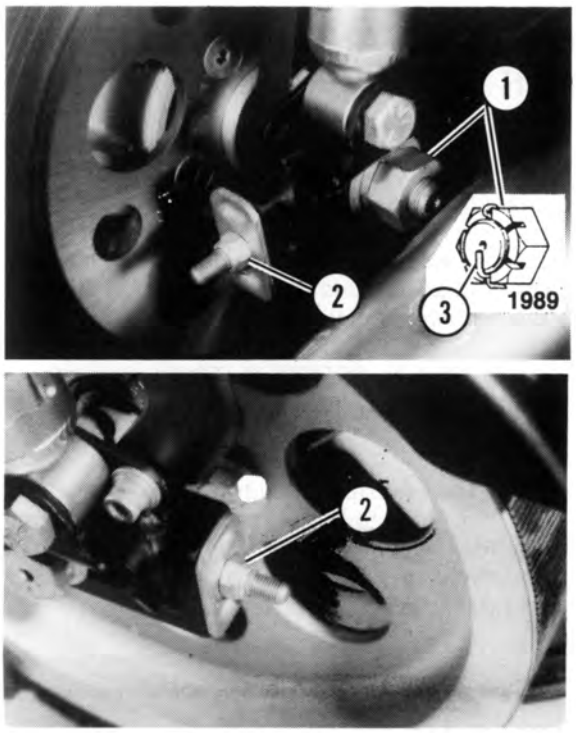
1. See Figure 6-11.

2. Adjust belt tension following the procedure given for FLT models.



1. Axle nut
2. Brake anchor nut, 1985
3. Adjuster nut
4. Cotter pin, 1989

Figure 6-10. Secondary Belt Adjustment — FLT



1. Axle nut
2. Adjuster nut
3. Cotter pin, 1989

Figure 6-11. Secondary Belt Adjustment — FXR

BELT REMOVAL AND INSTALLATION

1. Follow the removal procedures as described under REAR WHEEL in section 2.

2. Remove the primary chaincase as described later in this section under PRIMARY CHAINCASE.

3. Remove the rear swing arm. See section 7, TRANSMISSION CASE, REMOVAL, steps 10, 11 and 12.

4. 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 three inches diameter. Sharp bending can weaken the belt to such an extent that a premature failure will result. Always install belt in same direction of rotation as when removed.

5. Install the rear swing arm. See section 7, TRANSMISSION CASE, INSTALLATION, steps 3, 4, 5 and 6.

6. Install the primary chaincase as described later in this section under PRIMARY CHAINCASE, ASSEMBLY.

7. Install the compensating sprocket, primary chain and clutch as described under CLUTCH later in this section.

8. Follow the installation procedure as described under REAR WHEEL in section 2.

9. Adjust the rear belt as described earlier in this section.

TRANSMISSION SPROCKET

Removal

1. Remove primary chain and case as described under PRIMARY CHAINCASE REMOVAL later in this section.

2. 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-94660-37A. **Nut has a left hand thread.**

3. Loosen rear axle nut and axle adjuster nuts and slide rear wheel forward. Remove transmission sprocket.

Cleaning, Inspection and Repair

1. Clean sprocket of all grease and dirt using solvent.

2. Replace sprocket if there is any damage or cracks.

Installation

1. Install belt on sprocket as sprocket is installed on main drive gear. Apply a drop of Loctite 242 (blue) to threads and install nut finger tight.

2. Adjust rear belt as described earlier in this section.

3. Apply rear brake and tighten sprocket nut to 110-120 ft-lbs torque using Part No. HD-94660-37A. If necessary, turn the sprocket nut an additional amount (150 ft-lbs maximum), just enough to expose one of three locking screw holes. The proper hole location in relationship to the nut is shown in Figure 6-12. Coat threads of locking screw in the exposed hole and tighten to 50-60 in-lbs torque.

4. Install primary chain and case as described under PRIMARY CHAINCASE ASSEMBLY later in this section.

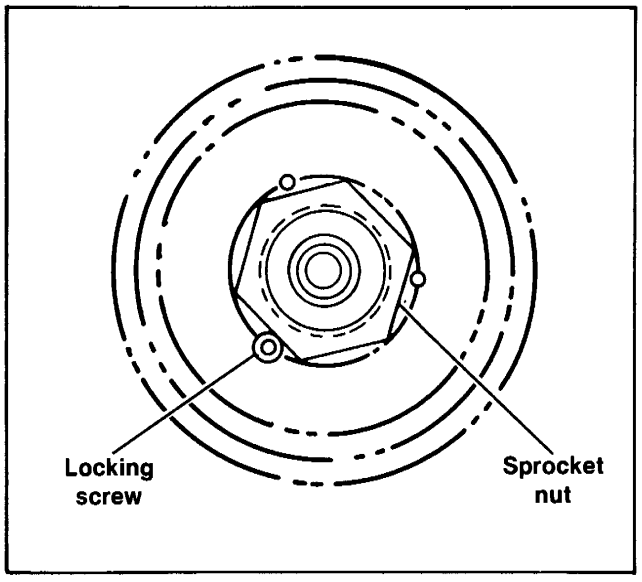


Figure 6-12. Securing Sprocket Nut

DRY CLUTCH — EARLY 1984

GENERAL

The clutch assembly is located in the primary chaincase. When clutch slips under load or drags in the released position, check TROUBLESHOOTING in Section 1 and the ADJUSTMENT in this section. If the clutch does not work after performing the adjustments, proceed to the DISASSEMBLY and REPAIR procedures in this section.

ADJUSTMENT

Clutch Hand Control (Figures 6-13, 6-14)

Clutch hand lever should have 1/16 in. freeplay before clutch starts to disengage. Adjust as follows:

1. See Figure 6-14. Loosen locknut (1) and turn adjusting sleeve (2) clockwise loosening cable.
2. Remove cable ball end from release arm (3).
3. Remove clutch cover on primary chaincase cover. Loosen clutch push rod locknut (4) and turn adjusting screw (5) clockwise until free movement in release arm (3) is eliminated.
4. Loosen adjusting screw 1/4 turn. Tighten locknut (4) and replace clutch cover.
5. Replace cable ball end in release arm (3) and turn adjusting sleeve (2) until there is 1/16 in. free play.
6. Tighten locknut (1) to 25 ft-lbs torque.

NOTE

Clutch cover must be installed airtight - use a new cover gasket and gasket sealer when installing. Do not use silicone sealant.

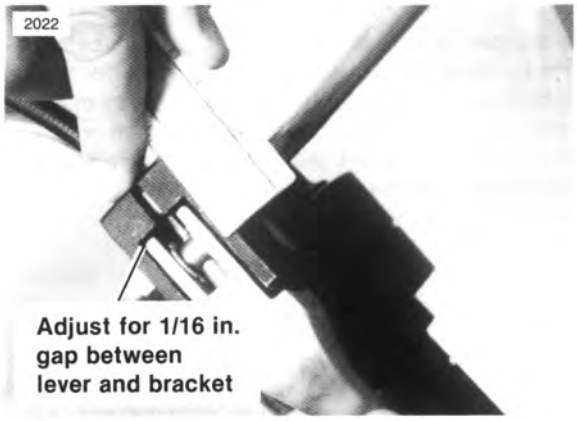
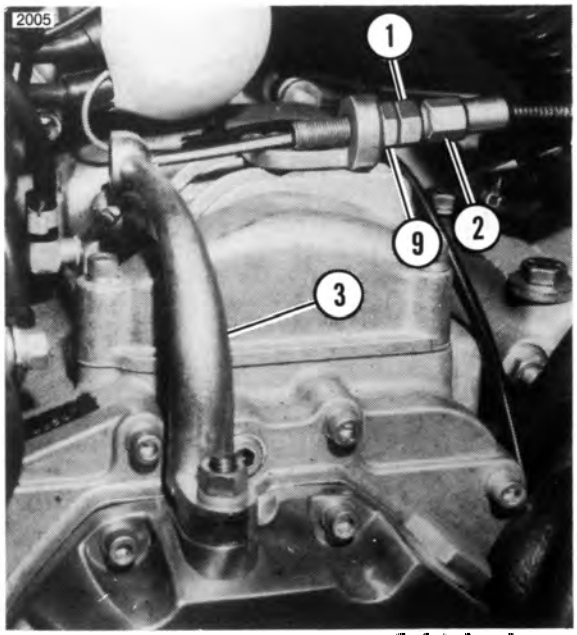
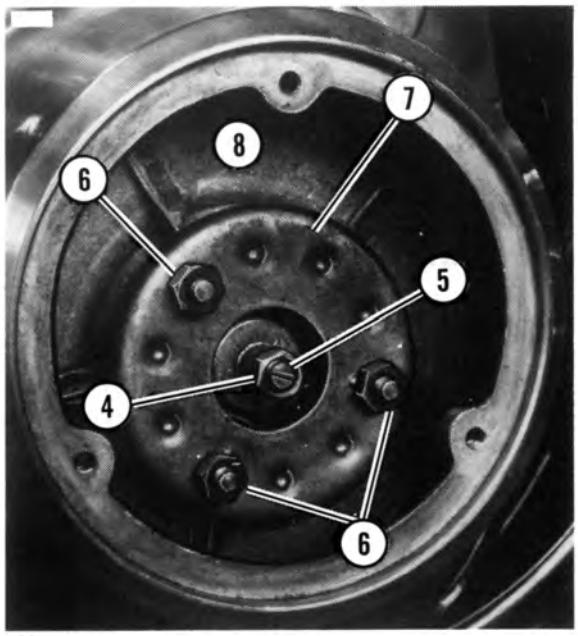


Figure 6-13. Adjusting Clutch Free Play





1. Locknut
2. Adjusting sleeve
3. Release arm
4. Pushrod locknut
5. Adjusting screw
6. Nut
7. Pressure plate
8. Outer disc
9. Swivel nut

Figure 6-14. Clutch Adjustment

Clutch Discs (Figure 6-14)

If clutch still slips after adjusting the controls, adjust the clutch as follows:

1. Remove clutch cover on the primary chaincase cover.

WARNING

Keep hands, feet and all clothing away from moving parts. Make sure transmission is in neutral.

2. Turn all nuts (6) clockwise 1/2 turn at a time. Test to see if clutch holds after each half turn on all 3 nuts by cranking the engine. DO NOT INCREASE SPRING TENSION ANY MORE THAN IS NECESSARY TO MAKE CLUTCH HOLD.

3. The distance between the spring collar (7) and outer disc (8) should be greater than 7/8 in. A new clutch is set-up so this distance is exactly 1-1/32 in. If this distance is equal to or less than 7/8 in., clutch will probably not disengage and should be disassembled and checked. Make sure spring collar (7) is equidistant from outer disc (8) at all points.

DISASSEMBLY

WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables (negative cable first) before performing any of the following procedures.

1. On FLT models remove the bolts securing the left footboard to the frame. Remove footboard and rear bracket. On FXR models remove the shifter lever and footrest bracket which is secured to the frame.

2. Remove primary chaincase cover.

3. See Figure 6-15. Remove push rod adjusting screw locknut. Place a flat washer (1) (1/8 in. thick, 1-3/4 in. diameter and 3/8 inside diameter) over the adjusting screw and replace the locknut.

4. Turn locknut down until spring adjusting nuts (2) are free and remove the nuts.

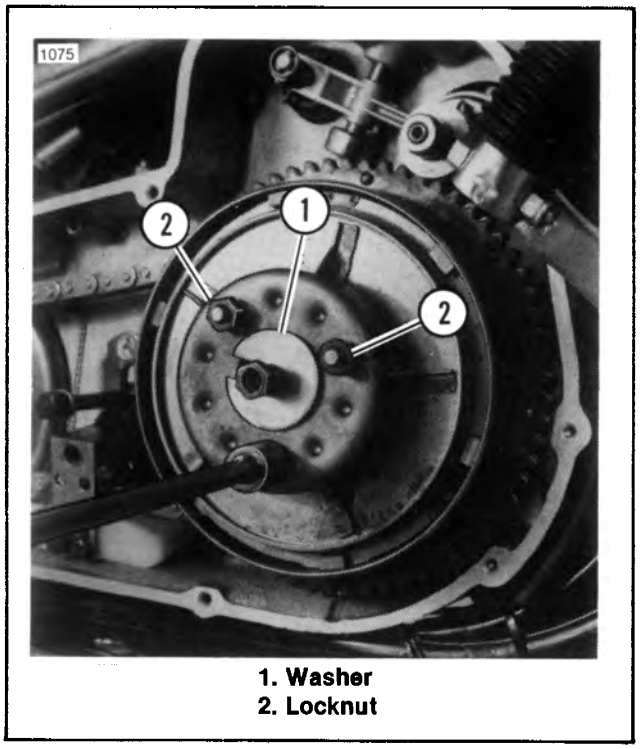
5. See Figure 6-16. Remove pressure plate (4), springs (5) and release disc (6) as an assembly. Do not disassemble these parts unless replacement is necessary.

6. Remove steel discs (7) and lined friction discs (8).

7. See Figure 6-17. Remove bolt (1) and engine compensating sprocket nut (2). Remove oil hose from chain adjuster fitting. Remove clutch shell, compensating sprocket and primary chain with adjuster all as one unit.

8. See Figure 6-16. Bend back ear of lockwasher (11) on hub (12). Remove clutch hub nut (10) using CLUTCH HUB NUT WRENCH, Part No. HD-94645-41 with transmission in gear and foot on brake. **Nut has a left-hand thread. Remove lockwasher.**

9. See Figure 6-18. Remove clutch hub using CLUTCH HUB PULLER, Part No. HD-95960-41A. Slip PULLER PLATE onto hub studs and secure with spring adjusting nuts. Turn tool center bolt clockwise until hub breaks free from end of shaft. Remove the clutch hub key.



1. Washer
2. Locknut

Figure 6-15. Clutch Disassembly

CLEANING, INSPECTION AND REPAIR

Wash all parts, except lined discs, in cleaning solvent and blow dry with compressed air.

Examine the clutch for the following:

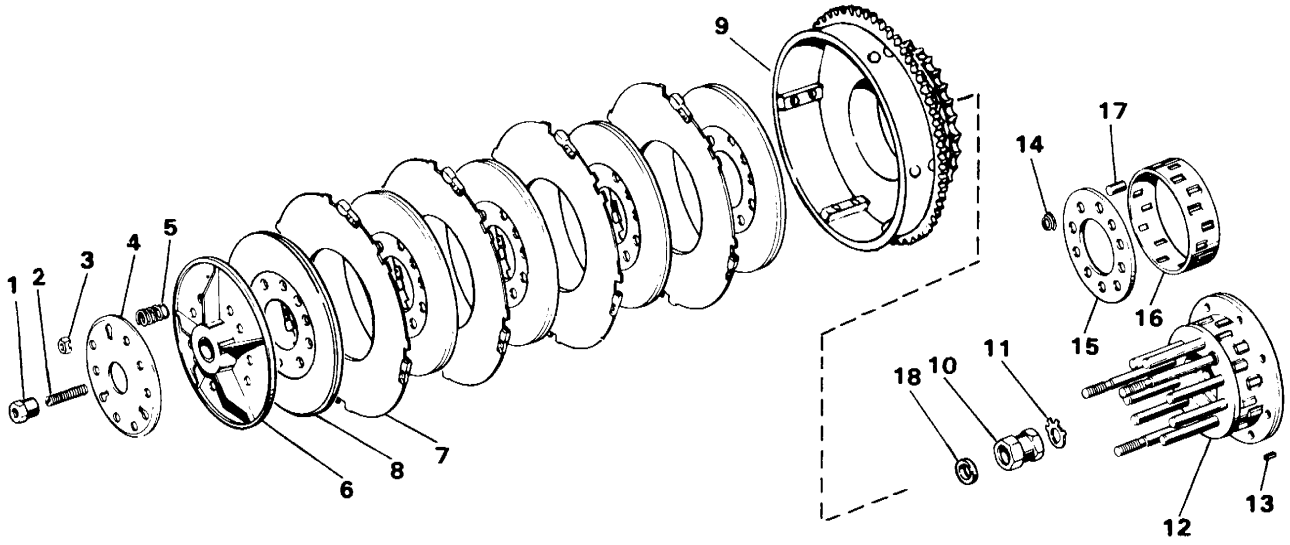
1. Glazed friction disc surface recognizable as a shiny, smooth and sometimes darkened appearance.

If conditions listed in Step 1 are found, discs can be reconditioned by roughing up disc surface with medium coarse sandpaper.

2. Oil impregnated friction discs.

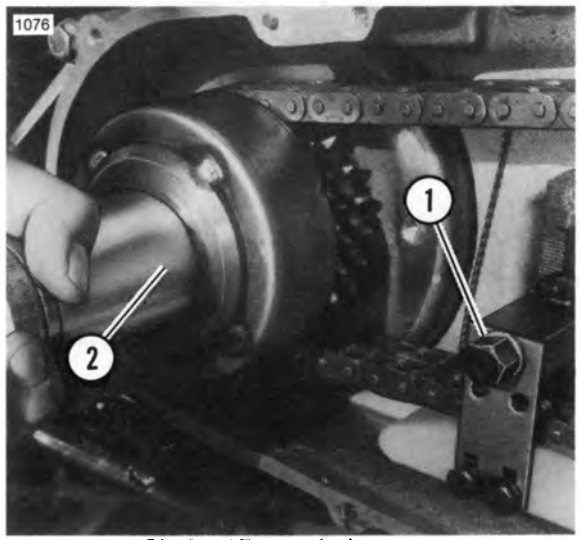
3. Worn or grooved lining surface.

4. Lining thickness worn down to 1/32 in. or less.



1. Push rod adjusting 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 thrd.)
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 6-16. Dry Clutch



1. Chain adjuster bolt
2. Compensating sprocket nut

Figure 6-17. Compensating Sprocket Nut Removal

5. Cracked or chipped linings.
6. Steel discs grooved or warped.
7. Clutch hub disc loose, cracked or oil soaked.

If any of the conditions described in Steps 3-6 are found, replace discs.

8. Check bearing race inside clutch shell. If it appears grooved or pitted, replace the clutch shell.
9. See Figure 6-16. Spin the clutch hub roller bearing assembly (14, 15, 16 and 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 springs (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 should be 30-38 lbs. at 1-1/4 in. Replace the springs if they don't meet these specifications.
11. Replace the seal (18).

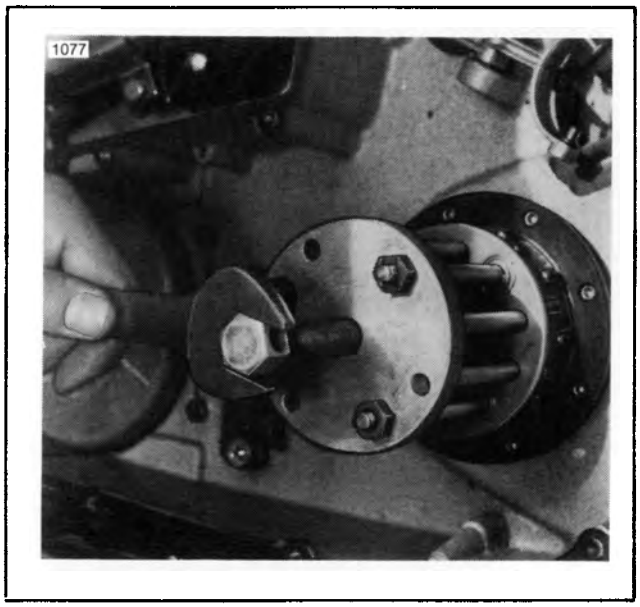


Figure 6-18. Clutch Hub Removal

ASSEMBLY (Figure 6-16)

1. Install riveted disc, if removed, then 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, primary chain adjuster and compensating sprocket as an assembly. Install oil hose (if present) on fitting with new clamp. Apply several drops of Loctite 242 to threads of compensating sprocket nut and tighten compensating sprocket nut to 80-100 ft-lbs torque.

3. Spray surfaces of lined clutch plates with silicone spray lubricant to help prevent friction material from absorbing moisture.

CAUTION

Do not use silicone sprays that contain penetrating oil or petroleum products as these may cause the clutch to slip.

Install friction and steel discs (7 and 8) as shown. Stagger the wide slots in shell. Install steel discs with side stamped OUT facing outward.

4. If parts (1, 2, 4, 5 and 6) have been disassembled, assemble as follows: Place releasing 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 releasing disc with 1-3/4 in. washer under nut.

5. Turn nut (1) down and install adjusting nuts (3). Remove 1-3/4 in. washer and reinstall nut (1). Draw down adjusting nuts until distance from back of pressure plate to front of spring collar equals 1-1/32 in.

6. Make final adjustments as described under ADJUSTMENT.

7. Install primary chaincase cover with a new gasket.

NOTE

After reassembly, primary chain housing 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 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 1500 rpm and the vent hose to oil tank pinched closed. A lower reading indicates an air leak into chain housing either at gasket, solenoid, starter shaft, hoses, O-ring or seals.

8. Install footboard (FLT) or shifter lever and footrest bracket (FXR).

9. Connect battery cables (positive first).

WET CLUTCH — LATE 1984-1989

GENERAL

This clutch is termed a diaphragm spring clutch or wet clutch. Lubricant is added to the primary chaincase and the primary drive chain runs in lubricant.

LUBRICATION

The primary chaincase lubricant is changed after the first 500 miles and every 5000 miles thereafter. Use Harley-Davidson PRIMARY CHAINCASE LUBRICANT, Part No. 99887-84 for all operating temperatures.

1. Stand vehicle in vertical position and remove clutch cover.
2. Drain lubricant into suitable container by removing drain plug at bottom of primary chaincase.
3. Clean drain plug. Install drain plug in chaincase.
4. Refill chaincase through clutch cover opening with recommended lubricant. Fill to bottom of clutch cover opening with vehicle standing upright.
5. Reinstall clutch cover with new O-ring. Replace plastic seals at screws prior to assembly.

ADJUSTMENT

CAUTION

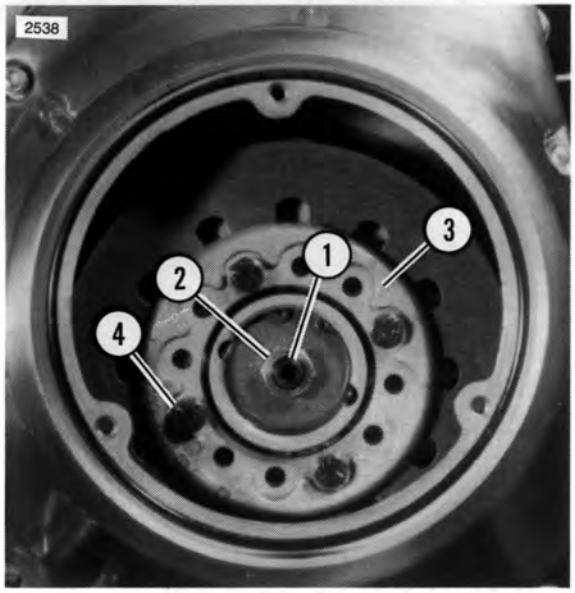
The Print-O-Seal gasket between the chain adjustment inspection cover and the chaincase cover must be replaced each time the cover is removed.

For proper clutch operation, it is most important to perform the following clutch adjustment at pre-delivery, 500 mile inspection, and every service interval thereafter.

NOTE

If clutch components are replaced during normal servicing, this adjustment must be performed. Adjust again after 500 miles of use.

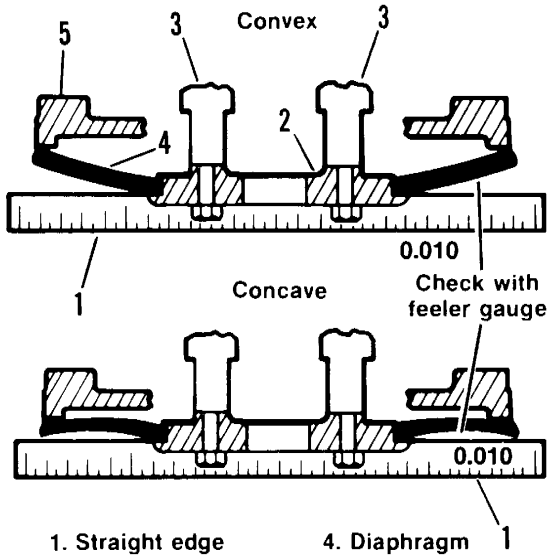
1. Stand vehicle upright and level.
2. Remove clutch cover.
3. On 1986 and earlier vehicles disconnect clutch cable at transmission. On 1987-1989 vehicles turn adjuster all the way in to provide slack in cable. See step 10.
4. See Figure 6-19. Loosen clutch adjuster-screw locknut (2) and turn adjuster screw (1) counterclockwise to provide clutch push rod free play.



1. Adjuster screw
2. Locknut
3. Adjuster plate
4. Bolt

Figure 6-19. Push Rod Adjustment

5. See Figure 6-20. Place a straightedge across the face of diaphragm spring, against the adjuster plate. With a feeler gauge, measure between the spring and straightedge. If there is a gap of more than 0.010 in., the compression of the spring needs adjustment.



1. Straight edge
2. Adjuster plate
3. Clutch hub
4. Diaphragm spring
5. Pressure plate

Figure 6-20. Checking Diaphragm Spring Adjustment

NOTE

See Figures 6-20, 6-21. Spring compression is adjusted by using the different bolt hole positions on the adjuster plate. If the spring is bowed outward over 0.010 in. in the center (convex), the plate is moved to the next hole position of greater compression. If the spring is dished inward over 0.010 in. in the center (concave), the adjuster plate is moved to the next position of less compression. The recommended spring position is flat to 0.010 in. concaved.

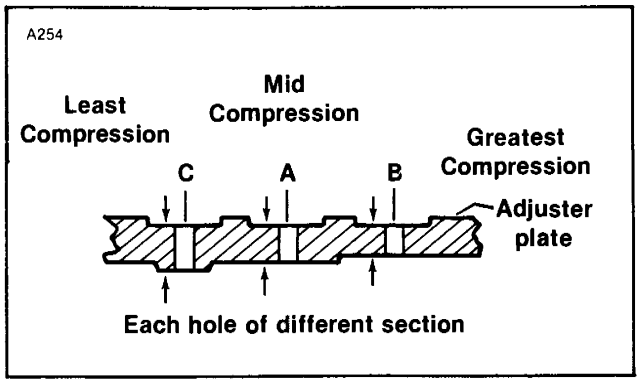


Figure 6-21. Adjuster Plate Hole Positions

6. To adjust spring compression, remove the four adjuster plate bolts by backing out each, alternately, 1/2 to 1 turn at a time until spring tension is relieved. Remove bolts. Position adjuster plate at the mounting holes which give the correct spring compression.

NOTE

If proper spring adjustment cannot be obtained the clutch plates must be removed and measured. If clutch plate thickness is within specifications, an additional steel plate can be added to increase the plate-disc stack height. See DISASSEMBLY and ASSEMBLY.

CAUTION

Premature clutch failure results if proper spring adjustment is not maintained.

7. Install adjuster plate bolts by tightening alternately in a cross pattern to 6.5 - 8 ft-lbs torque. Recheck adjustment. If adjustment is correct, once again loosen bolts as described in step 6, apply Loctite #222 (purple) to bolts, and tighten to 6.5 - 8 ft-lbs torque.

8. Turn push rod adjusting screw inward (clockwise) to take up all free play in push rods.

9. Back out adjusting screw (counterclockwise) 3/4 turn, and tighten locknut to 6-10 ft-lbs torque while holding adjusting screw with an allen wrench.

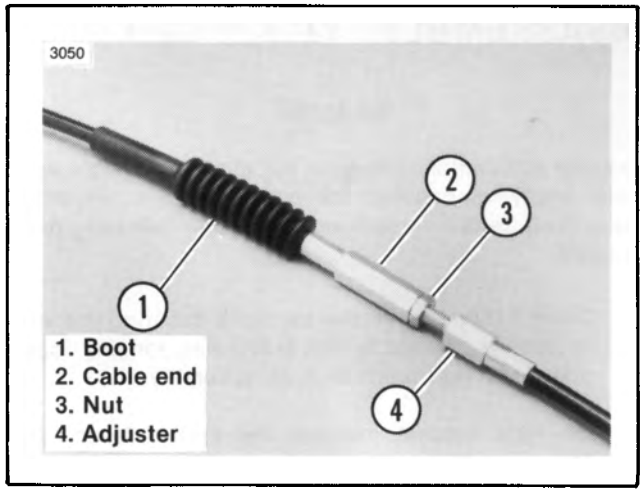


Figure 6-22. Clutch Cable Adjuster — 1987-1989

10. See Figure 6-14. On 1986 vehicles reattach clutch cable and loosen locknut (1). Turn adjusting sleeve (2) to provide 1/8 to 3/16 in. free play at hand lever. See Figures 6-22, 6-23. On 1987-1989 vehicles the adjuster is located midway between the clutch cable ends. Push boot (1) upwards on the cable until the adjuster is exposed. Squeeze clutch hand lever to maximum limit, three times, to set ball and ramp release mechanism. Pull outer cable conduit and at the same time adjust cable adjuster (4) to provide 1/8 to 3/16 in. free play at hand lever. Tighten locknut and return boot over adjuster.

11. Install clutch cover.

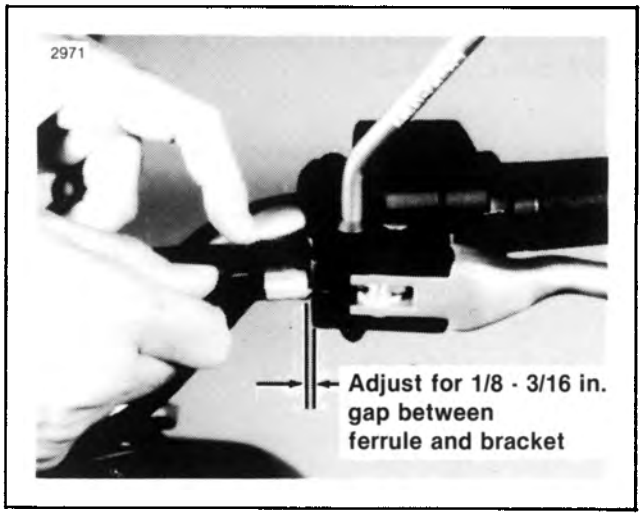


Figure 6-23. Measuring Free Play

DISASSEMBLY

WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables (negative cable first) before performing any of the following procedures.

1. On FLT models, remove the bolts securing the left footboard bracket to the frame and remove footboard and rear bracket as an assembly.

   On FXR models, remove the shifter lever and footrest bracket which is secured to the frame.

2. Drain primary chaincase lubricant. See LUBRICATION, earlier in this section.

3. Remove primary chaincase cover.

4. See Figure 6-25. Alternately loosen and remove the four bolts (15) together with lockwashers (16) and washers (17). Remove the adjuster plate (5) and spring diaphragm (1).

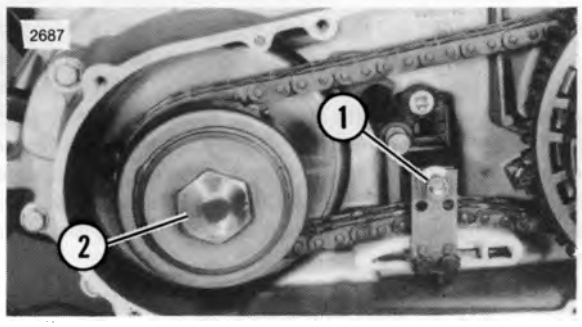
5. Remove pressure plate (2). The friction plates (3) and the steel discs (4) can now be changed or inspected without any further disassembly.

6. Remove nut (18) from the end of transmission main shaft. **The nut and shaft have left hand threads.** Remove push rod end piece.

NOTE

Attach Harley-Davidson CLUTCH PULLER, Part No. HD-95960-52B to clutch hub.

7. See Figure 6-24. Remove the bolt (1984) or nut (1985 and later) (1) and engine compensating sprocket nut (2). Pull the clutch hub drum assembly while removing the compensating sprocket and chain with adjuster.



1. Bolt (1984), Nut (1985 and later)
2. Sprocket nut

Figure 6-24. Compensating Sprocket and Primary Chain Adjuster Mounting

8. See Figure 6-25. Remove the steel discs (4) and friction plates (3).

9. With lock ring pliers, remove internal circlip (9) and external circlip (7).

CAUTION

Due to possible damage to the bearing, 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.

10. Press pilot bearing out of clutch drum if replacement is required.

CLEANING, INSPECTION AND REPAIR (Figure 6-25)

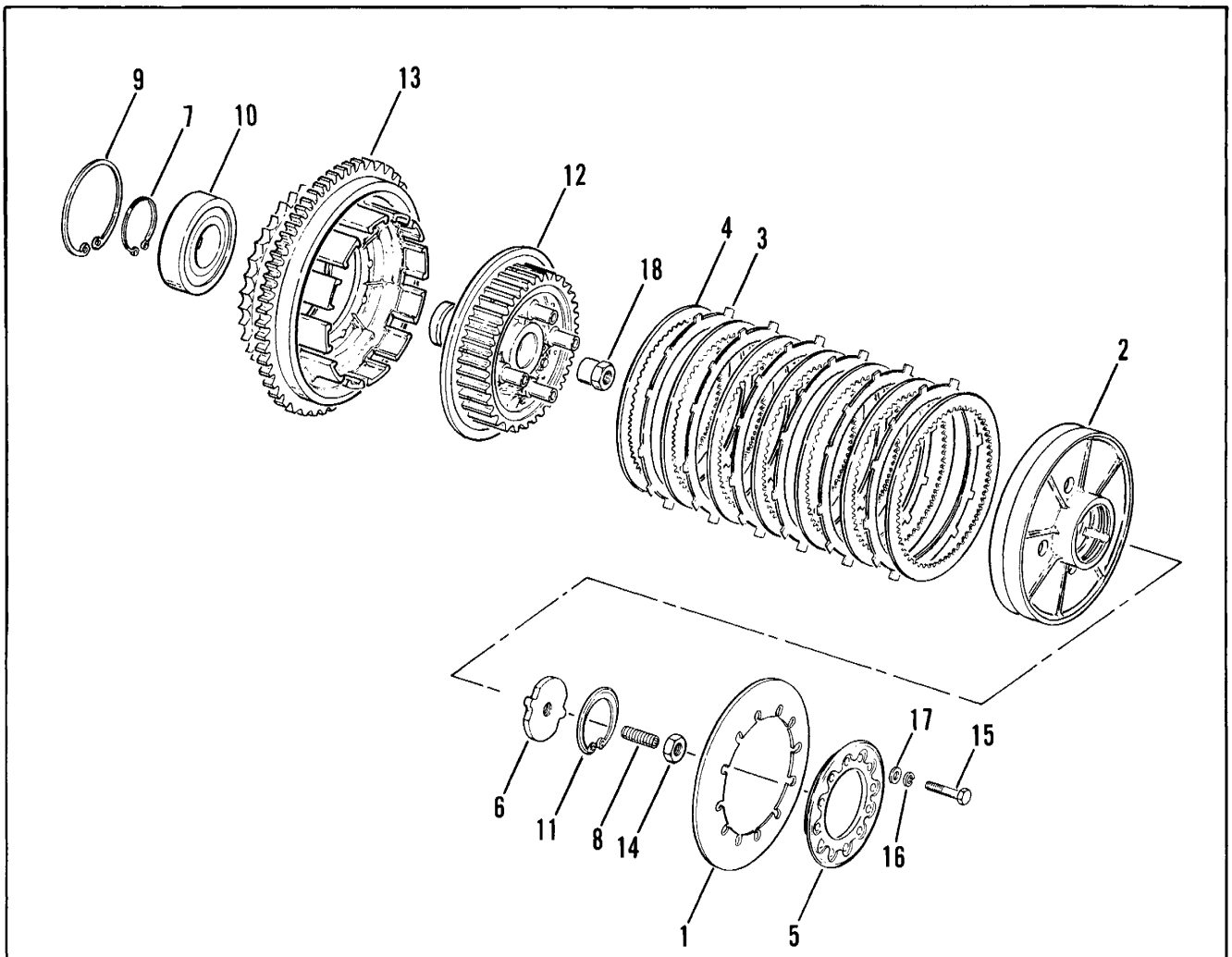
Wash all parts, except lined discs (6) and bearing (10), in cleaning solvent and blow dry with compressed air.

Examine the clutch for the following:

1. Worn lining surface.

2. Checked or chipped lining.

3. Steel discs — grooved or warped.



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. Pilot bearing
11. Ring, retaining
12. Clutch hub
13. Clutch shell
14. Locknut
15. Bolt (4)
16. Lockwasher (4)
17. Washer (4)
18. Nut (main shaft)

Figure 6-25. Wet Clutch — Exploded View

4. Check each steel plate for flatness in several places. Replace any that are warped more than 0.011 in.

5. Check the plate thickness and replace steel plates that are less than 0.044 in. thick. Replace any friction disc that is less than 0.078 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 (Figures 6-23, 6-24)

NOTE

Install the pilot bearing by pressing against the outer race. Be sure the numbered side of 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.

3. See Figure 6-26. Place drum (3) on arbor press with inner race supported by a sleeve (5). Press hub into bearing against hub shoulder.

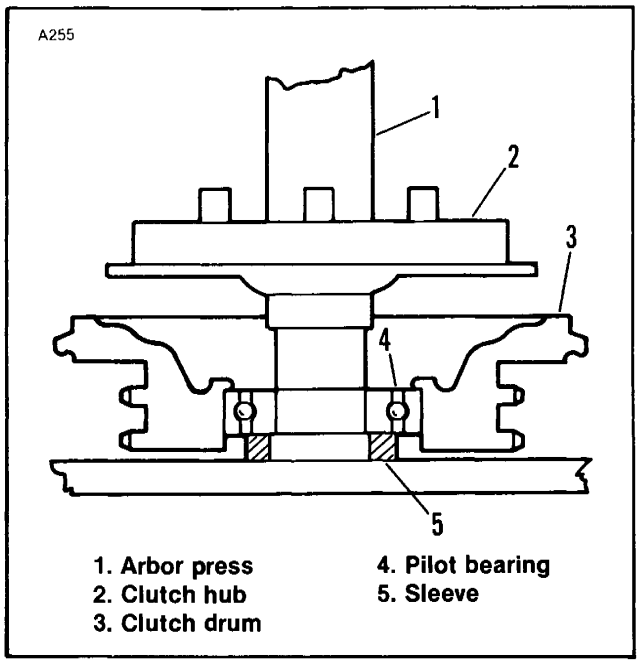


Figure 6-26. Clutch Hub into Pilot Bearing

4. See Figure 6-25. With lock ring pliers, expand external circlip (7) into groove next to pilot bearing.

NOTE

Minimum thickness of clutch plates: friction plates 0.078 in., steel discs 0.044 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 (21) and into drum (13) starting and ending with a steel disc.

6. The compensating sprocket, primary chain, chain adjuster and clutch hub and drum must be installed as an assembly. Carefully position the clutch hub keyway so it engages key in mainshaft. Be careful not to disturb key position.

NOTE

To ensure that key remains in mainshaft keyway, apply a quick curing glue to key and keyway. An alternate method is to apply Loctite 242 to key and insert key in keyway. Apply heat on key with propane torch to speed cure. Do not heat for more than two to four seconds.

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 two drops of Loctite 242 to the threads of hub nut (18) and compensating sprocket nut. Thread nut (18) onto shaft turning in direction of left hand thread. Tighten nut (18) to 50-60 ft-lbs torque. Tighten compensating sprocket nut to 80-100 ft-lbs torque.

CAUTION

Clutch hubs can be damaged by overtightening nut. Do not use impact wrench for tightening nut (18) unless the wrench is calibrated for torque settings during counter-clockwise rotation.

NOTE

Convex side of spring diaphragm must face out when re-assembled.

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, after final spring adjustment, 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 torque.

NOTE

If bevel retainer (11) has been removed, the beveled edge must face outward on reassembly.

10. Check and adjust clutch as instructed under ADJUSTMENT earlier in this section.

11. Adjust primary chain. See PRIMARY CHAIN, ADJUSTMENT. Install primary chaincase cover.

12. Stand vehicle upright and level and fill primary chaincase with PRIMARY CHAINCASE LUBRICANT, Part No. 99887-84. Fill to bottom of inspection cover opening.

13. Replace O-ring if damaged and place clutch inspection cover in position on primary chaincase.

14. Use new sealing washers and install clutch inspection cover screws. Tighten screws to a torque of 7-9 ft-lbs.

WET CLUTCH - 1990

GENERAL

The clutch is a wet, multi-plate, diaphragm spring design. The clutch is located in the primary chaincase, which contains Harley-Davidson PRIMARY CHAINCASE LUBRICANT, Part No.99887-84.

LUBRICATION

The primary chaincase lubricant is changed after the first 500 miles and every 5000 miles thereafter. Use Harley-Davidson PRIMARY CHAINCASE LUBRICANT, Part No. 99887-84 for all operating temperatures.

1. Drain lubricant into suitable container by removing drain plug at bottom of primary chaincase.
2. Clean drain plug. Install drain plug in chaincase.
3. Remove clutch cover.
4. Refill chaincase through clutch cover opening with 38 - 44 ounces of Harley-Davidson PRIMARY CHAINCASE LUBRICANT. If new clutch discs or discs that have been wiped to remove the lubricant are being installed, submerge the discs in PRIMARY CHAINCASE LUBRICANT, Part No.99887-84, for a minimum of five minutes before installing
5. See Figure 6-27. With vehicle standing upright, the lubricant must be level with the bottom of the outer diameter of the diaphragm spring (1).

CAUTION

Do not over-fill the primary chaincase with lubricant. Over-filling may cause rough clutch engagement and difficulty finding neutral.

6. Reinstall clutch cover with new O-ring.

ADJUSTMENT

CAUTION

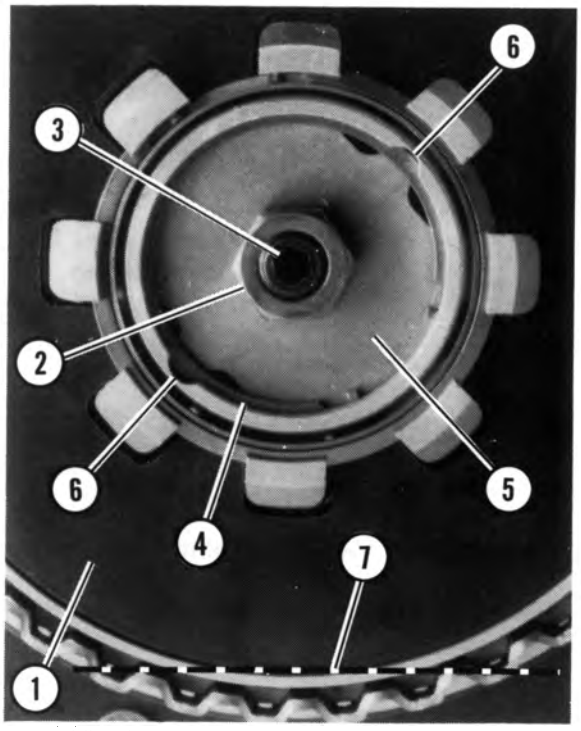
The clutch adjustment should be performed with the motorcycle at room temperature. See Figure 6-27. The clearance at the adjuster screw (3) will increase as the power train temperature increases. If adjuster screw is adjusted with power train hot, clearance at push rod bearing could be insufficient with power train cold and clutch slippage could occur.

For proper clutch operation, it is most important to perform the following clutch adjustment at pre-delivery, 500 mile inspection, and every service interval thereafter.

NOTE

If clutch components are replaced during normal servicing, this adjustment must be performed. Adjust again after 500 miles of use.

1. Stand vehicle upright and level.
2. Remove clutch cover.
3. See Figure 6-28. The cable adjuster is located midway between the clutch cable ends. Push boot (1) upwards on the cable until the adjuster is exposed. Loosen nut (3) and turn adjuster (4) all the way in to provide slack in cable.
4. See Figure 6-27. Loosen clutch adjuster-screw locknut (2) and turn push rod adjusting screw (3) inward (clockwise) to take up all free play in push rods.
5. Back out adjusting screw (counterclockwise) 1/2 to 3/4 turn and tighten locknut, while holding adjusting screw with an allen wrench, to 6 - 10 ft-lbs torque.



1. Diaphragm spring
2. Locknut
3. Adjuster screw
4. Retaining ring
5. Release plate
6. Slot
7. Lubricant level (motorcycle upright and level)

Figure 6-27. Push Rod Adjustment

6. See Figures 6-28, 6-29. Squeeze clutch lever to maximum limit, three times, to set ball and ramp release mechanism. Pull outer cable conduit and at the same time adjust cable adjuster (4) to provide 1/16-1/8 in. free play at hand lever. Tighten locknut (3) and return boot over adjuster.
7. Install clutch cover.

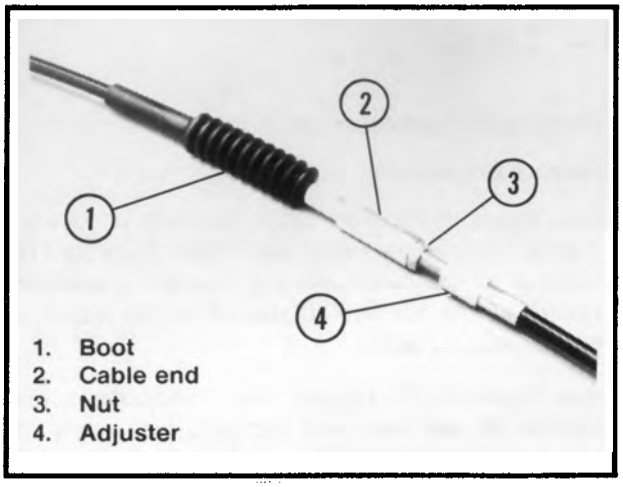


Figure 6-28. Clutch Cable Adjuster

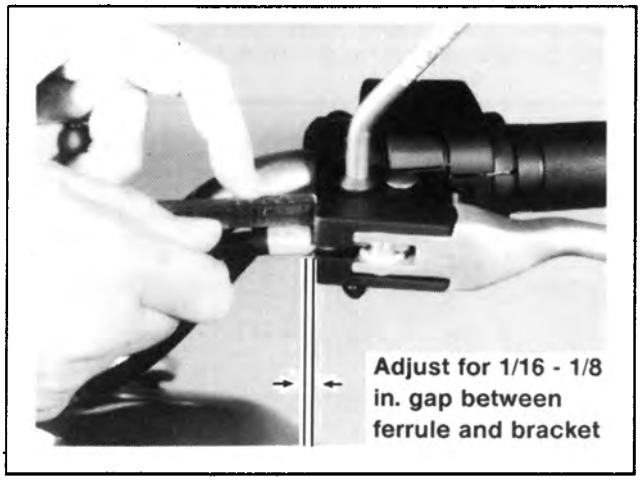


Figure 6-29. Measuring Free Play

DISASSEMBLY ON MOTORCYCLE

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. On FLT models, remove the bolts securing the left footboard bracket to the frame and remove footboard and rear bracket as an assembly.

   On FXR models, remove the shifter lever and footrest bracket which is secured to the frame.

2. Drain primary chaincase lubricant. See LUBRICATION, earlier in this section.

3. Remove primary chaincase cover.

4. See Figure 6-27. Loosen locknut (2) and remove adjuster screw (3) and locknut.

5. See Figure 6-30. Thread forcing screw (1) of H-D SPRING COMPRESSING TOOL, Part No. HD-38515 (2), into the threaded hole in release plate (3) until hex on forcing screw contacts release plate.

WARNING

Do not attempt to disassemble the clutch without SPRING COMPRESSING TOOL, Part No. HD-38515. The diaphragm spring is highly compressed and could "fly-out" and cause injury if the SPRING COMPRESSING TOOL is not used to remove the spring load.

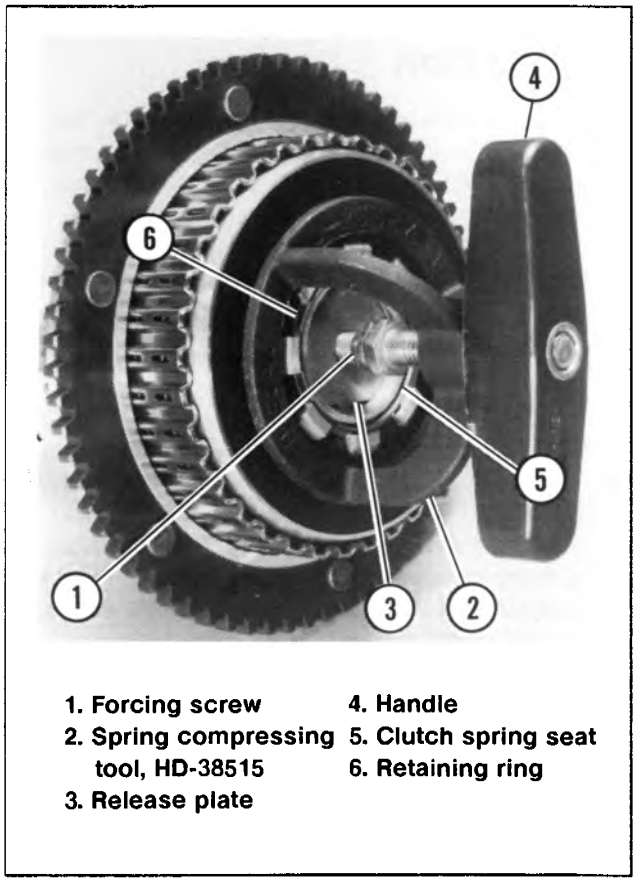


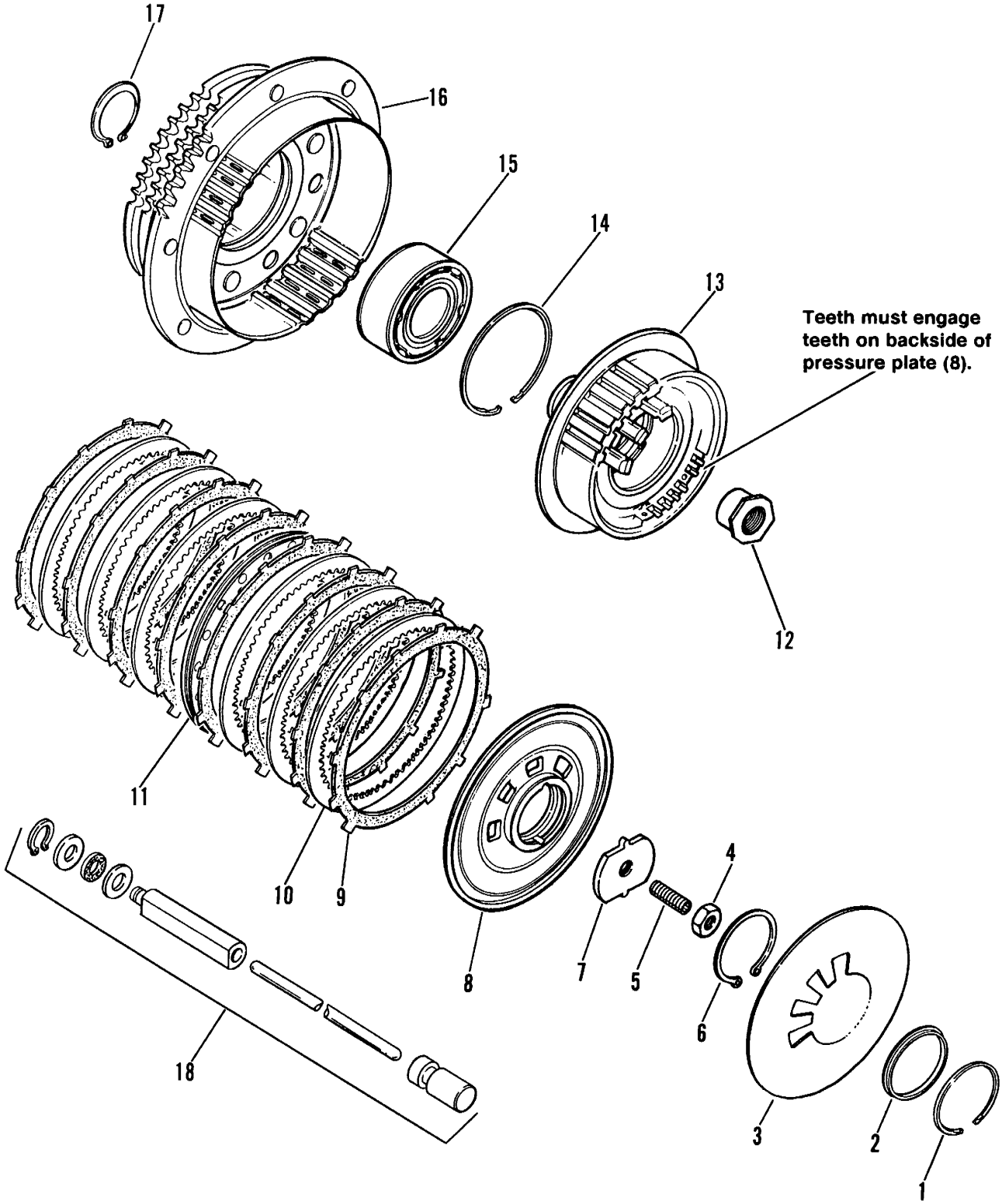
Figure 6-30. Compressing Clutch Diaphragm Spring

6. Turn handle (4) clockwise to compress the diaphragm spring and move the clutch spring seat (5) inward enough to allow removing retaining ring (6). Remove retaining ring (6) with a retaining ring pliers or gently pry ring from its groove with a screwdriver.

7. See Figure 6-31. Remove SPRING COMPRESSING TOOL, Part No. HD-38515 with diaphragm spring (3) and pressure plate (8) attached.

CAUTION

Do not loosen SPRING COMPRESSING TOOL, Part No. HD-38515, unless inspection and/or replacement of pressure plate and diaphragm spring is required. Loosening SPRING COMPRESSING TOOL will allow diaphragm spring to move and not maintain its concentric position on the pressure plate. If the diaphragm spring is not centered in the "spring-pocket" of the pressure plate it may cause difficulty finding neutral.



1. Internal retaining ring
2. Clutch spring seat
3. Diaphragm spring
4. Locknut
5. Adjusting screw
6. Internal retaining ring
7. Release plate
8. Pressure plate
9. Friction plate (8)
10. Steel plate (6)
11. Spring plate
12. Nut (main shaft, left hand threads)
13. Clutch hub
14. Internal retaining ring
15. Double-row ball bearing
16. Clutch shell
17. External retaining ring
18. Push rod components

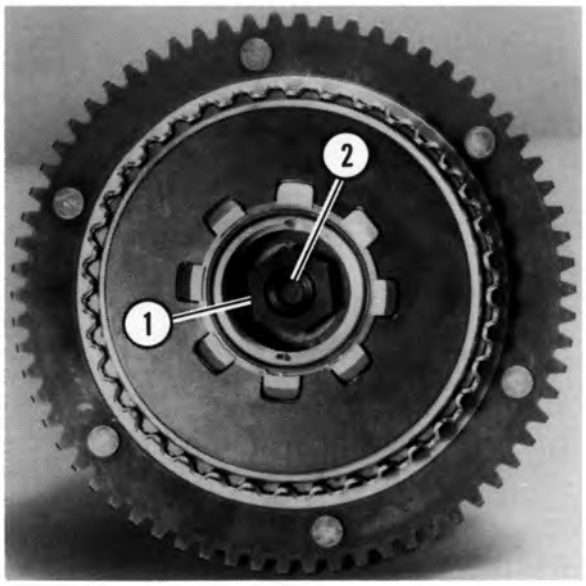
Figure 6-31. Clutch Assembly

NOTE

See Figure 6-31. The friction plates (9) and the steel discs (10, 11) can now be changed or inspected without any further disassembly. See CLEANING, INSPECTION AND REPAIR for instructions on checking the plates. The ASSEMBLY/INSTALLATION procedure covers assembly and installation of the clutch.

REMOVAL

1. Perform steps 1 through 3 of the "**DISASSEMBLY ON MOTORCYCLE**" procedure if you wish to remove clutch assembly with out disassembly. If complete disassembly is necessary perform steps 1 through 7 of the "**DISASSEMBLY ON MOTORCYCLE**" procedure or remove clutch assembly and then disassemble by performing steps 4 through 7 of the "**DISASSEMBLY ON MOTORCYCLE**" procedure.
2. See Figure 6-27. Remove retaining ring (4) and release plate (5). A small screwdriver may be inserted in either of the slots (6) to aid removing retaining ring (4).
3. See Figure 6-32. Place transmission in 5th gear and apply rear brake. Remove nut (1) from the end of transmission main shaft using a 1-3/16 in. socket. **The nut and shaft have left hand threads.**



1. Mainshaft nut **2. Mainshaft**

Figure 6-32. Mainshaft Nut Removal

NOTE

The main shaft and clutch hub are splined so a puller is not needed to remove clutch assembly.

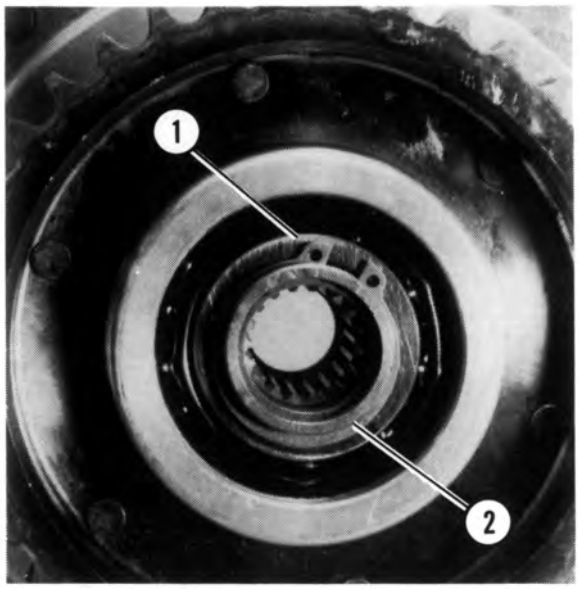
4. See Figure 6-24. Remove the nut (1) and engine compensating sprocket nut (2). Remove the clutch assembly and the compensating sprocket and chain with adjuster simultaneously.

DISASSEMBLY OF CLUTCH HUB AND SHELL

CAUTION

Due to possible damage to the bearing, the clutch shell and hub assembly should not be disassembled unless the bearing, hub or shell require replacement. If pressed apart, the bearing must be replaced.

1. If clutch diaphragm spring and clutch plates have not been removed, perform steps 4 through 8 of the "**DISASSEMBLY ON MOTORCYCLE**" procedure.
2. See Figure 6-33. Remove retaining ring (1).



1. External retaining ring **2. Clutch hub**

Figure 6-33. Clutch Hub Retaining Ring

3. See Figure 6-34. Press clutch hub from inner bearing race with arbor press.
4. See Figure 6-35. Remove retaining ring (1) from clutch shell groove (2). Press bearing (3) out of clutch shell (4) using a suitable press plug and arbor press. The press plug must be placed on the bearing at the primary-chain-sprocket side of the clutch shell because the bearing bore has a shoulder (5).

WARNING

Do not remove the retaining ring located at the bottom of the bore where the mainshaft nut secures the clutch hub to the mainshaft. These components are assembled at the manufacturer and are not serviceable. The parts are highly compressed and could "fly-out" and cause personal injury if the retaining ring was removed.

CLEANING, INSPECTION AND REPAIR (Figure 6-31)

Wash all parts, except lined discs (9) and bearing (15), in cleaning solvent and blow dry with compressed air.

Examine the clutch for the following:

1. Worn lining surface.

2. Checked or chipped lining.

3. Steel discs grooved or warped.

4. Check each steel plate for flatness in several places using a feeler gauge while the plate is on a surface plate or flat surface. Replace any that are warped more than 0.006 in.

5. Wipe the lubricant from the eight friction plates and stack them on top of each other. Measure the thickness of the eight stacked friction plates with a dial caliper or micrometer. **The minimum thickness must be 0.661 in. If the thickness is less, the friction and steel plates must be discarded and a new set of both friction and steel plates must be installed.**

6. See Figure 6-31. Check the bearing (15) for smoothness by rotating the clutch shell while holding the clutch hub. If bearing is rough or binds it must be replaced.

7. Check the primary chain sprocket and the starter ring gear on the clutch shell (16). If either sprocket or ring gear are badly worn or damaged, replace the clutch shell.

8. Check the slots that mate with the clutch plates on both clutch shell and hub. If slots are worn or damaged , replace shell and/or hub .

9. Check the diaphragm spring (3) for cracks or bent tabs. Install a new spring if either condition exists.

ASSEMBLY (Figure 6-31)

NOTE

Soak all plates in PRIMARY CHAINCASE LUBRICANT for at least 5 minutes before installing.

1. See Figure 6-35. With an arbor press and a press plug that contacts outer bearing race only, press bearing (3) into clutch shell (4) bore until it "bottoms" against shoulder (5). Install retaining ring (1) in groove (2).

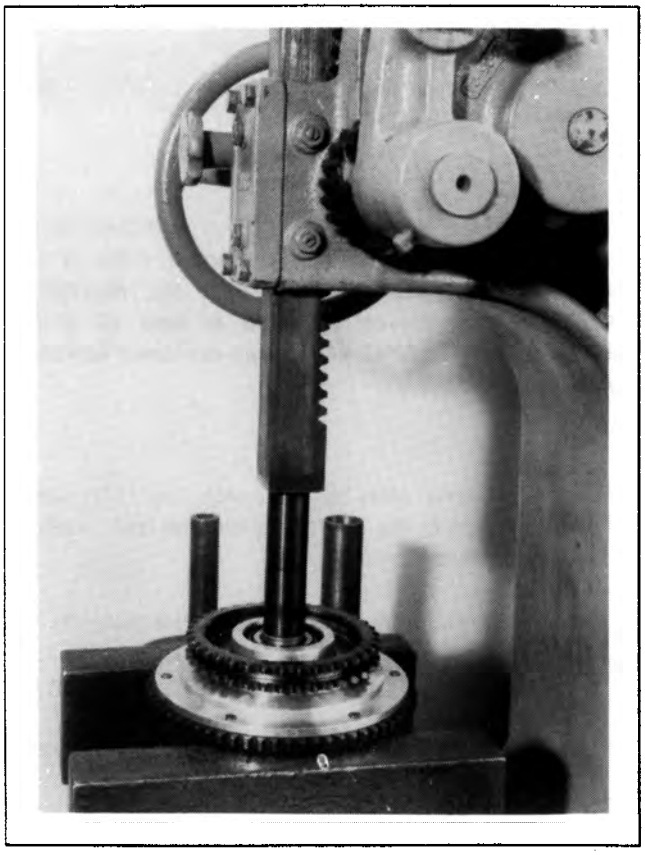


Figure 6-34. Pressing Clutch Hub From Bearing

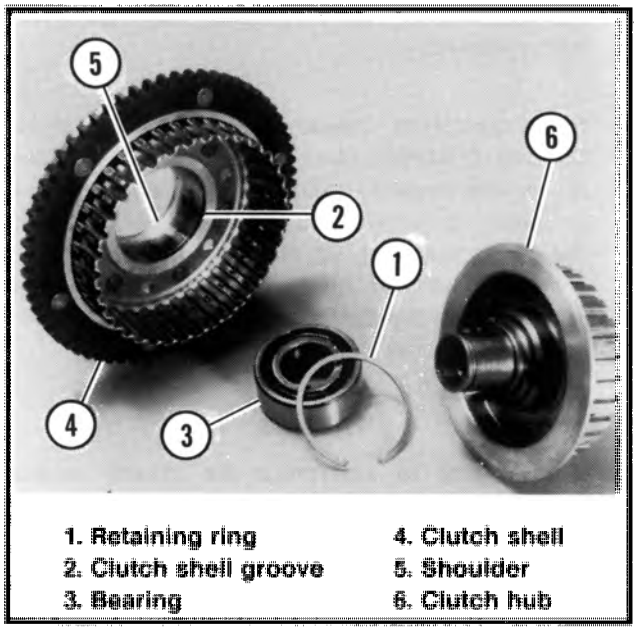


Figure 6-35. Removing Bearing From Clutch Shell

2. See Figure 6-26. Place drum (shell) (3) on arbor press with inner race supported by a sleeve (5). Press hub into bearing against hub shoulder.

3. See Figure 6-33. With lock ring pliers, expand external retaining ring (1) and install into groove next to bearing.

4. See Figure 6-31. Place a friction plate (9) over hub (13) and into drum (16). Next place a steel plate (10) over hub (13) and into drum (16). Continue installing plates alternately starting and ending with a friction plate.

NOTE

Make certain the spring plate (11) is installed in the center of the stack as shown in Figure 6-31. ***If the SPRING COMPRESSING TOOL, Part No. HD-38515, has not been removed continue at step 10. If the SPRING COMPRESSING TOOL was removed continue at step 6.***

5. Place pressure plate (8) on clutch hub (13) making sure the side of the pressure plate that has "teeth" is facing the hub.

6. Install diaphragm spring (3) on pressure plate (8) with "domed" or convex side of spring facing away from pressure plate. Center the diaphragm spring on the pressure plate; that is, the outer diameter of the diaphragm spring must be equidistant from the inside diameter of the pressure plate "spring-pocket.

7. Place clutch spring seat (2) on diaphragm spring (3) with lip of seat facing outward. Install release plate (7) and retaining ring (6) in pressure plate (8), if they were removed.

8. See Figure 6-30. Thread forcing screw (1) of H-D SPRING COMPRESSING TOOL, Part No. HD-38515 (2), into the threaded hole in release plate (3) until hex on forcing screw contacts release plate. Check that the outer diameter of the diaphragm spring is concentric with the inside diameter of the spring-pocket on the pressure plate. Center spring following instructions in step 6 above if required.

WARNING

Do not attempt to assemble the clutch without SPRING COMPRESSING TOOL, Part No. HD-38515. The diaphragm spring is highly compressed and could "fly-out" and cause injury if the SPRING COMPRESSING TOOL is not used to control the spring load.

9. Turn handle (4) clockwise to compress the diaphragm spring and move the clutch spring seat (5) inward enough to allow installing retaining ring (6). The ends of retaining ring (6) must not overhang the posts or bosses on the clutch hub. See Figure 6-27 for a properly installed retaining ring.

10. See Figure 6-30. Release compressing force on diaphragm spring by turning handle (4) counterclockwise while checking that clutch spring seat (5) lip is seated inside retaining ring (6).

11. Remove SPRING COMPRESSING TOOL, Part No. HD-38515.

12. See Figure 6-31. Install adjusting screw (5) and locknut (4) in release plate (7).

INSTALLATION

1. The compensating sprocket, primary chain, chain adjuster and clutch assembly must be installed as an assembly. The clutch hub and compensating sprocket are splined, so a slight rotation of the chain drive will aid in lining up the splines.
2. See Figure 6-32. Apply two drops of LOCTITE® 262 to the threads of nut (1). Thread nut (1) onto shaft turning in counterclockwise direction because of left hand thread. Tighten nut to a torque of 70-80 ft-lbs.
3. See Figure 6-24. Apply two drops of LOCTITE® 262 to the threads of engine sprocket nut (2) and tighten to 80-100 ft-lbs torque.
4. Check and adjust clutch as instructed under ADJUSTMENT earlier in this section.
5. Adjust primary chain. See PRIMARY CHAIN, ADJUSTMENT. Install primary chaincase cover.
6. See LUBRICATION paragraph given earlier in this section and fill chaincase to correct level.
7. Replace O-ring if damaged and place clutch inspection cover in position on primary chaincase.
8. Use new sealing washers and install clutch inspection cover screws. Tighten screws to a torque of 7-9 ft-lbs.

PRIMARY CHAINCASE

GENERAL

The primary chaincase is a sealed housing containing the primary chain, clutch, engine compensating sprocket, chain adjuster (and oiler on 1984 models with the dry clutch), solenoid, and starter drive mechanism.

DISASSEMBLY

1. Drain primary chaincase lubricant on "wet" clutch models.

2. Remove the primary chaincase cover, chain, clutch and engine compensating sprocket as described under CLUTCH, DISASSEMBLY given earlier in this section.

3. Remove the solenoid and plunger as described under SOLENOID, REMOVAL in section 5.

4. Disconnect the starter drive housing as described under STARTER MOTOR, REMOVAL in section 5.

5. On 1984 models, remove four screws securing FLT/FXRT chain boot to primary chaincase using REAR CHAIN BOOT REMOVER, Part No. HD-97101-81.

6. See Figure 6-36. Remove the mounting bolts and locking tabs securing the inner primary chaincase to the transmission. The lower bolts (dotted lines) are removed from the back side of the housing.

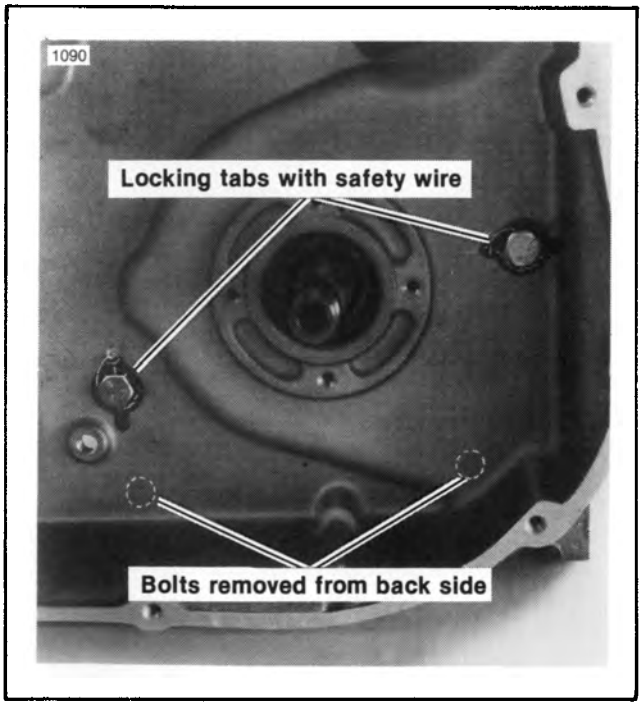


Figure 6-36. Removing Inner Primary Case from Transmission

7. Remove the safety wire and four bolts securing the inner primary chaincase to the engine.

8. On 1984 models, remove the case from the transmission mainshaft while rotating primary chaincase clockwise about mainshaft. On 1985 and later models, pull the inner primary chaincase off.

9. With case removed, pull mainshaft bearing from primary case. Late 1985 and later "wet clutch" models have retaining rings.

CLEANING, INSPECTION AND REPAIR

1. Inspect primary chaincase for cracks or damaged gasket surfaces.

2. Check bearing and replace if it is rough or sticks. On 1985 and later models, also check the bearing race that is pressed onto the mainshaft.

3. On 1989 models check starter jackshaft scraper, seal and bushing in inner primary chaincase and bushing in primary chaincase cover.

4. See STARTER JACKSHAFT - 1989 in Section 5 for removal/installation.

ASSEMBLY

1. On 1984 and early 1985 model vehicles, coat outer races of bearing with Loctite RETAINING COMPOUND No. 601 and install in primary chaincase. On late 1985 and later vehicles, the bearing is secured with two retaining rings.

2. See Figure 6-36. Install inner primary case and secure to transmission with lock tabs and bolts. Tighten 3/8 in. bolts to 21-27 ft-lbs torque and 5/16 in. bolts to 13-16 ft-lbs torque. Make sure mainshaft turns freely. Secure the locking tabs to the bolts.

3. See Figure 6-37. Install the bolts securing the inner primary case to the engine. On 1986 and earlier vehicles slightly loosen the four engine T-bracket to transmission bolts. On 1987 and later vehicles loosen the two engine to transmission 3/8 in. bolts. Tighten primary bolts to 16-18 ft-lbs torque and secure inner bolts with new safety wire on 1984 models. On 1987 and later vehicles tighten the two engine to transmission 3/8 in. bolts to 35-38 ft-lbs torque. Check to be sure mainshaft turns freely. On 1986 and earlier vehicles tighten the four T-bracket to transmission bolts to a torque of 13-16 ft-lbs.

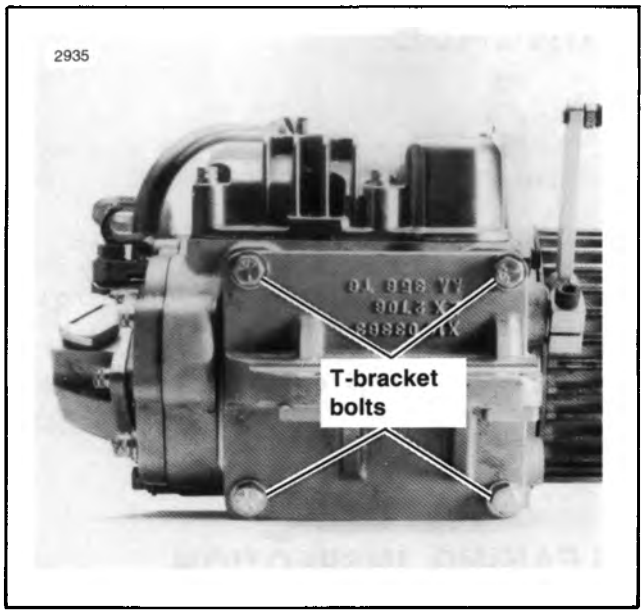


Figure 6-37. T-Bracket Bolts

NOTE

On 1987 and later transmissions the T-bracket is an integral part of the transmission case. The thread inserts in the engine-to-transmission bolt holes were eliminated on 1988 models. Also the bolts have changed from fine thread (3/8 - 24) to coarse thread (3/8 - 16).

