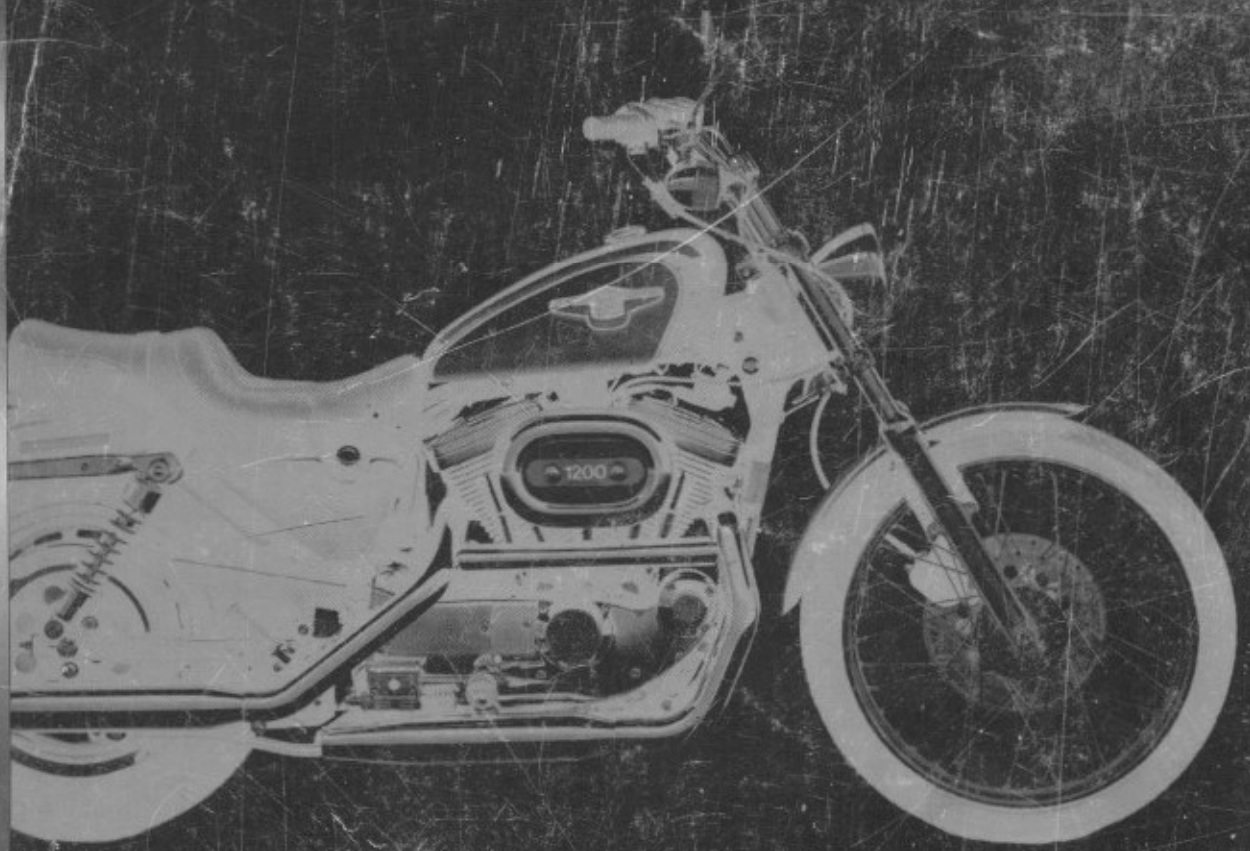
# SERVICE MANUAL

# XLH® MODELS

# 1998




OFFICIAL FACTORY MANUAL

PN99484-98

# 1998 XLH SPORTSTER MODELS

# SERVICE MANUAL

The information in this Service Manual applies to the 1998 XLH Sportster models.

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# PRODUCT 1

# GENERAL

## SERVICING A NEW MOTORCYCLE

**⚠WARNING**

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

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

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

After a new motorcycle has been driven its first 500 miles, and again at 5000 miles, a Harley-Davidson dealer should perform the service operations listed in the Regular Maintenance Intervals table on the next page.

## SAFE OPERATING MAINTENANCE

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

**⚠CAUTION**

- **Do not attempt to retighten engine head bolts. Retightening can cause engine damage.**
- **During the initial 500 mile (800 km) break-in period, use only Harley-Davidson 20W50 engine oil. Failure to use the recommended oil will result in improper break-in of the engine cylinders and piston rings.**
- **Do not lubricate the enrichment cable on CV carburetors.**

Check:

1. Tires for abrasions, cuts and correct pressure.
2. Secondary drive belt for proper tension and condition.
3. Brakes, steering and throttle for responsiveness.
4. Brake fluid level and condition. Hydraulic lines and fittings for leaks. Also, check brake pads and discs for wear.
5. Cables for fraying, crimping and free operation.
6. Engine oil and transmission fluid levels.
7. Wheel spoke tightness, if applicable.
8. Headlamp, tail lamp, brake lamp and directional lamp operation.

# Regular Maintenance Intervals – XLH Sportster Models

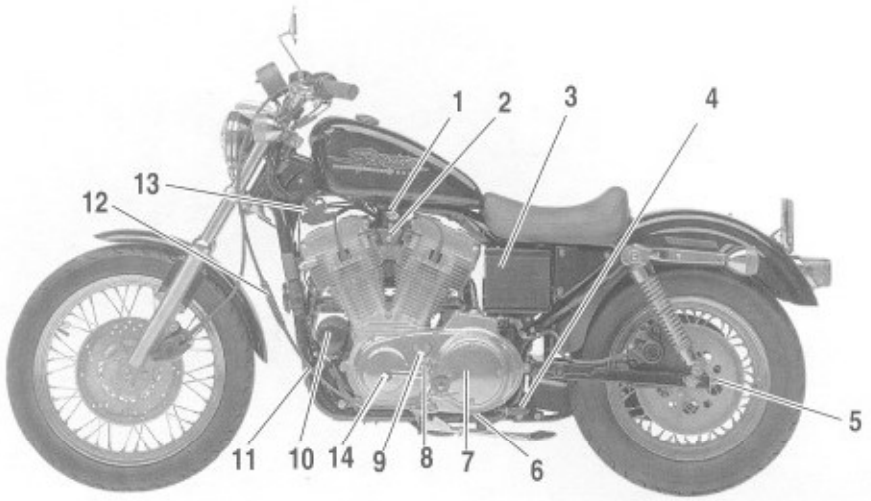
| SECTION | ODOMETER READING SERVICE OPERATIONS (see chart code below) | Pre ride | 500 mi 800 km | 2500 mi 4000 km | 5000 mi 8000 km | 7500 mi 12000 km | 10000 mi 16000 km | 12500 mi 20000 km | 15000 mi 24000 km | 17500 mi 28000 km | 20000 mi 32000 km | 22500 mi 36000 km | 25000 mi 40000 km | 27500 mi 44000 km | 30000 mi 48000 km | 32500 mi 52000 km | 35000 mi 56000 km | 37500 mi 60000 km | 40000 mi 64000 km | 42500 mi 68000 km | 45000 mi 72000 km | 47500 mi 76000 km | 50000 mi 80000 km |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Wheel bearings* | | | | | | IL | | | | IL | | | | IL | | | | IL | | | | IL |
| 2 | Wheel spoke tightness | I | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I |
| 2 | 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 |
| 2 | Brake fluid level and condition* | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I |
| 2 | Rear brake pedal height adjustment and freeplay | I | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I |
| 2 | Rear brake linkage | | | | IL | | IL | | IL | | IL | | IL | | IL | | IL | | IL | | IL | | IL |
| 2 | Brake pad linings and discs for wear | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| 2 | Condition of rear brake caliper mounting pins and boots | | | | IL | | IL | | IL | | IL | | IL | | IL | | IL | | IL | | IL | | IL |
| 2 | Front fork oil | | | | | | R | | | | R | | | | R | | | | R | | | | R |
| 2 | Front fork bearing adjustment | | I | | I | | IL | | I | | IL | | I | | IL | | I | | IL | | I | | IL |
| 2 | Rear fork pivot bolt | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | |
| 2 | Rear fork bearings* | | I | | I | | IL | | I | | IL | | I | | IL | | I | | IL | | I | | IL |
| 2 | Condition of rear shock absorbers | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I |
| 2 | Throttle control grip sleeve, speedometer cable | I | | | L | | L | | L | | L | | L | | L | | L | | L | | L | | L |
| 2 | Front brake hand lever, throttle control cables, clutch control cable and hand lever | | L | | L | | L | | L | | L | | L | | L | | L | | L | | L | | L |
| 2 | Jiffy stand | | I | | L | | L | | L | | L | | L | | L | | L | | L | | L | | L |
| 3 | Engine mounts | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | |
| 3 | Engine Oil* | I | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R |
| 3 | Oil filter | | R | | R | | R | | R | | R | | R | | R | | R | | R | | R | | R |
| 4 | Engine idle speed | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| 4 | Operation of throttle and enrichener controls | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| 4 | Air cleaner | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I |
| 4 | Fuel valve, lines and fittings for leaks | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| 4 | Fuel tank filter screen | | | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I |
| 4 | Air cleaner backplate EVAP butterfly valve operation (if equipped) | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| 6 | Primary chain | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I |
| 6 | Primary chaincase/transmission lubricant | | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R |
| 6 | Rear drive belt | I | A | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I |
| 6 | Clutch adjustment | | A | | A | | A | | A | | A | | A | | A | | A | | A | | A | | A |
| 7 | Ignition timing and MAP sensor (1200S) or vacuum-operated electric switch (V.O.E.S.) | | | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I |
| 7 | Bank Angle Sensor | | | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I |
| 7 | 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 |
| 7 | Spark plugs | | | | I | | R | | I | | R | | I | | R | | I | | R | | I | | R |
| 7 | Battery connections | | T | | T | | T | | T | | T | | T | | T | | T | | T | | T | | T |
| – | All fasteners except engine head bolts | | T | | T | | T | | T | | T | | T | | T | | T | | T | | T | | T |
| – | Road test | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |

**Table Code:**

**A** - Adjust.
**I** - Inspect, and if necessary, correct, adjust, clean or replace.
**L** - Lubricate with specified lubricant.

*Also perform prior to storage or annually
**R** - Replace or change.
**T** - Tighten to proper torque.
**X** - Perform.

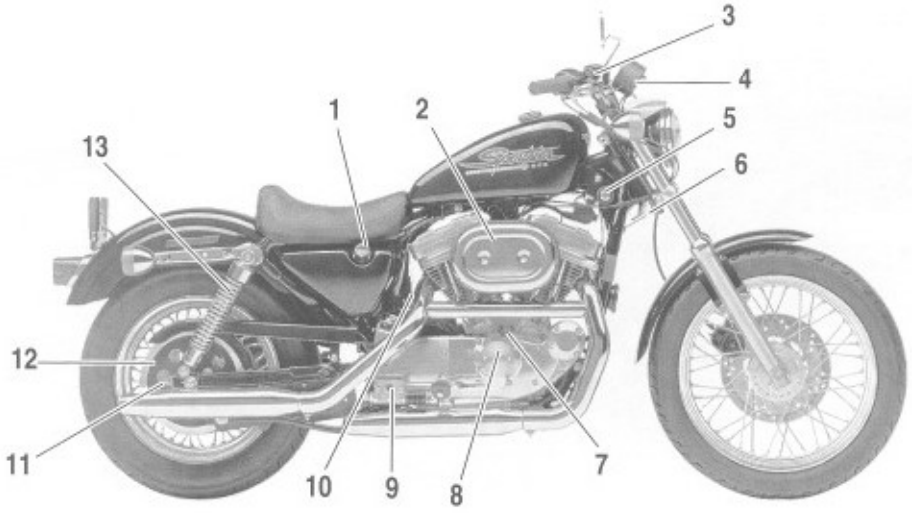
5765




1. Fuel supply valve
2. Carburetor enrichener knob
3. Battery
4. Engine oil tank drain hose
5. Rear axle adjuster
6. Primary & transmission drain plug
7. Clutch inspection cover
8. Primary chain cover
9. Primary chain inspection plug
10. Engine oil filter
11. Voltage regulator
12. Clutch cable adjuster
13. Ignition coil
14. Gear shift lever

XLH 883 – Left Side View (Typical)

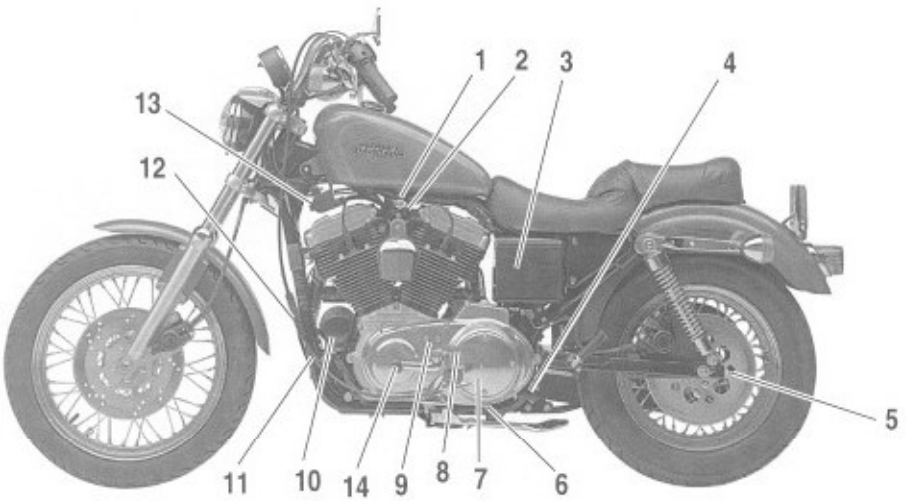
5764




1. Engine oil fill plug & dipstick
2. Carburetor/air cleaner
3. Front brake master cylinder & reservoir
4. Speedometer
5. Ignition/light switch
6. Fork lock brackets
7. Timing inspection hole plug
8. Ignition Module
9. Rear brake master cylinder & reservoir
10. Electric starter motor
11. Rear axle adjuster
12. Rear sprocket and drive
13. Shock absorber(s)

XLH 883 – Right Side View (Typical)

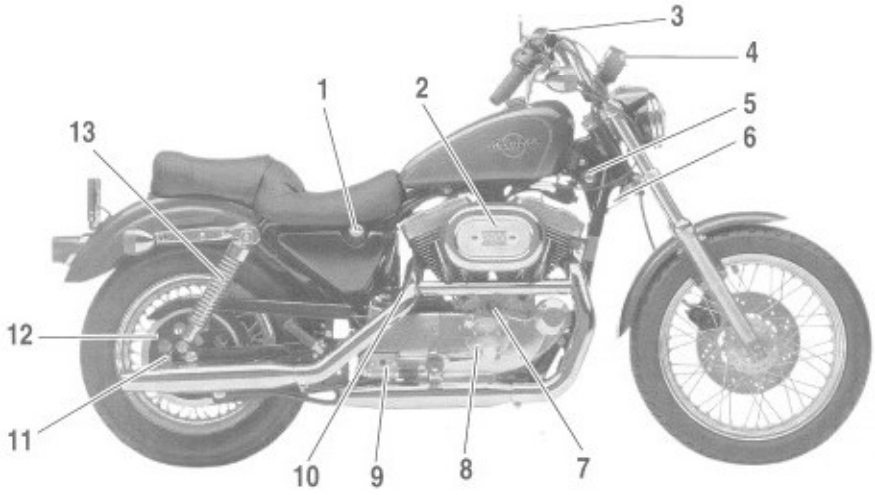
5769




1. Fuel supply valve
2. Carburetor enrichener knob
3. Battery
4. Engine oil tank drain hose
5. Rear axle adjuster
6. Primary & transmission drain plug
7. Clutch inspection cover
8. Primary chain cover
9. Primary chain inspection plug
10. Engine oil filter
11. Voltage regulator
12. Clutch cable adjuster
13. Ignition coil
14. Gear shift lever

XLH 1200 – Left Side View (Typical)

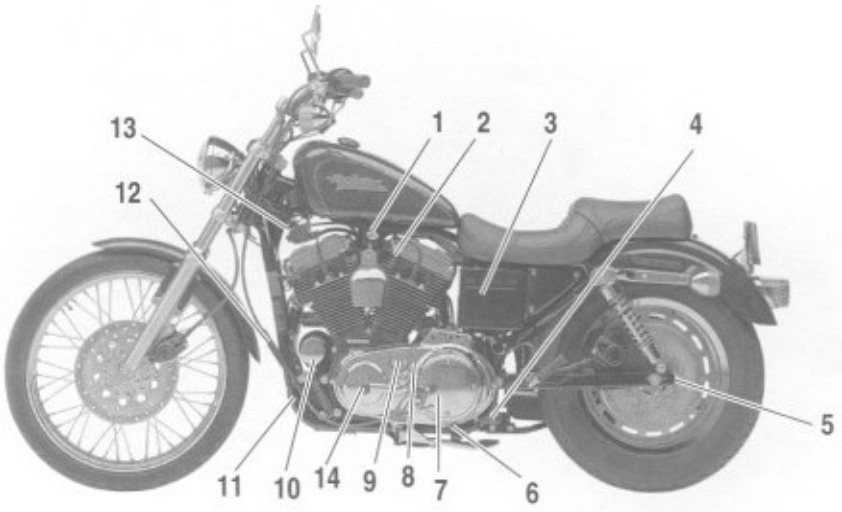
5768




1. Engine oil fill plug & dipstick
2. Carburetor/air cleaner
3. Front brake master cylinder & reservoir
4. Speedometer/tachometer
5. Ignition/light switch
6. Fork lock brackets
7. Timing inspection hole plug
8. Ignition Module
9. Rear brake master cylinder & reservoir
10. Electric starter motor
11. Rear axle adjuster
12. Rear sprocket and drive
13. Shock absorber(s)

XLH 1200 – Right Side View (Typical)

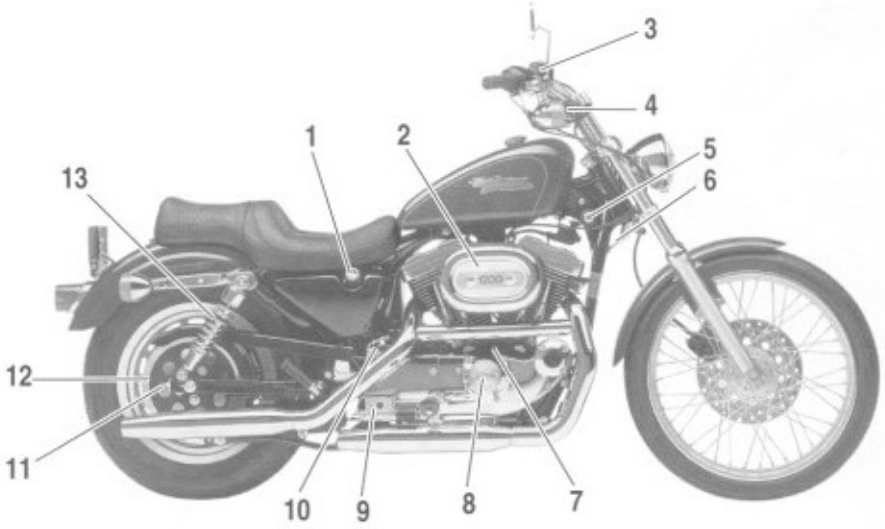
5773




1. Fuel supply valve
2. Carburetor enrichener knob
3. Battery
4. Engine oil tank drain hose
5. Rear axle adjuster
6. Primary & transmission drain plug
7. Clutch inspection cover
8. Primary chain cover
9. Primary chain inspection plug
10. Engine oil filter
11. Voltage regulator
12. Clutch cable adjuster
13. Ignition coil
14. Gear shift lever

XL 1200C Custom– Left Side View (Typical)

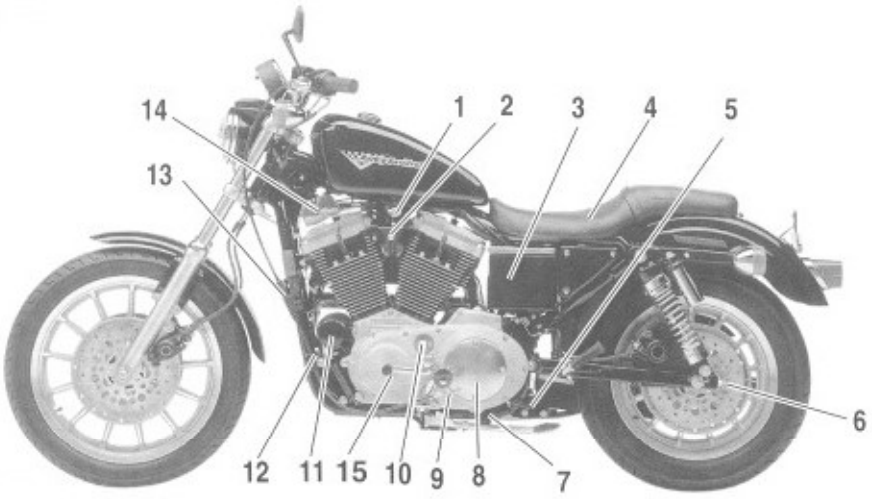
5772




1. Engine oil fill plug & dipstick
2. Carburetor/air cleaner
3. Front brake master cylinder & reservoir
4. Speedometer/tachometer
5. Ignition/light key switch
6. Fork lock brackets
7. Timing inspection hole plug
8. Ignition Module
9. Rear brake master cylinder & reservoir
10. Electric starter motor
11. Rear axle adjuster
12. Rear sprocket and drive
13. Shock absorber(s)

XL 1200C Custom – Right Side View (Typical)

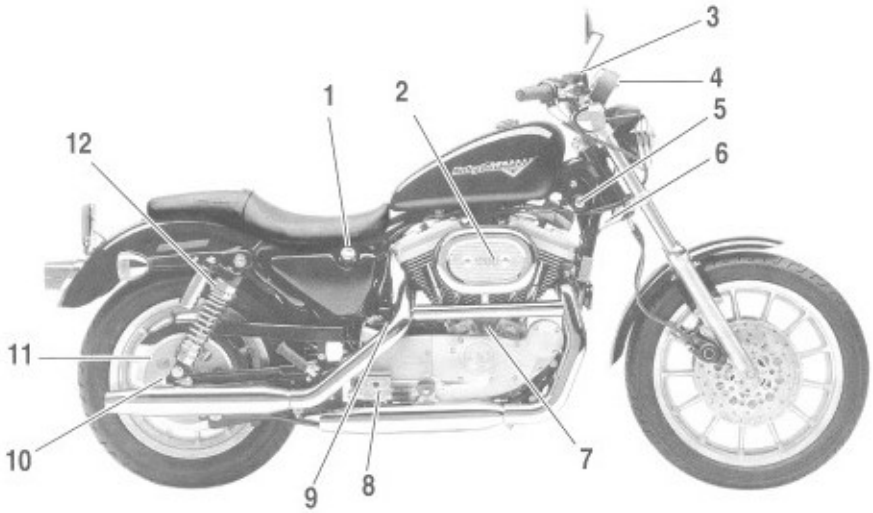
6327




1. Fuel supply valve
2. Carburetor enrichener knob
3. Battery
4. Ignition module (under seat)
5. Engine oil tank drain hose
6. Rear axle adjuster
7. Primary & transmission drain plug
8. Clutch inspection cover
9. Primary chain cover
10. Primary chain inspection plug
11. Engine oil filter
12. Voltage regulator
13. Clutch cable adjuster
14. Ignition coil
15. Gear shift lever

XL 1200S Sport– Left Side View (Typical)

6326




1. Engine oil fill plug & dipstick
2. Carburetor/air cleaner
3. Front brake master cylinder & reservoir
4. Speedometer/tachometer
5. Ignition/light switch
6. Fork lock brackets
7. Timing inspection hole plug
8. Rear brake master cylinder & reservoir
9. Electric starter motor
10. Rear axle adjuster
11. Rear sprocket and drive
12. Shock absorber(s)

XLH 1200S Sport– Right Side View (Typical)

# STORAGE

## GENERAL

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

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

**⚠WARNING**

**Gasoline is flammable. Do not store motorcycle having gasoline in tank within the home or garage where open flames, pilot lights, sparks or electric motors are present. Failure to heed this warning could lead to an explosion or fire resulting in personal injury.**

1. Fill fuel tank and add a gasoline stabilizer. Use one of the commercially available gasoline stabilizers following the manufacturer's instructions. Turn fuel supply valve off. Drain all gasoline from carburetor by loosening fuel bowl drain screw one full turn; gasoline will drain through fuel overflow fitting. Retighten drain screw after all gasoline has been drained from carburetor.

   **OR**

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

2. Fill the oil tank. Pinch off (or remove and plug) the line leading from the oil tank bottom to the oil pump feed fitting. This prevents oil from seeping past the check ball into the oil pump and filling the engine flywheel compartment.
3. Remove the spark plugs, inject a few squirts of engine oil into each cylinder and crank the engine 5-6 revolutions. Reinstall spark plugs.
4. Grease wheel bearings and install new seals.
5. Adjust primary chain.
6. 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.
7. Wash painted and chrome-plated surfaces. Apply a light film of oil to exposed unpainted surfaces.

**⚠WARNING**

**Do not apply any oil to brake discs or brake pads. Oil on disc pads degrades braking efficiency and can result in an accident resulting in personal injury.**

8. Remove battery from vehicle. Charge battery until the correct voltage is obtained. Charge the battery every other month if it is stored at temperatures below 60˚F (16˚C). Charge battery once a month if it is stored at temperatures above 60˚F (16˚C).

**⚠WARNING**

- **Always unplug or turn off battery charger before connecting or disconnecting charger clamps at battery. Connecting or disconnecting clamps with charger on could cause a spark and a possible battery explosion. A battery explosion may rupture the battery case and spray sulfuric acid onto the surrounding area and personnel, resulting in injury.**
- **Store battery out of reach of children. Battery contains sulfuric acid which can cause severe burns to eyes, skin and clothing.**

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

## REMOVAL FROM STORAGE

**⚠WARNING**

**After extended periods of storage and prior to starting vehicle, place transmission in gear, disengage clutch, and push vehicle back and forth a few times to ensure proper clutch disengagement. Incomplete clutch disengagement could cause vehicle to move unexpectedly at start-up, resulting in personal injury.**

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

# FLUID REQUIREMENTS

## GENERAL

### United States System

Unless otherwise specified, **all fluid volume measurements in this Service Manual are expressed in United States (U.S.) units-of-measure**. See below:

- 1 pint (U.S.) = 16 fluid ounces (U.S.)
- 1 quart (U.S.) = 2 pints (U.S.) = 32 fl. oz. (U.S.)
- 1 gallon (U.S.) = 4 quarts (U.S.) =128 fl. oz. (U.S.)

### British Imperial System

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

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

Although the same unit-of-measure terminology as the U.S. system is used in the British Imperial (Imp.) system, the actual volume of each British Imperial unit-of-measure differs from its U.S. counterpart. The U.S. fluid ounce is larger than the British Imperial fluid ounce. However, the U.S. pint, quart and gallon are smaller than the British Imperial pint, quart and gallon, respectively. Should you need to convert from U.S. units to British Imperial units (or vice versa), refer to the following:

- fluid ounces (U.S.) x 1.042 = fluid ounces (Imp.)
- pints (U.S.) x 0.833 = pints (Imp.)
- quarts (U.S.) x 0.833 = quarts (Imp.)
- gallons (U.S.) x 0.833 = gallons (Imp.)

- fluid ounces (Imp.) x 0.960 = fluid ounces (U.S.)
- pints (Imp.) x 1.201 = pints (U.S.)
- quarts (Imp.) x 1.201 = quarts (U.S.)
- gallons (Imp.) x 1.201 = gallons (U.S.)

### Metric System

Fluid volume measurements in this Service Manual include the metric system equivalents. In the metric system, 1 liter (L) = 1,000 milliliters (mL). Should you need to convert from U.S. units-of-measure to metric units-of-measure (or vice versa), refer to the following:

- fluid ounces (U.S.) x 29.574 = milliliters
- pints (U.S.) x 0.473 = liters
- quarts (U.S.) x 0.946 = liters
- gallons (U.S.) x 3.785 = liters

- milliliters x 0.0338 = fluid ounces (U.S.)
- liters x 2.114 = pints (U.S.)
- liters x 1.057 = quarts (U.S.)
- liters x 0.264 = gallons (U.S.)

## WHEEL BEARING GREASE

Use Harley-Davidson WHEEL BEARING GREASE (H-D Part No. 99855-89).

## BRAKE FLUID

**⚠WARNING**

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

Use only D.O.T. 5 SILICONE HYDRAULIC BRAKE FLUID (H-D Part No. 99902-77).

## FRONT FORK OIL

Use only HYDRAULIC FORK OIL TYPE "E" (H-D Part No. 99884-80).

## ENGINE OIL

Engine oil is a major factor in the performance and service life of the engine. Always use the proper grade of oil for the lowest temperature expected before the next scheduled oil change.

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

| Harley-Davidson Type | Viscosity | Harley-Davidson Rating | Lowest Ambient Temperature | Cold Weather Starts Below 50°F (10°C) |
|---|---|---|---|---|
| HD Multi-grade | SAE 10W40 | HD 240 | Below 40°F (4°C) | Excellent |
| HD Multi-grade | SAE 20W50 | HD 240 | Above 40°F (4°C) | Good |
| HD Regular Heavy | SAE 50 | HD 240 | Above 60°F (16°C) | Poor |
| HD Extra Heavy | SAE 60 | HD 240 | Above 80°F (27°C) | Poor |

## FUEL

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

## PRIMARY DRIVE/TRANSMISSION LUBRICANT

Use only Harley-Davidson SPORT TRANS FLUID (H-D Part No. 98854-96 quart (U.S.) size or H-D Part No. 98855-96 gallon (U.S.) size).

# 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 |

# FASTENER TORQUE VALUES

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

**⚠WARNING**

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

## ENGLISH

| FASTENER | TYPE | MINIMUM TENSILE STRENGTH | MATERIAL | BODY SIZE OR OUTSIDE DIAMETER | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | # (number) | | | | | | | in. (inches) | | | | | | | | | |
| | | | | 2 | 3 | 4 | 5 | 6 | 8 | 10 | 1/4 | 5/16 | 3/8 | 7/16 | 1/2 | 9/16 | 5/8 | 3/4 | 7/8 | 1 |
|  | SAE 2 STEEL | 74,000 PSI | LOW CARBON | | | | | | | | 6 | 12 | 20 | 32 | 47 | 69 | 96 | 155 | 206 | 310 |
|  | SAE 5 STEEL | 120,000 PSI | MEDIUM CARBON HEAT TREAT | | | | | | 14* | 22* | 10 | 19 | 33 | 54 | 78 | 114 | 154 | 257 | 382 | 587 |
|  | SAE 7 STEEL | 133,000 PSI | MEDIUM CARBON ALLOY | | | | | | | | 13 | 25 | 44 | 71 | 110 | 154 | 215 | 360 | 570 | 840 |
|  | SAE 8 STEEL | 150,000 PSI | MEDIUM CARBON ALLOY | | | | | | | | 14 | 29 | 47 | 78 | 119 | 169 | 230 | 380 | 600 | 900 |
|  | SAE 8 STEEL | 150,000 PSI | MEDIUM CARBON ALLOY | | | | | | | | 14 | 29 | 47 | 78 | 119 | 169 | 230 | 380 | 600 | 900 |
|  | SOCKET SET SCREW | 212,000 PSI | HIGH CARBON QUENCHED TEMPERED | | | | | 9* | 16* | 30* | 70* | 140* | 18 | 29 | 43 | 63 | 100 | 146 | | |
|  | STUDS | | | Use SAE 2, 5 and 8 values when grade is known, with nut of sufficient strength. | | | | | | | | | | | | | | | | |

*Torque values in **in-lbs.**

## METRIC EQUIVALENTS FOR ENGLISH FASTENERS

| FASTENER | TYPE | MINIMUM TENSILE STRENGTH | MATERIAL | BODY SIZE OR OUTSIDE DIAMETER | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | # (number) | | | | | | | mm (millimeters) | | | | | | | | | |
| | | | | 2 | 3 | 4 | 5 | 6 | 8 | 10 | 6.4 | 7.9 | 9.5 | 11.1 | 12.7 | 14.3 | 15.9 | 19.1 | 22.2 | 25.4 |
|  | SAE 2 STEEL | 5,202 kg/cm$^2$ | LOW CARBON | | | | | | | | 8.3 | 16.6 | 27.7 | 44.3 | 65.0 | 95.4 | 132.8 | 214.4 | 283.5 | 428.7 |
|  | SAE 5 STEEL | 8,436 kg/cm$^2$ | MEDIUM CARBON HEAT TREAT | | | | | | 1.6 | 2.5 | 13.8 | 26.3 | 45.6 | 74.7 | 107.9 | 157.7 | 213.0 | 355.4 | 528.3 | 811.8 |
|  | SAE 7 STEEL | 9,350 kg/cm$^2$ | MEDIUM CARBON ALLOY | | | | | | | | 18.0 | 34.6 | 60.8 | 98.2 | 152.1 | 213.0 | 297.3 | 497.9 | 788.3 | 1161.7 |
|  | SAE 8 STEEL | 10,545 kg/cm$^2$ | MEDIUM CARBON ALLOY | | | | | | | | 19.4 | 40.1 | 65.0 | 107.9 | 164.6 | 233.7 | 318.1 | 525.5 | 829.8 | 1220.0 |
|  | SAE 8 STEEL | 10,545 kg/cm$^2$ | MEDIUM CARBON ALLOY | | | | | | | | 19.4 | 40.1 | 65.0 | 107.9 | 164.6 | 233.7 | 318.1 | 525.5 | 829.8 | 1220.0 |
|  | SOCKET SET SCREW | 14,904 kg/cm$^2$ | HIGH CARBON QUENCHED TEMPERED | | | | | 1.0 | 1.8 | 3.4 | 8.1 | 16.1 | 24.9 | 40.1 | 59.5 | 87.1 | 138.3 | 201.9 | | |
|  | STUDS | | | Use SAE 2, 5 and 8 values when grade is known, with nut of sufficient strength. | | | | | | | | | | | | | | | | |

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

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

# TROUBLESHOOTING

The following check list can be helpful in locating most operating troubles. Refer to the appropriate sections in this Service Manual for detailed procedures.