4. Install starter and starter drive housing as described under STARTER MOTOR, INSTALLATION given in section 5.

5. Install solenoid and plunger as described under SOLENOID, ASSEMBLY steps 3-5 and SOLENOID, INSTALLATION in section 5.

6. Coat the rear chain boots and mating surfaces on the primary and transmission cases with RTV or 3M 750 SEALANT. Fasten the boots to the housing tightening the screws alternately to 3-4 ft-lbs torque.

7. Install the clutch, engine compensating sprocket, chain, chain adjuster and primary chaincase cover as described under CLUTCH ASSEMBLY given earlier in this section.

NOTE

On "wet" clutch models, fill primary chaincase with PRIMARY CHAINCASE LUBRICANT, Part No. 99887-84. On 1989 and earlier, fill to bottom of clutch inspection opening. On 1990 motorcycles, fill to the bottom edge of the diaphragm spring (2-3/4 in. from the centerline of the clutch adjusting screw).

CAUTION

Be sure you do not overfill the 1990 primary chaincase. Overfilling will cause rough clutch engagement and incomplete disengagement or clutch drag.

SUBJECT **PAGE NO.**

TRANSMISSION

SPECIFICATIONS

GENERAL

Type ..... 5-speed forward - constant mesh

Transmission Gear Ratios

1st 3.24
2nd 2.21
3rd 1.60
4th 1.23
5th 1.00

Lubrication

Type ..... Harley-Davidsion TRANSMISSION LUBRICANT, Part No. 99892-84
Capacity ..... 1 pint

SHIFTER FORKS

Shifter fork to cam groove end play .... 0.0017-0.0019 in.
Shifter fork to gear groove end play .... 0.0010-0.0110 in.
Shifter fork taper ..... 0.000-0.020 in.

SHIFTER CAM ASSEMBLY

Shifter cam end play ..... 0.0001-0.004 in.
Outside machined surface of bearing support to center cam groove nearest surface ..... 1.992-2.002 in.

MAINSHAFT

Tolerance

Mainshaft runout ..... 0.000-0.003 in.
Mainshaft end play ..... None
1st gear clearance ..... 0.0000-0.0080 in.
2nd gear clearance ..... 0.0000-0.0800 in.
3rd gear end play ..... 0.0050-0.0420 in.
clearance ..... 0.0003-0.0019 in.
4th gear end play ..... 0.0050-0.0310 in.
clearance ..... 0.0003-0.0019 in.

Main Drive Gear (5th)

Bearing fit in transmission case
Tight ..... 0.0004 in.
Loose ..... 0.00010 in.
Fit in bearing
Tight ..... 0.0009 in.
Loose ..... 0.0001 in.
Fit on mainshaft ..... 0.0001-0.0009 in.
End play ..... None

Side Door Bearing

Fit in side door (tight) ..... 0.0014-0.0001 in.
Fit on mainshaft
Tight ..... 0.0007 in.
Loose ..... 0.0001 in.

Shifter Dog Clearance

Gears	Clearance Min.	Clearance Max.
2nd-5th	0.035	0.139
2nd-3rd	0.035	0.164
1st-4th	0.035	0.152
1st-3rd	0.035	0.157

COUNTERSHAFT

Tolerance

Countershaft runout ..... 0.000-0.003 in.
Countershaft end play ..... None
1st gear end play ..... 0.0050-0.0039 in.
clearance ..... 0.0003-0.0019 in.
2nd gear end play ..... 0.0050-0.0440 in.
clearance ..... 0.0003-0.0019 in.
3rd gear clearance ..... 0.0000-0.0080 in.
4th gear end play ..... 0.0050-0.0390 in.
clearance ..... 0.0000-0.0080 in.
5th gear end play ..... 0.0050-0.0040 in.
clearance ..... 0.0000-0.0080 in.

Side Door Bearing

Fit in side door (tight) ..... 0.0014-0.0001 in.
Fit on side countershaft
Tight ..... 0.0008 in.
Loose ..... 0.00001 in.

TORQUES

Neutral indicator switch ..... 3-5 ft-lbs
Front mounting bracket bolts ..... 33-38 ft-lbs
Rear mounting bracket bolts ..... 13-16 ft-lbs
Side door mounting screws (5/16 in.) ..... 13-16 ft-lbs
Support block bolts ..... 7-9 ft-lbs
Clutch cable bracket screws ..... 6-8 ft-lbs
Shifter arm screw ..... 18-22 ft-lbs
Shifter arm adjusting screw locknut ..... 20-24 ft-lbs
Transmission sprocket nut ..... 110-120 ft-lbs
Socket head screw — sprocket ..... 50-60 in-lbs
Top cover mounting bolts ..... 7-9 ft-lbs
Side cover mounting bolts ..... 7-9 ft-lbs
Transmission drain plug ..... 7 ft-lbs
Transmission filler cap (1986 & Earlier) .... finger tight
Transmission dipstick (1987 & Later) ..... 25-75 in-lbs
Clutch release arm nut (1986 & Earlier) ..... 8-10 ft-lbs
All 1/4 in. fasteners ..... 7-9 ft-lbs
Mainshaft and countershaft side door nuts .. 27-33 ft-lbs
Clutch cable fitting to side cover ..... 3-5 ft-lbs

SHIFTER LINKAGE

ADJUSTMENT

When operating problems develop in a transmission, check the TROUBLESHOOTING procedure in section 1 and perform the following adjustments. If these adjustments fail to correct the problem, proceed to the disassembly and repair procedures in this section.

Shifter Linkage (Figure 7-1)

The foot shift linkage is set at the factory and normally should need no adjustment. However, if full engagement or full pedal travel is not being achieved, adjust linkage rod as follows:

FLT, 1984-1986 FXR MODELS

CAUTION

The foot shifter pedal should never hit the footboard when shifting to insure proper gear engagement and avoid possible damage to transmission. A minimum clearance of 3/8 in. between shifter pedal and floorboard must be maintained. This clearance is needed because of engine movement while engine is running.

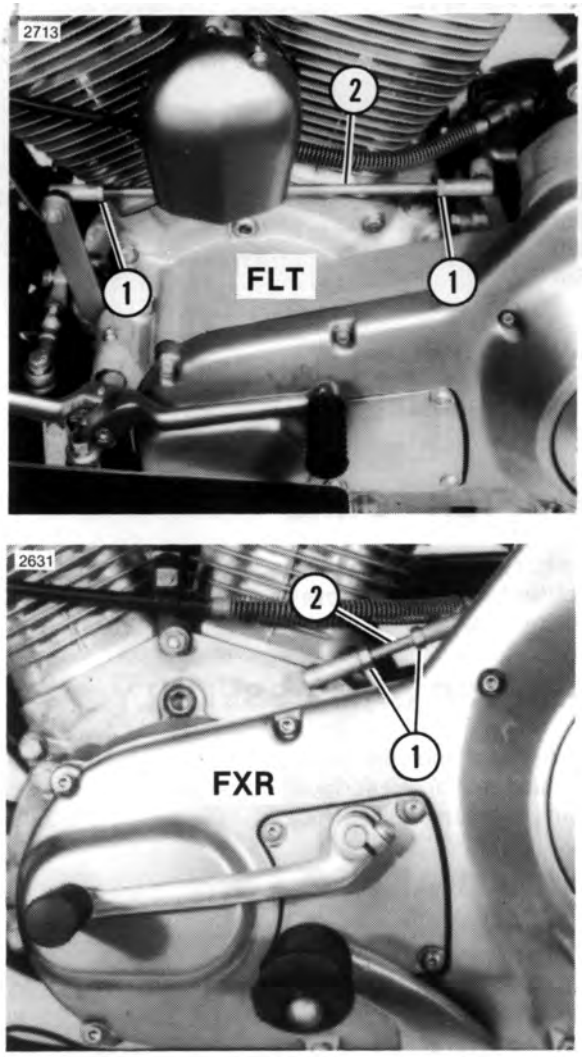
1. Disconnect one end of shifter rod.
2. Loosen locknuts (1). Adjust rod (2) as necessary and connect loose end of shifter rod.
3. Tighten locknuts (1) to 20-24 ft-lbs torque.

FXR MODELS — 1987 AND LATER

NOTE

One end of ball joint rod (2) and its mating ball joint assembly have left-hand threads. Turning ball joint rod will lengthen or shorten shift linkage and adjust shifter pedal position.

1. Hold ball joint assembly with a wrench placed on "flats" and with another wrench loosen locknut (1).
2. Repeat steps 1 on other end of shift linkage.
3. Turn ball joint stud to position shifter pedal to desired position.
4. Tighten both locknuts (1) to 20-24 ft-lbs torque.



1. Locknut **2. Rod**

Figure 7-1. Shifter Linkage Adjustment

Gear Engagement (Figure 7-2)

When gears are not engaging properly or not at all, make the following checks before performing Steps 1-3:

A. Check for proper CLUTCH operation. See Section 6.

B. Check the shifting linkage for wear, adjustment or interference.

C. Check for bent shifter forks. See SHIFTER FORKS CLEANING, INSPECTION AND REPAIR.

NOTE

Most shifting problems can be attributed to an improperly adjusted shifter pawl adjusting screw.

1. Shift transmission into 3rd gear.

NOTE

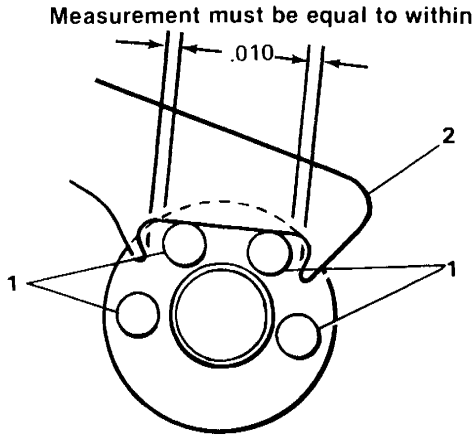
Be sure transmission is fully engaged in 3rd gear.

2. Move shifter lever and feel for free play and spring pressure in both directions. The shifter lever must be moved until you feel the pawl contacting the shifter drum pin in both directions.

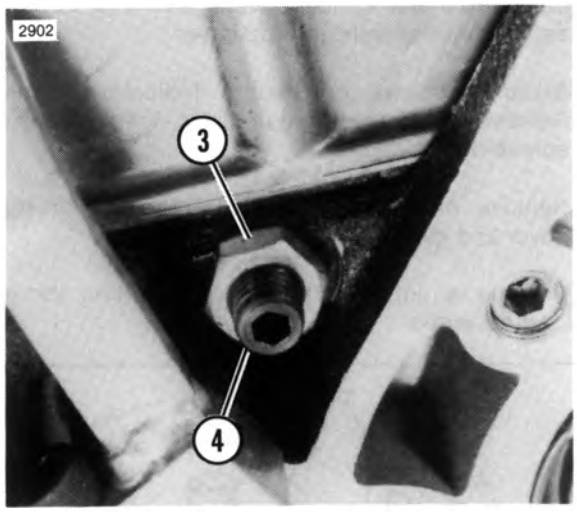
NOTE

See Figure 7-2. The spring pressure you feel defines the limits of travel of the shifter pawl (2) against the cam pins (1).

3. Locate the shifter pawl adjusting screw that extends from left side of transmission case behind the primary chaincase. Loosen locknut (3) and adjust allen bolt (4) in 1/4 in. turn increments or less (either clockwise or counterclockwise) until spring pressure is equal on both side of shift lever travel. Check adjustment again after tightening locknut (3) to be sure spring pressure is equalized.



1. Cam pin
2. Shifter pawl



3. Locknut
4. Adjusting screw

Figure 7-2. Gear Engagement Adjustment

SHIFTER CAM ASSEMBLY

GENERAL

The shifter cam assembly is located under the transmission top cover and is bolted to the transmission case. The cam assembly shifts the gears into desired ratios by means of the shifter forks. The forks slide the shifter clutch gears in and out of mesh with the various other gears.

DISASSEMBLY

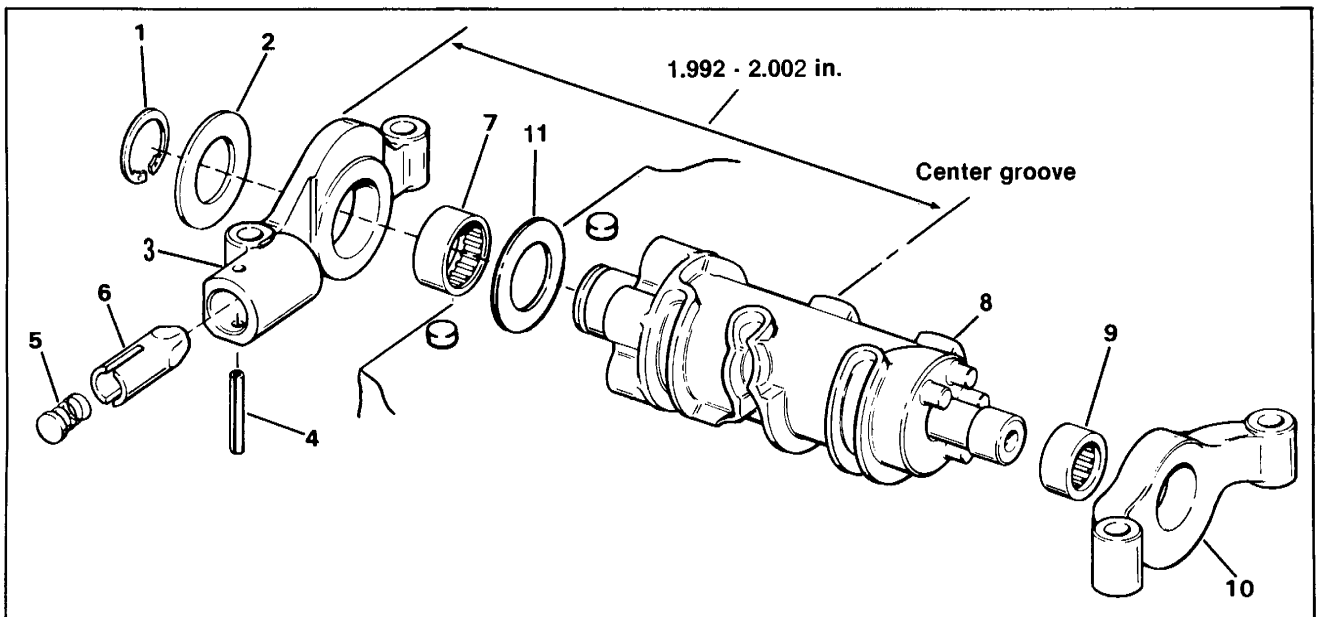
WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables (negative cable first) before performing any of the following procedures.

1. On 1986 and earlier vehicles disconnect the clutch cable from the clutch release arm and remove cable from transmission top cover.
2. Disconnect wire on neutral indicator switch. Remove hose from fitting in cover. Remove starter solenoid.
3. Remove mounting bolts and transmission top cover and gasket.
4. Remove mounting bolts, lockwashers and shifter cam assembly.
5. See Figure 7-3. The left support block (10) is a slip fit on the cam shifter and will slide off.
6. Remove retaining ring (1), outer thrust washer (2) and right support block (3). Mark thrust washers (2 and 11) so they are installed in their original position. Discard retaining ring.

CLEANING, INSPECTION AND REPAIR

1. See Figure 7-3. Clean all parts except bearings (7 and 9) with solvent.
2. Inspect neutral indicator switch in top cover. Depress plunger. It should spring back without binding. Switch is a non-repairable item and must be replaced if inoperative.
3. Inspect bearings (7 and 9) and shifter cam ends. If ends of shifter cam are pitted or grooved, replace the shifter cam and bearings. Install new bearings in support blocks by pressing on the side of the bearing with letters stamped on it. Stamped side of bearing should face outward when support block is installed on cam.
4. Inspect shifter cam (8) for cracks or wear and replace if necessary.



1. **Retaining ring**
2. **Outer thrust washer (variable thickness)**
3. **Right support block**
4. **Roll pin**
5. **Spring**
6. **Cam follower**
7. **Bearing**
8. **Shifter cam**
9. **Bearing**
10. **Left support block**
11. **Inner thrust washer (variable thickness)**

Figure 7-3. Shifter Cam Assembly

ASSEMBLY

1. See Figure 7-3. Install inner thrust washer (11) and right support block (3) on large end of shifter cam (8).

2. See Figure 7-4. Rotate the drum to its neutral position. With the drum snug against the thrust washer of right support block measure from the outside machined surface of the bearing support to the nearest edge of the center groove. This measurement should be 1.992-2.002 in. If distance is not as specified, substitute an inner thrust washer (11) of a different thickness to obtain proper measurement.

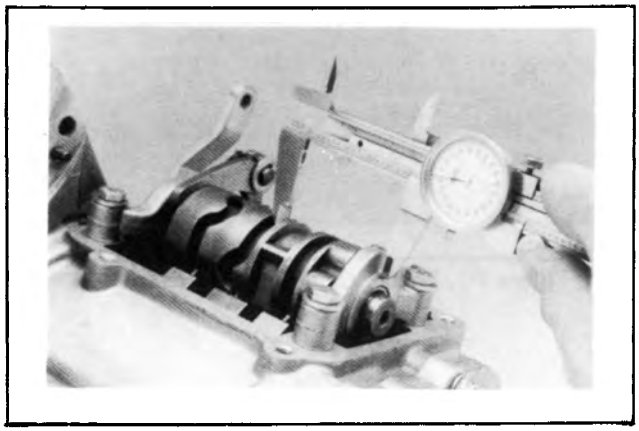
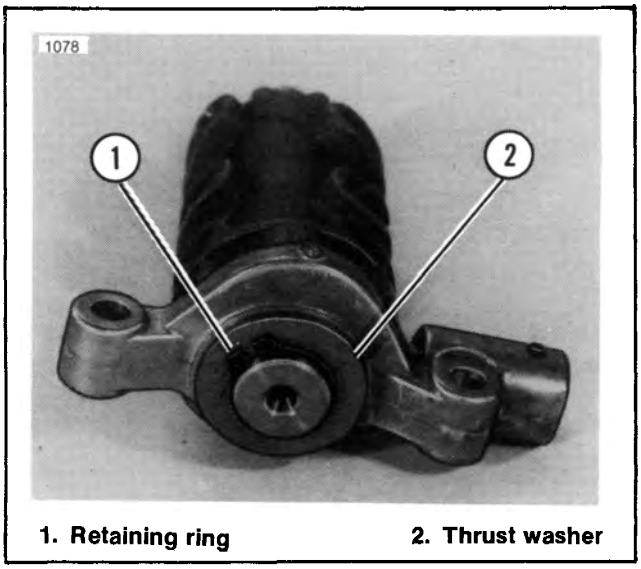


Figure 7-4. Measuring Shift Drum Position

3. See Figure 7-5. Install outer thrust washer (2) and new retaining ring (1).



1. Retaining ring **2. Thrust washer**

Figure 7-5. Right Support Block Retaining Ring

NOTE

See Figure 7-5. Retaining ring (1) must seat firmly in groove. The thrust washers (2) must spin after assembly. Thrust washers must not be so tight they will not move.

4. See Figure 7-6. Check end play of shifter cam. See Figure 7-3. If end play is not 0.001-0.004 in., remove outer thrust (2) and replace it with a thinner or thicker one. With proper end play, either thrust washer (2 or 11) should turn freely.

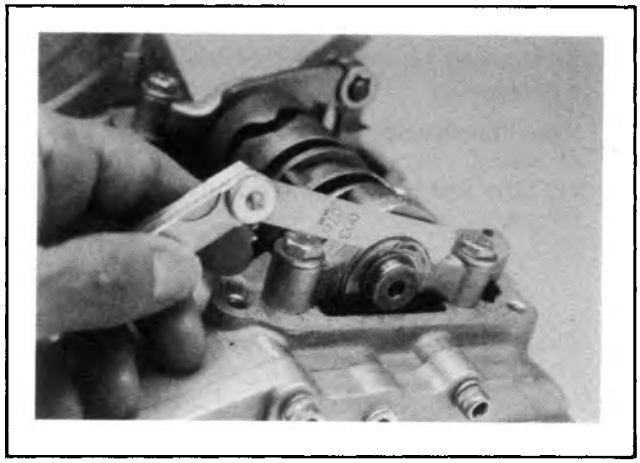


Figure 7-6. Checking End Play

Inner and outer thrust washers (2 and 11) are available in the following thicknesses: 0.017, 0.020, 0.022, 0.025, 0.028, 0.031, 0.035 and 0.039 in.

CAUTION

Do not change inner thrust washer (11) in order to alter shifter cam end play.

5. See Figure 7-3. Slip left support block (10) on small end of shifter cam.

NOTE

The numbers on the left support block should face downward when shifter cam is installed on the transmission.

6. See Figure 7-7. Place shifter cam assembly on transmission case with shifter forks positioned in the slots. The transmission case has dowel pins which fit into the mounting holes of the right support block. Align the cam assembly by securing the right support block and tighten all bolts to 7-9 ft-lbs torque. Check the left support block to see that it is not cocked and does not bind on its bearing.

CAUTION

Overtightening the support block fastener at the detent plunger will distort the plunger bore and cause shifting problems.

NOTE

Check the gear engagement and clearance in every gear to make sure assembly and alignment is correct.

7. Perform the Gear Engagement Adjustment as listed under ADJUSTMENTS. Install top cover with a new gasket.
8. If neutral indicator switch is replaced, coat threads of switch with Loctite PIPE SEALANT WITH TEFLON and tighten switch in cover to 3-5 ft-lbs torque.

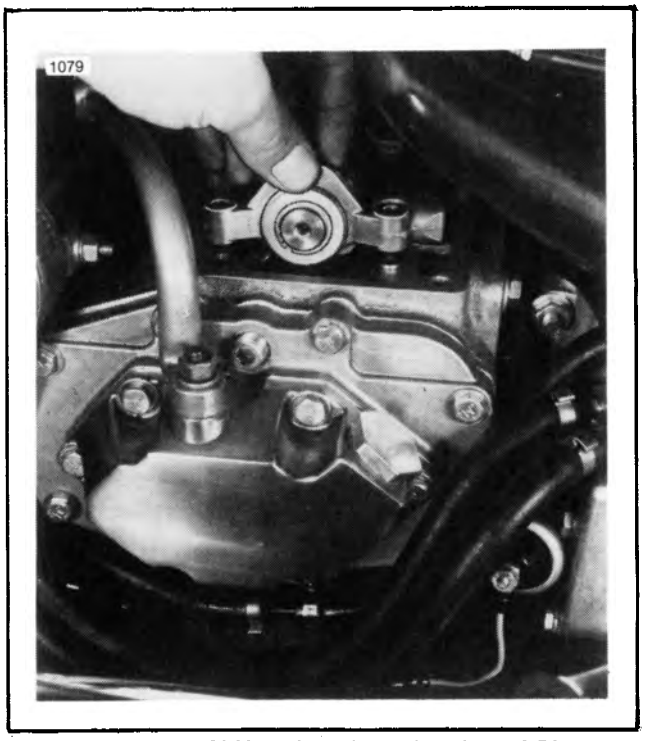


Figure 7-7. Shifter Cam Locating Dowel Pin

SHIFTER FORKS

REMOVAL

1. Remove the transmission top cover and shifter cam assembly as described in the SHIFTER CAM DISASSEMBLY section. On 1986 and earlier vehicles remove the clutch release arm. On 1987 and later vehicles remove the right side cover. See CLUTCH CONTROL, Section 2.

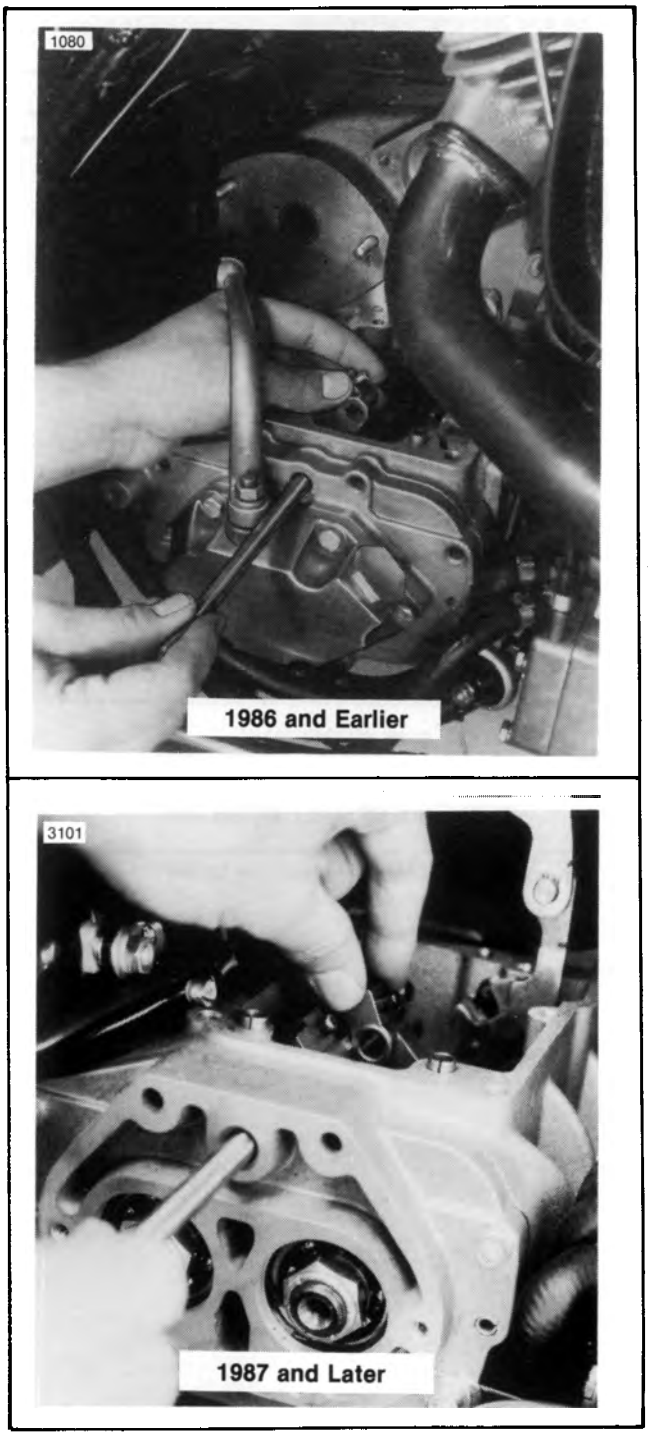


Figure 7-8. Fork and Fork Shaft Removal

2. See Figure 7-8. On 1986 and earlier motorcycles, remove the plug located on the right side of the transmission.

3. Slide fork shaft out through the hole and remove the shifter forks.

CLEANING, INSPECTION AND REPAIR

1. Clean all parts in cleaning solvent and blow dry with compressed air.

2. Check the shifter fork shaft and replace it if bent or damaged.

3. See Figure 7-9. Check to see if fork is square on the shaft using a small carpenter's square. If fork does not rest directly on the square, it is bent and must be replaced.

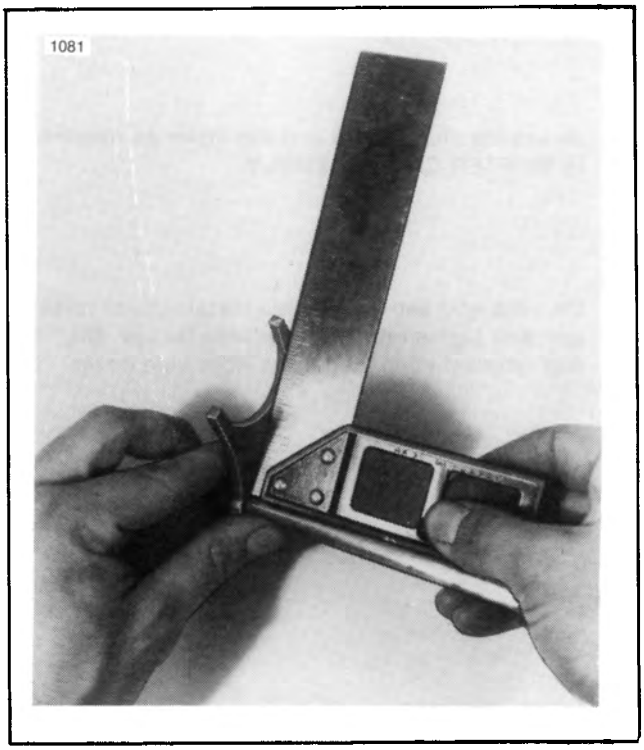


Figure 7-9. Checking Fork

4. Inspect the forks for wear, compare them to a new fork and replace them if they are worn 0.020 in. or more.

INSTALLATION

1. See Figure 7-10. The forks differ from each other and are shown here.

2. See Figure 7-11. Insert shifter fork (1) into the slot of the mainshaft 1st gear. Insert shifter fork (2) into the slot of the countershaft 3rd gear and insert shifter fork (3) into the slot of the mainshaft 2nd gear.

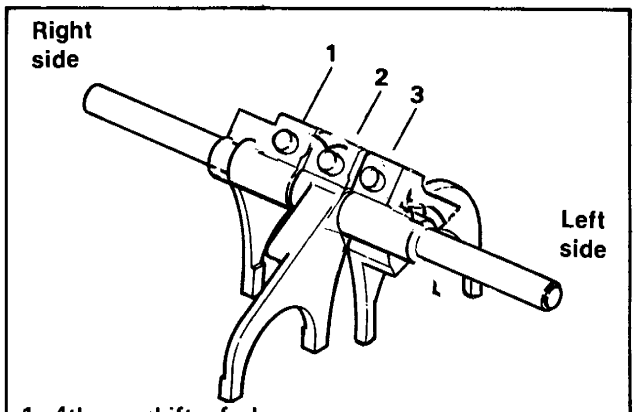
3. Slide fork shaft through the transmission case hole, through the forks and into the hole in the opposite side of the case.

4. On 1986 and earlier models, coat the plug threads with Loctite PIPE SEALANT WITH TEFLON. Insert plug in hole and tighten.

5. Check the sliding movement of forks and gears. All parts should move freely.

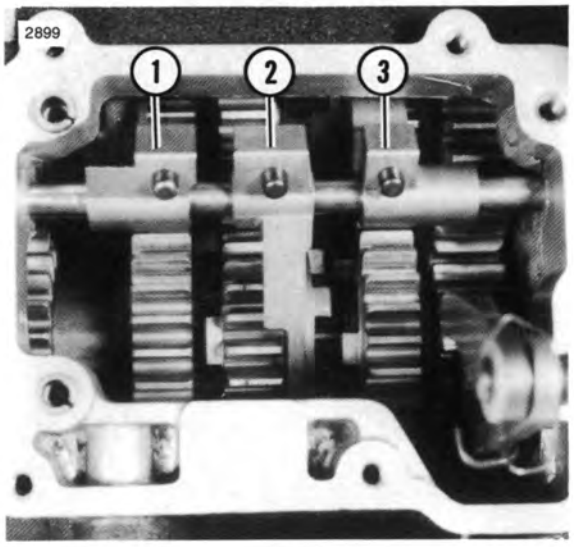
6. Assemble shifter cam and top cover as described in SHIFTER CAM ASSEMBLY.

7. On 1986 and earlier vehicles install clutch release arm and tighten nut to 8-10 ft-lbs torque. On 1987 and later vehicles install the right side cover.



1. 4th gear shifter fork
2. 1st and 2nd gear shifter fork
3. 3rd and 5th gear shifter fork

Figure 7-10. Shifter Fork Identification



1. 4th gear shifter fork
2. 1st and 2nd gear shifter fork
3. 3rd and 5th gear shifter fork

Figure 7-11. Transmission Forks Position

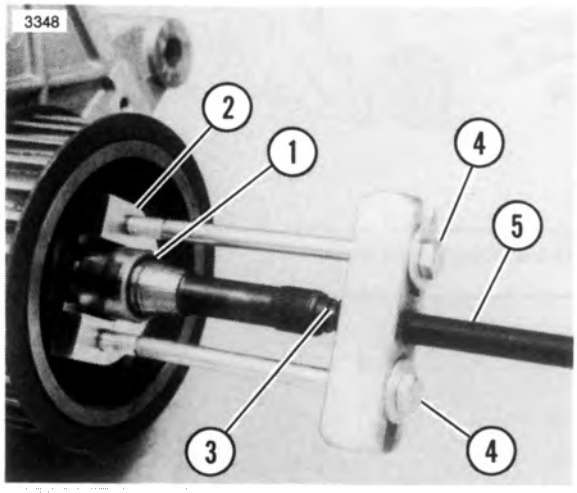
MAINSHAFT AND COUNTERSHAFT

GENERAL

The mainshaft and countershaft assemblies contain the gears which are powered in a selection of ratios according to load and speed requirements. The 1990 mainshaft has splines that mate with the clutch hub.

REMOVAL

1. Remove the clutch as described in section 6. Remove transmission top cover, shifter cam assembly and shifter forks as described earlier in this section.
2. Remove exhaust piping. It is necessary to remove the primary chaincase as described in section 6, and bearing inner race from the transmission mainshaft prior to disassembly. See Figure 7-12. The bearing inner race is removed by using BEARING RACE PULLER & INSTALLATION TOOL, Part No. HD-34902.
3. Remove the magnetic drain plug from the bottom of the transmission and drain the lubricant. Remove the side cover from the transmission side door. Lock the transmission by meshing the gears



1. Bearing inner race
2. U-shaped puller
3. Center cap
4. Bolt (2)
5. Puller screw

Figure 7-12. Removing Bearing Race

into two speeds at the same time and remove the locknuts and spacers from the shafts.

4. See Figure 7-13. If main drive gear (9, Figure 7-26) is to be removed, lock transmission as above, remove locking screw from sprocket and loosen sprocket nut using special WRENCH, Part No. HD-94660-37. Nut has left hand thread.

NOTE

The main drive gear bearing must be replaced if the main drive gear is removed. The bearing will be damaged during the removal procedure.

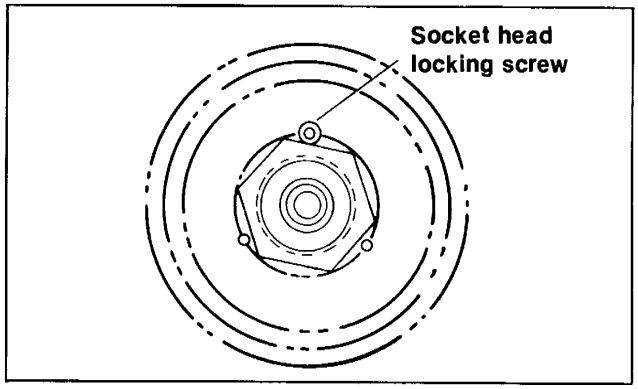


Figure 7-13. Sprocket Nut Secured

CAUTION

Cover splines, that engage clutch hub, with transparent Scotch® tape (or equal) before performing the following step. If splines are not covered, the seal in the inner primary cover may be damaged by sharp edges on splines.

5. See Figure 7-14. Remove the transmission side door mounting hardware. Pull the side door, mainshaft and countershaft from transmission case as an assembly.

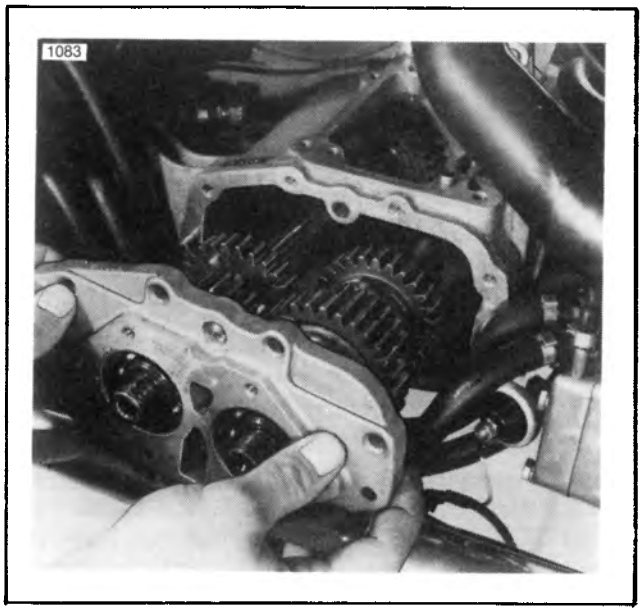


Figure 7-14. Transmission Side Door Removal

DISASSEMBLY

1. See Figure 7-15. Remove the three-piece push rod (23, 24 and 25) from the hole in the mainshaft.
2. With access door on end (shafts pointing upward), remove the retaining ring (12) from the countershaft (6) and remove the countershaft 5th gear (21), spacer (20) and countershaft 2nd gear (19).

1. Side door
2. Gasket
3. Mainshaft spacer
4. Countershaft spacer
5. Mainshaft
6. Countershaft
7. Spacer (2)
8. Nut (2)
9. Bearings (4)*
10. Mainshaft 4th gear
11. Thrust washer (5)
12. Retaining ring (6)
13. Mainshaft 1st gear
14. Countershaft 4th gear
15. Spacer
16. Countershaft 1st gear
17. Countershaft 3rd gear
18. Mainshaft 3rd gear
19. Countershaft 2nd gear
20. Spacer (1984 - early 1987)
21. Countershaft 5th gear
22. Mainshaft 2nd gear
23. Push rod
24. Push rod end — right side
25. Push rod end — left side

* A one-piece split cage bearing (9) has been used since late 1986. The one-piece bearing fits all 1984 and later transmissions.

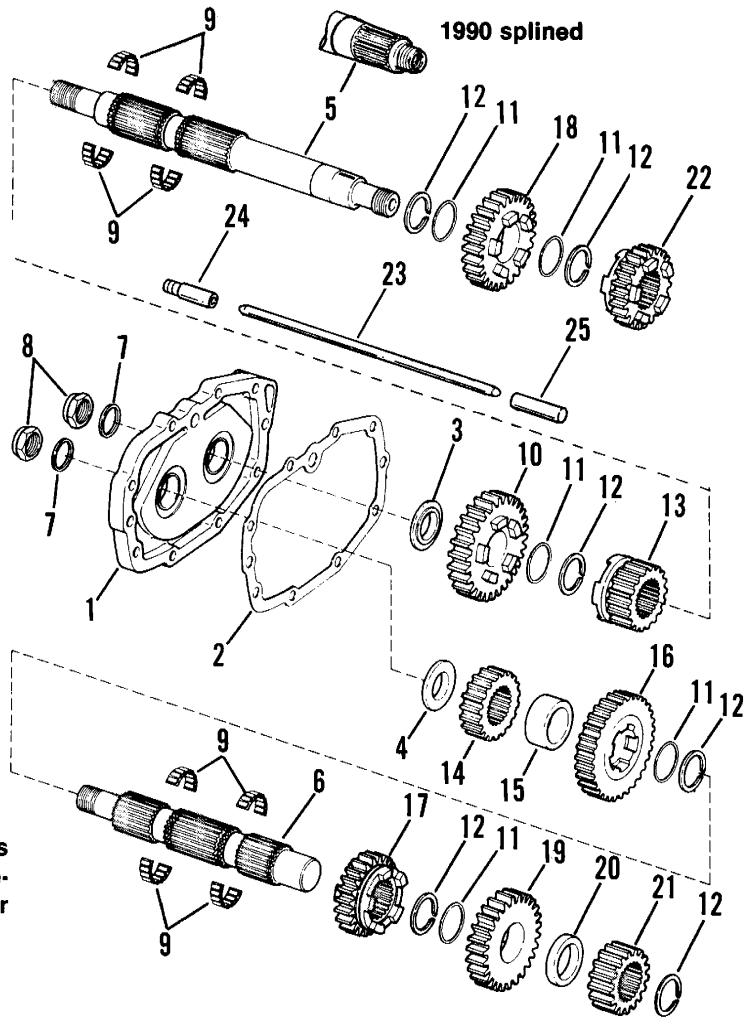


Figure 7-15. Side Door, Mainshaft and Countershaft

NOTE

On late 1987 and later transmissions, spacer (20) was eliminated. The width of gear (21) was increased to 1.037 - 1.041 in. to compensate for the spacer thickness. Gear (21) is now a service part for earlier transmissions. Do not install spacer (20) when installing a countershaft 5th gear (21) to service earlier transmissions.

Remove the bearings (9), retaining ring (12) and countershaft 3rd gear (17). Use RETAINING RING PLIERS, Part No. J-5586, to remove all retaining rings (12), leave 4th (10 and 14) and 1st gear (13 and 16) respectively on each shaft.

NOTE

See Figure 7-16. To remove the mainshaft 3rd gear, move the retaining ring on the access door side of 3rd gear out of the slot and slide it on the shaft away from 3rd gear. The gear will move down the shaft for easy access to the upper retaining ring.

3. See Figure 7-15. Remove the upper retaining ring, thrust washer (11), mainshaft 3rd gear (18), bearings and retaining ring.

4. Support countershaft 1st gear (16) and press out countershaft (6).

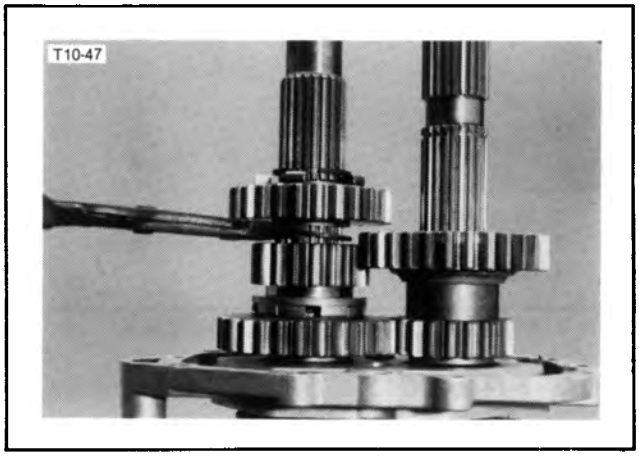


Figure 7-16. Move Retaining Ring

5. Support mainshaft 4th gear (10) and press out mainshaft (5).

CAUTION

Supporting the gears in the preceding step is necessary to provide support for the inner bearing races. Failure to support the gears will damage the bearings.

6. Remove the remaining spacers, and retaining rings.

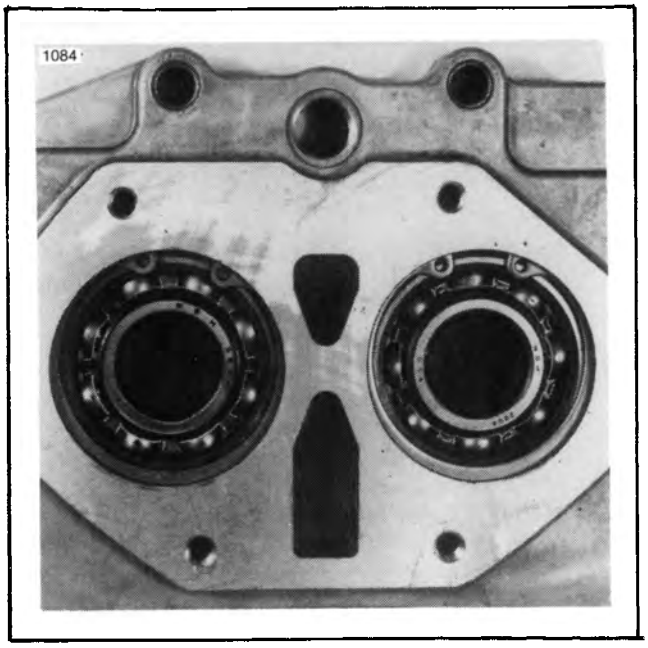


Figure 7-17. Side Door Bearings

CLEANING, INSPECTION AND REPAIR

1. Clean all parts in cleaning solvent and blow dry with compressed air.
2. Check gear teeth for damage. If gears are pitted, scored, rounded, cracked or chipped, they should be replaced.
3. Inspect the engaging dogs on the gears. Replace the gears if dogs are rounded, battered or chipped.
4. See Figure 7-17. Inspect the bearings in the side door. If bearings are pitted or grooved or feel rough when turned, replace the bearings.
5. If bearing replacement is required remove the retaining rings and press the bearings out of the side door.

CAUTION

To perform the next step, you must use a plate for support or the bearing door will be damaged.

6. When pressing new bearings in, press on the outside diameter of the bearing side with the numbers stamped on it. This side should face to the outside of the door. Support the door from the opposite side at the bearing bores with a flat plate.

ASSEMBLY

1. See Figure 7-15. Slip spacers (11) and retaining rings (12) on the mainshaft (5) and countershaft (6). Slip mainshaft 4th (10) gear on mainshaft and countershaft 1st gear (16) on countershaft.
2. Lightly coat bearings (9) with oil and install the bearings on the mainshaft (5) bottom race. Slide mainshaft 4th gear (10) over the bearings. Install one thrust washer (11) on top of the gear and secure with a retaining ring (12). Install mainshaft 1st gear (13) with the shifter fork slot facing the side door.
3. Slide countershaft 4th gear (14) and spacer (15) onto the countershaft (6).
4. See Figures 7-15, 7-18. Place bearing in countershaft race and install the countershaft 1st gear (16)

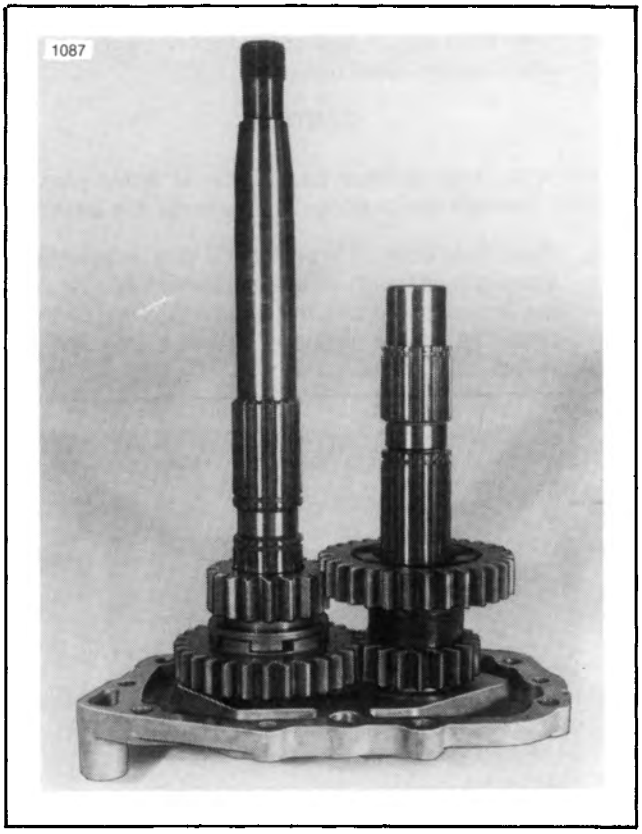


Figure 7-18. 4th and 1st Gears on Countershafts

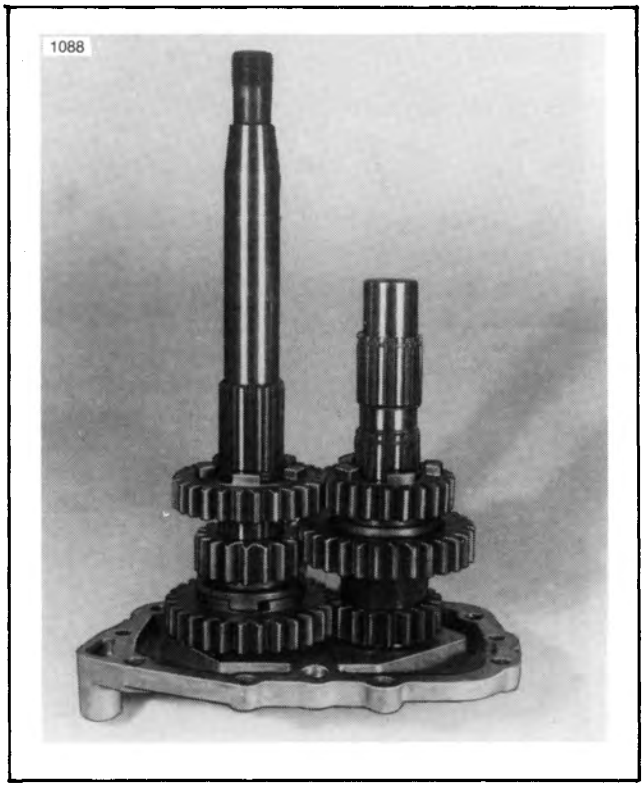


Figure 7-19. 3rd Gears

with the lip on the gear resting on the spacer and the pockets in the gear facing away from the side door. Install a thrust washer (11) on top of the gear and secure with a retaining ring (12).

5. See Figure 7-15. Slip spacers (7) on the shafts with the tapers facing the access door bearings. The mainshaft spacer has a shoulder while the countershaft spacer does not.

CAUTION

Failure to support inner bearing races while pressing shafts through the bearings will damage the bearings.

6. Place side door (1) in an arbor press. Support inner bearing races with a suitable socket. Starting with the mainshaft, press the shafts into the bearings. With the shafts properly pressed into the side door, spacers (3 and 4) will have no end play. The mainshaft (5) is installed to the left of the fork shaft hole when viewing the side door from the top.

7. Install one spacer (7) and nut (8) on each shaft and tighten the nuts finger tight. Final tightening is performed in step 13.

8. See Figures 7-15 and 7-19. Install countershaft 3rd gear (17) with shifter fork slot facing away from the side door.

9. Install a retaining ring (12) in the mainshaft groove just above 1st gear. Insert a thrust washer (11) on top of the retaining ring and place the bearings into the mainshaft race. Place mainshaft 3rd gear (18) over bearings and secure 3rd gear with a thrust washer (11) and retaining ring (12).

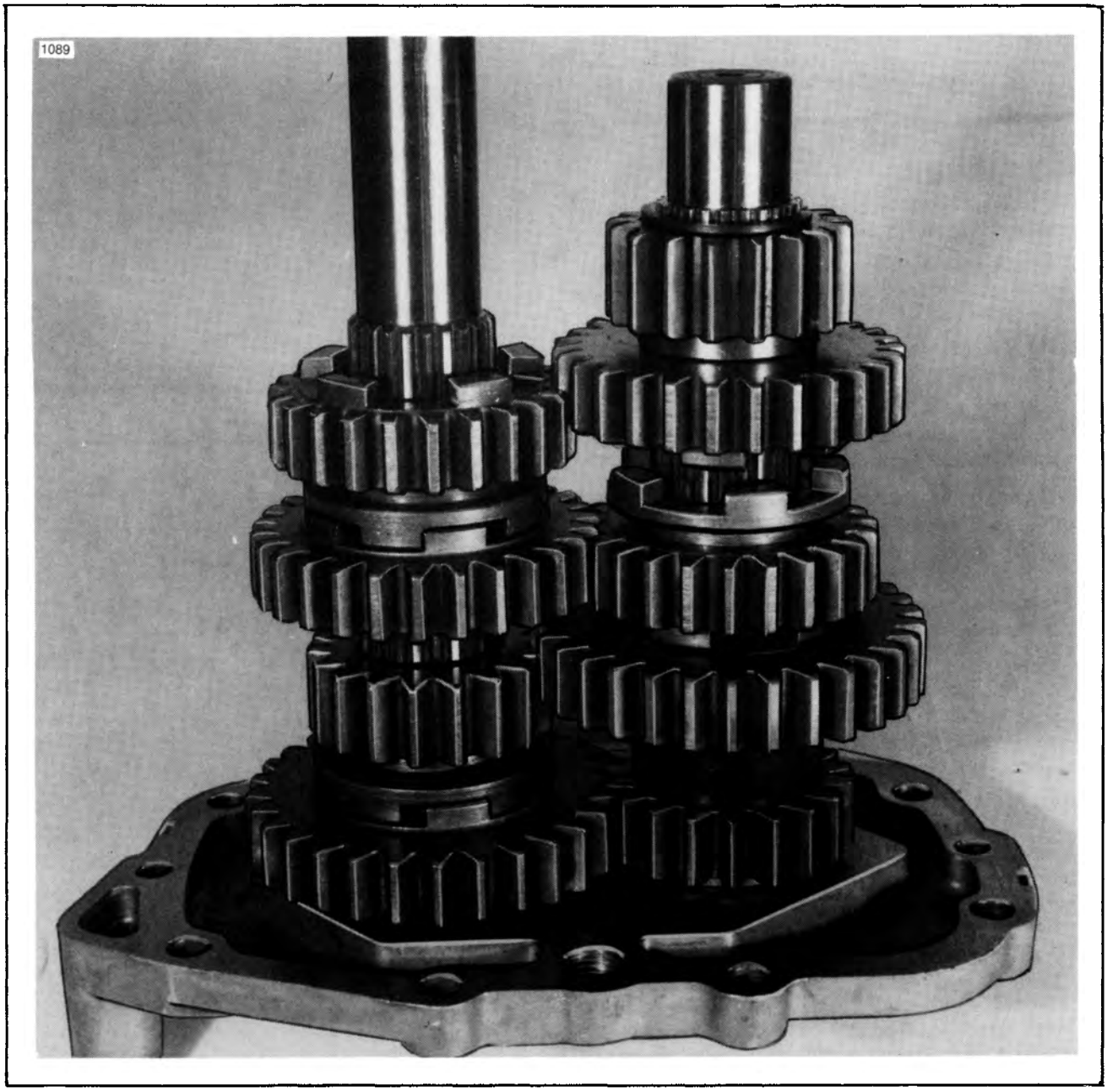


Figure 7-20. Side Door, Mainshaft and Countershaft — Final Assembly

10. Install a retaining ring (12) in the countershaft groove above 3rd gear (17). Slide a thrust washer (11) on top of the ring and place the bearings in the countershaft race. Install the countershaft 2nd gear (19) over the bearings.

11. Install the spacer (20) on 1984 - early 1987 models, and the countershaft 5th gear (21) on the countershaft. Secure 5th gear with a retaining ring.

12. Install the mainshaft 2nd gear (22) on the shaft with the shifter fork slot towards the side door. See Figure 7-20 for final assembly.

NOTE

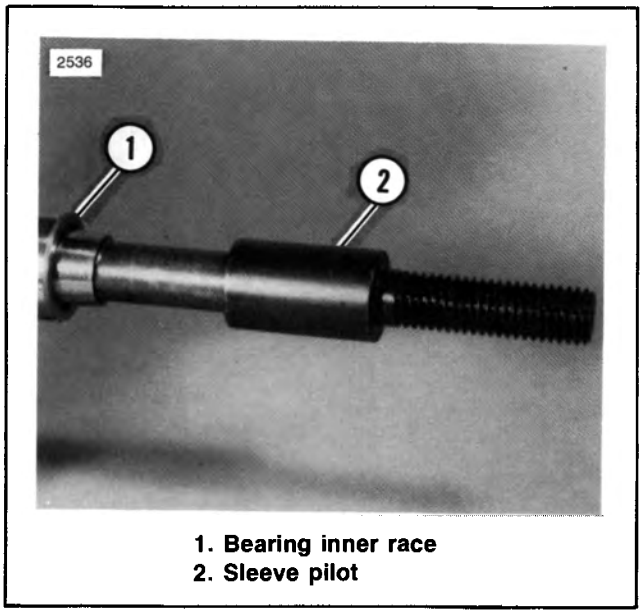
If main drive gear (9, Figure 7-26) was removed, install it now, following the procedures later in the section under ASSEMBLY.

13. See Figure 7-15. Install the assembly in the transmission case using a new gasket (2). Tighten 5/16 in. mounting hardware to 13-16 ft-lbs torque and 1/4 in. screws to 7-9 ft-lbs torque.

14. Lock the transmission by engaging two gears. Tighten mainshaft and countershaft nuts to 27-33 ft-lbs torque.

15. See Figures 7-21, 7-22. When assembling 1985 and later belt drive transmissions, the bearing race must be positioned on the shaft a precise distance to properly align with the bearing outer race in the primary chaincase. To install the bearing inner race, use the combination bearing race; PULLER AND INSTALLATION TOOL, Part No. HD-34902.

    a. Measure the length of the bearing inner race. Early 1985 models used a race 0.8075 - 0.8125 in. long. Later models have a race 0.9950 - 1.000 in. long. Record the length as it determines the race's position in step 'e'. Slide bearing inner race (1), chamfer edge first, onto mainshaft.



1. Bearing inner race
2. Sleeve pilot

Figure 7-21. Installation Tool Mounting

    b. Thread sleeve pilot (2) onto end of mainshaft (left hand thread).

    c. Position sleeve (3) over sleeve pilot (2) and against bearing race (1).

    d. Place washer (4) over threaded portion of sleeve pilot (2) and install nut (5).

    e. Tighten nut (5) while holding sleeve pilot (2) stationary with wrench on flats at end of screw threads. Press 0.8075 - 0.8125 in. long race onto shaft until race inside edge is 0.200 in. from main drive gear. If race length is 0.9950 - 1.000 in. long, press race onto shaft so inside edge is 0.100 in. from main drive gear.

CAUTION

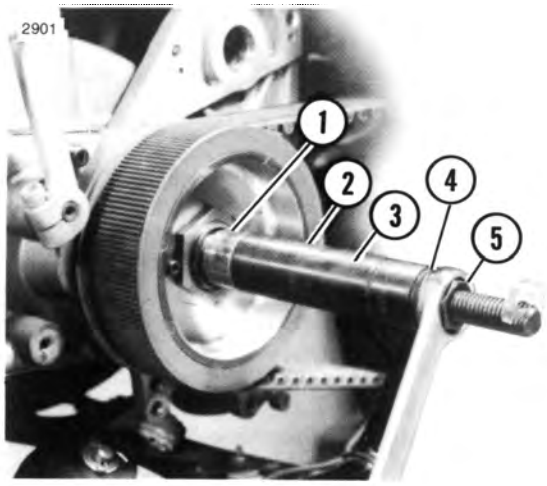
The primary chaincase has an oil seal installed between transmission sprocket bearing and the transmission mainshaft bearing. The seal prevents leakage of lubricant from the primary chaincase to the atmosphere. The oil seal should be replaced whenever the primary chaincase is removed.

16. Install the side cover. Install the shifter forks, shifter cam, top cover and clutch as described earlier in this section and section 6.

17. Install the drain plug and fill the transmission with one pint of Harley-Davidson TRANSMISSION LUBRICANT, Part No. 99892-84, or until the dipstick on the side cover filler plug shows FULL with motorcycle in level, upright position.

WARNING

Tighten the drain plug to 4-15 ft-lbs torque. Tighten the filler cap finger tight. Do not overtighten. Overtightening could cause the transmission lubricant to leak.



1. Bearing inner race
2. Sleeve pilot (not shown)
3. Sleeve
4. washer
5. Nut

Figure 7-22. Install Bearing Race

TRANSMISSION CASE

REMOVAL

NOTE

Removal of the transmission case is only necessary if it needs to be replaced.

1. Remove mainshaft and countershaft as described under MAINSHAFT, COUNTERSHAFT, REMOVAL earlier in this section. Remove starter as desribed under STARTER MOTOR, REMOVAL in section 5.

NOTE

Main drive gear and bearing can be removed with the transmission case in the frame. Use HD35316, MAIN DRIVE GEAR REMOVER AND INSTALLER.

2. Remove transmission sprocket. See section 6. See Figure 7-26. Remove main drive gear as follows:

   a. Remove retaining ring (7).

   b. Pull main drive gear (9), using HD-35316, MAIN DRIVE GEAR REMOVER AND INSTALLER.

   c. Remove bearing (8) from case using a block of wood and a hammer.

NOTE

The main drive gear bearing must be replaced if the main drive gear is removed. The bearing will be damaged during the removal procedure.

3. See Figure 7-24. Disconnect the foot shifter rod (1) from the shifter arm.

4. See Figure 7-26. Loosen screw (12) and remove shifter lever (13) from shifter arm (16).

NOTE

Do not perform step 5 if parts do not need to be replaced.

5. Loosen locknut (25) and turn adjusting screw (24) out until it clears the centering plate (18). Pull shifter arm assembly (16) out of the case (1).

6. Remove retaining ring (22), pin (19), springs (17 and 20) and centering plate (18). Pin is a press fit.

NOTE

1985 and later transmissions have only a vent hose. All oil hoses go to oil filter.

7. On 1984 FLT and FXRT models, disconnect the rear chain boots from the primary chaincase using REAR CHAIN HOUSING REMOVER, Part No. HD-97101-81. Locate the chain master link, disconnect it and pull the chain off the transmission sprocket. On 1985 & later models, loosen adjuster nuts at rear axle and turn adjuster bolt to relieve tension on belt. Remove belt from transmission sprocket.

8. Disconnect the oil hose(s) connected to the transmission. On 1985 and later model vehicles, match mark and disconnect the engine oil hoses at the oil filter mount. On 1984 models, unscrew the oil filter from the bottom of the transmission case. On late models, remove the oil filter mount.

9. Place motorcycle on a center stand and support engine from below with a block of wood.

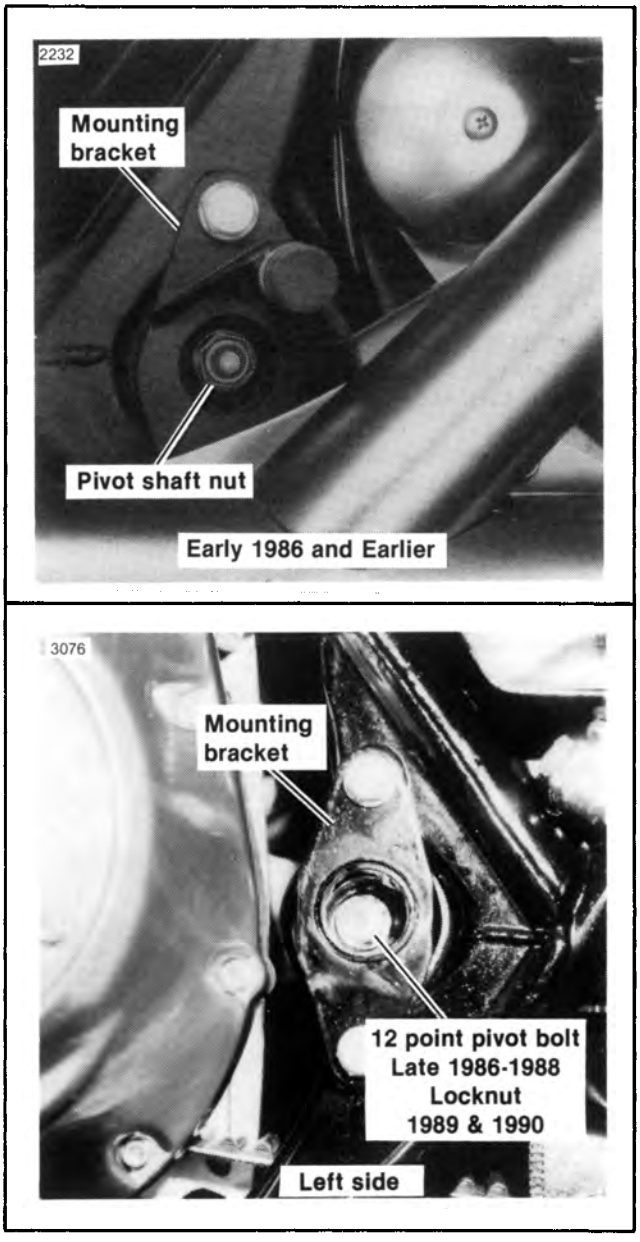
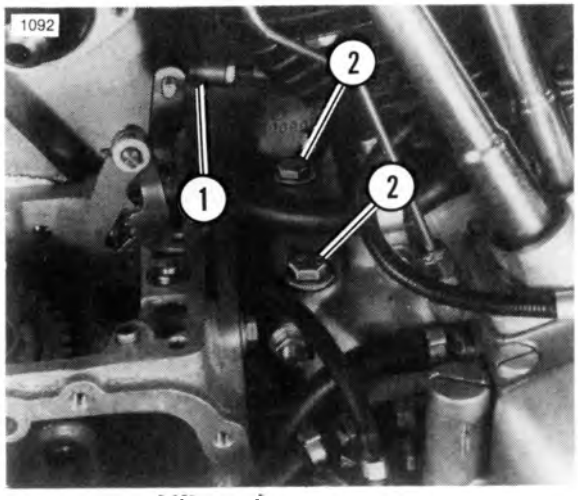


Figure 7-23. Rear Swing Arm Mounting

10. See Figure 7-23. On early 1986 and earlier vehicles remove the nut and spacer from right end of rear swing arm pivot shaft. On late 1986 through 1988 vehicles remove right pivot bolt while holding left pivot bolt. On 1989 and later models hold right side nut (6 point - 11/16 in. wrench size) and remove left side lock nut (6 point - 3/4 in. wrench) and cup washer.
11. Remove the right and left side passenger footrest mounting brackets on FLT models and pivot shaft mounting brackets on FXR models.
12. On 1984-1988 models, using a suitable drift, tap the pivot shaft out of the swing arm from the right side. On early 1986 and earlier vehicles it is not necessary to remove the nut and washer from the left side of the pivot shaft.
13. On 1989 and later models, tap the pivot shaft out of the swing arm from the left side using a suitable drift.



1. Foot shifter rod
2. Engine to transmission mounting bolts

Figure 7-24. Disassembling Transmission from Engine

14. See Figure 7-24. Remove the two bolts (2) and washers that secure the engine to the transmission.
15. See Figure 7-25. Remove the transmission mounting bolts and two locking tabs as shown.
16. Remove transmission case. If main drive gear was left assembled in transmission case, remove at this time following procedure in step 2.

CLEANING, INSPECTION AND REPAIR

1. Clean all parts in solvent except the case and needle bearings. Blow dry with compressed air.

NOTE

The transmission case and needle bearings must not be cleaned. Normal cleaning methods will wash dirt or other contaminants into the bearing case (behind the needles) and lead to bearing failure.

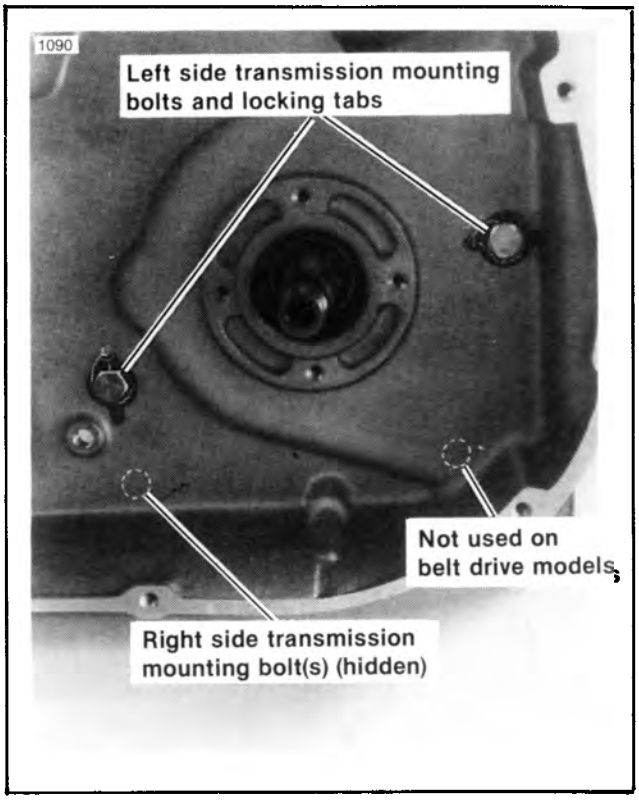


Figure 7-25. Transmission to Primary Mounting Bolts

2. When replacing seals, lightly coat outside diameter of seal with Loctite RETAINING COMPOUND No. 609.
3. Inspect the main drive gear for pitting and wear. Replace if necessary.
4. Replace the sprocket if the teeth are rounded or damaged.
5. Inspect the shifter pawl and centering plate for wear. If pawl ends are damaged or the centering plate is elongated, replace them.
6. See Figure 7-26. Inspect the springs (17 and 20). Replace the pawl spring (20) if it fails to hold the pawl (21) on the cam pin (19).
7. Inspect the needle bearings on the inside of the main drive gear (9). If mainshaft race surface appears pitted or grooved, replace these bearings.

NOTE

If the main drive gear needle bearings and/or seal need to be replaced, see steps 8, 9, 10 and 11 below.

8. Remove seal (6) and old needle bearings.

NOTE

To install the inner main drive gear needle bearings and seal, use MAIN DRIVE GEAR BEARING and SEAL INSTALLATION TOOL, Part No. HD-34734.

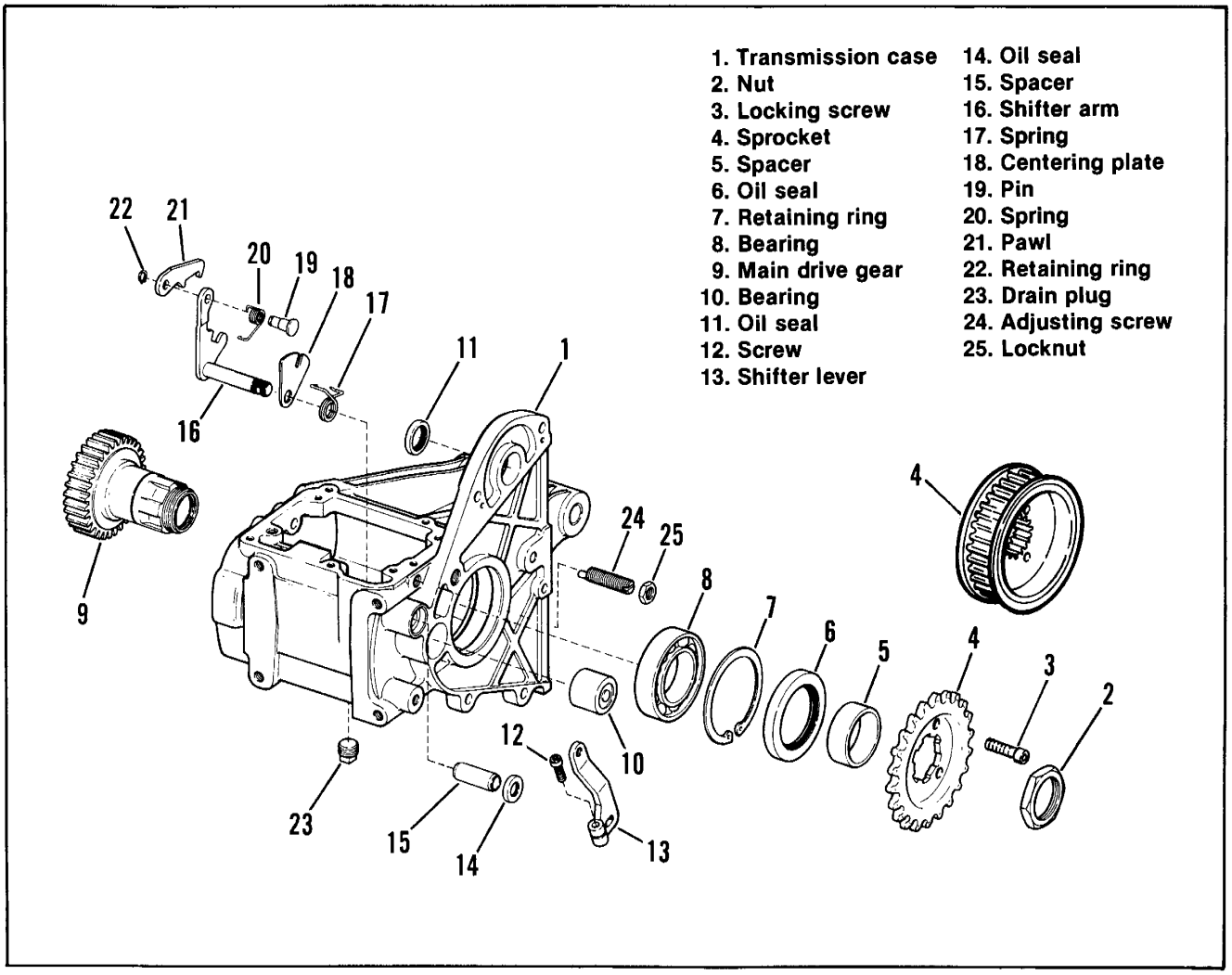


Figure 7-26. Transmission Case, Sprocket and Main Drive Gear

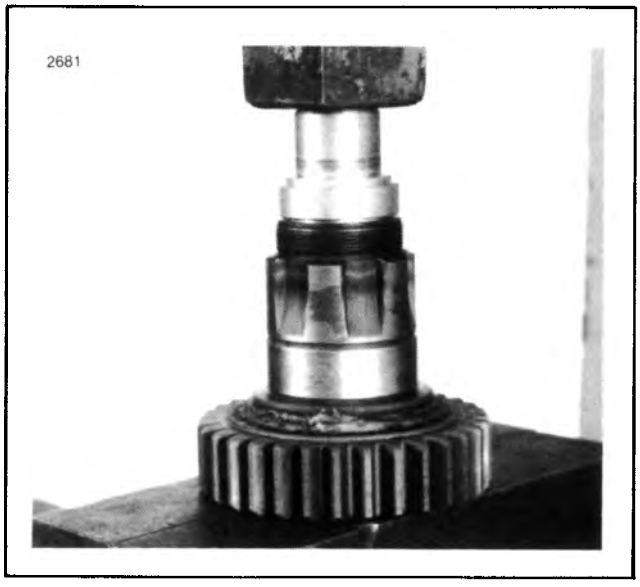


Figure 7-27. Installing Clutch Side Needle Bearing in main drive gear

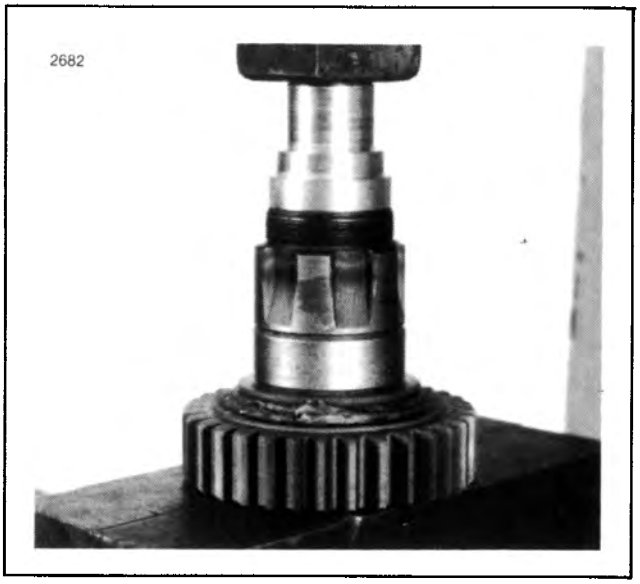


Figure 7-28. Pressing in Seal

9. See Figure 7-27. Install clutch side needle bearing using an arbor press and the 0.280 in. step end of tool HD-34734 as shown. Press until tool is flush.