## ENGINE

### Starting 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 relay or solenoid not functioning.
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 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 or battery connection or plug between ignition sensor and module.
9. Ignition coil not functioning.
10. Ignition module not functioning.
11. Ignition sensor not functioning.
12. Sticking or damaged valve or valves.
13. Engine flooded with gasoline as a result of overchoking.
14. Engine oil too heavy (winter operation).

### Starts Hard

1. Spark plugs in bad condition, have improper gap or are partially fouled.
2. Spark plug cables in bad condition and shorting.
3. Battery nearly discharged.
4. Loose wire connection at one of the battery terminals, at coil, or at plug between ignition sensor and module.
5. Carburetor controls not adjusted correctly.
6. Ignition coil not functioning.
7. Engine oil too heavy (winter operation).
8. Ignition not timed properly.
9. Fuel tank filler cap vent plugged, or carburetor fuel line closed off restricting fuel flow.
10. Water or dirt in fuel system and carburetor.
11. Enrichener valve inoperative.
12. Air leak at intake manifold.
13. Valves sticking.
14. Air cleaner backplate EVAP butterfly valve (if equipped) stuck closed or inoperative.

### Starts But Runs Irregularly or Misses

1. Spark plugs in bad condition or partially fouled.
2. Spark plug cables in bad condition and shorting.
3. Spark plug gap too close or too wide.
4. Ignition coil not functioning.
5. Ignition module not functioning.
6. Ignition sensor not functioning.
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 and carburetor or filter.
11. Fuel tank filler cap vent plugged or carburetor float bowl vent closed off.
12. Carburetor controls improperly adjusted.
13. Air leak at intake manifold or air cleaner.
14. Damaged intake or exhaust valve.
15. Weak or broken valve springs.
16. Incorrect valve timing.
17. Air cleaner backplate EVAP butterfly valve (if equipped) stuck closed or inoperative.

### Spark Plug Fouls Repeatedly

1. Incorrect spark plug.
2. Piston rings badly worn or broken.
3. Fuel mixture too rich (see CARBURETOR TROUBLESHOOTING).
4. Valve stem seals worn or damaged.
5. Valve guides badly worn.

### Pre-Ignition or Detonation (Knocks or Pings)

1. Excessive carbon deposit on piston head or combustion chamber.
2. Incorrect heat range spark plug.
3. Spark plugs not firing.
4. Ignition timing advanced.
5. Fuel octane rating too low.
6. Intake manifold vacuum leak.

### Overheating

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

### Valve Train Noise

1. Hydraulic lifter not functioning properly.
2. Bent push rod.
3. Cam, cam gears, or cam bushings worn.
4. Rocker arm binding on shaft.
5. Valve sticking in guide.

### Excessive Vibration

1. Upper mounting bracket loose, broken or improperly spaced.
2. Lower mounting bolts loose.
3. Broken frame.
4. Primary chain badly worn or links tight as a result of insufficient lubrication.
5. Wheels not aligned and/or tires worn.
6. Internal engine problem.

# ENGINE LUBRICATION SYSTEM

## Oil Does Not Return To Oil Tank

1. Oil tank empty.
2. Return pump gears damaged.
3. Oil feed pump not functioning.
4. Restricted oil lines or fittings.

## Engine Uses Too Much Oil or Smokes Excessively

1. Piston rings badly worn or broken.
2. Valve stem seals worn or damaged.
3. Valve guides worn.

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

1. Loose parts.
2. Imperfect seal at gaskets, push rod cover, washers, etc. To aid locating leaks, use BLACK LIGHT LEAK DETECTOR (Part No. HD-35457).
3. Restricted oil return line to tank.
4. Restricted breather passage(s) to air cleaner.

# ELECTRICAL SYSTEM

## Alternator Does Not Charge

1. Regulator-rectifier module not functioning.
2. Rectifier not grounded.
3. Engine ground wire loose or broken.
4. Loose or broken wires in charging circuit.
5. Stator not functioning.
6. Rotor not functioning.

## Alternator Charge Rate Is Below Normal

1. Regulator-rectifier module not functioning.
2. Stator not functioning.
3. Rotor not functioning.
4. Weak battery.
5. Loose connections.

# FUEL

## Carburetor Floods

1. Excessive "pumping" of hand throttle grip.
2. Inlet valve sticking.
3. Inlet valve and/or valve seat worn or damaged.
4. Dirt or other foreign matter between valve and its seat.
5. Float misadjusted or filled with fuel.

# TRANSMISSION

## Shifts Hard

1. Clutch dragging slightly.
2. Shifter forks (inside transmission) damaged.
3. Corners worn off shifter clutch dogs (inside transmission).

## Jumps Out of Gear

1. Shifter pawl improperly adjusted.
2. Shifter engaging parts (inside transmission) badly worn and rounded.
3. Shifter forks bent.
4. Damaged gears.

# CLUTCH

## Slips

1. Clutch controls improperly adjusted.
2. Worn friction plates.

## Drags or Does Not Release

1. Clutch controls improperly adjusted.
2. Clutch plates excessively warped.

## Chatters

1. Friction or steel plates worn, warped, or dragging.

# CHASSIS

## Irregular / Inadequate Brake Action

1. Master cylinder low on fluid.
2. Brake line contains air bubbles.
3. Master or wheel cylinder piston worn.
4. Brake pads impregnated with grease or oil.
5. Brake pads badly worn (1/16 in. (1.6 mm) minimum lining thickness).
6. Brake disc badly worn or warped.
7. Brake pads dragging or excessive braking (brake fades due to heat buildup).
8. Insufficient brake pedal or handlever free play (brake drags).

## Handling Irregularities

1. Tires improperly inflated. Check TIRE DATA Section. Do not overinflate.
2. Loose wheel axle nuts. Tighten front nut to 50-55 ft-lbs (68-75 Nm). Tighten rear nut to 60-65 ft-lbs (81-88 Nm).
3. Excessive wheel hub bearing play.
4. Rear wheel out of alignment with frame and front wheel.
5. Rims and tires out-of-true sideways (tire runout should not be more than 5/64 in. (2.0 mm)).
6. Rims and tires out-of-round or eccentric with hub (tire runout should not be more than 3/32 in. (2.4 mm)).
7. Irregular or peaked front tire tread wear.
8. Tire and wheel unbalanced.
9. Steering head bearings improperly adjusted. Correct adjustment, and replace pitted or worn bearings and races. See FRONT FORK STEM AND BRACKET.
10. Shock absorber not functioning normally.
11. Heavy front end loading. Non-standard equipment on the front end (such as heavy radio receivers, extra lighting equipment, or luggage) tends to cause unstable handling.

# SHOP PRACTICES

## REPAIR NOTES

*NOTE*

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

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

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

**SAFETY** – Safety is always the most important consideration when performing any job. Be sure you have a complete understanding of the task to be performed. Use common sense. Use the proper tools. Don't just do the job – do the job safely.

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

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

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

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

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

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

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

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

## REPAIR AND REPLACEMENT PROCEDURES

**HARDWARE AND THREADED PARTS** – Install helical thread inserts when inside threads in castings are stripped, damaged or not capable of withstanding specified torque.

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

Replace all damaged or missing lubrication fittings.

Use Teflon tape on pipe fitting threads.

**WIRING, HOSES AND LINES** – Replace hoses, clamps, electrical wiring, electrical switches or fuel lines if they do not meet specifications.

**INSTRUMENTS AND GAUGES** – Replace broken or defective instruments and gauges. Replace dials and glass that are so scratched or discolored that reading is difficult.

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

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

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

Be sure that the chamfered side of the bearing always faces the shoulder (when bearings installed against shoulders). Lubricate bearings and all metal contact surfaces before pressing into place. Only apply pressure on the part of the bearing that makes direct contact with the mating part.

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

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

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

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

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

**GASKETS** – Always discard gaskets after removal. Replace with new gaskets. Never use the same gasket twice. Be sure that gasket holes match up with holes in the mating part.

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

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

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

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

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

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

**GEARS** – Always check gears for damaged or worn teeth.

Remove burrs and rough spots with a honing stone or crocus cloth before installation. Lubricate mating surfaces before pressing gears on shafts.

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

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

Clean all rust from the machined surfaces of new parts.

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

## CLEANING

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

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

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

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

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

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

# TOOL SAFETY

## AIR TOOLS

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

## WRENCHES

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

## PLIERS/CUTTERS/PRYBARS

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

## HAMMERS

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

## PUNCHES/CHISELS

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

## SCREWDRIVERS

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

## RATCHETS AND HANDLES

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

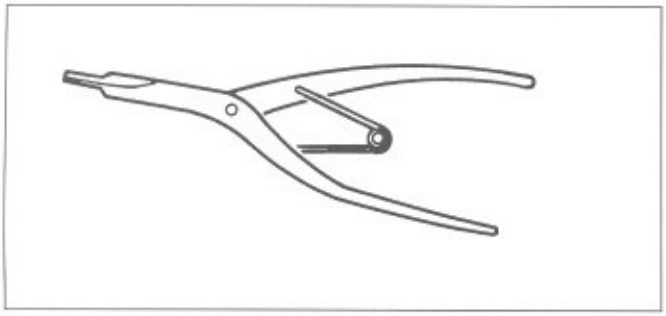
## SOCKETS

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

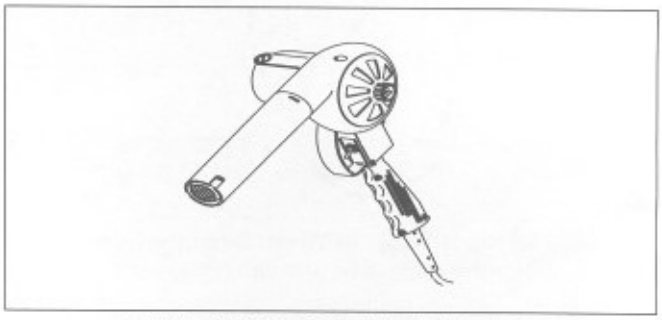
## STORAGE UNITS

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

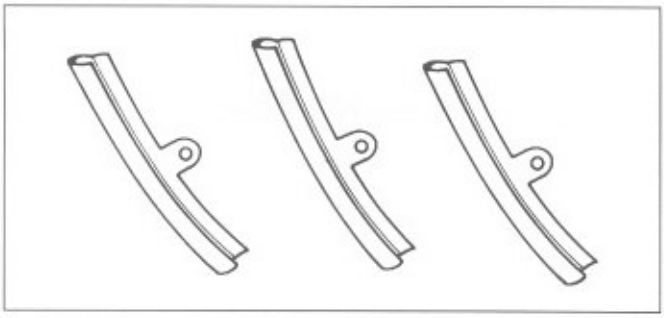
# TOOLS



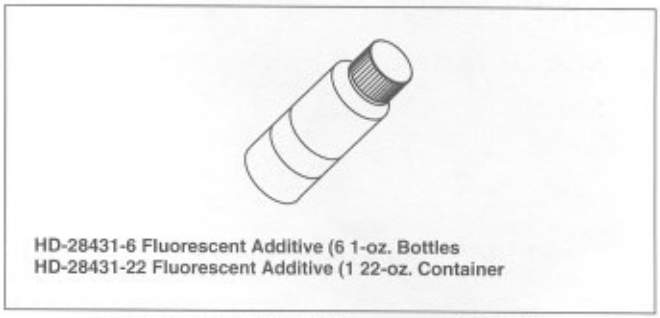
Part No. J-5586 Transmission Shaft Retaining Ring Pliers



Part No. HD-25070 Robinair Heat Gun

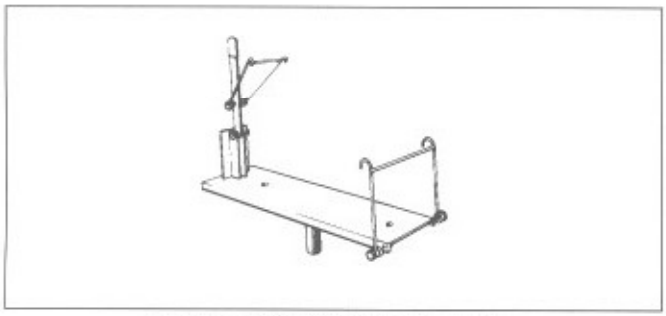


Part No. HD-01289 Rim Protectors

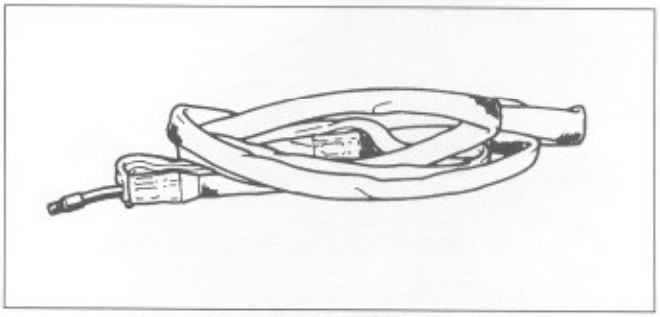


HD-28431-6 Fluorescent Additive (6 1-oz. Bottles
HD-28431-22 Fluorescent Additive (1 22-oz. Container

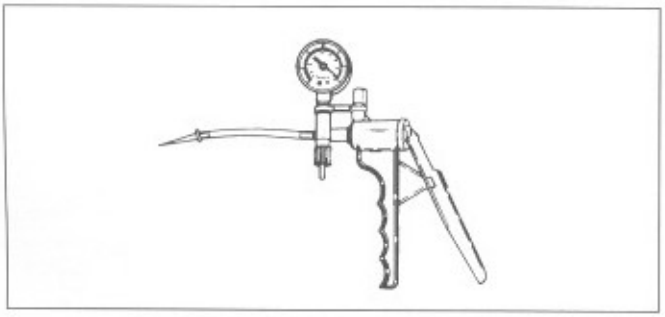
Part No. HD-28431B Fluorescent Additive (24 1-oz. Bottles). Use with HD-35457



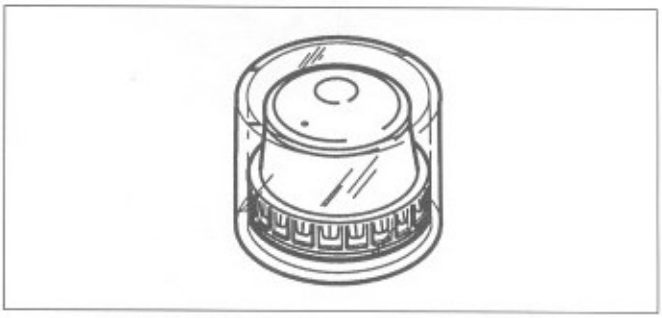
Part No. HD-21000 Tire Spreader



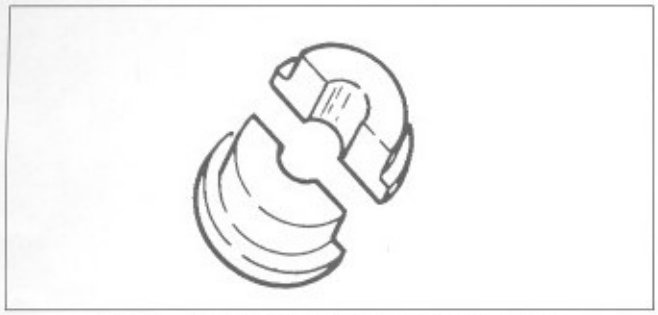
Part No. HD-28700 Tire Bead Expander



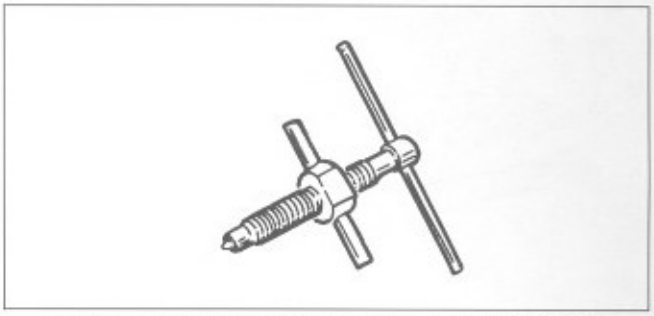
Part No. HD-23738 Vacuum Pump



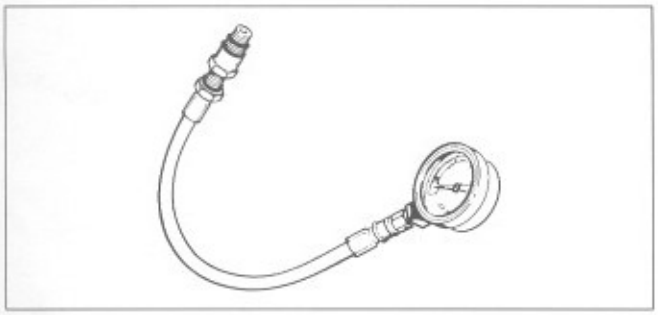
Part No. HD-33067 Wheel Bearing Packer



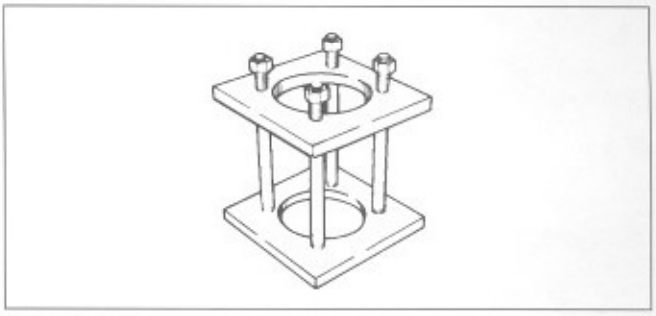
Part No. HD-33071A Wheel Bearing Race Remover/Installer. Use with HD-33416



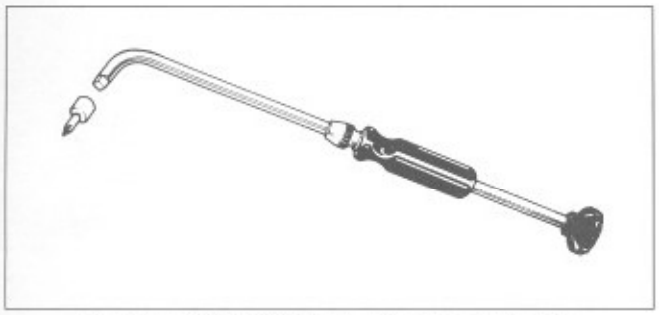
Part No. HD-33418 Universal Puller Forcing Screw



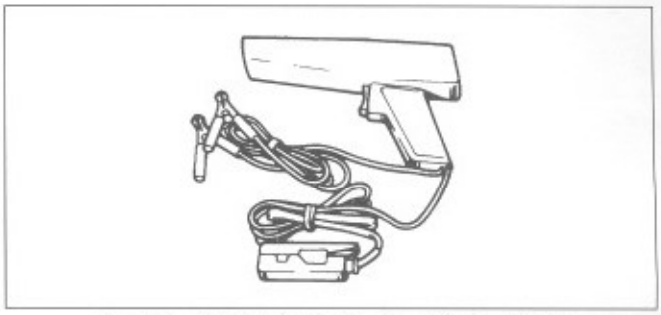
Part No. HD-33223-1 Cylinder Compression Gauge



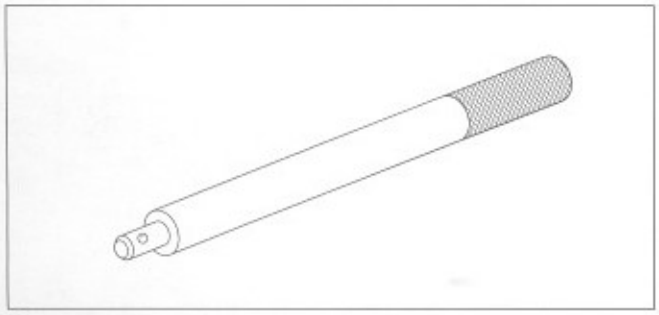
Part No. HD-33446A Cylinder Torque Plates



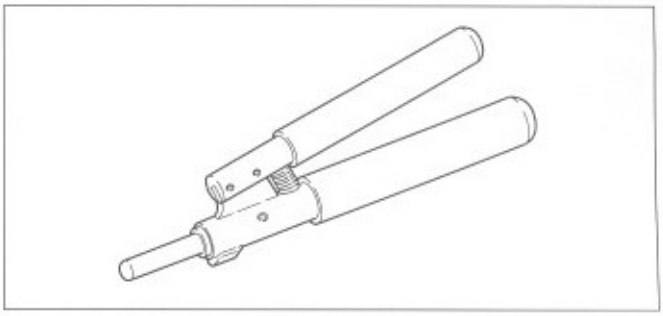
Part No. HD-33413 Carburetor Idle Adjuster



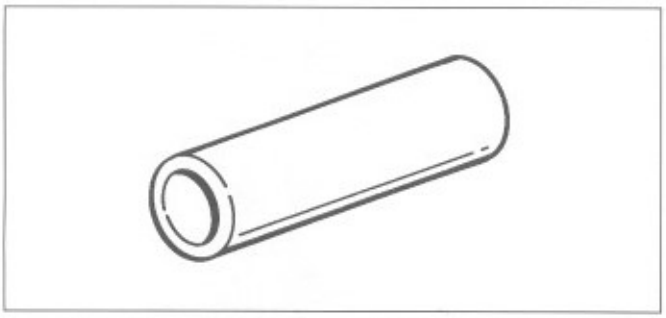
Part No. HD-33813 Inductive Timing Light



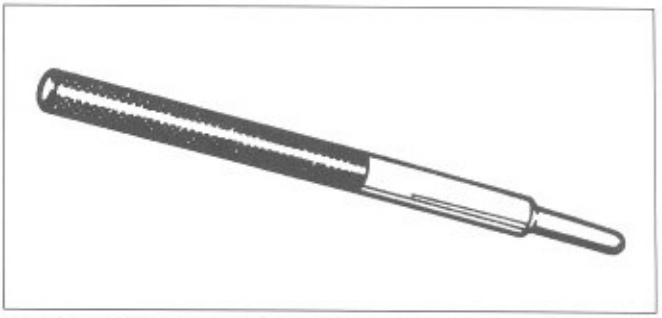
Part No. HD-33416 Universal Driver Handle



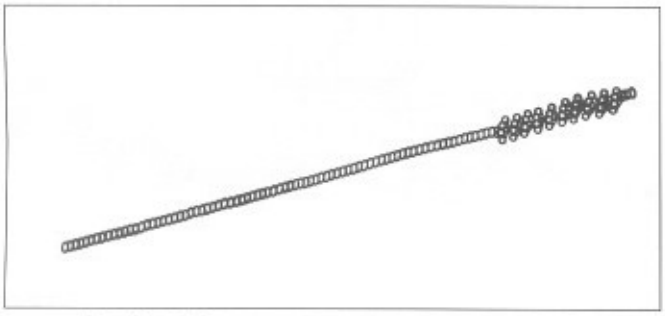
Part No. HD-34623B Piston Pin Retaining Ring Installer



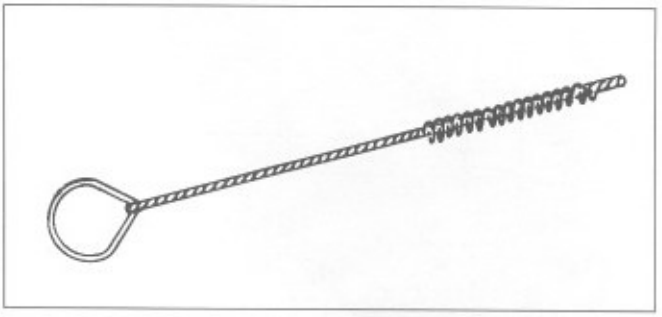
Part No. HD-34643A Shoulderless Valve Guide Seal Installer



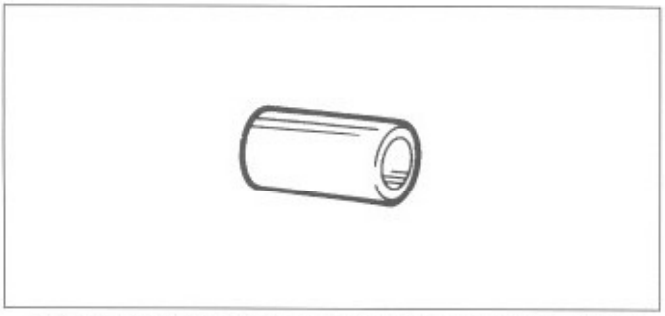
Part No. HD-34740 Driver Handle and Remover. Used with HD-34643A and HD-34731



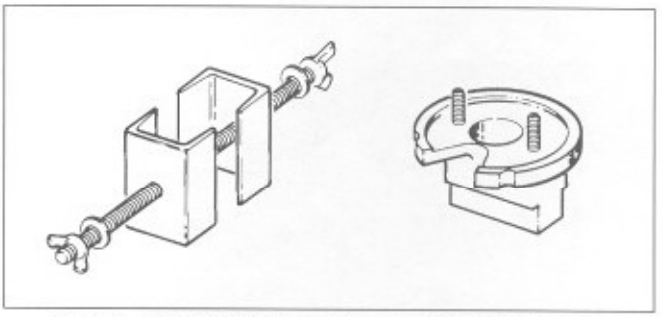
Part No. HD-34723 Valve Guide Hone (8 mm)



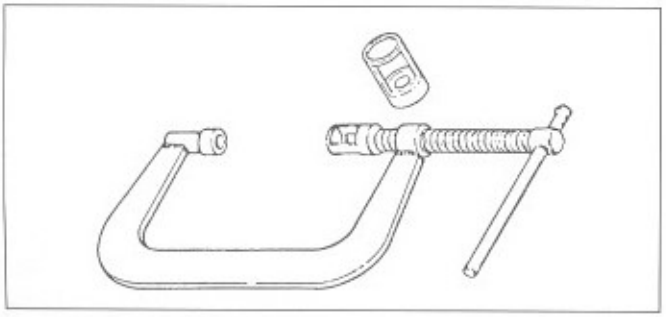
Part No. HD-34751 Nylon Valve Guide Cleaning Brush



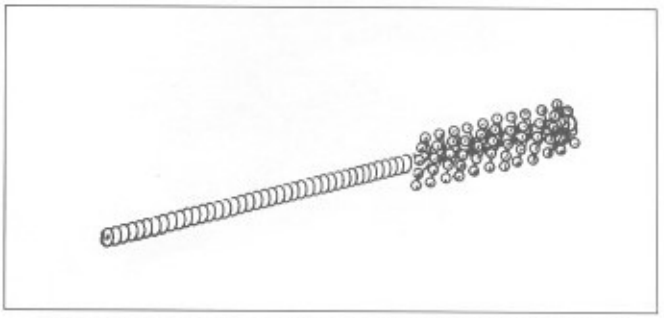
Part No. HD-34731 Shoulderless Valve Guide Installer



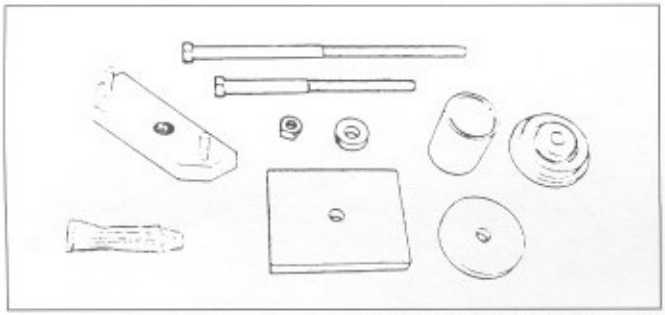
Part No. HD-34813 Rowe Flywheel Rebuilding Jig



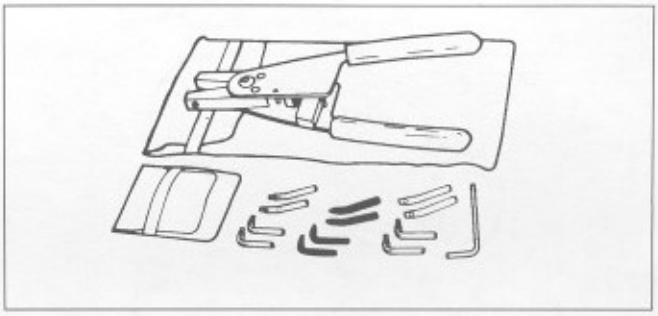
Part No. HD-34736B Valve Spring Compressor



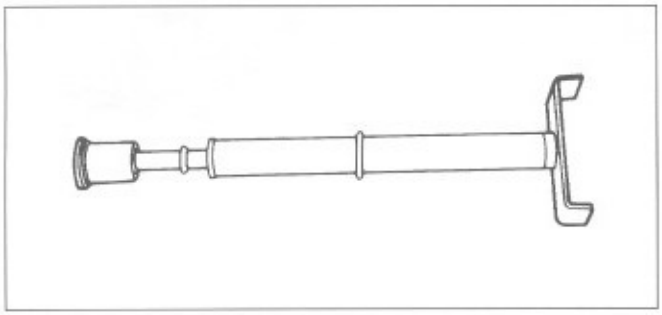
Part No. HD-35102 Wrist Pin Bushing Hone (20 mm)



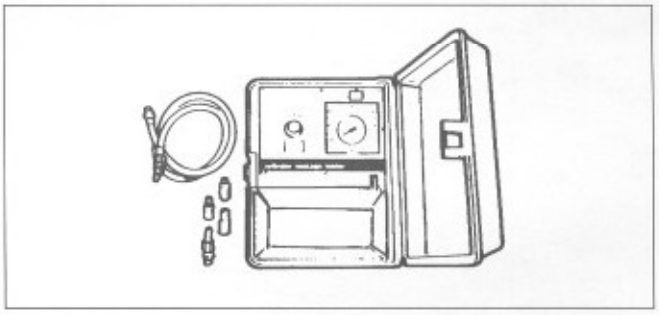
Part No. HD-35316A Main Drive Gear Remover/Installer and Main Drive Gear Bearing Installer



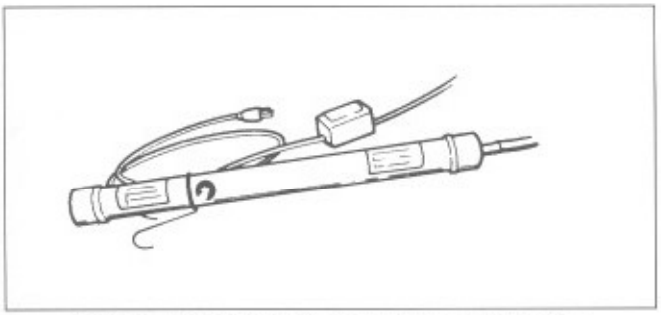
Part No. HD-35518 Internal/External Retaining Ring Pliers



Part No. HD-35381 Belt Tension Gauge

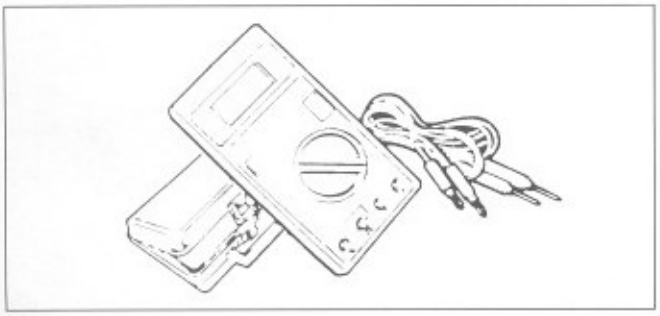


Part No. HD-35667A Cylinder Leakdown Tester

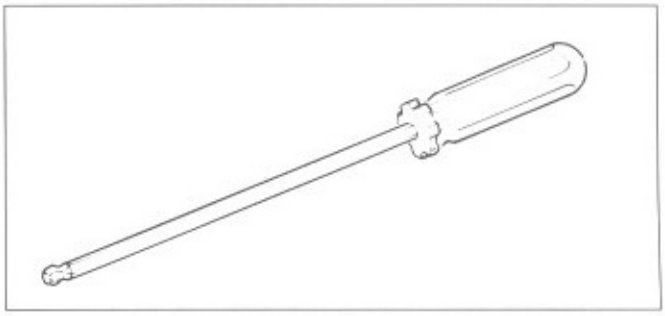


Part No. HD-35457 Black Light Leak Detector

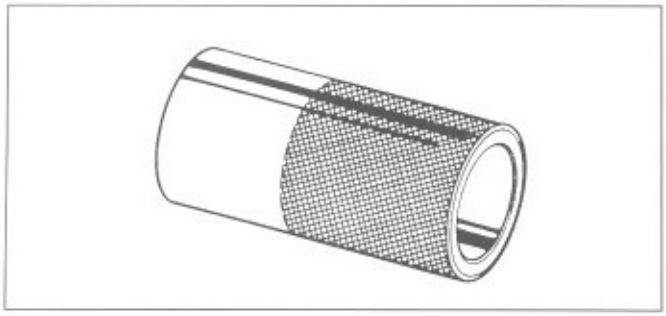
Part No. HD-35758 Neway Valve Seat Cutter Set



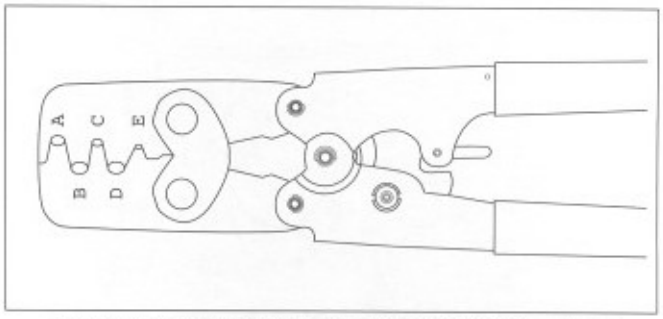
Part No. HD-35500B Digital Multi-Meter (FLUKE 23)