10. See Figure 7-28. Turn over tool and press in seal using the 0.090 in. step.

11. See Figure 7-31. Turn over the main drive gear in the arbor press. With the tool HD-34734, at the 0.090 in. step, press in inner module bearing.

NOTE

If the transmission case was removed, the shifter cam assembly and the main drive gear can be assembled before or after mounting the transmission on the frame. If the shifter cam and main drive gear assemblies are to be installed after mounting the transmission, install the transmission case at this time.

ASSEMBLY

NOTE

On belt drive models, place belt on transmission sprocket as transmission is placed in position, if the main drive gear was pre-assembled prior to mounting the transmission.

1. Place the transmission case in the motorcycle and secure it to the engine with the original bolts, washers and nuts. Tighten bolts finger tight.

2. Position swing arm at rear of transmission. If transmission boss will not fit back into the swing arm, use the following procedure: See Figure 7-29. Install CLEVEBLOC SPREADING TOOL, Part No. HD-33805, between swing arm cleveblocs as shown. Turn nuts spreading cleveblocs apart to approximately 4-9/16 in. Loosen nuts and remove tool.

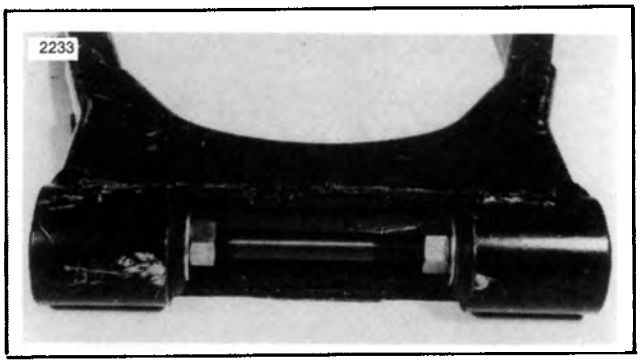
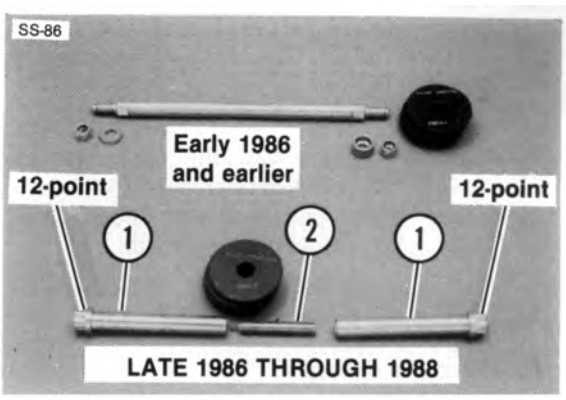
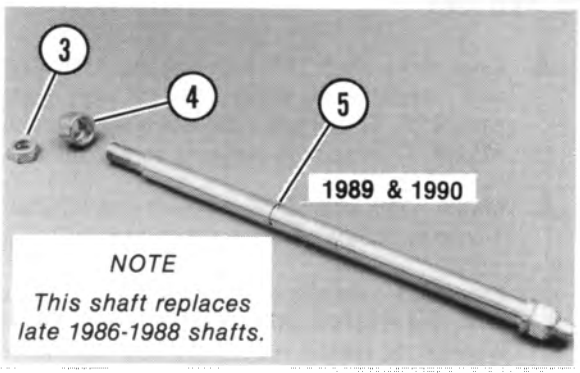


Figure 7-29. Spreading Cleveblocs

3. See Figure 7-30. Note the difference between early 1986 and earlier, late 1986 through 1988 and 1989 and later pivot shafts. See Figure 2-78 in Section 2. Assemble pivot shaft as follows:



1. Pivot bolt (2) **2. Center stud**



3. Locknut, 1989 **4. Cup washer, 1989**
5. Pivot shaft assembly, 1989

Figure 7-30. Rear Fork Pivot Shafts Comparison

EARLY 1986 and EARLIER

A. Insert pivot shaft (8) through rubber mount (7) with small diameter of mount facing outward as shown. Install washer (11) and nut (12) tighten nut until it bottoms on shaft.

B. Apply Loctite ANTI-SEIZE to pivot shaft (8) and slip nylon washer (6) on pivot shaft. Smaller diameter boss on nylon washer must face inward.

C. From left side slide pivot shaft through swing arm and transmission mount. Install nylon washer (6), rubber mount (7), washer (9) and nut (10) on right end of pivot shaft and tighten nut finger tight.

D. Proceed to step 4.

LATE 1986 THROUGH 1988

A. See Figure 2-78 on page 2-83. Thread pivot bolt (13) onto center stud (14).

B. Coat shank of pivot bolt (threaded on stud) with Loctite ANTI-SEIZE and insert pivot bolt with stud through rubber mount (7).

C. Place nylon washer (6) on pivot bolt (small diameter boss facing inward) and slide pivot bolt with stud through swing arm and transmission mount.

D. Coat remaining pivot bolt shank with Loctite ANTI-SEIZE, place rubber mount (7) and nylon washer (6) on pivot bolt and thread onto the center stud (14) from the right side.

E. Tighten pivot bolt finger tight.

F. Continue at step 4.

1989 AND 1990

A. Coat pivot shaft (15) with Loctite ANTI-SEIZE and insert pivot shaft (15) through rubber mount (7). The small diameter boss on rubber mount (7) must face outward as shown.

B. Install nylon washer (6) on pivot shaft. Smaller diameter boss on washer (6) must face inward.

C. From right side slide pivot shaft through swing arm and transmission mount. Install nylon washer (6), rubber mount (7), cup washer (16) and nut (17) on left end of pivot shaft and tighten nut finger tight.

4. Install the passenger footrest mounting bracket (FLT) or pivot shaft mounting brackets (FXR). The roll pin on each mounting bracket must register in the rubber mount locating hole.

NOTE

See Figure 2-78. On late 1987 and 1988 models a clip has been added to mounting bracket. Remove clip with needle-nose pliers. The 1989-1990 pivot shaft will retrofit on late 1986 through 1988 models. If 1989-1990 pivot shaft is installed do not install clips. Install clips on 1986 through 1988 (3-piece) shafts.

Tighten the mounting bracket bolts to 34-42 ft-lbs torque. On early 1986 and earlier vehicles make sure the flat on the pivot shaft registers in the flat on the right rubber mount.

Footrests must be installed so they fold up to the rear at a 45° angle. Tighten the footrest mounting nut to 20-25 ft-lbs torque.

In the following step, tighten 12-point fasteners to 85 ft-lbs and all others to 45 ft-lbs.

5. On early 1986 and earlier vehicles tighten the right pivot shaft nut to 45 ft-lbs torque. On late 1986 through 1988 vehicles tighten either pivot bolt to 85 ft-lbs torque while holding other pivot bolt stationary. Replace wire clip in both brackets. On 1989 and 1990 models hold right nut and tighten left nut to 45 ft-lbs torque.

6. See Figures 7-24, 7-32. Place the centering plate (18) on the shifter arm (16) as shown. Install the springs (17 and 20), pin (19) and retaining ring (22) if disassembled.

7. Insert the assembly into the transmission case with the adjusting screw in the centering plate slot.

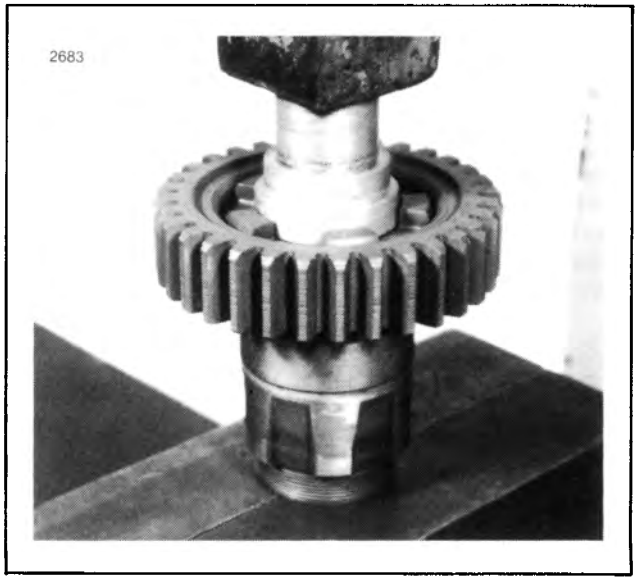


Figure 7-31. Installing Transmission Side Needle Bearing in Main Drive Gear

8. See Figure 7-26. Install shifter lever (13) on the shaft end and tighten the screw (12) to 18-22 ft-lbs torque. Make sure screw (12) registers in the slot on the shifter arm (16).

NOTE

Adjuster screw also functions as a stop.

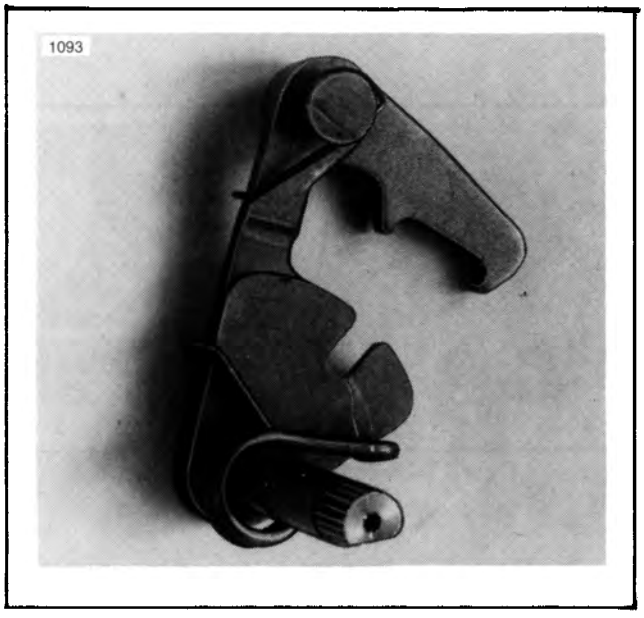


Figure 7-32. Shifter Arm Assembly

NOTE

If the transmission case was removed, it can be installed prior to assembling the main drive gear.

9. Install main drive gear and bearing. Install the main drive gear from inside the case using MAIN DRIVE GEAR AND BEARING INSTALLATION TOOL, Part No. HD-35316. Follow instructions provided with tool.

10. See Figure 7-26. Apply Loctite 242 (blue) to the threads of nut (2). Install the spacer (5), sprocket (4), and nut (2) on the main drive gear (9).

11. Run the chain onto the transmission sprocket, if so equipped.

12. On 1984 model vehicles, insert the chain through the rear housing rubber boots (FLT and FXRT). Reconnect the chain master link. See REAR CHAIN AND SPROCKETS, section 6.

NOTE

Place belt on transmission sprocket as sprocket is placed in position, if main drive gear is assembled with transmission mounted on frame.

13. Install bearings. Slide the countershaft and mainshaft assembly into the transmission case and lock the transmission by engaging two gears. Tighten the nut (2) to 110-120 ft-lbs torque.

14. See Figure 7-33. Select the tapped hole whose location most closely matches the desired tapped hole location shown in figure.

NOTE

If none of the tapped locations matches Figure 7-33 or the head of the locking screw contacts the sprocket nut, the sprocket nut should be additionally tightened. Do not exceed 150 ft-lbs torque. Do not loosen nut to obtain proper alignment.

15. Coat the threads of locking screw with Loctite LOCK AND SEAL (blue) and install the locking screw in the tapped hole.

16. Tighten locking screw to 50-60 in-lbs torque.

17. Install shifter cam and shifter forks. See previous sections.

18. Install top cover, right side cover, primary case, starter, starter solenoid, clutch, primary chain and sprocket. See previous sections.

19. See Figure 7-25. Install the transmission mounting bolts and two locking tabs on the primary chaincase. Tighten 3/8 in. bolts to 21-27 ft-lbs torque and 5/16 in. bolts to 13-16 ft-lbs torque. On 1984 vehicles, secure the two locking tabs to the bolts with safety wire.

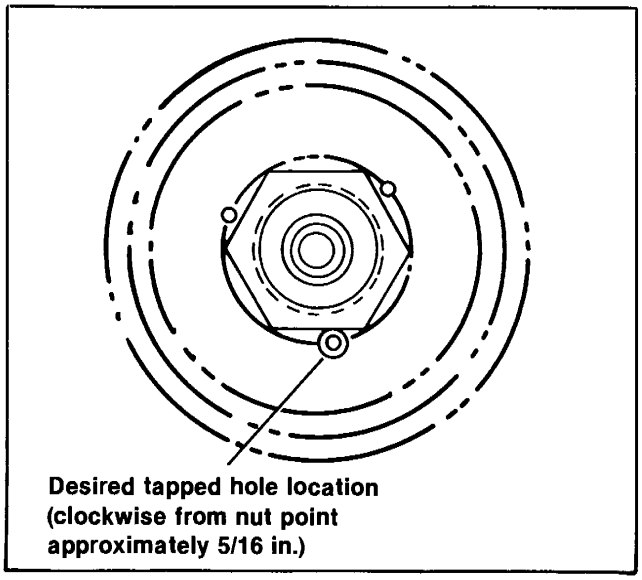


Figure 7-33. Securing Sprocket Nut

20. Coat the rear chain boots (1984 FLT and FXRT models) and mating surfaces on transmission and inner primary chaincase with 3M 750 SEALANT. Fasten the boots to the housing tightening screws alternately to 3-4 ft-lbs torque.

21. On 1985 and later models, adjust belt. See REAR BELT, INSTALLATION, section 6.

22. See Figure 7-24. Tighten the two transmission-to-engine mounting bolts (2) to 33-38 ft-lbs torque. Connect the foot shifter rod to the shifter arm.

23. On 1985 and later model vehicles, install the oil filter mount. On 1984 model vehicles, connect the oil hoses to the oil filter inlet and outlet ports. On all model vehicles coat the rubber seal with engine oil and screw the oil filter to the bottom of the transmission.

24. Perform all adjustments listed under TRANSMISSION, ADJUSTMENT. Adjust the rear chain or belt. See REAR CHAIN OR BELT ADJUSTMENT, section 6. Align the rear wheel. See REAR WHEEL ALIGNMENT, section 2.

25. Install the rear cylinder exhaust pipe and the footboards (FLT), left footrest and shifter lever (FXR).

NOTE

Check the pivot shaft nut torque every 5,000 miles.

26. Install transmission drain plug and fill with approximately 1 pint of TRANSMISSION LUBRICANT, Part No. 99892-84. See Owner's Manual.

27. On "wet" clutch models, fill primary chaincase with PRIMARY CHAINCASE LUBRICANT, Part No. 99887-84. With vehicle standing upright, fill to bottom of opening (clutch inspection cover) on 1989 and earlier models. On 1990 models the lubricant level must be at the bottom outside diameter of the clutch diaphragm spring.

NOTES

SUBJECT **PAGE NO.**

ELECTRICAL

SPECIFICATIONS

IGNITION

Ignition timing	Early 1984	Late 1984 and Later
Range	5°-50°BTDC	0°-35°BTDC
Start	5°BTDC	0° TDC
Fast idle	35°BTDC	35°BTDC
1800 rpm	50°BTDC	35°BTDC

SPARK PLUG

Part No.	No.	Size	Gap
32311-83	5R6A	14mm	0.038-0.045

NOTE:

Make sure spark plugs are gapped to this specification before installation.

CIRCUIT BREAKERS

CIRCUIT	CIRCUIT BREAKER RATING (Amperes)
Main	30
Ignition	15
Lights	15
Accessory	15
Radio	15
Constant	15

ALTERNATOR SYSTEM

Output Voltage ..... 14 V
Amperes — 1984-1988 ..... 22 amp.
1989 and later ..... 32 amp.

BATTERY

FLT Models

Voltage 12V
Amperes — 20 AH @ 10 Hour Rate
22 AH @ 20 Hour Rate

FXR Models

Voltage 12V
Amperes — 19 AH @ 10 Hour Rate
21 AH @ 20 Hour Rate

BULB CHART—FLT MODELS

Lamp Description (All Lamps 12 V)	Number of Bulbs Required	Current Draw (amperage)	Part Number
Headlamp		High Beam Low Beam	
FLTC	2	3.57 ea. 2.5 ea.	67717-65A
FLHT/C, FLHS	1	4.28 3.93	67697-81
Tail and Stop Lamp	1		68165-64
Tail Lamp		0.59	
Stop Lamp		2.1	
Passing Lamps — FLHT/C, FLHS	2	2.34	68674-69
Turn Signal Lamps			
Front/Running Lamp	2	0.59, 2.1	68165-64
Rear	2	2.1	68681-85A
Tour-Pak Side Lamps	4	0.10	53439-79
Tour-Pak Tail and Stop Lamp (Ultra models only)	2	See Tail & Stop Lamp above	68165-64
Fender Tip Lamps	2	0.10	53439-79
Instrument Panel Lamps	9	0.04	71099-74

BULB CHART — FXRT

Lamp Description (All Lamps 12 V)	Number of Bulbs Required	Current Draw (amperage)	Part Number
Headlamp	1		67697-81
High Beam		4.29	
Low Beam		3.93	
Tail and Stop Lamp	1		68165-64
Tail Lamp		0.59	
Stop Lamp		2.1	
Turn Signal Lamps			
Rear	2	2.1	68572-64A
Front/Running Lamp	2	2.1/.59	68165-64
Instrument Lamps			
Fuel Gauge	1	0.27	71099-74
Speedometer	2	0.12	53439-71
Tachometer	1	0.12	53439-71
High Beam Indicator	1	0.12	68588-86
Neutral Indicator	1	0.08	68574-83
Oil Pressure Signal	1	0.08	68484-83
Turn Signal Indicator	2	0.27	68465-86

BULB CHART — FXLR, FXRS/SE*/SP/CON, FXR

Lamp Description (All Lamps 12 V)	Number of Bulbs Required	Current Draw (amperage)	Part Number
Headlamp	1		67698-81A
High Beam		3.57	
Low Beam		2.5	
Tail and Stop Lamp	1		68165-64
Tail Lamp		0.59	
Stop Lamp		2.1	
Turn Signal Lamps			
Front/Running Lamp	2	0.59, 2.1	68165-64
Rear	2	2.1	68572-64A
Instrument Lights			
Turn Signal Indicator	2	0.27	68465-83
High Beam Indicator	1	0.27	70021-83
Neutral Indicator	1	0.80	68574-83
Oil Pressure Indicator	1	0.80	68489-64
Speedometer	1	0.27	71090-83
Tachometer	1	0.27	71090-64
Fuel Gauge	1	0.12	71099-74

* Sport Edition

IGNITION SYSTEM

GENERAL

The ignition system is a breakerless inductive discharge ignition system. It has two circuits, the primary circuit and the secondary circuit. The primary circuit consists of the battery, switch, primary coil winding, computerized ignition timer and associated wiring. The secondary circuit consists of the secondary coil, the spark plugs and associated wiring.

The computerized ignition system consists of three assemblies, the rotor and sensor plate, the computerized microprocessor module, and the vacuum operated electric switch (V.O.E.S.). The rotor and sensor plate are located in the gearcase cover on the right side of the motorcycle. The computer module is mounted on the left side of the fairing mount on FLT models and under the right side cover on FXR models. The V.O.E.S. is located to the left of the intake manifold. The computer has two functions. First, it computes the spark advance for proper ignition firing. Second, it opens and closes the low voltage circuits between the battery and ignition coil to produce high voltage discharge to the spark plugs.

The vacuum operated electric switch (V.O.E.S.) senses intake manifold vacuum through an opening in the carburetor body. The V.O.E.S. is connected to the carburetor with a vacuum hose. The switch is open under acceleration and high engine load conditions (low vacuum) and closed under low engine load conditions (high vacuum). The computer module is programmed

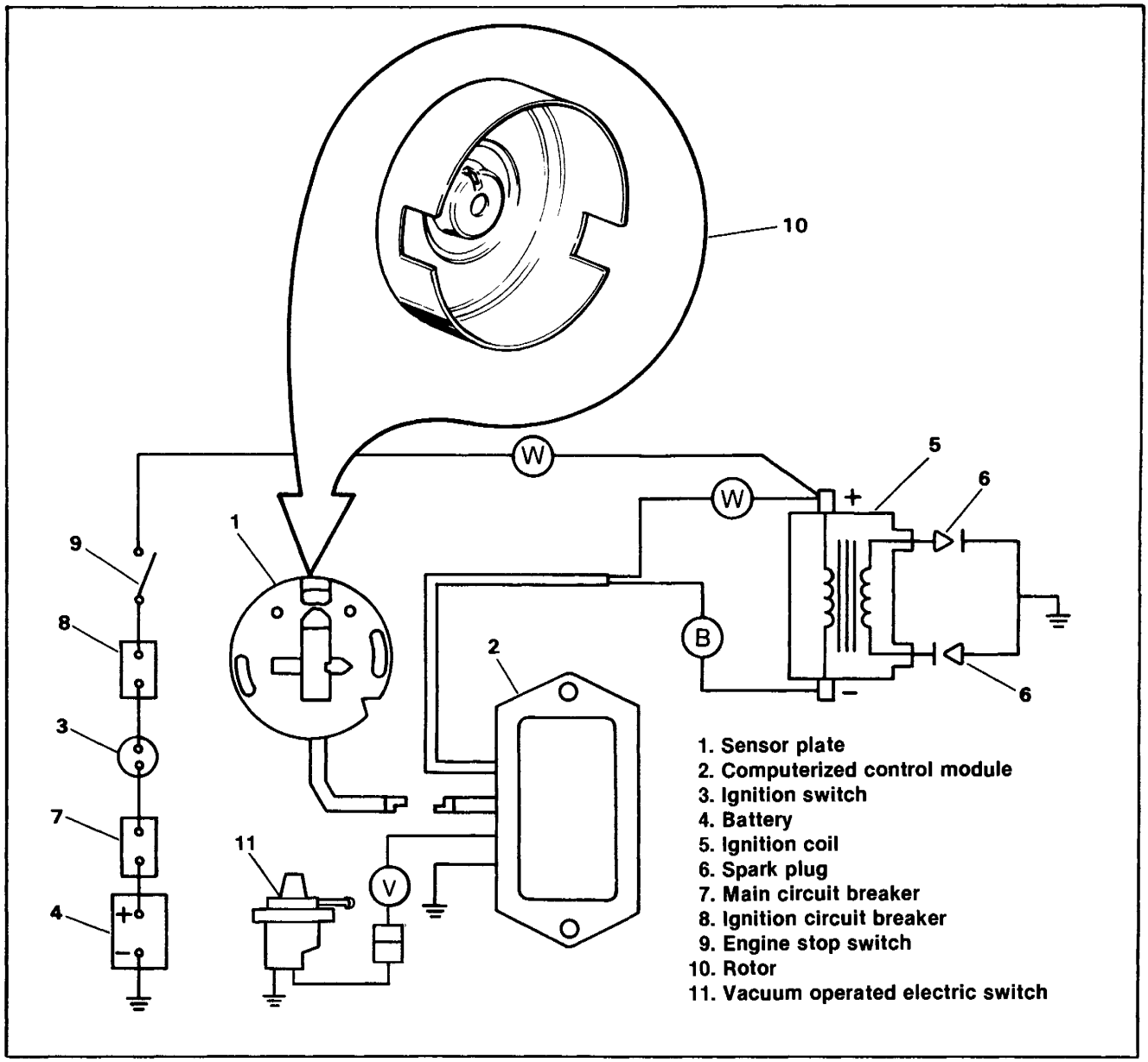


Figure 8-1. Ignition System Components

with two spark advance curves to meet varying engine loads. The high vacuum curve selected for maximum spark advance under normal light load cruising conditions provides improved fuel economy and performance. The low vacuum curve (retarded spark) minimizes spark knock, while maintaining performance, under high load conditions (acceleration and highway driving).

The computer module selects the proper curve when it receives an open or closed electrical signal from the V.O.E.S. This system ensures correct timing to suit starting, low and high speed requirements.

The ignition timer includes a rotor, sensor plate, and a computerized microprocessor control module and a V.O.E.S. A single ignition coil fires both spark plugs at the same time, but one spark occurs with no effect during a noncompressoin stroke of one cylinder, while the other spark fires the combustible gasses in the other cylinder to produce the power stroke.

The rotor is bolted on to the camshaft and operates at one-half crankshaft speed. As the rotor turns, slots in its external edge break the magnetic field of a Hall-effect device mounted on the sensor plate. The output of the Hall-effect device is a logic-type signal that corresponds to the timing information from the spinning rotor. This technique gives accurate timing information down to "0" speed.

Basically, the system gives a spark near Top Dead Center (TDC) for starting, and at rpm's and loads above this gives a spark advance that varies between 5° and 50° BTDC on early 1984 models or between TDC and 35° BTDC on late 1984 and later models. The whole timing program can be shifted by mechanical rotation of the sensor plate. See Advance Timing.

The computerized control module contains all of the solid state components used in the ignition system. The dwell time for the ignition coil is also calculated in the microprocessor and is dependent upon engine speed. The programmed dwell is an added feature to keep battery drain to a minimum and yet gives adequate spark duration at all speeds.. (The microprocessor control module has added protection against transient voltages, continuous reverse voltage protection, and damage due to jump starts.) The 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 with the following tests.

Check for Engine Spark

1. Disconnect spark plug cables from spark plugs. Check condition of plugs and cables. Clean or replace as necessary.
2. Insert a conductive adapter into spark plug cable nipple and establish a 3/16 in. gap between adapter and cylinder head. Turn on ignition and engine stop switches. Crank engine. Check to see if 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. Battery voltage must be 11-13V DC.

   Check specific gravity of battery electrolyte with hydrometer. Specific gravity must be 1.250 (temperature corrected) or higher. If voltage and specific gravity are low, charge battery.
4. Check to make sure that ignition module ground (black lead) is securely fastened to the frame and that the ground wire from the battery to the frame is in good condition. Check condition of engine to frame ground strap and be sure it is attached securely. If there is still no spark at engine proceed to the tests under No Spark at Engine.

No Spark at Engine

To conduct all the procedures in this test it will be necessary to assemble a set of jumper wires as shown in Figure 8-2. Cut two lengths of wire of ample length to reach from a good ground connection to the negative terminal of the coil primary. Use a known good condensor such as used in earlier breaker point ignition systems if a suitable capacitor is not readily available. When conducting the spark tests steps 3 and 5, use a spare plug and connect it to one of the plug wires or remove one of the engine spark plugs and lay it on the engine cylinder head with the plug wire connected. The spark is then checked jumping across the plug electrodes.

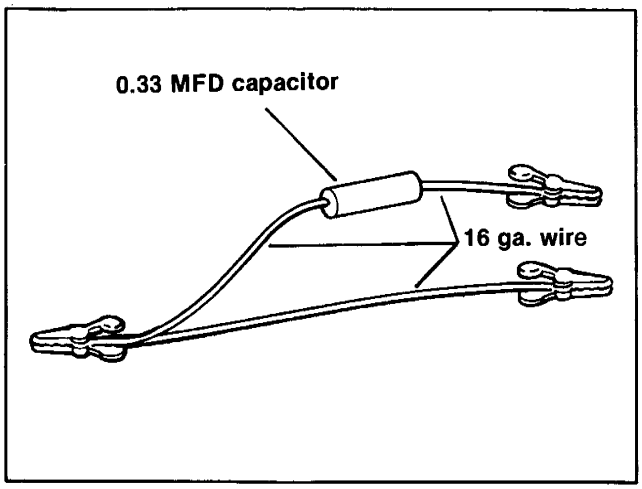


Figure 8-2. Test Jumper

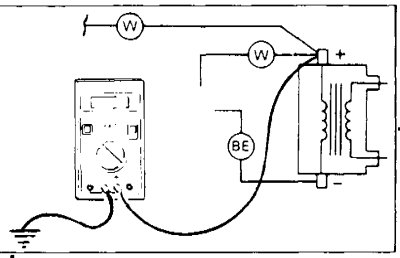
CONTINUOUS NO SPARK AT SPARK PLUG

1

A. Ignition switch on.

B. Multimeter red wire to white wire terminal, black wire to ground.

C. Meter should register 12V + or – one volt.



NO POWER → Check circuit breaker, loose wires, switches. See Troubleshooting Section 5.

YES

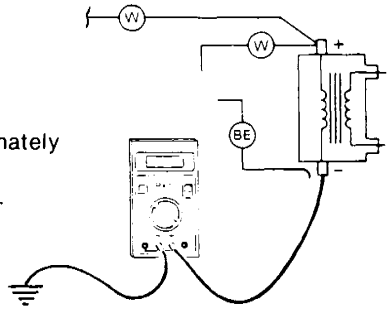
2

A. Remove blue wire from coil terminal.

B. Ignition switch on.

C. Multimeter red wire alternately to white wire terminal and to blue wire terminal.

D. Meter should register 12V at both terminals.



NO POWER → Check coil resistance. See COIL later in this section. Resistance O.K. Check spark step 3.

YES

3

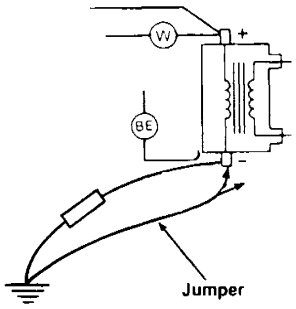
A. Blue wire disconnected.

B. Ignition switch on.

C. **Jumper wire — connect capacitor wire to blue wire terminal at coil.**

D. Connect both wires to common ground.

E. **Momentarily touch ground wire to blue wire terminal at coil. Should have spark at plug.**



NO SPARK → Replace coil.

YES

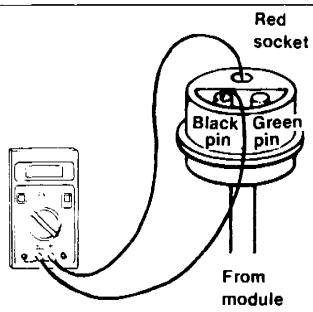
4

A. Reconnect blue wire to coil.

B. Ignition switch on.

C. Disconnect sensor.

D. Connector from module — multimeter red wire to red wire socket and black wire to black pin. Should register 5V + or – 0.5 volts.



NO POWER → Check module ground and power wire to module for loose connections. Check spark step 5.

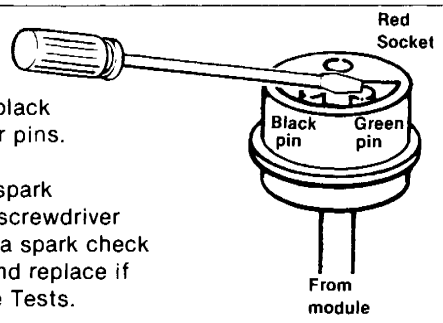
YES

5

A. Ignition on.

B. Momentarily place screwdriver across black and green connector pins.

C. Strong evidence of spark at spark plug when screwdriver removed. If there is a spark check sensor resistance and replace if bad. See Resistance Tests.



NO SPARK →

Check module resistance.
Replace module if resistance is bad.
See Resistance Tests.

INTERMITTENT IGNITION PROBLEM — VIBRATION

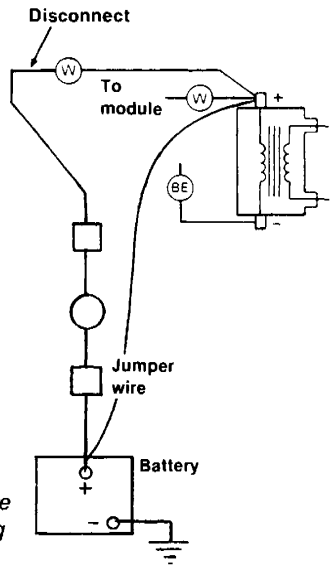
A. Check battery connections and cable conditions, disconnect module ground (scrape paint, add star washer).

B. Disconnect white wire at coil terminal (not module feed).

C. Connect 16 ga. jumper wire from battery positive terminal to white wire terminal of coil.

D. Operate vehicle to see if problem is eliminated.

NOTE: Vehicle no longer has an engine stop switch. Engine must be stopped by removing jumper wire.



YES →

Problem is vibration possibly loose connection at safety switches in starter circuit.
See TROUBLESHOOTING, section 5.

INTERMITTENT IGNITION PROBLEM — TEMPERATURE

A. Remove outer timing cover.

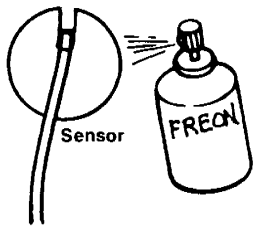
B. Remove inner timing cover and gasket.

C. Start-up vehicle.

D. Spray nose of sensor with coolant (obtainable at electronic supply houses) to see if engine kills.

E. With engine hot, at operating temperature and cover off, apply heat (blow dryer) to nose of sensor and see if engine kills.

F. Apply heat to module (blow dryer) and see if engine kills.



YES →

Problem is temperature sensitive sensor/module.
Replace sensor or module.

Resistance Tests

If sensor or module fail to pass the resistance tests replace the faulty component.

NOTE

These tests and the corresponding readings are valid only when using the "tan-colored" KMT multimeter, Part No. HD-35500. If you use a different type of meter; different scales, actual voltage and polarity of the test leads may produce results different than the values given in these tests.

NOTE

Review instruction sheet for proper operation of HD-35500 multimeter.

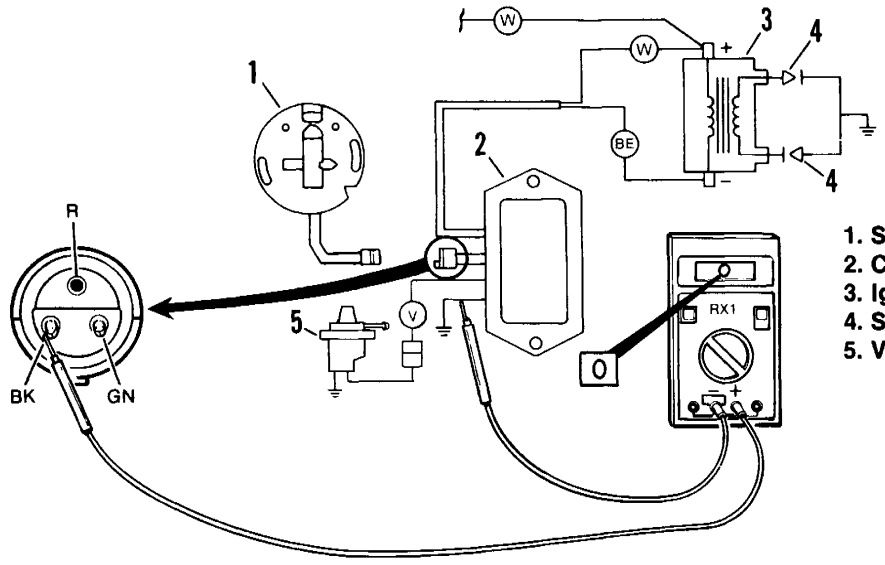
CAUTION

If resistance tests are performed on a "live" circuit, the multimeter will be damaged. Turn off the ignition and disconnect the battery.

IGNITION COMPONENT RESISTANCE (OHMS) TESTS

IGNITION MODULE

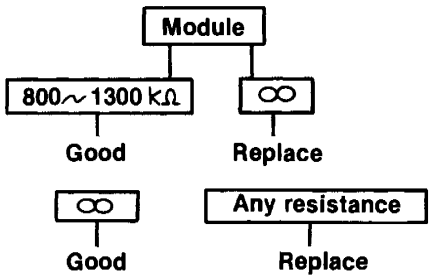
TEST	METER SETTING	POSITIVE (+) PROBE	NEGATIVE (−) PROBE	METER READING
Check for grounds	RX1	To black wire in harness	To black module ground wire	Module → 0 - 1 ohm: Good; More than 1 ohm: Replace

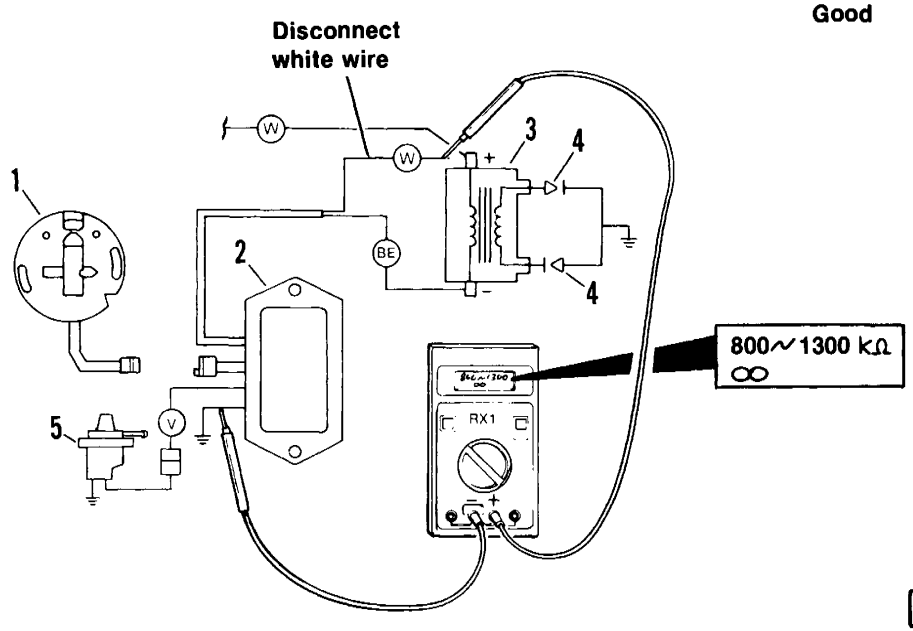


1. Sensor plate
2. Computerized control module
3. Ignition coil
4. Spark plugs
5. Vacuum operated electric switch

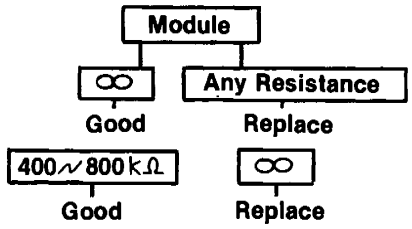
IGNITION MODULE (CONT'D)

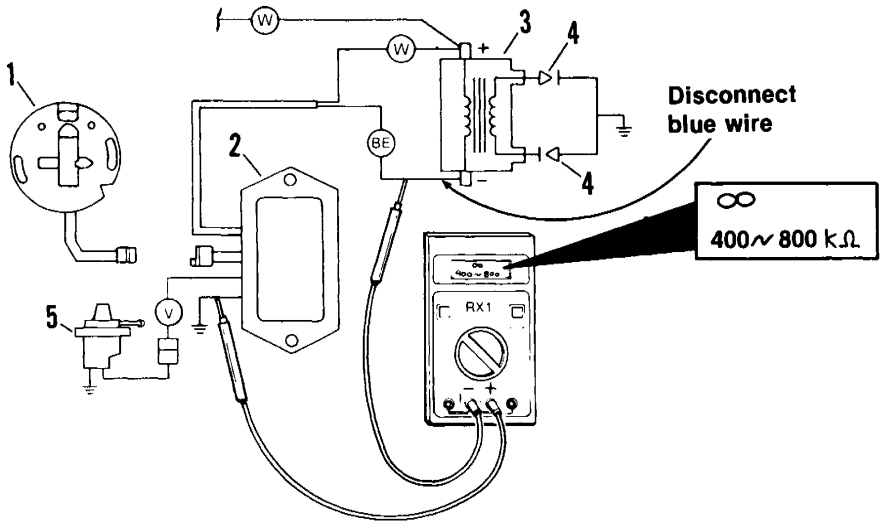
TEST	METER SETTING	POSITIVE (+) PROBE	NEGATIVE (−) PROBE	METER READING
Power supply diode test	RX1	To white coil wire	To black module ground wire	
	RX1	Black module ground wire	To white coil wire	





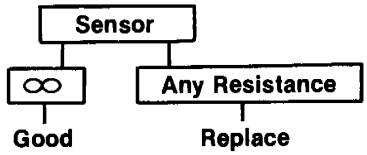
TEST	METER SETTING	POSITIVE (+) PROBE	NEGATIVE (−) PROBE	METER READING
Coil driver transistor check	RX1	To blue coil wire	To module ground wire	
	RX1	To module ground wire	To blue coil wire	

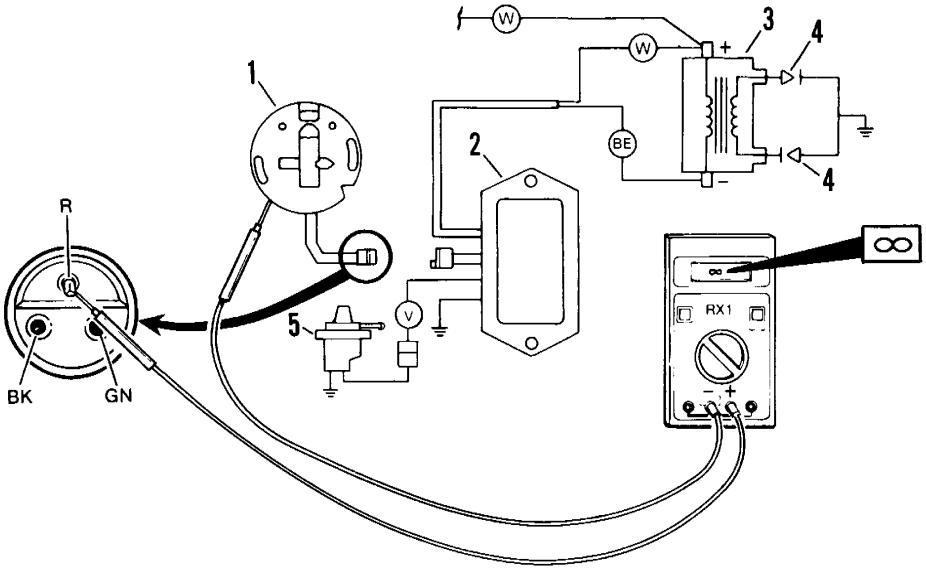




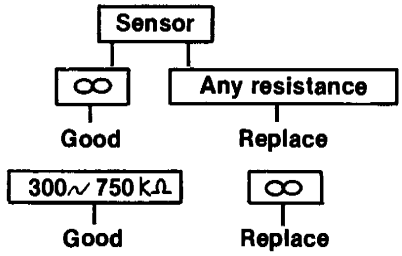
SENSOR CHECKS

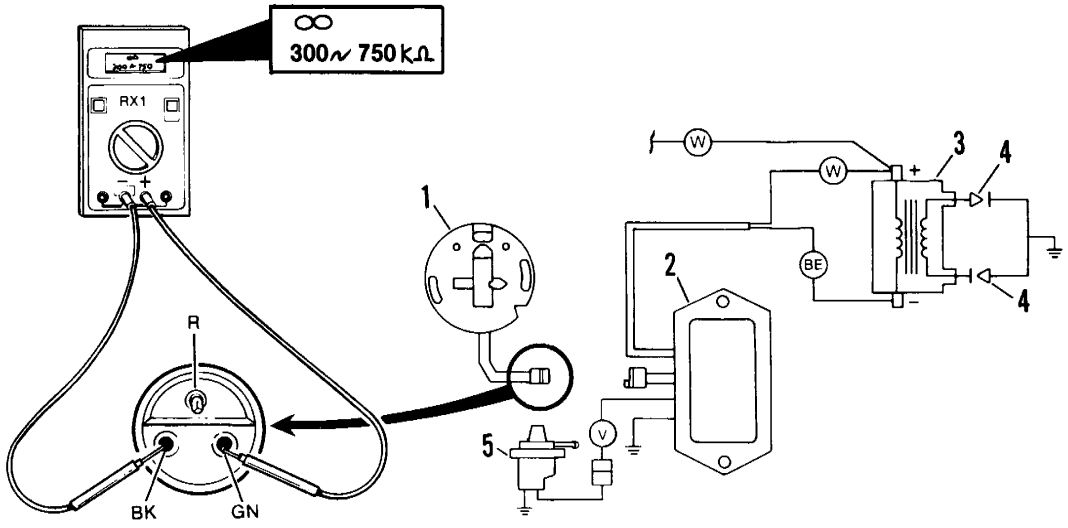
TEST	METER SETTING	POSITIVE (+) PROBE	NEGATIVE (−) PROBE	METER READING
Check for grounds	RX1	Attach alternately to each wire	To sensor plate	





Sensor output	RX1	To green sensor wire	To black sensor wire
	RX1	To black sensor wire	To green sensor wire





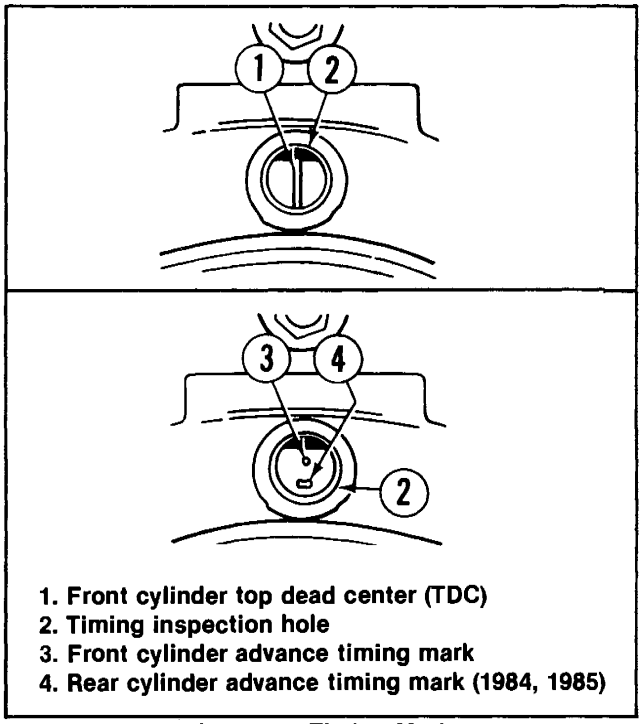
ADJUSTMENT/TESTING

Advance Timing (Figure 8-3)

Ignition timing should be checked every 5000 miles.

Use an INDUCTIVE TIMING LIGHT, Part No. HD-33813 (timing gun) to view ignition timing mark on flywheel through TIMING MARK VIEW PLUG, Part No. HD-96295-65C, screwed into timing inspection hole. Make sure view plug does not touch flywheel.

1. Connect timing light leads to front spark plug cable, ground and battery positive terminal.



1. Front cylinder top dead center (TDC)
2. Timing inspection hole
3. Front cylinder advance timing mark
4. Rear cylinder advance timing mark (1984, 1985)

Figure 8-3. Timing Marks

2. Make sure vacuum hose is properly installed at carburetor and at vacuum operated electric switch.

3. Start engine and set engine speed at 1300-1500 rpm. Light will flash each time spark occurs.

4. See Figure 8-3. Aim timing light into timing inspection hole. Front cylinder advance timing mark should be centered in timing inspection hole.

5. If timing mark is not centered or visible in the timing inspection hole, remove timer covers in accordance with steps 1 and 2 under IGNITION MODULE AND SENSOR PLATE, REMOVAL. Loosen sensor plate screws just enough so that plate can be rotated using a screwdriver in the notch.

6. With timing light aimed into inspection hole, rotate plate until timing mark is in the center of the inspection hole.

7. Tighten sensor plate screws.

8. Install gasket inner and outer timer covers following steps 8 and 9 under IGNITION MODULE AND SENSOR PLATE, INSTALLATION.

CAUTION

When checking advance timing, always check V.O.E.S. operation. Failure to do so may result in running engine with too much spark advance, and may cause extreme engine knock and engine failure.

Timing Advance

	EARLY 1984	LATE 1984, & LATER
RANGE	5°-50° BTDC	TDC-35° BTDC
START	5° BTDC	TDC
FAST IDLE	35° BTDC	35° BTDC
1800-2800 rpm	50° BTDC	35° BTDC

VACUUM OPERATED ELECTRIC SWITCH (V.O.E.S.)

TESTING

After engine has been timed with a strobe light, perform the following check:

With the engine idling, remove vacuum hose from carburetor and momentarily plug carburetor fitting. Timing will retard and engine speed should decrease. Reinstall vacuum hose to carburetor. Timing mark should reappear and engine speed should increase to preset speed.

If speed does not decrease and increase as described, check V.O.E.S. wire connection to computer module and ground wire. V.O.E.S. must be replaced if malfunctioning.

REMOVAL AND INSPECTION

1. Disconnect wire from V.O.E.S. to computer module.
2. Disconnect V.O.E.S. ground wire from engine.
3. Remove V.O.E.S.
4. Connect ohmmeter across two V.O.E.S. wires. Ohmmeter should indicate an open circuit (∞ ohms).
5. Attach hose of VACUUM PUMP, Part No. HD-23738, to V.O.E.S.
6. Slowly squeeze vacuum pump handle and observe vacuum gage and ohmmeter.
7. The ohmmeter should indicate switch closure (0 ohms) at the following vacuum readings.

   FLT Models - 5.0-6.0 in. of mercury
   FXR Models - 3.5-4.5 in. of mercury

8. Vacuum readings other than those listed above require V.O.E.S. replacement.
9. Refer to the latest Harley-Davidson Parts Catalog for V.O.E.S. part number.

1. Outer cover rivet (2)
2. Outer cover
3. Inner cover screw (2)
4. Inner cover
5. Gasket
6. Sensor plate screw (2)
7. Washer (2)
8. Sensor plate
9. Rotor screw
10. Rotor
11. Camshaft oil seal
12. Connector
13. Ignition module
14. Ignition coil
15. Spark plug cable (2)
16. Ignition coil terminal
17. V.O.E.S. wire
18. Vacuum operated electric switch

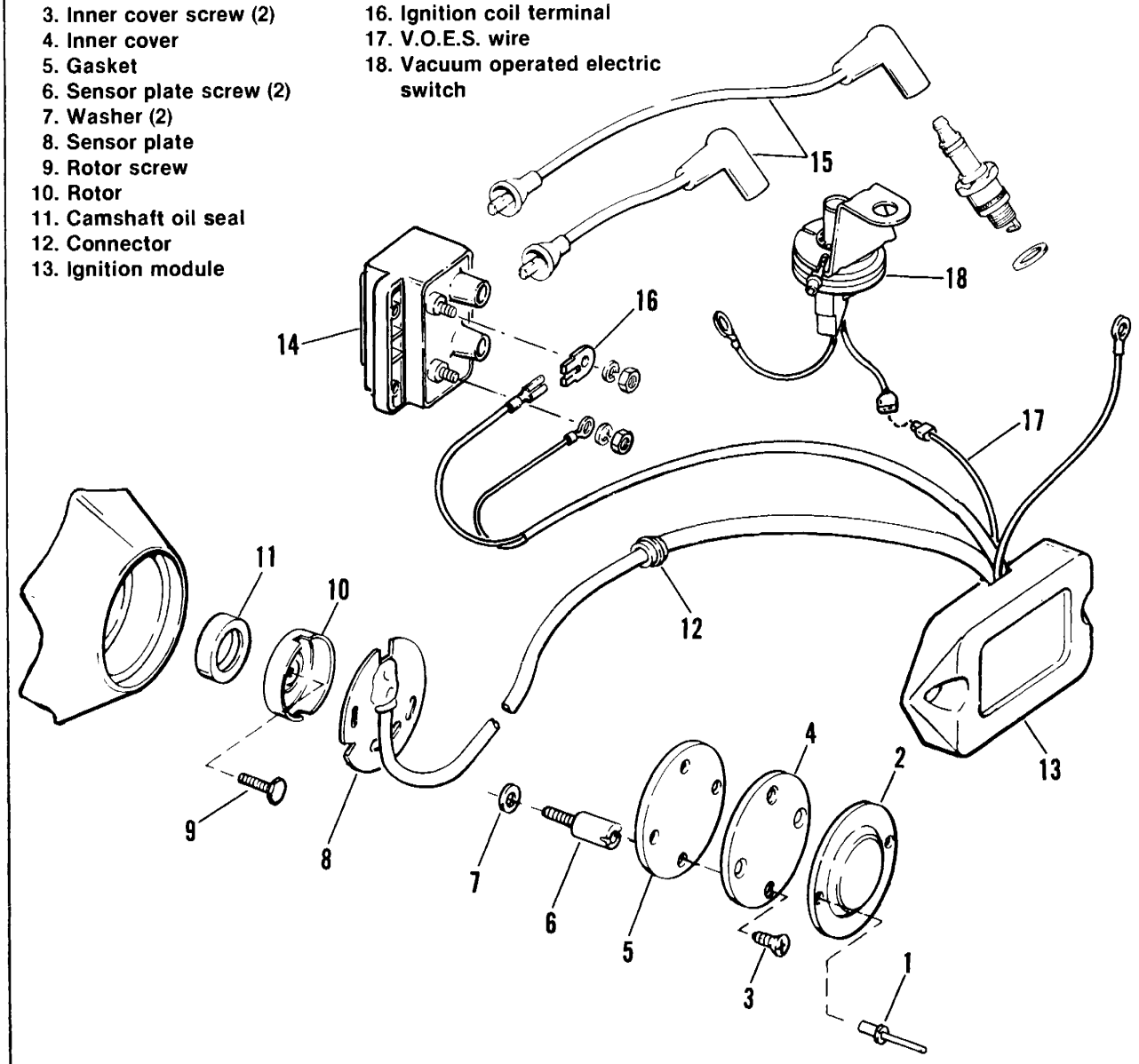


Figure 8-4. Ignition Components

IGNITION MODULE AND SENSOR PLATE

REMOVAL (Figure 8-4)

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.
5. Remove rotor screw (9) and rotor (10).
6. Seal (11), if damaged, can be pried out from ignition side of gearcase. Use care not to damage camshaft end and/or gear cover while prying.
7. Disconnect ignition module wires from coil and V.O.E.S.
8. To remove ignition module (13), on FXR vehicles, remove right frame side cover. Remove two mounting bolts, and the screw securing the ground wire. The module is located at left side of steering head on FLHT vehicles or at fairing bracket on FLT vehicles.

INSTALLATION (Figure 8-4)

1. Assemble ignition module (13) to left side of fairing mount on FLT models or steering head on FLHT vehicles and under right side cover on FXR models. Make sure that the black ground wire is secured and in contact with clean bare metal not insulated by paint or other insulating materials.
2. Connect ignition module wires to ignition coil and V.O.E.S. as shown in the wiring diagrams.
3. If seal (11) was removed, install new seal (11) in gearcase, lip side to gear side of gearcase.

CAUTION

Seal (11) must be pressed into gearcase until it stops. A seal that is not fully seated may leak.

4. Apply Loctite LOCK 'N SEAL to rotor bolt (9). Install rotor (10) with rotor bolt (9) making sure tab on rotor engages slot in camshaft. Torque bolt (9) to 75-80 in-lbs (6 ft-lbs).

CAUTION

Use only the grade of Loctite specified to prevent thread damage during disassembly.

5. Install sensor plate (8) with sensor plate screws (6) and washers (7).

NOTE

If sensor plate (8) was completely removed it may be necessary to install new wire pins, sockets and body receptacle.

6. Set timing plate so screws (6) are in center of slots. Start the engine and check advanced ignition timing under running conditions as described in previous section.
7. Install gasket (5) and inner cover (4) with screws (3).
8. Rivet outer cover (2) to inner cover (4) with rivets (1).

CAUTION

See Figure 8-5. Use only rivets Part No. 8699 to secure outer cover. Timing cover rivets are specially designed so there is no rivet end to fall off into timing compartment as with regular rivets. Use of regular rivets could cause damage to ignition components.

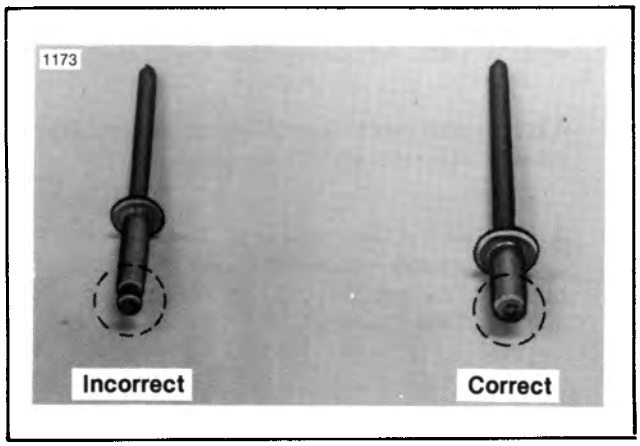


Figure 8-5. Special Timing Cover Rivet

SPARK PLUGS

GENERAL

Spark plugs must be checked at 5000 miles and replaced at 10,000 miles.

The number 5R6A plug is supplied as original equipment and is the only plug that should be used.

The resistor plug reduces radio interference created by the ignition system and will not affect performance or fuel economy.

INSPECTION (Figure 8-6)

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 or seals, 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 white, yellow or light tan to rusty brown powdery deposit indicates balanced combustion. The deposits may be cleaned off at regular intervals if desired.

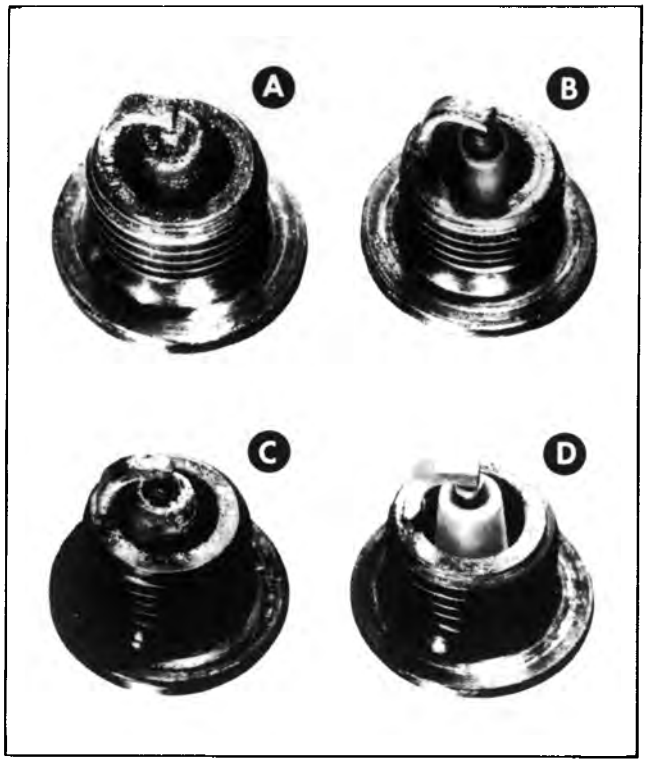


Figure 8-6. Types of Plug Base Deposits

ADJUSTMENT

Use only a wire-type gauge. Bend the outside electrode so only a slight drag on the gauge is felt when passing it between electrodes. Never make adjustments by bending the center electrode. Set gap on all plugs at 0.038-0.045 in.

INSTALLATION

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. Install spark plug finger tight and then torque to 18 to 22 ft-lbs.

3. Check engine idle speed, and adjust if necessary. Idle speeds and adjustment are listed in FUEL section.

IGNITION COIL

GENERAL

The ignition coil is a pulse type transformer that transforms or steps up low battery voltage to the high voltage necessary to jump the electrode at the spark plug in the cylinder head. Internally the coil consists of primary and secondary windings with a laminated iron core and sealed in waterproof insulating compound. The ignition coil cannot be taken apart or repaired. If the ignition coil is faulty it must be replaced.

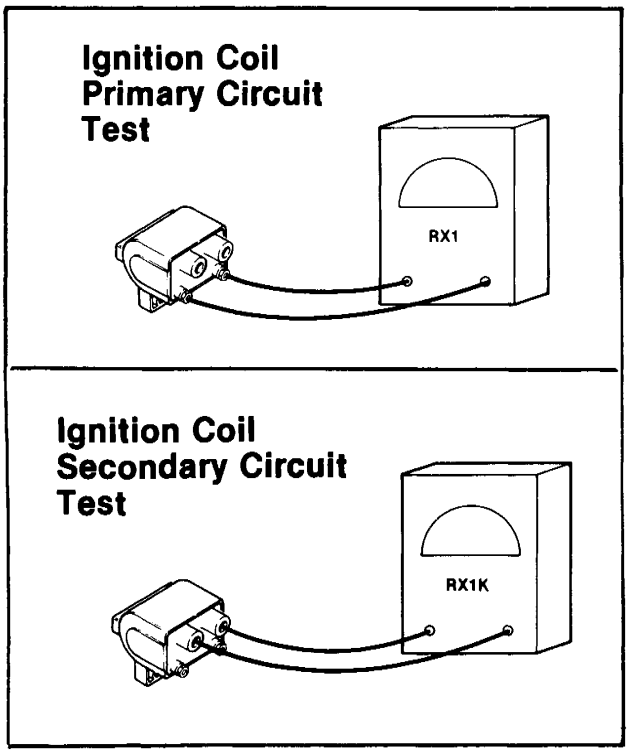


Figure 8-7. Test Ignition Coil

TROUBLESHOOTING

When engine will not start or when hard starting or missing indicates a faulty ignition system, follow the procedure listed under ignition system TROUBLESHOOTING. If condition persists, check primary and secondary resistance of ignition coil with an ohmmeter. See Figure 8-7. Resistances should be within the following limits: Primary resistance 2.5 - 3.1 ohms, secondary resistance 11,250 -13,750 ohms. Check ignition coil with a coil tester.

If a coil tester 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. See Wiring Diagram.

CAUTION

Connect ignition coil wires as shown in Figure 8-1. 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 for damaged cables and insulation. 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 motorcyle has been washed.

If spark plugs foul or do not fire, check spark plug cable resistance with an ohmmeter. Resistance for 10 in. wires should be 2500 - 5833 ohms. Resistance for 20 in. wires should be 5000 - 11,667 ohms. Replace wires that do not meet specifications.

CHARGING SYSTEM

GENERAL

Some 1988 (Police) and all 1989 and later models are equipped with a high output charging system that supplies 29-32 amperes. The 1988 engines with crankcase numbers 1588 348 063 and 2088 348 006 (California engines) and all subsequent crankcase numbers have left crankcases machined to accept the new stator. See your Harley-Davidson dealer for further information.

Identifying High Output Charging System (32 Amp.)

With regulator male plug disconnected, the new stator female plug extends above the left crankcase surface. This plug is below the crankcase surface on the old 22 Amp. system. The center-to-center distance of the plug terminals and their diameter has been increased. This prevents connecting an old regulator to a new stator or a new regulator to an old stator.

Alternator

The alternator consists of two main components: the rotor which is behind the engine compensating sprocket and the stator.

Regulator

The regulator is a series regulator with shunt control. The circuit combines the functions of rectifying and regulating.

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. Make sure star washers are between regulator and mounting bracket. Also check for a good ground at the mounting bracket.

See Figure 8-8. The radio memory and the clock are energized at all times. If battery runs down when motorcycle is not being used, the problem could be excessive current draw. With ignition switch off, connect multimeter between ground and the battery terminal as shown. With ignition switch and all lights and accessories turned off, amperage reading should be as follows:

YEAR	MODEL	METER READING (milliamperes)
1986 & 1987	FLT/C & FLHT/C	Less than 40
1986 & 1987	FXRT	Less than 40
1988 - 1990	FLTC & FLHTC	Less than 10 (radio memory)
1989, 1990	FLTC Ultra & FLHTC Ultra	Less than 15 (radio and CB memory)
1984-1990	All Models without clock/radio	Less than 3 (regulator leakage)

NOTE

Any reading that exceeds the above "Meter reading" values indicates excessive current draw. Check for bad radio, clock, CB, regulator or a short in the interconnecting wiring. Isolate problem by disconnecting suspect components and observe change in meter reading.

See Figure 8-8. If battery runs down during use, the current draw of the motorcycle components and accessories may be exceeding output of the charging system. To check that current draw is not more than the charging system output, connect load tester between the battery negative terminal and ground as shown.

With ignition and all continuously operating lights and accessories turned on (headlamp on high beam), read the total current draw. Compare this reading to alternator output of 22 amperes (amps) on 1988 and earlier models or 32 amps on 1989 and later models. Current draw should be at least 3.5 amperes less than alternator output. If current draw is greater than 18.5 amps on 1988 and earlier models or 28.5 amps on 1989 and later models, there may be too many accessories for the charging system to handle.

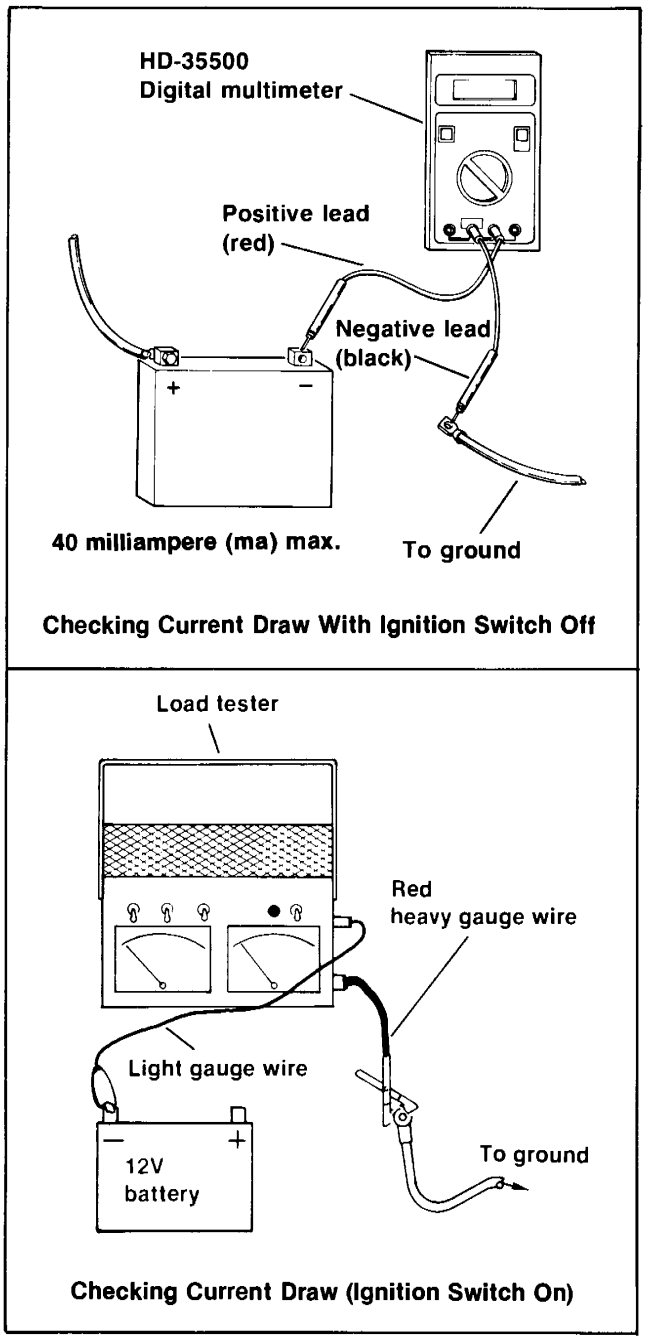


Figure 8-8. Checking Current Draw

Charging System Output Test

1. Connect load tester as shown in Figure 8-9.

2. Run the engine at 2000 rpm. By using a combination of load switches, as required, reduce voltage to obtain a constant 13.0 volt reading.

   The alternator current output should be 19 amperes minimum to 23.0 amperes on 1988 and earlier models and 29 amperes minimum to 32 amperes on 1989 and later models.

If the reading is within the range, the charging system is good and no further tests are necessary. If the amperage reading is not within the specs, continue by performing the **grounded stator test** and **alternating current output test** in order to determine if the problem lies in the alternator or the voltage regulator.

Turn off load switches, then read the load tester voltage meter. Voltage to the battery must not be more than 15 volts. If voltage is higher, regulator is not functioning properly and must be replaced.

CAUTION

Do not leave any load switch turned on for more than 20 seconds or overheating and tester damage are possible.

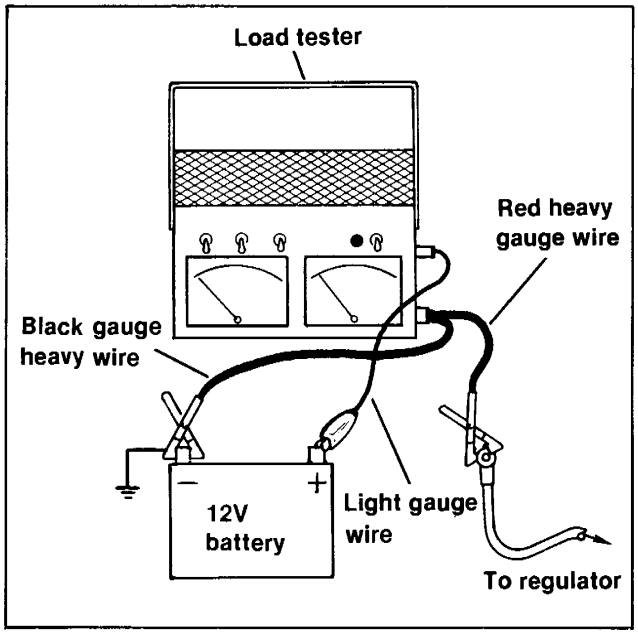


Figure 8-9. Charging System Output Test

Stator Check

GROUNDED

1. To check for a grounded stator, turn off ignition and disconnect the regulator/rectifier from the stator at the plug at front of the crankcase on the motorcycle left side.

2. See Figure 8-10. Set ohmmeter on the RX1 scale. Test for continuity between each stator socket and ground. There must be no continuity (infinite ohms). Any other reading indicates stator is grounded and must be replaced.

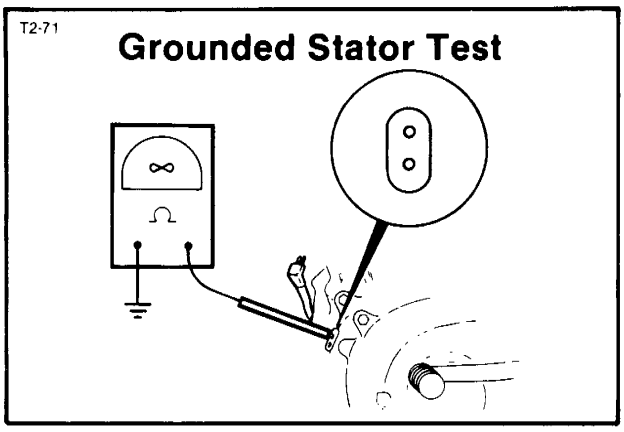


Figure 8-10. Testing For Grounded Stator

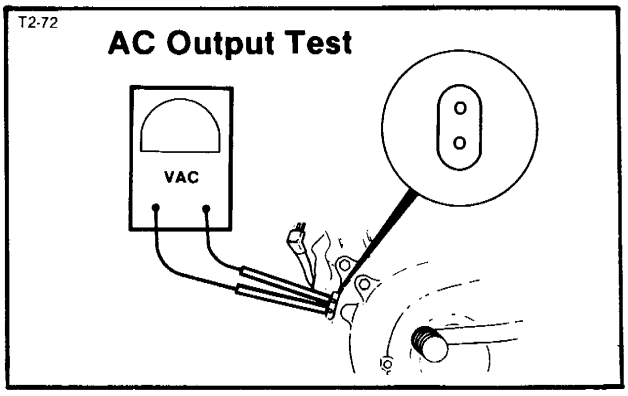


Figure 8-11. Checking Alternator Output

SHORTED

Check the stator resistance with an ohmmeter set on the RX1 scale. Measure across the stator sockets. The stator coil resistance should be 0.2 - 0.4 ohms on 1988 and earlier mdoels and 0.10 - 0.12 ohms on 1989 and later models. If the resistance is higher or no needle measurement (infinite ohms) is detected, the stator must be replaced.

Stator AC Output Check (Figure 8-11)

Disconnect the regulator/rectifier and connect an AC voltmeter across stator sockets. The alternator should produce 19 - 26 AC volts per 1000 rpm on 1988 and earlier models and 16 - 20 vac per 1000 rpm on 1989 and later models.

If stator and rotor are good, charging problem can be assumed to be a faulty regulator/rectifier.

ALTERNATOR

DISASSEMBLY

WARNING

To avoid accidental start-up of vehicle and possible personal injury disconnect the battery cables (negative cable first) before performing any of the following procedures.

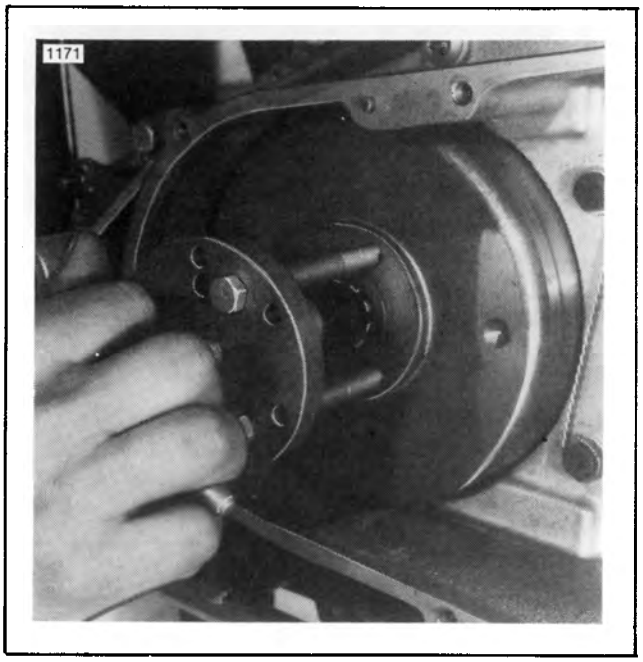


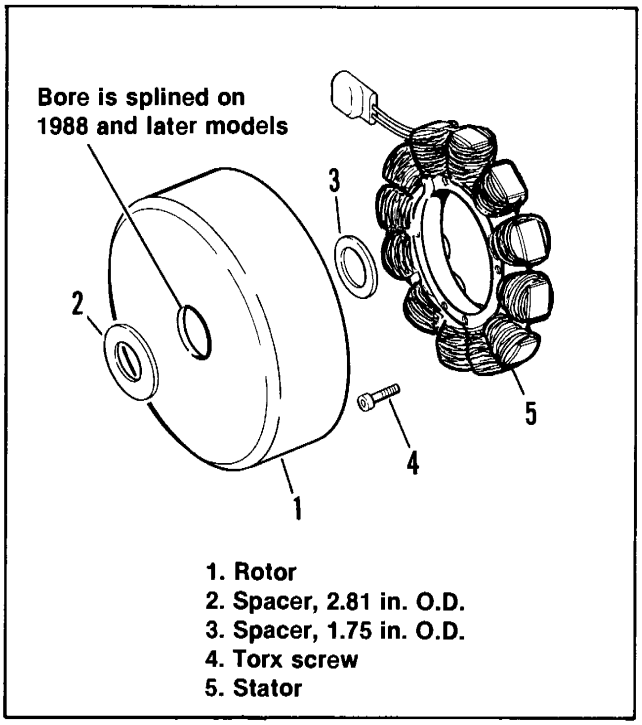
Figure 8-12. Pulling the Rotor

1. On late 1984 and later models, drain the primary chaincase lubricant. Remove the left side footboard (FLT models), shifter pedal and primary cover.

2. Remove the clutch, primary adjusting shoe, front sprocket and primary chain as an assembly. See CLUTCH DISASSEMBLY in section 6. Remove the sprocket shaft extension and washer.

3. See Figure 8-12. Pull the alternator rotor using the ROTOR PULLER, Part No. HD-95960-52B, if puller holes are provided. Fabricate wire hooks to pull rotor at spline area if puller holes are not provided. See Figure 8-13, 1986 and 1987 rotors have spacers in place of the splined rotor hub. Splines and spacers are used on 1988-1990 models.

4. See Figure 8-15. Remove the four screws (1) and two lock plates, if equipped (2). Remove two connector screws (3). Unplug the regulator and remove the stator (4). See Figure 8-13. Later stators have Torx fasteners without lock plates. **DO NOT REUSE THE TORX FASTENERS**. 1986 and later vehicles have coil windings that are not encapsulated.



1. Rotor
2. Spacer, 2.81 in. O.D.
3. Spacer, 1.75 in. O.D.
4. Torx screw
5. Stator

Figure 8-13. Rotor and Stator Mounting — 1986 and Later

CLEANING, INSPECTION AND REPAIR

The rotor and stator can be replaced individually if either is damaged or faulty.

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.

CAUTION

Do not strike or drop alternator rotor, or magnet adhesive may be damaged, resulting in rotor failure.

ASSEMBLY

CAUTION

See Figure 8-14. Use only new Torx fasteners. Torx fasteners contain a locking compound in pellet form on the threads. When fastener is started, the pellets break releasing the compound. Torx fasteners cannot be reused.

1. See Figure 8-15. Install the stator on the crankcase and fasten using the locking plates, if equipped (2) and four screws (1). Tighten screws (1) to 30-40 in-lbs torque. Install the two screws (3) and plug-in the regulator.

NOTE

The engine sprocket is aligned with the clutch sprocket by a selection of variable thickness washers located between the sprocket extension and the rotor. See Figure 6-4 in DRIVE section.

2. Install the rotor onto the sprocket shaft. See Figure 8-13. On 1986 and later vehicles place the small diameter spacer (3) at the inside (stator side) of rotor (1) and the larger diameter spacer (2) at the outside of the rotor. Install the variable thickness washer and the sprocket extension. Install the engine sprocket, chain or belt and clutch. See CLUTCH ASSEMBLY in section 6.

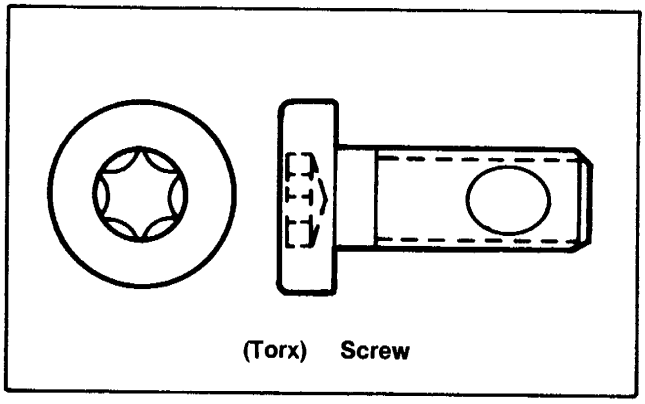
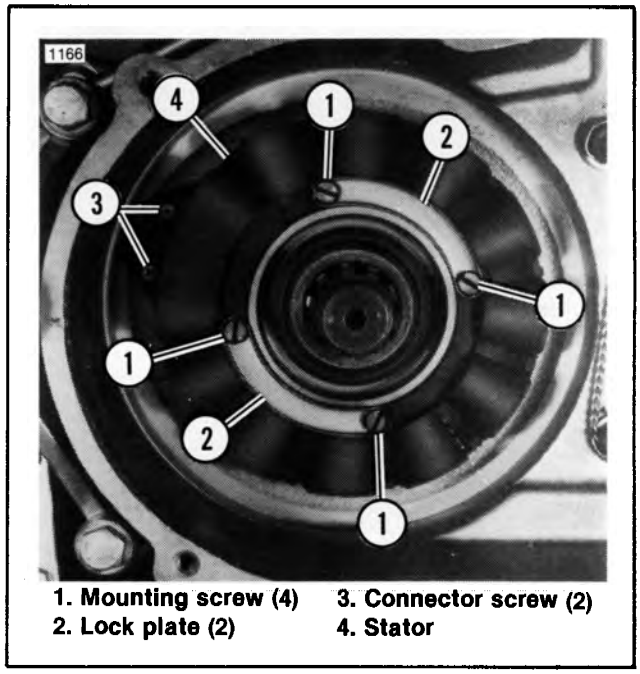


Figure 8-14. Stator Mounting Fastener — Later Models

CAUTION

Be sure the compensating sprocket nut is torqued properly and Loctite 242 (blue) is used on the threads. Do not strike or drop alternator rotor, or magnet adhesive may be damaged, resulting in rotor failure.

3. Install primary cover and left side footboard (FLT models) and shifter pedal.



1. Mounting screw (4) **3. Connector screw (2)**
2. Lock plate (2) **4. Stator**

Figure 8-15. Pulling the Stator — Early Models

4. On wet clutch models, fill primary chaincase with PRIMARY CHAINCASE LUBRICANT, Part No. 99887-84. Fill to bottom of clutch inspection opening on 1989 and earlier models. On 1990 models, lubricant must just reach bottom of clutch diaphragm spring, outer diameter.

NOTE

On dry clutch models, after reassembly, chain housing 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 place screw in the threaded fitting of the gauge. Then, with engine running, and the vent hose to primary case pinched closed with a pliers, check gauge to see that there is a reading indicating 25 in. water vacuum or more at 2000 rpm. A lower reading indicates an air leak into chain housing.

REGULATOR

GENERAL

The regulator is a non-repairable item and must be replaced if it fails.

REMOVAL

1. Unplug the regulator from the crankcase.
2. On FXR and 1987 FLT models, remove the left side cover and disconnect the regulator lead from the main circuit breaker. On 1988 and later FLT models, remove right side cover and disconnect regulator lead from main circuit breaker. Cut the cable straps securing the wire to the frame. On 1986 and earlier FLT models, disconnect the wire at the junction mounted on the steering head.
3. Remove the mounting bolts and replace the old regulator with a new one.

INSTALLATION

1. Attach regulator by installing mounting bolts. Cut wires to proper length and install connectors.
2. On FXR and 1987 FLT models, route the wire along the inside of the bottom frame member and connect it to the main circuit breaker on left side. On 1988 and later FLT models route wire along inside of the bottom frame member and connect wire to the main circuit breaker (silver terminal) on right side. Install the side cover and secure the wire to the frame with cable straps. On 1986 and earlier FLT models, route the wire to the junction and connect it to the terminal.
3. Plug the regulator into the stator plug in the crankcase.

BATTERY

GENERAL

All Harley-Davidson batteries are lead and sulfuric acid electrolyte units. The battery is designed for load requirements under normal intended use.

REMOVAL

FLT Models (Figure 8-16)

The battery is located behind the side cover on the right side of the motorcycle. Remove the right side saddlebag and side cover.

2. Disconnect the negative cable first, then positive cable. Disconnect vent hose located near negative terminal. Remove the hold down strap and lift the battery out of the carrier.

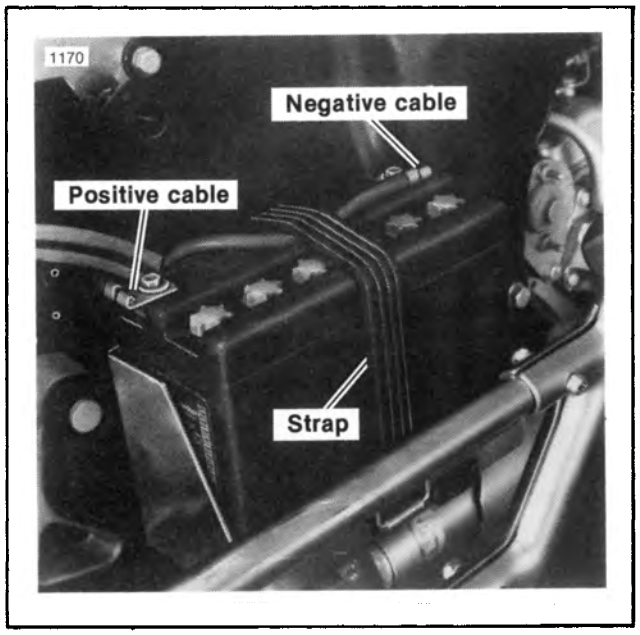


Figure 8-16. Battery Location — FLT Models

FXR Models (Figure 8-17)

1. The battery is located under the seat. Lift up on seat latch, tilt seat up. On fixed seat models remove seat.

2. Disconnect the negative cable first, then the positive cable. Loosen locknut (1), screw (2) and remove lanyard (4). Remove battery hold down bracket (3) by pushing it rearward and sliding towards left side of motorcycle. Bracket can then be removed from slots in the frame.

3. Disconnect vent hose located near negative terminal and lift battery from carrier.

CLEANING, INSPECTION AND REPAIR

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

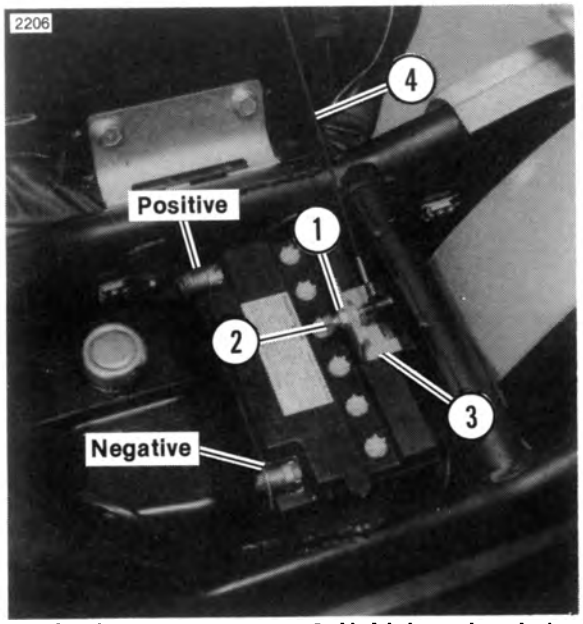
External — Flush with water.

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.



1. Locknut
2. Screw
3. Hold-down bracket
4. Lanyard

Figure 8-17. Battery Location — FXR Models

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, additional water can be added to bring electrolyte to correct level (between the two level lines on the side of the battery).

CAUTION

If battery is filled to a higher level than specified, some of the solution will be forced out through the vent tube when battery is charging. This will not only weaken the solution, but also may damage parts near the battery. Keep battery clean and lightly coat terminals with grease or petroleum jelly to prevent corrosion. Do not overtighten terminal connections. To prevent battery case damage caused by pressure build-up, be sure vent tube is properly routed and not kinked or obstructed.

WARNING

If battery fluid level is low, add distilled water only. Do not add acid.

5. Inspect the battery case for cracks or leaks.

ADJUSTMENT/TESTING

Use the following tests to determine the condition of a battery:

Specific Gravity Test

To make specific gravity test on all cells, use a quality hydrometer with a temperature correction feature.

1. Specific gravity tests must be made with correct electrolyte level in the battery. If electrolyte level is too low to test, add distilled water, then fully charge battery and allow to stand at least 1 hour before testing.

2. For accurate hydrometer readings, the float must be floating freely. Read hydrometer with eye at same level as fluid for accuracy. The specific gravity should remain the same for three successive hourly readings.

3. Specific gravity readings are accurate when the electrolyte temperature is 80° F. Adjust specific gravity readings for temperatures other than 80° F. as follows:

   a. For each 10° F. above 80° F., add four gravity points (0.004) to the actual reading.

   b. For each 10° F. below 80° F., subtract four gravity points (0.004) from the actual reading.

Example:

Hydrometer reading	1.225
Electrolyte temperature 90° F.	
Adjustment for temperature	+ 0.004
Accurate specific gravity	1.229

BATTERY CHARGE CONDITION

State of Charge	Specific Gravity (A)
100%	1.270-1.280
75%	1.240-1.260
50%	1.210-1.230
25%	1.170-1.190

4. If the specific gravity between the highest and lowest cell varies 50 (0.50) points or more, the battery should be replaced.

5. Make sure vent tube is securely attached to the battery vent nipple.

Load Testing (Figure 8-18)

Fully charge the battery before testing. Load battery to 3 times Ampere-hour rating, using a suitable tester. Voltage reading after 15 seconds should be 9.6 volts or more.

Attach load tester as shown.

WARNING

Do not leave any load switch turned on for more than 20 seconds or overheating and tester damage are possible.

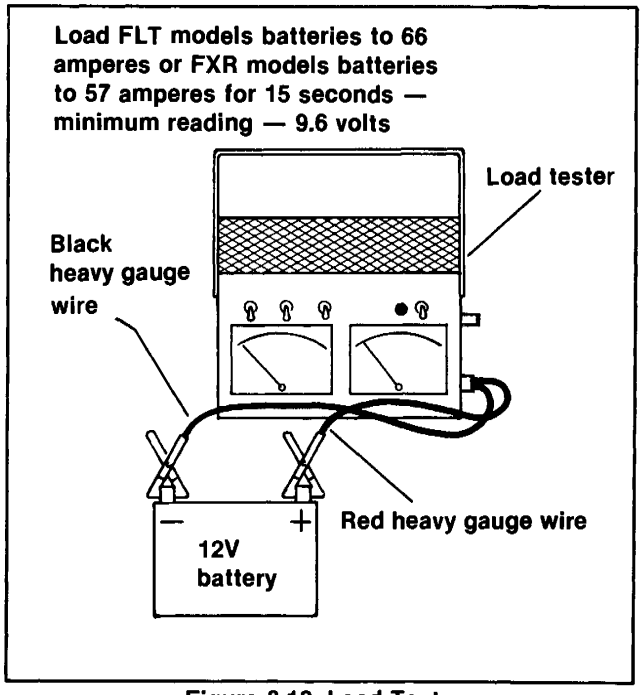


Figure 8-18. Load Test

Charging

Never allow a battery to remain in a discharged condition. Start charging it at once at the recommended continuous charge rate. Be sure charger is properly connected and adjusted observing positive (+) and negative (–) polarity to battery.

To determine the condition of a battery charge, check solution in each cell with a battery hydrometer. When hydrometer reading is 1.200 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 6 AMP AUTOMATIC CHARGER, Part No. 66485-81.

FLT - 12 volt 22 ampere hour battery - 2 amperes
FXR - 12 volt 19 ampere hour battery - 2 amperes

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 specified above. Charging at a higher rate such as a "quick charge" will cause the battery to overheat which will damage the battery. If battery gets hot, over 110°F, (44°C), discontinue charging and let battery cool. If battery gasses excessively, lower the charging rate and continue charging until required specific gravity reading is obtained.

WARNING

Batteries produce explosive hydrogen gas at all times — especially when being charged. Keep cigarettes, open flame, and sparks away from battery at all times. Ventilate area when charging battery. Always protect hands and protect eyes with shield or goggles when working near a battery or acid. KEEP BATTERIES AND ACID OUT OF THE REACH OF CHILDREN!

INSTALLATION

FLT Models (Figure 8-16)

1. Place the battery in the carrier with the positive post to the rear of the motorcycle.
2. Connect the positive cable (2) and the negative cable (1) as shown.
3. Connect the strap (3) to the carrier.
4. Install the side cover and saddlebag.

FXR Models (Figure 8-17)

1. Place battery in the carrier with positive post to the right side of the motorcycle.
2. Insert battery hold down bracket (3) into slots in frame and slide to the right of the motorcycle. Place lanyard (4) over screw as shown and tighten screw (2) and locknut (1).
3. Connect the positive cable and the red wire from the main circuit breaker as shown. Make sure red wire is routed behind battery carrier, not over the battery. Connect the negative cable and the vent hose.
4. Close the seat on hinged seat models or install seat on fixed seat models.

WARNING

Always make sure battery vent hose is routed away from exhaust pipes or mufflers. Sparks near end of hose could cause battery to explode.

HEADLAMP — FLT/C

GENERAL

The headlamps are a sealed type, specially designed for Harley-Davidson. When the headlamps burn out, use only direct replacement headlamps as specified in the Parts Catalog and in the electrical SPECIFICATIONS section of this Service Manual.

CAUTION

The use of any other headlamp, other than what is specified, could result in damage to the electrical system or battery discharge.

NOTE

If either filament burns out or if lens is broken, entire sealed beam unit must be replaced.

ADJUSTMENT

The headlamp beam must be adjusted for height and direction. To get the greatest efficiency from the headlamp and to meet the requirements of the law make the following adjustment in a darkened room or at night.

1. See Figure 8-19. 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 a straight alignment.

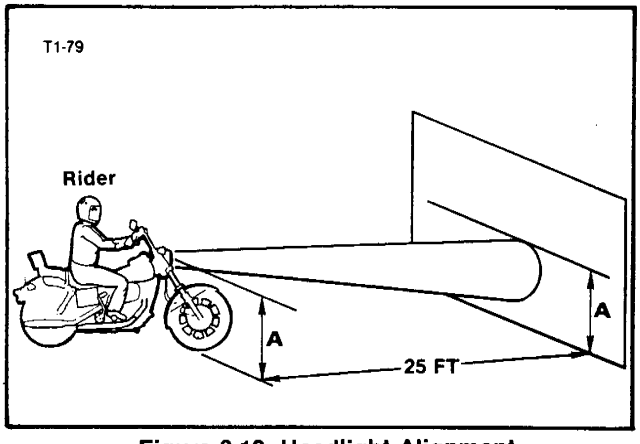


Figure 8-19. Headlight Alignment

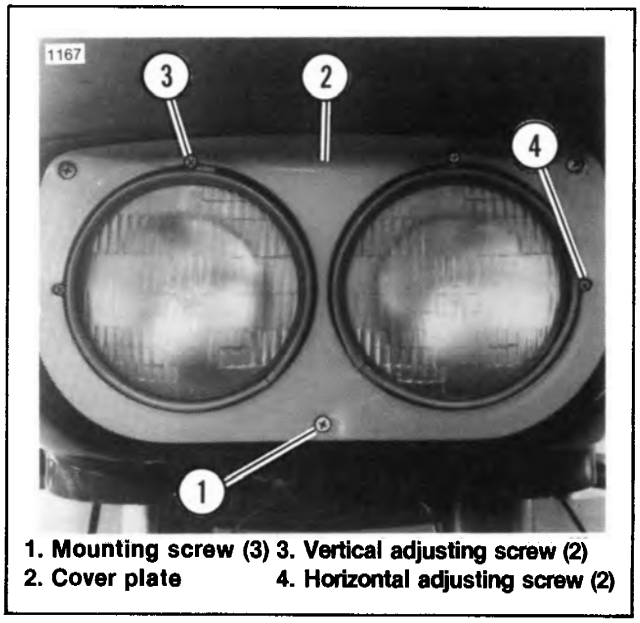
NOTE

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 slightly compress the fork.

2. Turn the 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. See Figure 8-20. If beam requires adjustment turn the vertical adjusting screws (3) until the top of the main beam of light is even with, but not higher than, the horizontal line.

   Turn horizontal adjusting screws (4) so the light beams shine straight ahead.

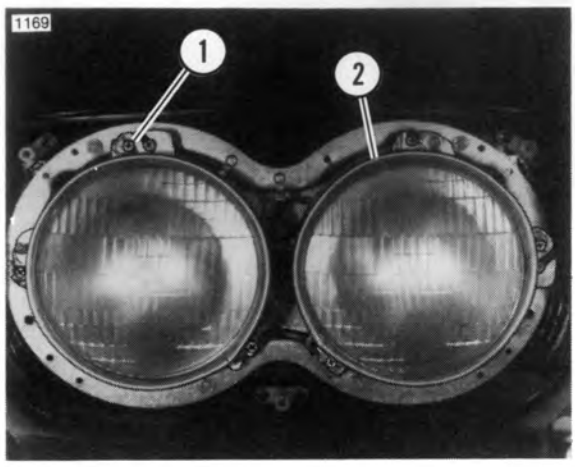


1. Mounting screw (3) 3. Vertical adjusting screw (2)
2. Cover plate 4. Horizontal adjusting screw (2)

Figure 8-20. Headlamp Cover Plate — FLT/C

REMOVAL

1. See Figure 8-20. Remove the three screws (1) and the cover plate (2). Be careful of loose spacers at two upper corners.



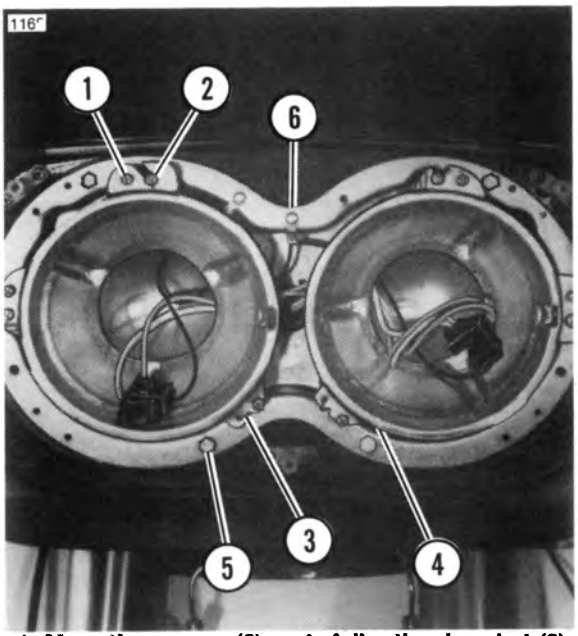
1. Retaining ring screw (6)
2. Retaining ring (2)

Figure 8-21. Removing Headlamp — FLT/C

2. See Figure 8-21. Loosen the retaining screws (1). Turn the retaining ring (2) and remove it.
3. Unplug the old light and discard.
4. See Figure 8-22. Remove the mounting screws (1), adjusting screws (2), springs (3) and adjusting brackets (4).
5. Remove the screws (5) and the headlamp housing (6).

INSTALLATION

1. See Figure 8-22. Coat the mating surface of the fairing and headlamp housing (6) with an RTV silicone sealant. Place the housing in the fairing and secure it with new screws (5).
2. Install the adjusting bracket (4) and secure them with springs (3), adjusting screws (2) and mounting screws (1). Plug in new headlamp.
3. See Figure 8-21. Reinstall the ring (2) and tighten the screws (1).
4. See Figure 8-20. Install the cover plate (2) and screws (1). Adjust the headlamps as described under ADJUSTMENT.



1. Mounting screw (6)
2. Adjusting screw (4)
3. Spring (2)
4. Adjusting bracket (2)
5. Housing screw (4)
6. Headlight housing

Figure 8-22. Removing Headlamp Housing — FLT/C

HEADLAMP — FLHT/C, FLHS

GENERAL

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.

ADJUSTMENT

The headlamp beam must be adjusted for height and direction. To get the greatest efficiency from the headlamp and to meet the requirements of the law make the following adjustment in a darkened room or at night.

1. See Figure 8-19. 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 a 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 slightly compress the fork.

2. Turn the 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. See Figure 8-23. If beam requires adjustment turn top adjusting screw (7) in or out to raise or lower the top of the main beam of light so it is even with, but not higher than, the horizontal line.

4. Turn adjusting screw (7) on left side of headlamp so main light beam shines straight ahead.

REMOVAL

1. See Figure 8-23. Remove headlamp door screw (1) and headlamp door (2). It may be necessary to loosen and tip the fairing to remove the door on 1985 and earlier models.

2. Remove the three retaining ring screws (4) and retaining ring.

3. Remove headlamp body (5) and unplug connector (6).

4. Remove rubber boot (9), press wire clip together and remove bulb (10).

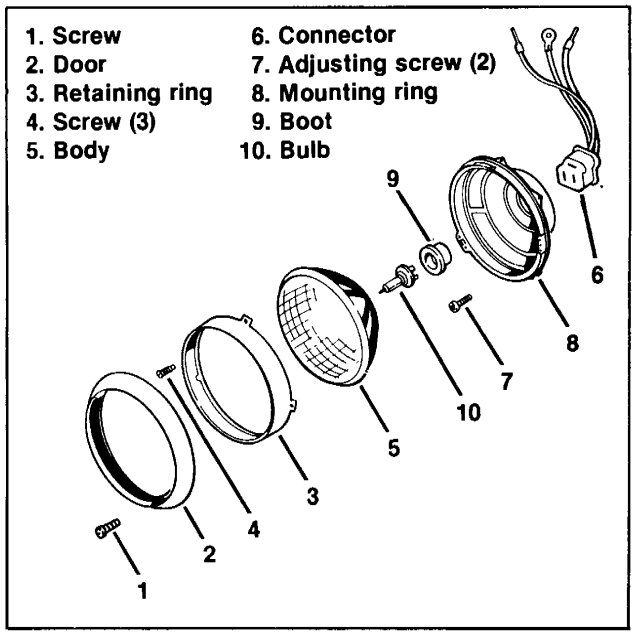


Figure 8-23. Headlamp Assembly — FLHT/C

INSTALLATION

1. See Figure 8-23. Install new bulb into headlamp body (5) and secure with clip.

2. Plug connector (6) into bulb and install in housing. Adjust light beam as described under ADJUSTMENT.

3. Secure headlamp to housing with retaining ring (3) and screws (4).

4. Install headlamp door (2) with screw (1).

HEADLAMP — FXR, FXRS/SE/SP/CON

GENERAL

The headlamp is a sealed type, specially designed for Harley-Davidson. When the headlamp burns out, use only direct replacement headlamps as specified in the Parts Catalog and in the electrical SPECIFICATIONS section of this Service Manual.

CAUTION

The use of any other headlamp, other than what is specified, could result in damage to the electrical system or battery discharge.

NOTE

If either filament burns out or if lens is broken, entire sealed beam unit must be replaced.

ADJUSTMENT

The headlamp beam must be adjusted for height and direction. To get the greatest efficiency from the headlamp and to meet the requirements of the law make the following adjustment in a darkened room or at night.

1. See Figure 8-19. 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 a straight alignment.

NOTE

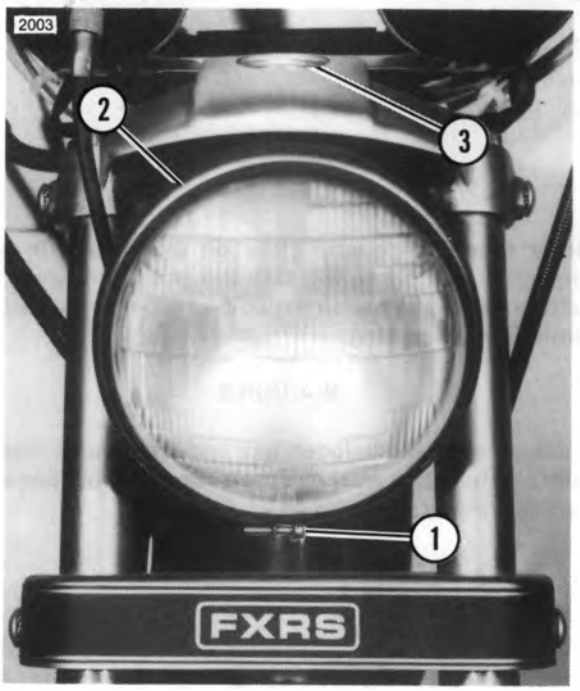
To properly adjust the headlamp it will be necessary to have someone of about the same weight as the rider seated on the motorcycle because the weight of the rider will slightly compress the fork.

2. Turn the 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. See Figure 8-24. If beam requires adjustment remove snap plug on top of headlamp housing and loosen nut (3).

4. Tilt headlamp up or down so the top of the main beam of light is even with, but not higher than, the horizontal line. At the same time, turn headlamp left or right so the light beam shines straight ahead.

5. Tighten nut (3) making sure not to move the headlamp in the process.



1. Screw
2. Molding ring
3. Nut

Figure 8-24. Headlamp — FXR, FXRS/SE/SP

REMOVAL (Figure 8-24)

Remove the screw (1) and front molding ring (2). Remove the sealed beam unit from the rubber mounting ring and disconnect the terminal block from the rear of the sealed beam unit.

INSTALLATION (Figure 8-24)

1. Install new sealed beam by reversing REMOVAL procedure. Make sure contacts in terminal block are clean to ensure good electrical connection.

2. Adjust headlamp as described under ADJUSTMENT.

HEADLAMP — FXRT, FXRD

GENERAL

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 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.

ADJUSTMENT

The headlamp beam must be adjusted for height and direction. To get the greatest efficiency from the headlamp and to meet the requirements of the law make the following adjustment in a darkened room or at night.

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 a straight alignment.

NOTE

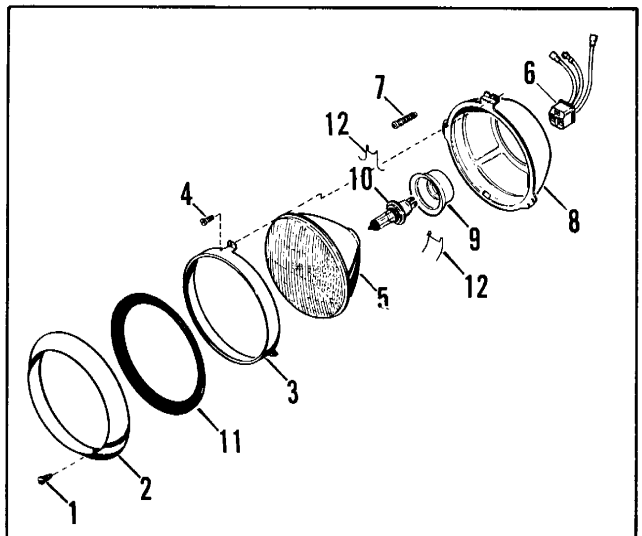
To properly adjust the headlamp it will be necessary to have someone of about the same weight as the rider seated on the motorcycle because the weight of the rider will slightly compress the fork.

2. See Figure 8-19. 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 remove screws holding clear plastic headlamp cover on fairing and remove cover.

4. See Figure 8-25. Turn top adjusting screw (7) in or out to raise or lower the top of the main beam of light so it is even with, but not higher than, the horizontal line.

   Turn adjusting screw (7) on left side of headlamp so main light beam shines straight ahead.



1. Screw
2. Door
3. Retaining ring
4. Screw (3)
5. Body
6. Connector
7. Adjusting screw (2)
8. Mounting ring
9. Boot
10. Bulb
11. Gasket
12. Spring (2)

Figure 8-25. Headlamp Assembly — FXRT

REMOVAL (Figure 8-26)

1. From the rear of the fairing, unplug the connector.
2. Remove rubber boot, press wire clip together and remove bulb.

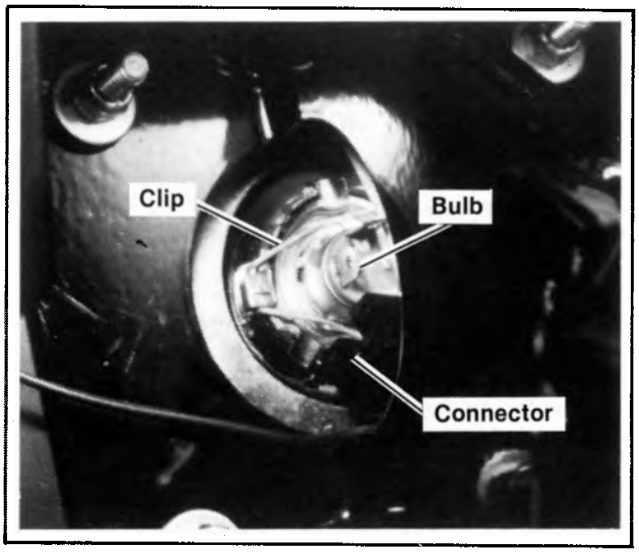


Figure 8-26. Bulb Replacement — FXRT

INSTALLATION

1. Install new bulb into housing and secure with wire clip.
2. Replace rubber boot and plug in the connector.

HEADLAMP — FXLR

GENERAL

The headlamp is a sealed type, specially designed for Harley-Davidson. When the headlamp burns out, use only direct replacement headlamps as specified in the Parts Catalog and in the electrical SPECIFICATIONS section of this Service Manual.

CAUTION

The use of any other headlamp, other than what is specified, could result in damage to the electrical system or battery discharge.

NOTE

If either filament burns out or if lens is broken, entire sealed beam unit must be replaced.

ADJUSTMENT

The headlamp beam must be adjusted for height and direction. To get the greatest efficiency from the headlamp and to meet the requirements of the law make the following adjustment in a darkened room or at night.

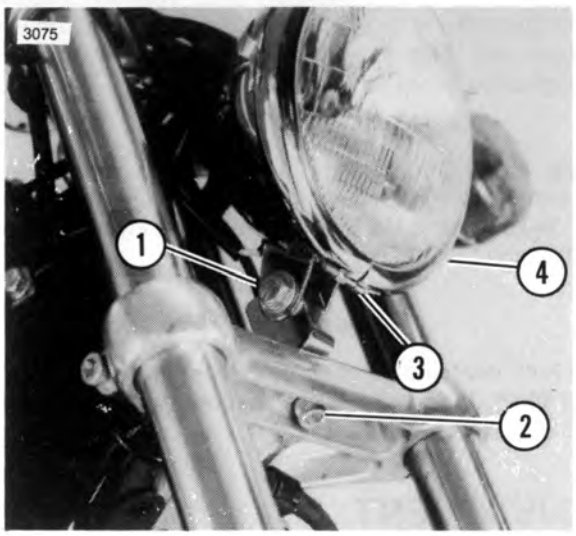
1. See Figure 8-19. Have the motorcycle standing on a level surface with tires correctly inflated about 25 feet from, and headed toward a wall or screen upon which a horizontal line has been drawn at exactly the same height as the headlamp center. The motorcycle must be resting on both wheels and the front wheel must be in a 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 slightly compress the fork.

2. Turn the 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. See Figure 8-27. If beam requires adjustment, loosen bolt (2) for horizontal adjustment and bolt (1) for vertical adjustment.



1. Adjusting bolt (vertical)
2. Adjusting bolt (horizontal)
3. Screw
4. Molding ring

Figure 8-27. Headlamp Adjustment — FXLR

4. Tilt headlamp up or down so the top of the main beam of light is even with, but not higher than, the horizontal line. At the same time, turn headlamp left or right so the light beam shines straight ahead.

5. Tighten bolts (1) and (2) to 30-35 ft-lbs torque making sure not to move the headlamp in the process.

REMOVAL (Figure 8-27)

Remove the screw (3) and front molding ring (4). Remove the sealed beam unit from the rubber mounting ring and disconnect the terminal block from the rear of the sealed beam unit.

INSTALLATION (Figure 8-27)

1. Install new sealed beam by reversing REMOVAL procedure. Make sure contacts in terminal block are clean to ensure good electrical connection.

2. Adjust headlamp as described under ADJUSTMENT.

TURN SIGNALS

GENERAL

NOTE

If after replacing a bulb, the turn signal still will not light, check the wiring, the switch and the flasher. All 1989 and later FLT models are equipped with an electronic self-cancelling turn signal controller.

1984 - 1987 — FLT/C, FXRT, FXRD

The front turn signal lights are built into the fairing. To change the bulb, unlock the storage compartment on whichever side the bulb is burnt out. Reach in and remove socket. Push in and turn the bulb 1/4 turn counterclockwise and pull it out of the socket. Replace the bulb and install the socket into the housing.

1988 FLTC

The front turn signals are mounted on the lower fairing brackets. See FLHT/C, FLHS-Front for service instructions.

FLT/C, FXRT, FXRD, FLHT/C, FLHS

The rear turn signals are mounted to a light bar at the rear of the saddlebags. To change a bulb, remove the lens, turn the bulb 1/4 turn and remove it. Replace the bulb and install the lens. The lens may be indexed with the lamp.

FLHT/C, FLHS — Front (Figure 8-30)

1. To replace the front bulb, remove the screws (4) and the amber lens. Push in and turn the bulb 1/4 turn counterclockwise.

2. Make sure contacts in socket are clean to ensure a good electrical contact. Replace the bulb and install the lens with screws (4). The lens may be indexed with the lamp.

FXR, FXRS/SE/SP

Front and rear turn signals are located behind the amber lens. Remove the lens and push in and turn the bulb 1/4 turn counterclockwise to remove it. Make sure contacts in socket are clean to ensure good electrical contact. Replace the bulb and install the lens. The lens may be indexed with the lamp.

TURN SIGNAL FLASHER

GENERAL

All 1989 and later FLT models are equipped with an electronic turn signal canceler that does not require a flasher.

See Figure 8-28. A new turn signal flasher, Part No. 68543-64B, was used in late 1986 and later motorcycles. The new flasher is round (cylindrical shaped) and will retrofit or replace the earlier rectangular shaped flasher. The existing mounting clip will hold the new flasher. A blue stripe on the circumference of the flasher distinguishes it from the 4-way flasher.

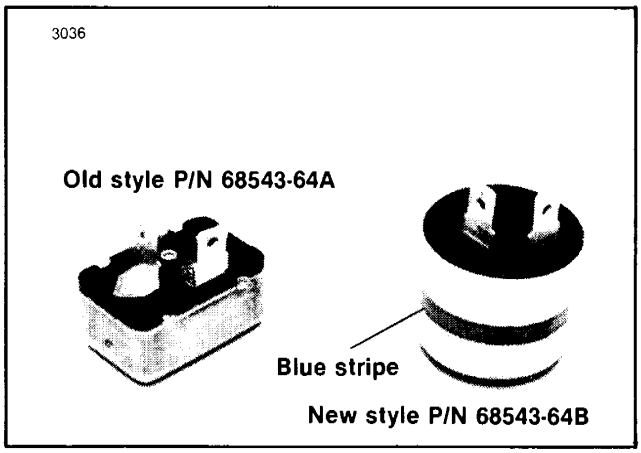


Figure 8-28. Turn Signal Flashers

WARNING

Do not use round 4-way flasher, Part No. 68541-64A, in the turn signal circuit. The electrical characteristics of the 4-way flasher will cause incorrect turn signal operation.

TROUBLESHOOTING

If both right and left front and rear turn signals do not light or flash the flasher may be inoperative.

NOTE

On 1986 models, make certain that both left and right handlebar turn signal switches are not latched in the ON position. With both switches ON the flasher is overloaded and will not function properly.

REMOVAL

All FXR Models — Except FXRT, FXRD and FXLR

1. Remove headlamp sealed beam unit. See REMOVAL, Headlamp in this section.
2. See Figure 8-29. Remove wires from flasher and pull flasher from mounting clip.

Figure 8-29. Flasher Installation

FXRT, FXRD

Flasher is mounted above headlamp inside fairing.

1. Remove speedometer — tachometer instrument panel following procedure in Section 2, INSTRUMENTS AND GAUGES.
2. Reach through instrument panel opening in fairing and remove wires from flasher and pull flasher from mounting clip.

FXLR

Flasher is mounted above carburetor on upper engine mount stabilizer bracket. Disconnect wires from flasher and pull flasher from mounting clip.

FLHT/C (1988 and Earlier)

The turn signal and hazard (4-way) flashers are mounted on the left end (as viewed through headlamp opening) of a bracket attached to the fork stem.

1. Remove complete headlamp assembly.
2. Reach through headlamp opening to remove wires from flasher and pull flasher from it's mounting clip.

FLT/C, FLHS (1988 and Earlier)

The turn signal and hazard flashers are mounted on the right end of a bracket attached to the fork stem.

1. Remove instrument panel following procedure in Section 2, INSTRUMENTS AND GAUGES.
2. Reach through instrument panel opening and remove wires from flasher and pull flasher from its mounting clip.

INSTALLATION

All FXR Models — Except FXRT, FXLR

1. See Figure 8-29. Insert new flasher in clip as shown. Flasher terminals must be positioned towards the rear of the headlamp housing.

CAUTION

Flasher must be positioned as shown to avoid interference with headlamp sealed beam unit. This interference could bend flasher terminals and dislodge flasher from mounting clip.

2. Connect wires and check turn signal operation.
3. Assemble headlamp.
4. Check headlamp adjustment following procedure given in this section.

FXRT, FXRD

1. Insert flasher in mounting clip.
2. Perform step 2 given for All FXR Models.
3. Install instrument panel.

FXLR

1. Install flasher in mounting clip.
2. Connect wires and check turn signal operation.

FLHT/C Models (1988 and Earlier)

1. Insert turn signal flasher or hazard flasher in their respective mounting clips.

NOTE

Hazard flasher must be installed in outer-left (as seen through headlamp opening) clip. Turn signal flasher must be installed inboard (to right) of hazard flasher.

2. Connect wires and check turn signal/4-way flasher operation.
3. Assemble headlamp.
4. Check headlamp adjustment following procedure given in this section.

FLT/C, FLHS (1988 and Earlier)

1. Insert turn signal or hazard flasher in their respective mounting clips.

NOTE

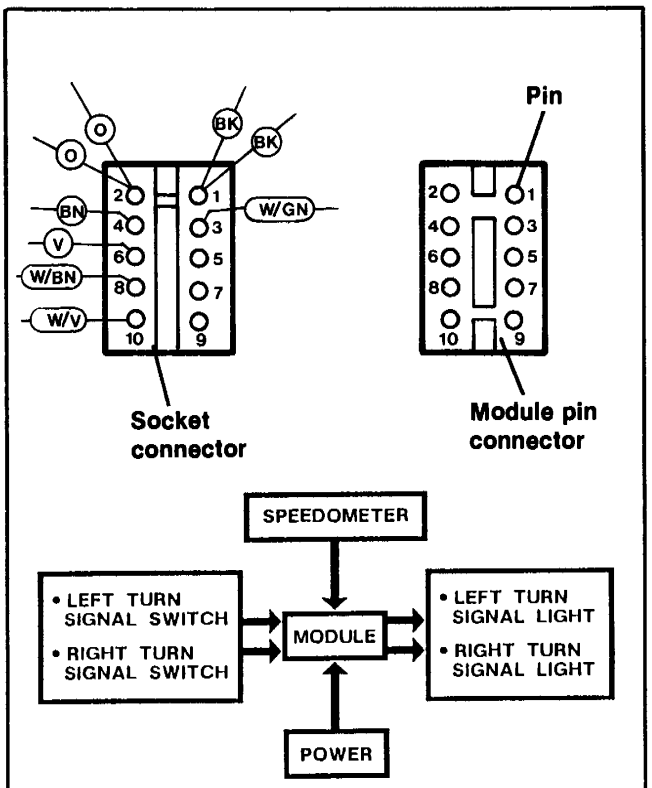
Hazard flasher must be installed in outer-right clip. Turn signal flasher must be installed inboard (to left) of hazard flasher.

2. Connect wires and check turn signal/4-way flasher operation.
3. Install instrument panel.

FLT TURN SIGNAL CANCELER (1989 AND LATER)

HOW-IT-WORKS

The turn signals and 4-way flashers are controlled by an electronic module attached to the upper right fork tube. The electronic module contains circuitry to generate pulses for "flashing" the appropriate lamps and eliminates both the directional and hazard flashers. See Figure 8-30. To explain the canceler operation, the following steps identify what happens when a rider signals for a left turn.



PIN NO.	DESCRIPTION/FUNCTION
1	Module ground to motorcycle
2	12vdc input from accessory circuit breaker
3	Speedometer reed switch input
4	Pulsed 12vdc for flashing right signal lights
5	Not used
6	Pulsed 12vdc for flashing left signal lights
7	Not Used
8	12vdc from right switch (when pressed)
9	Not used
10	12vdc from left signal switch (when pressed)

Figure 8-30. Turn signal Canceler

1. Pressing left turn signal switch causes a momentary 12 vdc to be applied to pin 10. The module sends a series of 12 vdc pulses (pin 6) to flash left front and rear signal lights.

2. The module monitors the number of speedometer reed switch closures at pin 3. These switch closures indicate the speed and the distance traveled. When the number of switch closures equals the quantity preset in module for the given speed, the left signal is canceled.

3. Pressing the right turn signal switch causes a momentary 12 vdc to be applied to pin 8 and an output at pin 4 identical to that described for a left turn.

NOTE

Parts and Accessory turn signal canceler kits for 1988 and earlier models will have the same functions at each pin, but the wire colors are different.

Manual or Rider Control

Turn signals may be canceled by pressing the turn signal switch a second time. Also, pressing the left turn signal switch, while the right turn signal lights are flashing will cancel the right turn lights and turn on left turn lights or vice-versa.

Hazard Flasher (4-Way)

To activate the hazard flashers, press and hold in both right and left turn signal switches for 1-1/2 seconds. To cancel hazard flashers, press and release right and left turn signal switches simultaneously.

TROUBLESHOOTING

See the following chart for troubleshooting procedure.

CAUTION

Do not apply 12vdc to module with pin 1 not connected to ground. Module burn-out will occur.

Problem	Cause	Solution
1. Right or left turn signals do not flash - front or rear lamp on in-operative side is lit, but does not flash. (Other side signals operate normally.)	1.1 Burned-out bulb.	1.1.1 Replace bulb that does not light and check for normal operation.
	1.2 Broken lamp wire.	1.2.1 Repair broken wire.
	1.3 Loose lamp socket (Where staked at housing.)	1.3.1 Replace lamp.
	1.4 Poor ground.	1.4.1 Scrape paint or replace ground wires.
	1.5 Corroded Contacts.	1.5.1 Clean bulb/socket. Apply grease to bulb contacts.
2. Turn signals on one side operate — other side inoperative.	2.1 Handlebar directional switch on in-operative side not functioning.	2.1.1 With ignition switch ON, press directional switch and measure voltage at pin 8 or 10. (See Figure 8-30 for applicable pin.) With switch pressed and held 12 vdc must be present at pin. Measure with positive probe at pin and negative probe connected to ground. If voltage is present go to 2.4.1.
	2.2 Broken or discon-nected wire in directional switch circuit	2.2.1 If no voltage is present, refer to Wiring Diagram and determine (using voltage or continuity checks) whether switch or wiring is faulty. Replace switch (See HANDLEBAR SWITCHES in Section 2) or repair wiring as needed.
	2.3 A possible combination of causes found in Problem 1.	2.3.1 See Problem 1. Solutions.
	2.4 Module malfunctioning.	2.4.1 If voltage was present in 2.1.1 and lamps and wires are good, but module does not generate pulses, module is bad and must be replaced.

Problem	Cause	Solution
3. Turn signals and hazard flashers are inoperative	3.1 No power (12vdc) at at pin 2 of module due to "bad" accessory circuit breaker, starter relay, ignition switch or main circuit breaker or the connecting wiring.	3.1.1 Refer to Wiring Diagram and check for 12 vdc on load side of accessory circuit breaker. Use voltage or continuity checks. Isolate the "bad" component or broken wire. Replace bad component or repair broken wire.
	3.2. Pin 1 of module not connected to ground at anti-dive manifold.	3.2.1 Check for ground with ohmmeter. Clean and tighten ground connections or repair broken ground wires. **CAUTION** **Operating module without pin 1 grounded will cause module to burn out.**
4. Turn signals do not cancel.	4.1 No reed switch signal at Pin 3 of module.	4.1.1 Check for speedometer reed switch input at Pin 3 of module. Connect ohmmeter to W/GN lead and ground. Spin front wheel or turn speedometer cable. Ohmmeter must alternate between '0' ohms and infinity. Check for broken wire or "bad" reed switch if above ohmmeter reading is not obtained. If reed switch signal is present module is bad. *NOTE* *Reed switch signal is also used to control Sound System volume and cruise control speed on 1990 Ultra models.*
	4.2 Bad module.	4.2.1 Replace module.

REMOVAL/INSTALLATION

The turn signal electronic module is attached to the right upper fork tube with cable straps. Cut cable straps to remove. To install, plug-in socket connector and attach to right fork tube with new cable straps.

PASSING LAMPS — FLHT/C, FLHS

ADJUSTMENT (Figure 8-31)

Passing lamps are mounted on a swivel block. To adjust the passing lamp proceed as follows:

1. Remove the two screws (3) on turn signal bracket.
2. Loosen nut inside turn signal bracket and adjust lamp to desired position.

NOTE

Passing lamps should shine straight ahead with the top of the main light beam just below a line on a wall 25 ft. away. The line should be horizontal at the same height as the center of the passing lamps.

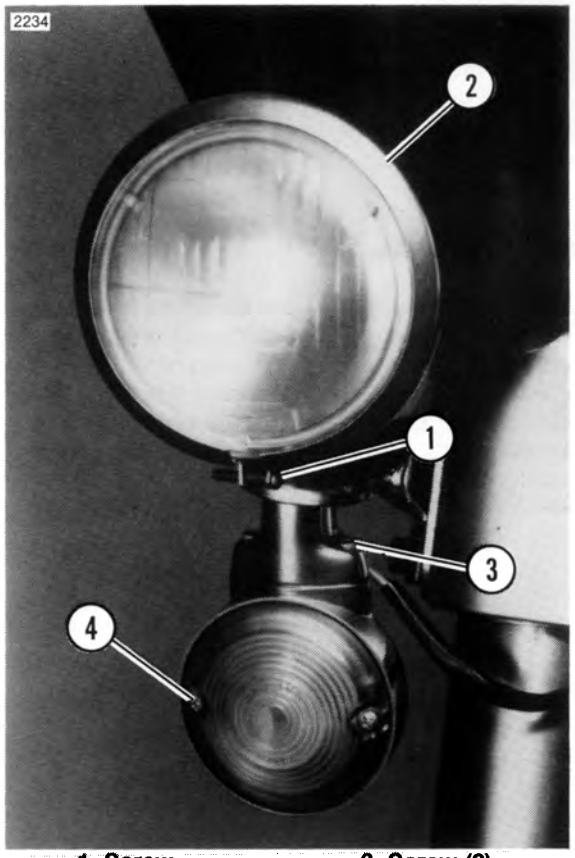
3. Tighten nut to 4 ft-lbs torque while holding lamp in place.
4. Install turn signal on bracket using two screws (3).

REMOVAL (Figure 8-31)

Remove screw (1) and door (2). Disconnect wires from back of sealed beam unit and discard faulty sealed beam unit.

INSTALLATION (Figure 8-31)

Install new sealed beam in housing. Install door (2) and screw (1).



1. Screw
2. Door
3. Screw (2)
4. Screw (2)

Figure 8-31. Passing Lamp and Turn Signal — FLHT/C, FLHS

IGNITION/LIGHT SWITCH

GENERAL

WARNING

DO NOT modify the ignition/light switch wiring to circumvent the automatic-on headlight feature. High visibility is an important safety consideration for motorcycle riders.

FLT MODELS

The FLT ignition/light switch/fork lock is located at the base of the instrument panel. The switch portion of this switch/fork lock combination is not repairable and must be replaced if it does not work properly. See IGNITION/FORK LOCK ASSEMBLY in section 2 of this service manual for further servicing procedures for the ignition/light switch.

FXR MODELS

The FXR ignition/light switch is located below the fuel tank on the left side of the motorcycle. This switch is not repairable and must be replaced if it does not work properly. Always make sure wires do not contact the frame or engine causing an electrical short.

HORN

FLT Models

The horn is located on the left side of the engine and is mounted to the choke cable mounting bracket.

FXR Models

The horn is located under and mounted to the bottom of the battery box, just ahead of the rear wheel.

If the horn fails to sound or does not function satisfactorily, check for loose, frayed or damaged wiring at the horn. If the wiring appears to be good, proceed as follows:

1. Disconnect the GREEN (FLT) or TAN (FXR) wire at the horn.
2. Connect a voltmeter — Positive (+) lead to wire terminal, Negative (−) lead to ground.
3. Turn the ignition switch ON. Depress the horn switch. If battery voltage is present, the horn or horn grounding is damaged; If battery voltage is not present, either the horn switch or wiring to the horn is faulty.
4. If you have determined that the horn is damaged, it must be replaced as an assembly because it is non-repairable. If the horn switch is faulty, replace it following the procedure in Section 2 of this service manual under HANDLEBAR CONTROLS AND INSTRUMENTS.

CIGARETTE LIGHTER

The 1989 and later Ultra models are equipped with a cigarette lighter. The lighter is located to the right of the oil pressure gauge on the FLTC Ultra and above the oil pressure gauge on the FLHTC Ultra.

TROUBLESHOOTING

1. Ignition switch must be "ON" or in Accessory position for lighter operation.
2. If lighter does not work, substitute a known good lighter element.
3. If lighter is still inoperative, check for 12vdc at center of socket and ground at outer shell.
4. Refer to applicable Wiring Diagram at rear of manual if 12vdc or ground are not present. Use voltage checks to isolate problem.

REMOVAL

FLTC Ultra

1. To remove lighter socket, the headlamp housing must be removed.
2. Reach through headlamp opening, disconnect wires from lighter shell. Place a finger in the lighter socket and unscrew the outer shell (housing) securing the socket.
3. Remove socket from rear (rider side) of fairing.

FLHTC Ultra

1. The outer fairing must be removed to reach lighter socket. See Section 2 for outer fairing removal instructions.
2. Disconnect wires from lighter shell. Place a finger in the lighter socket to hold it, while unscrewing the outer shell that secures socket.
3. Push socket to rear and remove from rider side of fairing.

INSTALLATION

Reverse REMOVAL instructions to install lighter socket.

CRUISE CONTROL — ULTRA MODELS - 1989, 1990

HOW-IT-WORKS

The Cruise Control System is an electronic servo system that provides automatic vehicle speed control.

System Diagram and Operation

1. See Figure 8-32. To illustrate how the system works, the following steps explain how to engage, allow the cruise control to control speed and disengage the system.

2. While riding in fourth or fifth gear, turn CRUISE switch "ON". Power is supplied through a 2 ampere (amp) fuse to the electronics module.

NOTE

On 1990 models, the servo cable is connected directly to the carburetor.

6. The electronics module will continually monitor the engine rpm and electrically signal the servo motor to open or close the throttle to keep the rpm constant on 1989 models. On 1990 models, the electronics module monitors the engine rpm and the speedometer reed switch signal. The module signals the servo motor to open or close the throttle to keep the speedometer reed switch signal constant. The engine rpm is monitored to detect engine - over speed which will cause cruise disengagement. (See next paragraph.)

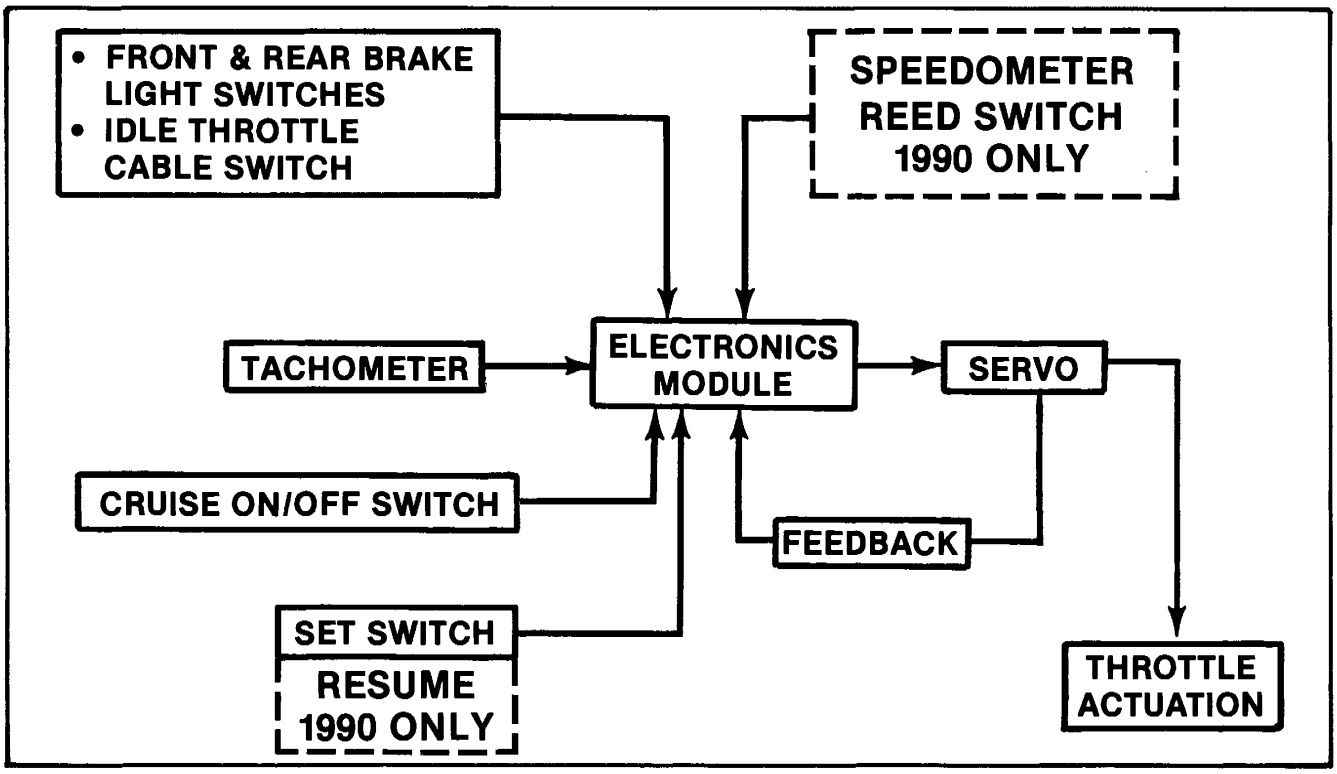


Figure 8-32. Cruise Control System Diagram

3. With motorcycle traveling at the desired "cruise" speed (40 mph or greater) momentarily press the "SET" switch on right handlebar control on 1989 models or press "RESUME/SET" switch down on 1990 models.

4. The electronics module responds to the SET switch input by "reading" the tach input on 1989 models or the speedometer reed switch input on 1990 models. The read rpm or reed switch signal becomes the desired speed.

5. The electronics module sends a signal to the servo to engage the electro-magnetic clutch and drive the rack inward to take up the slack in the servo-to-throttle-bracket cable on 1989 models.

7. The cruise control will disengage (servo clutch disengages and rack moves to full out position) when the electronics module receives any of the following inputs:
   a. Front or rear brake is applied.
   b. Throttle is "rolled back" (closed) actuating idle cable switch.
   c. Motorcycle clutch disengaged, module senses too great an increase in rpm.
   d. Cruise ON/OFF switch turned OFF.
   e. Engine STOP switch turned OFF. (This removes tachometer input signal and module disengages.)

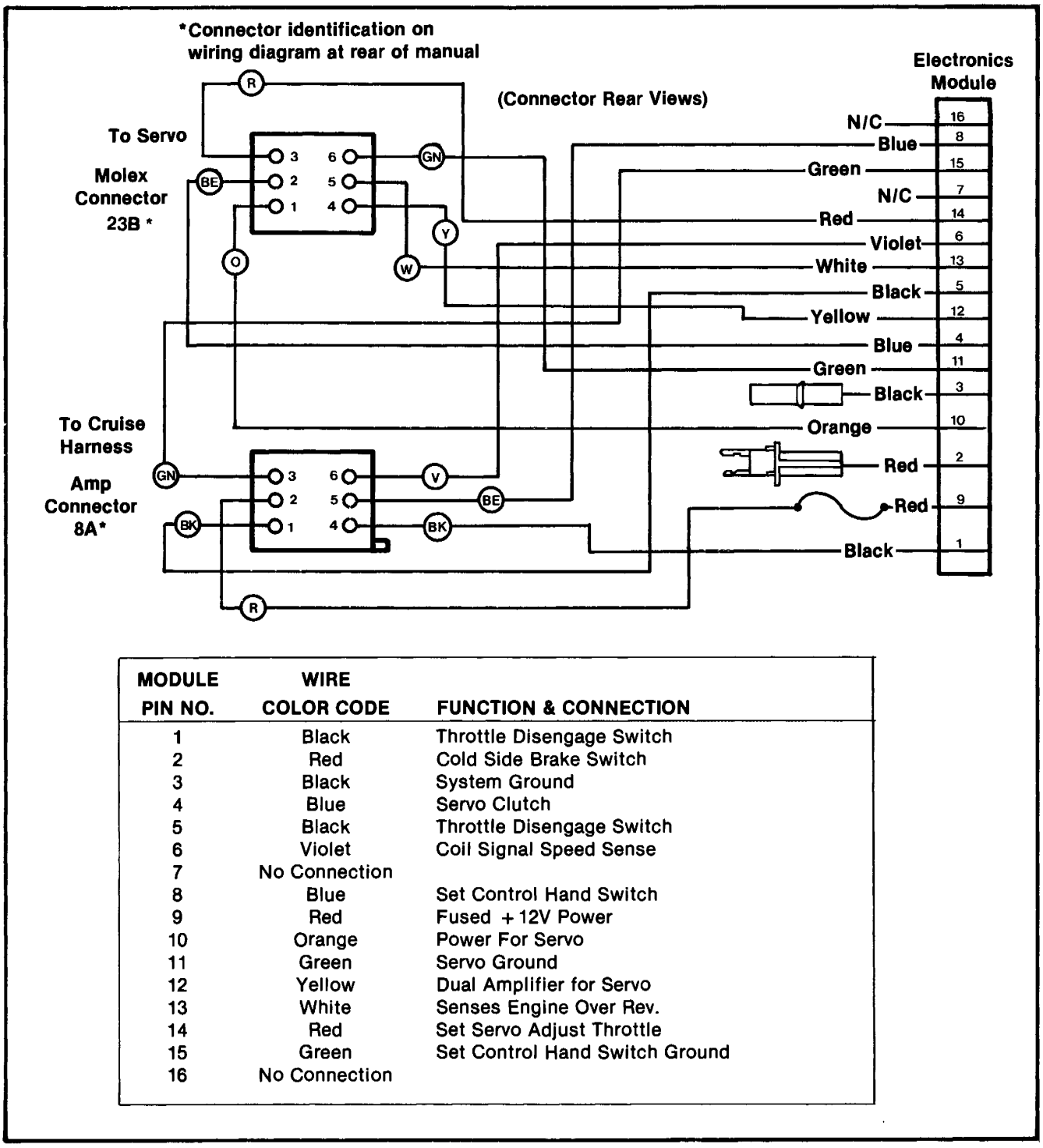
Troubleshooting (Figure 8-33 for 1989 models, 8-33A for 1990 models)

If the Cruise Control is inoperative, refer to the following troubleshooting chart. Connector references such as "8A" refer to the connector identification used in the wiring diagrams at rear of this manual.

CAUTION

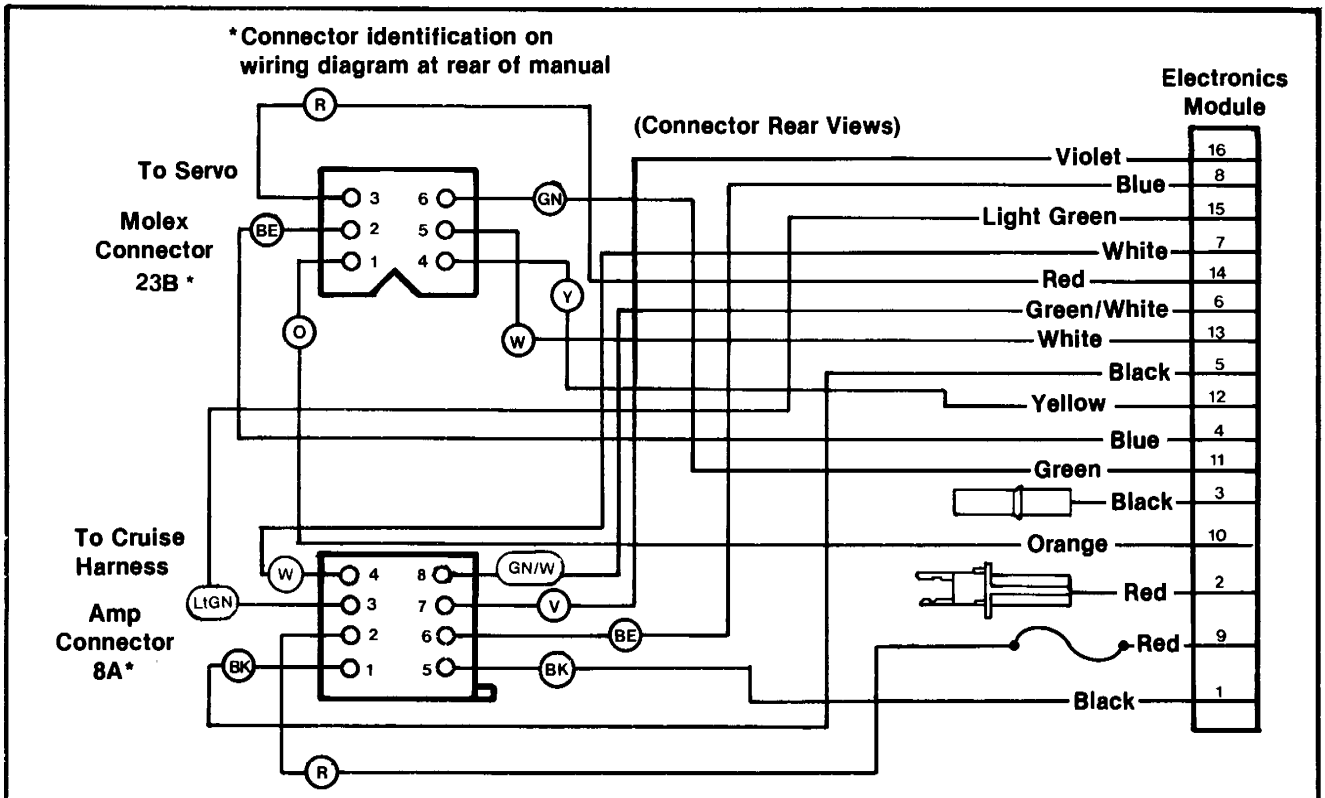
Both electronics module and servo are sealed nonrepairable components. Evidence of disassembly may void warranty.

Problem	Cause	Solution
1. No indicator light with Cruise ON/OFF switch "ON"- Cruise control operates.	1.1 Filament in indicator is burnt-out.	1.1.1 On FLTC Ultra, replace indicator. On FLHTC Ultra replace rocker switch.
	1.2 Poor ground for indicator bulb.	1.2.1 Correct poor ground.
2 Same as 1. above, but Cruise Control does not operate.	2.1 Power (12 vdc) not present at switch. Switch wired wrong. or Inoperative Cruise ON/OFF switch.	2.1.1 Remove seat. See Figure 8-33 for 1989 models or Figure 8-33A for 1990 models. With voltmeter or test lamp check between red wire (pin 2 of 6-pin Amp connector) and ground. With ignition switch ON, test lamp must go on and off with Cruise Switch ON and OFF or voltmeter must read 9-12 vdc with Cruise and ignition switches ON. If voltage is not present on red wire, remove Cruise ON/OFF switch, check wiring against wiring diagram at rear of this manual and verify switch is ok. Correct switch hook-up or replace switch if bad.
3.1 Cruise Control will not SET (System inoperative).	3.1 Blown (2 amp cartridge) fuse in red lead near electronics module.	3.1.1 Replace 2 amp cartridge fuse.
	3.2 Brake light filaments burnt-out in taillight and both Tour Pak lights. All three filaments must be open or burnt-out.	3.2.1 Check brake light bulbs in taillight and both wrap-around Tour-Pak lights Replace burnt-out bulbs.
	3.3 Brake lights constantly ON.	3.3.1 Check for shorted rear brake light switch or a binding or shorted front brake light switch. Replace shorted brake light switch or eliminate binding in front brake light switch.
	3.4 Idle throttle cable adjusted too tight causing disengage switch to close, connecting pin 1 to pin 5 on electronics module.	3.4.1 Refer to throttle cable adjustment section following this troubleshooting chart.
	3.5 See Figure 8-33 or 8-33A. System not grounded. Pin 3 on electronics module must be grounded and pin 11 provides ground for servo.	3.5.1 Check that black lead from pin 3 is connected through 1-pin connector to ground. Ohmmeter must indicate 0.5 ohm or less at pins 3 & 11. Tighten ground screw or repair loose wires as needed.