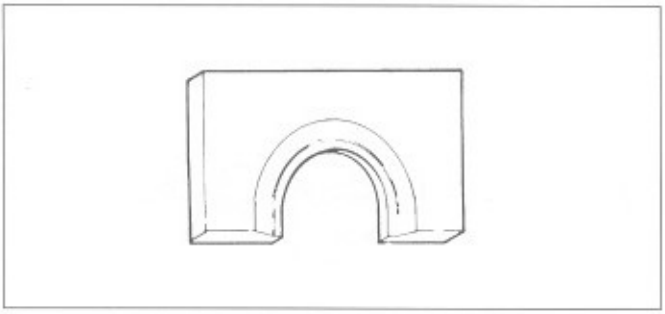
Part No. HD-35801 Intake Manifold Screw Wrench



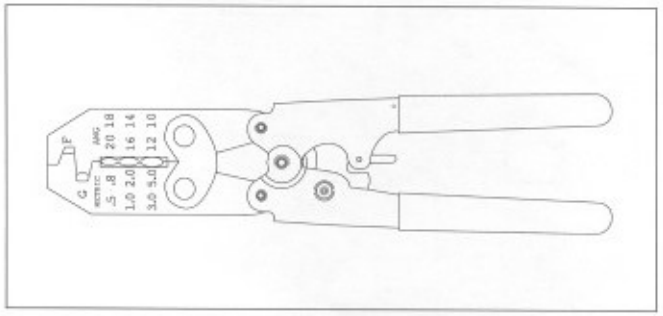
Part No. HD-36583 Fork Bushing Seal Installer



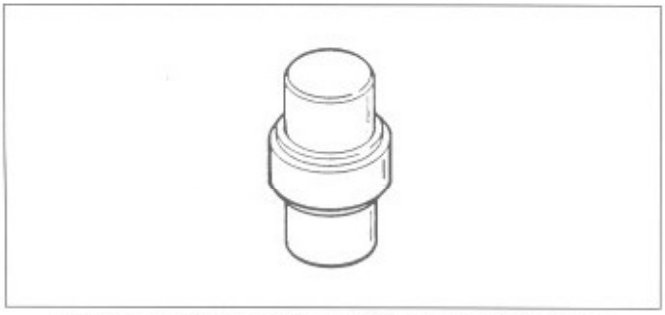

Part No. HD-38125-7 Packard Terminal Crimp Tool (Nonsealed)



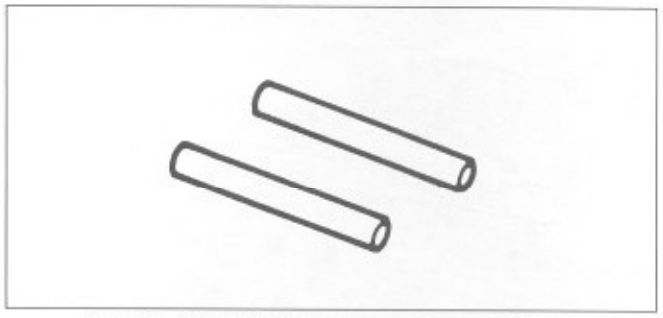
Part No. HD-37404 Countershaft Gear Support Plate



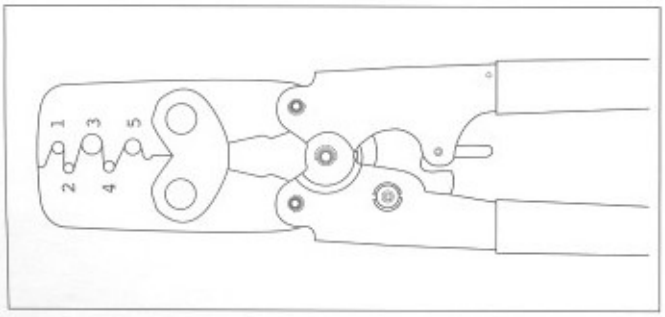

Part No. HD-38125-8 Packard Terminal Crimp Tool



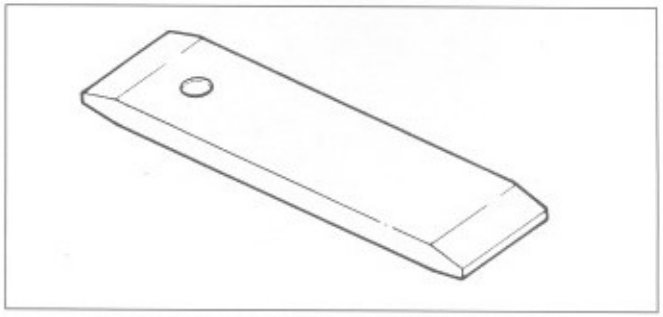
Part No. HD-37842A Inner/Outer Main Drive Gear Needle Bearing Installer



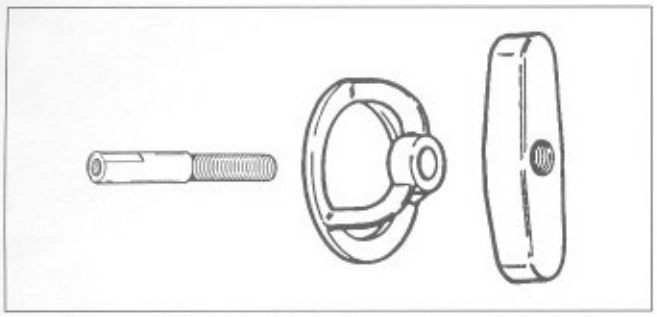
Part No. HD-38361 Cam Gear Gauge Pin Set (0.108 in. (2.74 mm) Diameter)



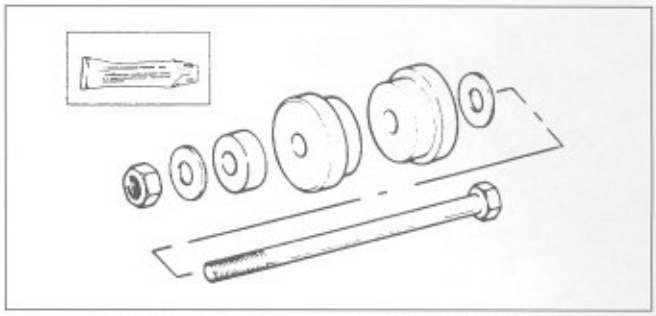

Part No. HD-38125-6 Packard Terminal Crimp Tool (Sealed)



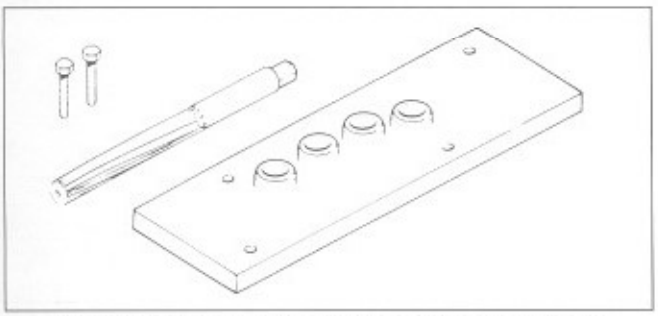
Part No. HD-38362 Sprocket Locking Link



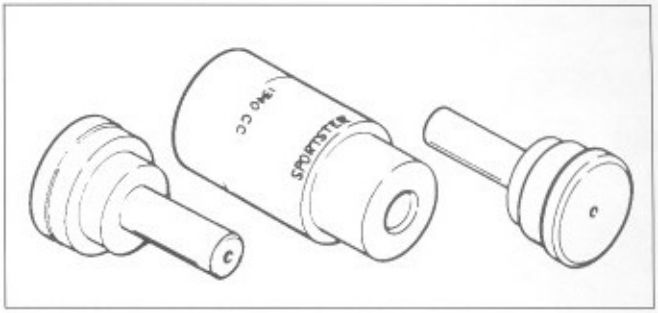
Part No. HD 38515A Clutch Spring Compressor



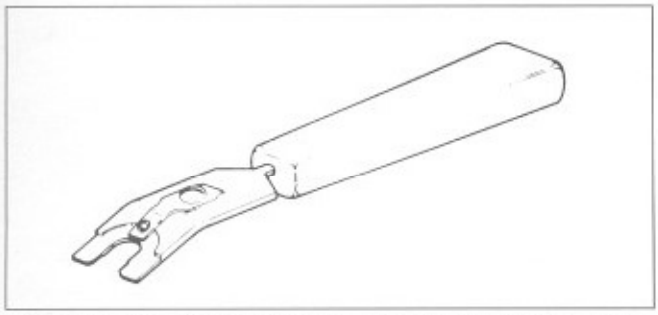
Part No. HD-39302 Steering Head Bearing Race Installer



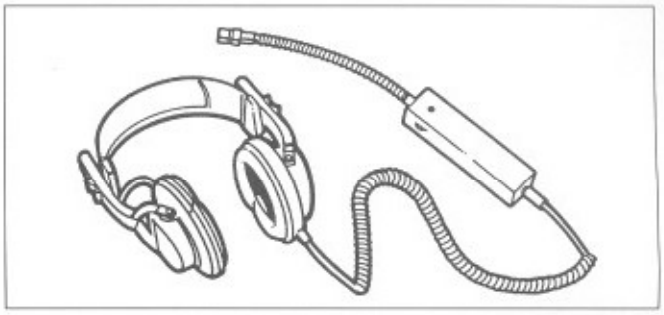
Part No. HD-38871 Camshaft Bushing Plate Pilot and Reamer



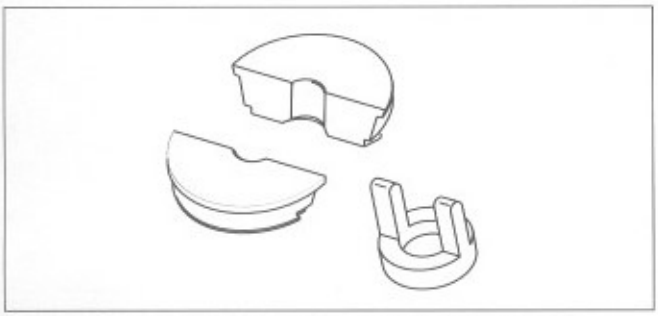
Part No. HD-39458 Sprocket Shaft Bearing Outer Race Installer



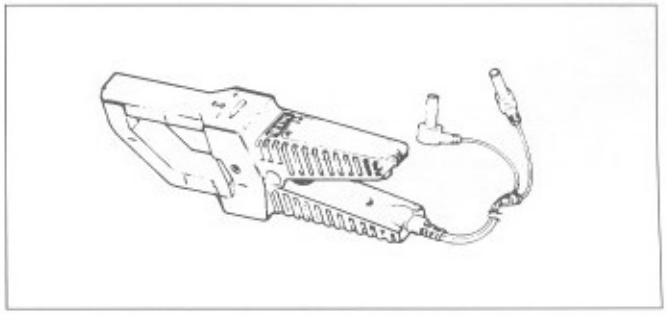
Part No. HD-39151 Shift Drum Retaining Ring Installer



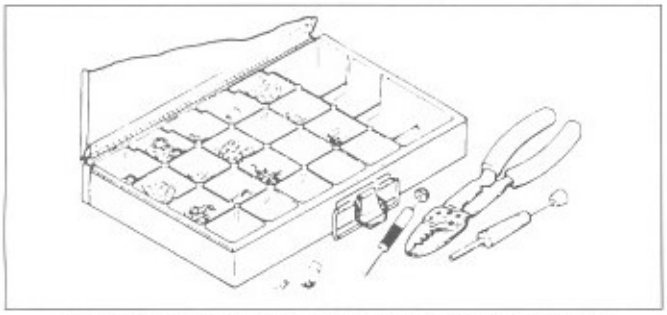
Part No. HD-39565 Engine Ear



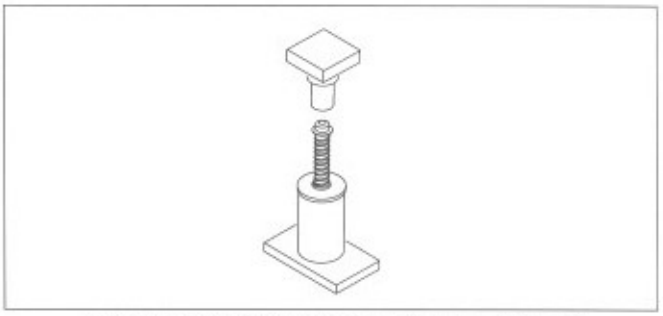
Part No. HD-39301A Steering Head Bearing Race Remover



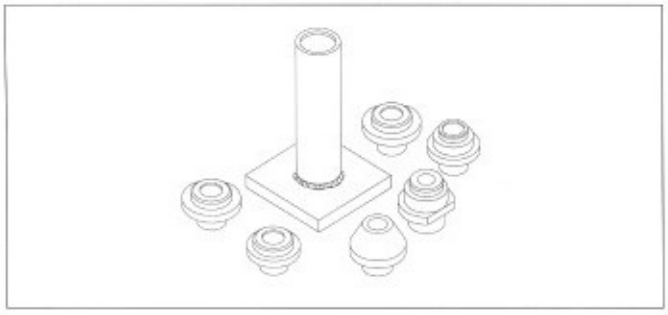
Part No. HD-39617 Inductive Amp Probe. Use with HD-35500A



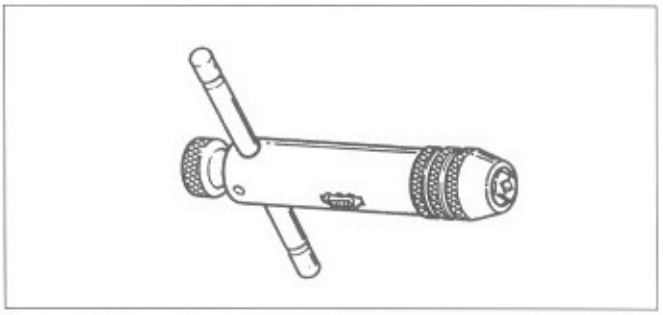
Part No. HD-39621 Electrical Terminal Repair Kit



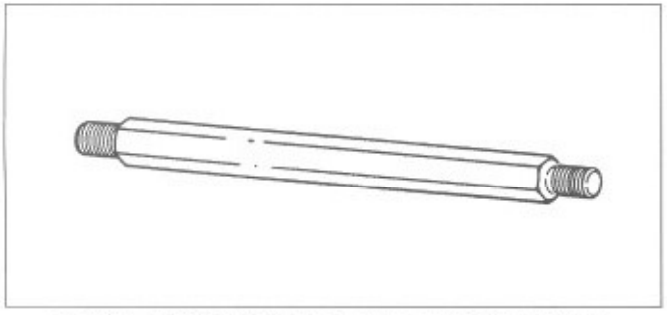
Part No. HD-39800 Oil Filter Crusher (Small)



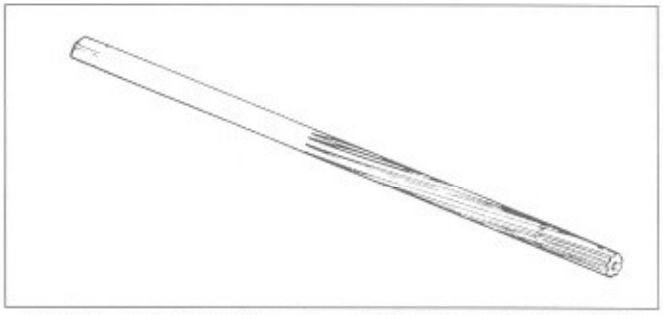
Part No. HD-39782 Cylinder Head Support



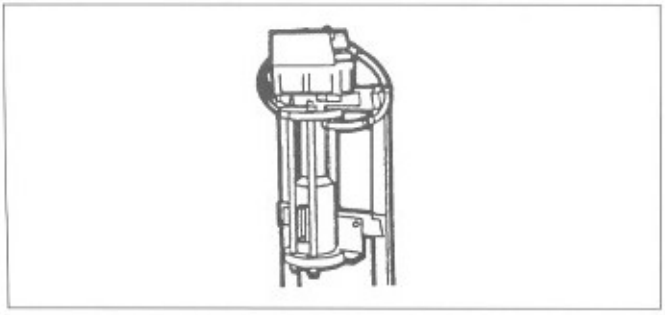
Part No. HD-39847 Universal Ratcheting Tap/Reamer Handle



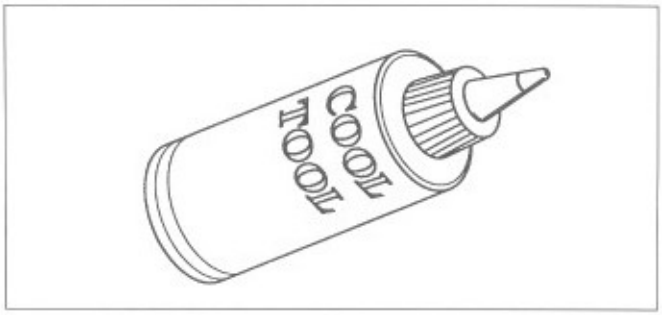
Part No. HD-39786 Cylinder Head Holding Fixture



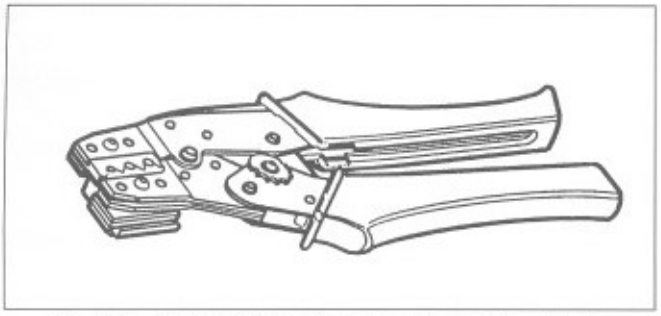
Part No. HD-39932 (Steel) or HD-39932-CAR (Carbide) Intake and Exhaust Valve Guide Reamer



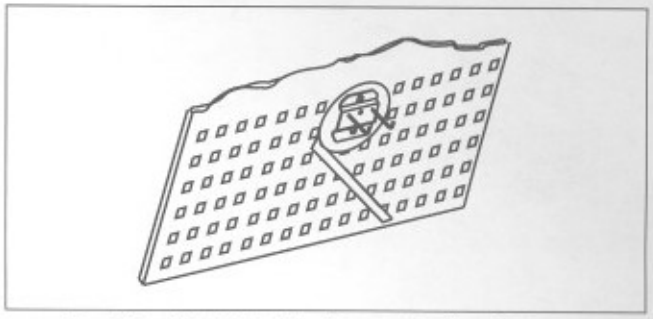
Part No. HD-39823 Oil Filter Crusher (Large)



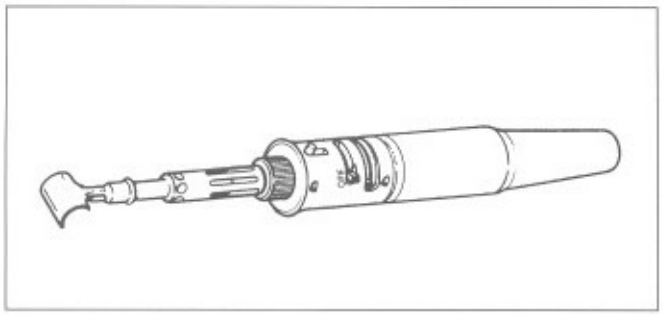

Part No. HD-39964 Reamer Lubricant (Cool Tool)



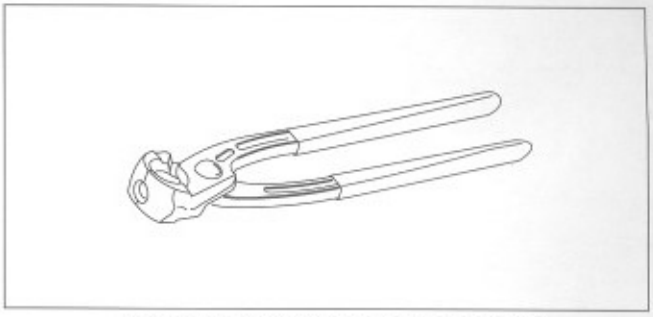
Part No. HD-39965 Deutsch Terminal Crimp Tool



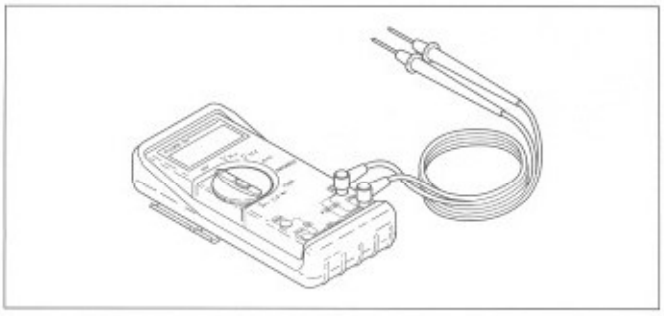
Part No. HD-41025 Tool Organizational System



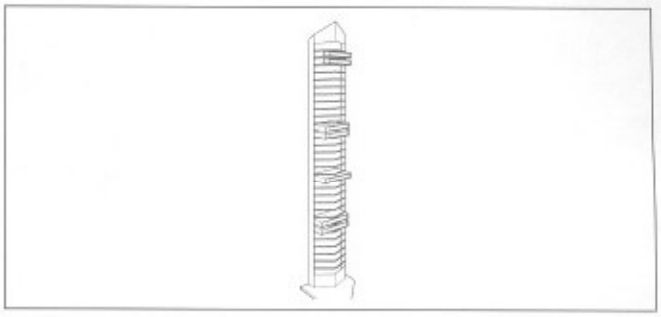
Part No. HD-39969 UltraTorch UT-100



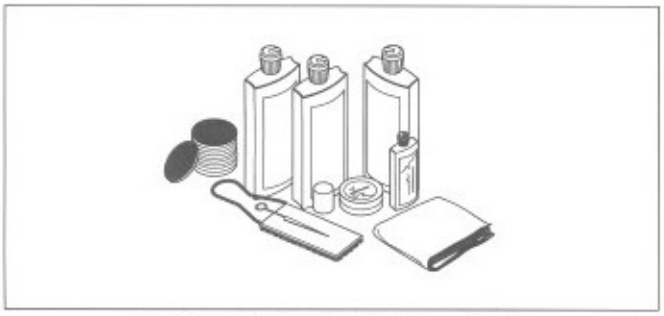
Part No. HD-41137 Hose Clamp Pliers



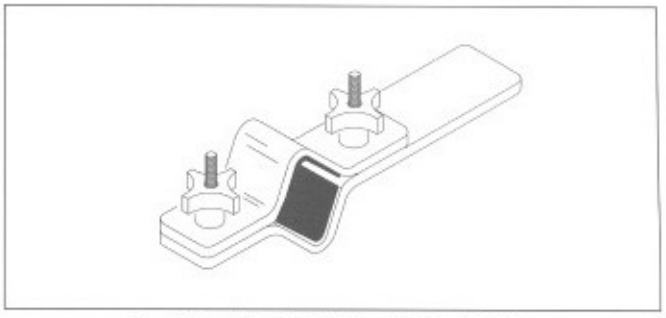
Part No. HD-39978 Digital Multimeter (Fluke 78)



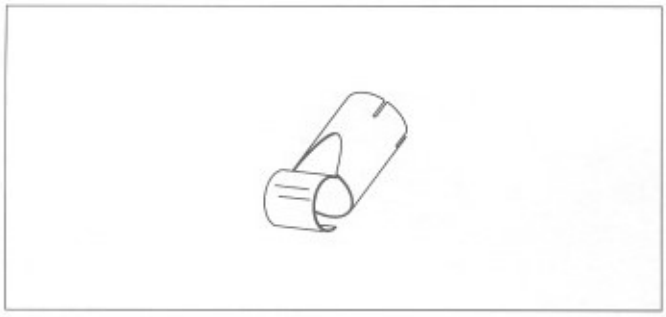
Part No. HD-41155 VHS Tape Storage Tower



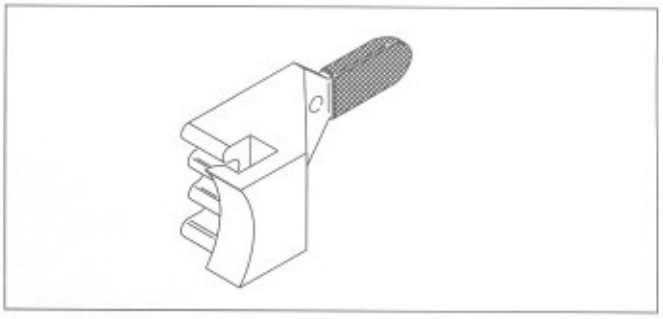
Part No. HD-39994 Paint Repair Kit



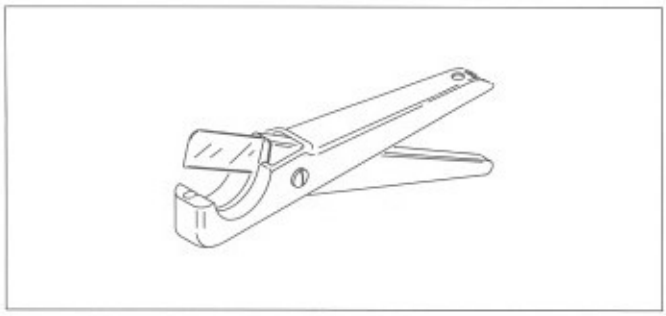
Part No. HD-41177 Fork Tube Holder



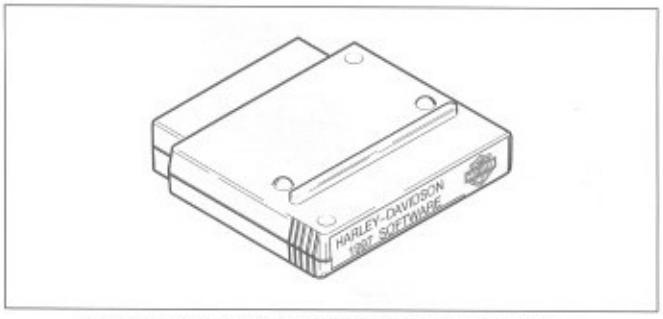
Part No. HD-41183 Shrink Attachment



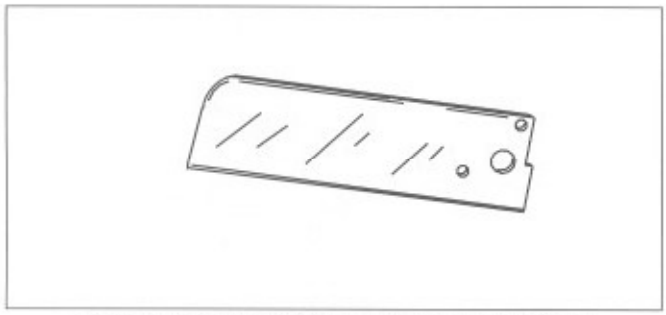
Part No. HD-41321 Sprocket Locking Tool



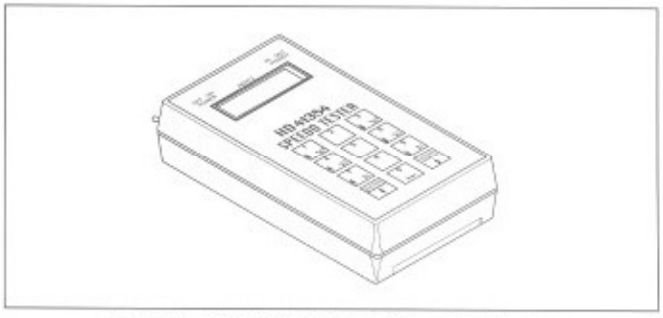
Part No. HD-41185 Hose Cutting Tool



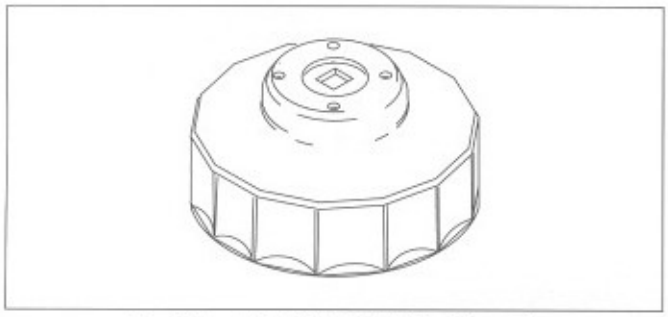

Part No. HD-41325-95A Scanalyzer Cartridge



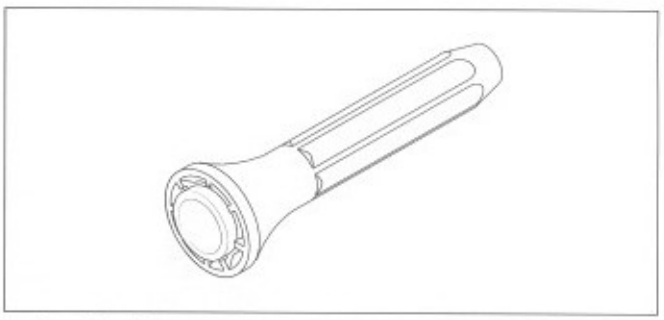
Part No. HD-41185-1 Hose Cutting Tool Blade



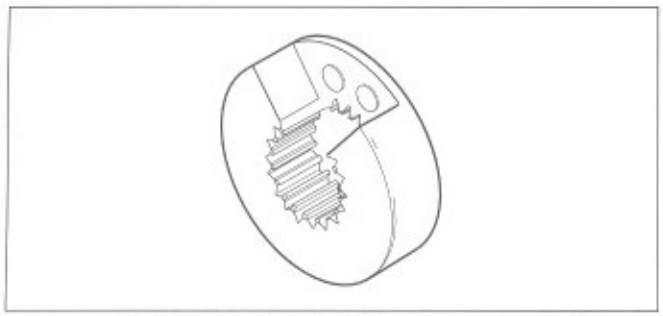
Part No. HD-41354 Speedometer Tester



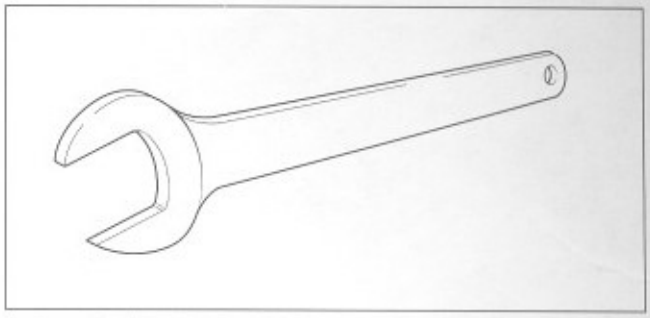
Part No. HD-41215 Oil Filter Wrench



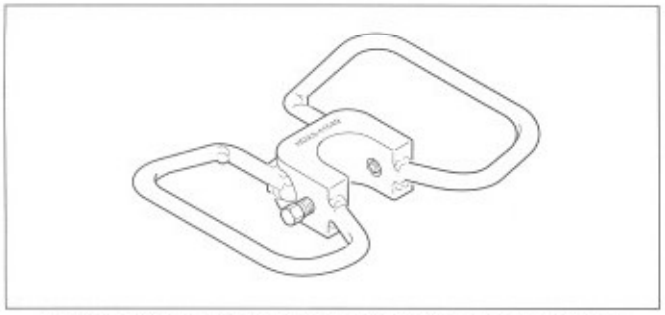
Part No. HD-41496-Transmission Case Seal Installer



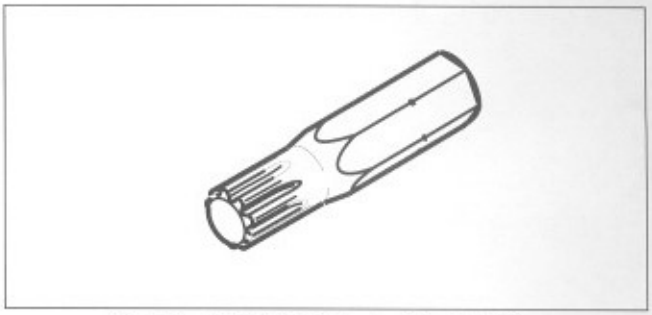
Part No. HD-41506-Crankshaft Locking Tool



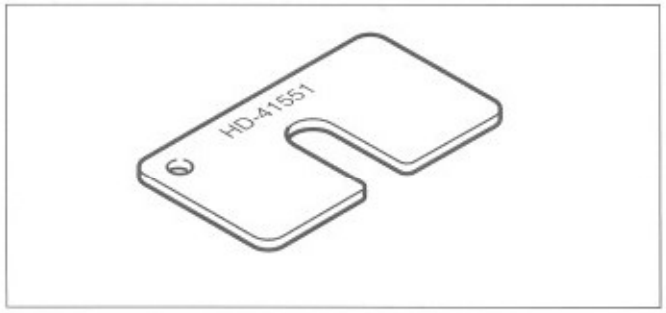
Part No. HD-41675-Oil Pressure Sending Unit Wrench



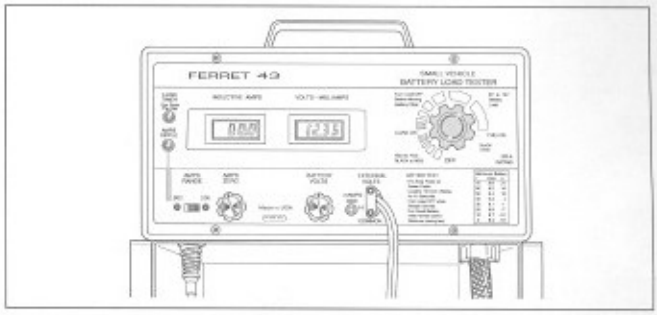
Part No. HD-41549A-Fork Spring Compressing Tool