MODULE PIN NO.	WIRE COLOR CODE	FUNCTION & CONNECTION
1	Black	Throttle Disengage Switch
2	Red	Cold Side Brake Switch
3	Black	System Ground
4	Blue	Servo Clutch
5	Black	Throttle Disengage Switch
6	Violet	Coil Signal Speed Sense
7	No Connection	
8	Blue	Set Control Hand Switch
9	Red	Fused +12V Power
10	Orange	Power For Servo
11	Green	Servo Ground
12	Yellow	Dual Amplifier for Servo
13	White	Senses Engine Over Rev.
14	Red	Set Servo Adjust Throttle
15	Green	Set Control Hand Switch Ground
16	No Connection	

Figure 8-33. Cruise Control Wiring — 1989

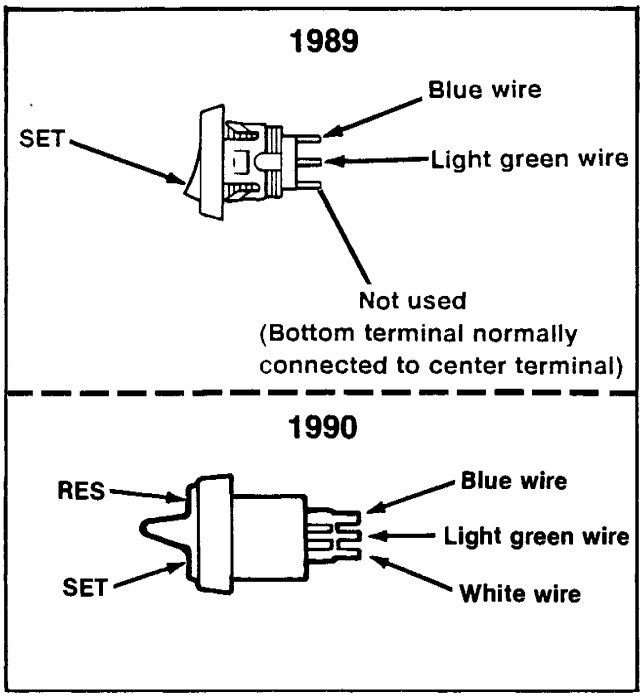


MODULE PIN NO.	WIRE COLOR CODE	FUNCTION & CONNECTION
1	Black	Throttle Disengage Switch
2	Red	Cold Side Brake Switch
3	Black	System Ground
4	Blue	Servo Clutch
5	Black	Throttle Disengage Switch
6	Green/White	Speedometer Reed Switch Input
7	White	Resume/Set Control Handlebar Switch
8	Blue	Resume/Set Control Handlebar Switch
9	Red	Fused + 12V Power
10	Orange	Power For Servo
11	Green	Servo Ground
12	Yellow	Dual Amplifier for Servo
13	White	Senses Engine Over Rev.
14	Red	Set Servo Adjust Throttle
15	Light Green	Set Control Handlebar Switch Ground
16	Violet	Coil (tachometer) Input

Figure 8-33A. Cruise Control Wiring — 1990

Problem	Cause	Solution
3. Cruise Control will not SET (System inoperative).	3.6 On 1989's, tach signal not being received by electronics module at pin 6 on 6-pin connector (also pin 6 on electronics module). *NOTE* *On 1990 models tach. signal not present at pin 7 of 8-pin connector (pin 16 on electronics module.)*	3.6.1 With ignition switch ON, not in Accessory and engine not running, 9-12 vdc must be present at Pink wire socket 6 of connector 8B on 1989 models or socket 7 of connector 8B on 1990 models. *NOTE* *If rotor is lined up with sensor, 0 vdc will be present. "Bump" starter button to move rotor slightly or push motorcycle while in gear to move rotor. Compare voltage at socket with voltage at tach coil connection.* If voltage is not present, check that 1-pin connector on pink wire in front harness is connected.
	3.7 Reed switch signal not present at pin 8 of 8-pin connector on 1990 models.	3.7.1 Connect one lead of ohmmeter to pin 8 of 8-pin connector 8 A and other lead to ground. Raise front wheel and spin wheel to drive speedometer. Ohmmeter must fluctuate between zero ohms and infinity. If ohmmeter reading does not fluctuate, check that white/green wire with 1-pin connector is connected to connector 20B. If 1-pin connector is connected, reed switch may be inoperative or not grounded or the connecting wires may be broken. Refer to wiring diagram at rear of this manual to isolate problem.
	3.8 Set-switch signal not reaching electronics module due to bad switch or disconnected wire.	3.8.1 Connect ohmmeter to green and blue wires at 6-pin (1989) or 8-pin (1990) connector 8A. Press SET (1989) or press RES/SET downward (1990). Ohmmeter must indicate 0.5 ohm or less. If above reading is not present, check that 2-pin (1989) or 3-pin (1990) connector 17A & B is connected and SET switch is operating properly. Plug-in connector or replace switch as required. See sketch in 3.9.1 for correct switch hookup.

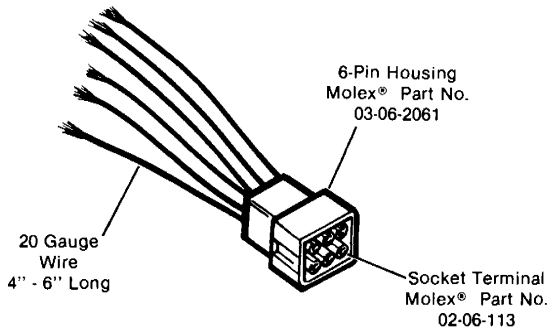
Problem	Cause	Solution
3. Cruise Control will not RES (Resume) 1990 (System inoperative).	3.9 Resume signal not reaching electronics module due to bad switch contacts or wiring.	3.9.1 Connect ohmmeter to light green and white wires at 8-pin connector 8A. Move paddle switch up (RES), ohmmeter must indicate 0.5 ohm or less. If preceding reading is not present, check that 3-pin connector 17A &B is connected and RES portion of SET/RES switch is operating properly. Plug-in connector or replace switch as required. The following sketch shows proper switch hookup.
3. Cruise Control will not SET or RES (Resume) 1990 (System inoperative).	3.10 Motorcycle speed less than 40 mph.	3.10.1 Inform rider that cruise will not engage (SET) below 40 mph.
	3.11 RESUME will not activate if speed of motorcycle has changed more than 10 mph from last SET speed.	3.11.1 Inform rider that speed of motorcycle must be increased or decreased to within 10 mph of last SET speed for RESUME to activate.
	3.12 Small 6-pin Molex connector unplugged from servo.	3.12.1 Install plug.



Sketch 1.

Problem	Cause	Solution
	3.13 Incorrect or broken brake light wiring.	3.13.1 Place positive lead of voltmeter in socket half of red wire 1-pin connector and negative voltmeter lead to ground. With ignition switch ON and either brake applied, voltmeter must indicate 9-12 vdc. If no reading is obtained, check for incorrect or broken wiring.
3. Cruise Control will not SET or RES (Resume) 1990 (System inoperative).	3.14 Servo malfunction.	3.14.1 See Figure 8-33 or 8-33A. Unplug Molex connector 23 A& B. See Sketch 2 below. Connect Servo Test Adapter (Molex socket connector half with six 4-1/2 in. wires the same colors as used in the module to servo harness) to the servo and perform the following: A. Connect ohmmeter to red and white wires on Servo Test Adapter. With rack extended (throttle closed) ohmmeter must indicate 5Kohms-8Kohms. Lock throttle open. (A "bungee cord" wrapped around throttle grip and anchored on mirror stem may be used.) See Figure 8-38. Remove nuts (1), push cable housing (2) forward and push rack of servo motor in using a stiff feeler gauge or equivalent. With rack in (throttle open) ohmmeter must indicate 1500-2500 ohms. **CAUTION** **In the following test do not drive the servo to wide-open-throttle, 1/2 in. of movement is adequate. During this test the servo clutch is locked and will not disengage. By continuing to apply voltage, damage to the servo or the throttle linkage will occur.** B. Using test cables with alligator clips, connect green wire of Servo Test Adapter to ground (-) and blue wire to + 12vdc . Touch yellow wire of Servo Test Adapter to blue wire (+ 12 vdc) and orange adapter wire to green wire (ground -). Servo rack must pull in opening throttle. C. Touch or connect orange adapter wire to blue wire (+ 12 vdc) and yellow wire to green wire (ground -). Servo rack must extend, throttle returns to idle. Replace servo if test results were not as given in A,B and C above. If servo passed tests, electronics module is bad and must be replaced. See REMOVAL/INSTALLATION section on following pages.

CRUISE CONTROL SERVO TEST ADAPTER



Sketch 2.

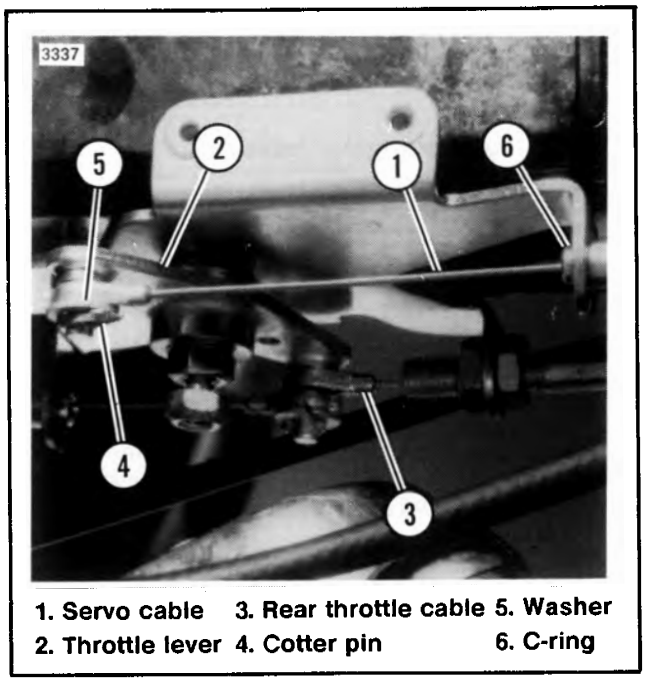
Problem	Cause	Solution
4. Servo motor runs continuously with ignition switch and Cruise ON/OFF switch ON and throttle in idle position **(1990) only**.	4.1 Servo cable too loose.	4.1.1 Adjust servo cable following instructions given for servo cable under 1990 CABLE ADJUSTMENT given later in this section.
5. Engine idles too fast and/or cruise control causes motorcycle to accelerate when SET **(1990) only**.	5.1 Servo cable too tight.	5.1.1 See 4.1.1 above.
6. Cruise system either surges constantly (opens throttle too much, then closes throttle too much) or system maintains a lower or higher than desired or SET speed.	6.1 Set button pressed and held too long or on 1990 models holding paddle switch up will cause "acceleration" or if switch is held down "deceleration" will occur.	6.1.1 Inform rider that holding SET button in reduces SET speed on 1989 models. On 1990 models, explain the "accelerate" and "decelerate" functions as given in the Owner's Manual.
	6.2 Bad electronics module.	6.2.1 Replace module.
	6.3 Cables not adjusted properly.	6.3.1 See CABLE ADJUSTMENT procedure and check and adjust cables if required.
7. Cruise System does not disengage with clutch pulled in.	7.1 Normal operation (1989 only).	7.1.1 If engine speed is increased after cruise is "SET"and rpm's do not go below SET rpm the cruise will not disable when clutch is pulled.
8. Cruise System allows speed to increase on "up-shift".	8.1 Normal operation (1989 only).	8.1.1 If engine is accelerated by rider and a quick up-shift made the cruise will maintain the SET rpm, resulting in a higher rate of speed.

CRUISE CONTROL — THROTTLE CABLES - 1989

GENERAL

To provide for cruise control and rider control of the throttle a throttle control assembly, under frame backbone, and four cables have been utilized.

See Figure 8-34. The cruise control servo cable (1) is connected to a bell crank or throttle lever (2). When the servo pulls or retracts cable (1) the bell crank pivots and pulls on the rear accelerator cable (3) opening the throttle plate at the carburetor. See Figure 8-35. The rider can open the throttle in the normal manner by twisting the right handgrip. This movement causes the front throttle cable (1) to pull the rear cable (4) and the throttle open. The idle control cable (2) allows rider to close the throttle by twisting handgrip outward and this cable contains an in-line switch (3) to disengage cruise control when throttle is rolled-back or closed.



1. Servo cable
2. Throttle lever
3. Rear throttle cable
4. Cotter pin
5. Washer
6. C-ring

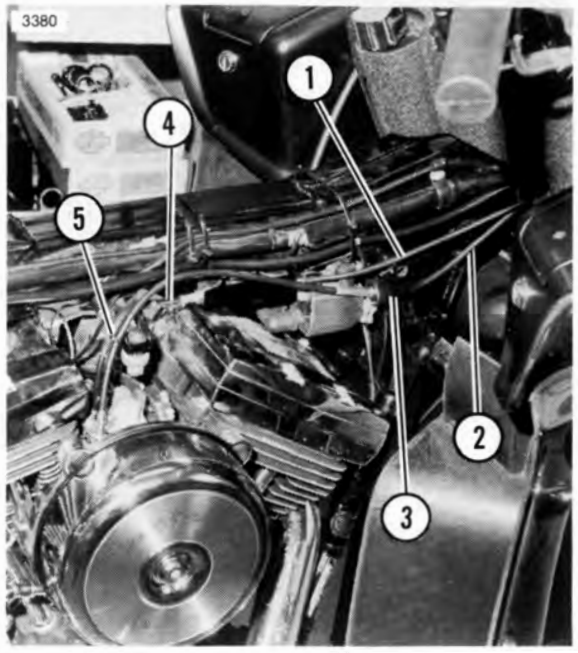
Figure 8-34. Cruise Throttle Cable Assembly

CABLE ADJUSTMENT

NOTE

See Figure 8-35. The throttle opening cable, cable (1) and (4), must be adjusted with the idle cable (2) completely loosened (slack). Therefore, adjust the cables in the sequence given in the procedure.

These procedures cover adjustment only. If you must remove and install any of the cables refer to the REMOVAL AND INSTALLATION procedure that follows.



1. Front throttle cable
2. Idle cable
3. Cruise disengage switch
4. Rear throttle cable
5. Cable strap

Figure 8-35. Idle, Rear and Front Throttle Cables

REAR THROTTLE CABLE

NOTE

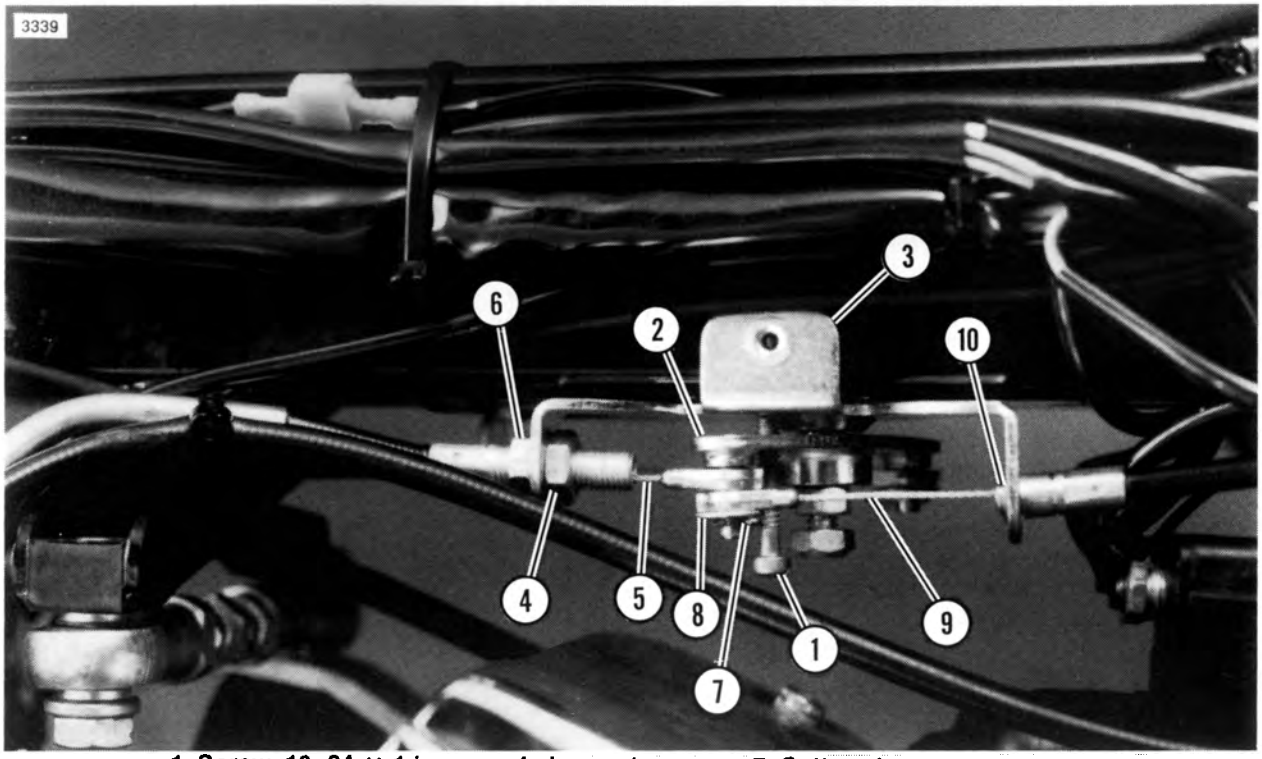
This cable adjustment is only required when the carburetor or this cable has been replaced. Proceed to FRONT THROTTLE CABLE If neither carburetor or rear throttle cable has been removed/replaced. Removal and Installation are covered in the procedure following adjustment.

1. See Figure 8-36. Install a 10-24 screw (1) through the tapped hole in the throttle lever (2) so the screw enters the slot in the throttle bracket. The screw (1) positions or centers the throttle lever with throttle plate in carburetor closed or in idle position.

2. Loosen jam nut (4). Check slack in inner cable (5). Adjust cable by turning jam nut (6) toward throttle bracket (3) just until slack in inner cable is removed.

CAUTION

Over-tightening nut (6) will open throttle plate.



1. Screw, 10 -24 × 1 in.
2. Throttle lever
3. Throttle bracket
4. Jam nut
5. Inner cable
6. Jam nut
7. Cotter pin
8. Washer
9. Front accelerator cable
10. C-ring

Figure 8-36. Adjusting Rear Throttle Cable

3. Tighten jam nuts (4 and 6) against throttle bracket (3).

4. Remove screw (1).

FRONT THROTTLE CABLE ADJUSTMENT (Connects throttle lever [bellcrank] to throttle grip)

NOTE

See Figure 8-36. Since the front throttle cable is connected to the rear throttle cable (5), the two cables will be referred to as the "pull-open cable". Adjust the pull-open cable as follows:

A. With handlebar in straight ahead position, idle cable adjusted to full slack and throttle grip turned to full open, adjust pull open cable to obtain full throttle opening at carburetor.

B. Twist throttle grip to full closed position. Check that idle stop-screw is touching carburetor with handlebar in straight ahead position, and while turning handlebar from "lock-to-lock".

NOTE

If idle stop-screw is not touching carburetor, adjust (loosen) pull-open cable just enough so that idle stop-screw is touching carburetor through full lock-to-lock handlebar movement. It is acceptable, with throttle grip rotated to wide open throttle (W.O.T.) to have throttle cam stop 1/8 in. or less from stop boss on the carburetor.

C. Rotate throttle grip to W.O.T. and release, throttle must return to idle position freely. If it does not, check for incorrect cable routing, damaged cables or binding in the throttle grip.

IDLE CABLE ADJUSTMENT (Connects throttle grip to carburetor)

1. See Figure 8-35. With idle cable (2) still adjusted to full slack position, remove wires from the throttle, disengage (roll-off) switch (3) and connect an ohmmeter to the roll-off switch terminals. Ohmmeter must indicate infinity (switch contacts open). If ohmmeter indicates continuity, the roll-off switch may be shorted and entire cable must be replaced.

NOTE

If seat is removed, ohmmeter may be connected to black leads on 6-pin connector 8B.

2. With handlebar in straight ahead position, adjust idle cable until approximately 0.06 in. of freeplay exists at the outside diameter (OD) of the throttle grip.

3. Rotate the throttle grip, with light force, toward the closed position. The ohmmeter must indicate continuity. If it does not, decrease freeplay at throttle grip by adjusting the idle cable to to obtain continuity while maintaining some freeplay at the throttle grip.

4. While holding the throttle grip (with light force) in the closed position, turn handlebar from "lock-to-lock". Ohmmeter must indicate continuity throughout handlebar movement.

5. With handlebar in straight ahead position, rotate throttle grip to W.O.T. and release, throttle must return to idle position freely.

6. Repeat step 5 with handlebar at full left and right positions. If throttle does not return to idle position freely, loosen idle cable slightly and repeat steps 3 - 6.

SERVO CABLE

See Figure 8-34. The servo cable (1) does not require adjustment.

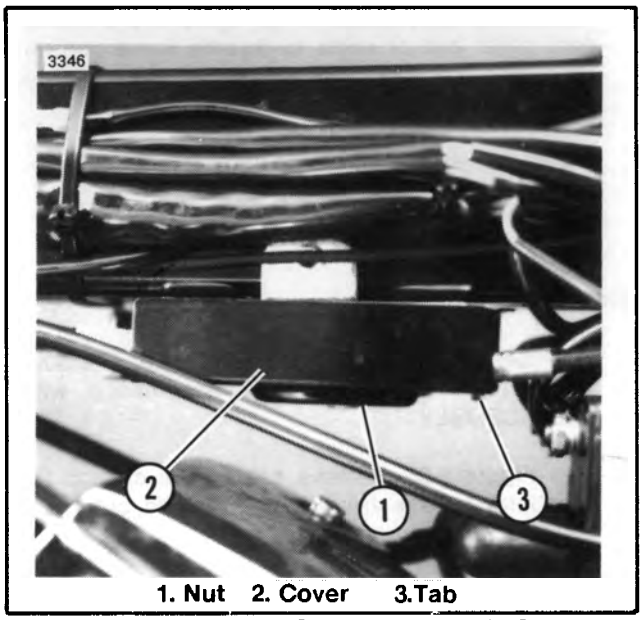
CABLE REMOVAL AND INSTALLATION — 1989

General

To gain access to the throttle cable control assembly, remove seat, front bolt from fuel tank and rear fuel tank mounting screws. Lift rear of fuel tank gently to allow access to the throttle cable control assembly.

Rear Throttle Cable

1. See Figure 8-37. Remove nut (1) and throttle cable control assembly cover (2). Note that throttle bracket tab extends through slot in cover at (3).



1. Nut 2. Cover 3.Tab

Figure 8-37. Cable Control Assembly Cover

2. See Figure 8-36. Remove cotter pin (7), washer (8), and front accelerator cable end (9) from throttle lever (2) pin.

3. Remove jam nut (4) and unhook inner cable (5).

4. See Figure 8-35. Cut cable strap (5) and remove cable end from carburetor.

5. Install new cable following the reverse of the removal procedure. Bend ends of new cotter pin (7) tightly against sides of pin.

6. Adjust the cable in accordance with the adjustment procedure previously given.

Front Throttle Cable

1. Refer to step 1 of REAR THROTTLE CABLE REMOVAL and the preceding GENERAL paragraph for information on gaining access to cable end connected to throttle cable control assembly.

2. See Figure 8-36. Remove cotter pin (7), washer (8) and cable end (9).

3. Remove C-ring (10) from cable conduit fitting and cable will be free.

4. See Section 2, THROTTLE CONTROL of this manual for the procedure to remove cable from throttle grip.

5. Install new cable following steps 1 through 4 of ASSEMBLY, THROTTLE CONTROL in Section 2 to assemble new cable to throttle grip.

6. Route new cable as shown in Figure 8-35 and connect other end of cable to throttle cable control assembly following the reverse of the removal steps 2 and 3.

7. Adjust cable in accordance with adjustment procedure previously given.

Idle Cable

1. See Section 2, THROTTLE CONTROL. Remove cable from throttle grip in accordance with DISASSEMBLY.

2. See Figure 8-35. Remove cable from clamps (7), disconnect wires from switch (3) and cut cable straps (6).

3. Disconnect cable from carburetor.

4. Install new cable to throttle grip in accordance with steps 1 through 4 of ASSEMBLY, THROTTLE CONTROL IN Section 2.

5. Route the cable as shown in Figure 8-35.

6. Adjust the new cable referring to the adjustment procedure previously given for the idle cable.

Servo Cable

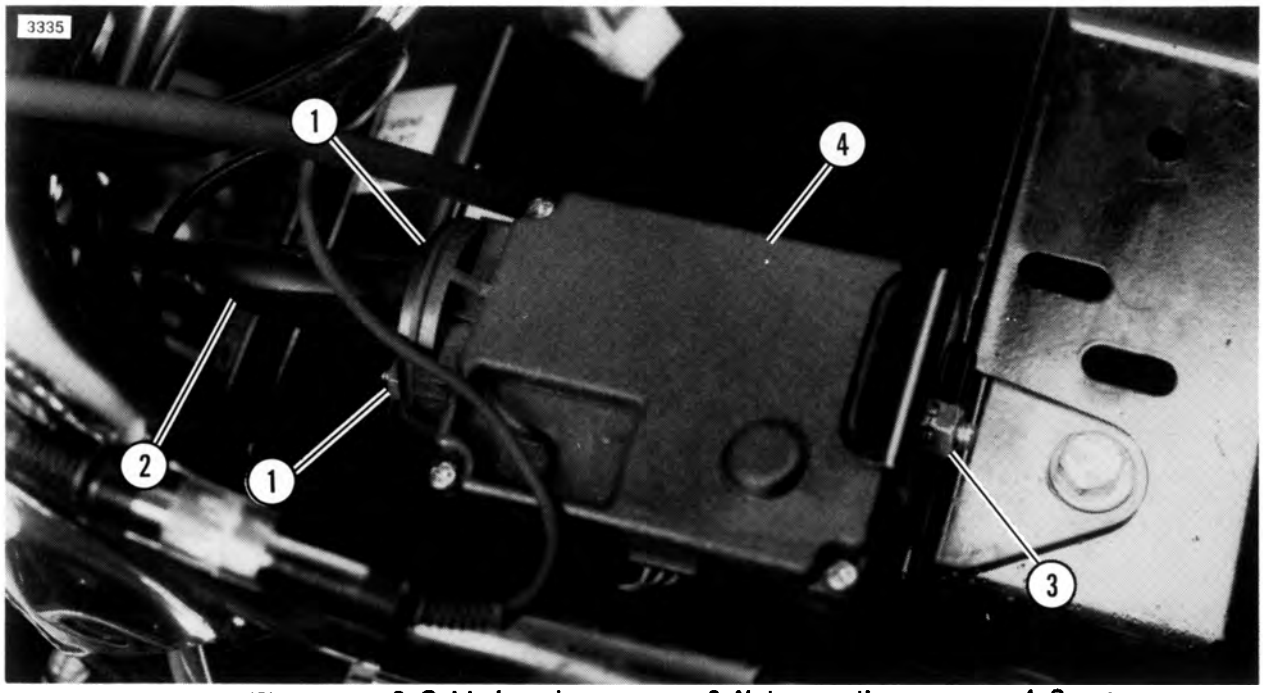
1. See Figure 8-34. Remove cotter pin (4), washer (5) and cable (1) from pin on throttle lever (2).

2. Remove C-ring (6) from conduit fitting groove.

3. See Figure 8-38. Remove the two nuts (1) that attach cable housing (2) to servo. Pull cable forward and disengage inner cable from servo rack.

4. Install new cable reversing the removal instructions.

5. See Figure 8-34. Make certain C-ring (6) is in groove and ends of cotter pin (4) are bent around throttle lever pin.



1. Nuts (2) 2. Cable housing 3. Nut, mounting 4. Servo

Figure 8-38. Servo, Cruise Control

CRUISE CONTROL — THROTTLE CABLES - 1990

GENERAL

See Figure 8-39. The throttle cables on 1990 models do not require a bellcrank assembly. The servo motor cable (1) is connected directly to the carburetor.

The throttle cable (2) is identical to the throttle cables used on all FLT models. The idle cable (3) is similar to non-cruise control models; except it has the cruise disengage switch (4), Figure 8-40.

CABLE ADJUSTMENT

NOTE

See Figure 8-39. The throttle cable (2) must be adjusted with the idle cable (3) completely loosened (slack). Therefore, adjust the cables in the sequence given in the procedure.

These procedures cover adjustment only. If you must remove and install any of the cables refer to the REMOVAL AND INSTALLATION procedure that follows.

THROTTLE CABLE ADJUSTMENT

1. With handlebar in straight ahead position, idle cable adjusted to full slack and throttle grip turned to wide open throttle (W.O.T.), adjust pull open cable to obtain full throttle opening at carburetor.

2. Twist throttle grip to full closed position. Check that idle stop-screw is touching idle stop with handlebar in straight ahead position, and while turning handlebar from "lock-to-lock".

NOTE

If idle stop-screw is not touching carburetor, adjust (loosen) pull-open cable just enough so that idle stop-screw is touching idle stop through full lock-to-lock handlebar movement. Also check that servo cable has slack and is not opening throttle. Loosen servo cable if required.

3. Rotate throttle grip to W.O.T. and release, throttle must return to idle position freely. If it does not, check for incorrect cable routing, damaged cables or binding in the throttle grip.

IDLE CABLE ADJUSTMENT
(Connects throttle grip to carburetor)

1. See Figure 8-40. With idle cable (1) still adjusted to full slack position, remove wires from the throttle disengage (roll-off) switch (2) and connect an ohmmeter to the roll-off switch terminals (3). Ohmmeter must indicate infinity (switch contacts open). If ohmmeter indicates continuity, the roll-off switch may be shorted and entire cable must be replaced.

NOTE

If seat is removed, ohmmeter may be connected to black leads on 8-pin connector 8B.

2. With handlebar in straight ahead position, adjust idle cable until approximately 0.06 in. of freeplay exists at the outside diameter (OD) of the throttle grip.

3. Rotate the throttle grip, with light force, toward the closed position. The ohmmeter must indicate continuity. If it does not, decrease freeplay at throttle grip by adjusting the idle cable to obtain continuity while maintaining some freeplay at the throttle grip.

4. While holding the throttle grip (with light force) in the closed position, turn handlebar from "lock-to-lock". Ohmmeter must indicate continuity throughout handlebar movement.

5. With handlebar in straight ahead position, rotate throttle grip to W.O.T. and release. Throttle must return to idle position freely.

6. Repeat step 5 with handlebar at full left and right positions. If throttle does not return to idle position freely, loosen idle cable slightly and repeat steps 3 - 6.

SERVO CABLE (Connects servo motor to carburetor)

NOTE

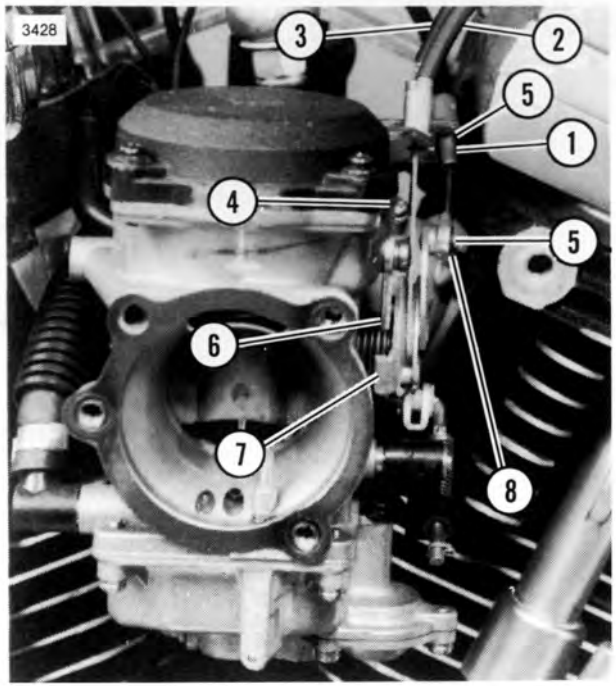
Servo cable must be adjusted last; that is, after throttle and idle cables have been adjusted. Servo cable will only require adjustment if servo motor or cable are being replaced.

1. See Figure 8-41. With servo cable attached to servo motor, adjust cable length to 3.410 in. as shown. Servo motor rack must be fully out during this adjustment.

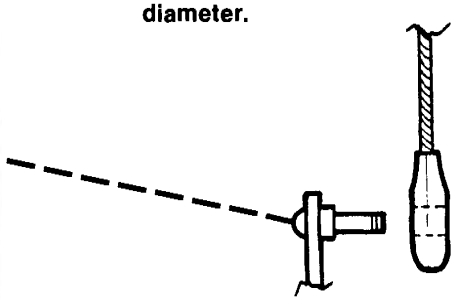
2. See Figure 8-42. Route servo cable (1) through the two plastic retainers (2), then forward and over the top engine stabilizer (3) and down between cylinder heads to the carburetor.

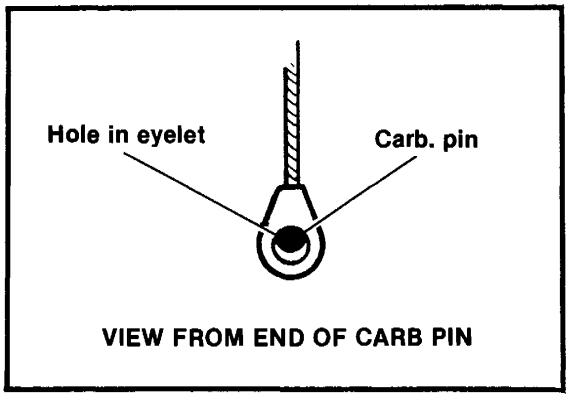
3. See Figure 8-39. Check slack in servo cable as shown. Shorten or lengthen cable as required.

4. Place eyelet end of cable on carburetor pin.



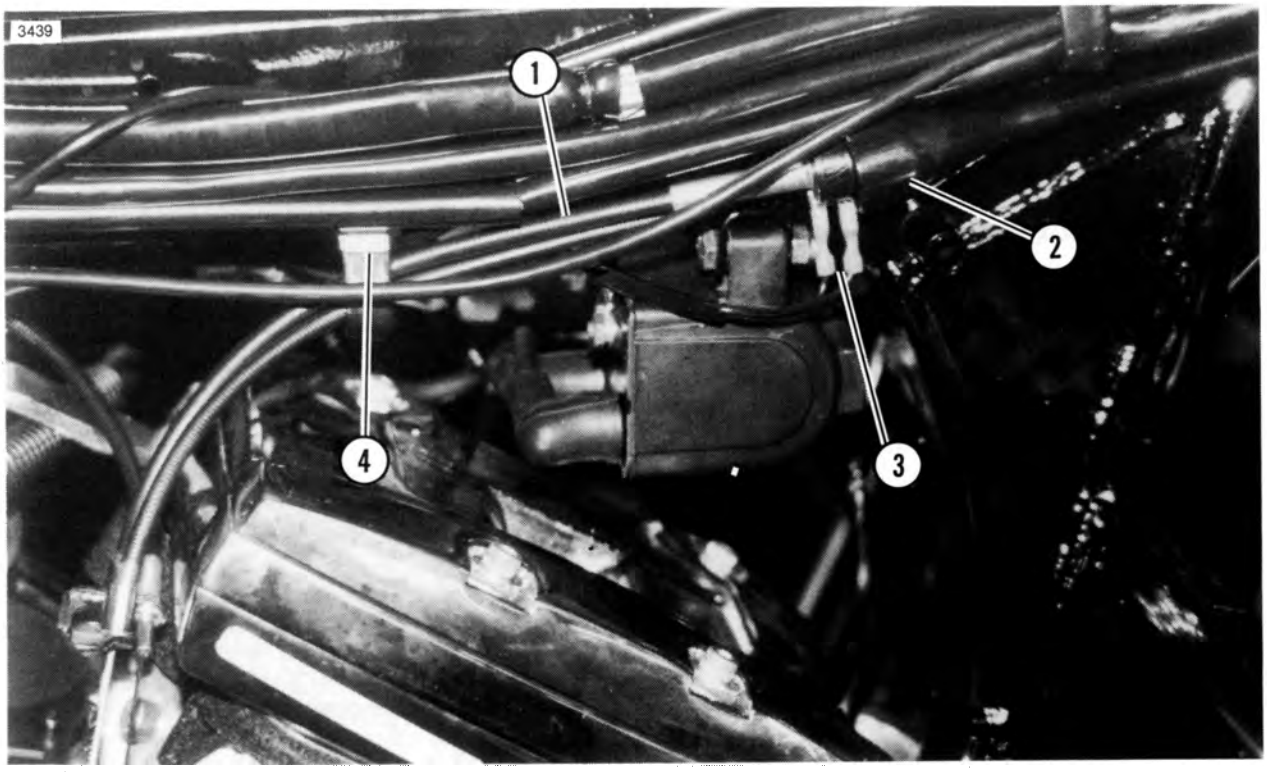
Servo cable slack must be such that hole in eyelet extends beyond pin on carburetor a distance equal to 1/3 rd. the hole diameter.





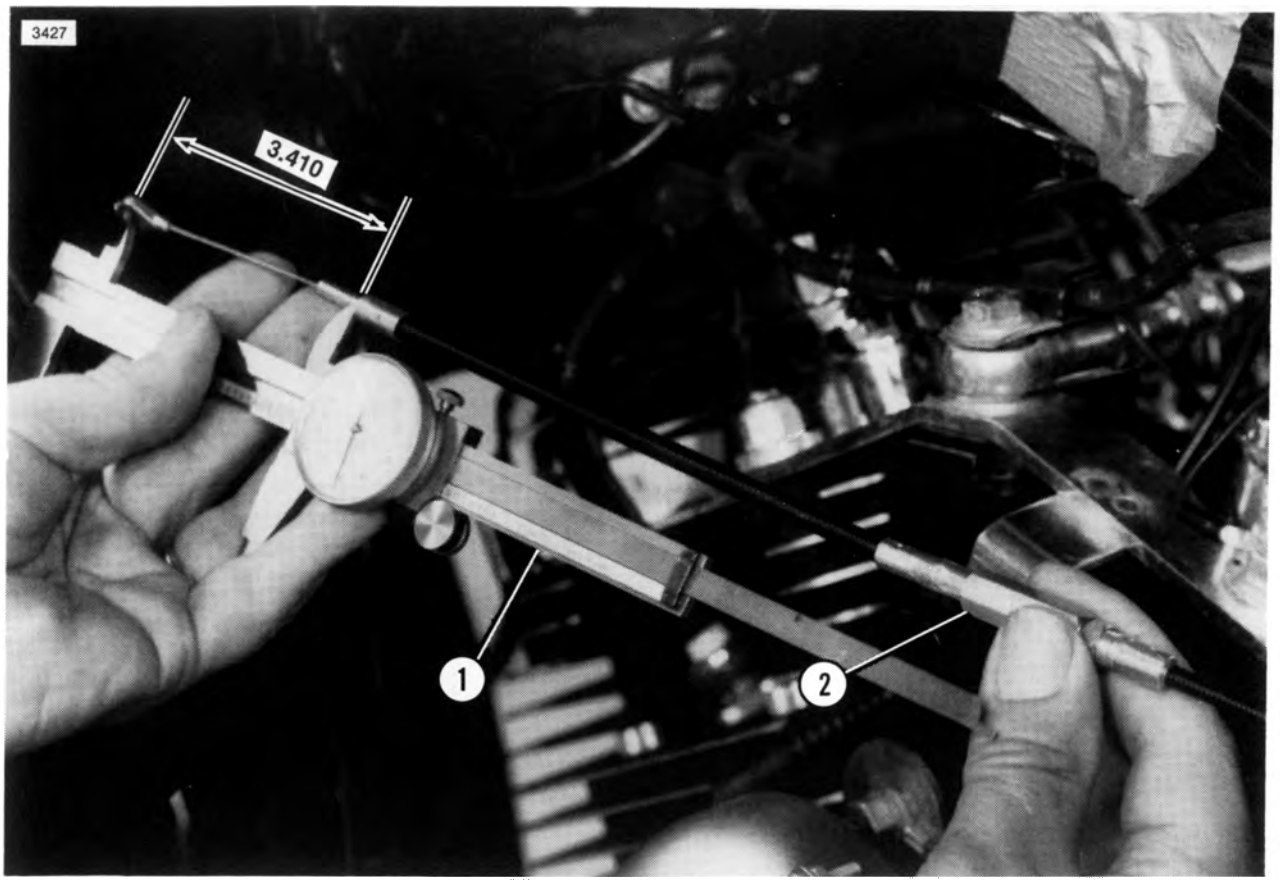
1. Servo cable
2. Throttle cable
3. Idle cable
4. Idle adjusting screw
5. C-ring (2)
6. Throttle stop
7. Moveable throttle stop
8. Washer

Figure 8-39. Carburetor Cables



1. Idle cable
2. Disengage switch
3. Switch terminals
4. Cable bracket

Figure 8-40. Throttle Cable Routing — 1990



1. Dial caliper 2. Adjuster

Figure 8-41. Pre-setting Servo Cable Length

5. Install c-ring (5) to secure servo cable to cable bracket. Install washer (8) and another c-ring (5) to secure cable eyelet to carburetor pin.

6. Check that idle adjusting screw (4) is touching idle stop. Loosen servo cable until screw does touch idle stop. Repeat step 3 if necessary.

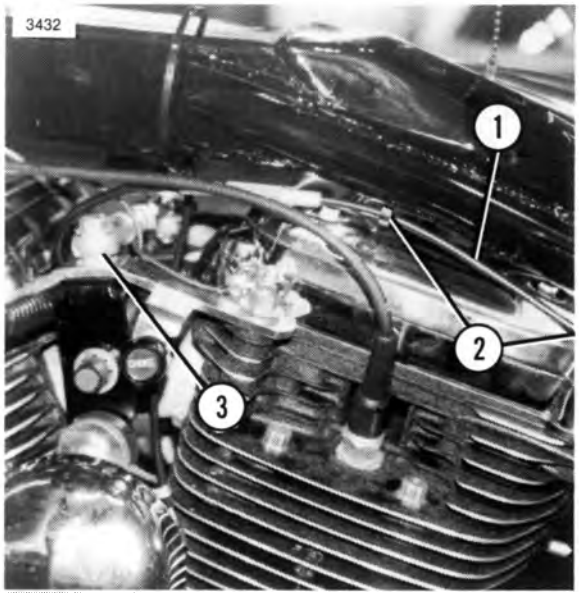
NOTE

If the servo cable is adjusted too tight, it may cause the following:

A. Motorcycle will gain 1 - 2 mph when RES/SET switch is pressed down to "SET" speed.

B. Servo cable will pull idle adjusting screw off idle stop and prevent setting idle speed.

If servo cable is too loose, the servo motor will run continuously (with ignition and cruise switches "ON") and the "SET" speed may be lower than the speed present when cruise was "SET".



1. Servo cable 3. Top engine stabilizer
2. Plastic retainers

Figure 8-42. Servo Cable Routing

REMOVAL AND INSTALLATION 1990 CRUISE CABLES

Throttle and Idle Cables

The throttle cable is identical on all 1990 FLT models.

NOTE

Except for the cruise disengage switch, the idle cable is similar to those on "non-cruise" FLT's.

Refer to Section 2, THROTTLE CONTROL for removal and installation. See CABLE ADJUSTMENT procedure preceding this procedure for cable adjustment instructions.

NOTE

See Figure 8-40 for proper routing of throttle and idle cables and cable bracket location.

Servo Cable

1. See Figure 8-39. Remove c-ring (5) and washer that secures cable (1) eyelet to carburetor cable wheel pin.
2. Remove c-ring (5) that secures cable sheath or housing to cable bracket.
3. See Figure 8-38. Remove seat. Remove the two nuts (1) that attach cable housing (2) to servo. Pull cable forward and disengage inner cable from servo rack.
4. Attach new cable to servo by reversing step 3.
5. See Figure 8-41. Adjust cable to dimension shown and perform steps 1 - 6, given in CABLE ADJUSTMENT procedure for servo cable.
6. Install seat.

REMOVAL AND INSTALLATION OF CRUISE CONTROL COMPONENT (1989 & 1990)

Servo

1. Remove seat.
2. To remove servo, disconnect 6-pin electrical connector that connects servo to the electronics module.
3. See Figure 8-38. Disconnect servo cable following step 3 in SERVO CABLE REMOVAL procedure.
4. Remove nut (3) and servo may be removed.
5. Install new servo reversing the removal instructions. Fill 6-pin connector halves with wheel bearing grease to seal out moisture.

NOTE

On 1990 models check and if needed, adjust servo cable.

Electronics Module

1. Remove seat.
2. See Figure 8-43. Unplug all wires and harnesses connected to the module.

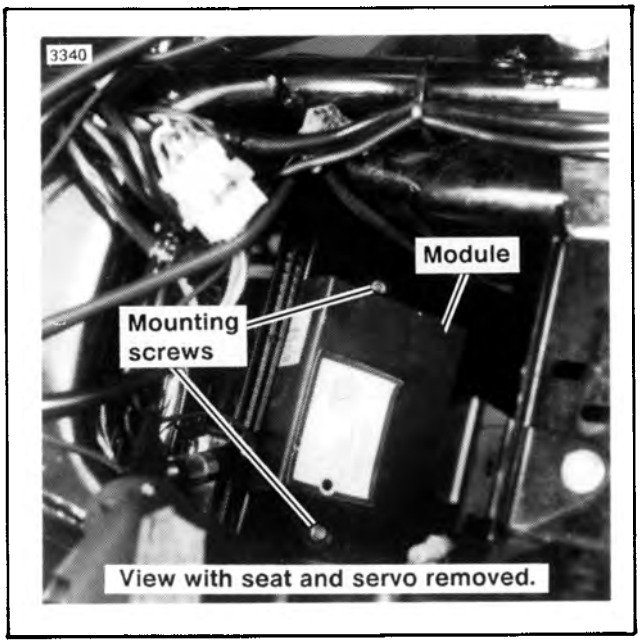


Figure 8-43. Cruise Control Module

3. Remove the two mounting screws and gently remove module.
4. Fill connector halves with wheel bearing grease to keep out water before connecting them to new module.
5. Place module in position and install the mounting screws.
6. Install seat.

Cruise Control Switches

ON/OFF SWITCH

On FLTC Ultra models, remove instrument panel to remove and install switch. The switch may be pried from the inner fairing on FLHTC Ultra models. After wires are connected switch will "snap" back into inner fairing.

SET SWITCH - 1989 OR RESUME/SET SWITCH - 1990

1. See Figure 8-44. To remove set switch, remove two screws clamping control housing to handlebar and remove switch.

2. Install wires to new switch and install switch in housing. See sketch in 3.9.1 of TROUBLESHOOTING for correct wire hookup.

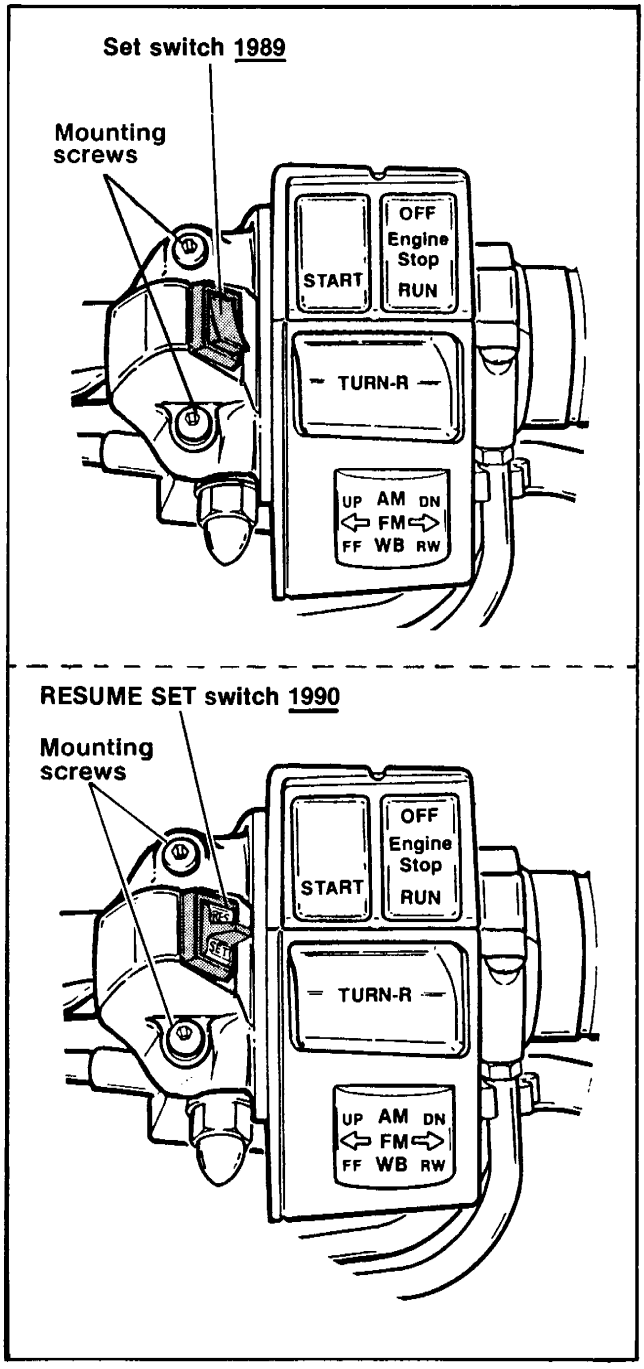


Figure 8-44. Cruise Set Switch

CB/INTERCOM/REAR SPEAKERS 1989 AND 1990 ULTRAS

The CB/Intercom/Rear speakers system provides rider and passenger 2-way communication on the CB channels, "intercom" capability between rider and passenger and two rear speakers powered by an additional 20 watts per channel amplifier. The rear speakers' amplifier receives a low level audio signal from the sound system, i.e. AM, FM, WB or tape signal.

HOW-IT-WORKS

Figure 8-45 is a block diagram of the system. A simplified theory-of-operation for each control is given and finally the interaction between sound system, CB and intercom is covered.

Helmet Speaker (Ht-spkr)/Speakers Switch

This switch directs the sound system (radio) output to the fairing speakers in the "Speakers" position.

In the "Helmet speaker" position two relays are energized and remove the fairing speakers' input.

Also the speedometer reed switch input is removed from the radio causing the automatic volume control (AVC) to be off. A 12 vdc input from the Ht-spkr/Speaker switch is applied to the yellow lead (single conductor connector 14A&B) in wiring diagram. This input energizes a relay in the console pod connecting the low level 2-channel (stereo) audio frequency input (carried on 3 conductor DIN, Deutsche Industrie-Normen German Industrial Standards cable) from the radio to the Ht-spkr amplifier in the console pod. The left channel or left speaker signal is carried on socket 3 and the right channel signal is on socket 1, socket 2 (and its wire) carry the mute signals in the DIN cable. The output of the Ht-spkr amplifier powers the left and right headphones of both rider and passenger. The low level audio input from the radio is supplied to the console pod 40 watt amplifier in both switch positions. This amplifier outputs to the rear speakers only. The Ht-spkr only receive an input from the radio when switch is in Ht-spkr position. The Ht-spkr amplifier receives the microphone inputs from rider/passenger microphones when intercom switch is on. (See Intercom ON/OFF switch).

In the "quiet-ride" mode (CB and intercom switched OFF radio "ON" or "OFF") the rider and passenger can communicate by pressing their PTT switches. The Mute Check Circuit will sense the PTT switch closure and "Mute" the radio if on. Both microphones will be active (ON) with one or both PTT switches pressed.

CB CONTROLS AND OPERATION

CB ON/OFF and Volume

Full counter-clockwise rotation of the switch knob turns switch OFF. This activates a relay in the transceiver removing the 12 vdc supplied through the 2 ampere (amp) fuse. Rotating clockwise until click is heard indicates "power on" condition for CB. At this time a channel number should be visible in the display. If no channel number is displayed, select a higher or lower channel, i.e., move channel selector switch forward or backward. Further rotation will continuously increase CB signal strength of low level audio at transceiver. This will increase volume at headset or fairing speakers. CB audio is never connected to rear speaker amplifier.

Local/Distance (LO/DX) Switch

DX is the most sensitive position and should be used for listening to distant transmitters. DX operation is also very noisy. For quieter operation switch to LO.

Squelch

This control in conjunction with the LO/DX switch controls the required CB signal strength (or in-band noise) necessary to mute (shut-off radio while CB signal is being received).

Mute/Sens. (sensitivity) — 1990 Models

This control adjusts the "threshold" at which a voice (microphone) input will mute the radio. The least sensitive position of the control is full counterclockwise (CCW); most sensitive is full clockwise (CW). The control may also be turned OFF by turning CCW until a click is heard.

NOTE

Music, wind or air flow when riding, may cause muting. Adjust to lower sensitivity to prevent unwanted muting.

WARNING

Don't turn up the stereo volume. If you do, and then adjust the squelch or turn OFF the CB, you could get blasted when the stereo sound returns. This could be especially harmful to your ears if you have the helmet speakers switched on. It could also distract you from the proper operation of your vehicle. Always lower the stereo volume *before* you adjust the squelch or turn OFF the CB.

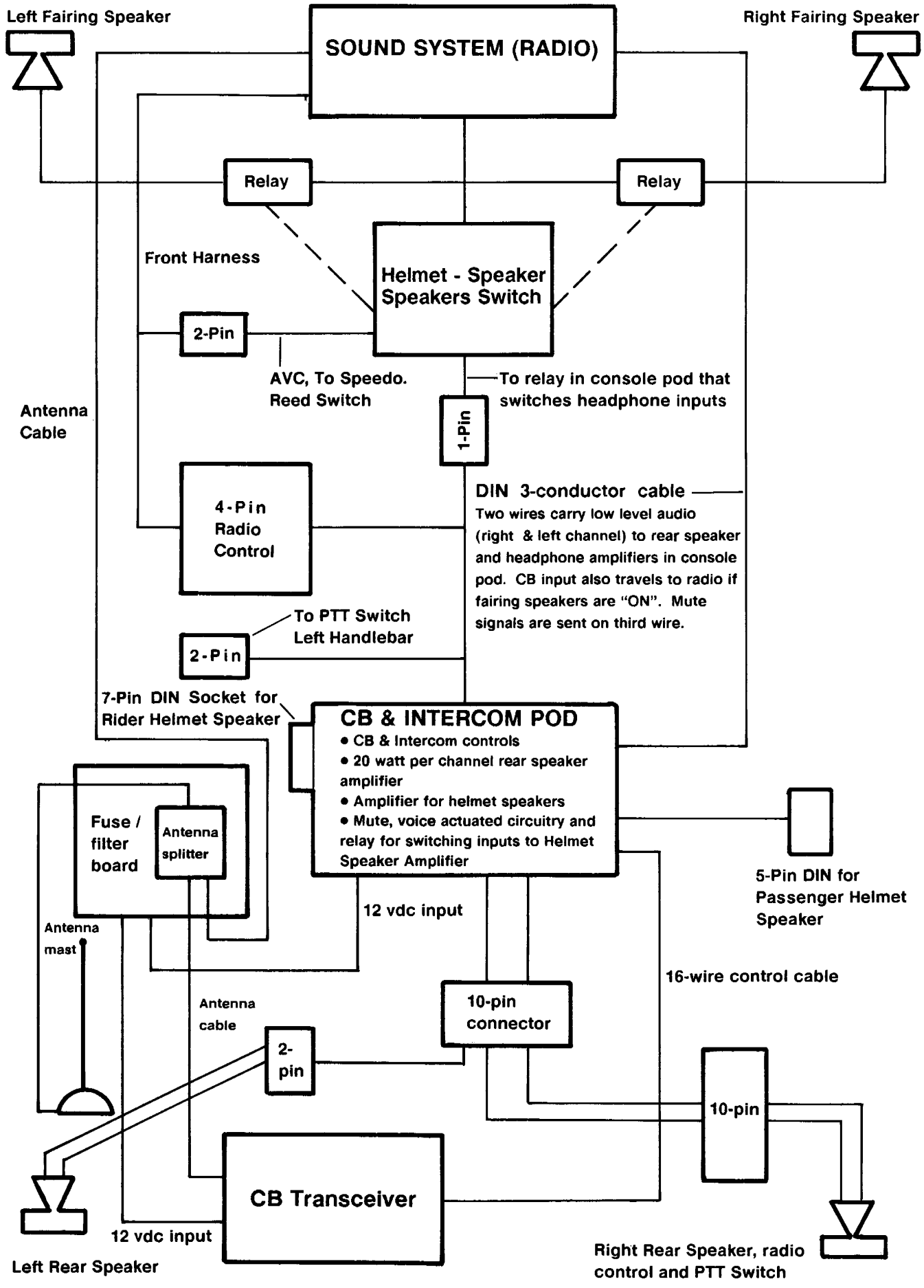


Figure 8-45. CB / Intercom / Rear Speakers Block Diagram

CB Channel Selector

A momentary 2-position switch that selects next higher channel when pressed forward and immediately released. Will "slew", that is, step rapidly up or down channels if moved forward or back and held in position.

CB Channel Display

Indicates channel number to which CB is tuned. CB memory, powered through 1 amp fuse, retains last channel, that is, if tuned to channel 19 and CB switch is turned OFF and then ON, channel 19 will return to display.

INTERCOM ON/OFF SWITCH

With switch in ON position rider and passenger can converse simply by speaking into the microphone. The mute check circuit will recognize the voice actuated microphone input and send mute signals to the radio and rear speaker amplifier.

Muting requires a strong signal at the microphone. A microphone positioned further than 1/2 in. from mouth or very soft speech will not trigger mute.

With switch OFF, microphone inputs to headset amplifier are grounded.

For 1990 the ON/OFF switching is accomplished by turning MUTE/SENS full CCW.

INTERACTION WITH RADIO, CB AND INTERCOM ON

To illustrate how the systems interact, the following explanations trace how the circuits react to signal inputs or rider/passenger control inputs.

Reception of CB Transmissions

Reception of a CB transmission with signal strength great enough to break squelch causes mute check circuit to send mute commands to rear speakers' amplifier and radio. If Ht-spkr switch is in "Speaker" position the CB transmission will be "inputted" to the radio via the DIN cable and will be heard from the fairing speakers if the radio is ON. If switch is in "Ht-spkr" position the low level CB transmission will be switched by a relay in the console pod to the Ht-spkr amplifier and heard in the headset. When the mute check circuit senses the incoming CB transmission has ended, it cancels the mute signals to radio and rear speaker amplifier. Radio output is restored to fairing speakers or headset and rear speakers.

PTT (Rider or Passenger) Switch Pressed

The mute check circuit senses the switch closure and send mute commands to radio and rear speaker amplifier. Both microphones are active (ON) and the microphones input is transmitted by the transceiver. (The transmission is audible in the headsets.) Release of the PTT switch removes mute commands, radio output returns. PTT switches will energize Intercom even with CB/Intercom switches OFF. (See Helmet Speaker/Speaker switch.)

Intercom Input

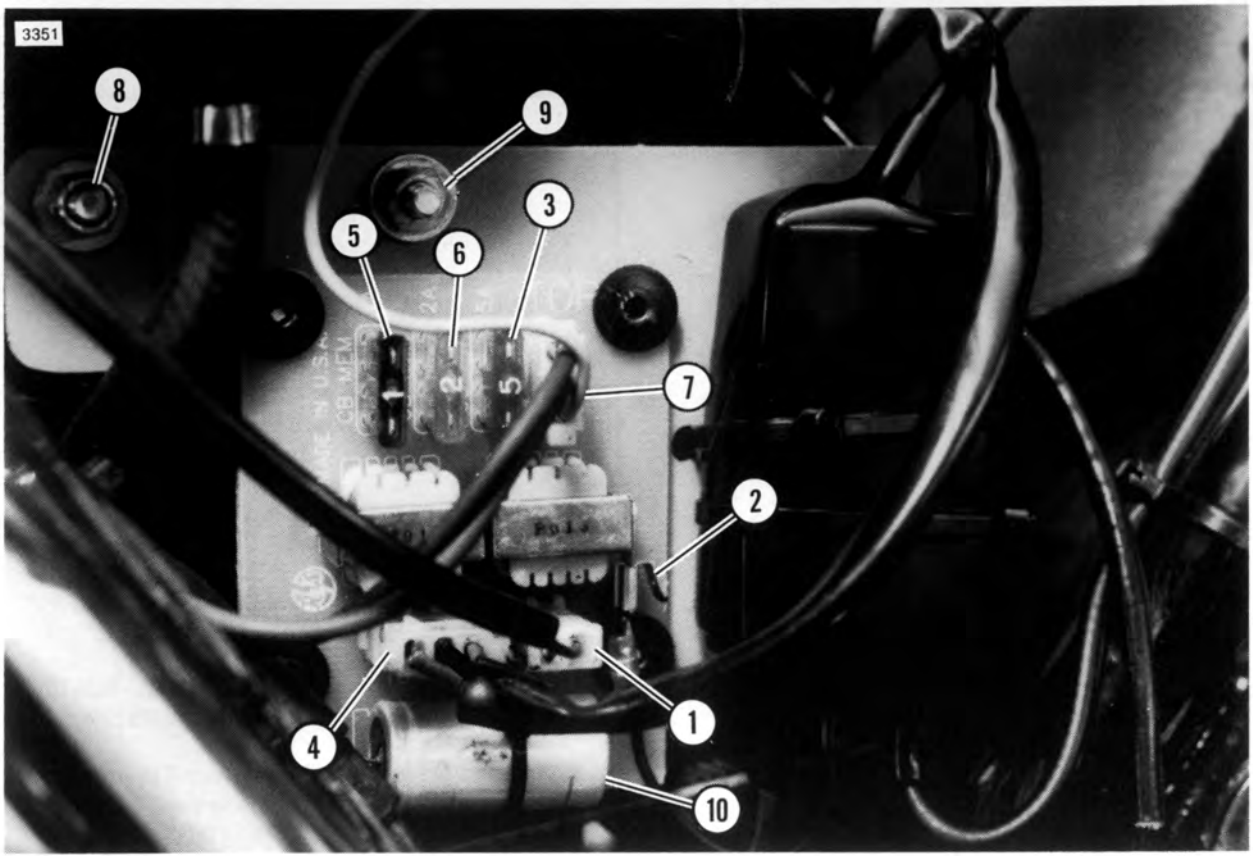
If rider or passenger speak into their microphone, this voice actuated signal is detected by the mute check circuit and the circuit sends mute commands to the radio and rear speaker amplifier. The microphone input is amplified and sent to both headsets. After rider-passenger have completed their conversation and a 1 to 2 second delay has elapsed the mutes will be lifted and radio output is restored.

TROUBLESHOOTING

If difficulty with CB/Intercom/Rear Speakers is encountered, review the PREMIUM SOUND SYSTEM Manual, Harley-Daivdson Part No. 99464-89 or 99464-90, especially the CONTROL INTERACTION table. If problem persists see the following Troubleshooting chart.

Troubleshooting, CB, Intercom and Rear Speakers

Problem	Cause	Solution
1. Excessive alternator hum (changes with engine speed).	1.1 Poor (high resistance) ground connections.	1.1.1 Check the following ground connections. A "good" ground connection should not exceed 0.5 ohm resistance when checked with an ohmmeter. Clean / tighten connections as required. Check the ground connections in the order listed. GROUND — LOCATION 1. Regulator — Between front frame downtubes 2. Ground strap — Under front of transmission, bolted to transmission case and bottom frame cross member 3. Negative battery cable — Rear starter mounting bolt 4. Fuse/filter panel ground — See figure 8-46. Bolt (8) is common ground point. 5. Antenna ground — Inside Tour-Pak, remove liner tighten ground cable nut at antenna mount and bolt securing cable to Tour-Pak bottom (luggage rack). Also tighten antenna cable nut. 6. Connector ring on 16-pin CB cable — See Figure 8-47. Tighten 16-pin connector ring. 7. Antenna cable connector at transceiver — See Figure 8-48. Tighten cable ring at connector (1). 8. Splitter box to fuse/ filter panel ground — See Figure 8-46. Check that splitter box ground wire is connected at (2). Check with ohmmeter between terminal (2) and crankcase. 9. Sound System (radio) chassis ground — Back side (toward front of motorcycle) of radio. Ground cable is grounded to anti-dive manifold ground strip on FLHTC and to fairing stud on FLTC.
	1.2 Weak or discharged battery	1.2.1 Charge battery and check if hum has been eliminated. (Most battery chargers will cause hum in system, so remove charger before checking.)



1. 2-pin connector
2. Splitter box ground
3. 5-amp fuse
4. 3-pin connector "TO CB"
5. 1-amp fuse, CB memory
6. 3-amp fuse (CB)
7. 3-pin connector "PWR IN"
8. Common ground & mount. bolt
9. Mounting bolt
10. Filter capacitor

Figure 8-46. Fuse / Filter Board

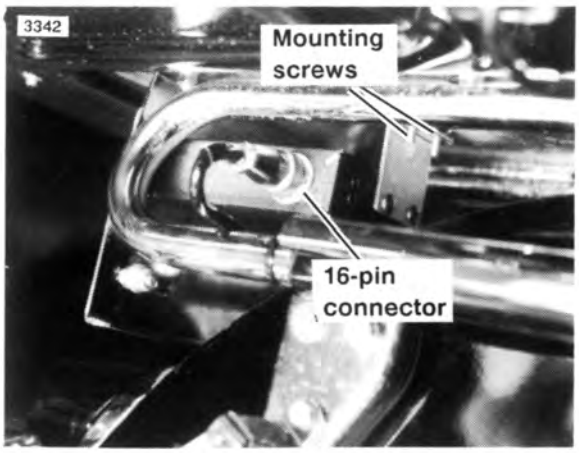
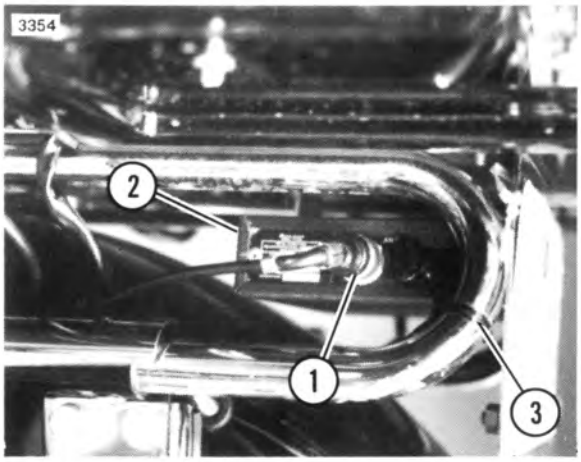


Figure 8-47. Transceiver Mounting

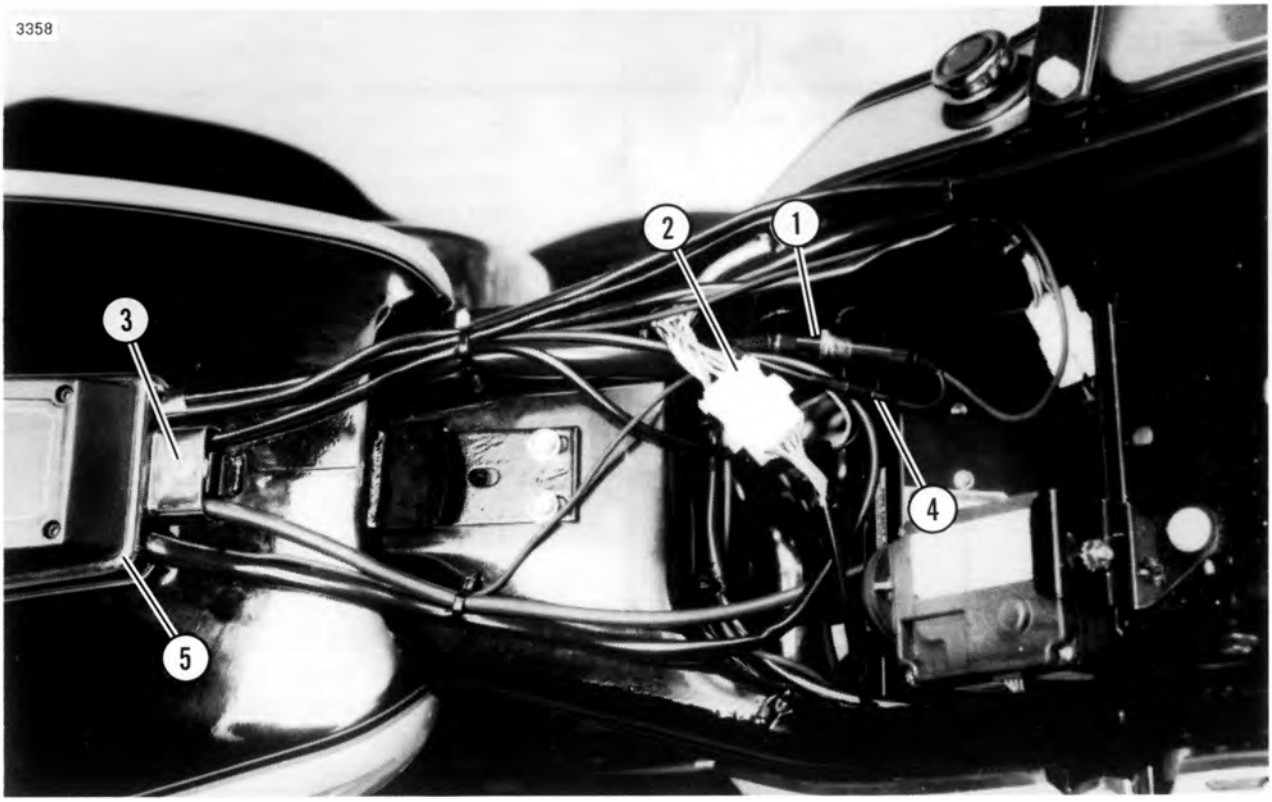


2. Transceiver

Figure 8-48. Left Side View of Transceiver

Troubleshooting, CB, Intercom and Rear Speakers

Problem	Cause	Solution
1. Excessive alternator hum (changes with engine speed).	1.3 Damaged fuse/filter board	1.3.1 See Figure 8-46. Check for broken leads on filter capacitor (10). Replace fuse/filter board if leads are broken. Also check for broken wires in leads connected to board and/or sockets loose on pins.
	1.4 Malfunction in fuel tank console panel (pod) circuitry	1.4.1 Remove seat and left side cover. See figure 8-49. Disconnect DIN connector (1) and 1-pin connector (4). Connect one probe of ohmmeter to single pin-half of connector (4), that is the lead connected to the console pod. See Figure 8-46. Unplug 2-socket "To Pod"connector (1) on fuse board. Connect the other ohmmeter probe to the black wire in connector (1). Ohmmeter must read 2.0 ohms minimum. If ohmmeter reading is less than 2.0 ohms, the console pod is faulty and must be replaced. See REMOVAL AND INSTALLATION. Check the pin half of the DIN connector (1) to determine if it has been sealed against moisture as described in Service Bulletin M-979. If the pin half of the DIN connector (1) is not covered with shrink tubing, refer to Service Bulletin M-979 and perform the sealing operation.
	1.5 Slight hum is normal with CB on and radio volume low.	1.5.1 Normal operation.
2. Intercom signal or radio signal in helmet speaker not satisfactory.	2.1 "Bad" helmet speaker	2.1.1 Substitute known good helmet speaker, if problem solved - replace helmet speaker.
	2.2 Poor fitting helmet speakers. Speakers must be centered over ear openings.	2.2.1 Adjust speaker or obtain new helmet designed for helmet speakers.
	2.3 Incorrect speaker input impedance, or one speaker with correct impedance and the other incorrect.	2.3.1 Both rider and passenger must have Harley-Davidson Part No. 77125-88 (full face) or 77126-88 (open face) helmet speakers. Earlier H-D or after-market speakers may give poor performance.
	2.4 Moisture in rider or passenger DIN connectors	2.4.1 Dry both halves of connectors with compressed air or contact cleaner. Be sure to wrap mating surface of DIN connector halves with two layers of PVC electrical tape.



1. DIN Connector (3 conductor) 3. Screw, rear 5. Console pod
2. 10-pin connector (15A & B) 4. 1-pin connector (shield jumper)

Figure 8-49. CB Console Pod Wiring

Troubleshooting, CB, Intercom and Rear Speakers

Problem	Cause	Solution
3. Static on CB transmit or receive	3.1 "Poor" grounds at antenna or splitter box. Loose antenna cable connector at transceiver.	3.1.1 Check integrity of grounds at the antenna, the Tour-Pak bottom, antenna input to CB and splitter box ground at the fuse/filter board. Tighten antenna cable connector at transceiver.
	3.2 Poor or broken antenna mast to loading coil connections. (Loading coil is in middle of mast.)	3.2.1 Remove antenna cable from antenna base in Tour Pak. Using clip-on test leads, connect one lead of ohmmeter to center pin in antenna base and other lead to antenna tip jam nut. Meter must read 5 ohms or less. Wiggle or flex mast while observing meter. If resistance is more than 5 ohms or varies when mast is wiggled- replace mast.
4. Poor CB transmission or reception	4.1 No tip on antenna mast.	4.1.1 Replace tip and adjust to midpoint of adjustment.
	4.2 Standing Wave Ratio (SWR) too high	4.2.1 Adjust antenna extension (tip) at upper end of antenna or antenna splitter box. See ADJUSTMENT, SWR following this TROUBLESHOOTING.
5. Power loss to console pod and/or transceiver.	5.1 Fuses burned out on fuse/filter board, corroded connections on fuse/filter board or disconnected or broken wires.	5.1.1 Check for input power following the INPUT POWER TEST that follows SWR adjustment.
		5.1.2 Clean corroded connector pins, fuse terminals and apply wheel bearing grease to connector pins and sockets to prevent corrosion.
6. No music (radio output) at rear speakers and intercom does not function.	6.1 Three - pin DIN cable disconnected at radio or under seat.	6.1.1 See Figure 8-49. Check and plug-in DIN connector (1) including the single pin connector (4) that "bridges" the DIN connector to assure a good shielded ground connection.

Problem	Cause	Solution
	6.2 Incorrect resistances or voltages present on DIN cable.	6.2.1 See Figures 8-49 and 8-50.