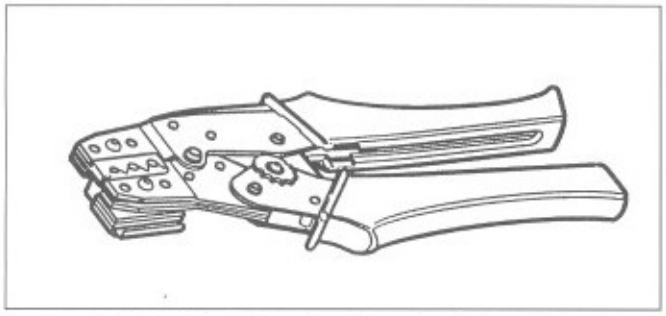
Part No. HD-42135 Spoke Nipple Driver



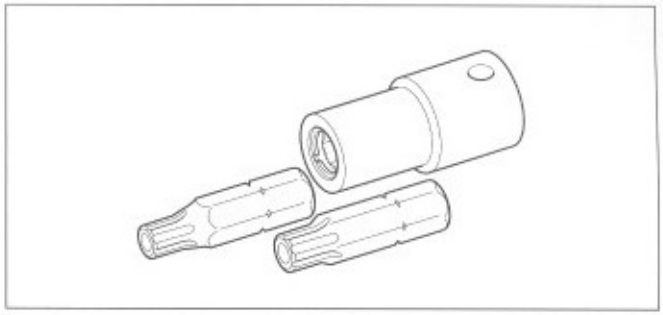

Part No. HD-41551-Fork Spring Keeper



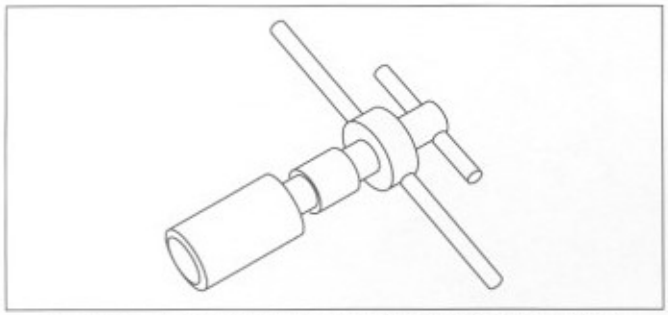

Part No. HD-42376 Battery/Charging System Load Tester



Part No. HD-41609 Amp Terminal Crimp Tool

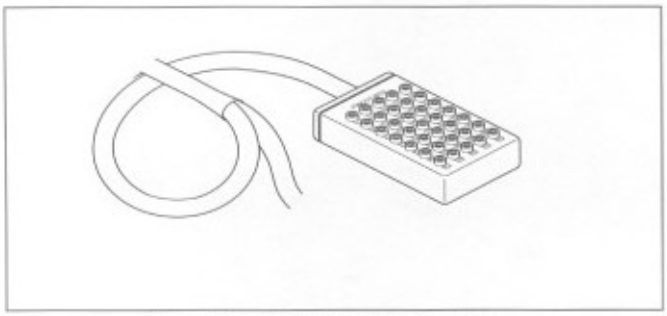


Part No. HD-42508 T-40 I.P. and T-45 I.P. Torx Plus Driver

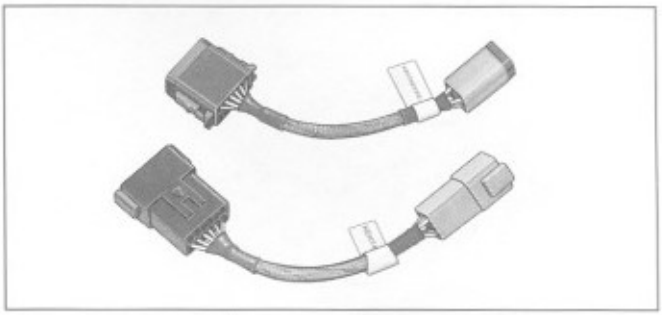


Part No. HD-42579 Sprocket Bearing/Seal Installer

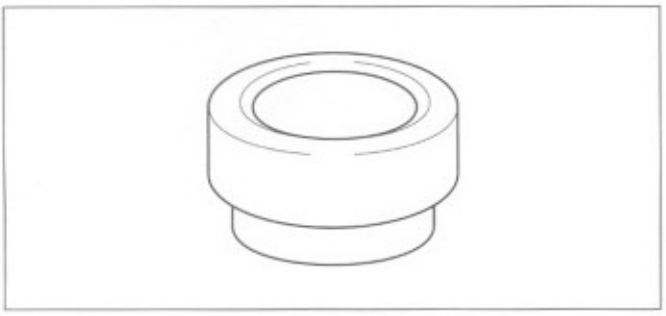
Part No. HD-42921 Scanalyzer Cable



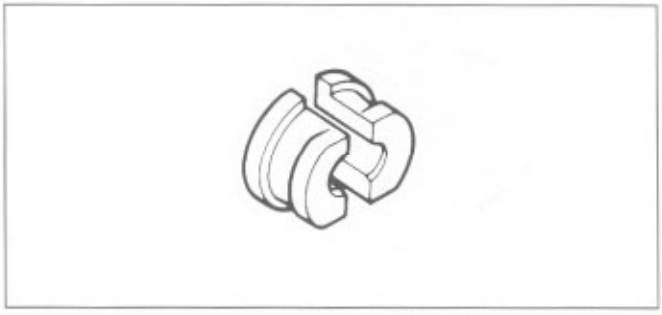
Part No. HD-42682 Breakout Box



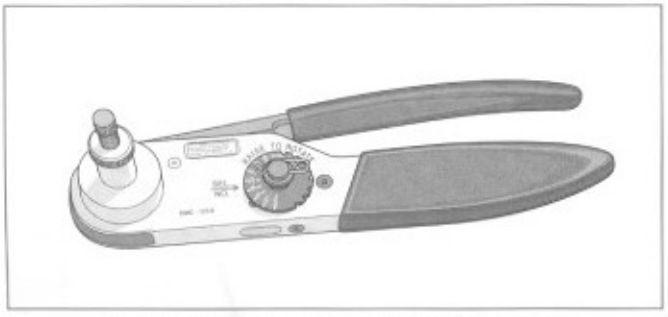
Part No. HD-42962 Breakout Box Adapters



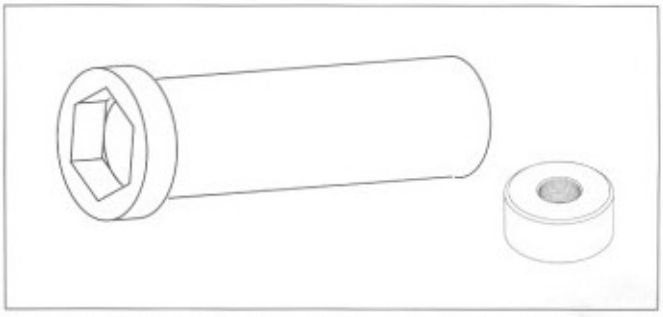
Part No. HD-42774 Seal Installer



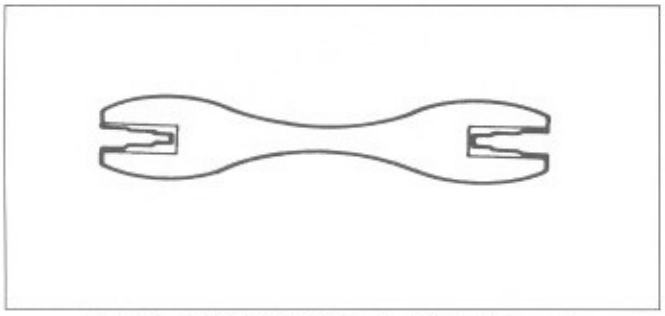
Part No. HD-94547-101 Crankshaft Bearing Outer Race Remover/Installer



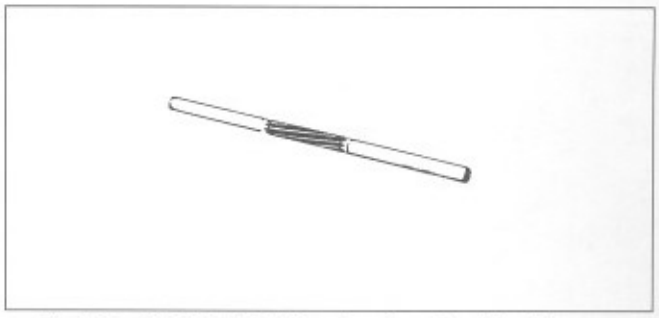
Part No. HD-42879 Electrical Crimp Tool



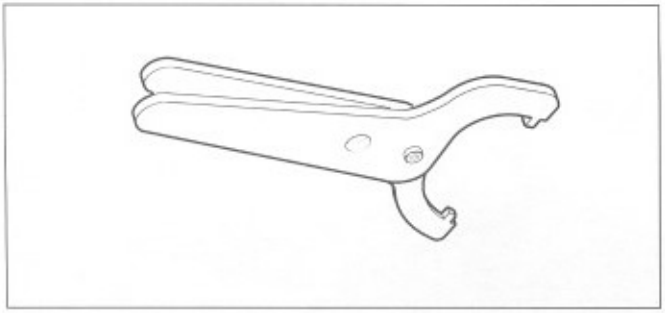
Part No. HD-94600-37B Mainshaft Locknut Wrench



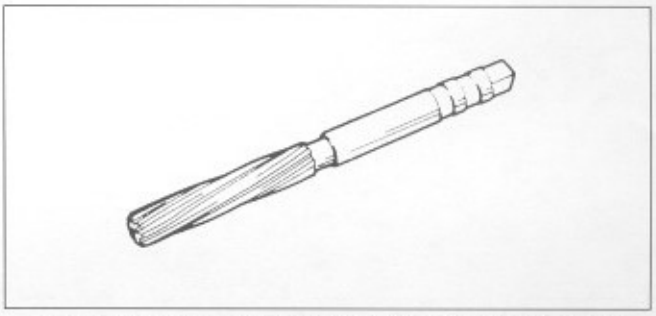
Part No. HD-94681-80 Spoke Nipple Wrench



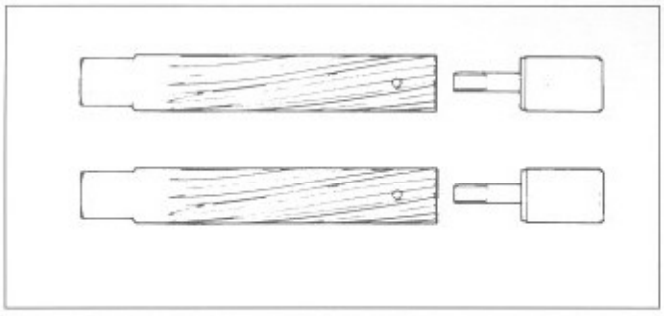
Part No. HD-94804-57 Rocker Arm Bushing Reamer



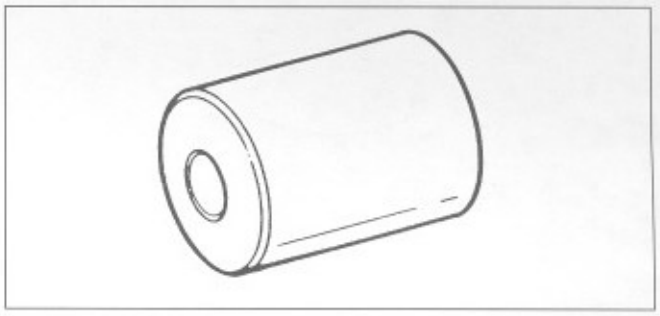
Part No. HD-94700-52C Shock Spanner



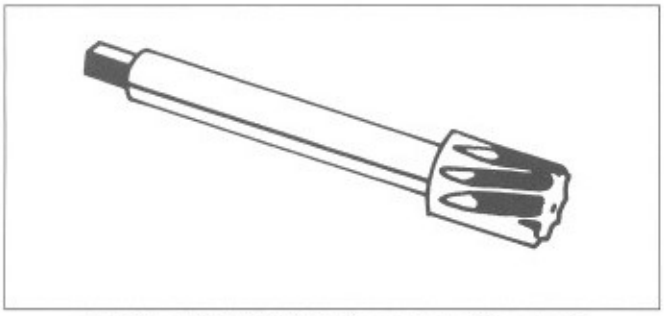
Part No. HD-94812-1 Pinion Shaft Bushing Reamer.
Use with HD-94812-87



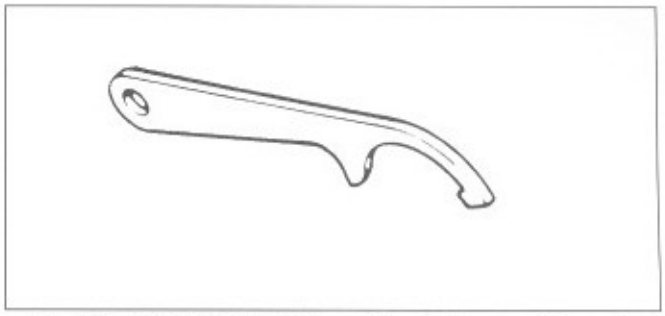
Part No. HD-94800-26A Connecting Rod Bushing
Reamers and Pilots



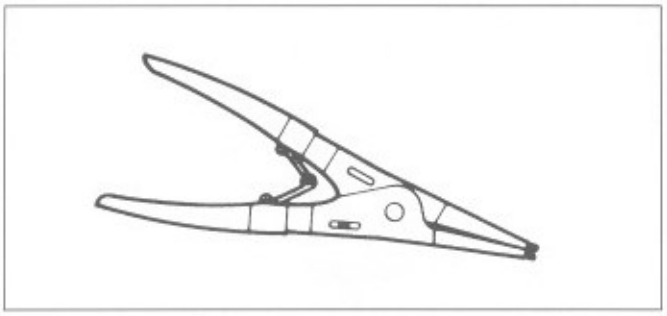
Part No. HD-94812-87 Pinion Shaft Reamer Pilot.
Use with HD-94812-1.



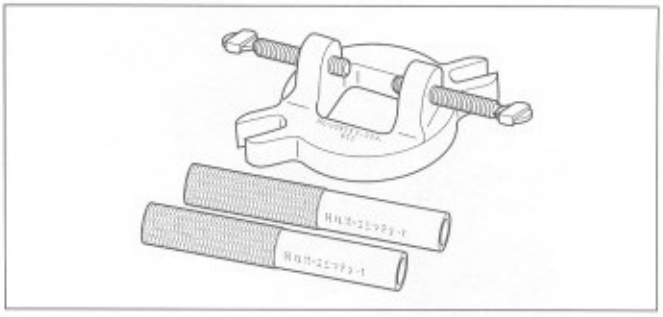
Part No. HD-94803-67 Rear Intake Camshaft
Bushing Reamer



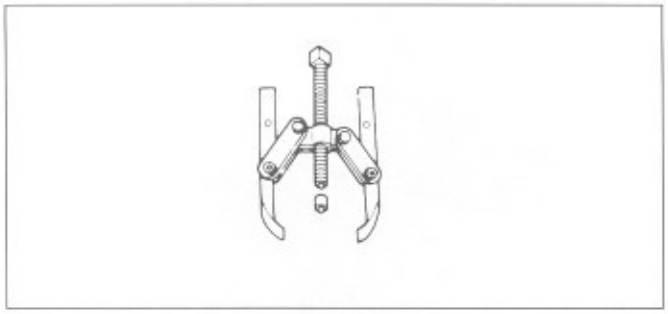
Part No. HD-94820-75A Rear Shock Spanner Wrench



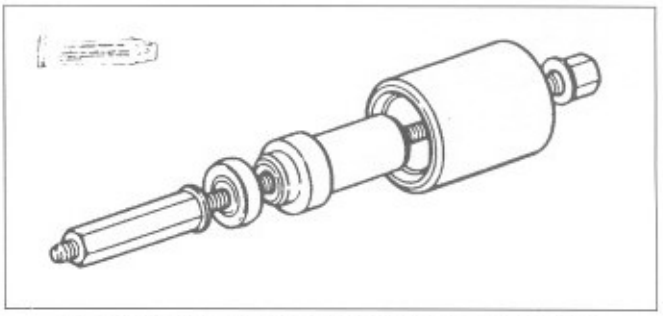
Part No. HD-95017-61 Large External Retaining Ring Pliers



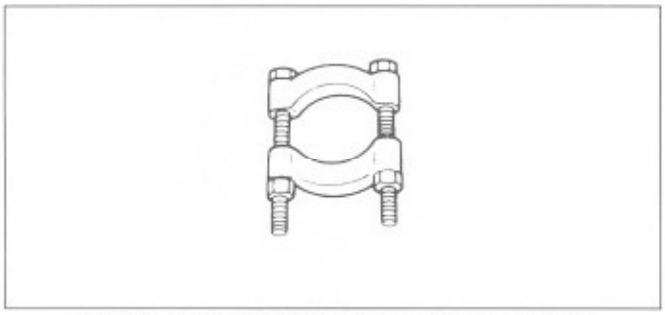
Part No. HD-95952-33B Connecting Rod Clamping Tool



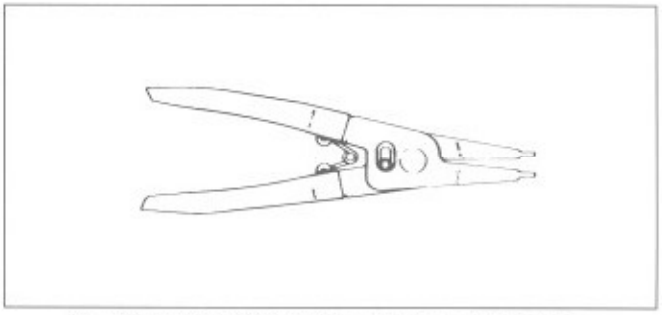
Part No. HD-95635-46 All-Purpose Claw Puller



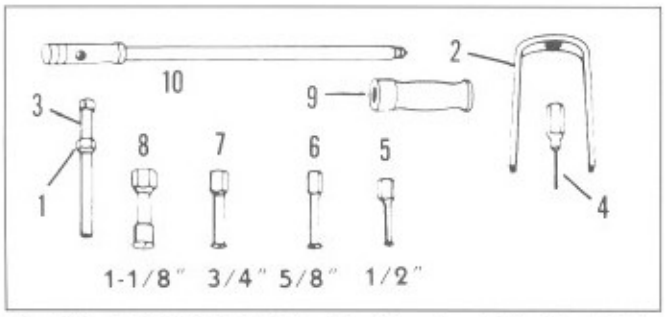
Part No. HD-95970-32C Piston Pin Bushing Tool



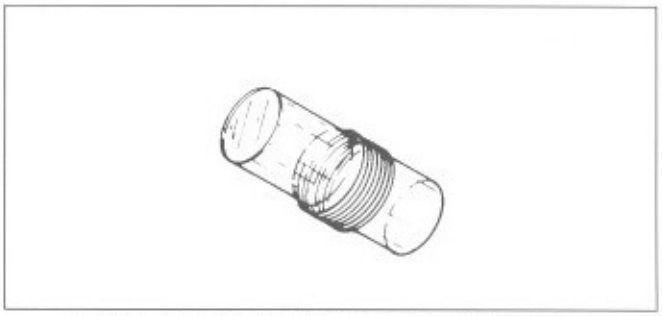
Part No. HD-95637-46A Wedge Attachment for Claw Puller. Use with HD-95635-46.



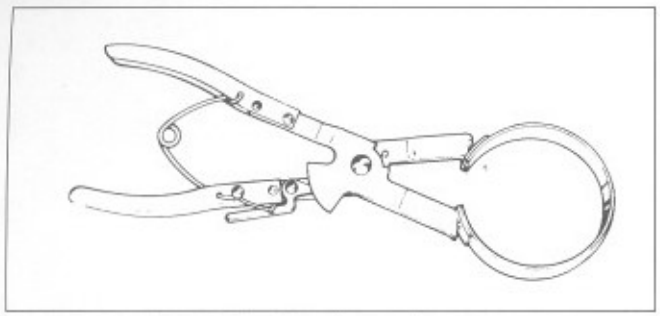
Part No. HD-96215-49 Small Internal Retaining Ring Pliers



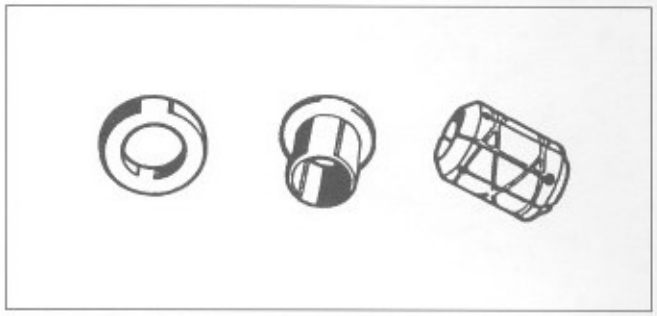

Part No. HD-95760-69A Bushing/Bearing Puller Tool Set. Set includes items 1-7. Items 8 (HD-95769-69), 9 (HD-95770-69) and 10 (HD-95771-69) are optional.



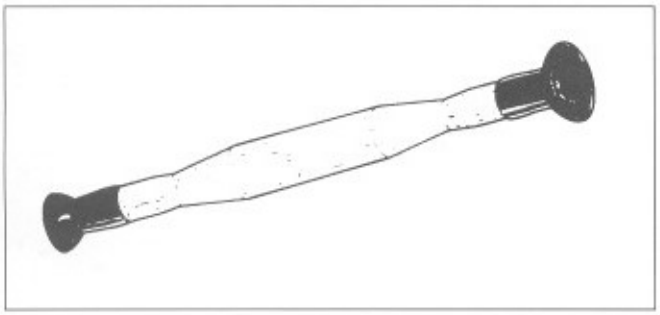
Part No. HD-96295-65D Timing Mark View Plug. Use with HD-33813.



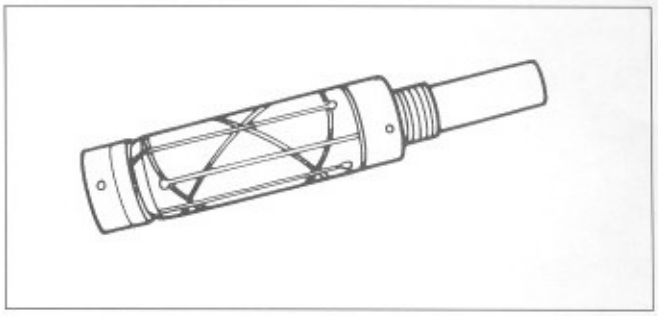
Part No. HD-96333-51B Piston Ring Compressor



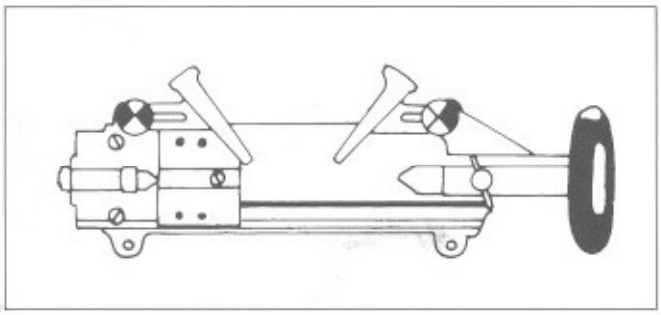
Part No. HD-96718-87 Pinion Bearing Outer Race Lapping Kit



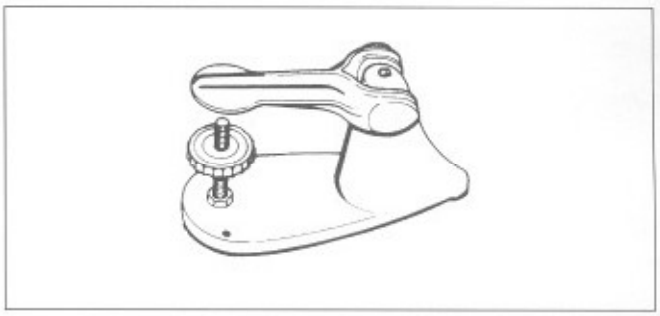
Part No. HD-96550-36A Valve Lapping Tool



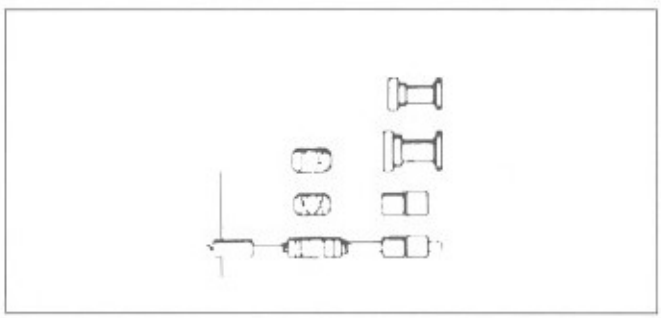
Part No. HD-96740-36 Connecting Rod Lapping Arbor



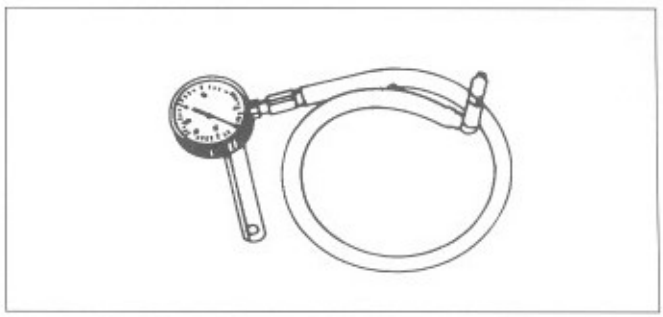
Part No. HD-96650-80 Flywheel Truing Stand



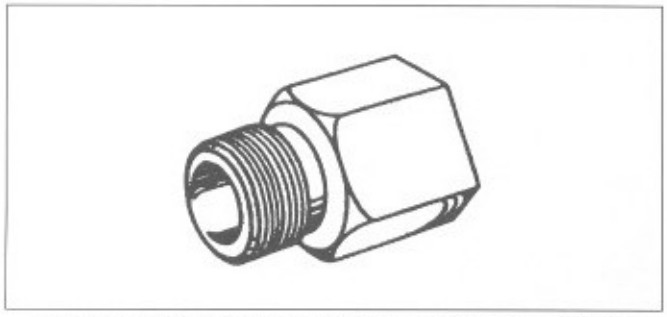
Part No. HD-96796-47 Valve Spring Tester



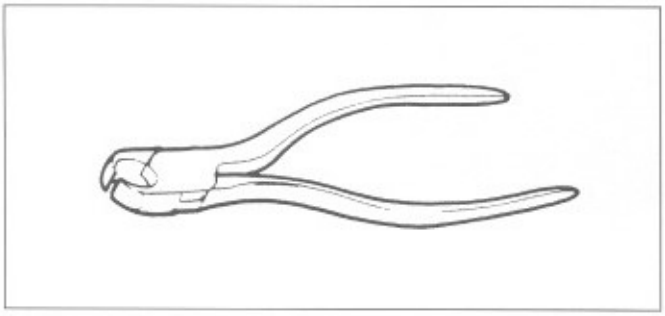
Part No. HD-96710-40B Crankcase Main Bearing Lapping Tool



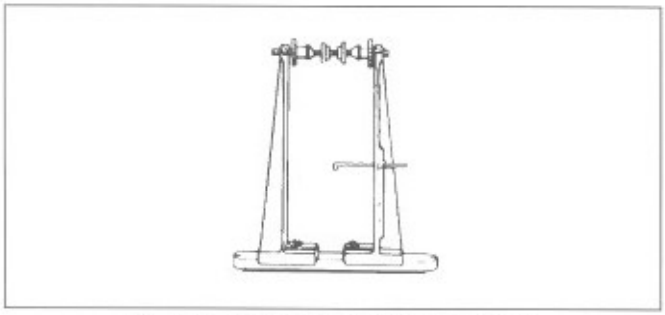
Part No. HD-96921-52A Oil Pressure Gauge



Part No. HD-96940-52A Oil Pressure Gauge Adapter.
Use with HD-96921-52A.



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



Part No. HD-99500-80 Wheel Truing
and Balancing Stand

# CHASSIS 2

# SPECIFICATIONS

| | XLH 883 | | XLH 883 HUGGER | | XLH 1200 | | XL 1200C CUSTOM | | XL 1200S SPORT | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Dimensions** | **in.** | **mm** | **in.** | **mm** | **in.** | **mm** | **in.** | **mm** | **in.** | **mm.** |
| Wheelbase | 60.2 | 1529 | 59.0 | 1499 | * | * | 59.0 | 1499 | * | * |
| Overall length | 87.6 | 2225 | 87.25 | 2216 | * | * | 87.25 | 2216 | * | * |
| Overall width | 33 | 838 | 35 | 889 | 35 | 889 | 35 | 889 | 35 | 889 |
| Overall height | 47.5 | 1207 | 49.75 | 1264 | 47.5 | 1207 | 49.75 | 1264 | 49.75 | 1264 |
| Road clearance | 6.70 | 170.2 | 4.50 | 114.3 | * | * | * | * | * | * |
| **Weights** | **lbs.** | **kg** | **lbs.** | **kg** | **lbs.** | **kg** | **lbs.** | **kg** | **lbs.** | **kg** |
| Weight (as shipped from the factory) | 488 | 221 | 485 | 220 | 494 | 224 | 483 | 219 | 497 | 225.6 |
| **Vehicle Weight Ratings** | **lbs.** | **kg** | **lbs.** | **kg** | **lbs.** | **kg** | **lbs.** | **kg** | **lbs.** | **kg** |
| The Gross Vehicle Weight Ratings (GVWR) and the Gross Axle Weight Ratings (GAWR) are found on a label on the frame steering head. | | | | | | | | | | |
| GVWR | 948 | 430 | * | * | * | * | * | * | * | * |
| GAWR – Front | 353 | 160 | * | * | * | * | * | * | * | * |
| GAWR – Rear | 595 | 270 | * | * | * | * | * | * | * | * |
| **Capacities** | **U.S. gal.** | **liters** | **U.S. gal.** | **liters** | **U.S. gal.** | **liters** | **U.S. gal.** | **liters** | **U.S. gal.** | **liters** |
| Fuel tank | | | | | | | | | | |
| Total | 3.30 | 12.5 | * | * | 3.30 | 12.5 | 3.30 | 12.5 | 3.30 | 12.5 |
| Reserve | 0.50 | 1.9 | * | * | * | * | .50 | 1.9 | .50 | 1.9 |
| | **U.S. qt.** | **liters** | **U.S. qt.** | **ml** | **U.S. qt.** | **ml** | **U.S. qt.** | **ml** | **U.S. qt.** | ml |
| Oil tank – with filter | 3.0 | 2.8 | * | * | * | * | * | * | * | * |
| | **U.S. oz.** | **ml** | **U.S. oz.** | **ml** | **U.S. oz.** | **ml** | **U.S. oz.** | **ml** | **U.S. oz.** | ml |
| Transmission | 32 | 946 | * | * | * | * | * | * | * | * |
| Front fork (per fork side) | | | | | | | | | | |
| Wet | | 266 | | 316 | * | * | * | * | * | * |
| Dry | 9.0<br>10.2 | 302 | 10.7<br>12.1 | 358 | * | * | * | * | * | * |
| **Adjustments** | | | | | | | | | | |
| Rear brake pedal free play | None | * | * | * | * | * | * | * | * | * |
| **Brake Disc** | **in.** | **mm** | **in.** | **mm** | **in.** | **mm** | **in.** | **mm** | **in.** | **mm** |
| Diameter | | | | | | | | | | |
| Front | 11.5 | 292 | * | * | * | * | * | * | * | * |
| Rear | 11.5 | 292 | * | * | * | * | * | * | * | * |
| Minimum thickness | | | | | | | | | | |
| Front | 0.180 | 4.57 | * | * | * | * | * | * | * | * |
| Rear | 0.205 | 5.21 | * | * | * | * | * | * | * | * |
| Maximum disc runout (front and rear) | 0.008 | 0.20 | * | * | * | * | * | * | * | * |

* Same as XLH 883.

# SPECIFICATIONS (CONTINUED)

| | XLH 883 | | XLH 883 HUGGER | | XLH 1200 | | XL 1200C CUSTOM | | XL 1200S SPORT | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Tire Data** | **psi** | **bars** | **psi** | **bars** | **psi** | **bars** | **psi** | **bars** | **psi** | **bars** |
| Tire pressure (cold) | | | | | | | | | | |
| Up to 300 lb. load | | | | | | | | | | |
| (includes rider, passenger and cargo) | | | | | | | | | | |
| Front | 30 | 2.1 | * | * | * | * | * | * | * | * |
| Rear | 36 | 2.5 | * | * | * | * | * | * | * | * |
| Up to GVWR maximum load ** | | | | | | | | | | |
| Front | 30 | 2.1 | * | * | * | * | * | * | * | * |
| Rear | 40 | 2.8 | * | * | * | * | * | * | * | * |
| **Torque Values** | **ft-lbs** *** | **Nm** | **ft-lbs** | **Nm** | **ft-lbs** | **Nm** | **ft-lbs** | **Nm** | **ft-lbs** | **Nm** |
| Front axle nut | 50-55 | 68-75 | * | * | * | * | * | * | * | * |
| Rear axle nut | 60-65 | 81-88 | * | * | * | * | * | * | * | * |
| Sprocket mounting bolts | | | | | | | | | | |
| Cast wheels | 55-65 | 75-88 | * | * | * | * | * | * | * | * |
| Laced wheels | 45-55 | 61-75 | | | | | | | | |
| Brake disc mounting screws | | | | | * | | | | | |
| Front wheel | 16-24 | 22-33 | * | * | * | * | * | * | * | * |
| Rear wheel | 30-45 | 41-61 | * | * | | * | * | * | * | * |
| Brake caliper mounting screws | | | | | * | | | | | |
| Front wheel | 25-30 | 34-41 | * | * | * | * | * | * | * | * |
| Rear wheel | 15-20 | 20-27 | * | * | * | * | * | * | * | * |
| Brake master cylinder cover screws | **10-15** | 1.1-1.7 | * | * | * | * | * | * | * | * |
| Front brake master cylinder clamp screws | **70-80** | 7.9-2.7 | * | * | * | * | * | * | * | * |
| Rear brake master cylinder mounting screws | **155-190** | 17.5-21.5 | * | * | * | * | * | * | * | * |
| Rear brake master cylinder cartridge locknut | 30-40 | 41-54 | * | * | * | * | * | * | * | * |
| Brake line banjo fitting bolts | 17-22 | 23-30 | * | * | * | * | * | * | * | * |
| Brake caliper bleeder valve | 80-100 | 9.0-11.3 | * | * | * | * | * | * | * | * |
| Front inboard brake pad retaining screw | 40-50 | 4.5-6.8 | * | * | * | * | * | * | * | * |
| Front fork upper bracket pinch screws | 30-35 | 41-47 | * | * | * | * | * | * | * | * |
| Front fork lower bracket pinch screws | 30-35 | 41-47 | * | * | * | * | * | * | * | * |
| Front axle pinch screw and nut | 21-27 | 28-37 | * | * | * | * | * | * | * | * |
| Front fender mounting fasteners | 8-13 | 11-18 | * | * | * | * | * | * | * | * |
| Rear fender support mounting fasteners | 8-13 | 11-18 | * | * | * | * | * | * | * | * |
| Clutch control clamp screws | **70-80** | 7.9-9.0 | * | * | * | * | * | * | * | * |
| Handlebar switch housing screws | **18-24** | 2.0-2.7 | * | * | * | * | * | * | * | * |
| Throttle control clamp screws | **18-24** | 2.0-2.7 | * | * | * | * | * | * | * | * |
| Handlebar clamp screws | 12-15 | 16-20 | * | * | * | * | * | * | * | * |
| Rear fork pivot shaft | 50 | 68 | * | * | * | * | * | * | * | * |
| Right footrest mount castle nut | 35-40 | 47-54 | * | * | | * | * | * | * | * |
| Rear shock absorber | | | | | * | | | | | |
| Upper mounting fasteners | 21-35 | 28-47 | * | * | * | * | * | * | * | * |
| Lower mounting fasteners | 30-50 | 41-68 | * | * | * | * | * | * | * | * |
| Front muffler mounting locknut | 20-40 | 27-54 | * | * | * | * | * | * | * | * |
| Rear muffler mounting locknut | 10-15 | 14-20 | * | * | * | * | * | * | * | * |
| Exhaust pipe-to-cylinder head nuts | 6-8 | 8-11 | * | * | * | * | * | * | * | * |
| | | | * | * | * | * | * | * | * | * |

* Same as XLH 883

** Gross Vehicle Weight Rating (GVWR) is printed on a label on the frame steering head

*** Numbers in bold are in **in-lbs**.

# SPECIFICATIONS (CONTINUED)

## TIRES

**⚠WARNING**

**Tires must be correctly matched to wheel rims. Only the tires listed in the fitment tables below can be used for replacement. Mismatching tires and rims can cause damage to the tire bead during mounting. Using tires other than those specified can adversely affect motorcycle stability and may result in personal injury.**

Tire sizes are molded on the sidewall. Refer to the TIRE FITMENT TABLES below. Rim size and contour are cast or stamped into the exterior surface of the rim.

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

### Fitment – Tubeless Cast Wheels

| WHEEL SIZE & POSITION | RIM SIZE & CONTOUR | RIM VALVE HOLE DIA. | TIRE SIZE |
|---|---|---|---|
| | | | DUNLOP D401 ELITE S/T |
| 19 in. – Front | T19 x 2.15 MT | 0.45 in. | 100/90-19 |
| 16 in. – Rear | T16 x 3.00 D | 0.35 in | 130/90-16 |
| | | | DUNLOP K591 S&FR ELITE SP |
| 19 in. - Front | T19 x 2.15 MT | 0.45 in. | 100/90-V19 |
| 16 in. - Rear | T16 x 3.00 D | 0.35 in | 130/90-V16 |

### Tire Fitment – Tube Type Laced Wheels

| WHEEL SIZE & POSITION | RIM SIZE & CONTOUR | TUBE SIZE | TIRE SIZE |
|---|---|---|---|
| | | | DUNLOP D401 ELITE S/T |
| 19 in. – Front | T19 x 2.50 TLA | MJ90-19 | 100/90-19 |
| 16 in. – Rear | T16 x 3.00 D | MT90-16 | 130/90-16 |
| | | | DUNLOP TOURING ELITE II |
| 21 in. - Front | T21x 215 TLA | 3.00 x 21 | MH90 - 21 56H |
| 16 in. – Rear | T16 x 3.00 D | MT90-16 | MT90 - B16 |

# SPECIFICATIONS (CONTINUED)

## VEHICLE IDENTIFICATION NUMBER

A 17-digit serial number, or Vehicle Identification Number (VIN), is stamped on the right side of the steering head (ex., 1HD4CEM13VY200037).

An abbreviated VIN is stamped on the front left side of the crankcase (ex., CEMV200037). See Figure 2-1.

*NOTE*

*Always give the VIN or abbreviated VIN when ordering parts or making inquiries.z*

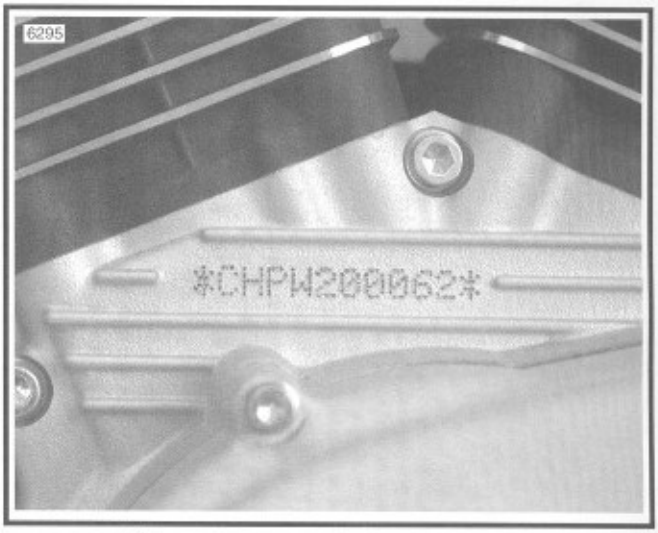
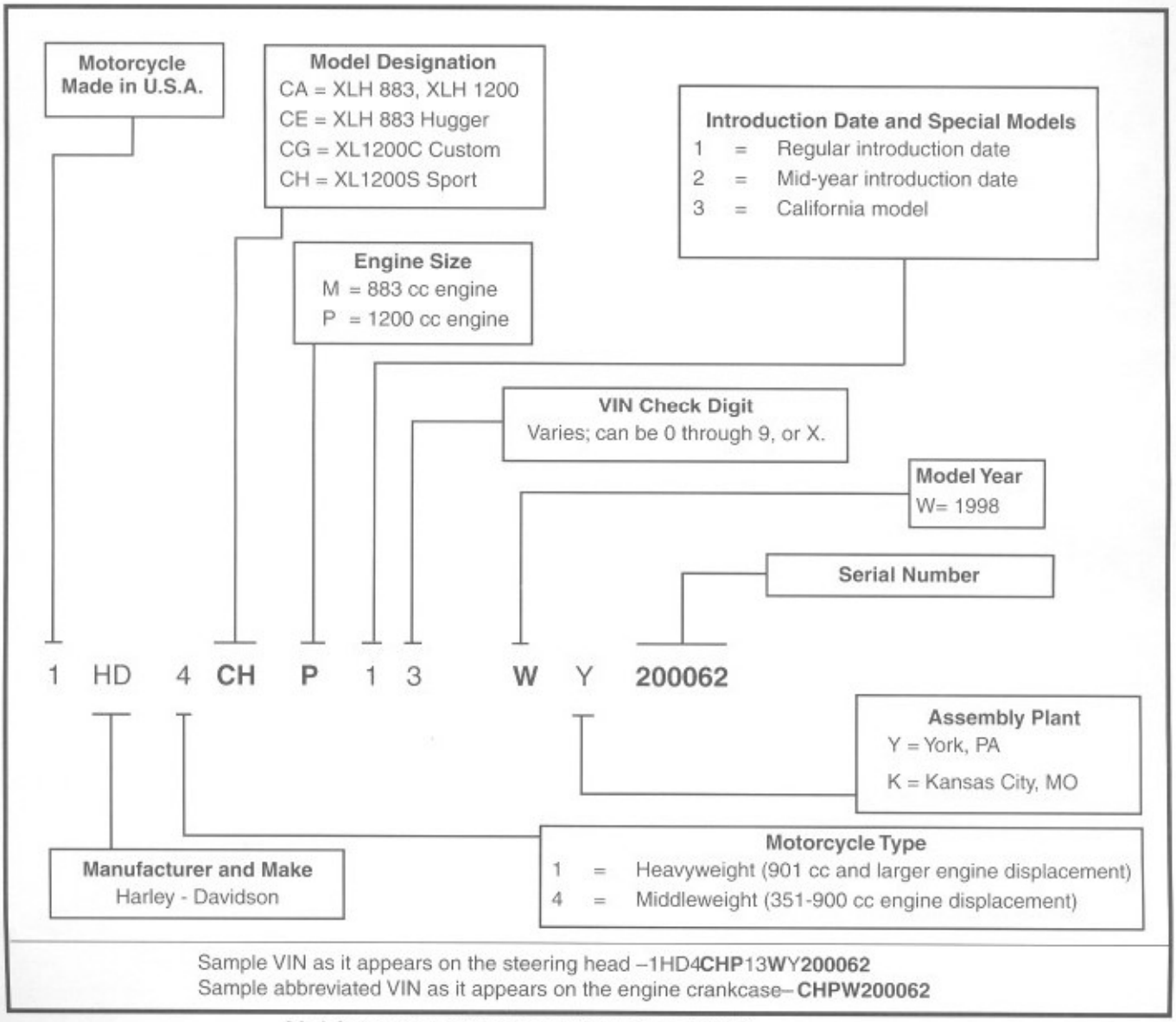



**Figure 2-1. Abbreviated VIN Location**




Sample VIN as it appears on the steering head –1HD4**CHP**13**W**Y**200062**
Sample abbreviated VIN as it appears on the engine crankcase– **CHPW200062**

**Vehicle Identification Number (VIN)**

# WHEELS

## GENERAL

Good handling and maximum tire mileage are directly related to the care of wheels and tires. Regularly inspect wheels and tires for damage and wear. If handling problems occur, check the TROUBLESHOOTING guide in Section 1 or see the table below for a list of probable causes.

Keep tires inflated to the recommended air pressure. Always balance the wheel after replacing a tube or tire.

**⚠WARNING**

**Do not exceed the maximum tire pressure listed on the sidewall. Incorrect tire pressure could lead to premature tire failure and possible personal injury.**

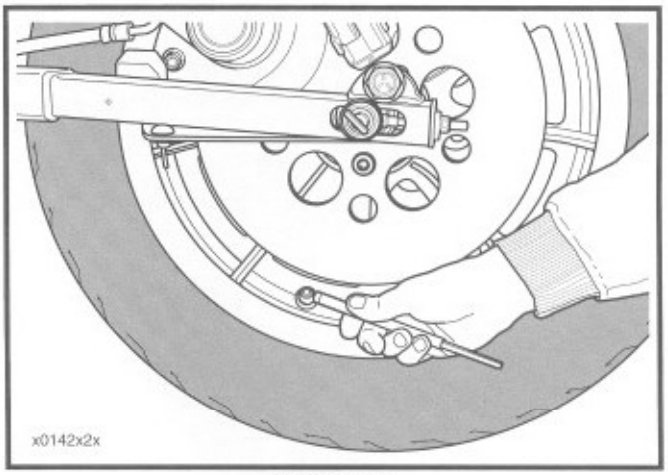



**Figure 2-1.**

## TROUBLESHOOTING

See Figure 2-2. Check tire inflation pressure at least once each week. At the same time, inspect tire tread for punctures, cuts, breaks and other damage. Repeat the inspection before road trips.

### Wheel Service Chart

| CHECK FOR | REMEDY |
|---|---|
| 1. Loose axle nuts. | Tighten front axle nut to 50-55 ft-lbs (68-75 Nm) torque. Tighten rear axle nuts to 60-65 ft-lbs (81-88 Nm) torque. |
| 2. Excessive side-play or radial (up-and-down) play in wheel hubs. | Replace wheel hub bearings. |
| 3. Loose spokes. | Tighten or replace spokes. See TRUING WHEELS and LACING WHEELS. |
| 4. Alignment of rear wheel in frame or with front wheel. | Check wheel alignment as described in this section or repair rear fork as described in REAR FORK. |
| 5. Rims and tires out-of-true sideways; should not be more than 5/64 in. (2.0 mm). | True wheels, replace rims or replace spokes. See LACING WHEELS and TRUING WHEELS. |
| 6. Rims and tires out-of-round or eccentric with hub; should not be more than 3/32 in. (2.4 mm). | See Item 5 above. |
| 7. Irregular or peaked front tire wear. | Replace as described in REMOVAL and INSTALLATION, FRONT and REAR WHEEL; and REMOVAL and INSTALLATION, TIRE. |
| 8. Correct tire inflation. | Inflate tires to correct pressure. See SPECIFICATIONS. |
| 9. Correct tire and wheel balance. | Static balance may be satisfactory if dynamic balancing facilities are not available. However, dynamic balancing is strongly recommended. |
| 10. Steering head bearings. | Correct adjustment and replace pitted or worn bearings. See FORK STEM and BRACKET ASSEMBLY. |
| 11. Damper tubes. | Check for leaks. See FRONT FORK. |
| 12. Shock absorbers. | Check damping action and mounting stud bushings. See REAR FORK. |
| 13. Rear fork bearings. | Check for looseness. See REAR FORK. |

**⚠WARNING**

**Excessively worn tires adversely affect motorcycle traction, steering and handling and can result in personal injury.**

At regular intervals of 5000 miles (8000 km), or whenever handling irregularities are noted, see the chart on the preceding page for the recommended service procedure.

If tires must be replaced, same as original equipment tires must be used. Other tires may not fit correctly and may be hazardous to use.

**⚠WARNING**

**Use the following guidelines when installing a new tire or repairing a flat:**

1. **Always locate and eliminate the cause of the original tire failure.**
2. **Do not patch or vulcanize a tire casing. These procedures weaken the casing and increase the risk of a blowout.**
3. **Only patch an inner tube as an emergency measure. Replace the damaged tube as soon as possible.**
4. **Be sure the inner tube is the correct size for the tire casing. Any stretching or wrinkling within the casing will weaken the tube and result in premature failure.**
5. **The use of tires other than those specified can adversely affect handling resulting in personal injury.**
6. **Tires, tubes and wheels are critical safety items. Since the servicing of these components requires special tools and skills, Harley-Davidson recommends that you see your dealer for these services.**

# FRONT WHEEL

## REMOVAL (Figure 2-2)

1. Block motorcycle underneath frame so front wheel is raised off the ground.
2. Remove caliper mounting hardware (9). Let the caliper hang loose.

*NOTE*

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

3. Insert screwdriver or steel rod through hole in axle (5) on right side of vehicle. While holding axle stationary, remove axle nut (6), lockwasher (7) and flat washer (8) on left side of vehicle.
4. Loosen nut (4) on pinch screw (1). Pull axle out of hub while supporting wheel.
5. Remove spacer.

## DISASSEMBLY (Figure 2-3, Figure 2-4)

1. Move wheel to bench area. On the side of the wheel opposite the brake disc (hub plate side of cast wheel), remove external spacer (12) from hub. Pry out oil seal (6). Remove bearing inner race (7) and spacer sleeve (9). Discard oil seal.
2. On brake disc side of wheel, remove oil seal (6), bearing inner race (7), spacer washer (16) and shim pack (15). Discard oil seal.
3. Remove the T-40 TORX® screws (4) and brake disc (5). On cast wheels, remove the T-40 TORX screws to remove the hub plate (11), if necessary. Discard TORX screws.
4. If bearing replacement is necessary, remove the outer bearing races (8) using WHEEL BEARING RACE REMOVER/INSTALLER (Part No. HD-33071A).
5. Remove tire. Remove the tube from the rim, if applicable. See TIRES.
6. If it is necessary to remove the hub from laced wheels, loosen all the spoke nipples and remove the rim and spokes.

## CLEANING, INSPECTION AND REPAIR

1. Thoroughly clean all parts in solvent.

**⚠WARNING**

**Never use compressed air to "spin-dry" bearings. Very high bearing speeds can damage unlubricated bearings. Spinning bearings with compressed air can also cause a bearing to fly apart, which may result in personal injury.**

2. Inspect all parts for damage or excessive wear. Inspect bearing races for scoring, discoloration, casing cracks and other damage.
3. Always replace bearing assemblies as a complete set-both bearings, inner and outer races.
4. Inspect shims for tears, cuts or kinks. Replace as necessary.

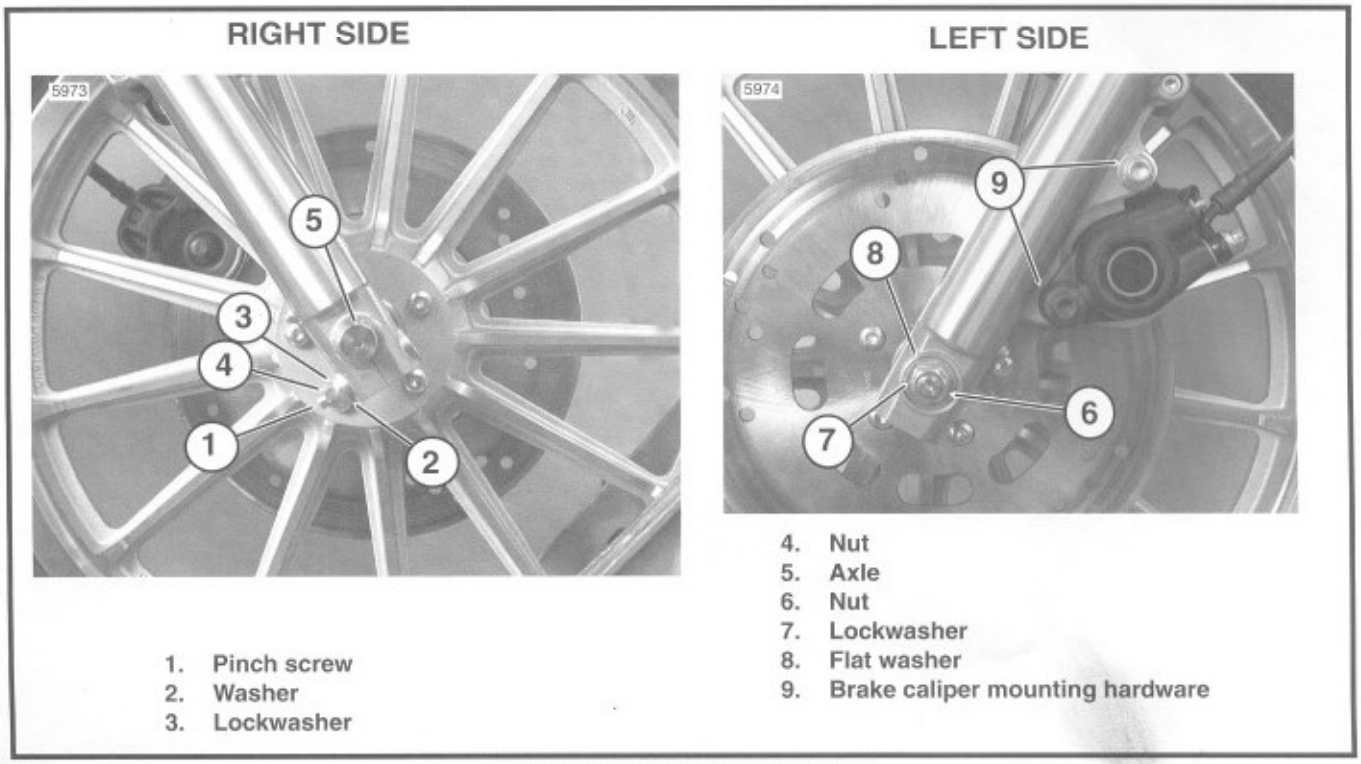



**Figure 2-2. Front Wheel Mounting**

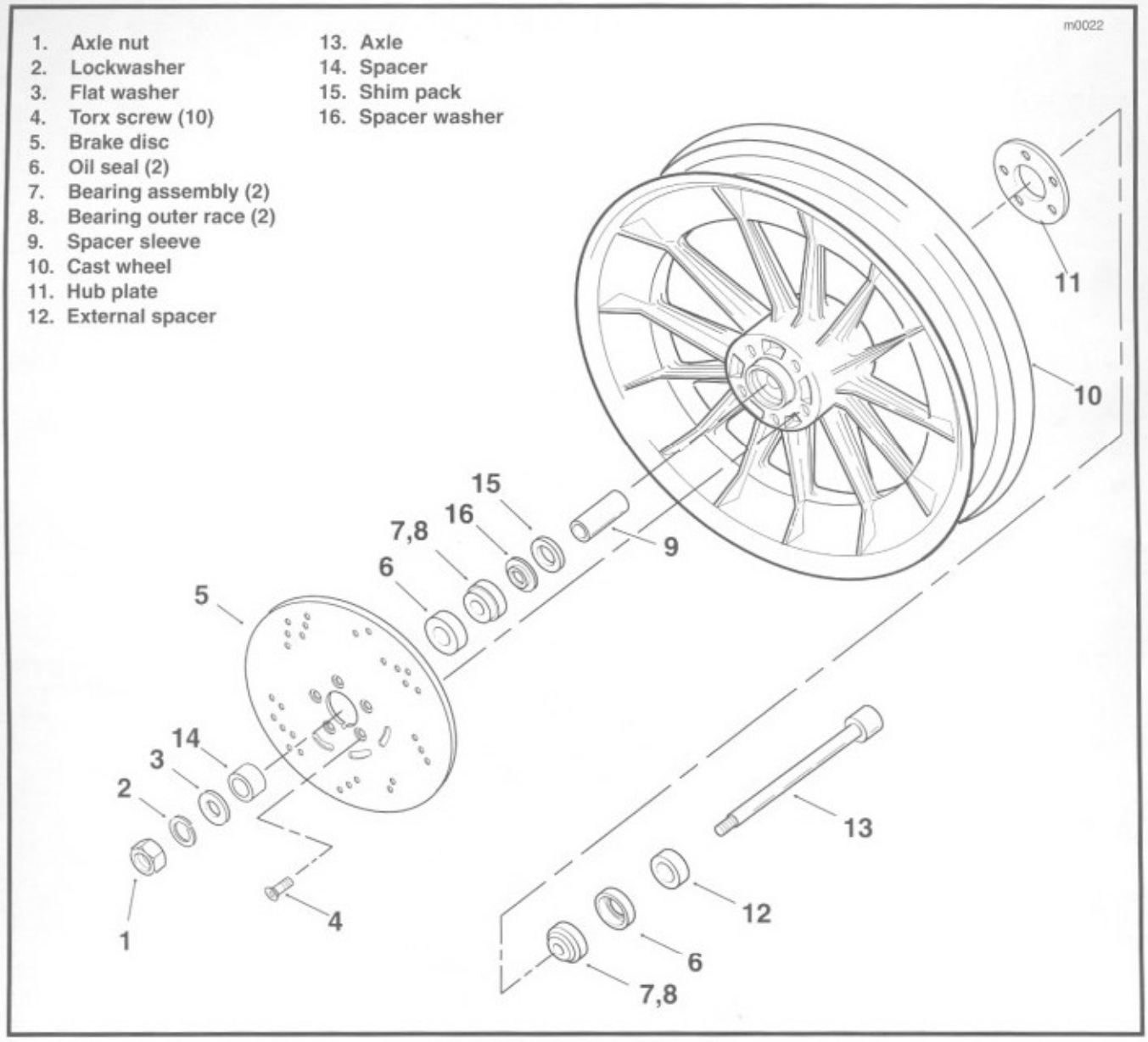



**Figure 2-3. Cast Front Wheel**

5. Inspect brake disc. Replace disc if warped or badly scored. Measure disc thickness for excessive wear. Minimum acceptable thickness is stamped on side of disc.
6. Obtain a set of **new** oil seals. Obtain **new** T-40 TORX screws, if removed.
7. On laced wheels, replace spokes, rim or hub if damaged.

## ASSEMBLY (Figure 2-3, Figure 2-4)

1. On laced wheels, if the hub and rim were disassembled, assemble the hub, spokes and rim. See LACING WHEELS.

**⚠WARNING**

**Do not allow brake fluid, bearing grease, lubricants, etc. to contact brake disc or reduced braking ability will occur, possibly resulting in personal injury and/or vehicle damage.**

2. Verify that the brake disc is thoroughly clean. Install disc on hub aligning notch in disc with 1/4-in. (6.35 mm) diameter hole in hub. Secure disc with **new** T-40 TORX screws (4). Tighten screws to 16-24 ft-lbs (22-33 Nm) torque.
3. On cast wheels (Fig. 2-4), install hub plate (11) to wheel hub using **new** T-40 TORX screws, if removed. Tighten screws to 16-24 ft-lbs (22-33 Nm) torque.
4. If removed, press outer races (8) into each side of hub using WHEEL BEARING RACE REMOVER/INSTALLER (Part No. HD-33071A). Apply a liberal amount of bearing grease to bearing outer races after installation.
5. Apply a liberal amount of bearing grease to bearing inner races (7). Pack grease into cavities around rollers. Use of HD-33067 Wheel Bearing Packer is recommended.

*NOTE*

*Use a good quality wheel bearing grease, such as H-D Part No. 99855-89.*

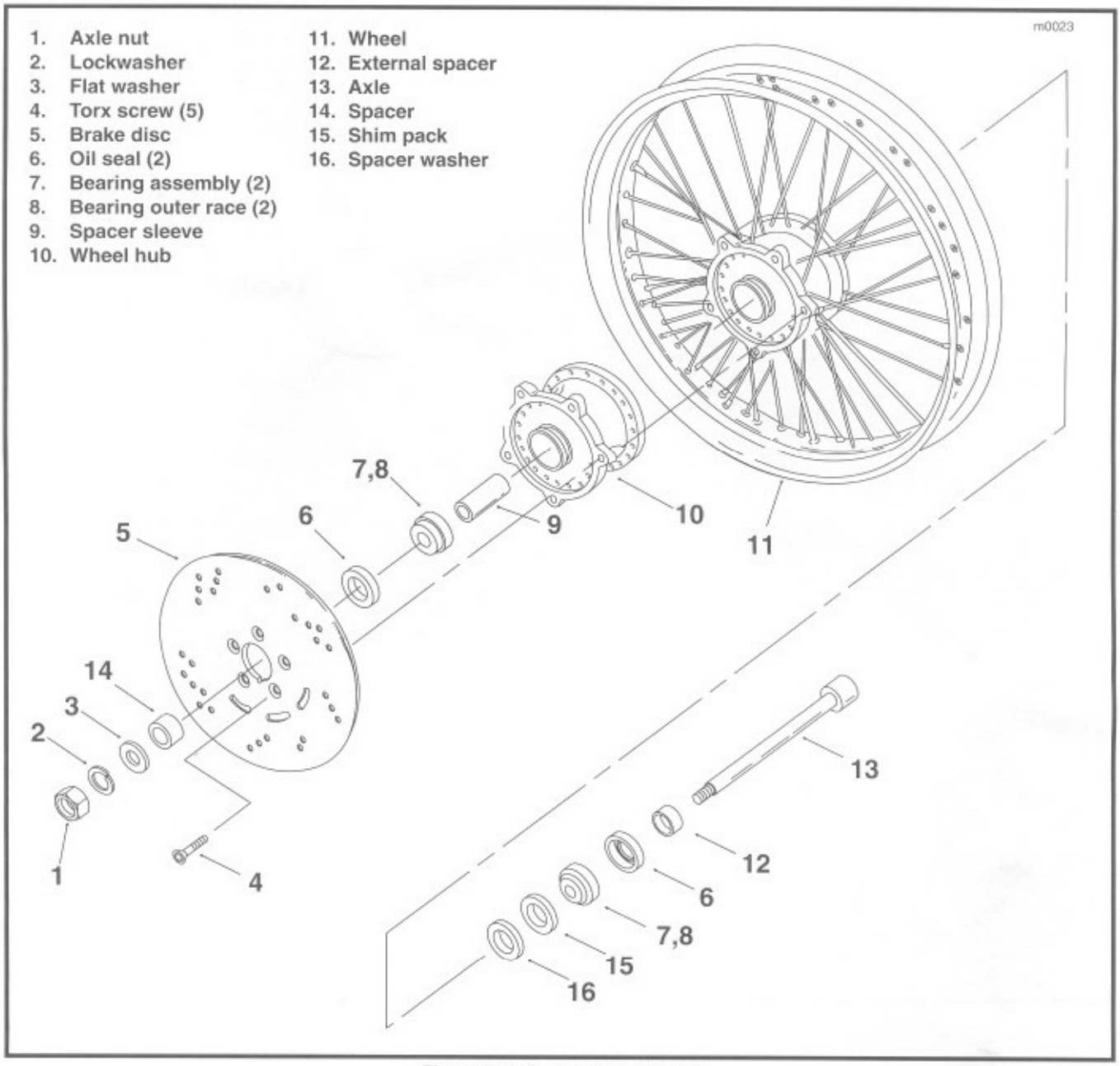



**Figure 2-4. Laced Front Wheel**

6. Insert shim pack (15) into brake disc side of hub until it contacts counterbore. With the shoulder facing outside, insert spacer washer (16) into hub until it seats against the shims. Insert tapered end of bearing inner race (7) into hub until it contacts shoulder of spacer washer.
7. Lightly coat outside lip of **new** oil seal (6) with clean engine oil. With the open side in, press in oil seal until flush with hub face (to 0.020 in. (0.51 mm) recessed).
8. Pack cavity between oil seal and bearing with bearing grease.
9. On the side of the wheel opposite the brake disc (hub plate side of cast wheel), insert spacer sleeve (9) into hub until it seats in bore on brake disc side. Spacer sleeve must not be cocked or tilted in bore. Insert tapered end of bearing inner race (7) into hub until it contacts end of spacer sleeve.
10. Lightly coat outside lip of **new** oil seal (6) with clean engine oil. With the open side in, press in oil seal until flush with hub face (to 0.020 in. (0.51 mm) recessed).
11. Pack cavity between oil seal and bearing with bearing grease.
12. With the chamfer facing inward, install external spacer (12) in oil seal ID.
13. Install tube on wheel rim, if applicable. Install tire, if removed.
14. Verify that wheel and tire are true. See TRUING LACED WHEEL or CHECKING CAST RIM RUNOUT, whichever applies.

## INSTALLATION

1. Position wheel between forks with brake disc on left side of vehicle, external spacer on right. With pinch screw loose, insert threaded end of axle through right side fork. Push axle through fork and wheel hub until it begins to emerge from left side of hub.

2. See Figure 2-5. Push axle through left fork, until axle shoulder contacts external wheel spacer on right fork side.

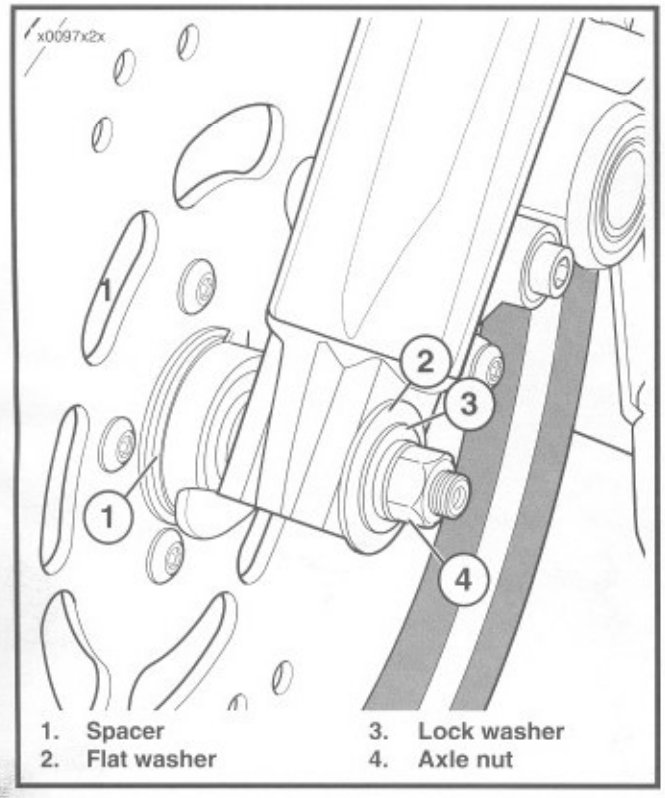



**Figure 2-5. Install Spacer**

3. See Figure 2-6. Install flat washer (2), lock washer (3) and axle nut (4) over threaded end of axle. Insert screwdriver or steel rod through hole in axle on right side of vehicle. While holding axle stationary, tighten axle nut to 50-55 ft-lbs (68-75 Nm) torque.

4. See Figure 2-2. Tighten pinch screw nut (4) to 21-27 ft-lbs (28-37 Nm) torque.

5. Install brake caliper. Tighten brake caliper mounting screws (9) to 25-30 ft-lbs (34-41 Nm) torque. For more detailed information, see FRONT BRAKE CALIPER, INSTALLATION, in this section.

**⚠WARNING**

**Check wheel bearing end play after tightening axle nut to proper torque. Excessive end play can adversely affect motorcycle handling. Insufficient end play can cause bearing seizure, resulting in possible loss of vehicle control and personal injury.**

6. See Figure 2-6. Mount a magnetic base dial indicator on the brake disc. Set the indicator contact point on the end of the axle. Move the wheel back as far as it will go. Holding the wheel in position, zero the dial indicator gauge. Move the wheel forward as far as it will go. Note the reading of the dial indicator. The lateral movement or end play must fall between 0.002 and 0.006 in. (0.05-0.15 mm). Repeat the procedure to verify the reading.