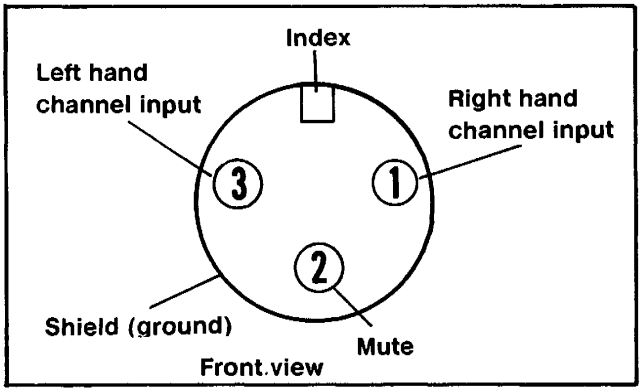


Figure 8-50. 3-pin DIN Cable To Radio

Disconnect DIN cable (1) under seat and check for the following:

1. Pins 1 and 3, Figure 8-50, must measure 500 - 1500 ohms to ground.
2. Pin 2 must measure 0.2 - 0.3 vdc with radio volume at minimum and 3.5 - 4.0 vdc with radio volume at maximum. Grounding pin 2 must cause radio to mute.

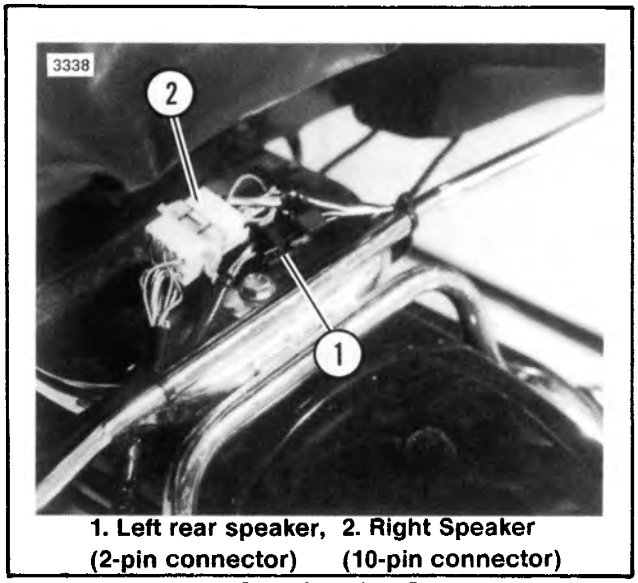
NOTE

The above measurements are checking radio circuitry; therefore, if the above measurements are not obtained, the DIN cable may be disconnected at the radio or have broken wires.

3. Disconnect DIN cable at radio and check each wire for continuity; i. e., with one ohmmeter probe on socket 1 at one end of DIN cable and other probe on socket 1 at the other end of the cable, the ohmmeter must indicate 0.5 ohm or less. Higher readings would indicate broken wires.
4. If continuity checked 0.5 ohm or less on the three cable wires, check for shorts between each of the cable wires and between each of the three wires and the cable shield.
5. Place ohmmeter probes on sockets 1 and 2 with both ends of DIN cable disconnected. Ohmmeter must read between 20,000 ohms and infinity.

Troubleshooting, CB, Intercom and Rear Speakers

Problem	Cause	Solution
14. Audio is muted by music, wind or airflow while riding.	14.1 "MUTE/SENS." control set too sensitive.	14.1.1 Turn knob of "MUTE/SENS." control counterclockwise until mute is lifted, then speak into mike and adjust "MUTE/SENS."to required sensitivity.
15. CB does not turn OFF. Pod CB ON/OFF switch checks good.	15.1 Internal transceiver relay "stuck" on.	15.1.1 Check by turning CB ON/OFF switch OFF and ignition switch ON. Press PTT switch and monitor on a another CB for transmision. If transceiver transmitted signal, replace transceiver.
16. No music at rear speakers, no intercom and no CB display	16.1 Bad 5-amp. fuse	16.1.1 Replace 5-amp. fuse on fuse/filter board.



1. Left rear speaker, 2. Right Speaker
(2-pin connector) (10-pin connector)

Figure 8-51. Rear Speaker Connectors

Troubleshooting, CB, Intercom and Rear Speakers

Problem	Cause	Solution
6. CONTINUED No music (radio output) at rear speakers and intercom does not function.	6.2 CONTINUED Incorrect resistances or voltages present on DIN cable.	6. Repeat step 5 above with probes on sockets 1 and 3 and 2 and 3. 7. Connect one ohmmeter probe to the cable shield (the 1-pin connector is connected to the shield) and then place the other probe on sockets 1 through 3. The meter must indicate between 20 Kohms and infinity at each socket. If the cable passed all step 1-7 tests above, continue at **Problem 9 and 10**.
7. No sound in fairing speakers, helmet speakers or rear speakers	7.1 Inoperative CB	7.1.1 Turn SQUELCH fully clockwise and LOCAL/DX switch to "LOCAL". If problem remains continue at 7.1.2. 7.1.2 See Figure 8-47. Disconnect 16-pin connector from transceiver, if sound returns refer to and perform Problem 15. If Transceiver checked OK, see CONSOLE POD SWITCH/TRANSCEIVER TESTS and Figure 8-55 to isolate problem to pod or transceiver.
	7.2 Inoperative DIN cable	7.2.1 See Figure 8-49. Disconnect DIN connector (1) from the console pod. If sound returns, console pod is defective. If still no sound, go to 7.2.2. 7.2.2 Disconnect DIN cable at radio. If sound returns, replace DIN cable.
	7.3 Radio inoperative	7.3.1 Inspect and troubleshoot radio, see Section 2.
8. No sound from both rear speakers	8.1 Grounded rear volume control wires.	8.1.1 See Figure 8-51. Unplug 10-pin connector (2). If sound comes on in left speaker, the violet wire in connector (2) may be grounded. Check resistance between violet wire and ground with an ohmmeter. Meter must read 500 ohms minimum, if reading is lower check for "pinched" or grounded wire.
	8.2 DIN cable unplugged or damaged	8.2.1 See 6.2.1 and perform checks.
	8.3 Inoperative rear speker amplifier in pod.	8.3.1 Perform 9.1.1 and 10.1.1 to isolate trouble.

Troubleshooting, CB, Intercom and Rear Speakers

Problem	Cause	Solution
9. No sound in right speaker only	9.1 Speaker inoperative, speaker wires disconnected, wires from console pod amplifier broken, DIN cable bad, radio right channel inoperative or bad console pod	9.1.1 See Figure 8-51. Measure voltage between green wire and ground and white/green wire and ground at the right rear speaker enclosure connector (2). If both read 5 - 7 vdc, the speaker may be defective. Check speaker by referring to "Cone Inspection" and "Impedance Check" in Section 2. If speaker is bad, see REMOVAL/INSTALLATION that follows TROUBLESHOOTING. If voltage was not 5-7 vdc, check green and white/green wires for 5-7 vdc at connector (2, Figure 8-49). If voltage is present, wires are bad, repair. If voltage is not present, perform Solution 6.2.1 to check the DIN cable and radio. If DIN cable and radio check ok, console pod is bad and must be replaced.
10. No sound in left rear speaker only	10.1 See 9.1, causes are the same, except radio left channel may be bad	10.1.1 See Figure 8-51. Refer to 9.1.1 above, but measure voltage between brown and white/brown wires and ground. These wires are in 2-pin connector (1) in Figure 8-51. Follow 9.1.1 to find and correct problem.
11. No music in helmet speakers.	11.1 Bad headset or cord. 11.2 Helmet Speaker / Speakers switch bad or miswired, broken wire or console pod may be inoperative.	11.1.1 Check with known good headset - replace headset if music is present. 11.2.1 With the fairing switch in the Helmet Speaker position, the yellow wire in the socket side of 10-pin connector 15B must measure battery voltage. If voltage is not present, the fairing switch or wires feeding to and from the switch may be defective. Check switch and wiring and replace or repair. If voltage is present and rear music is present, the console pod may be defective and must be replaced. See REMOVAL/INSTALLATION that follows.
	11.3 DIN cable unplugged or damaged	11.3.1 See 6.2.1 and check DIN cable.
12. System inoperative	12.1 No power input, burned out fuses or damaged wires	12.1.1 See INPUT POWER TEST and perform the test to isolate and correct problem.
	12.2 Out-of-specification voltages or resistances in the system	12.2.1 See Voltage and Resistance Tests and Figures 8-53 and 8-54. Perform Figure 8-53 tests first and if problem still exists, do the Figure 8-54 tests.
13. Audio is muted when brakes are applied, especially at low engine rpm.	13.1 High momentary current draw required by three brake light filaments (approximately 60 amps)	13.1.1 Normal system reaction to high current draw during first brake application. Subsequent brake applications with brake light bulbs warm will not cause muting.

ADJUSTMENT/TESTING

SWR Adjustment

Standing wave ratio or SWR is a technical term for the procedure that checks how well the CB transmitter and antenna are matched. The SWR should be 2:1 or below on channel 19.

To check SWR, a SWR meter or bridge is required. Your Harley-Davidson dealer will either have a SWR meter or direct you to a CB repair shop for a SWR check. Since the operating procedures for SWR meters vary, be sure you carefully follow the operating instructions for the SWR meter being used.

1. Locate motorcycle outdoors or in a building with a ceiling of 11 ft. minimum above floor. Also, there must be 8 ft. of radial clearance around motorcycle. Adjusting the SWR in an area with a low ceiling (less than 11 ft.) and less than 8 ft. radial clearance around motorcycle may result in an inaccurate adjustment.

2. See Figure 8-48. Remove the antenna cable (1) and connect the SWR meter to the transceiver. The SWR meter is connected in series with the antenna cable so the antenna will be connected to the SWR meter.

3. Check the antenna ground cable in Tour-Pak is tight and antenna cable is tightly connected to antenna base in Tour-Pak.

4. Check that antenna mast is threaded securely on to base and setscrew is tight.

5. Before measuring the SWR, the SWR meter must be calibrated. Follow the instructions for the meter being used. The following procedure is the general calibration most meters instructions specify.

6. With ignition and CB switches ON, the SWR meter set on "FWD", Channel 19 selected, press either PTT switches. Hold the PTT switch and rotate the calibration (CAL) control until the meter needle aligns with the "CAL" mark.

7. Release the PTT switch and move the FWD/REF switch to "REF" (reflected).

8. Press and hold either PTT switch. The meter reading is the SWR.

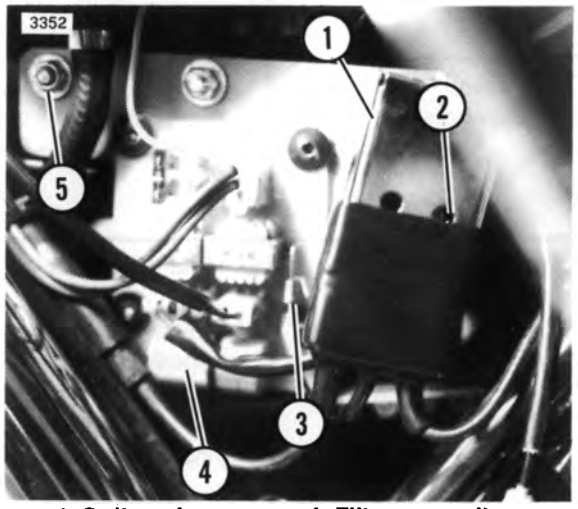
CAUTION

Do not touch the antenna or meter during calibration or SWR measurement. Move CAL knob and then move your hand away from meter while calibrating. Do not press PTT switches with antenna and SWR meter disconnected. Transceiver damage could result.

9. If SWR is less than 3:1, but more than 2:1, adjust antenna length by loosening locknut and turning antenna knob (tip) in or out. If SWR is more than 3:1 go to step 11.

10. Repeat step 8. If SWR became higher, adjust antenna tip in opposite direction. Continue adjusting antenna until the minimum SWR is achieved. If you cannot obtain a SWR of 2:1 or less by adjusting the antenna length, the antenna splitter box must be adjusted.

11. See Figure 8-52. Remove the left side cover. Remove the cable straps from the splitter box (1) and lubricate top cable and plastic cover with silicone spray. Gently move cover so adjustment screw (2) is exposed.



1. Splitter box **4. Filter capacitor**
2. SWR adjust. screw **5. Ground bolt**
3. Splitter box ground

Figure 8-52. Fuse / Filter Board and Splitter Box

NOTE

A non-metallic screwdriver or alignment screwdriver works best to adjust the splitter box screw. A metal screwdriver will interfere with SWR meter readings. If a metal screwdriver is used, turn screw and move screwdriver away from splitter box while reading meter.

The splitter box adjustment screw is a very sensitive adjustment, only turn screw about 1/16 of a turn or less at a time and monitor meter closely.

12. Repeat step 8 and adjust splitter box for the lowest SWR.

13. If SWR is slightly above 2:1, "fine-tune" the antenna length. If a 2:1 SWR is obtained, the adjustment is complete.

NOTE

If after adjusting splitter box and antenna length, the SWR is still over 3:1, the antenna cable or splitter box may be open, shorted or poorly grounded. Refer to and perform antenna test (Figure 2-123 in Section 2). Also see Figure 8-52 and check that splitter box ground (3) is connected.

14. After a SWR of 2:1 or less has been obtained, replace splitter box plastic cover and install cable straps as shown in Figure 8-46.

INPUT POWER TEST

Perform the following tests at the fuse/filter board with the connectors "plugged-in". Touch sockets on connectors from the rear with the meter probes.

"TO POD" 2-Pin Connector

1. See Figure 8-46. With ignition switch ON, place negative probe of voltmeter on splitter box ground (2) and positive probe on orange wire in connector (1). Battery voltage, 12 vdc must be present or 5 amp "POD PWR" fuse (3) is blown. Replace fuse and check for short or current overload.

2. Turn ignition switch OFF. With ohmmeter, check from black wire to ground at panel ground bolt (8). Meter should indicate 0 ohms.

NOTE

If the proper meter readings were not obtained in step 1 or 2 above, go to the "PWR IN" test. If readings are OK, continue at "TO CB" 3-pin connector.

"TO CB" 3-pin Connector

1. See Figure 8-46. With ignition switch ON place negative probe of voltmeter on black (middle) wire of connector (4) and positive probe on red wire. Voltmeter must indicate 12 vdc or 1 amp "CBMEM" fuse (5) is blown. Replace fuse and check for short or reason for current overload.

2. Move positive probe to orange wire, 12 vdc must be present or 3 amp "CBPWR" fuse (6) is blown. Replace fuse and check for short or reason for current overload.

3. Turn ignition switch OFF. With ohmmeter check from black wire to ground. Meter reading must be 0 ohms.

"PWR IN" 3-Pin Connector

NOTE

If all voltage and resistances were present at the "TO POD" and "TO CB" connectors you may skip this test.

1. With ignition switch ON (See Figure 8-46), place negative probe of voltmeter on green (middle) wire of connector (7) and positive probe on orange wire. Meter must read 12 vdc, the input for both 3 and 5 amp fuses. If voltage is not present, see Wiring diagram at rear of manual and measure voltages and check continuity to find problem.

2. Turn ignition switch OFF. Place positive probe on black wire, voltmeter must indicate 12 vdc, the constant-on input for CB memory (1 amp fuse).

3. With ohmmeter, check green wire to ground. Meter must indicate 0 ohms. Clean or tighten ground connections if higher resistance is measured.

VOLTAGE AND RESISTANCE TESTS

Perform the following tests in the order given; i.e. Console Pod 10-pin connector must be tested first. If problem is not found and corrected during these tests, then test Right Rear Speaker and Control 10-Pin Connector.

Console Pod 10-Pin Connector

See Figure 8-49. Check the voltages and resistances on the leads of 10-pin connector (2) as listed in Figure 8-53. In the wiring diagram at rear of this manual this connector is identified as 15A (pin) and 15B (socket).

Right Rear Speaker and Control 10-Pin Connector

See Figure 8-51. The 10-pin connector (2) is located under the seat. In the wiring diagram at the rear of this manual this connector is identified as 21A (pin) and 21B (socket). See Figure 8-54 for voltage and resistance checks.

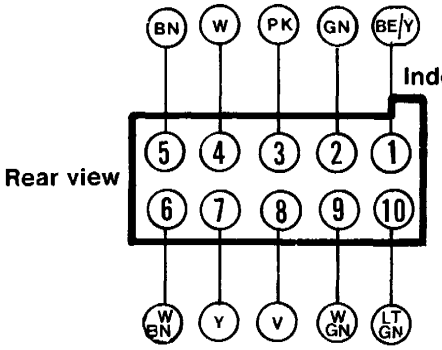
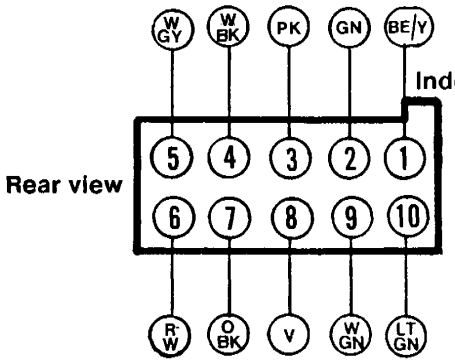


FIGURE 8-53 GENERAL TEST CONDITIONS:

1. **Radio, CB and Intercom switches ON**
2. **Connnector halves 15A and 15B plugged together**
3. **Connect negative probe of voltmeter to common ground bolt (5, Figure 8-52).**

Pin No.	Test Conditions and Meter Readings	Circuit or Component
1	10-12 vdc until either PTT switch is pressed, then less than 0.5 vdc. 1. If above readings are not obtained, unplug connector 15B and check continuity on sockets 1 and 10 with PTT switch pressed. 2. If continuity (0.5 ohm) is read, PTT switch and wires are ok, replace console pod. If continuity is not present, replace PTT switch or repair wires.	Console pod mute control, PTT switch and wires
2, 9, 5 & 6	Each pin shall measure 5-7 vdc. If voltages are not present, replace console pod.	Pins 2&9 are right rear speaker leads; Pins 5&6 are left rear speaker volume control leads
10	Must measure less than 5 ohms to ground, if greater resistance is present-replace console pod.	PTT switch lead (Floating ground)
7	With ignition switch ON, must measure 10-12 vdc with speaker switch in Helmet Speaker position and near 0 vdc when switch is in Speakers position. Look for bad or miswired speaker switch, broken wire(s) or unplugged connector 14A & B if above meter readings are not obtained.	Fairing Speaker Switch
4	Must measure 1.0-4.0 vdc with system unmuted and 0.5-0.6 vdc when system is muted. If these readings are not present, replace console pod.	Sidecar mute.(signal to mute sidecar amplifier)
3	Must measure 2.0-3.0 vdc with rear volume control at maximum and 1.0-1.5 with volume control at minimum. If voltages are not present, check pin 8 as follows:	
8	Must measure 3-4 vdc. If voltage not present, check rear volume control as follows: 1. Unplug connector 15B and connect ohmmeter to Pink and violet wires. Rotate rear volume control while monitoring the ohmmeter. Resistance shall vary from 20-Kohms to 70-Kohms. 2. Leave one ohmmeter probe on pink wire and place other probe on light green wire. Rotate rear volume knob, resistance must vary from 40-Kohms to 90-Kohms. 3. If resistances are present, console pod must be replaced. 4. If resistances were not obtained, repeat steps 1 and 2 at connector half 21A (2, Figure 8-51). 5. If resistances are not present at connector 21A, the rear volume control must be replaced. 6. If resistances are present, the audio harness is bad and must be repaired or replaced.	Voltage feed to rear volume control

Figure 8-53. Voltage and Resistance Check of Console Pod Connector



Rear view

Connector 21A in Wiring Diagram

FIGURE 8-54 GENERAL TEST CONDITIONS:

1. **Previous test of 10-pin connector must have been completed.**
2. **Pins 3 and 8 and the associated circuitry were checked in Figure 8-53.**
3. **This connector is shown in Figure 8-51 item (2).**

Pin no.	Test Conditions and Meter Readings	Circuit or Component
4,5,6 & 7	Check pins 4,5,6 & 7 at pin connector 21A with connector unplugged. Check following the test given in Section 2, Switch Contacts, Figure 2-130, steps 1 through 3. Please note wire color codes are identical, but pin numbers are different. If switch contacts check ok, but control does not function, repeat Switch Contact check with connector 21A and B plugged together and ohmmeter connected to wires at connector 6A and B. Replace switch or repair wires as required.	Passenger radio function leads (Same switch as on right handlebar)
1	Unplug connector 21A and check continuity on pins 1 and 10 with passenger (rear) PTT switch pressed. Continuity (0.5 ohm or less) shall exist. Replace rear control board if switch is bad.	PTT switch wire
2 and 9	Plug connector 21A and B together, turn ignition switch ON and measure voltage at pins 2 and 9. Voltmeter must read 5-7 vdc with negative probe on ground bolt. If voltage is not present, audio harness is bad.	Right speaker leads
10	Turn ignition switch OFF. Pin 10 must measure less than 4 ohms resistance to ground or audio harness is bad.	PTT switch lead

Figure 8-54. Voltage and Resistance Check of Right Rear Speaker and Control Connector

CONSOLE POD SWITCHES AND TRANSCEIVER TESTS

See Table 1. If a problem arises with the C.B., the following Table gives the technician a method of testing the console pod/transceiver. These tests will help determine if there is a problem in the console pod or the transceiver; that is, if either the pod (switch failure) or the transceiver (transceiver failure) should be replaced.

NOTE

- *See Figure 8-55. The sockets in the 16 pin connector are too small for a probe, so insert a paper clip in the sockets and touch the paper clip with the probe. Be sure to remove any rough edges on the paper clip.*
- *Conduct all tests with 16 pin and pod DIN disconnected. If system tested does not pass test; replace pod. If system tested passes test; replace transceiver.*

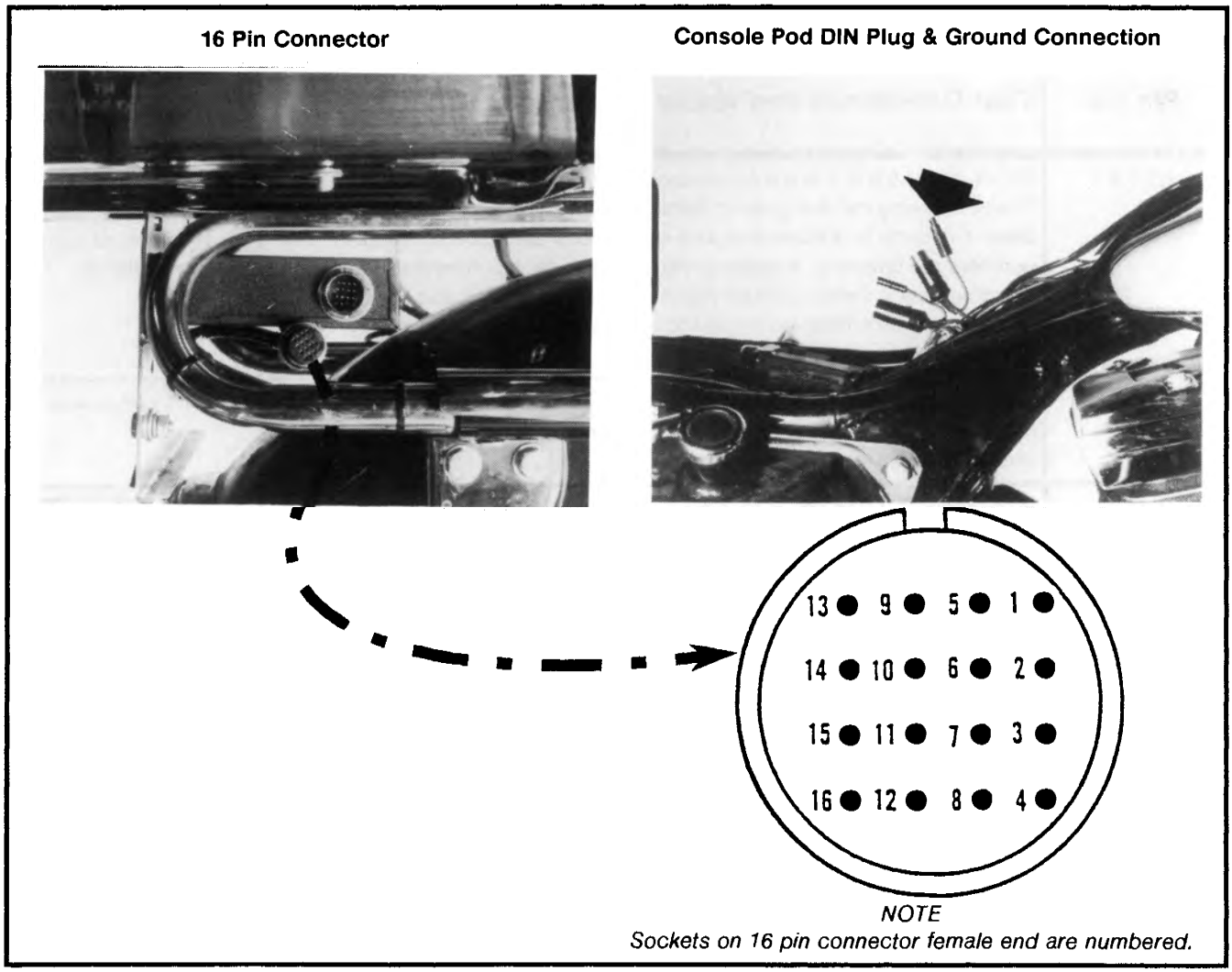


Figure 8-55. 16 Pin Connector and Console Pod DIN Plug and Ground Connection

Table 1. CONSOLE POD SWITCH/TRANSCEIVER TESTS

SYMPTOM	PIN NO.	TEST RESULTS SHOULD BE:	CIRCUIT	ACTION
C.B. blows fuses repeatedly:	1, 5, 6, to pod DIN ground	Resistance to ground . . . . . infinity	C.B. power on/off, lo/dx	Replace pod
Will not turn on or off	1 to 5	CB on/off switch closed (on): . . . . . less than 1 Ohm CB on/off switch open (off): . . . . . infinite Ohms	CB on/off switch	See 15. in troubleshooting chart. If transceiver is good, replace pod.
Moving switch has no effect	1 to 6	Dx: . . . . . infinite Ohms Lo: . . . . . less than 1 Ohm	Local/distance switch	Replace pod
Will not channel down	4 to Pod DIN ground	Channel selector neutral: . . . . . infinite Ohms Channel selector pushed down: . . . . . less than 1 Ohm	CB channel – down	Replace pod
Will not channel up	8 to Pod DIN ground	Channel selector neutral: . . . . . infinite Ohms Channel selector pushed up: . . . . . less than 1 Ohm	CB channel – up	Replace pod
Squelch adjustment has no effect	11 to Pod DIN ground	Squelch open (counterclockwise): . . . less than 50 Ohms Squelch closed (clockwise): . . . . . 8K - 12K Ohms	Squelch adjustment	Replace pod
Volume adjustment has no effect	14 to Pod DIN ground	8K - 12K Ohms . . (position of knob will not affect reading)	Volume adjustment	Replace pod
PTT switch has no effect	15 to Pod DIN ground	PTT pressed: . . . . . high resistance PTT released: . . . . . infinite Ohms **DIODE TESTER (Alternate method)** PTT pressed: . . . . . 0.5 Volt drop PTT released: . . . . . usually open circuit voltage, 1.5 Volts (may vary depending on meter)	PTT switch	Replace pod

NOTE

You MUST use pod DIN ground jumper (single pin attached to console pod DIN connector half that is directly connected to the pod.)

REMOVAL/INSTALLATION

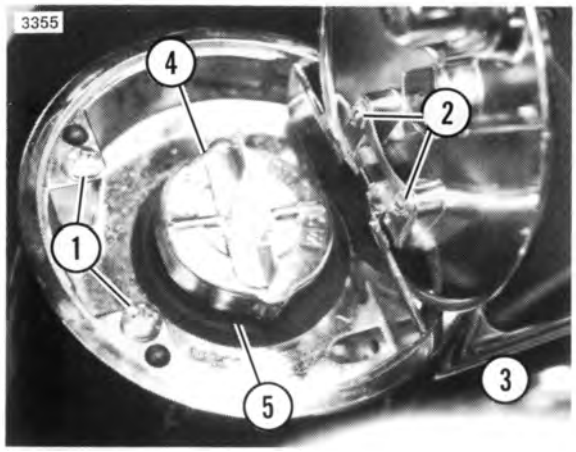
Console Assembly (Pod) Removal

If testing has identified a malfunction in the pod, remove it following these instructions:

1. See Figure 8-56. Remove the front mounting screws (1) and the hinge pin screws (2).

NOTE

Steps 1 and 2 below apply to 1989 models only. For 1990 models proceed to step 3. (On 1989 models pod is not removed from console, on 1990 model it is.)



1. Screw (2)
2. Hinge pin screws (2)
3. cover
4. Gas cap
5. Filler neck grommet

Figure 8-56. Console Front Mounting Fasteners

2. Remove the console cover (3). Handle cover with care and store in a safe place. Cover will be installed on the replacement pod.

3. See Figure 8-49. Remove seat. Disconnect DIN connector (1) and 10-pin connector (2). Remove cable straps securing the DIN and Pod cable.

4. See Figure 8-47. Disconnect the 16-pin connector on right side of transceiver and cut all cable straps holding the cable.

5. See Figure 8-46. Unplug 2-pin connector (1) and remove cable straps holding the cable.

6. Remove the cable straps that secure the 5-pin DIN connector cable.

7. See Figure 8-56. Remove gas cap (4). See Figure 8-49. Remove screw (3) and gently lift console upward until grommet (5, Figure 8-56) at filler neck is free.

8. See Figure 8-57. Turn console pod over and remove overflow hose.

9. Check that all cables connected to pod have been disconnected and remove pod.

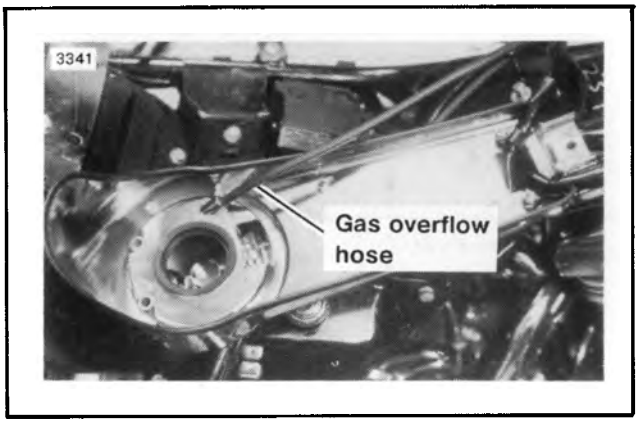


Figure 8-57. Underside of Console Pod

10. On 1990 models, invert the console and pod assembly and remove the nuts that secure the pod to the console.

11. Remove pod from console and carefully feed the harnesses through the hole in the console.

Console Assembly (POD) Installation

Install the new pod by reversing the REMOVAL procedure.

CAUTION

Coat all connector pins with wheel bearing grease to seal out moisture and prevent corrosion. Seal the DIN connectors with 2-layers of PVC electrical tape applied over the mating line between the connector halves.

WARNING

Be very careful not to collapse the gas overflow hose when installing cable straps. Hose blockage could cause spilled gasoline to remain around gas cap and could cause a possible fire hazard.

CB Transceiver Removal

1. See Figure 8-47. Disconnect the 16-pin connector from the right side of the transceiver.

2. See Figure 8-48. Disconnect the antenna cable (1) from left side of transceiver.

3. Cut cable strap (3) and follow power cable to fuse/filter board under left side cover removing cable straps that secure power cable.

4. See Figure 8-46. Unplug connector (4) from fuse/filter board.

5. Remove Tour-Pak liner, remove four mounting bolts from Tour-Pak. Raise Tour-Pak and remove the two screws, shown in Figure 8-47, that secure "L" bracket to luggage rack.

6. Remove the two rear transceiver mounting screws located under the license plate and remove transceiver.

CB Transceiver Installation

Reverse removal instructions to install the transceiver. Make sure 16-pin connector is to the right and front when attaching "L" bracket and installing transceiver.

Right Rear Speaker and Control Removal/Disassembly

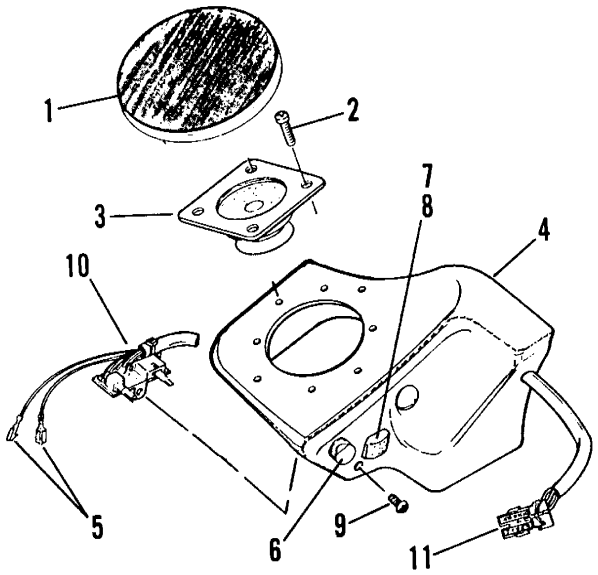
1. See Figure 2-142. Remove seat, unplug connector (2) and remove cable straps.
2. See Figure 2-141. The speaker assembly is fastened to the Tour-Pak with (3) bolts and wellnuts.
3. Remove mounting bolts and speaker housing is free.

Disassembly

NOTE

The speaker and switch assembly can be removed and installed without removing the speaker housing from the Tour-Pak.

1. See Figure 8-58. Remove speaker grill assembly (1) by gently prying the assembly off the four double-ended clips (Christmas tree fasteners) with a wide, thin bladed screwdriver.
2. Remove the four screws (2) securing the speaker, gently remove speaker (3) from housing (4) and disconnect speaker leads (5).
3. Remove Volume/PTT knob by gently pulling knob off switch shaft. Remove setscrew (7) from the function switch knob (8). A 1.5 millimeter hex wrench is needed to remove setscrew (7) on early 1989 models that have the same knob as the handlebar switch. Slide knob off switch.
4. Remove screw (9) to loosen switch assembly (10) and using Pin Terminal Tool, HD-97362-71, remove all wires from pin connector housing (11).



1. Speaker grille
2. Screws (4)
3. Speaker
4. Speaker housing
5. Speaker leads
6. Volume / PTT knob
7. Setscrew
8. Function switch knob
9. Screw
10. Switch assembly
11. Connector housing

Figure 8-58. Rear Speaker Housing

Assembly/Installation

Reverse assembly and installation procedure to assemble and install speaker, switch assembly and housing.

Left Rear Speaker

Refer to right speaker for removal, disassembly and installation instructions. Disregard the instructions pertaining to the switch assembly and removal of pin terminals.

Rider Push-To-Transmit (PTT) Switch

See the Cruise Control section. The SET switch removal and installation is the same as for the PTT switch.

WIRING DIAGRAM INDEX

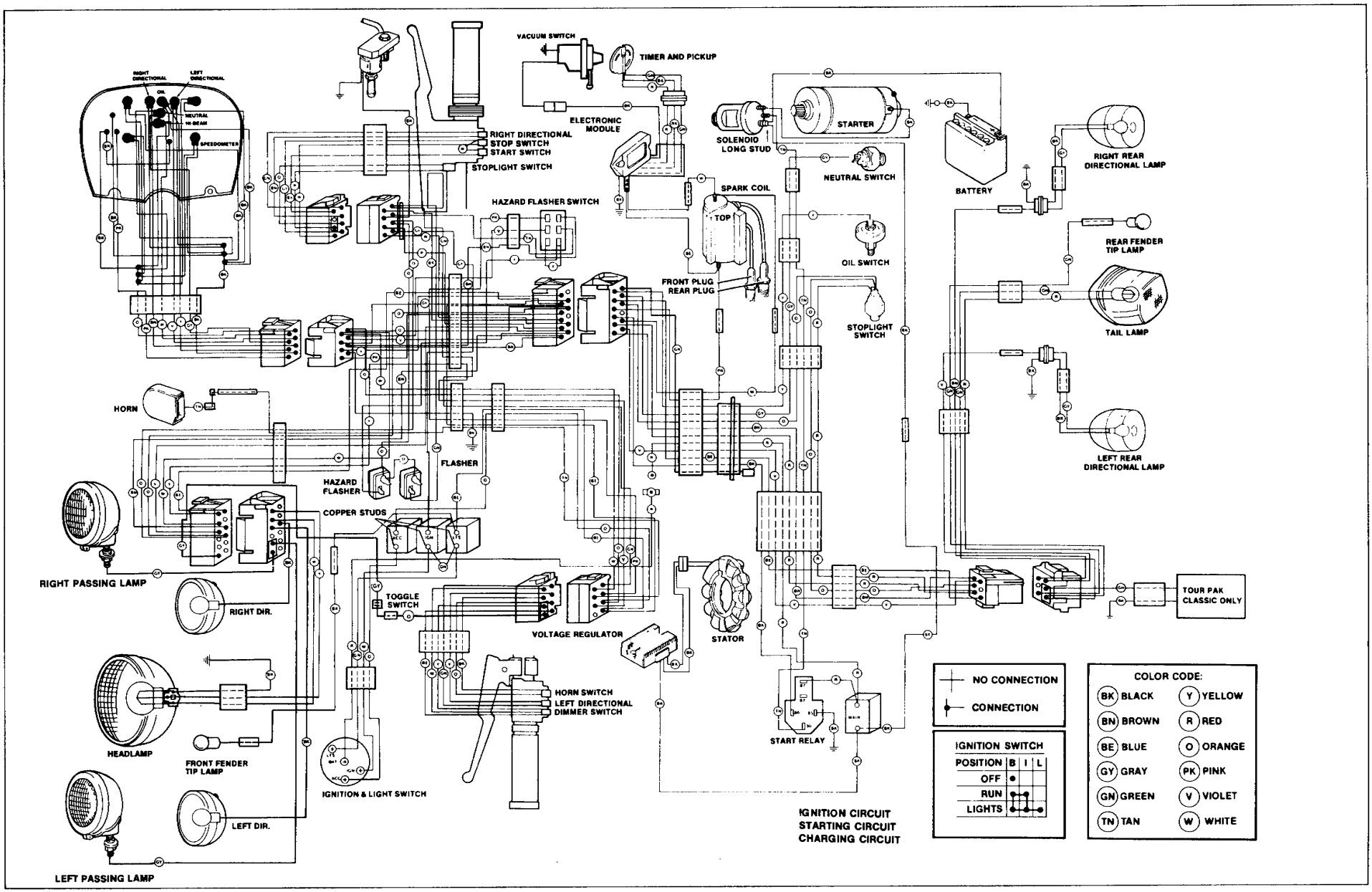
The following tabulation lists year(s), model(s) and page number of applicable wiring diagram for all motorcycles covered by this Manual. Please note that the "Ultra" models have three page wiring diagrams.

(Index continued on next page.)

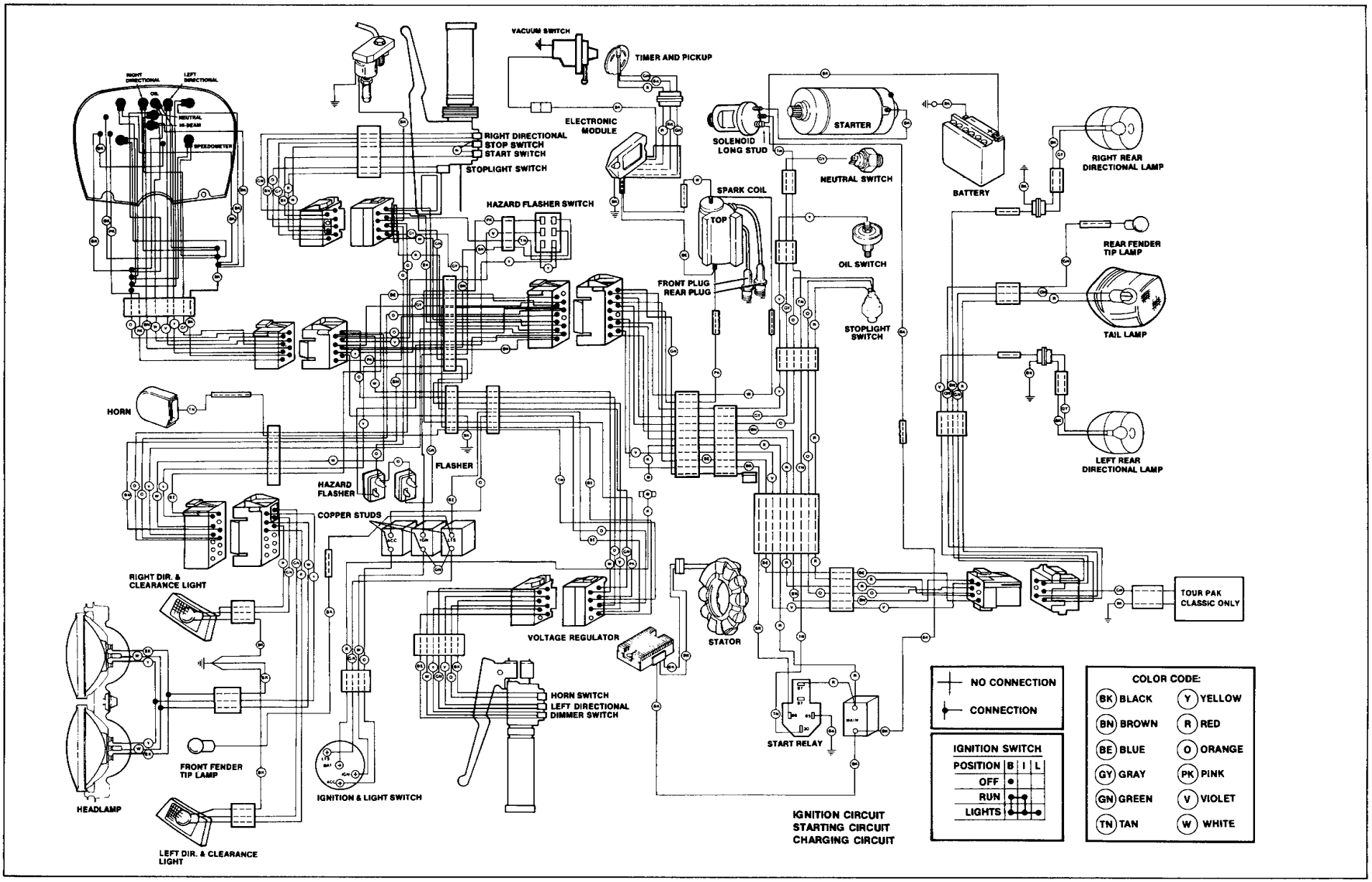
YEAR(S)	MODEL(S)	PAGE NUMBER
1990	FLHTC Chassis	8-120
1990	FLHS	8-121
1990	FLTC Ultra Chassis Fairing CB /Intercom, Cruise	8-122 8-123 8-124
1990	FLHTC Ultra Chassis Fairing CB /Intercom, Cruise	8-125 8-126 8-127

NOTE

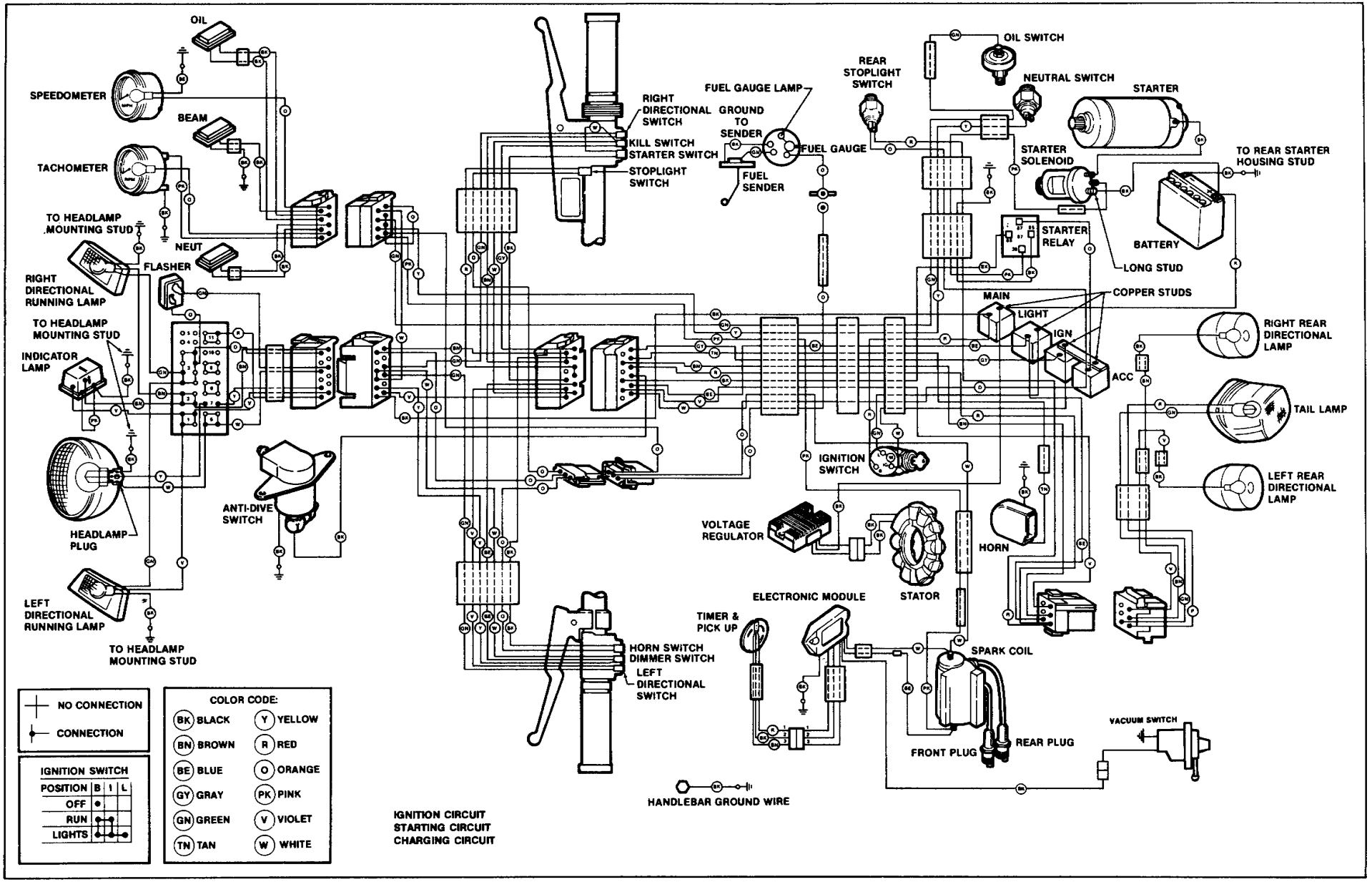
Chassis wiring changes on 1990 FLTC, FLHTC and FLHS models required new chassis wiring diagrams. The fairing and instrument wiring did not change on the above models, so the 1989 & 1990 fairing or instrument diagrams cover both 1989 and 1990 models.



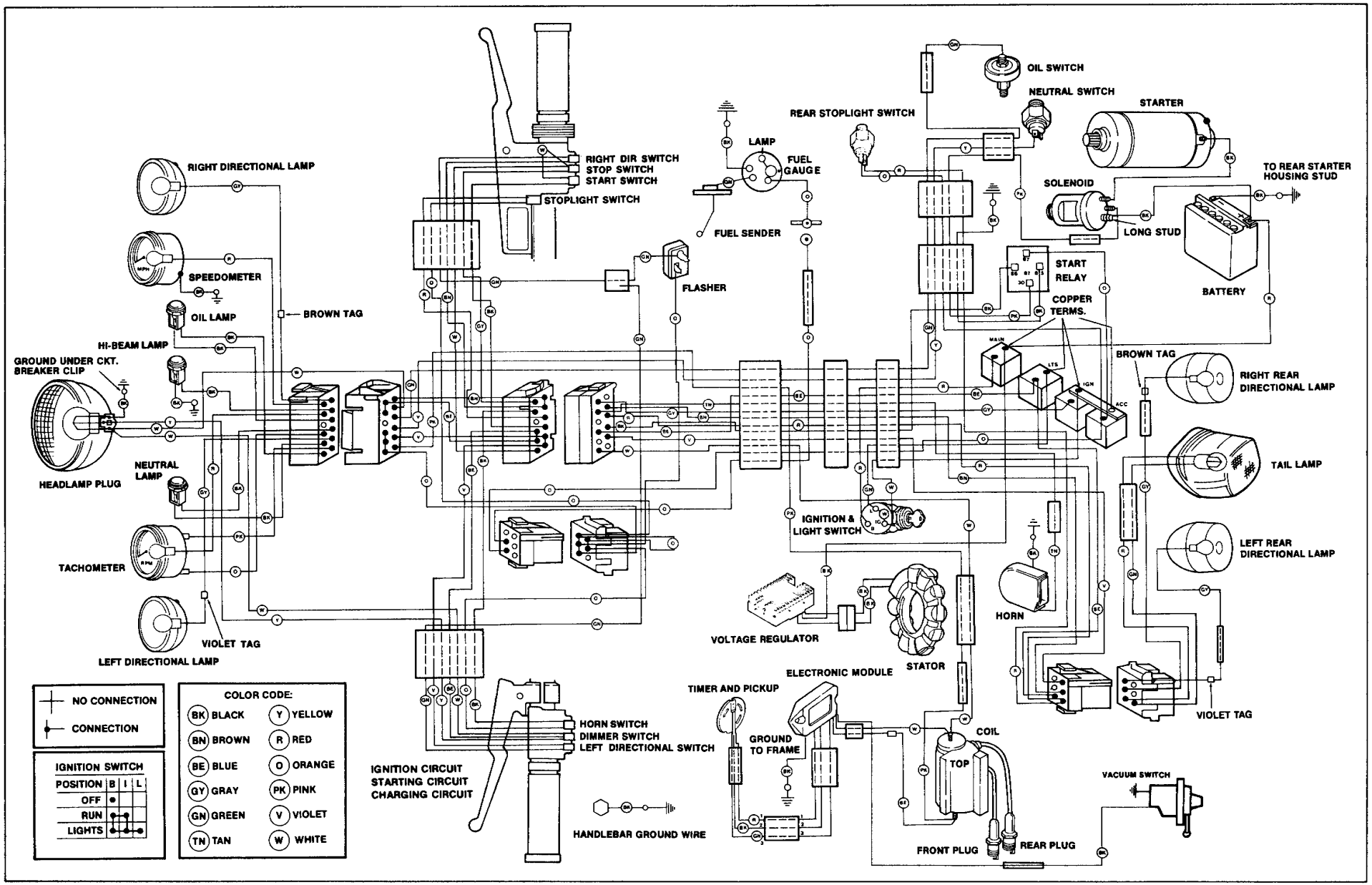
EARLY 1984 FLHTC



EARLY 1984 FLTC



EARLY 1984 FXRT



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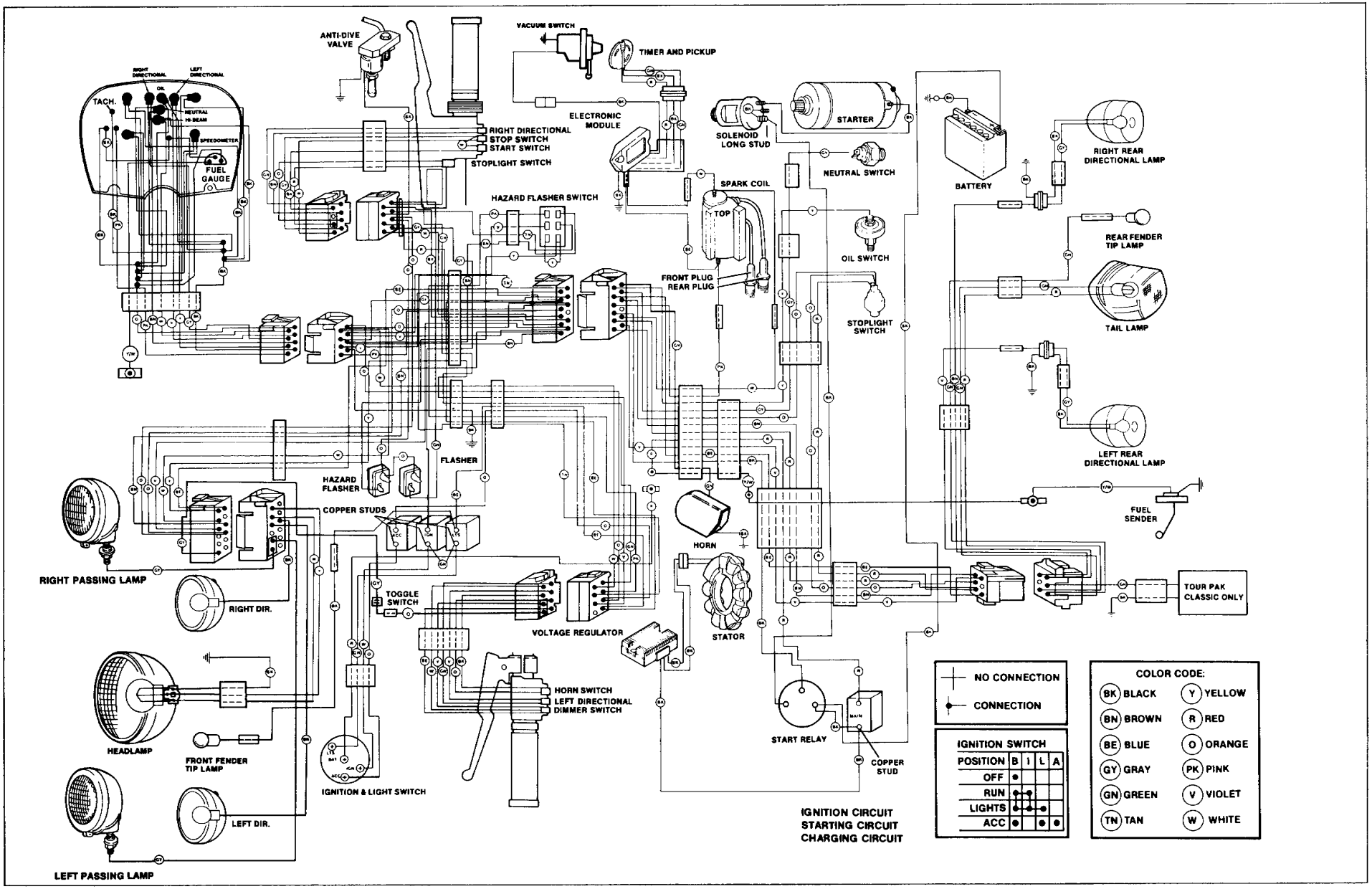
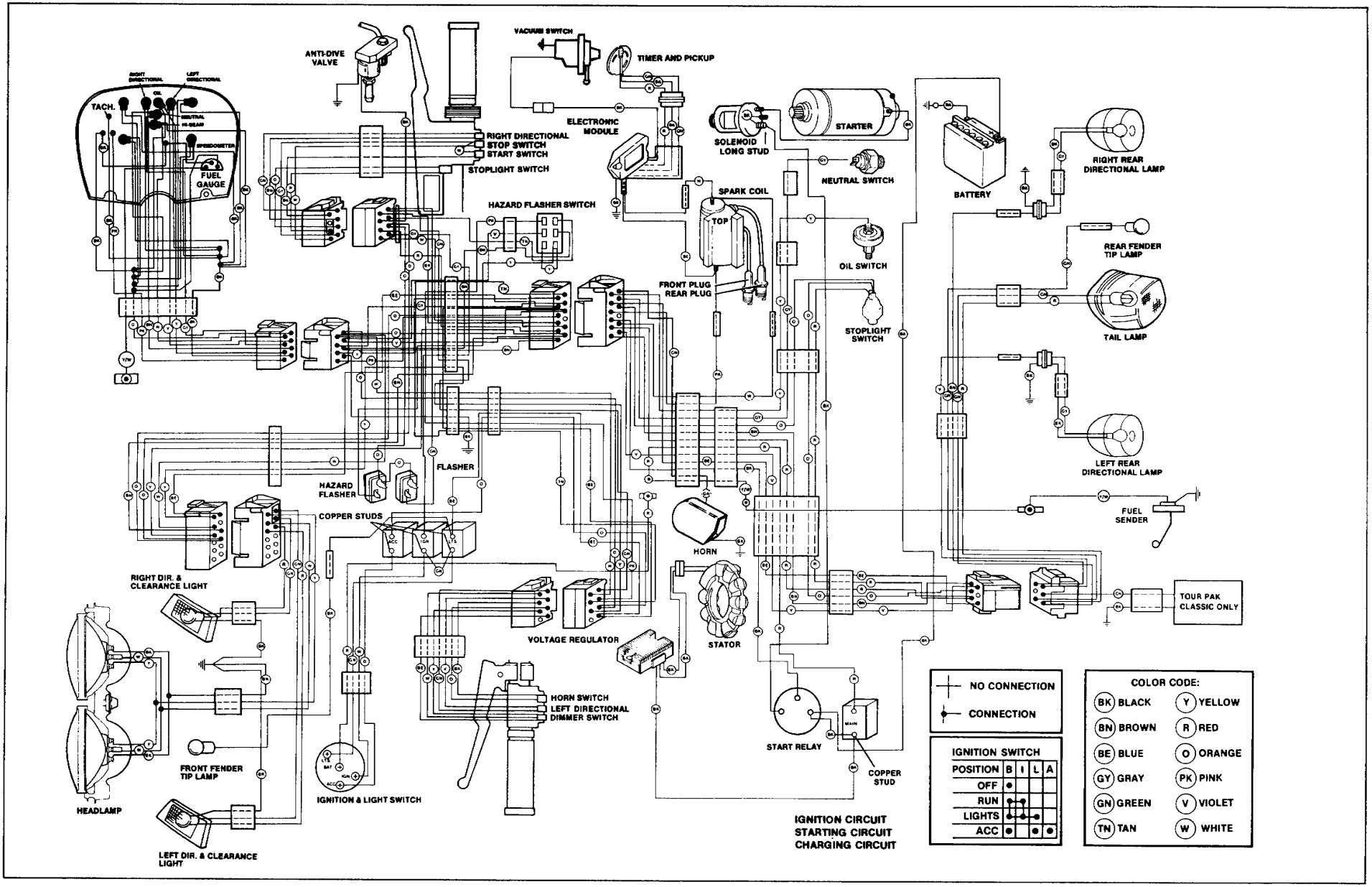
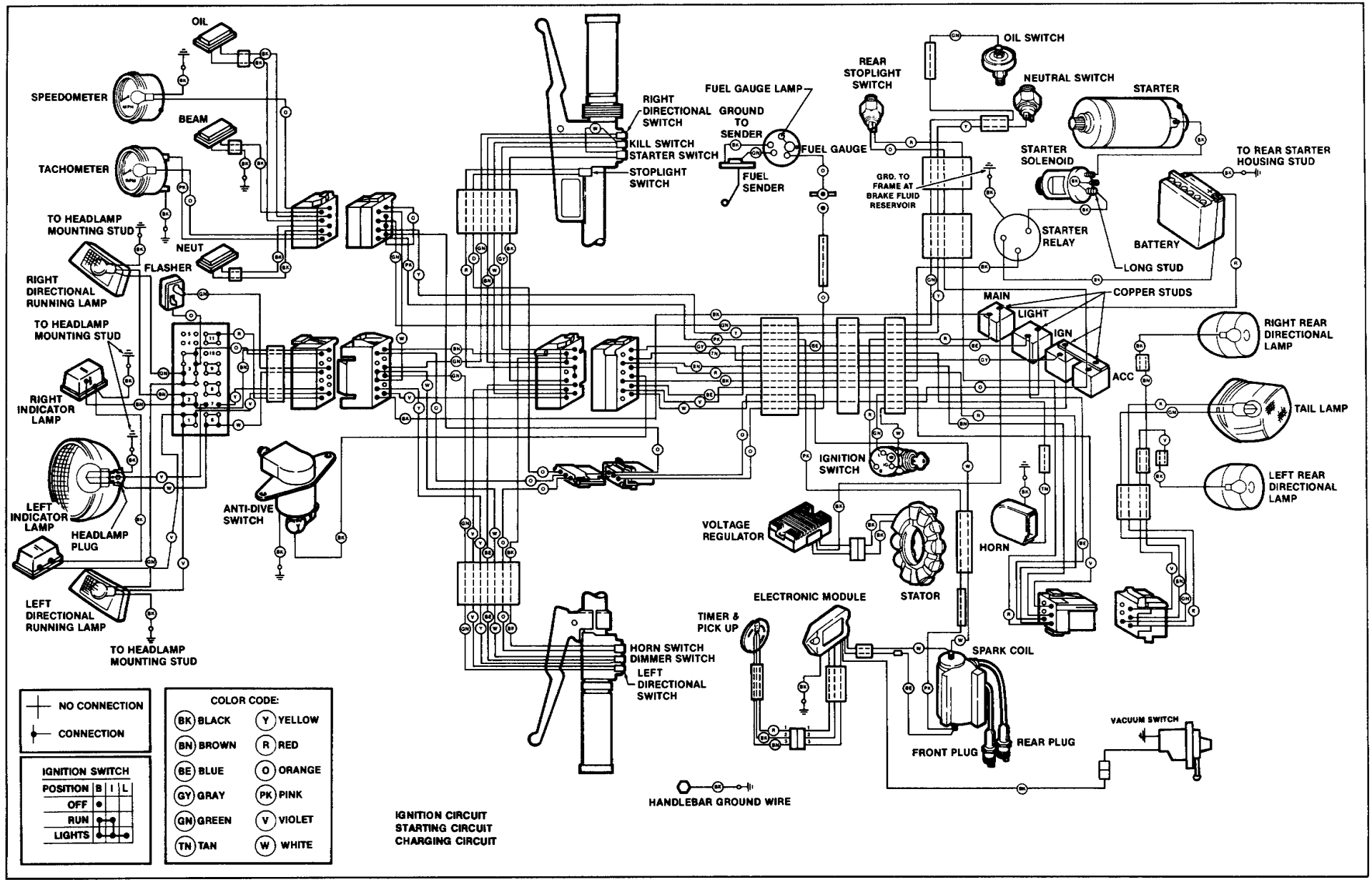


LATE 1984 & 1985 FLHTC



LATE 1984 & 1985 FLTC



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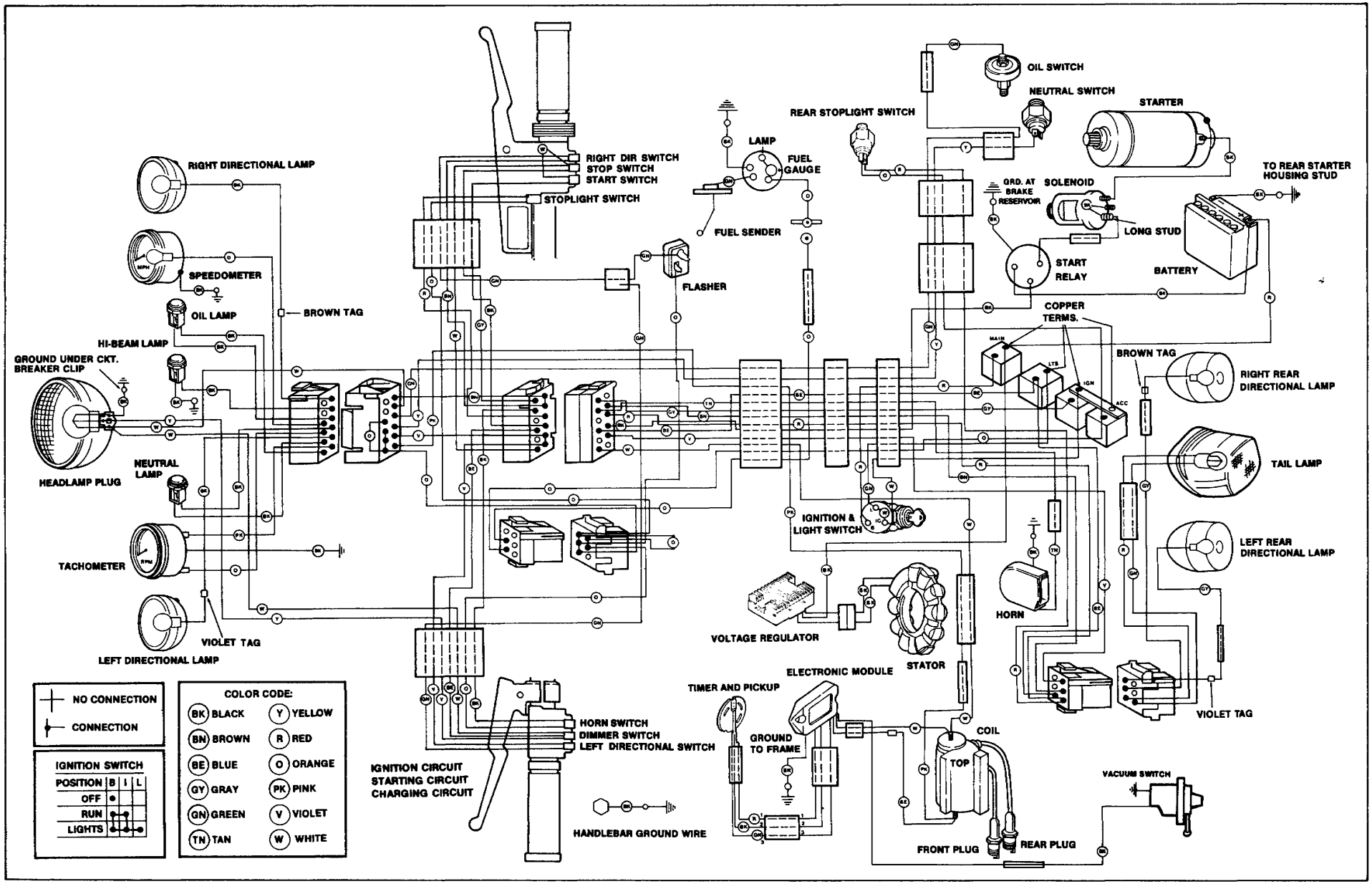
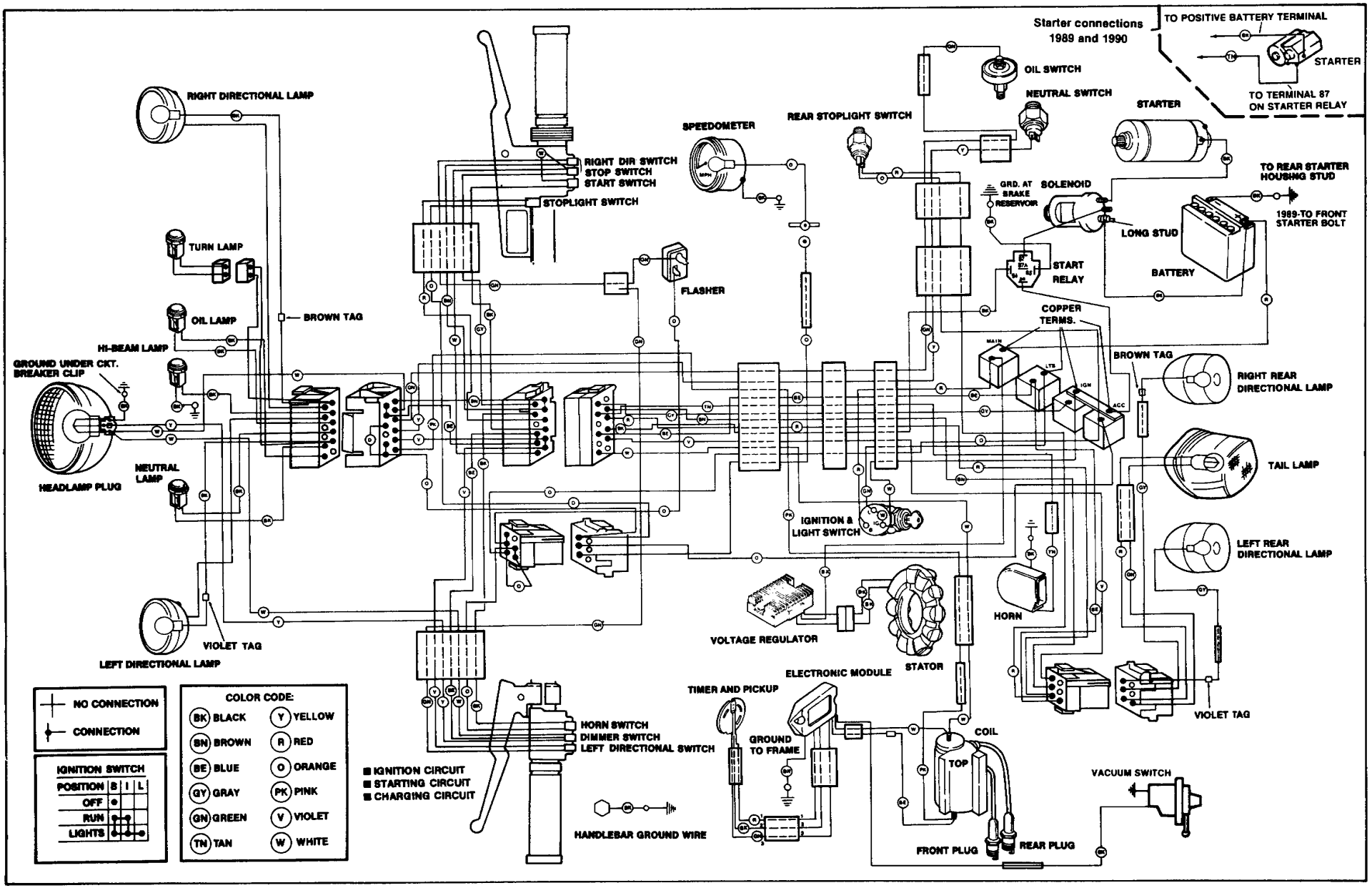
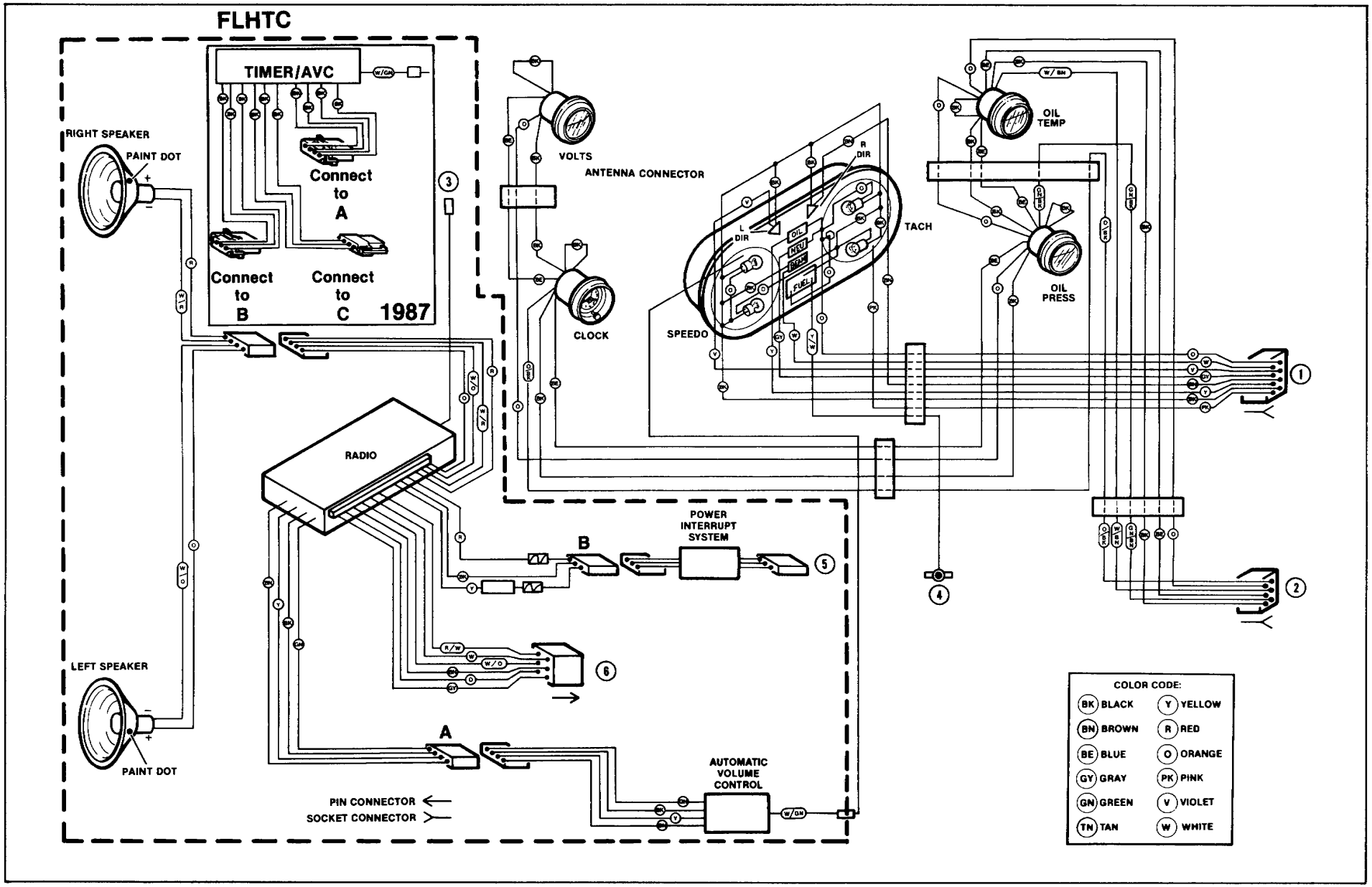