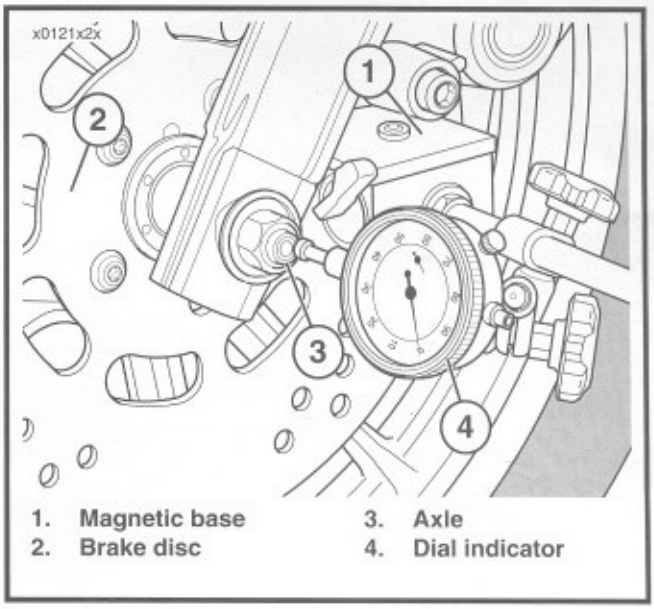



**Figure 2-6. Check Wheel Bearing End Play**

7. Remove the wheel and substitute thicker spacer shim(s) if the end play must be increased. Use thinner spacer shim(s) to reduce the end play. See the following table for the available spacer shim thicknesses.

### Front Wheel Bearing Spacer Shims

| Thickness | | Part Number |
|---|---|---|
| in. | mm | |
| 0.030 to 0.033 | 0.76 to 0.84 | 43290-82 |
| 0.015 to 0.017 | 0.38 to 0.43 | 43291-82 |
| 0.0075 to 0.0085 | 0.190 to 0.216 | 43292-82 |
| 0.0035 to 0.0045 | 0.089 to 0.114 | 43293-82 |
| 0.0015 to 0.0025 | 0.038 to 0.064 | 43294-82 |

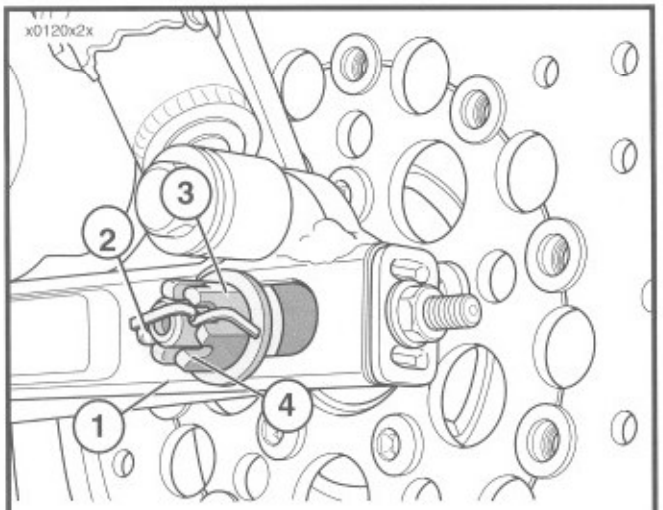
# REAR WHEEL

## REMOVAL

1. Raise rear end of motorcycle high enough to permit wheel removal. Support motorcycle with suitable blocking underneath frame.

2. Loosen axle, slide wheel forward and slip belt off sprocket.

3. See Figure 2-8. Remove cotter pin (2), axle nut (1) and flat washer (3).




1. Axle nut
2. Cotter pin
3. Flat washer
4. Rear axle

**Figure 2-8. Rear Wheel Mounting**

4. Gently tap end of axle (4) with a soft hammer to loosen. Pull axle free of frame assembly.

*NOTE*

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

5. Remove spacer (16, Figure 2-9; 18, Figure 2-10) and rear wheel assembly.

## DISASSEMBLY

### Cast Wheel (Figure 2-9)

1. Move wheel to bench area. On the sprocket side of the wheel, remove external spacer (4) from hub. Pry out oil seal (3). Remove bearing inner race (5) and spacer sleeve (7). Discard oil seal.

2. On brake disc side of wheel, remove external spacer (4) from hub. Remove oil seal (3), bearing inner race (5), spacer washer (11) and shim pack (19). Discard oil seal.

3. Using a TORX T-45 driver, remove the T-45 TORX screws (9) to remove the brake disc (10).

*NOTE*

*TORX screws (9) have a thread lock patch that provides fastener locking for three removal and installation cycles. Always replace screws after three use cycles or fastening integrity may be compromised.*

4. Remove five bolts (18) with flat washers (17). Remove belt sprocket (13).

5. If bearing replacement is necessary, remove the outer bearing races (6) using WHEEL BEARING RACE REMOVER/INSTALLER (Part No. HD-33071A).

### Laced Wheel (Figure 2-10)

1. Move wheel to bench area. On the sprocket side of the wheel, remove external spacer (4) from hub. Pry out oil seal (3). Remove bearing inner race (5) and spacer sleeve (7). Discard oil seal.

2. On brake disc side of wheel, remove external spacer (4) from hub. Remove oil seal (3), bearing inner race (5), spacer washer (12) and shim pack (8). Discard oil seal.

3. Using a TORX T-45 driver, remove the T-45 TORX screws (9) and locknuts (10) to remove the brake disc (11).

*NOTE*

*TORX screws (9) have a thread lock patch that provides fastener locking for three removal and installation cycles (or remakes). Always replace screws after three use cycles or fastening integrity may be compromised.*

4. Remove five bolts (20) with washers (19) and locknuts (14). Remove belt sprocket (15).

5. If bearing replacement is necessary, remove the outer bearing races (6) from hub using WHEEL BEARING RACE REMOVER/INSTALLER (Part No. HD-33071A).

6. If it is necessary to remove the hub from the wheel, loosen all spoke nipples and remove the rim and spokes.

## CLEANING, INSPECTION, AND REPAIR

1. Thoroughly clean all parts in solvent.

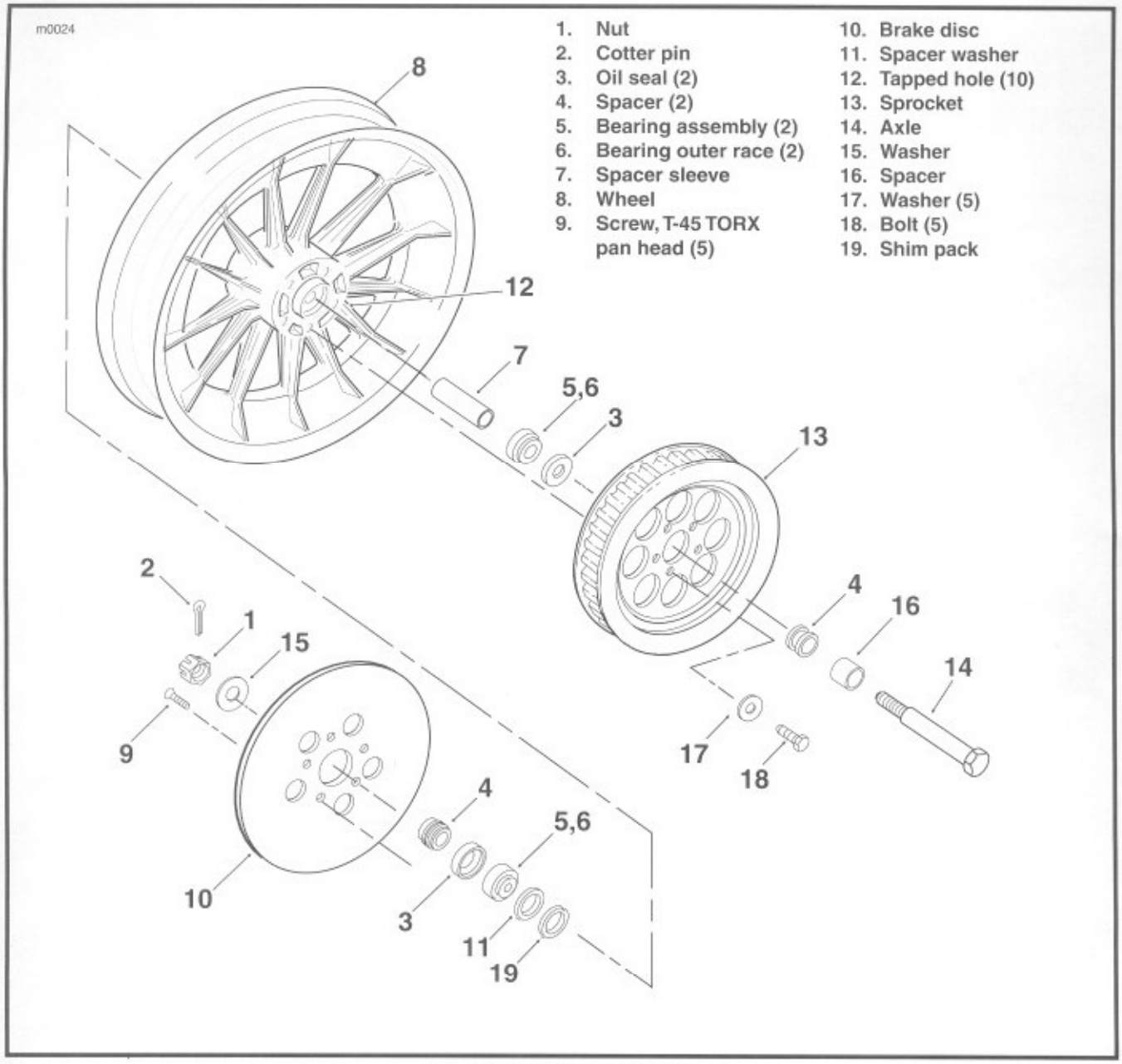



Figure 2-9. Cast Rear Wheel

**⚠WARNING**

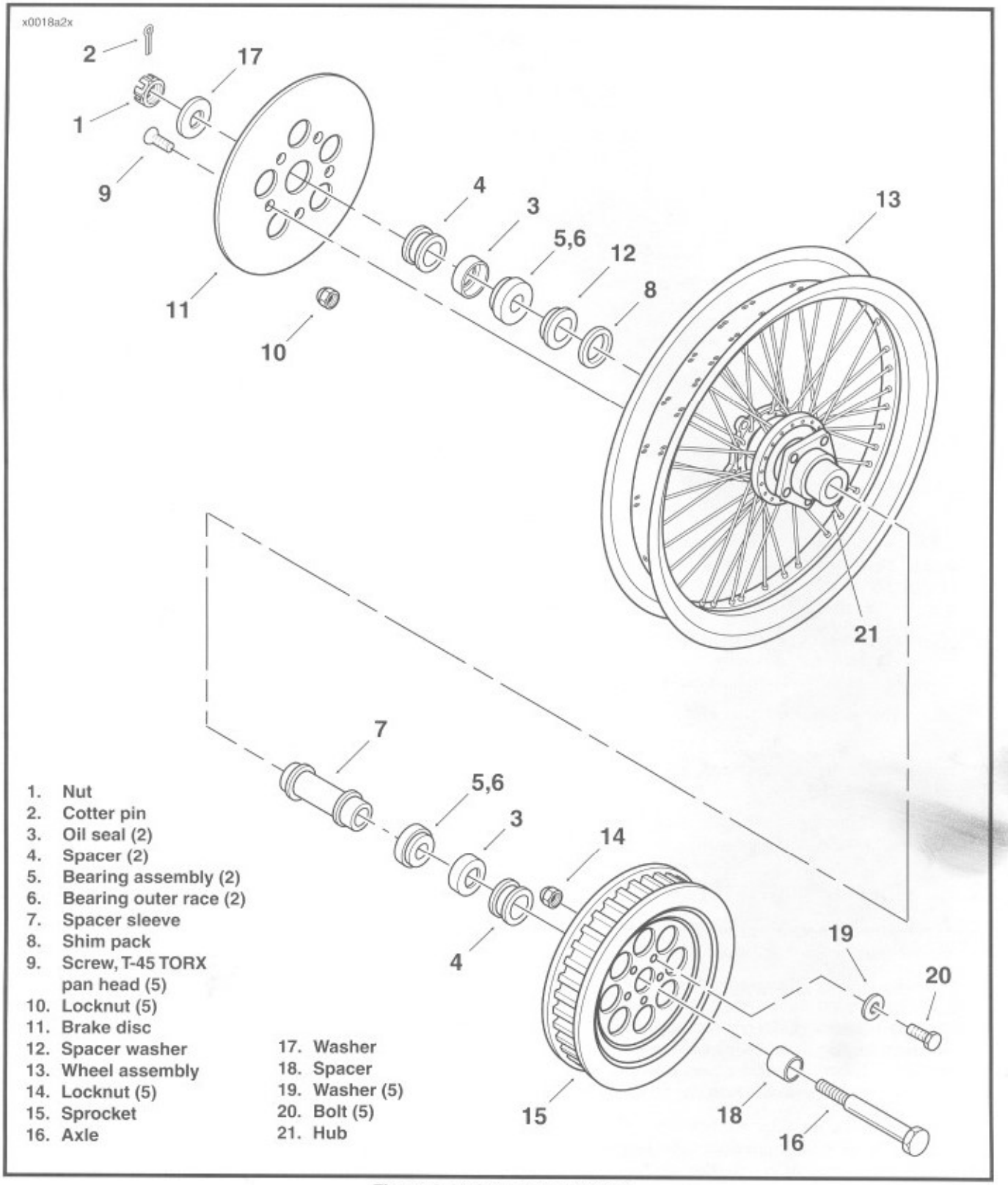
- **Never use compressed air to "spin-dry" bearings. Very high bearing speeds can damage unlubricated bearings. Spinning bearings with compressed air can also cause a bearing to fly apart, which may result in personal injury.**
- **ALWAYS wear safety glasses when using solvent to clean parts.**

2. Inspect all parts for damage or excessive wear. Inspect bearing races for scoring, discoloration, casing cracks and other damage.
3. Always replace bearing assemblies as a complete set-both bearings, inner and outer races.
4. Inspect shims for tears, cuts or kinks. Replace as necessary.
5. Inspect brake disc. Replace disc if warped or badly scored. Measure disc thickness for excessive wear. Minimum acceptable thickness is stamped on side of disc.
6. Obtain a set of **new** oil seals. Use **new** T-45 TORX screws after three use cycles. See NOTE under Disassembly, Cast Wheel.
7. On laced wheels, replace spokes, rim or hub, if damaged.

# ASSEMBLY

## Cast Wheel (Figure 2-9)

1. If removed, press outer races (6) into each side of hub using WHEEL BEARING RACE REMOVER/INSTALLER (Part No. HD-33071A). Apply a liberal amount of bearing grease to bearing outer races after installation.




1. Nut
2. Cotter pin
3. Oil seal (2)
4. Spacer (2)
5. Bearing assembly (2)
6. Bearing outer race (2)
7. Spacer sleeve
8. Shim pack
9. Screw, T-45 TORX pan head (5)
10. Locknut (5)
11. Brake disc
12. Spacer washer
13. Wheel assembly
14. Locknut (5)
15. Sprocket
16. Axle
17. Washer
18. Spacer
19. Washer (5)
20. Bolt (5)
21. Hub

**Figure 2-10. Laced Rear Wheel**

**⚠WARNING**

**Do not allow brake fluid, bearing grease, lubricants, etc. to contact brake disc or reduced braking ability will occur, possibly resulting in personal injury.**

2. Verify that brake disc (10) is thoroughly clean. Secure disc to hub with T-45 TORX screws (9). Use **new** T-45 TORX screws after three use cycles. Tighten screws to 30-45 ft-lbs (41-61 Nm) torque.
3. Apply two drops of LOCTITE THREADLOCKER 271 (red) to threads of each sprocket bolt (18). Install belt

sprocket (13) using bolts and washers (17). Tighten bolts to 55-65 ft-lbs (75-88 Nm) torque.

4. Apply a liberal amount of bearing grease to bearing inner races (5). Pack grease into cavities around rollers.

*NOTE*

*Use a good quality wheel bearing grease, such as H-D Part No. 99855-89.*

5. Insert shim pack (19) into brake disc side of hub until it contacts counterbore. With the shoulder facing outside, insert spacer washer (17) into hub until it seats against the shims. Insert tapered end of bearing inner race (5) into hub until it contacts shoulder of spacer washer.
6. Lightly coat outside lip of **new** oil seal (3) with clean engine oil. With the open side in, press in oil seal until recessed 0.31 in. (7.9 mm) from hub face.
7. Pack cavity between oil seal and bearing with bearing grease.
8. With the chamfer facing inward, install external spacer (4) in oil seal I.D.
9. On the sprocket side of the wheel, insert spacer sleeve (7) into hub until it seats in bore on brake disc side. Spacer sleeve must not be cocked or tilted in bore. Insert tapered end of bearing inner race (5) into hub until it contacts end of spacer sleeve.
10. Lightly coat outside lip of **new** oil seal (3) with clean engine oil. With the open side in, press in oil seal until recessed 0.31 in. (7.9 mm) from hub face.
11. Pack cavity between oil seal and bearing with bearing grease.
12. With the chamfer facing inward, install external spacer (4) in oil seal I.D.
13. Install tire, if removed. Verify that wheel and tire are true. See CHECKING CAST RIM RUNOUT.

## Laced Wheel (Figure 2-10)

1. If the hub and rim were disassembled, assemble the hub, spokes and rim. See LACING WHEELS.
2. If removed, press outer races (6) into each side of hub using WHEEL BEARING RACE REMOVER/INSTALLER (Part No. HD-33071A). Apply a liberal amount of bearing grease to bearing outer races after installation.

**⚠WARNING**

**Do not allow brake fluid, bearing grease, lubricants, etc. to contact brake disc or reduced braking ability will occur, possibly resulting in personal injury.**

3. Verify that brake disc (11) is thoroughly clean. Secure disc to hub with T-45 TORX screws (9) and locknuts (10). Use **new** T-45 TORX screws after three use cycles. Tighten screws to 30-45 ft-lbs (41-61 Nm) torque.
4. Apply two drops of LOCTITE THREADLOCKER 271 (red) to threads of each sprocket bolt (20). Install the belt sprocket (15) using bolts, washers (19) and locknuts (14). Tighten bolts to 45-55 ft-lbs (61-75 Nm) torque.
5. Apply a liberal amount of bearing grease to bearing inner races (5). Pack grease into cavities around rollers. Use of HD-33067 Wheel Bearing Packer is recommended.

*NOTE*

*Use a good quality wheel bearing grease, such as H-D Part No. 99855-89.*

6. Insert shim pack (8) into brake disc side of hub until it contacts counterbore. With the shoulder facing outside, insert spacer washer (12) into hub until it seats against the shims. Insert tapered end of bearing inner race (5) into hub until it contacts shoulder of spacer washer.
7. Lightly coat outside lip of **new** oil seal (3) with clean engine oil. With the open side in, press in oil seal until recessed 0.26-0.28 in. (6.6-7.1 mm) from hub face.
8. Pack cavity between oil seal and bearing with bearing grease.
9. With the chamfer facing inward, install external spacer (4) in oil seal ID.
10. On the sprocket side of the wheel, insert spacer sleeve (6) into hub until it seats in bore on brake disc side. Spacer sleeve must not be cocked or tilted in bore. Insert tapered end of bearing inner race (5) into hub until it contacts end of spacer sleeve.
11. Lightly coat outside lip of **new** oil seal (3) with clean engine oil. With the open side in, press in oil seal until recessed 0.26-0.28 in. (6.6-7.1 mm) from hub face.
12. Pack cavity between oil seal and bearing with bearing grease.
13. With the chamfer facing inward, install external spacer (4) in oil seal I.D.
14. Install inner tube and tire, if removed.
15. Verify that wheel and tire are true. See TRUING LACED WHEEL.

## INSTALLATION

1. Place wheel centrally in the rear fork (swingarm) with the brake disc in the caliper. Slide wheel far enough forward to slip belt over sprocket and then slide the wheel back.
2. Apply LOCTITE ANTI-SEIZE LUBRICANT to axle (14, Figure 2-9; 16, Figure 2-10). Insert axle through right side of rear fork, spacer (16, Figure 2-9; 18, Figure 2-10), wheel assembly, rear caliper bracket and left side of rear fork.
3. See Figure 2-8. Install flat washer (3) and nut (1) on end of axle (4). Tighten axle nut to 60-65 ft-lbs (81-88 Nm) torque.

**⚠WARNING**

**Check wheel bearing end play after tightening axle nut to proper torque. Excessive end play can adversely affect motorcycle handling. Insufficient end play can cause bearing seizure, resulting in possible loss of vehicle control and personal injury.**

4. See Figure 2-9 and Figure 2-10. Mount a magnetic base dial indicator on the brake disc. Set the indicator contact point on the end of the axle. Move the wheel back as far as it will go. Holding the wheel in position, zero the dial indicator gauge. Move the wheel forward as far as it will go. Note the reading of the dial indicator. The lateral movement or end play must fall between 0.002 and 0.006 in. (0.05-0.15 mm). Repeat the procedure to verify the reading.
5. Remove the wheel and substitute thicker spacer shim(s) (19, Figure 2-9; 8, Figure 2-10) if the end play must be increased. Use thinner spacer shim(s) to reduce the end play. See the following table for the available spacer shim thicknesses.

### Rear Wheel Bearing Spacer Shims

| Thickness | | Part Number |
|---|---|---|
| in. | mm | |
| 0.030 to 0.033 | 0.76 to 0.84 | 43290-82 |
| 0.015 to 0.017 | 0.38 to 0.43 | 43291-82 |
| 0.0075 to 0.0085 | 0.190 to 0.216 | 43292-82 |
| 0.0035 to 0.0045 | 0.089 to 0.114 | 43293-82 |
| 0.0015 to 0.0025 | 0.038 to 0.064 | 43294-82 |

6. Check for proper belt tension (see SECONDARY DRIVE BELT in Section 6 DRIVE/TRANSMISSION). Align wheel (see TIRES, INSTALLATION, WHEEL ALIGNMENT in this section).
7. See Figure 2-8. Install cotter pin (2) onto rear axle nut.

# 16 INCH WHEEL LACING

## General

T-30 I.P. (Torx Plus) head spokes are shown below.

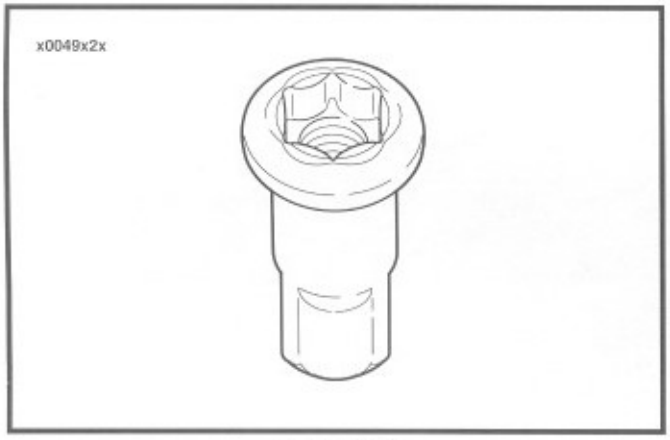



Figure 2-11

The 16 inch laced wheel hub is shown below.

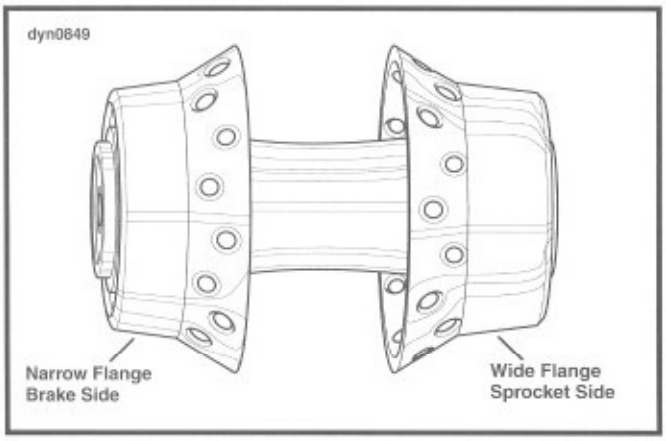



Figure 2-12

The new 16 inch laced wheel rim is shown below. New rims can be identified by the "half moon" shape around the valve stem hole.

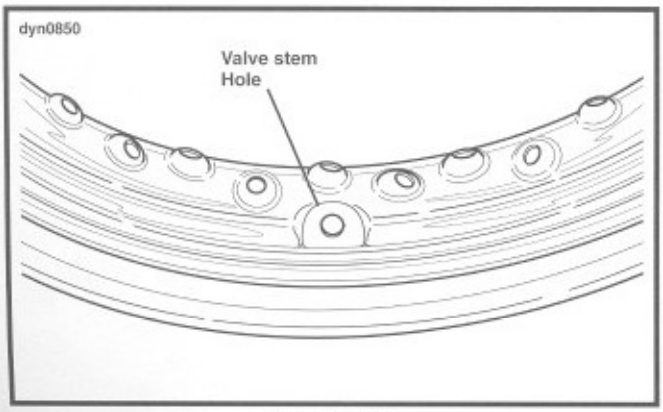



Figure 2-13

## Lacing Wheel

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

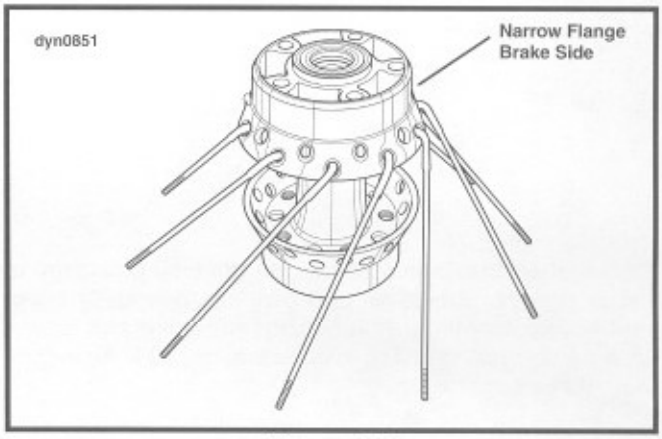



Figure 2-14

2. Position rim over the hub and spokes with valve stem hole up. Using any lower row spoke, place the first spoke into the rim hole to the left of the valve stem hole on the upper half of the rim centerline.

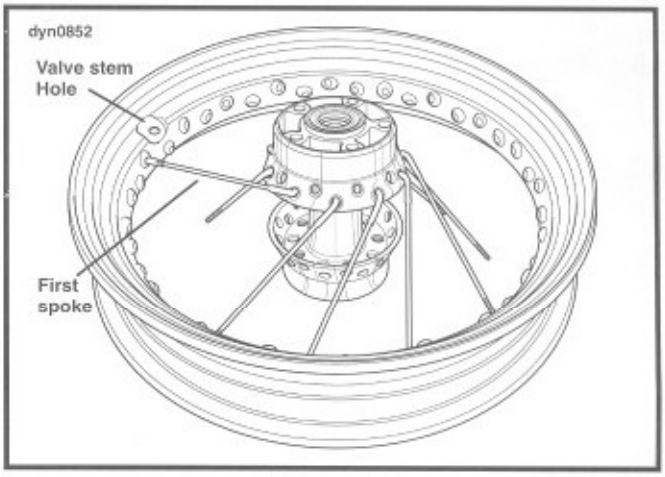



Figure 2-15

3. Install remaining lower row spokes in every fourth hole.

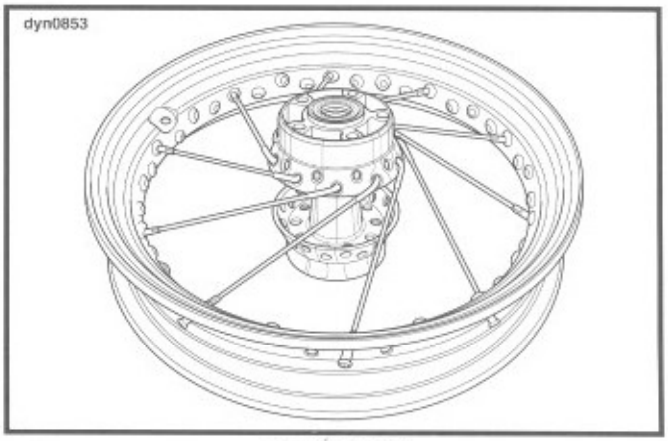



Figure 2-16

4. Place the first upper row spoke into the hub as shown below. Angle the spoke counterclockwise **crossing four lower row spokes**. The spoke must enter the hole to the right of the valve stem hole.

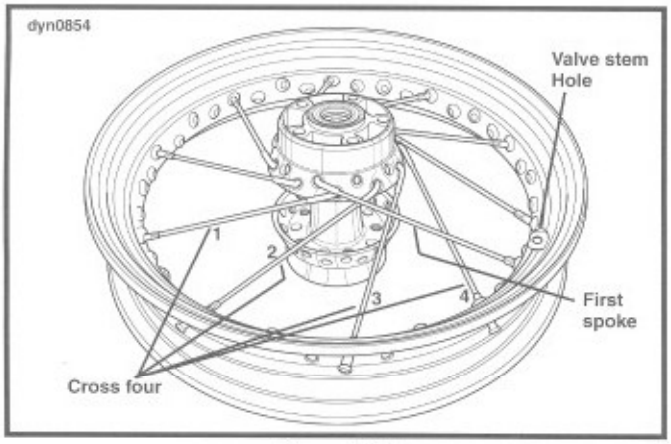



Figure 2-17

5. Install the remaining nine upper row spokes into every fourth remaining hole above the rim centerline. This completes spoke installation on brake disc side.

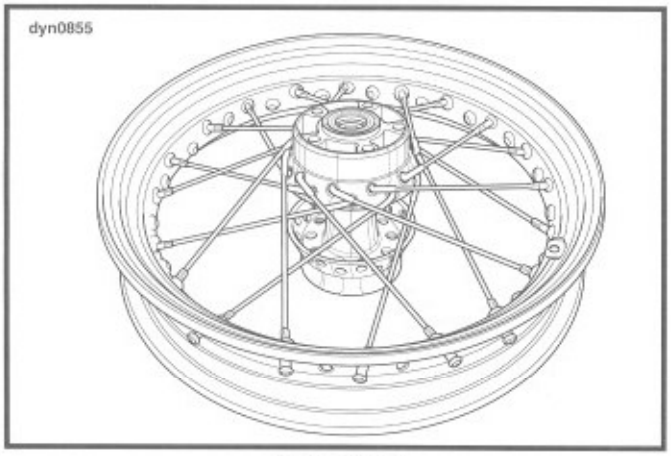



Figure 2-18

6. Turn wheel assembly over so the sprocket side (wide) faces up. Place any lower row spoke into hub. Angle spoke clockwise and place into rim hole angled to accept it.

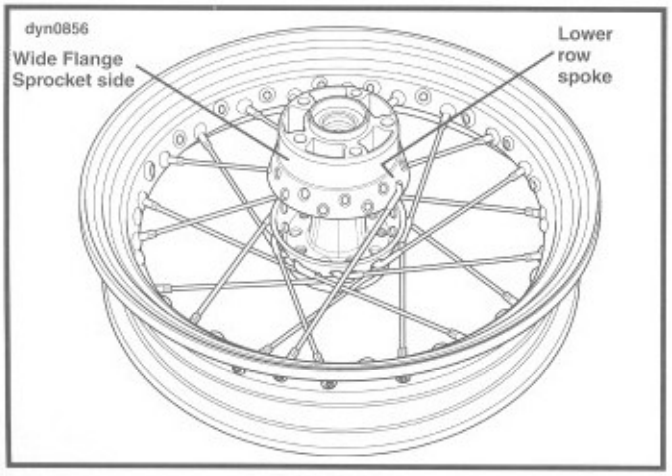



Figure 2-19

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

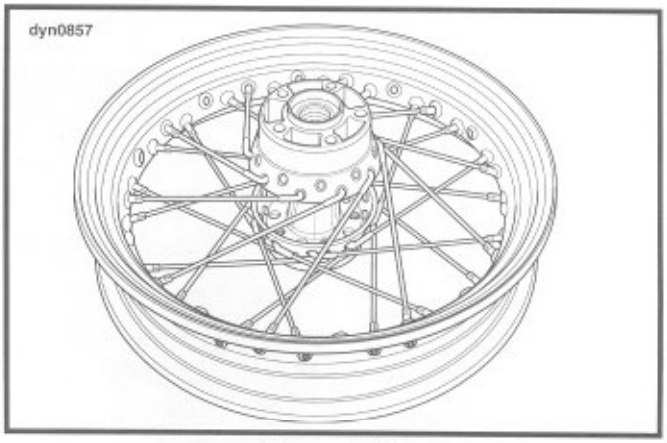



Figure 2-20

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

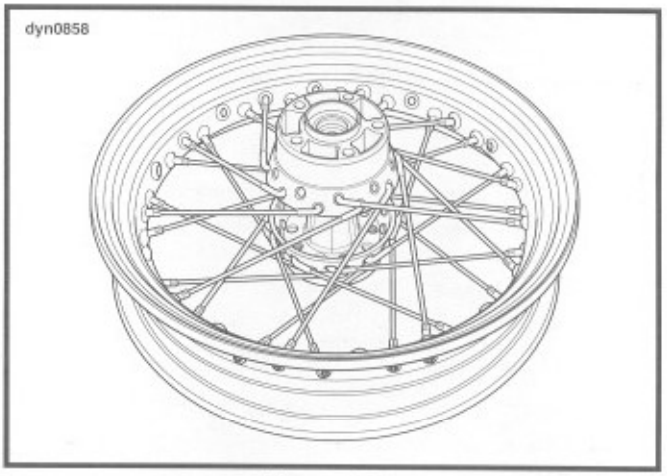



Figure 2-21

9. Install remaining nine upper row spokes. This completes spoke installation. Proceed to wheel truing section, page 2-20.