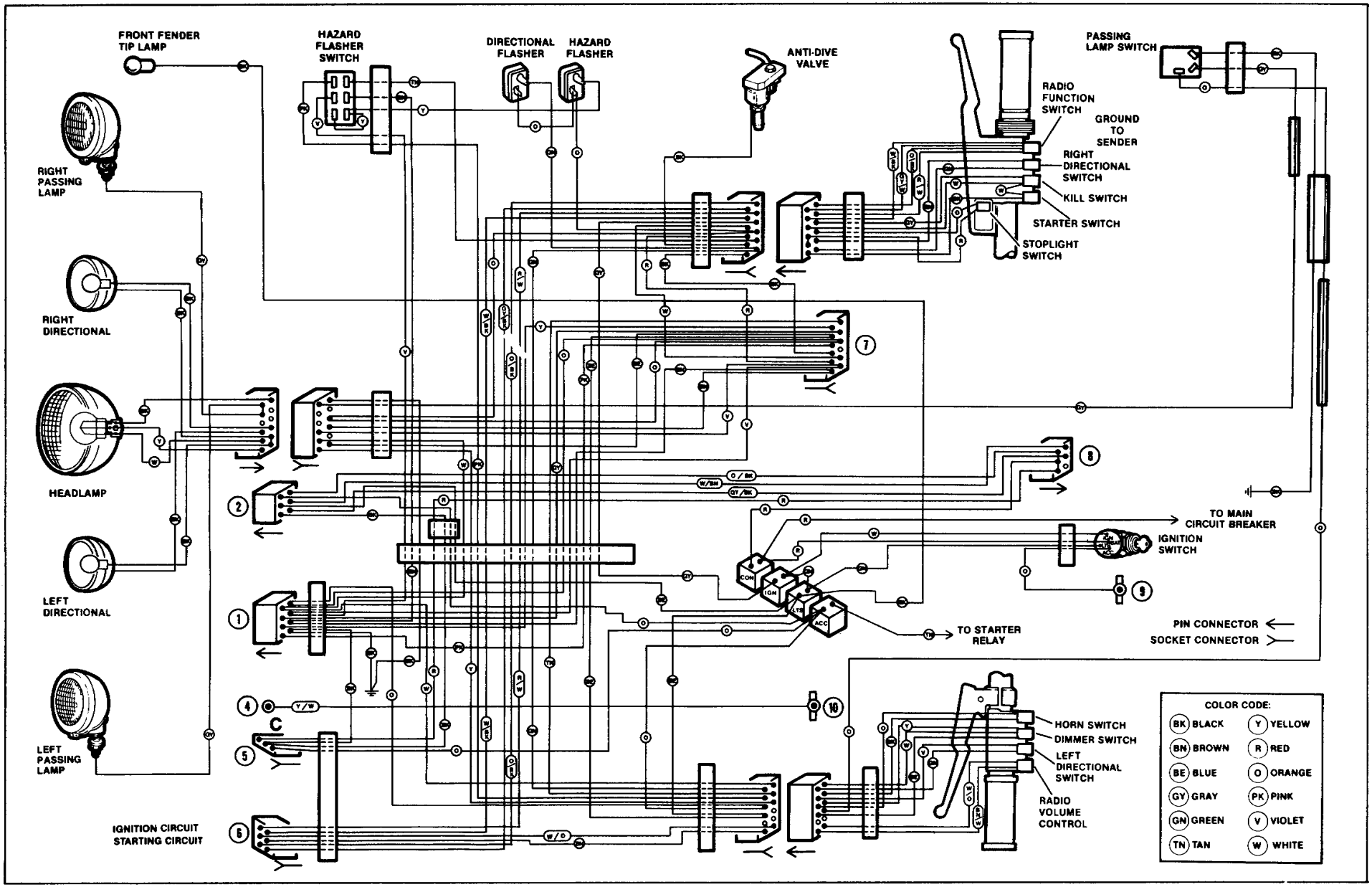
LATE 1984 & 1985 FXRS



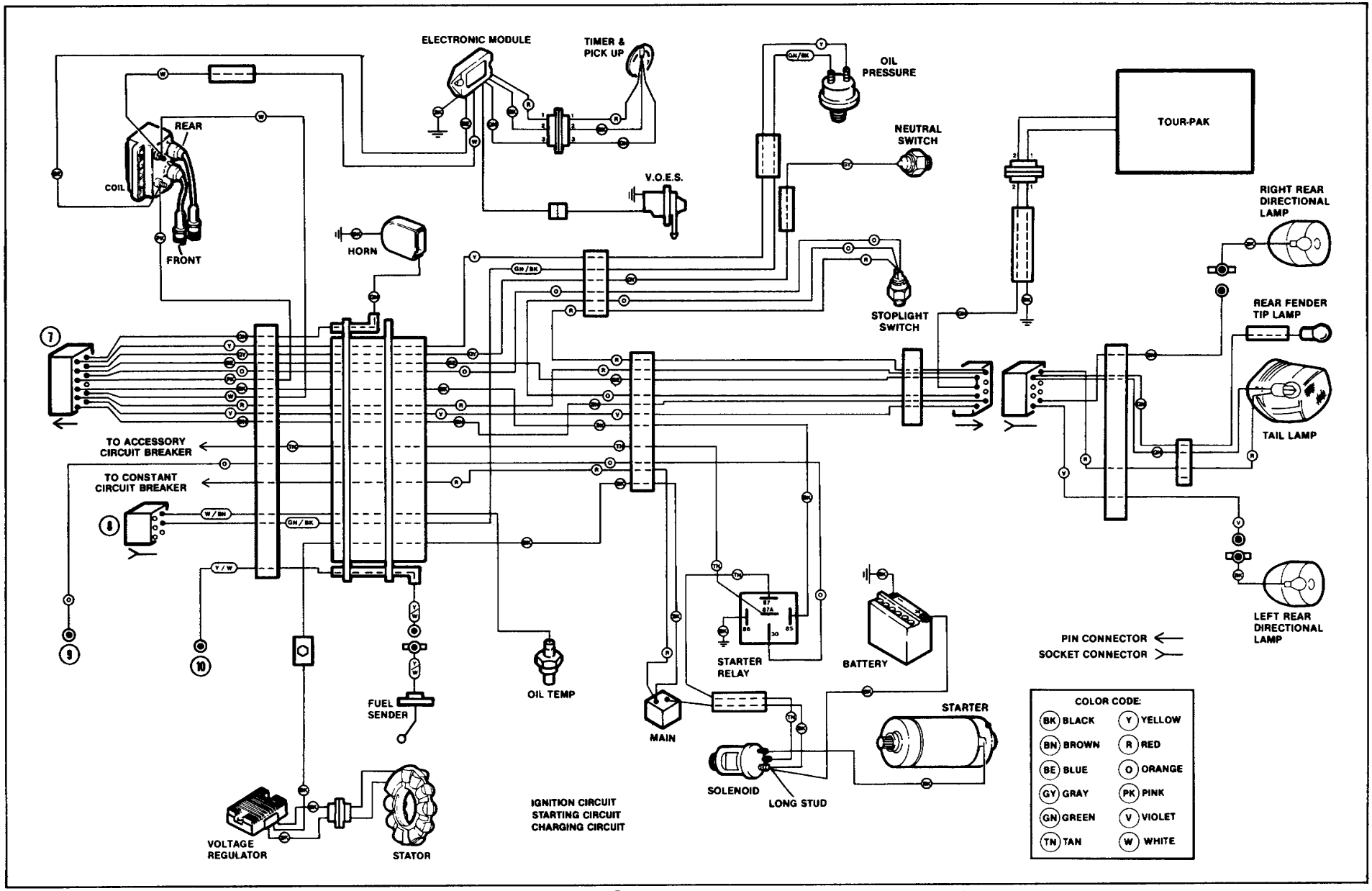
1986-1990 FXR



1986, 1987 FLHT/C FAIRING



1986, 1987 FLHT/C CHASSIS (Sheet 1 of 2)



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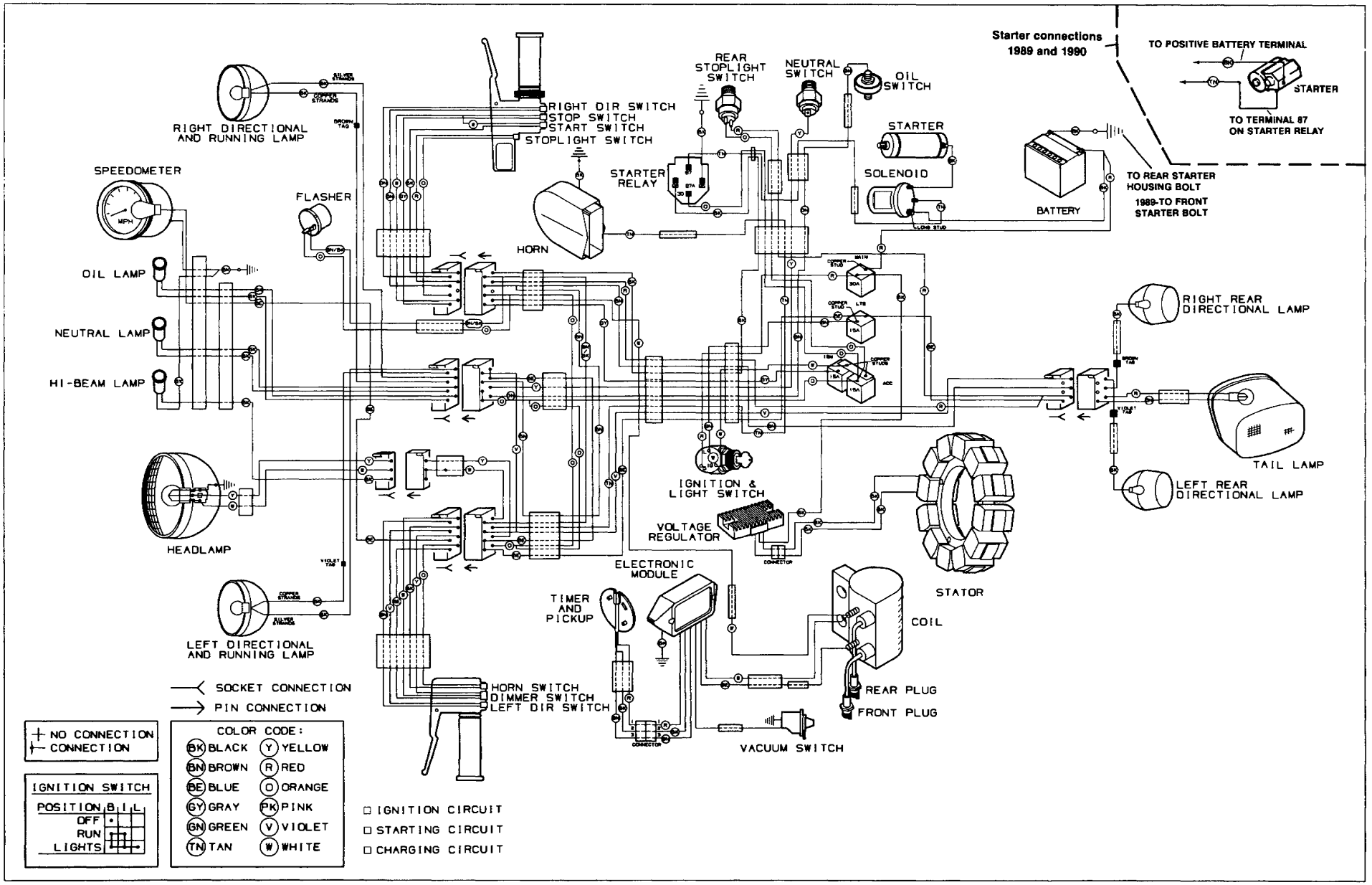

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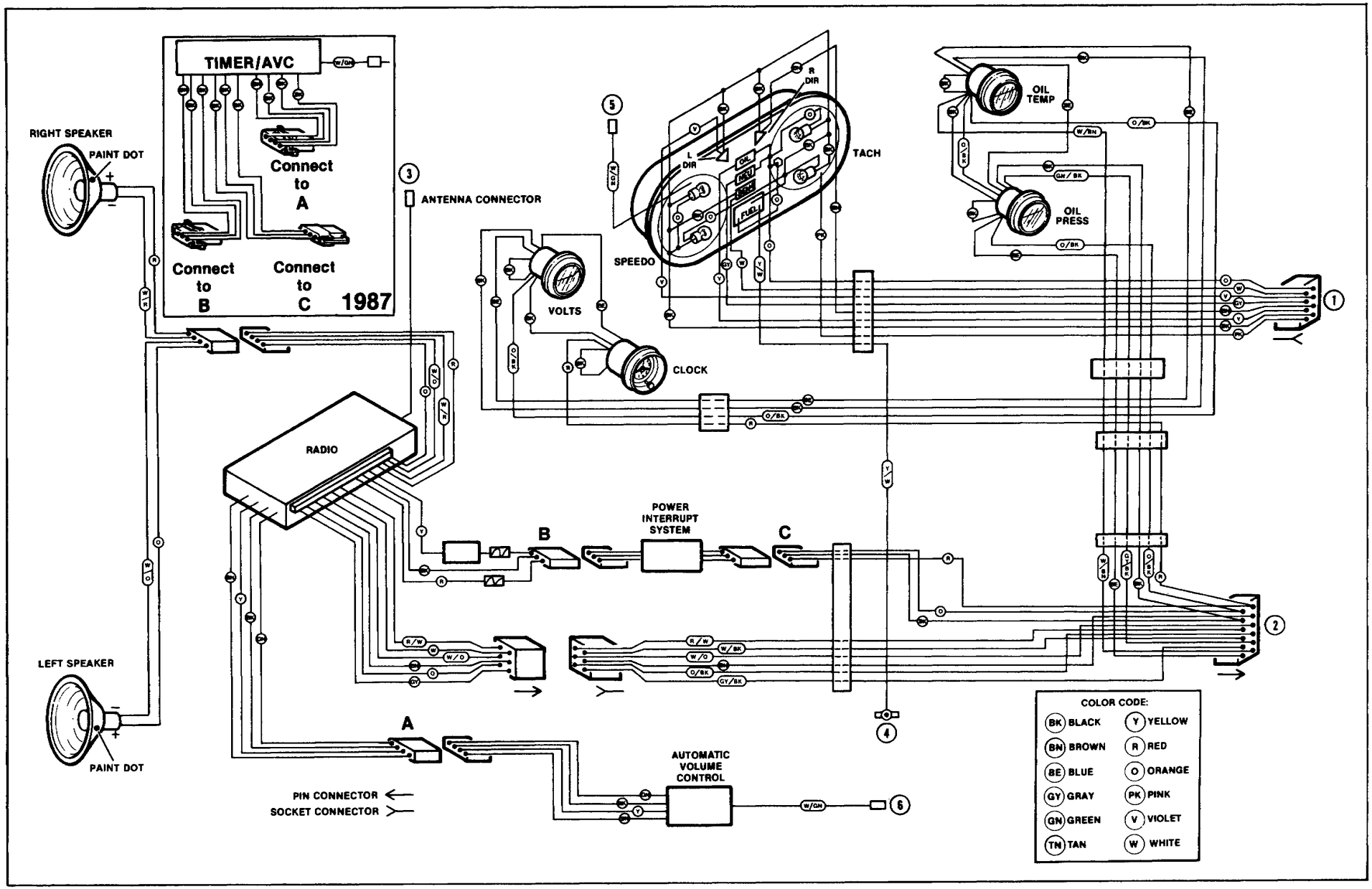

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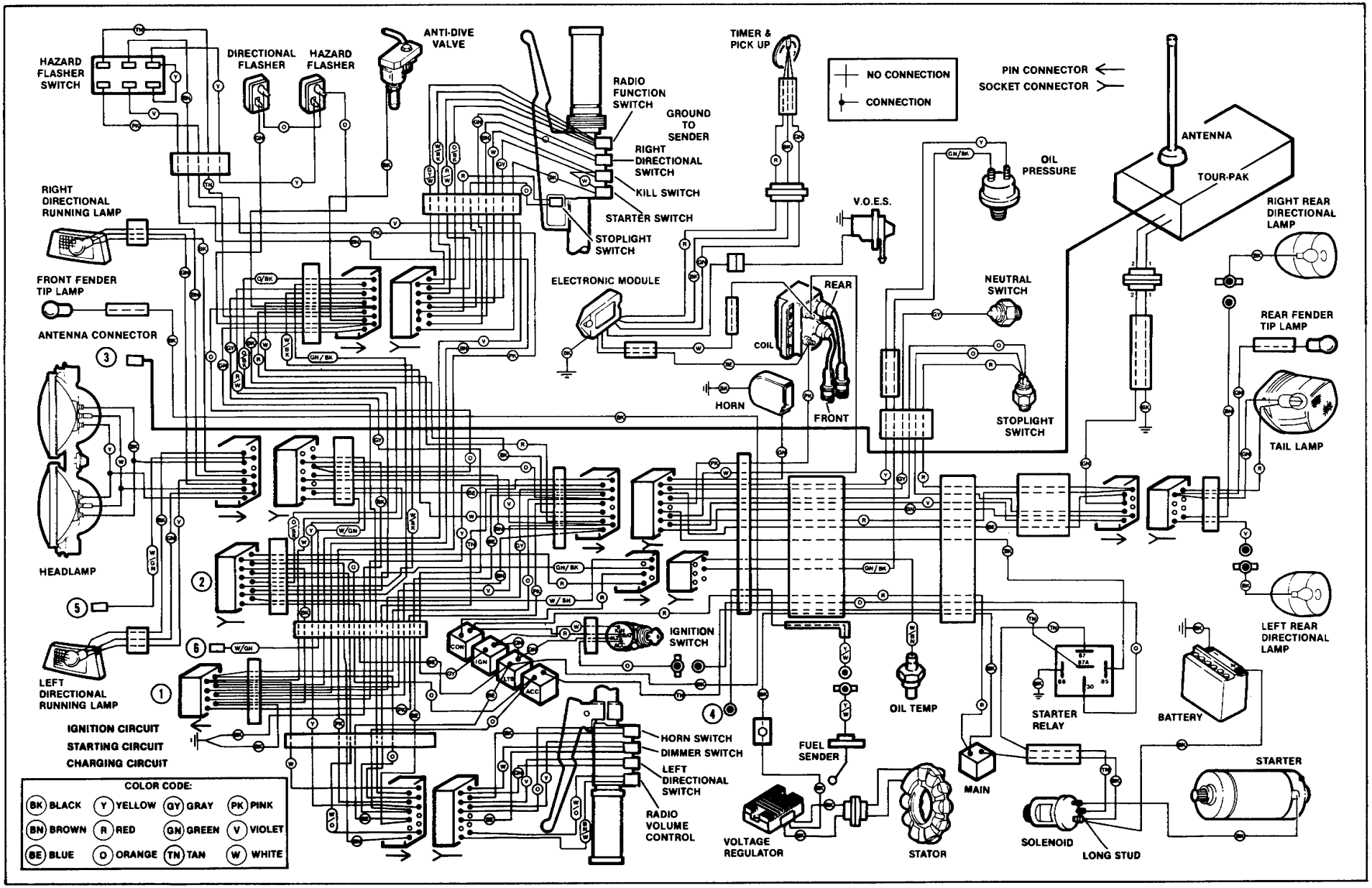
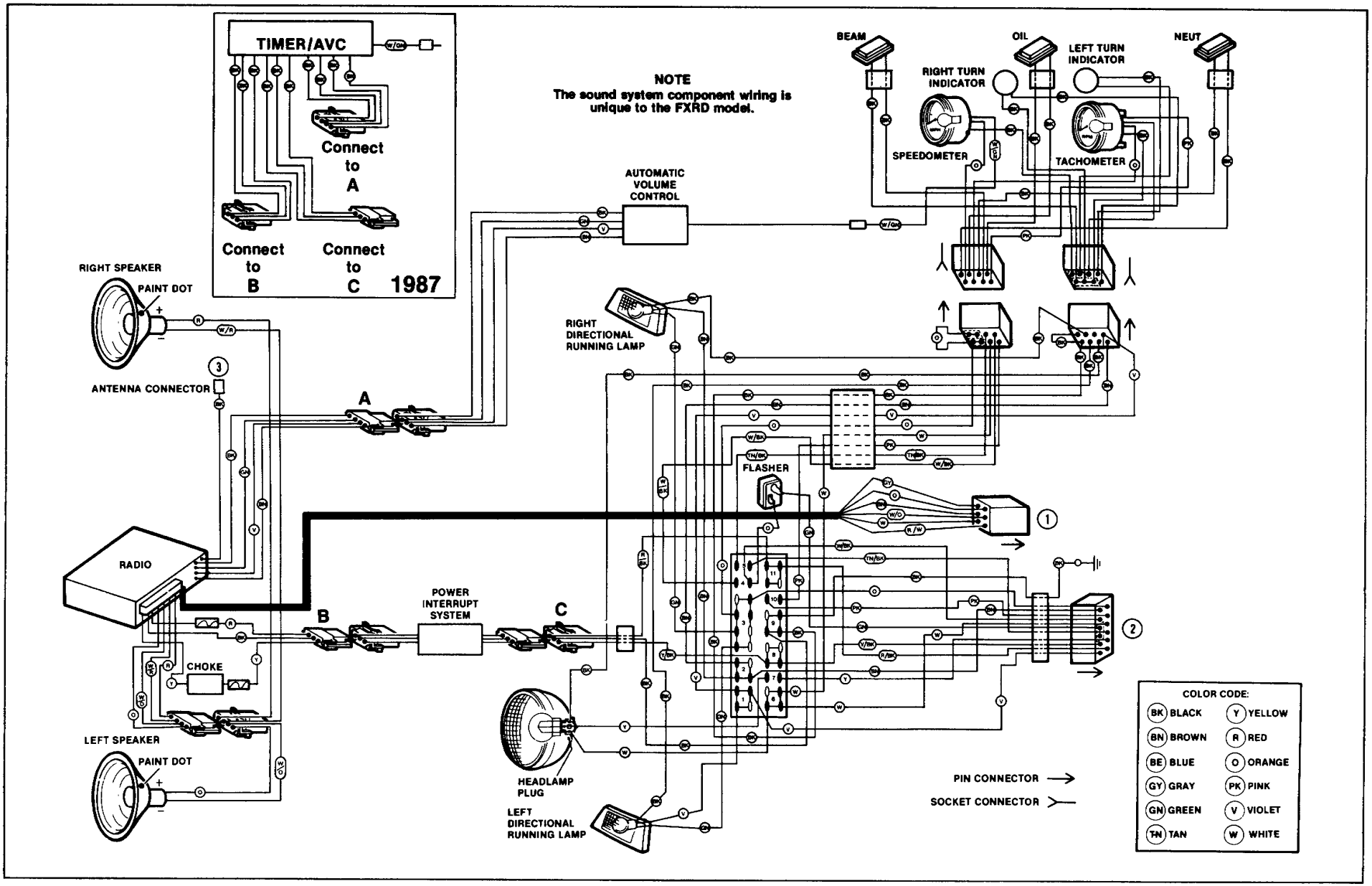
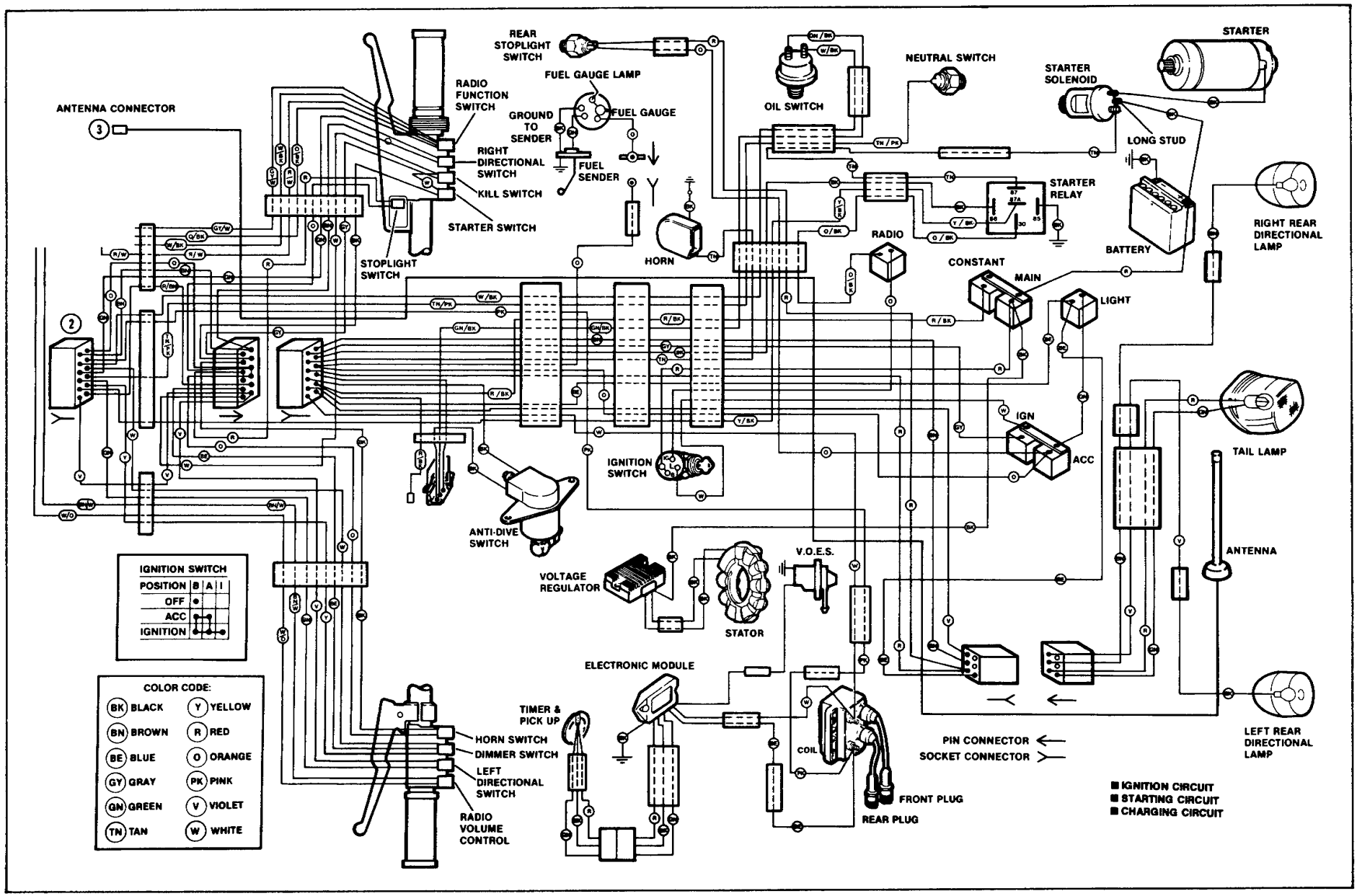


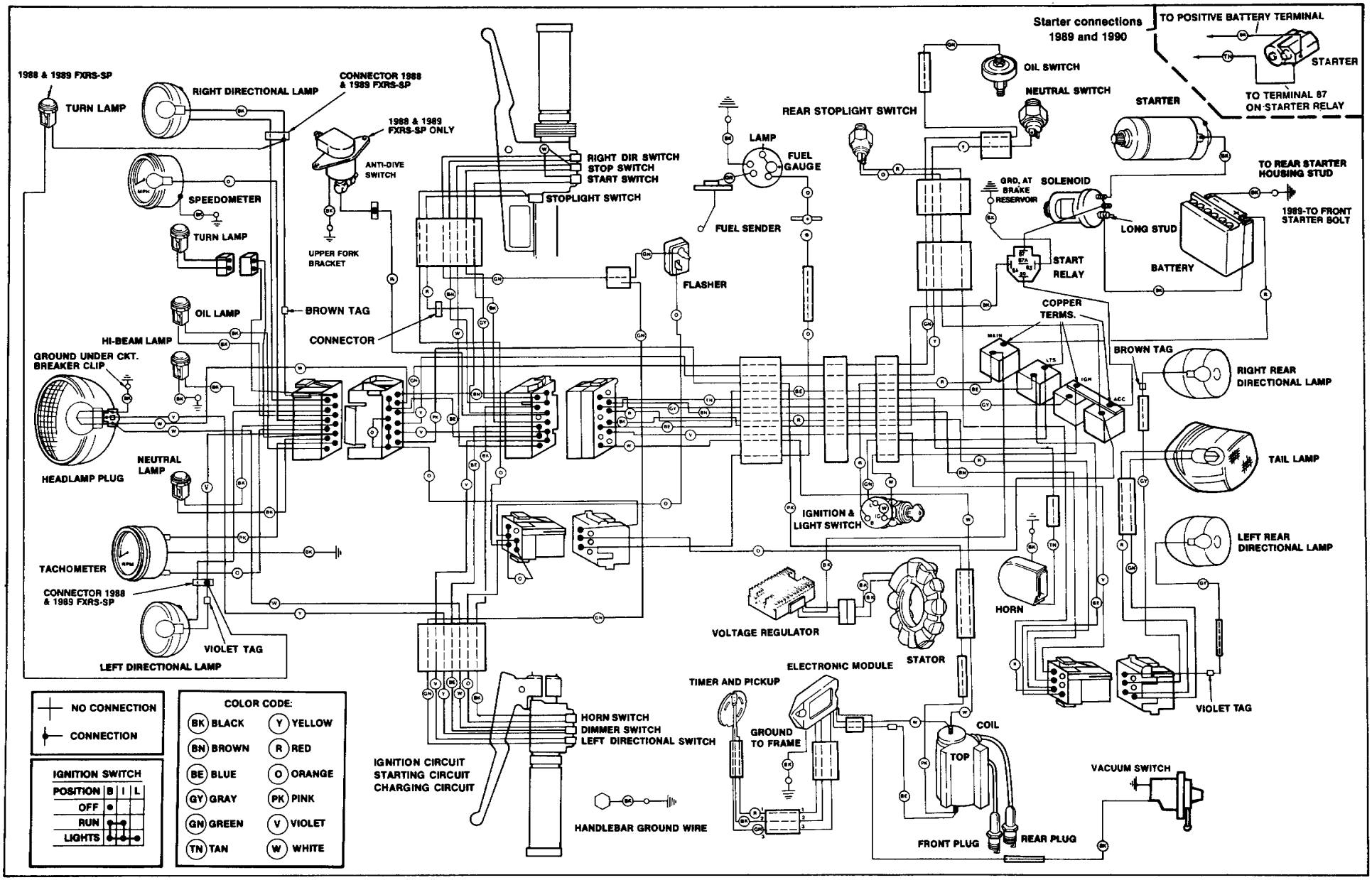
1986, 1987 FLTC CHASSIS



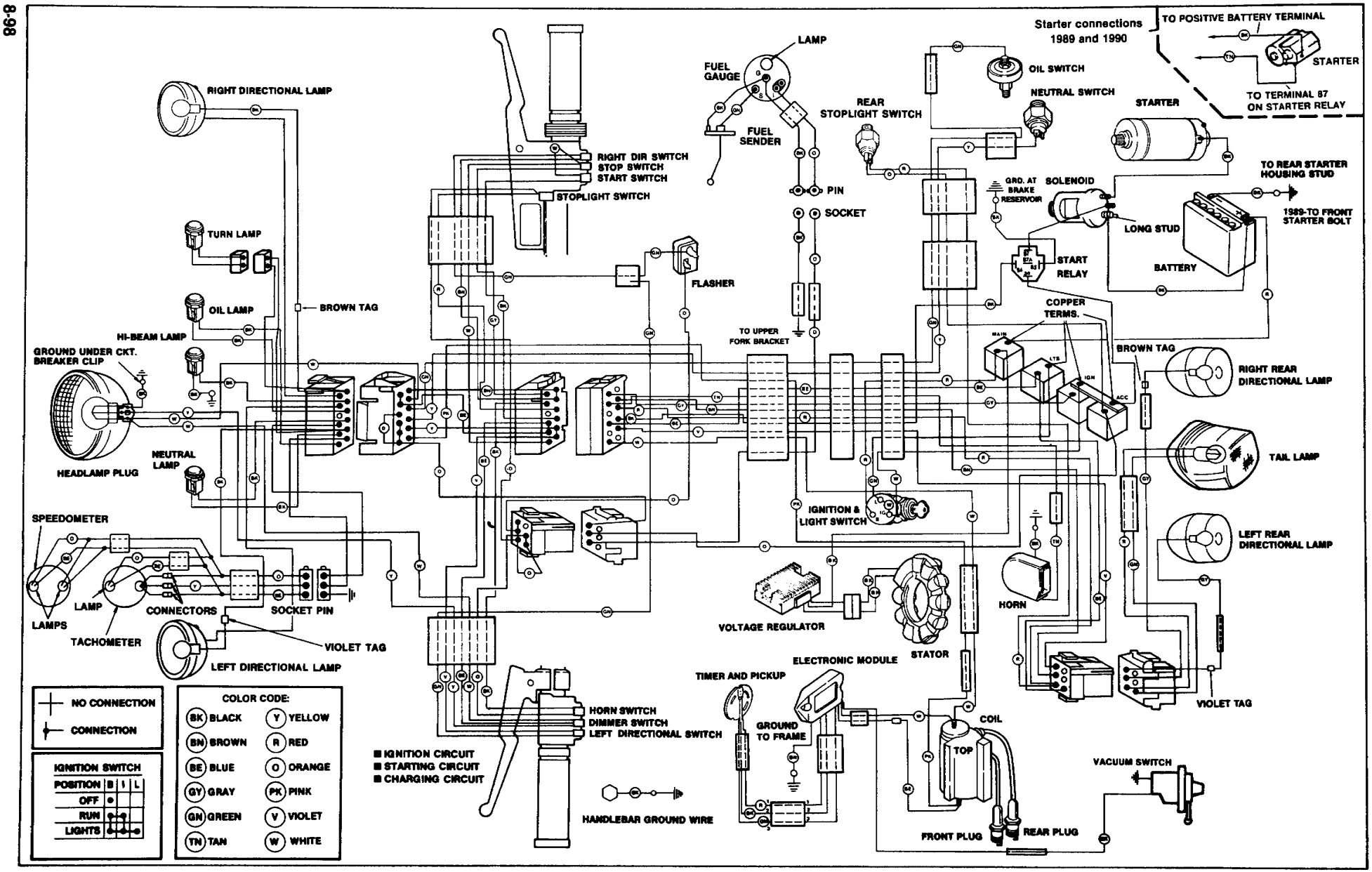
1986 FXRD/1986, 1987 FXRT FAIRING



1986 FXRD/1986, 1987 FXRT CHASSIS



1986, 1987 FXRS & 1988-1990 FXRS-SP



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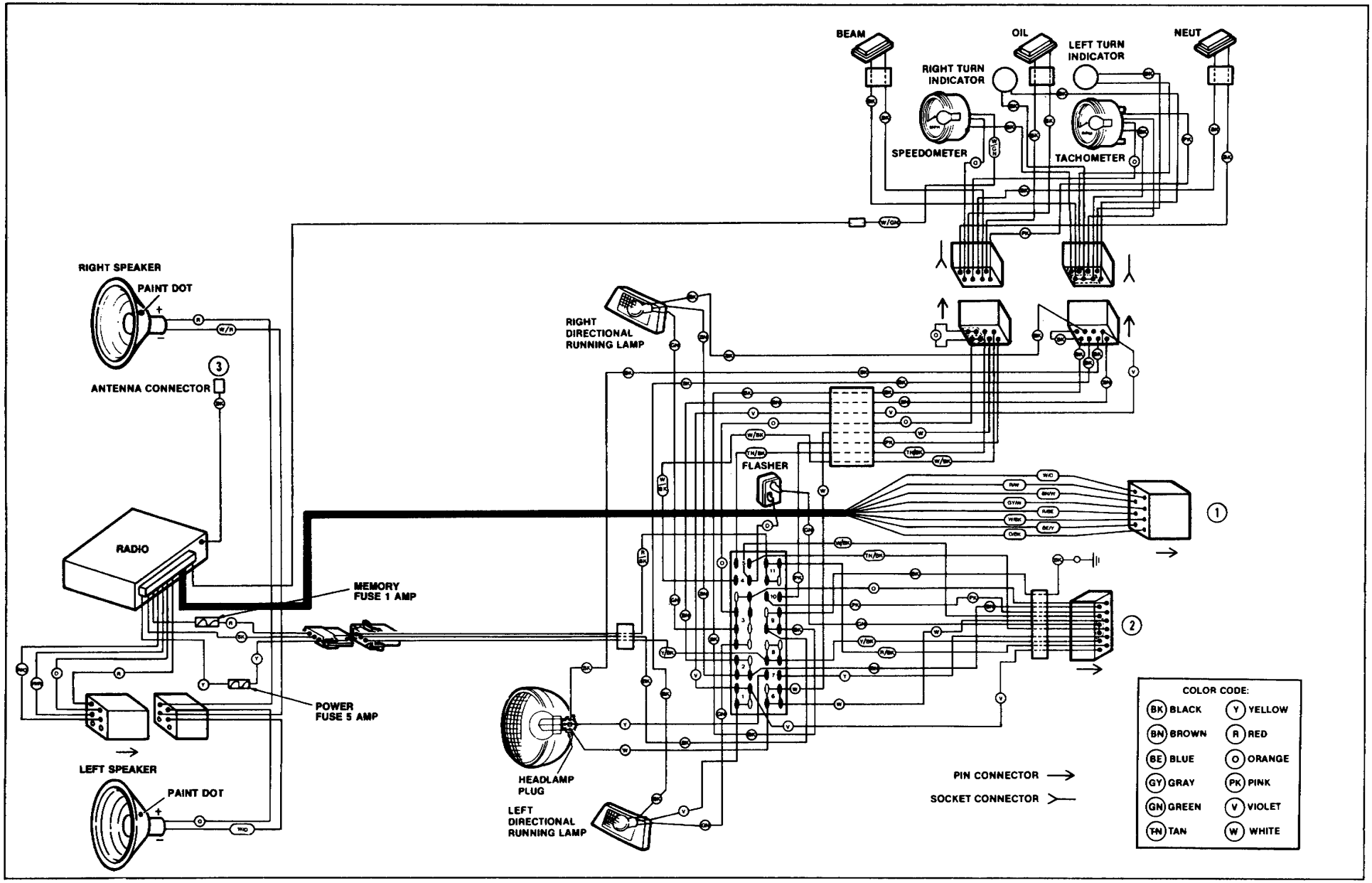

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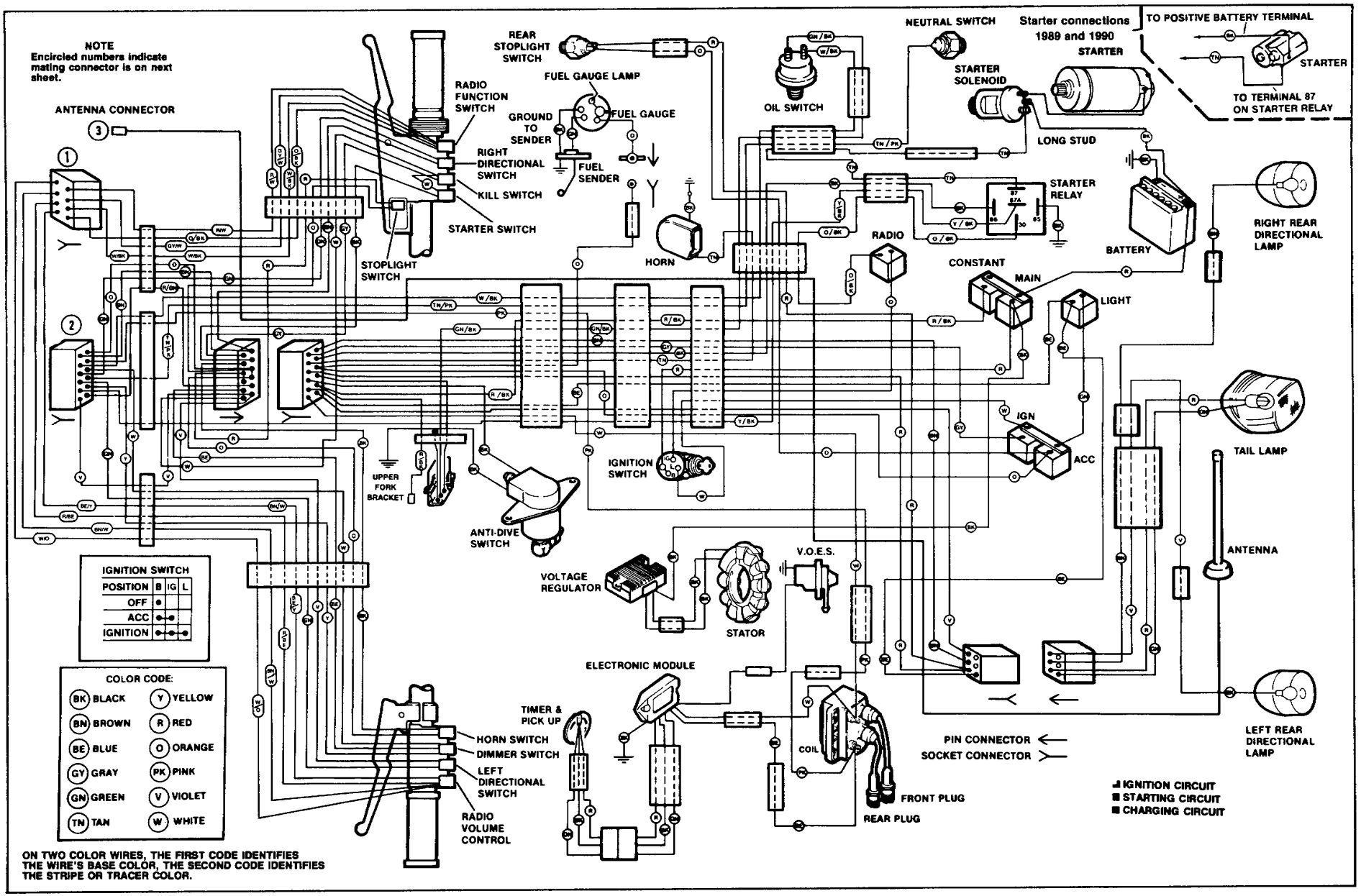

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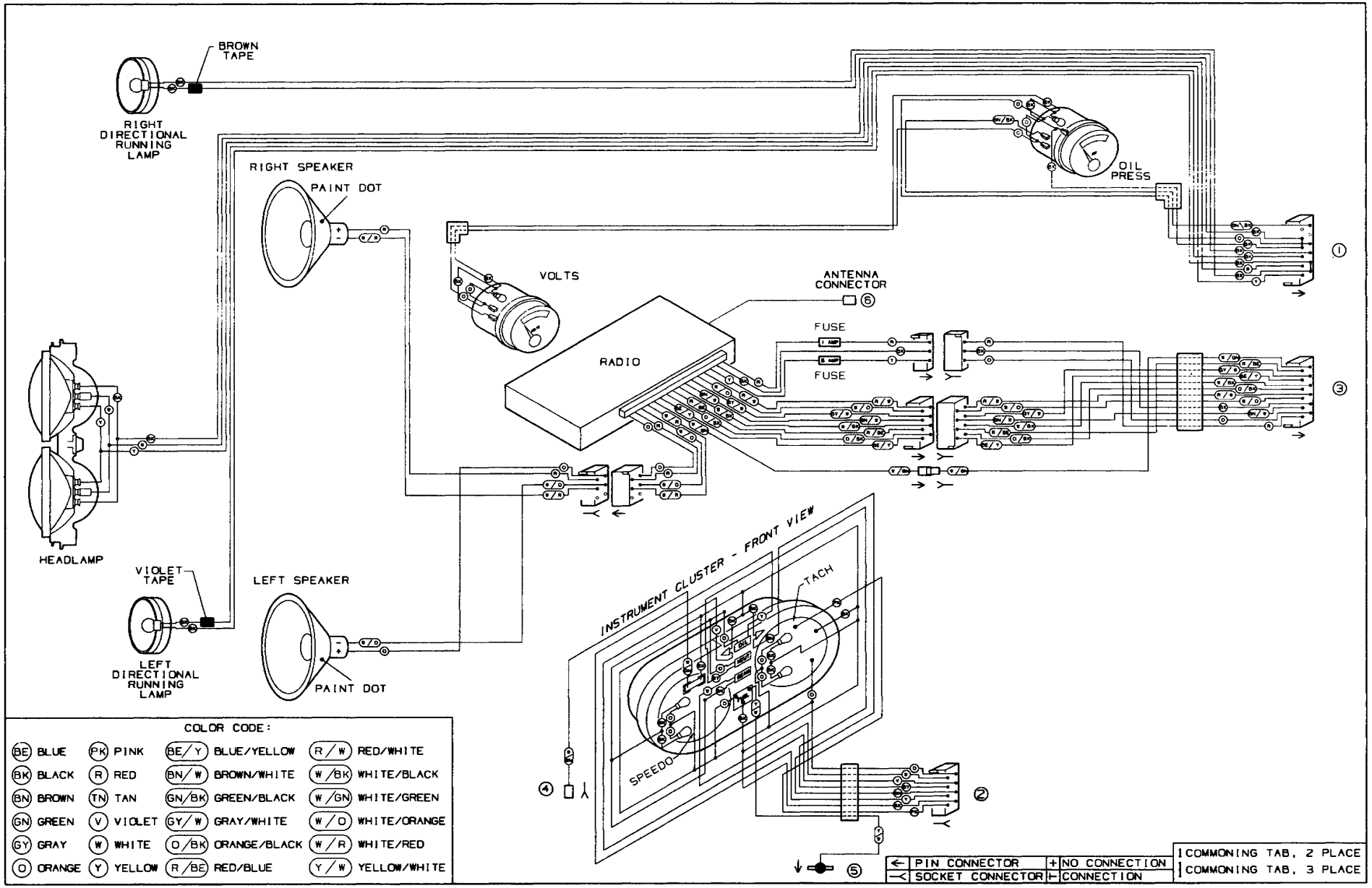

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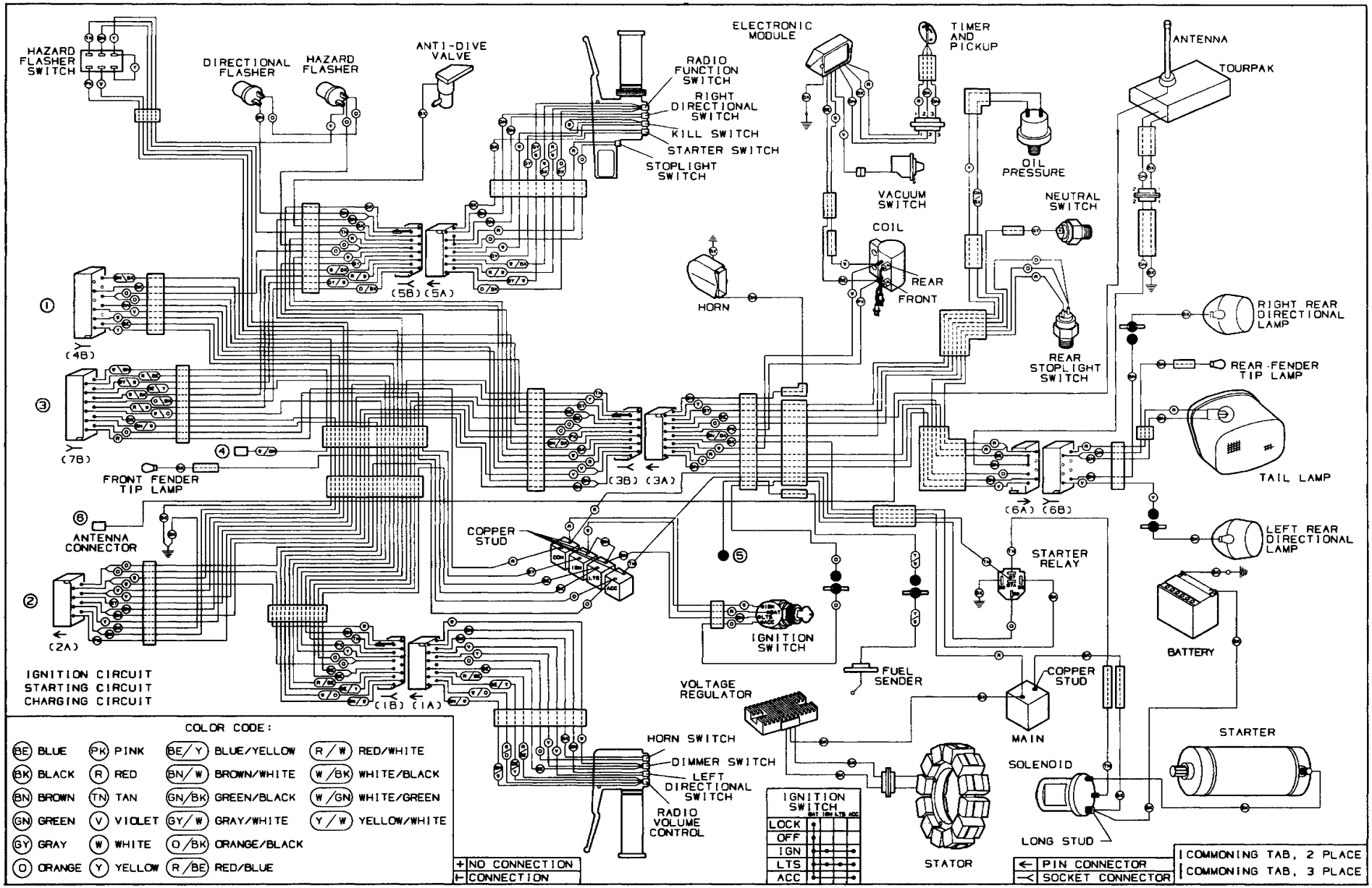

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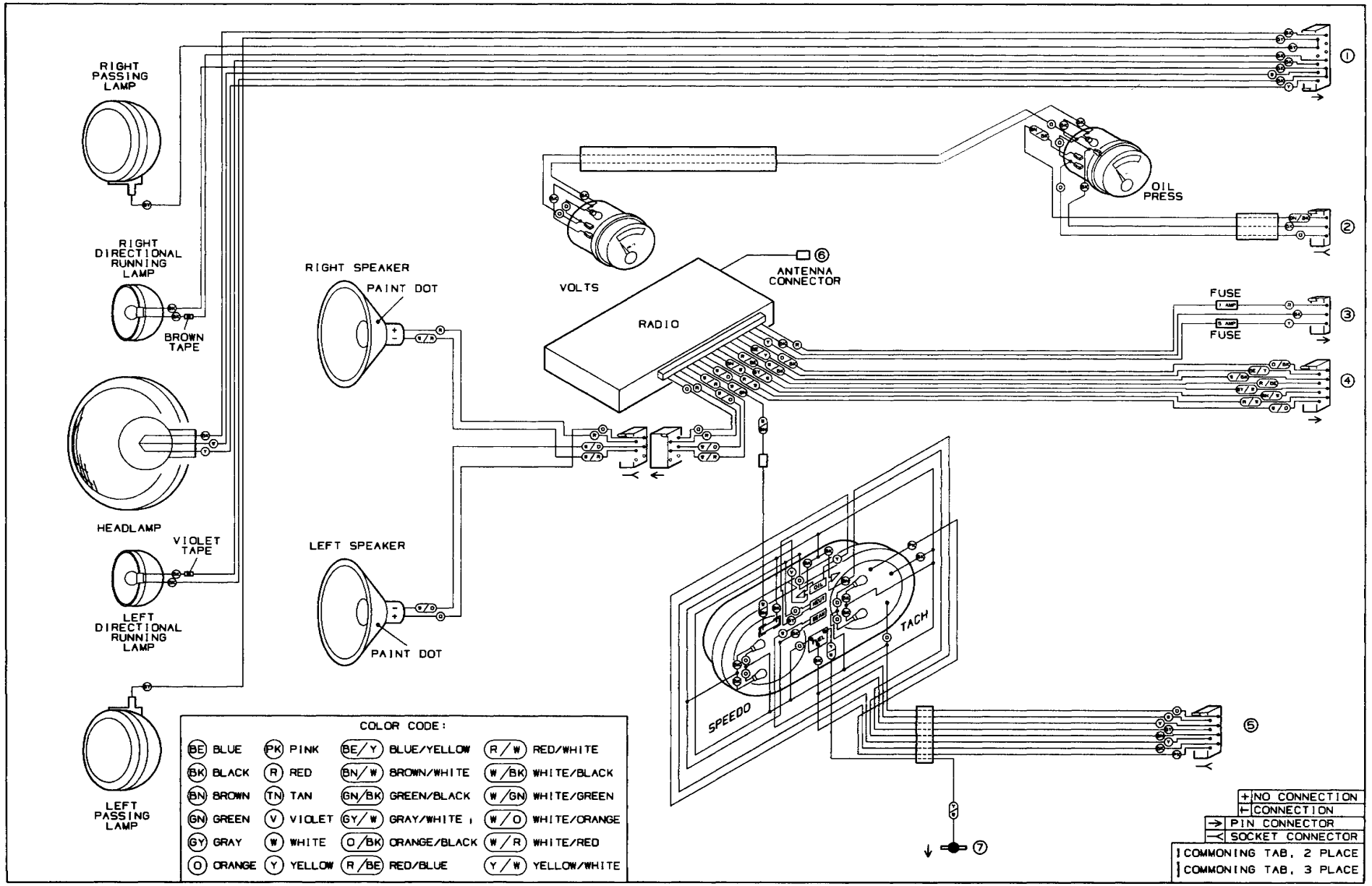

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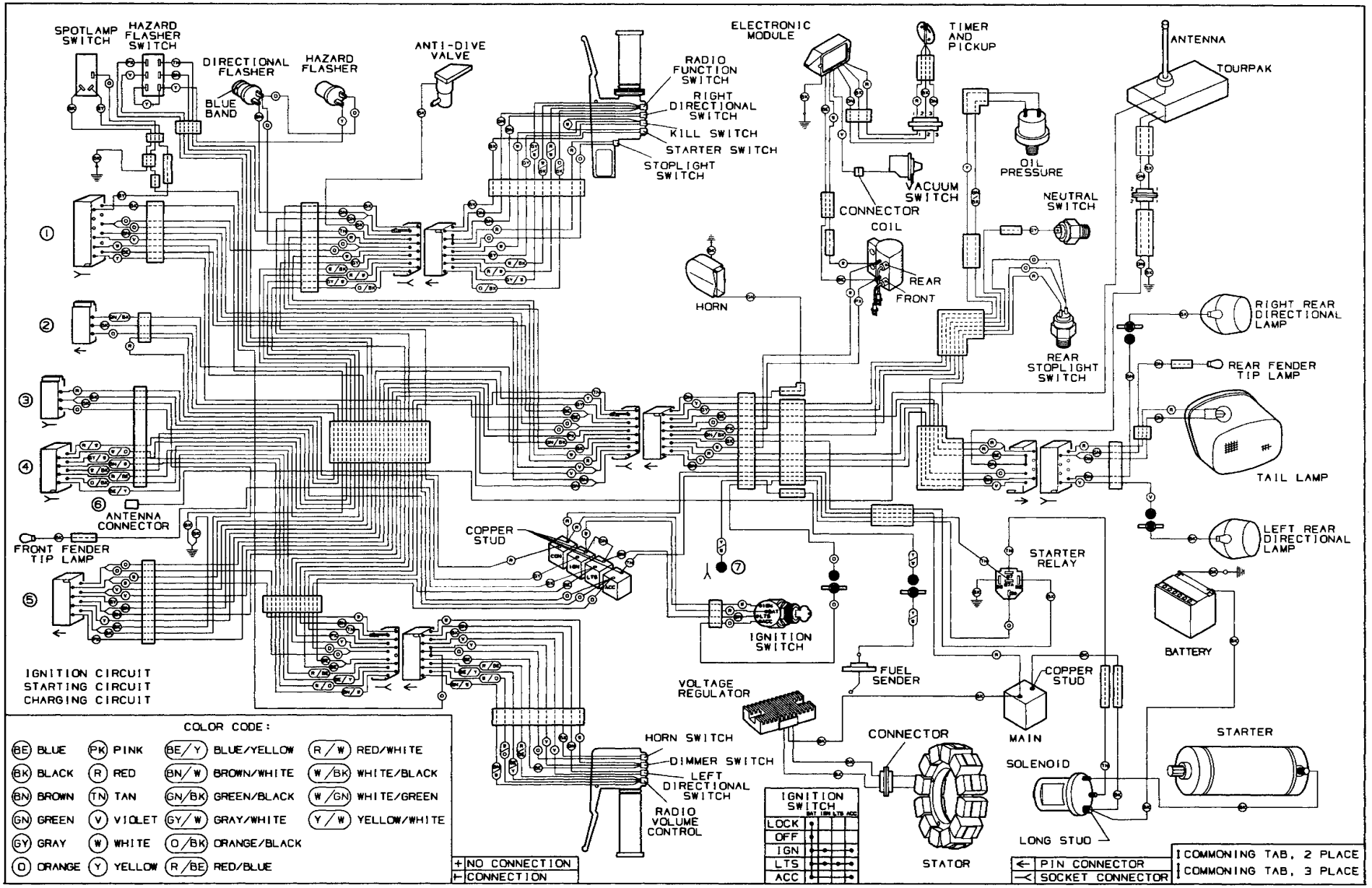

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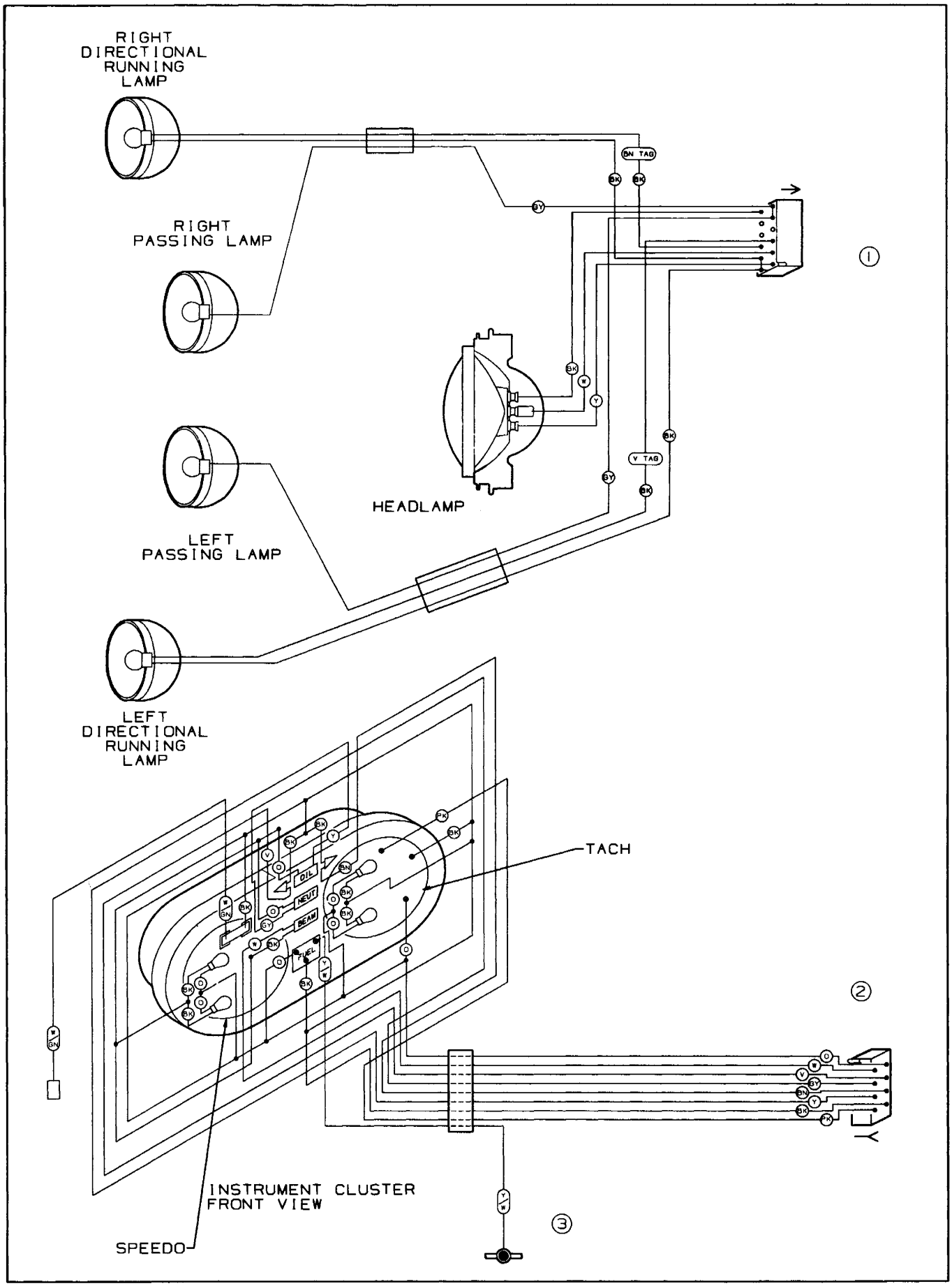

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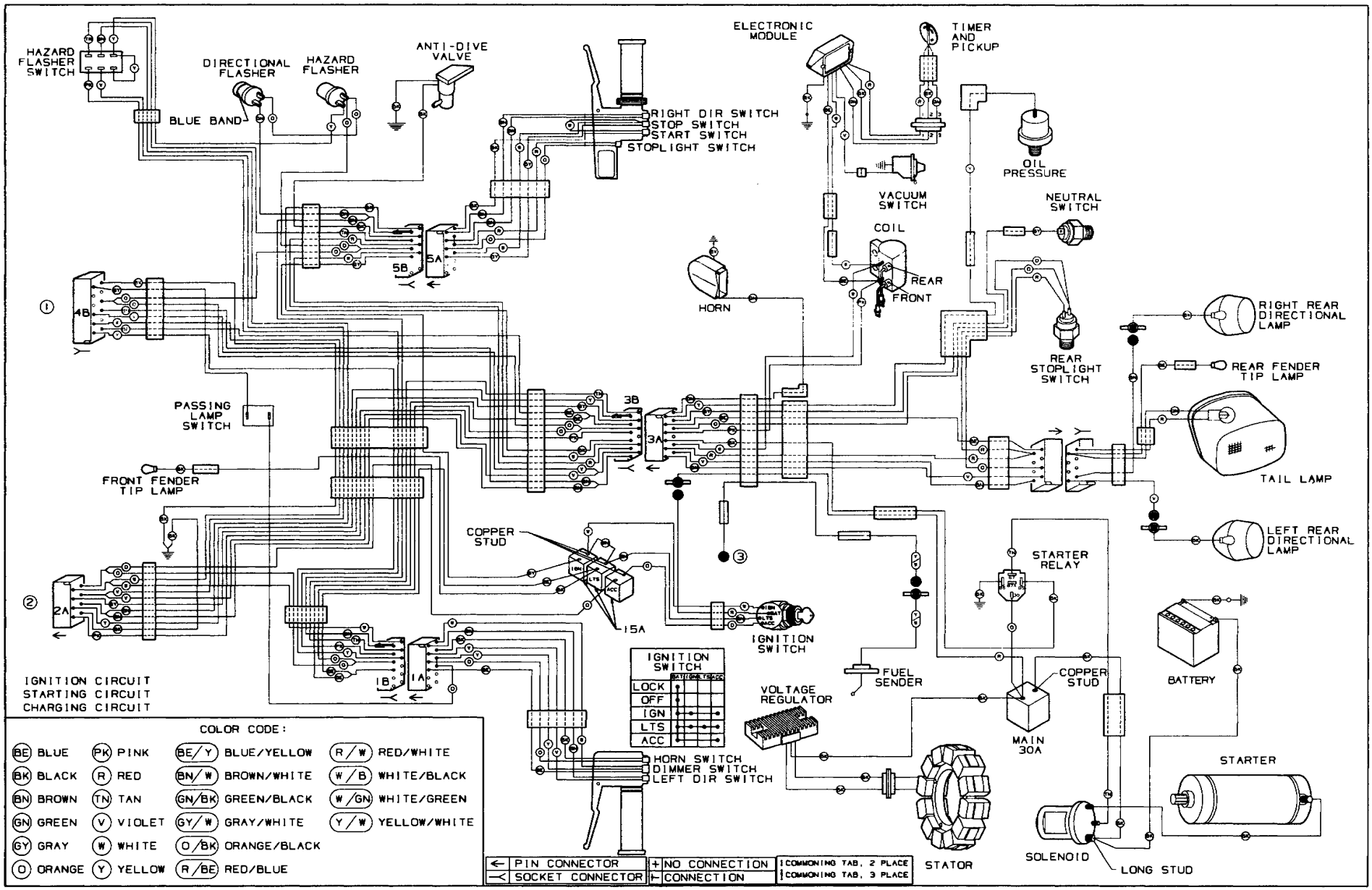

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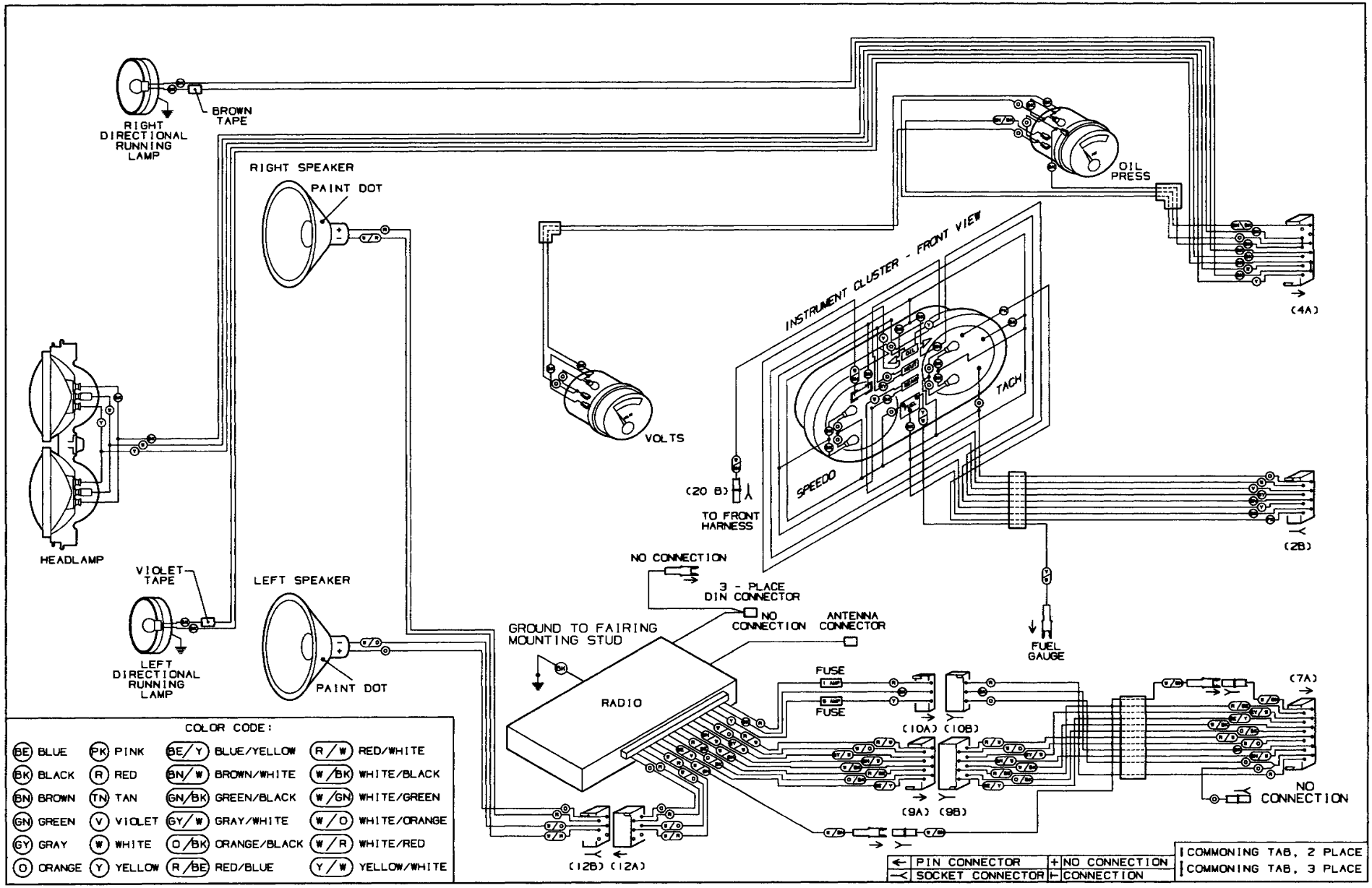