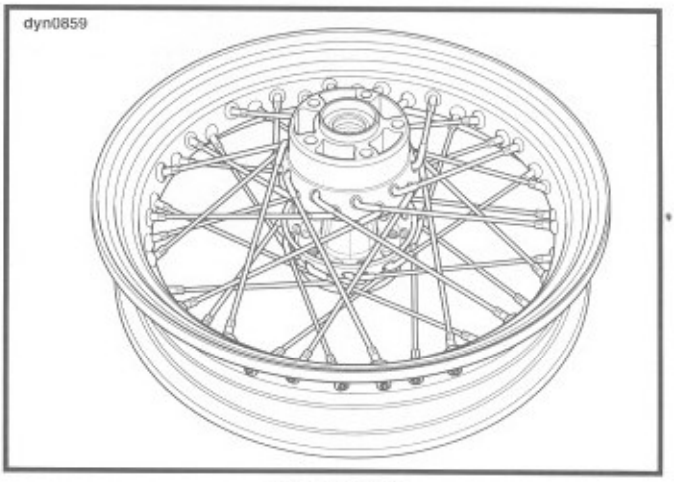



Figure 2-22

# 19-INCH WHEELS

1. See Figure 2-23. 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.

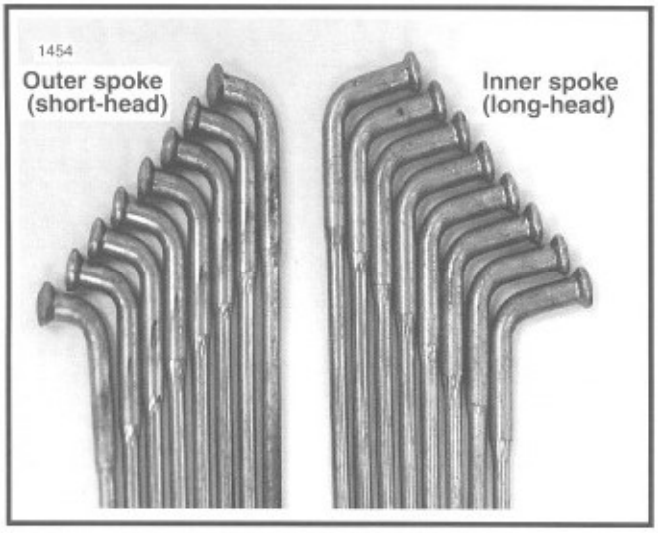



**Figure 2-23. Spoke Identification**

**⚠WARNING**

**Exercise caution to avoid using oils that attack or contribute to the deterioration of rubber materials. Use of unsuitable oils may lead to premature tire failure, possibly resulting in personal injury and/or property damage.**

2. Lubricate spoke threads and nipple shoulders with tire mounting lubricant.

3. See Figure 2-24. 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.

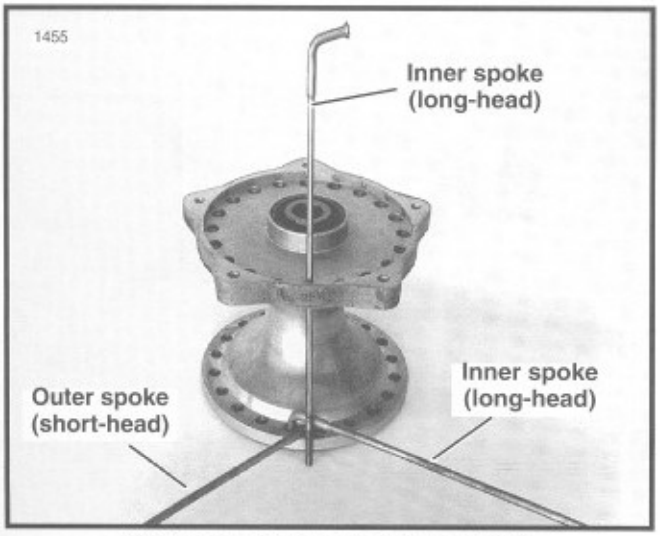



**Figure 2-24. Lacing 19-in. Wheel Hub**

4. 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.

5. See Figure 2-25. 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.

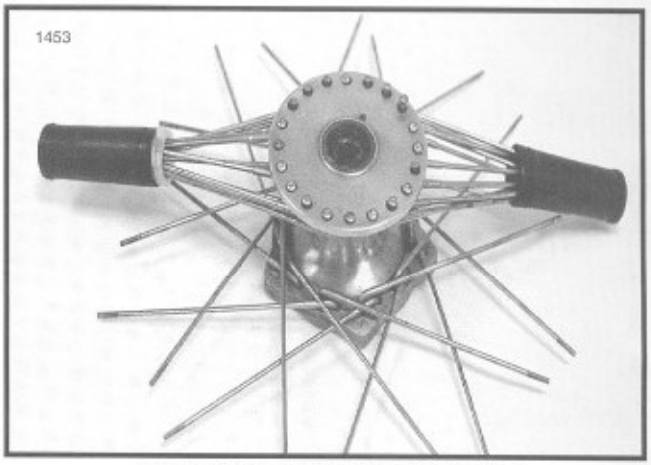



**Figure 2-25. Bundling Top Spokes**

6. 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.

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

8. See Figure 2-26. 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 three 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.*

9. 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.

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

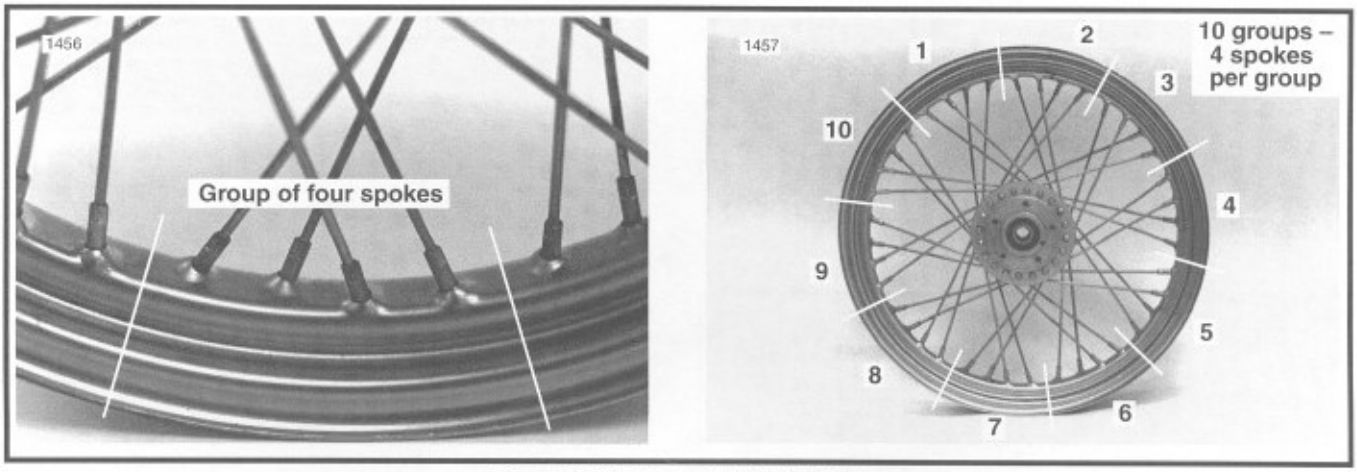



**Figure 2-26. Grouping the Spokes**

11. Lace the top flange outer spokes. Swing them counter-clockwise and make sure each one crosses four inner spokes before securing it to the rim.

12. True the wheel. See TRUING LACED WHEEL.

# TRUING LACED WHEEL

1. See Figure 2-27. With a piece of tape, mark the center of each of four groups of four as shown. The groups should be directly across from one another and approximately 90° apart.

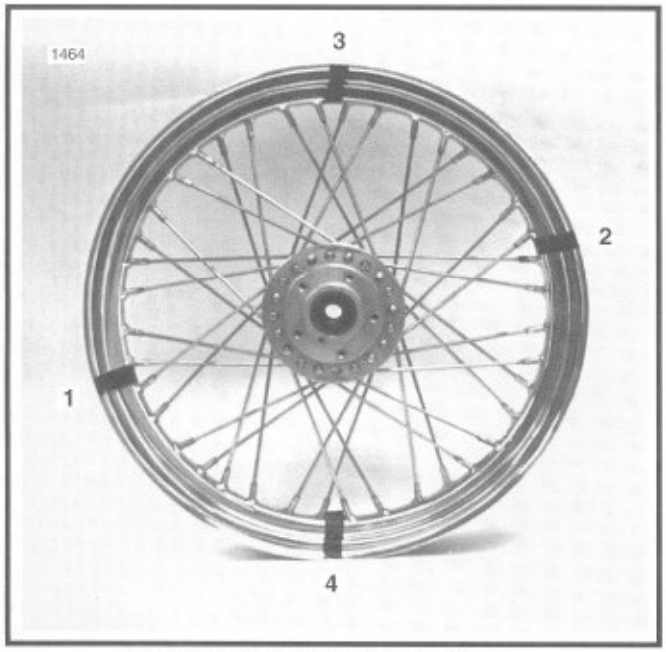



**Figure 2-27. Marking Spoke Groups**

*NOTE*

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

2. Finger tighten the spokes in these four groups. Leave all other spokes loose.
3. Install truing arbor in wheel hub and place wheel in WHEEL TRUING STAND (Part No. HD-99500-80). Tighten arbor nuts so hub will turn on its bearings.
4. See Figure 2-28. and Figure 2-29. The hub must be centered sideways with the rim. Lay a straightedge across the hub brake disc flange and one of the marked spoke groups. Measure the distance from the straightedge to the rim as shown. If this dimension is not equal on both sides of the wheel, loosen and tighten the four spokes accordingly. Use SPOKE WRENCH (Part No. HD-94681-80).

*NOTE*

*See Figure 2-28. and Figure 2-29. Dimension "A" must be maintained to ensure centering of wheel on motorcycle.*

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 0.040 in. (1.02 mm) for both sides.

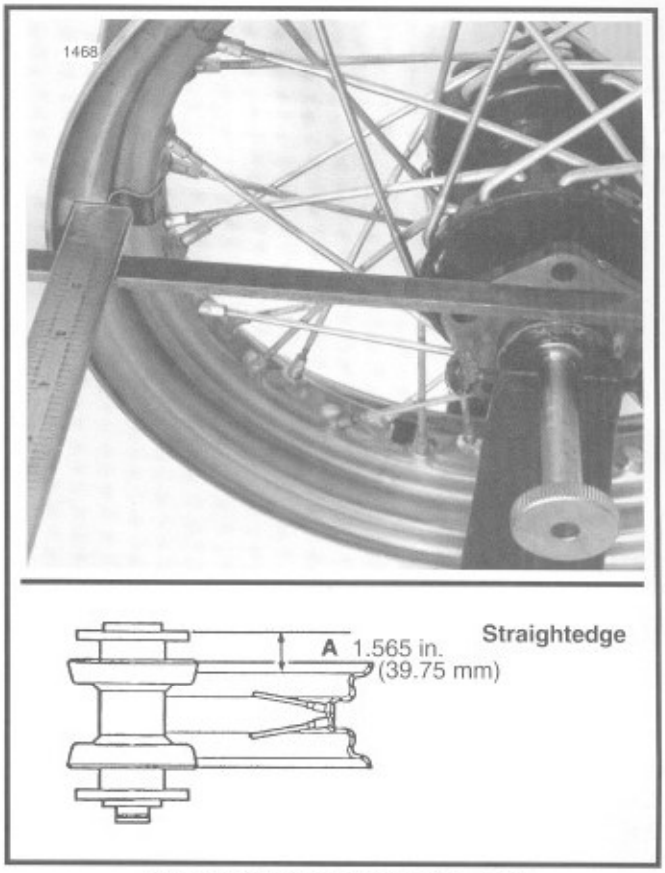



**Figure 2-28. Centering 16-in. Hub**

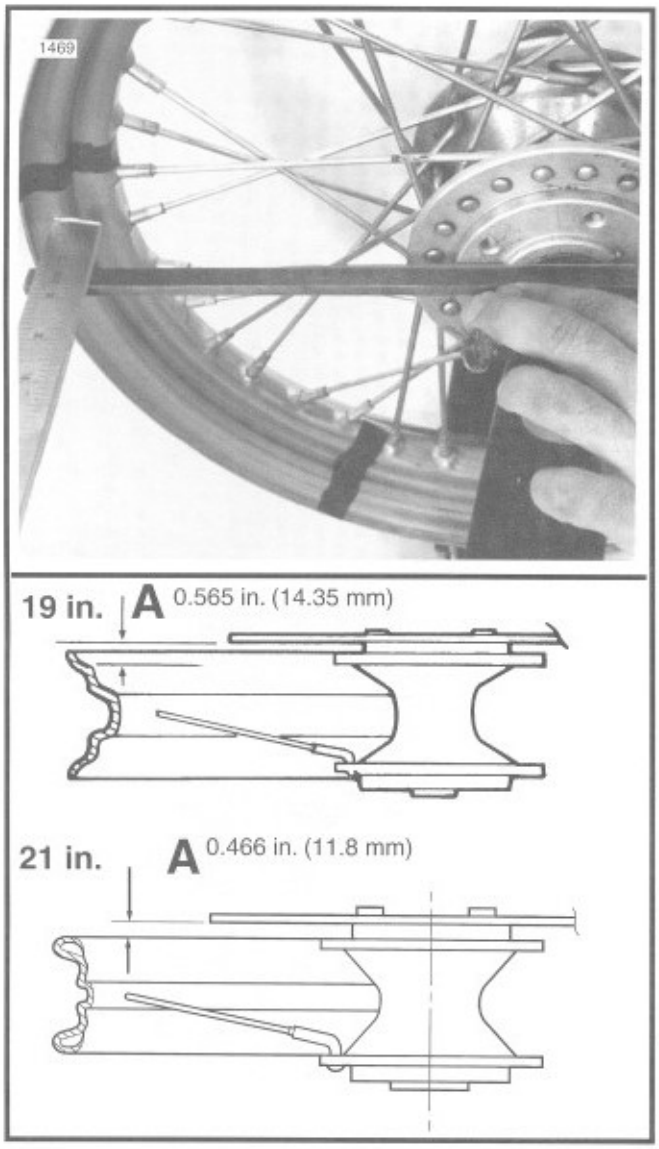



**Figure 2-29. Centering 19-in and 21-in Hub**

**⚠CAUTION**

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

Repeat Step 4 for all four groups on the wheel.

5. See Figure 2-30. After rim has been centered sideways it must be checked and trued radially. Adjust truing stand gauge to the rims tire bead seat as shown. The rim should be trued within 0.030 in. (0.76 mm).

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 alternately 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**

**Overtightening spokes may cause nipples to be drawn through rim, or hub flanges to be distorted. Spokes left too loose continue to loosen when wheel is put into service. Loose spokes will also lead to breakage of adjacent tight spokes, which are carrying a larger share of the load.**

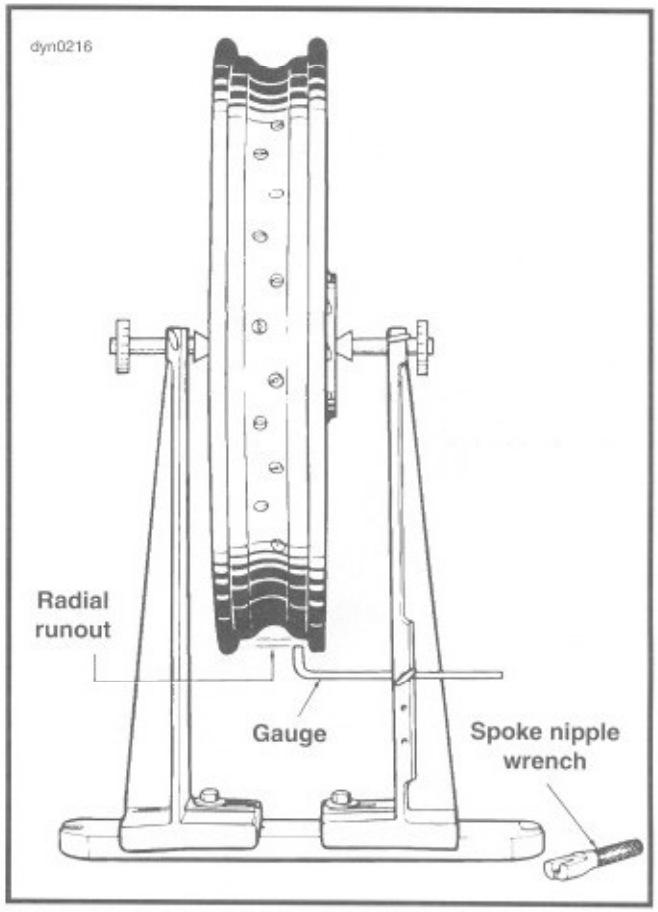



**Figure 2-30. Truing Rim Radially**

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

10. See Figure 2-28. and Figure 2-29. Check dimension A and retrue wheel if not within specifications.

# CHECKING CAST RIM RUNOUT

Check cast wheels for lateral and radial runout before installing a new tire.

1. See Figure 2-31. Install truing arbor in wheel hub and place wheel in WHEEL TRUING STAND (Part No. HD-99500-80). Tighten arbor nuts so hub will turn on its bearings. To check rim lateral runout, place a gauge rod or dial indicator near the rim bead. If lateral runout exceeds 0.040 in. (1.02 mm), replace the wheel.

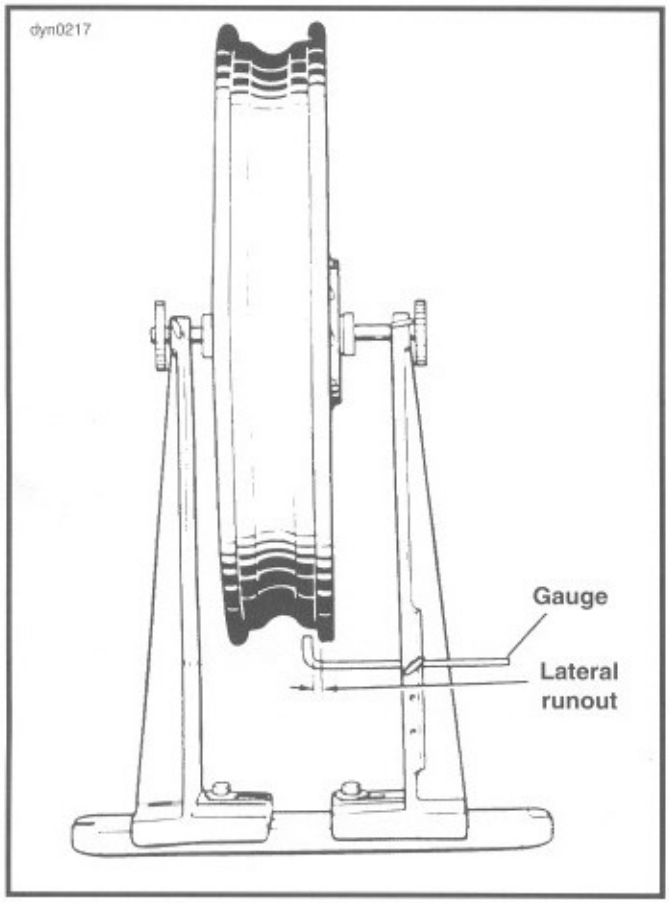



**Figure 2-31. Checking Cast Rim Lateral Runout.**

2. See Figure 2-32. Check for radial runout as shown. Replace the wheel if runout exceeds 0.030 in. (0.76 mm).

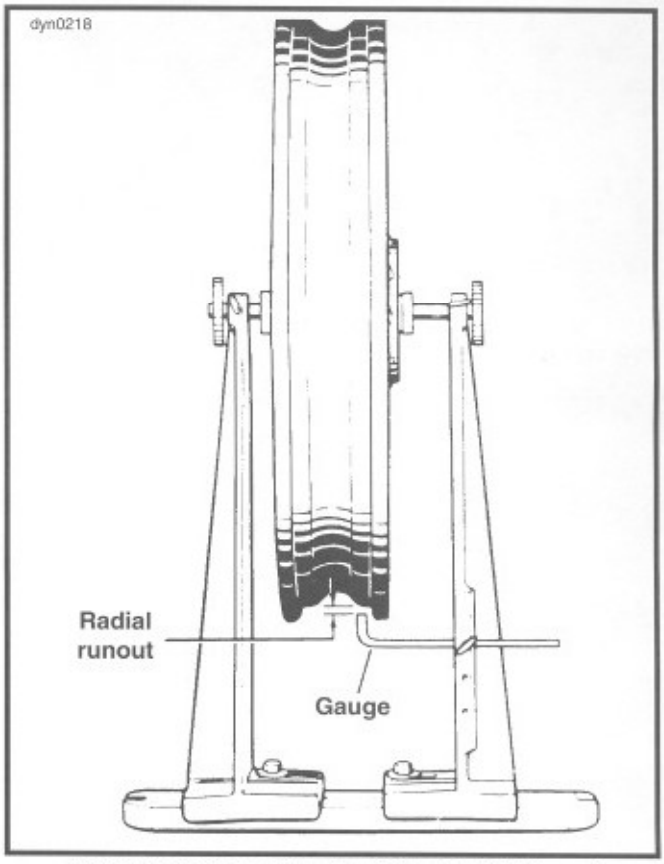



**Figure 2-32. Checking Cast Rim Radial Runout**

# TIRES

## GENERAL

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

Whenever a tire on a laced wheel is replaced, the tube should also be replaced. Inner tubes should be patched only as an emergency measure. Replace a damaged or patched tube as soon as possible. Rim bands must be used on all laced wheels.

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

**⚠WARNING**

**Always check both tire sidewalls for arrows indicating forward rotation. Some tires require different tire rotation depending on whether tire is used on front or rear wheel. Failure to observe this warning could result in tire failure which may result in personal injury.**


**Figure 2-33. Starting Tire Off Rim**

## REMOVAL

1. Remove wheel from motorcycle. See FRONT or REAR WHEELS.
2. Deflate tire.
3. Loosen both tire beads from rim flange. In most cases, a bead breaker machine will be required to loosen the beads from the rim.
4. See Figure 2-33. Attach RIM PROTECTORS (Part No. HD-01289) to the rim. Using tire tools (not sharp instruments), start upper bead over edge of rim at valve. Repeat all around rim until first bead is over rim. Remove the tube on tube type wheels.

**⚠CAUTION**

**Do not use excessive force when starting bead over rim. Excessive force may damage wires in tire bead.**

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.
6. On tubeless tire rims, remove the valve stem if it is damaged or leaks.

*NOTE*

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

7. Mount the tire on TIRE SPREADER (Part No. HD-21000) for inspection and repair procedures.

## CLEANING, INSPECTION, AND REPAIR

1. Clean the inside of tire and outer surface of tube.
2. If rim is dirty or rusty, clean with a stiff wire brush.
3. Inspect the tire and tube for wear and damage. Replace worn tires. Replace damaged tubes. Use TIRE REPAIR KIT (Part No. HD-20000) for tire repair. Follow the kit manufacturer's instructions.

# INSTALLATION

## Tube Type Tires

**⚠WARNING**

**Use the correct inner tube and tire as specified. See TIRE DATA in SPECIFICATIONS. Failure to do so could result in tire failure, causing personal injury.**

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


**Figure 2-34. Installing Rim Strip**

2. Thoroughly lubricate the rim flanges and both beads of the tire with tire lubricant.
3. See Figure 2-35. Starting at the valve stem hole, 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.
4. Inflate tube just enough to round it out. Lubricate thoroughly 360° around the tube base. Insert tube in tire with valve stem in hole.
5. See Figure 2-36. 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 valve stem before prying the remaining bead over the rim flange.
6. Make sure 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. Install the valve core, then inflate to recommended pressure.


**Figure 2-35. Starting Bead on Rim**


**Figure 2-36. Starting Second Bead on Rim**

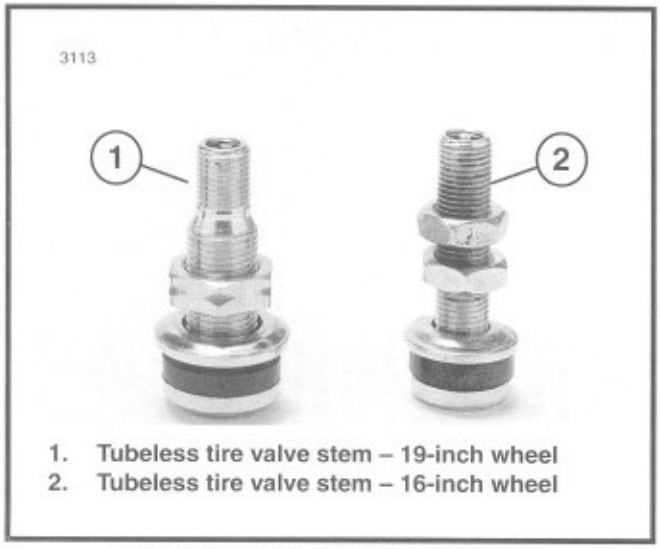
## Tubeless Tires

**⚠WARNING**

**Only install original equipment (stock) tire valves and valve caps. A valve or valve and cap combination that is too long may interfere with (strike) adjacent components, damage the valve and cause rapid tire deflation. Rapid tire deflation could cause loss of control and personal injury.**

**Also, aftermarket valve caps that are heavier than the stock cap may have clearance at slow speeds; but, at high speed the valve/cap will be moved outward by centrifugal force. This outward movement could cause the valve/cap to strike the adjacent components, damage the valve and cause rapid tire deflation. Rapid tire deflation could cause loss of control and personal injury.**

1. See Figure 2-37. On tubeless wheels, damaged or leaking valve stems must be replaced. Place rubber grommet on valve stem with shoulder in recess of the valve stem head.




1. **Tubeless tire valve stem – 19-inch wheel**
2. **Tubeless tire valve stem – 16-inch wheel**

**Figure 2-37. Tubeless Tire Valve Stem**

2. Insert valve stem into rim hole, and install metal washer with raised center facing away from rim. Install first hex nut, and tighten to 20-25 **in-lbs** (2.3-2.8 Nm) torque. Tire valves for 19-inch rims have only one nut that must be tightened to 35-40 **in-lbs** (4.0-4.5 Nm) torque.
3. Install second hex nut. While holding first nut with a wrench, tighten second nut to 40-60 **in-lbs** (4.5-6.8 Nm) torque.
4. Thoroughly lubricate the rim flanges and both beads of the tire with tire lubricant.
5. See Figure 2-35. Starting at the valve stem, start the first bead into the rim well. Work the bead on as far as possible by hand. Use a tire tool to pry the remaining bead over the rim flange.
6. See Figure 2-36. Start 180° from the valve stem hole and start the second bead on the rim. Work the bead onto the rim with tire tools, working toward the valve in both directions.
7. Apply air to the stem to seat the beads on the rim. It may be necessary to use a BEAD EXPANDER, Part No. HD-28700 on the tire until the beads seal on the rim.

**⚠WARNING**

**Do not inflate over 40 psi (2.8 bars) to seat the beads. Inflating the tire beyond 40 psi (2.8 bars) 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 to 40 psi (2.8 bars), deflate and relubricate the bead and rim and reinflate to seat the beads but do not exceed 40 psi (2.8 bars).**

## Checking Tire Lateral Runout (Figure 2-38)

1. Turn wheel on axle and measure amount of displacement from a fixed point to tire sidewall.
2. Tire tread lateral runout should be no more than 0.080 in. (2.03 mm). If runout is more than 0.080 in. (2.03 mm), remove tire from rim, and check rim bead side runout to see if rim is at fault.

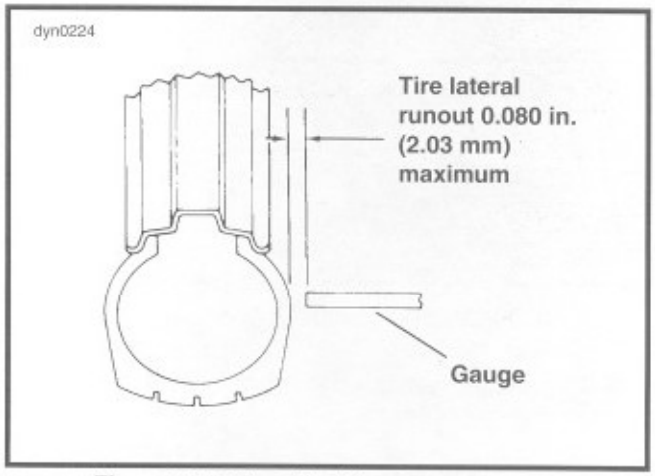



**Figure 2-38. Checking Tire Lateral Runout**

## Checking Tire Radial Runout (Figure 2-39)

1. Turn wheel on axle and measure tread radial runout.
2. Tire tread radial runout should not be greater than 0.090 in. (2.29 mm). If runout exceeds specification, remove tire from rim and check rim bead runout to determine if rim is at fault.
3. If rim bead seat runout is less than 0.030 in. (0.76 mm), then tire is at fault and must be replaced. If rim bead seat runout is greater than 0.030 in. (0.76 mm), correct by tightening selected spoke nipples (laced wheels) or replace wheel (cast wheels). Install tire and check tire tread radial runout again.

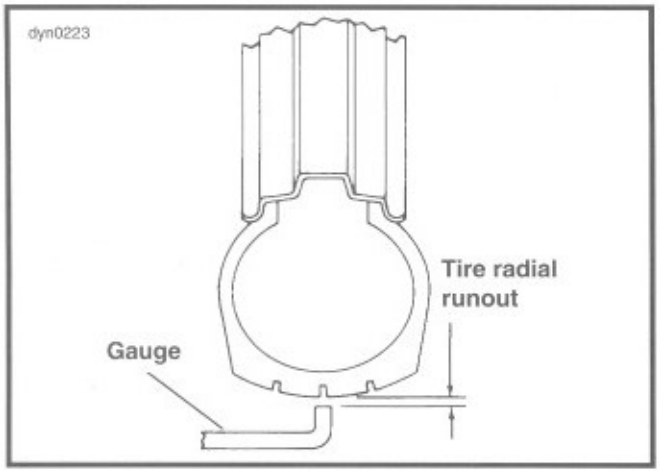



Figure 2-39. Checking Tire Radial Runout

## Wheel Alignment

### CHECKING WHEEL ALIGNMENT (FIGURE 2-40)

**⚠WARNING**

**Correct vehicle alignment is very important for proper vehicle handling and vibration control. Carefully check alignment according to the following procedure. Incorrect vehicle alignment could cause loss of control, resulting in personal injury.**

1. Fabricate an alignment tool (1) using a piece of 1/8-in. (3.175 mm) diameter aluminum welding rod 11-1/4 in. (286 mm) long. Grind one end down to a blunt point. Use pliers to bend rod 90° as shown. Place a snug-fitting rubber grommet (4) on rod to act as a slide measurement indicator.
2. Insert pointed end of alignment tool in index hole (2) on right side of swing arm (3). Slide rubber grommet along tool shaft until it aligns with center of rear axle. Measure distance from pointed end of alignment tool to grommet. Repeat measurement for left side of swing arm.
3. If left and right side measurements are not equal, adjust rear wheel alignment according to the following procedure – ADJUSTING ALIGNMENT.

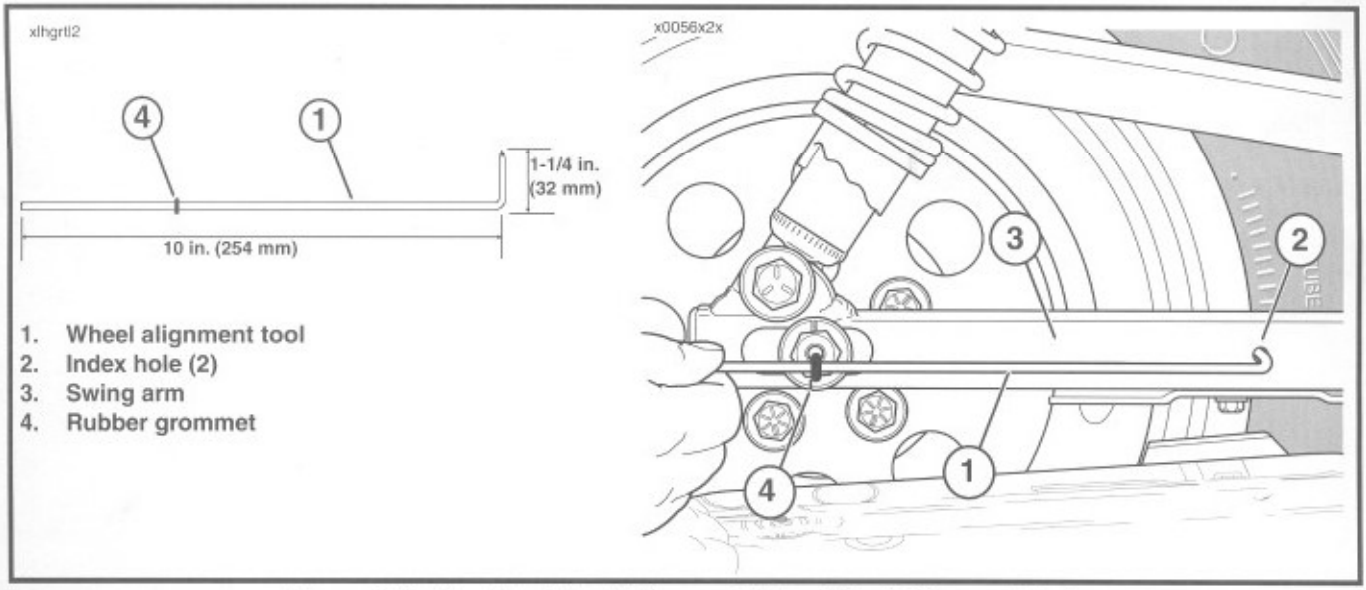
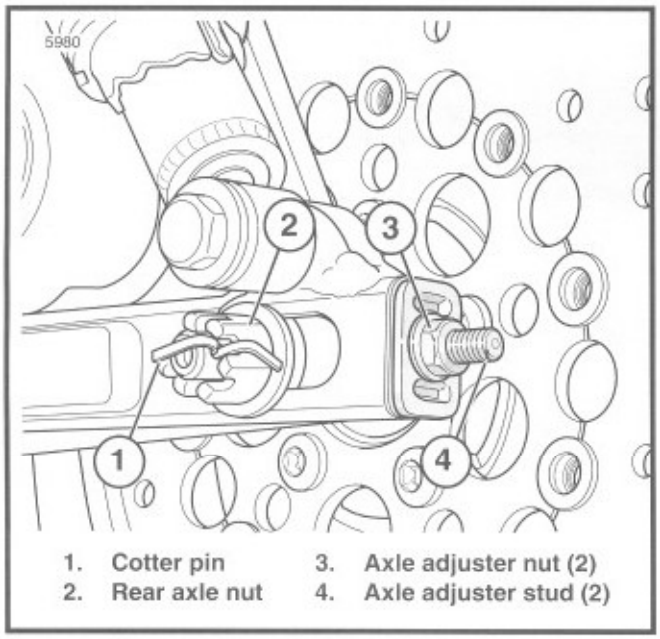



Figure 2-40. Checking Wheel Alignment Using Wheel Alignment Tool

### ADJUSTING WHEEL ALIGNMENT (FIGURE 2-41)

1. Remove and discard cotter pin (1).




1. Cotter pin
2. Rear axle nut
3. Axle adjuster nut (2)
4. Axle adjuster stud (2)

**Figure 2-41. Adjusting Wheel Alignment**

2. Loosen rear axle nut (2).

3. On side of rear fork which has longer distance from index hole to axle center, turn nut (3) on axle adjuster stud (4) counterclockwise to shorten distance. Adjust axle until left and right side alignment measurements are equal.