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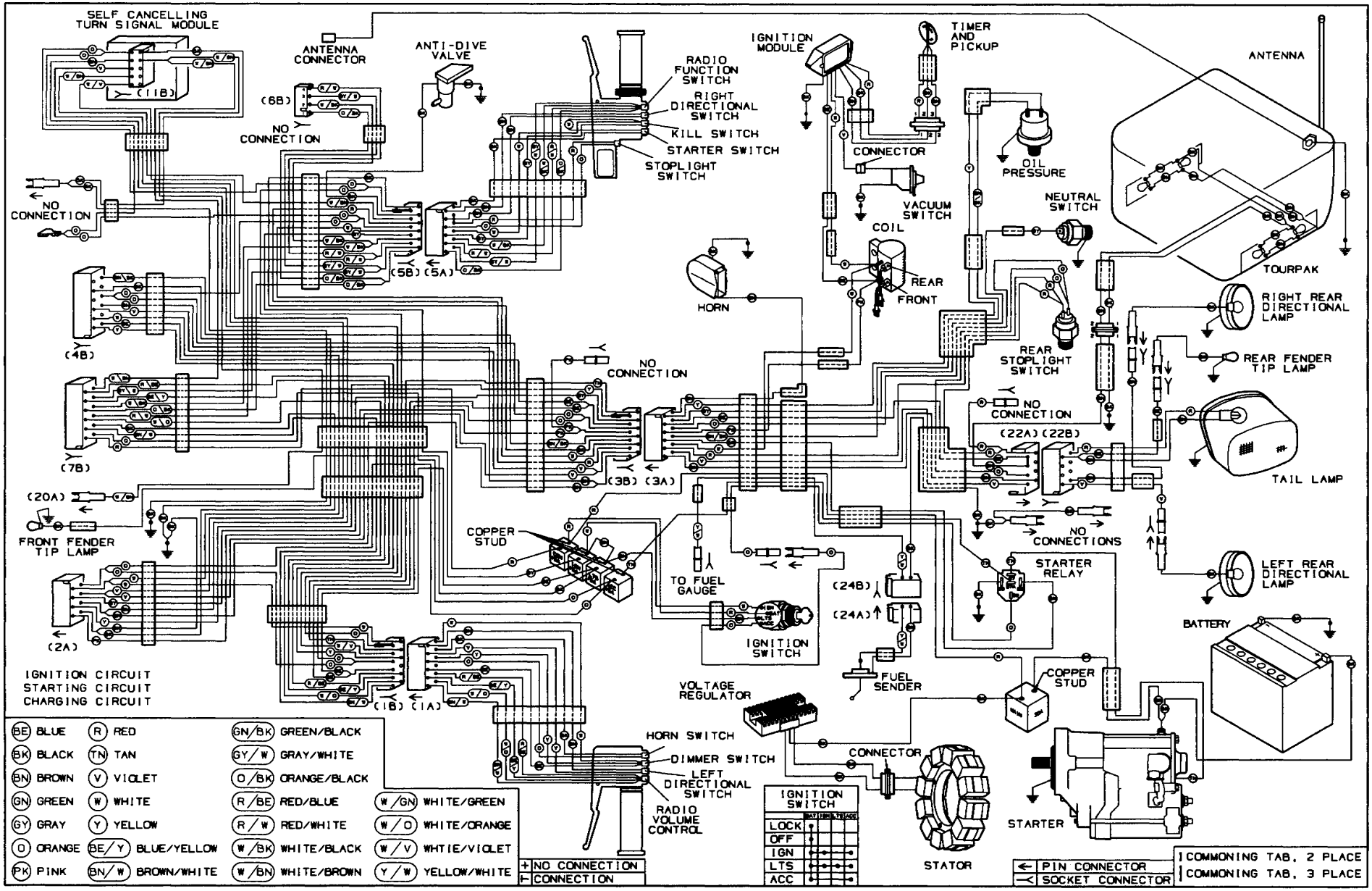
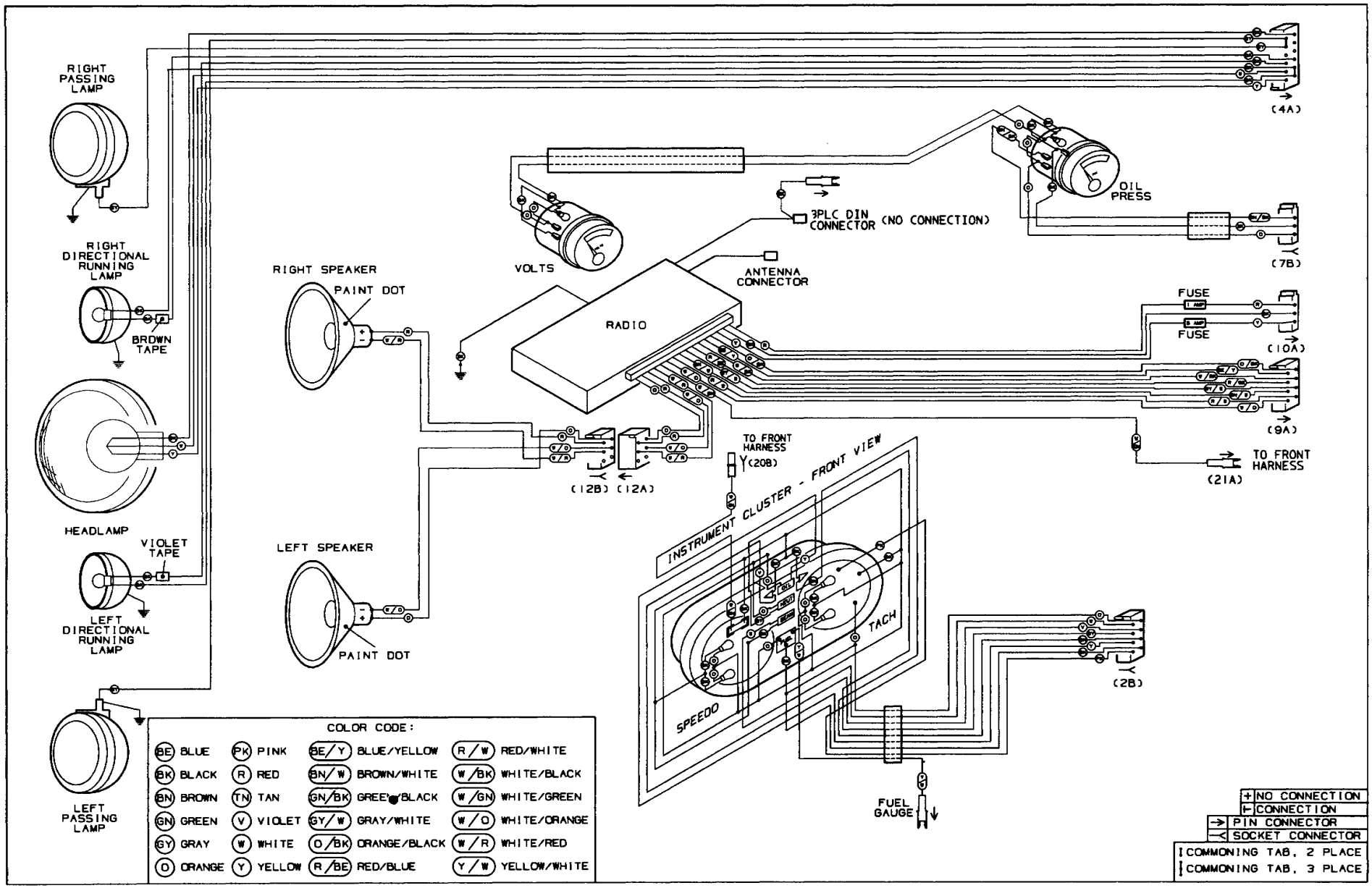


1989 FLTC, Chassis



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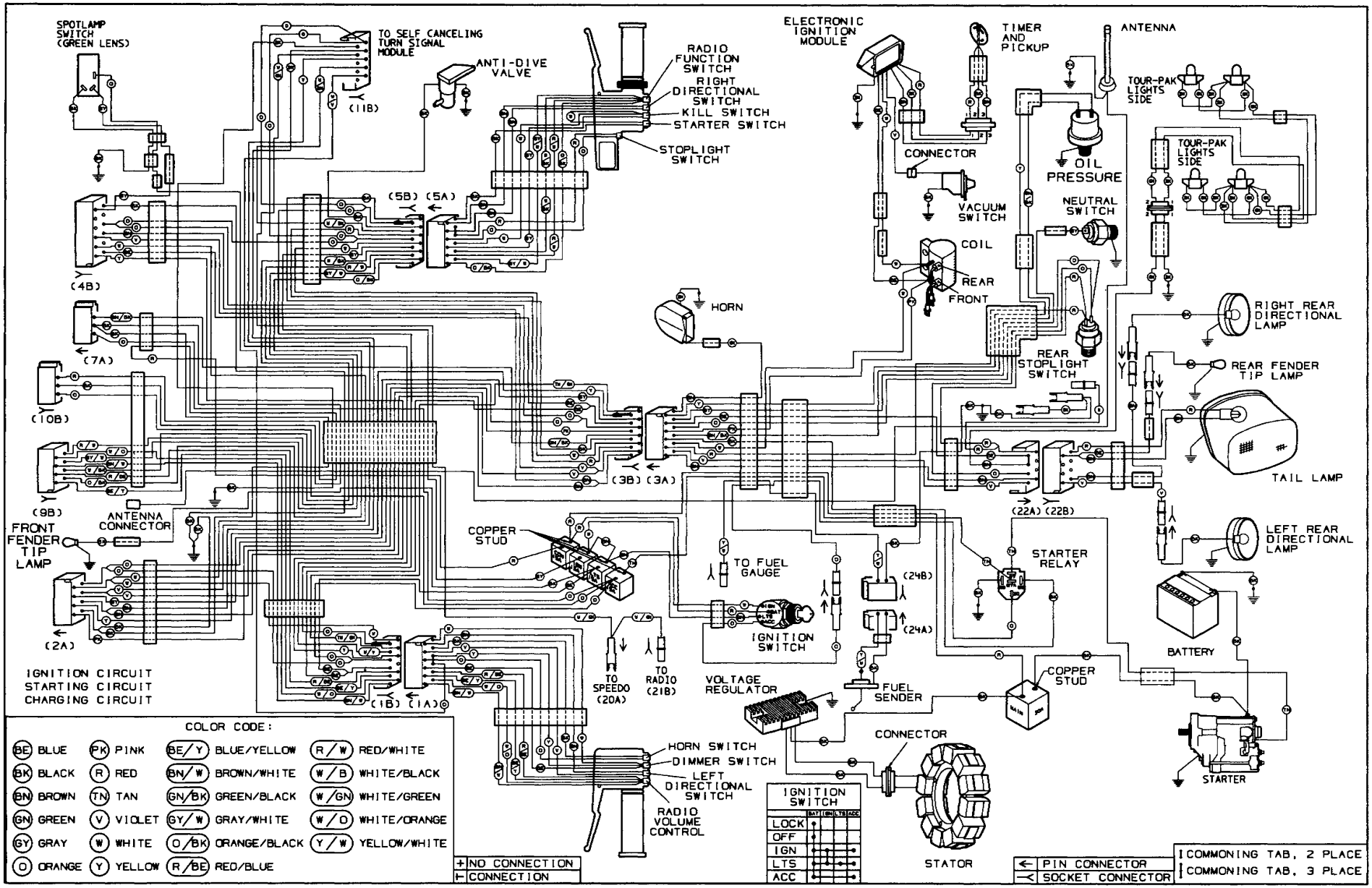

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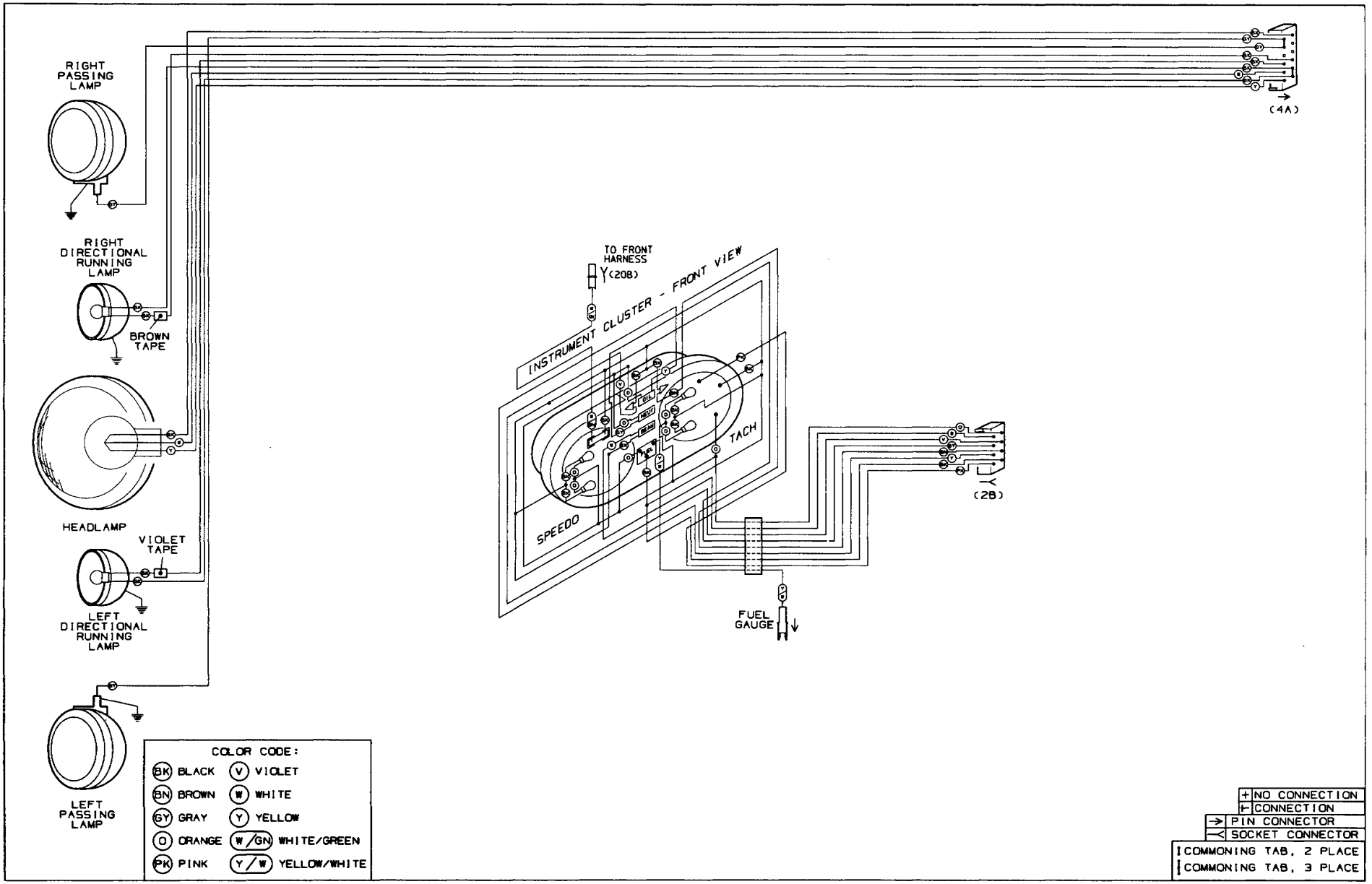
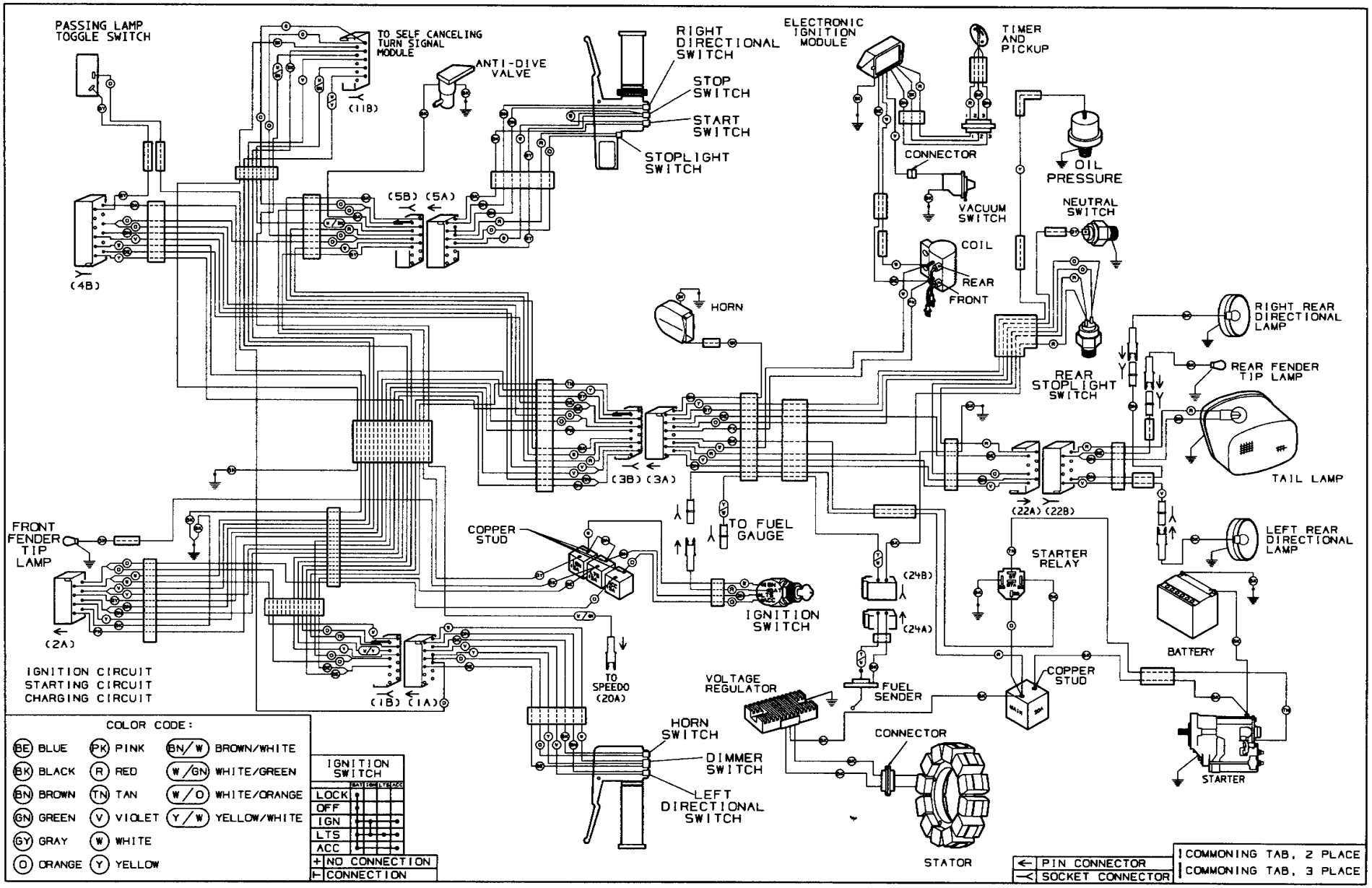
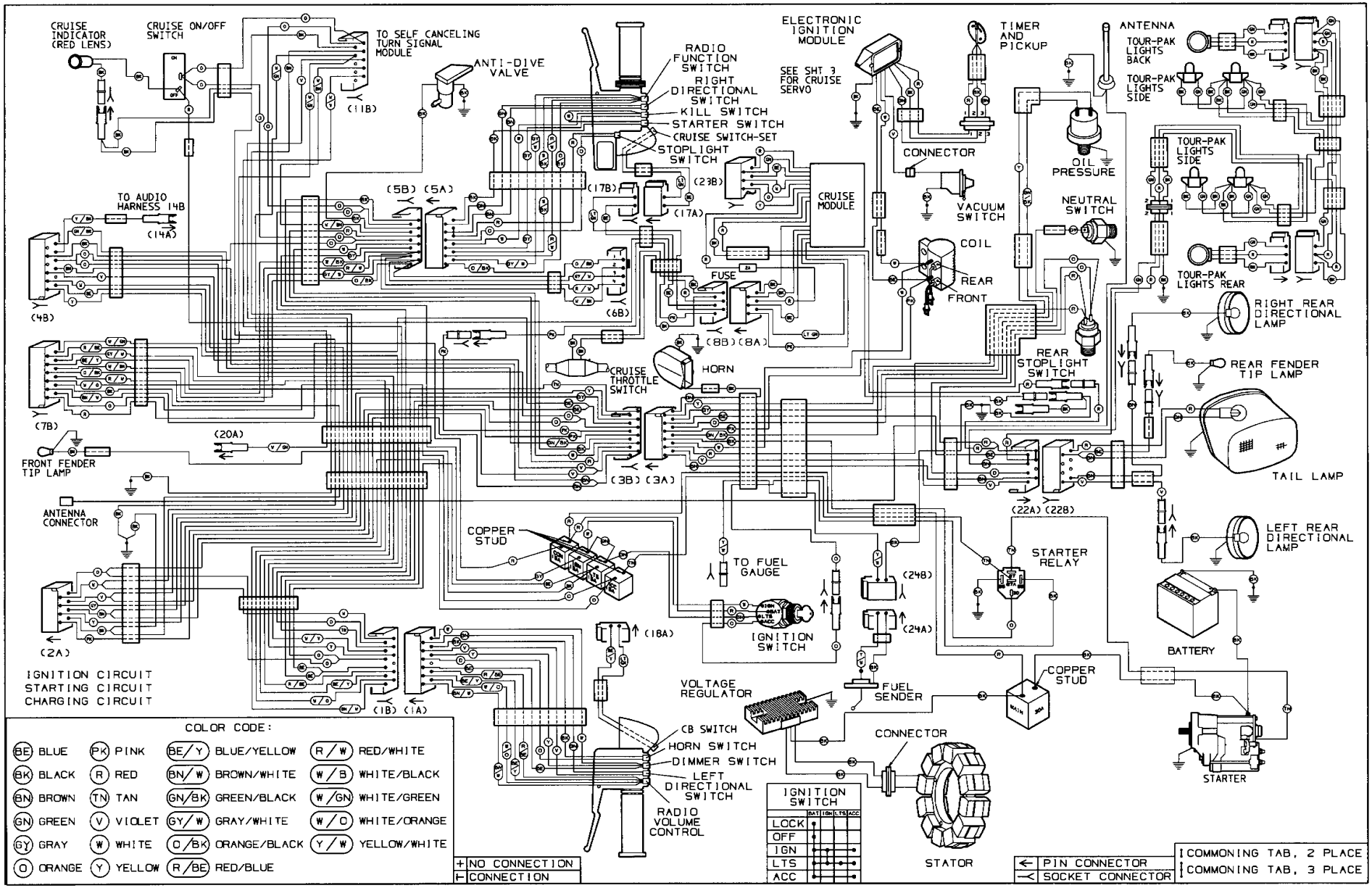


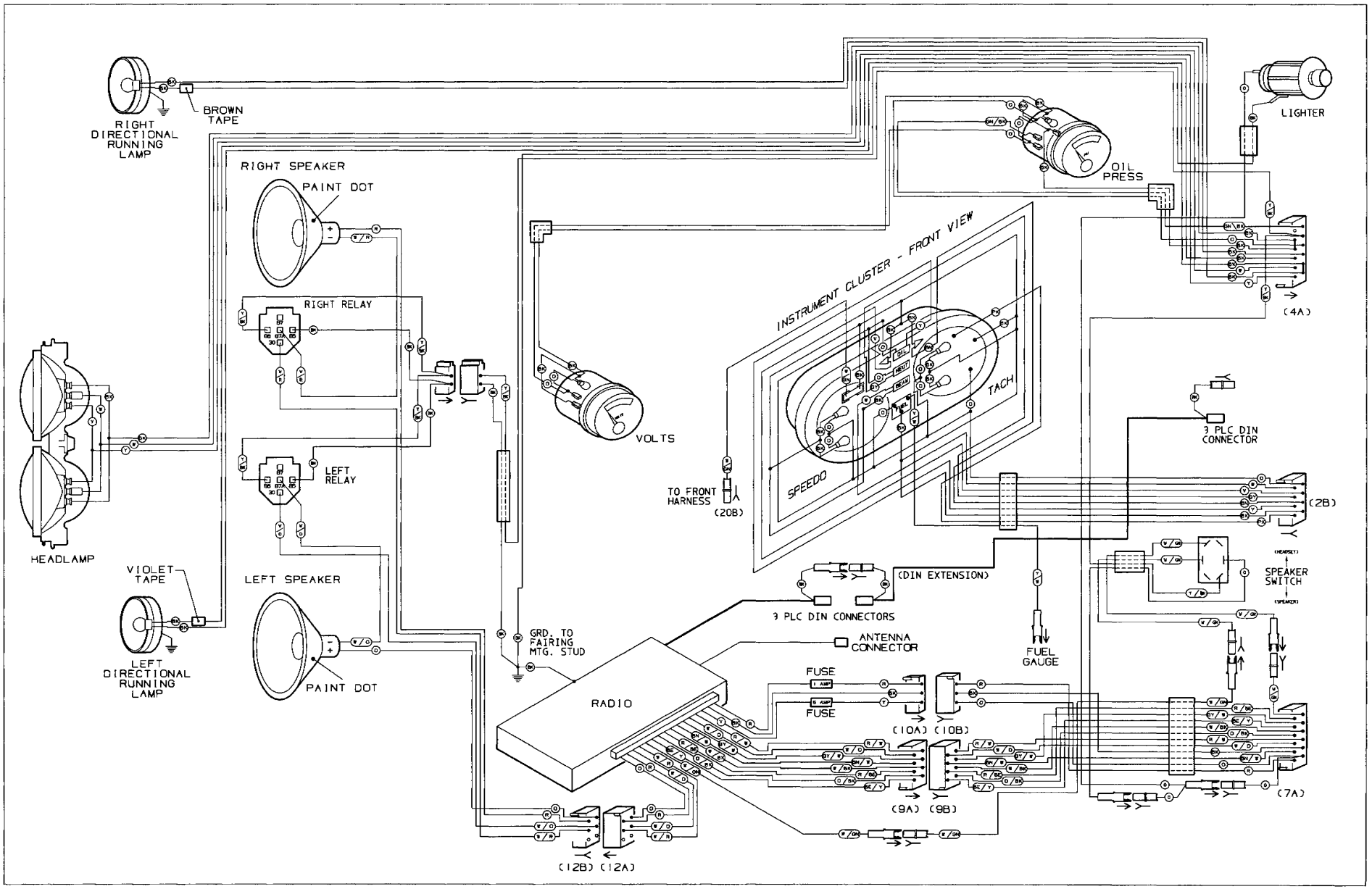
1989-1990 FLHS INSTRUMENTS



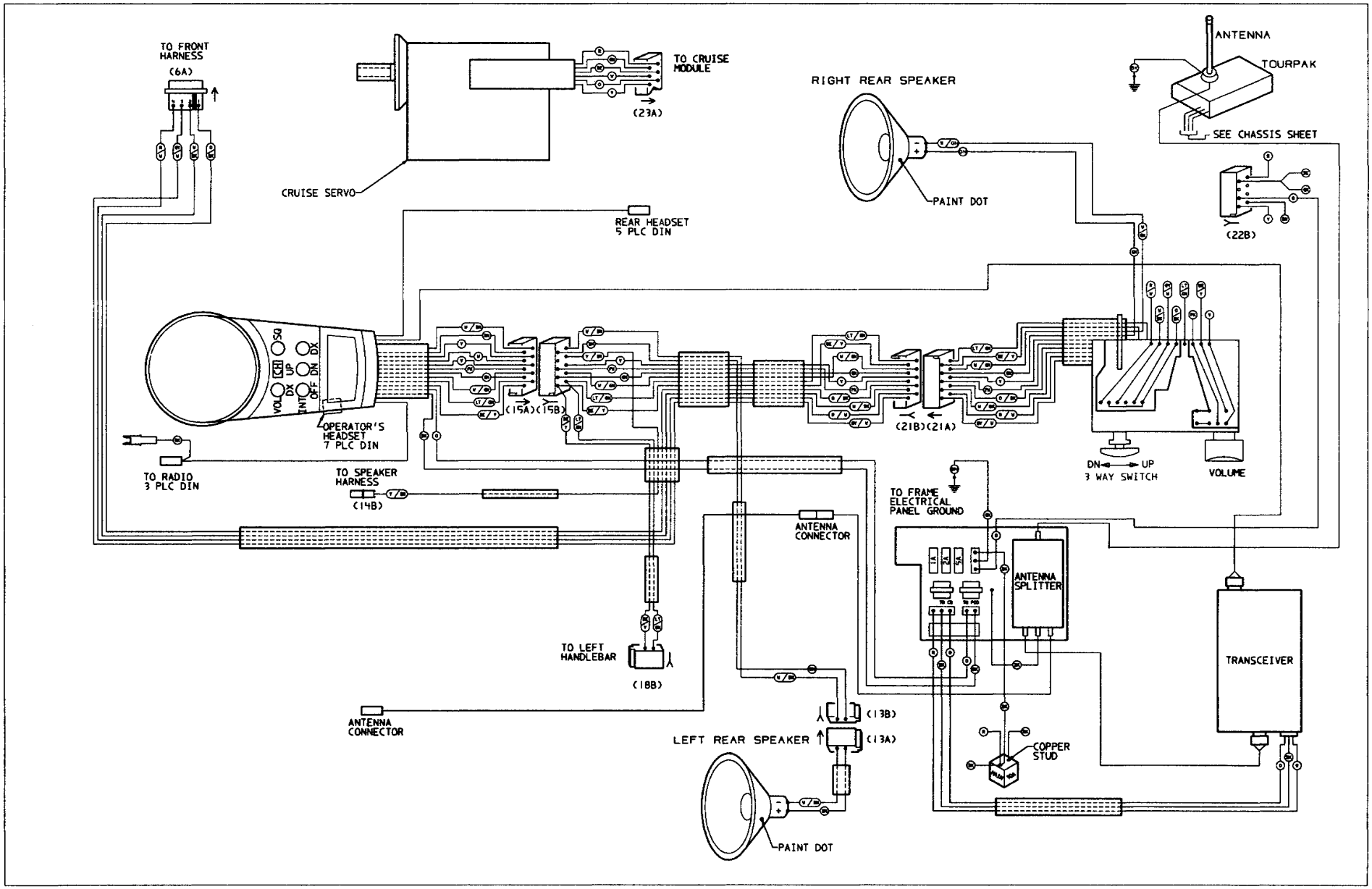
1989 FLHS Chassis



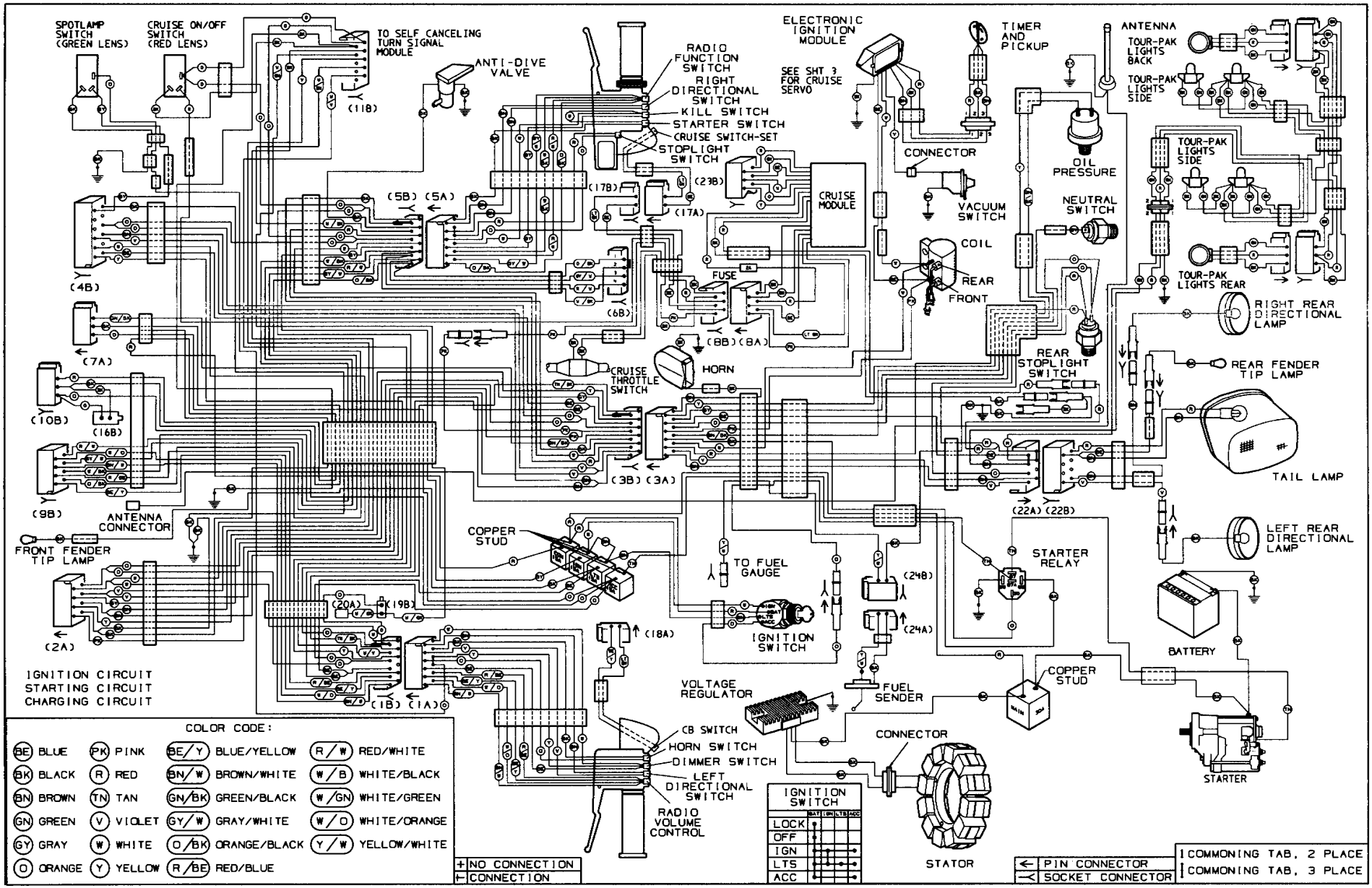
1989 FLTC Ultra, Chassis (Sheet 1 of 3)



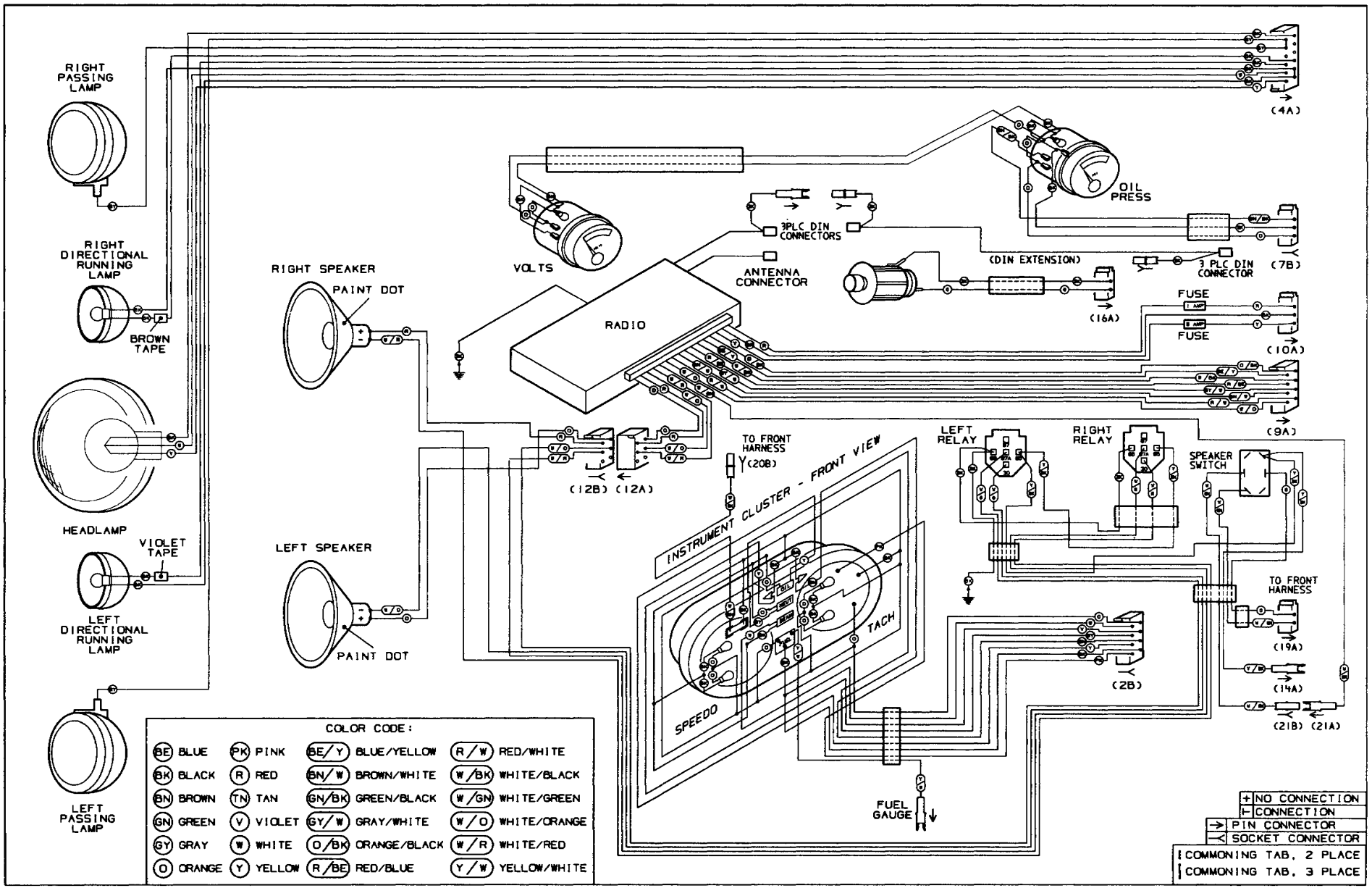
1989 FLTC Ultra, Fairing (Sheet 2 of 3)



1989 FLTC Ultra, CB/Intercom (Sheet 3 of 3)



1989 FLHTC Ultra, Chassis (Sheet 1 of 3)



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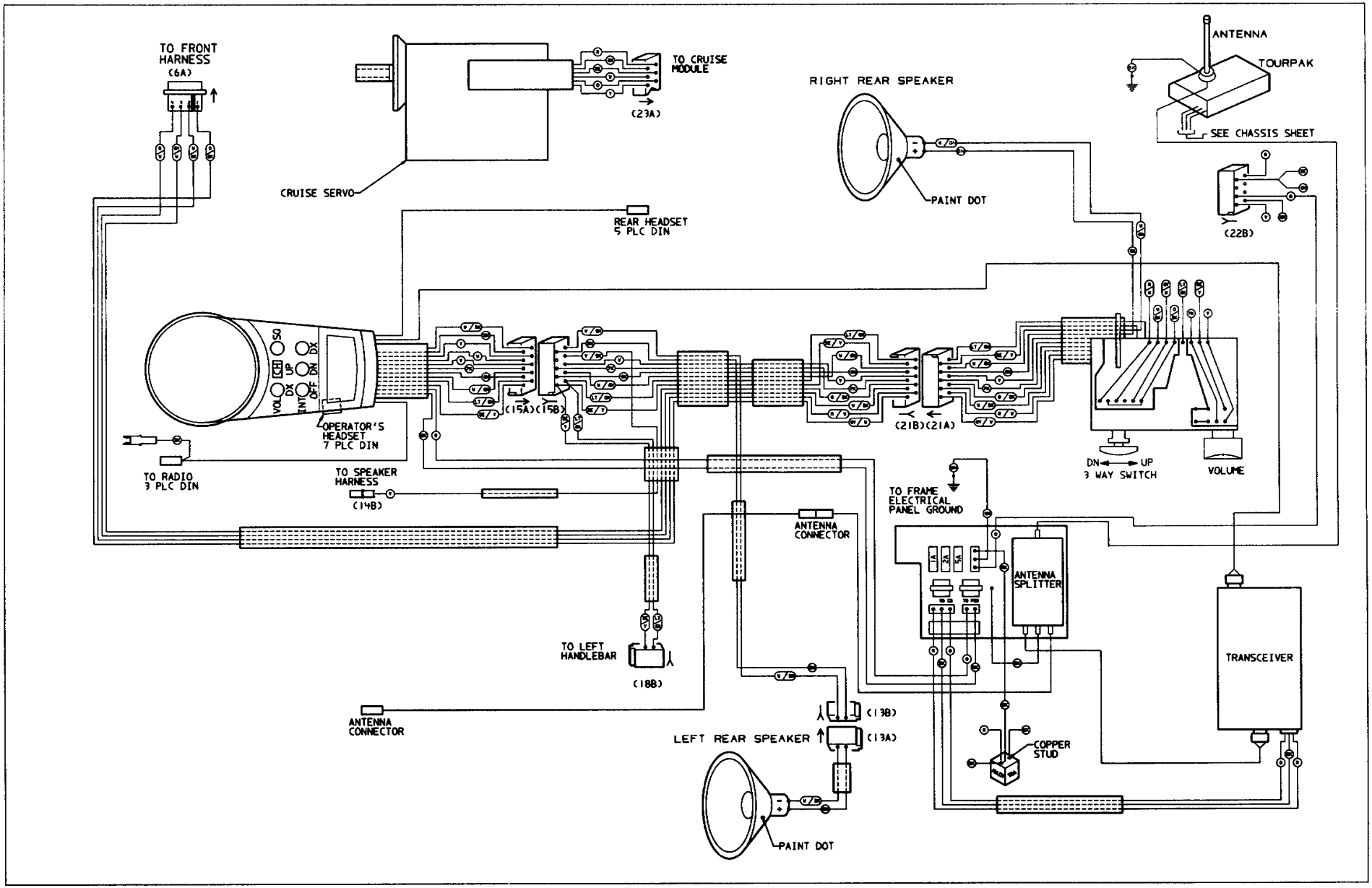
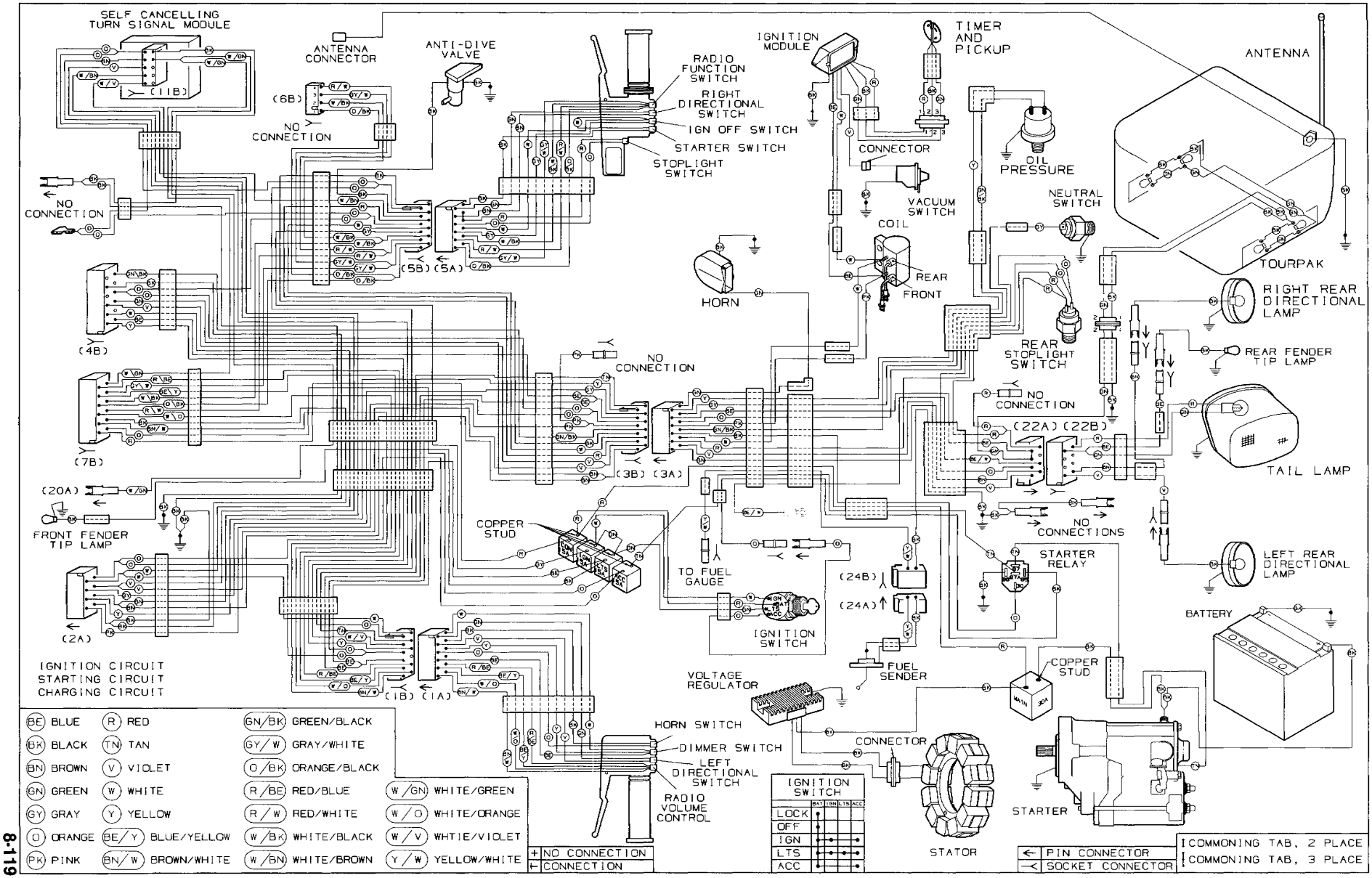
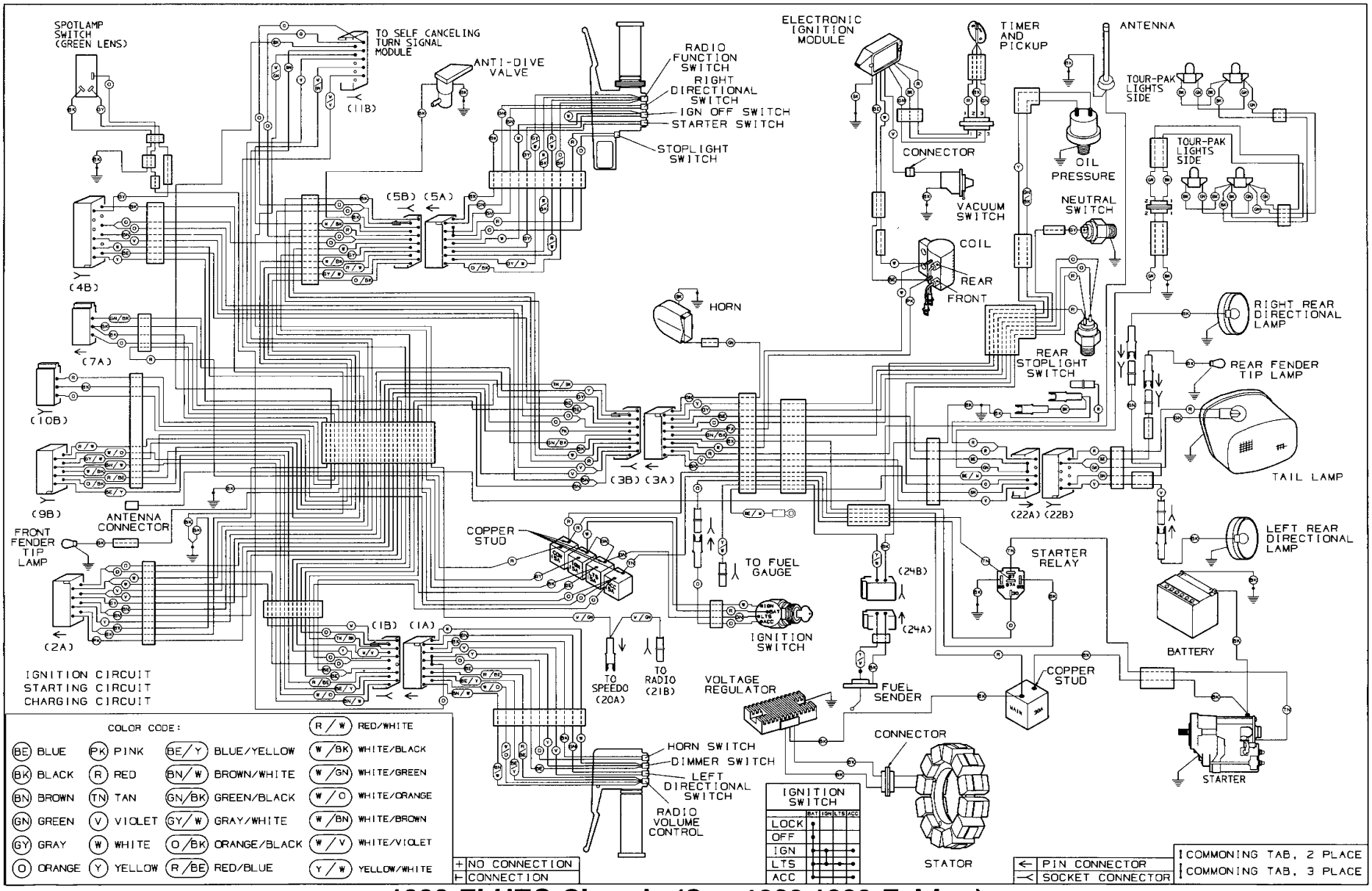


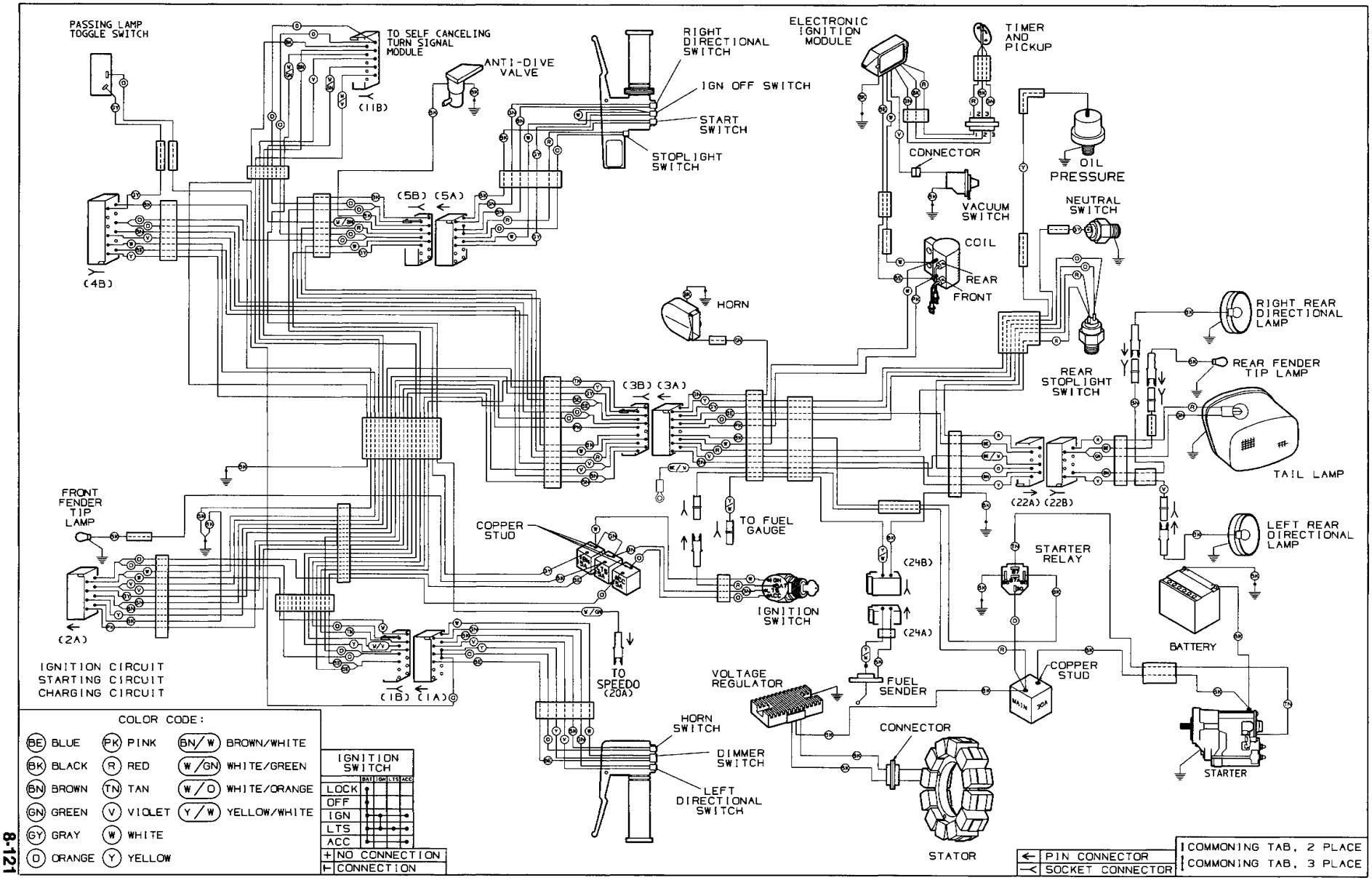
1989 FLHTC Ultra, CB/Intercom (Sheet 3 of 3)



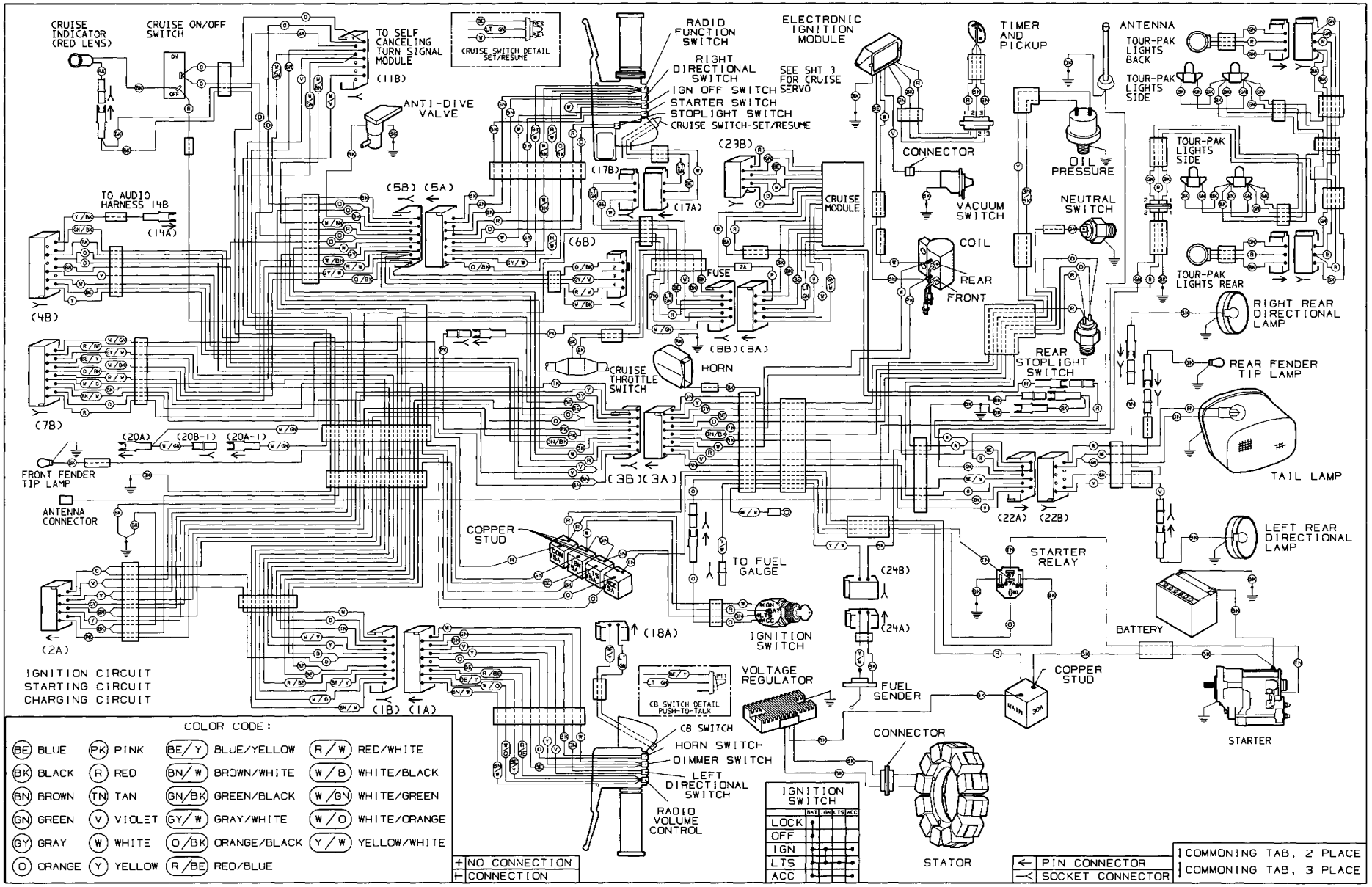
1990 FLTC Chassis (See 1989-1990 Fairing)



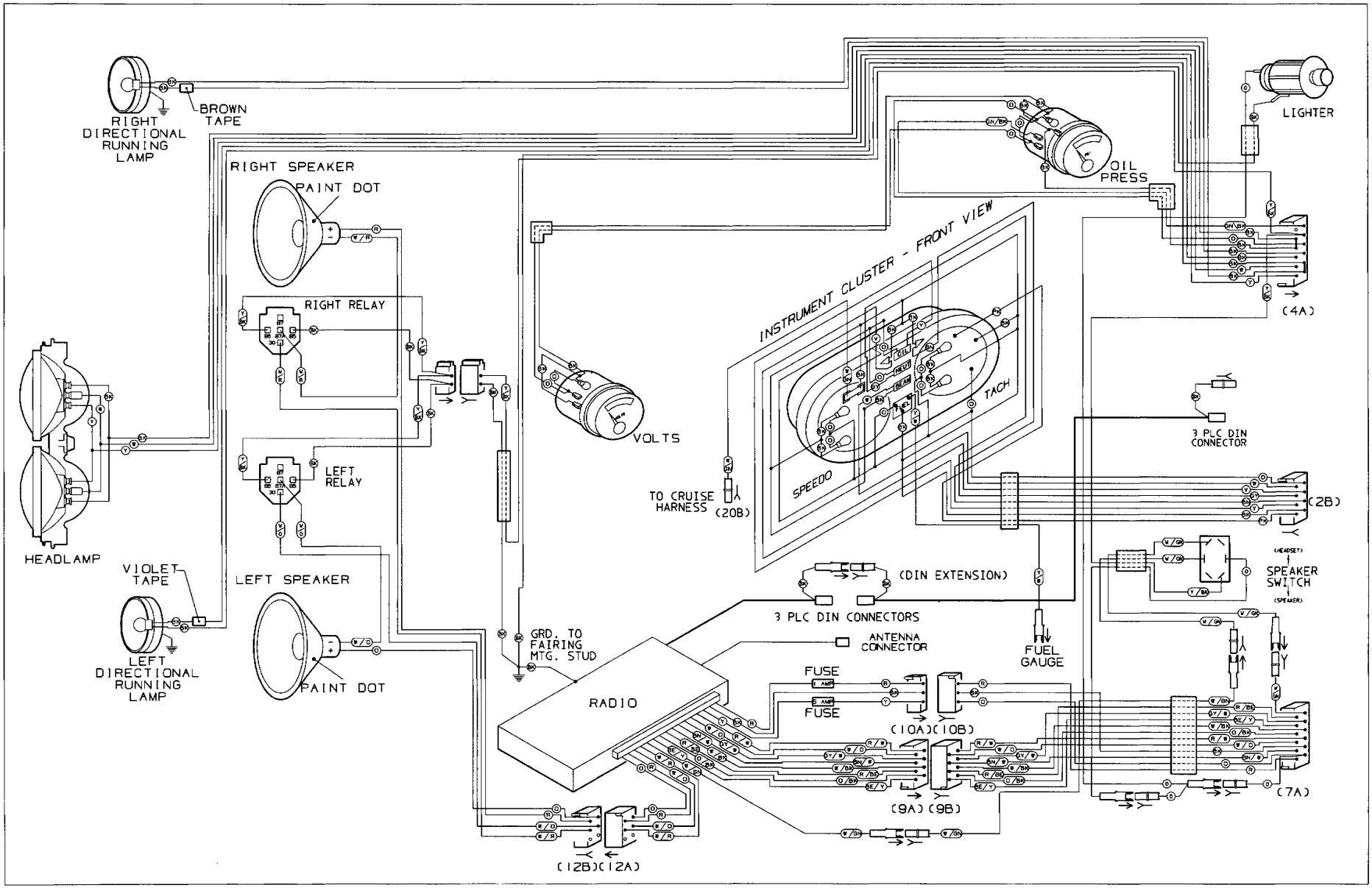
1990 FLHTC Chassis (See 1989-1990 Fairing)



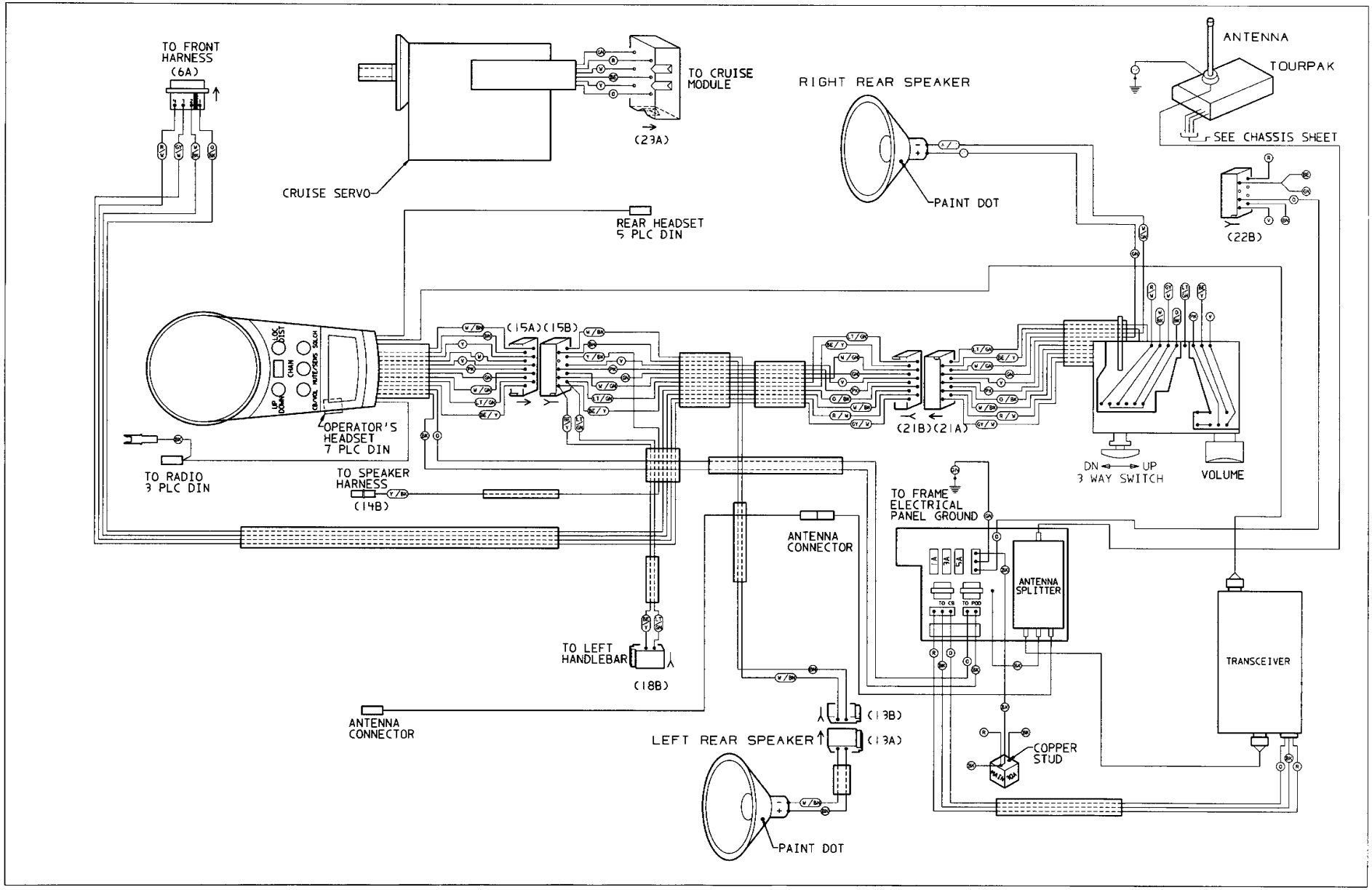
1990 FLHS Chassis (See 1989-1990 Instruments)



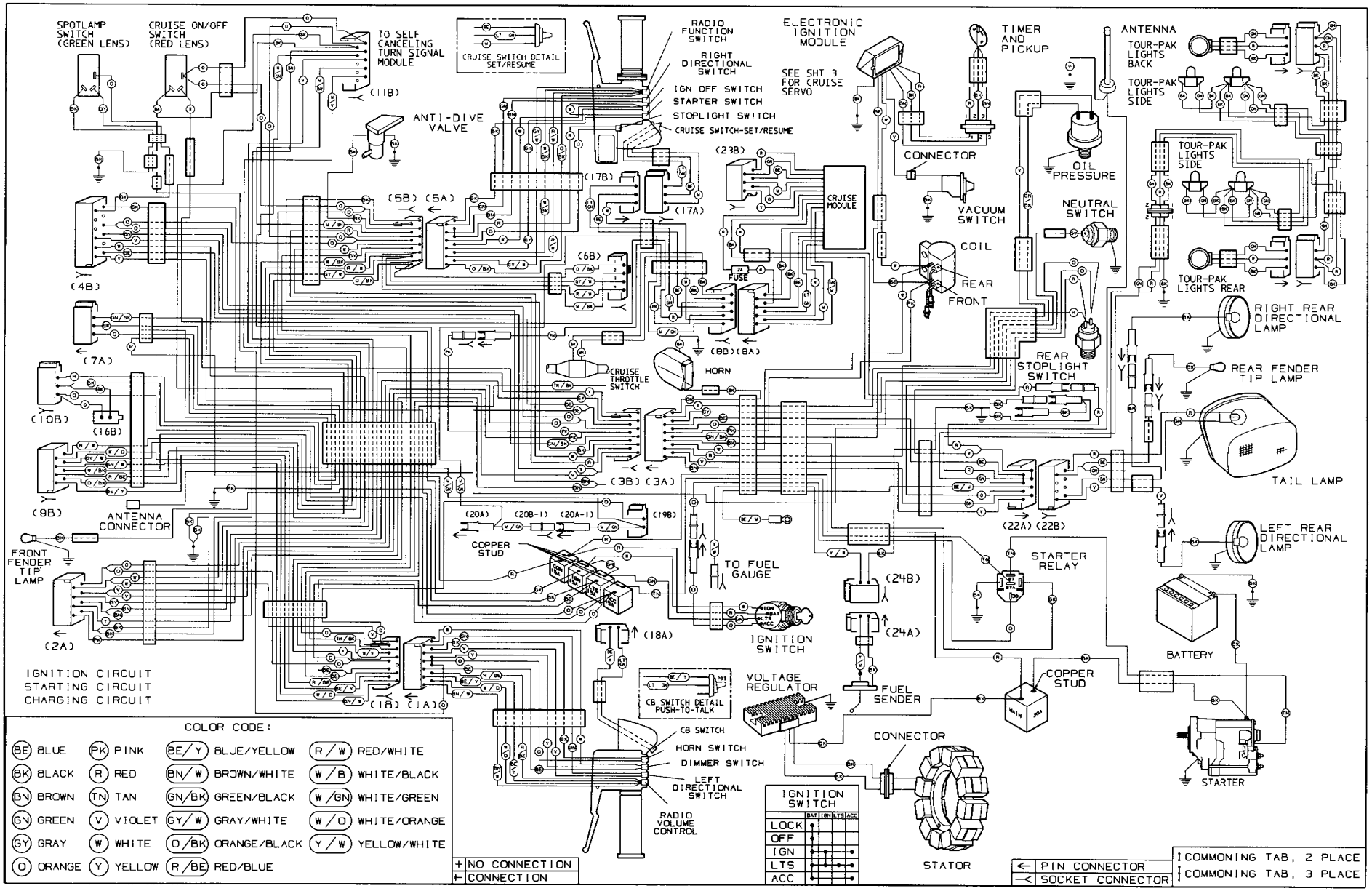
1990 FLTC Ultra Chassis (Sheet 1 of 3)



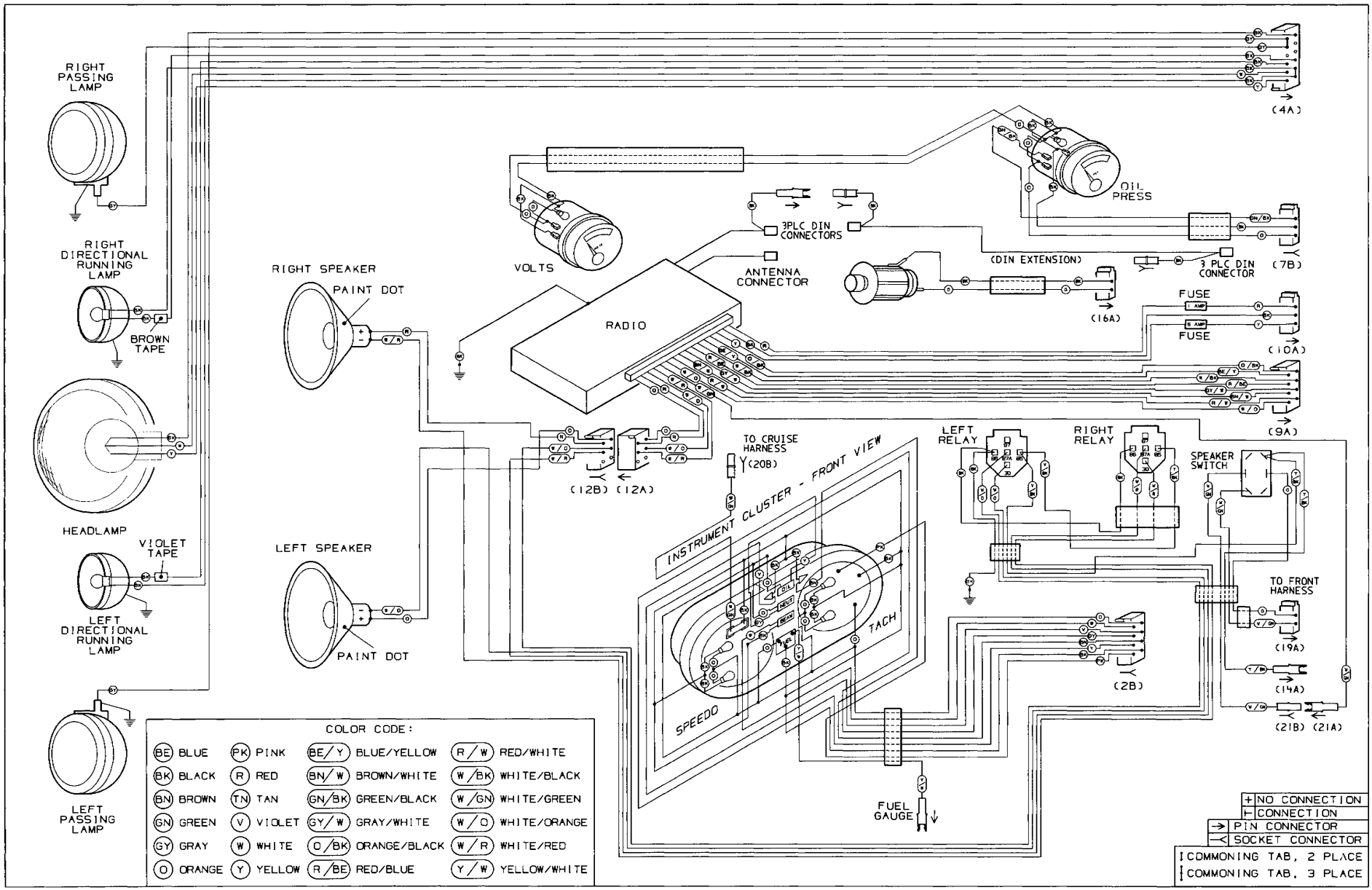
1990 FLTC Ultra Fairing (Sheet 2 of 3)



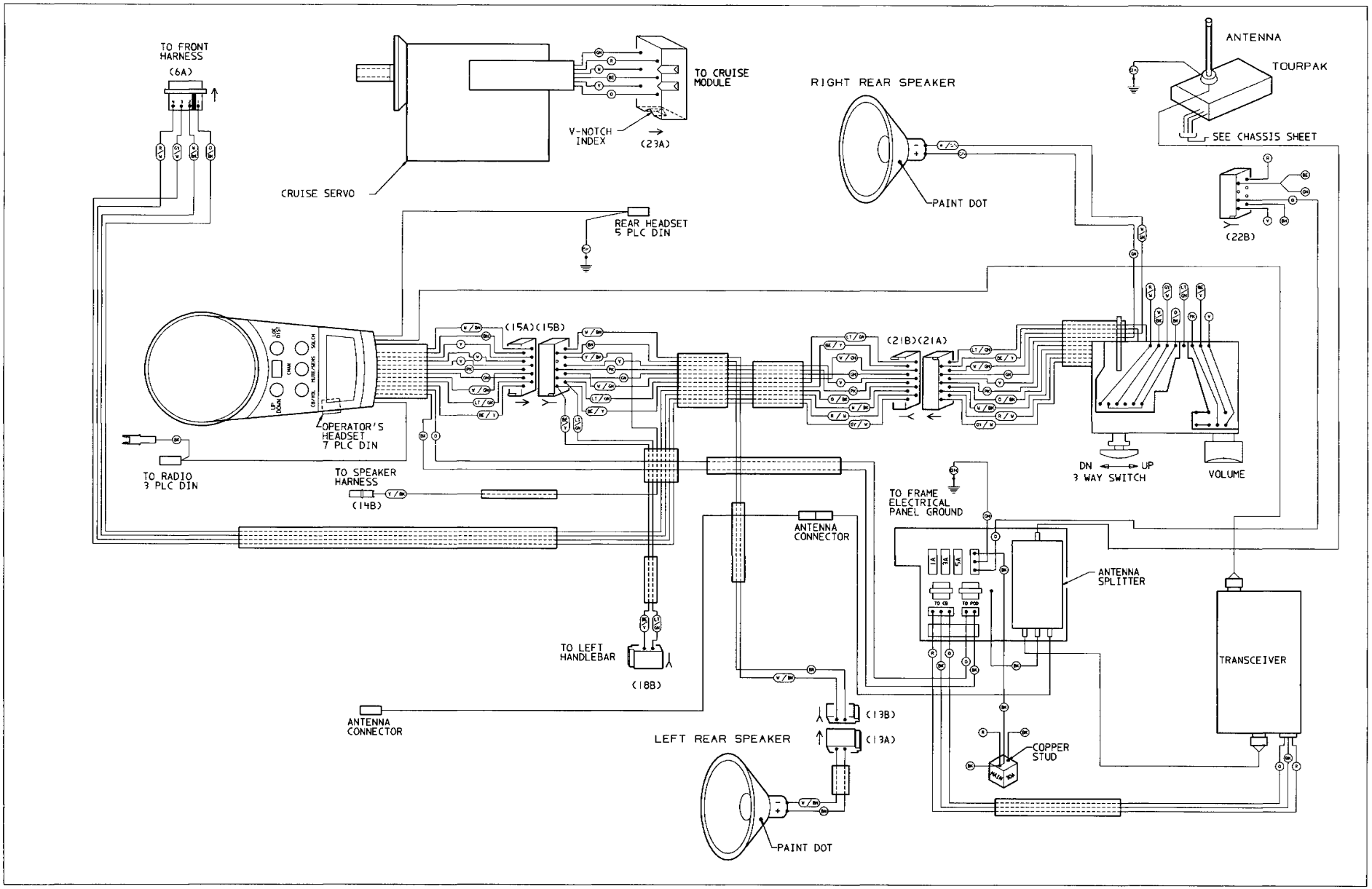
1990 FLTC Ultra, CB/Intercom (Sheet 3 of 3)



1990 FLHTC Ultra Chassis (Sheet 1 of 3)



1990 FLHTC Ultra Fairing (Sheet 2 of 3)



1990 FLHTC Ultra, CB/Intercom (Sheet 3 of 3)

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