*NOTE*

- *Keep axle adjuster mechanisms firmly seated (under tension) on each side of rear fork during wheel alignment procedures above. Do so by applying moderate upward force on lower span of rear belt. This tensions rear belt, which holds rear axle forward against both adjuster mechanisms.*

- *Do not tighten rear axle nut (2) or install cotter pin (1) until after checking rear drive belt tension.*

4. Check rear drive belt tension after aligning rear wheel; adjust if required. See DRIVE/TRANSMISSION, SECONDARY DRIVE BELT, ADJUSTMENT.

5. If not yet performed, tighten axle nut (2) to 60-65 ft-lbs (81-88 Nm) torque, and install **new** cotter pin (1).

## Wheel Balancing

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

In most cases, static balancing using WHEEL TRUING STAND (Part No. HD-99500-80) will produce satisfactory results. However, dynamic balancing, utilizing a wheel spinner, can be used to produce finer tolerances for best high-speed handling characteristics. Follow the instructions supplied with the balance machine you are using.

The maximum weight permissible to accomplish balance is 3-1/2 oz. (866 g) (total weight applied to the rim). Wheels should be balanced to within 1/2 oz. (14 g) at 60 mph (97 km/h).

### WEIGHTS FOR LACED WHEELS

Harley-Davidson specifies the following spoke balance weights, which are crimped over the spoke nipple.

### Laced Wheel Balance Weights

| Weight (Mass) | | HD Part Number |
|---|---|---|
| 1/2 oz. (U.S.) | 14 g | 95578-41 |
| 3/4 oz. (U.S.) | 21 g | 95581-47 |
| 1 oz. (U.S.) | 28 g | 95582-47 |

### WEIGHTS FOR CAST WHEELS

Harley-Davidson specifies the following cast wheel balance weights, which have special self-adhesive backings.

### Cast Wheel Balance Weights

| Weight (Mass) oz. (U.S.) | grams | Finish | HD Part Number |
|---|---|---|---|
| 1/4 | 7 | black | 95594-84 |
| 1/4 | 7 | silver | 95595-84 |

These weights are applied to the flat surface of the wheel rim according to the following procedures.

1. Make sure that area of application is completely clean, dry, and free of oil and grease.

*NOTE*

*If 1 oz. (28 g) or more of weight must be added at one location, split the amount so that half is applied to each side of rim.*

2. Remove paper backing from weight. Apply three drops of LOCTITE® SUPERBONDER® 420 to the adhesive side of the weight. Place the weight on flat surface of wheel rim. Press weight firmly in place, and hold for ten seconds.

3. Allow eight hours for adhesive to cure completely before using wheel.

# BRAKES

## GENERAL

The front and rear brakes are fully hydraulic disc brake systems that require little maintenance. The front brake master cylinder is an integral part of the brake hand lever assembly. The rear brake master cylinder is located on the right side of the motorcycle near the brake pedal. Check the master cylinder reservoirs for proper fluid levels every 5000 miles (8000 km). With the reservoir in a level position, add D.O.T. 5 SILICONE HYDRAULIC BRAKE FLUID until the fluid level is 1/8 in. (3.2 mm) from the top.

Check brake pads and discs for wear every 2500 miles (4000 km). Replace brake pads if friction material is worn to 1/16 in. (1.6 mm) or less.

Minimum brake disc thickness is stamped on side of disc. Replace any brake disc that is worn beyond this limit. For disc removal and installation procedures, see FRONT or REAR WHEEL.

**⚠WARNING**

- **Clean brake system components using denatured alcohol. Do not use mineral base cleaning solvents, such as gasoline or paint thinner. Use of mineral base solvents causes deterioration of rubber parts that continues after assembly and can result in component failure and/or personal injury.**

- **Always test motorcycle brakes at low speed after servicing or bleeding system. Harley-Davidson recommends that all brake repairs be performed by a Harley-Davidson dealer or other qualified mechanic.**

- **Exercise caution when handling brake fluid. Brake fluid can cause irritation of eyes and skin and may be harmful or fatal if swallowed. If swallowed, administer two tablespoons of salt in a glass of warm water to induce vomiting. Call a doctor immediately. In case of contact with skin or eyes, flush with plenty of water. Get medical attention for eyes. KEEP BRAKE FLUID OUT OF THE REACH OF CHILDREN.**

## TROUBLESHOOTING

Use the following troubleshooting guide to help in determining probable causes of poor brake operation.

| CONDITION | CHECK FOR | REMEDY |
|---|---|---|
| Excessive lever or pedal travel or spongy feel. | Air in system.<br>Master cylinder low on fluid. | Bleed brake(s).<br>Fill master cylinder with approved brake fluid. |
| Chattering sound when brake is applied. | Worn pads.<br>Loose mounting bolts.<br>Warped disc. | Replace brake pads.<br>Tighten bolts.<br>Replace disc. |
| Ineffective brake – lever or pedal travels to limit. | Low fluid level.<br><br>Piston cup not functioning. | Fill master cylinder with approved brake fluid, and bleed system.<br>Rebuild cylinder. |
| Ineffective brake – lever or pedal travel normal. | Distorted or glazed disc.<br>Distorted, glazed or contaminated brake pads. | Replace disc.<br><br>Replace pads. |
| Brake pads drag on disc – will not retract. | Cup, in master cylinder not uncovering relief port.<br>Rear brake pedal linkage out of adjustment. | Inspect master cylinder.<br><br>Adjust linkage. |

# FRONT BRAKE MASTER CYLINDER

## GENERAL

Master cylinders designed for dual disc (two caliper) operation have an 11/16 inch (17.5 mm) bore, while those that are designed for single disc (one caliper) operation have a 9/16 inch (14.3 mm) bore. The bore size is stamped on the master cylinder assembly inboard of the handlebar clamp bracket. See Figure 2-42.

**⚠WARNING**

**Do not use a 9/16 inch bore master cylinder assembly on dual disc (two caliper) models. Likewise, do not use an 11/16 inch bore master cylinder assembly on single disc (one caliper) models. These master cylinder assemblies are not interchangeable. Using the wrong assembly can adversely affect braking efficiency or result in brake failure causing personal injury.**

## REMOVAL/DISASSEMBLY

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

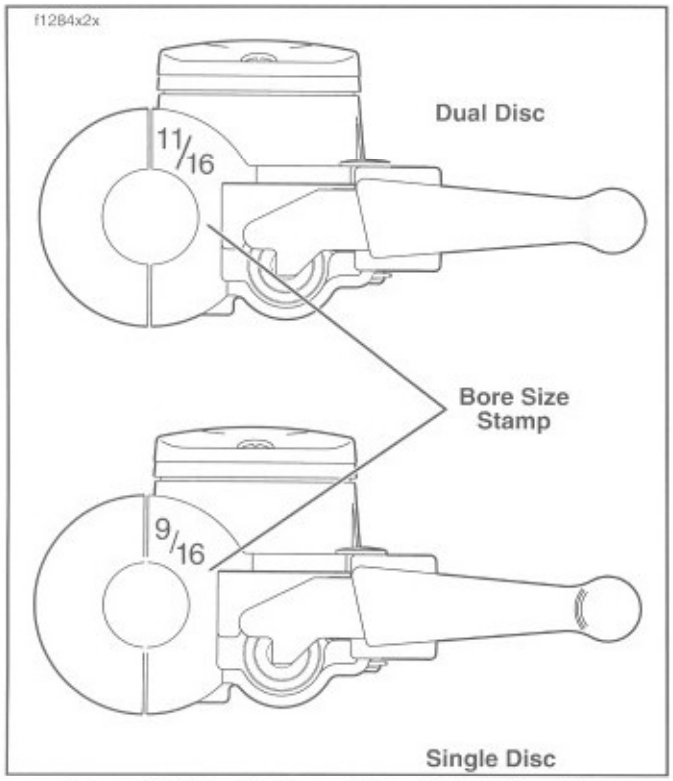



**Figure 2-42. Verify Correct Bore Size Before Use**

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

**⚠CAUTION**

**Do not remove the master cylinder assembly without first placing the 5/32 inch cardboard insert between the brake lever and lever bracket. Removal without the insert may result in damage to the rubber boot and plunger of the Front Stoplight Switch.**

*NOTE*

*Use the eyelet of an ordinary cable strap if the cardboard insert is not available.*

3. Place the cardboard insert between the brake lever and lever bracket. See Figure 2-43.

4. Using a T27 TORX drive head, remove the two screws with flat washers securing the handlebar clamp to the master cylinder housing. Remove the brake lever/master cylinder assembly and clamp from the handlebar. See Figure 2-44.

**⚠WARNING**

**Always wear proper eye protection when removing retaining rings. Slippage may propel the ring with enough force to cause serious eye injury. Use the correct retaining ring pliers. Verify that the tips of the pliers are not excessively worn or damaged.**

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

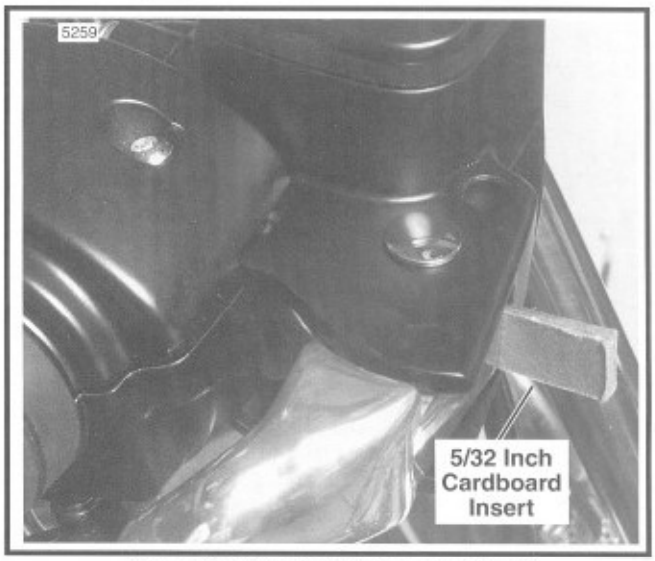



**Figure 2-43. Install Cardboard Insert Before Removing Master Cylinder Assembly**

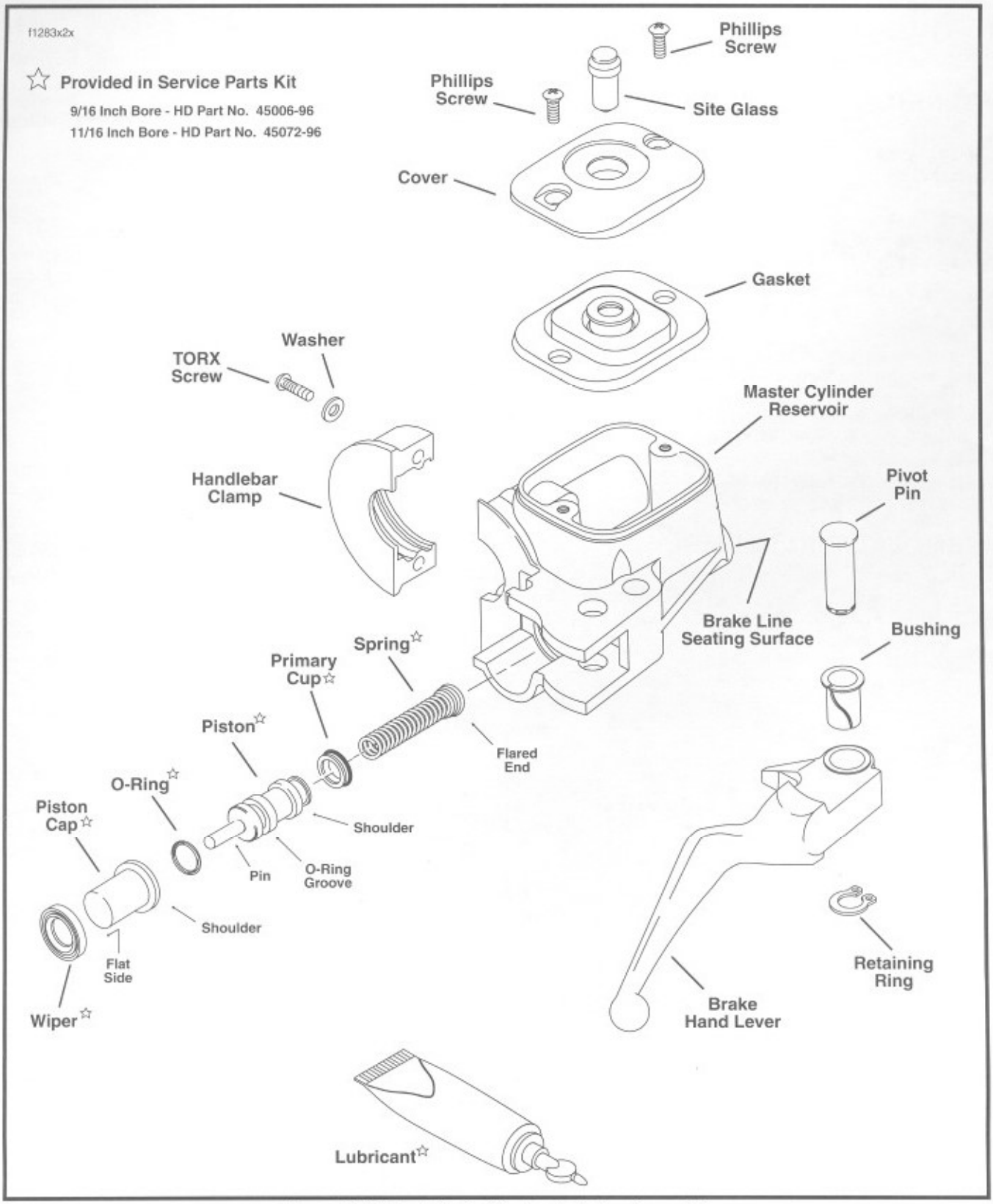



**Figure 2-44. Front Brake Master Cylinder Assembly**

1. Remove pivot pin and brake hand lever from master cylinder assembly.
2. Carefully remove wiper with pick or similar tool.
3. Remove piston cap.
4. Remove piston with O-ring and primary cup.
5. Remove spring.

**⚠CAUTION**

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

1. Remove the two Phillips screws, cover and cover gasket from the master cylinder reservoir.

## CLEANING, INSPECTION AND REPAIR

**⚠WARNING**

**Do not use replacement parts from single caliper repair kits (9/16 inch bore) on dual caliper models. Likewise, do not use replacement parts from dual caliper repair kits (11/16 inch bore) on single caliper models. Parts are not interchangeable. Using the wrong replacement parts can adversely affect braking efficiency or result in brake failure causing personal injury.**

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

2. Clean all parts with denatured alcohol or D.O.T. 5 BRAKE FLUID. Do not contaminate with mineral oil or other solvents. Wipe dry with a clean, lint free cloth. Blow out drilled passages and bore with a clean air supply. Do not use a wire or similar instrument to clean drilled passages in bottom of reservoir.

**⚠WARNING**

**Always use denatured alcohol to clean brake system components. Do not use mineral base solvents (such as gasoline and paint thinner) or deterioration of rubber parts may occur after assembly. Deterioration of components may result in premature brake failure, possibly causing personal injury.**

3. Carefully inspect all parts for wear or damage and replace as necessary.

4. Inspect the piston bore in the master cylinder housing for scoring, pitting or corrosion. Replace the housing if any of these conditions are found.

5. Inspect the outlet port that mates with the brake line fitting. As a critical sealing surface, replace the housing if any scratches, dents or other damage is noted.

6. Inspect the cover gasket for cuts, tears or general deterioration. Replace as necessary.

## ASSEMBLY/INSTALLATION

1. Fit O-ring into groove at front of piston (pin side). See Figure 2-44.

2. Fit primary cup over lip at back of piston so that closed side (smaller OD) contacts shoulder.

3. Coat piston bore of housing with special lubricant supplied in the service parts kit. Also apply the lubricant to OD of installed O-ring and primary cup.

4. Insert flared end of spring into master cylinder bore so that it seats against the counterbore (recess) at bottom.

5. Slide piston over spring.

6. Fit wiper over piston cap so that the flat side of wiper contacts cap shoulder.

7. Fit piston cap over piston pin.

8. Press down on wiper until it contacts the counterbore. Larger OD of wiper must be completely seated in groove on outlet side of piston bore.

9. Install the cover (with gasket) on the master cylinder reservoir. Install two Phillips screws to fasten the cover to the reservoir, but do not tighten at this time.

10. Align hole in brake hand lever with hole in master cylinder bracket. From the top of the assembly, slide pivot pin through bracket and hand lever.

**⚠WARNING**

**Always wear proper eye protection when installing retaining rings. Slippage may propel the ring with enough force to cause serious eye injury. Use the correct retaining ring pliers. Verify that the tips of the pliers are not excessively worn or damaged.**

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

**⚠CAUTION**

**See Figure 2-45. Do not install the master cylinder assembly without first placing the 5/32 inch cardboard insert (or cable strap eyelet) between the brake lever and lever bracket. Installation without the insert may result in damage to the rubber boot and plunger of the Front Stoplight Switch.**

12. Position the brake lever/master cylinder assembly inboard of the switch housing assembly engaging the tab on the lower switch housing in the groove at the top of the brake lever bracket. See Figure 2-46.

13. Align the holes in the handlebar clamp with those in the master cylinder housing and start the two screws (with flat washers). Position for rider comfort. Beginning with the top screw, tighten the screws to 70-80 **in-lbs** (7.9-9.0 Nm) torque using a T27 TORX drive head.

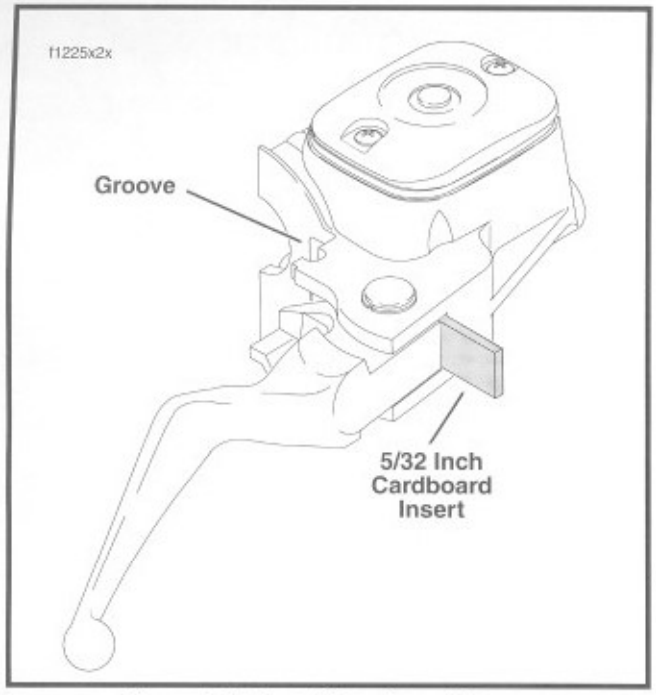



**Figure 2-45. Install Cardboard Insert Before Installing Master Cylinder Assembly**

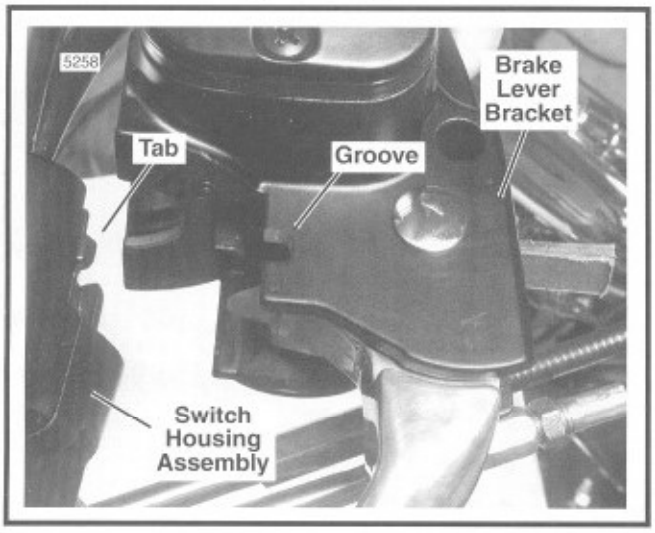



**Figure 2-46. Fit Brake Lever/Master Cylinder to Right Handlebar Switch Housings**

**⚠CAUTION**

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

1. Position **new** steel/rubber washers on each side of hydraulic brake line fitting. Insert bolt through washers and fitting. Thread bolt into master cylinder housing and tighten to 17-22 ft-lbs (23-30 Nm) torque.

2. Install length of clear plastic tubing over caliper bleeder valve, if removed. Place free end of tube in a clean container.

3. Remove the master cylinder cover. Stand the motorcycle upright so that the master cylinder is in a level position.

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

**⚠WARNING**

**A plugged or covered relief port can cause brake drag or lockup, which may result in loss of vehicle control and possible personal injury.**

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

6. Add brake fluid to the master cylinder reservoir until the fluid level is 1/8 inch (3.2 mm) from the top.

7. Depress and hold the brake hand lever to build up hydraulic pressure.

8. Open bleeder valve about 1/2-turn. Brake fluid will flow from bleeder valve through tubing. Close bleeder valve when brake hand lever has moved 1/2 to 3/4 of its full range of travel. Allow brake hand lever to return slowly to its released position.

9. Repeat Steps 19-21 until all air bubbles are purged.

10. Final tighten the bleeder valve to 80-100 **in-lbs** (9.0-11.3 Nm) torque. Install the bleeder cap.

11. Add brake fluid to the master cylinder reservoir until the fluid level is about 1/8 inch (3.2 mm) from the top.

12. Note that the angular shape of the master cylinder cover makes one side thicker than the other. Install the cover (with gasket) on the master cylinder reservoir so that the thicker side is positioned above the brake line fitting. Install two Phillips screws to fasten the cover to the reservoir. Tighten the screws to 6-8 **in-lbs** (0.7-0.9 Nm) torque.

13. With the Ignition/Light Key Switch turned to IGNITION, actuate the front brake hand lever to verify operation of the brake lamp.

**⚠WARNING**

**Always test motorcycle brakes at low speed after completing repairs or bleeding the system. Failure to do so may result in personal injury.**

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

# REAR BRAKE MASTER CYLINDER

## ADJUSTMENT

### Brake Pedal

See Figure 2-47. Loosen locknut (20). With motorcycle on level surface, adjust push rod (1) so that brake pedal is parallel with floor (see Figure 2-48). Tighten locknut.

## REMOVAL/DISASSEMBLY (Figure 2-47)

*NOTE*

*Do not disassemble the master cylinder unless problems are being experienced. Discard all seals during the disassembly procedure. Install a complete rebuild kit when the unit is assembled.*

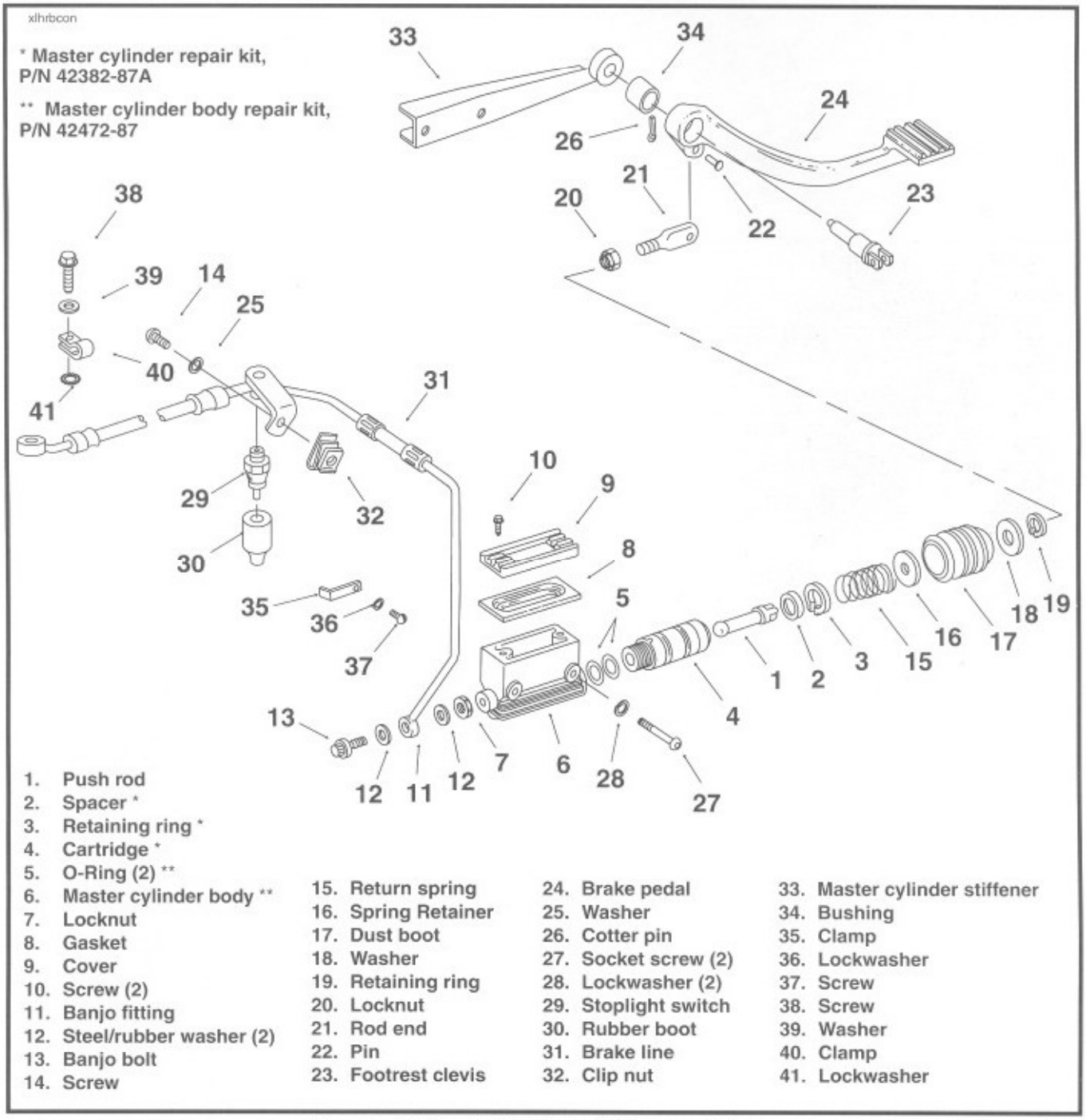



Figure 2-47. Rear Brake Master Cylinder and Linkage

1. Open bleeder nipple cap on rear caliper. Install end of a length of plastic tubing over caliper bleeder valve, while placing free end in a suitable container. Open bleeder valve about 1/2-turn. Pump brake pedal (24) to drain brake fluid.
2. Remove screw (37) and lockwasher (36) to detach brake line clamp (35) from sprocket cover. Remove banjo fitting bolt (13) and steel/rubber washers (12). Discard washers.
3. Lift banjo fitting (11) away from master cylinder (6). Remove two socket screws (27) and lockwashers (28) holding master cylinder to sprocket cover. Loosen locknut (20). Turn push rod (1) at flats until free of rod end (21).

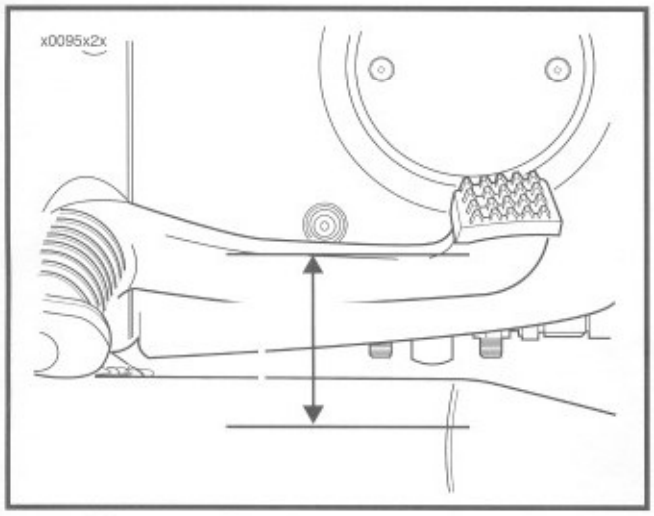



**Figure 2-48. Rear Brake Pedal Adjustment**

**⚠CAUTION**

**Do not press against banjo seating surfaces without taking precautions against damage.**

4. Press down on large washer (18) to compress return spring (15). While spring is compressed, remove retaining ring (19) from push rod (1). Carefully release spring.
5. Remove washer (18), dust boot (17), spring retainer (16) and return spring (15).
6. Remove locknut (7). Pull cartridge and push rod assembly from master cylinder body (6). Remove retaining ring (3) from bore of cartridge (4). Pull the push rod (1) with spacer (2) free of cartridge. Remove two O-rings (5) from external grooves on cartridge; discard O-rings.

**⚠CAUTION**

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

7. Remove master cylinder cover screws (10), cover (9) and cover gasket (8).

## CLEANING, INSPECTION AND REPAIR (Figure 2-47)

**⚠WARNING**

**Clean brake system components using denatured alcohol. DO NOT use mineral-base cleaning solvents, such as gasoline or paint thinner. Use of mineral-base solvents causes deterioration of rubber parts that continues after assembly and can result in improper and unsafe brake operation which may lead to personal injury. NovaGard silicone is recommended for lubrication of seals prior to assembly.**

1. Thoroughly clean master cylinder and all brake system components. Examine walls of master cylinder reservoir for scratches and grooves. Replace if damaged. Verify that vent holes in master cylinder are completely open and free of dirt or debris. Stand master cylinder on wooden block or towel to protect seating surfaces.
2. Inspect cover gasket (8) for cuts, tears or general deterioration. Replace as necessary.

## ASSEMBLY/INSTALLATION

1. See Figure 2-47. Insert original push rod (1) into bore at unthreaded end of cartridge (4). Install spacer (2) over end of push rod. Install retaining ring (3) in groove next to spacer inside cartridge bore. Slide two **new** O-rings (5) into external grooves on cartridge (4). Insert cartridge into master cylinder body (6). Align slot at top of cartridge with key in master cylinder body. Push cartridge through master cylinder body until cartridge bottoms in bore. Install locknut (7). Tighten locknut to 30-40 ft-lbs (41-54 Nm) torque.
2. Place protective shields over vise jaws and lightly clamp master cylinder body in vise with push rod (1) upright.
3. Place return spring (15) over push rod (1). Place spring retainer (16) on top of spring. Slip large I.D. end of dust boot (17) over retainer and spring. Seat the small I.D. end of boot against spring retainer (16). Be sure vent/drain hole in boot is at the bottom.
4. Place washer (18) on top of boot. Push down on washer to compress spring (15). With spring compressed, install **new** retaining ring (19) in groove of push rod (1).

**⚠CAUTION**

**To avoid leakage after assembly, verify that washers (12), bolt (13), banjo fitting (11) and bore of master cylinder (6) are completely clean.**

5. Position master cylinder next to sprocket cover. Position **new** steel/rubber washers (12) on each side of banjo fitting (11). Insert bolt (13) through washers and banjo fitting. Thread bolt into cartridge and tighten to 17-22 ft-lbs (23-30 Nm) torque.
6. Position large I.D. end of dust boot (17) into groove in master cylinder body (6).

7. Install clamp (35), screw (37) and lockwasher (36) to secure rear brake line (31) to sprocket cover. Tighten clamp screw to 45-65 **in-lbs** (5-7 Nm) torque.

8. Install exhaust pipes. Install **new** locknut at exhaust support bracket. Tighten to 20-40 ft-lbs (27-54 Nm) torque.

9. Turn push rod (1) at flats to thread on rod end (21).

10. Position master cylinder body (6) over mounting holes in sprocket cover. Secure with screws (27) and lockwashers (28). Tighten screws to 155-190 **in-lbs** (17.5-21.5 Nm) torque.

11. Install footrest assembly.

12. Adjust push rod until brake pedal is parallel with floor, as shown in Figure 2-48. Tighten locknut (20).

13. With the master cylinder in a level position, verify that the brake fluid level in the reservoir is 1/8 in. (3.2 mm) from the top. Add D.O.T. 5 SILICONE HYDRAULIC BRAKE FLUID if necessary.

**⚠WARNING**

**A plugged or covered relief port can cause brake drag or lockup, which may result in loss of vehicle control and possible personal injury.**

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

15. Install cover gasket (8), cover (9) and screws (10).

16. Bleed brake system. See BLEEDING HYDRAULIC SYSTEM in this section.

17. Remove master cylinder cover (9). Verify proper fluid level- see Step 12.

18. Reinstall master cylinder cover. Tighten screws to 10-15 **in-lbs** (1.1-1.7 mm) torque.

19. Test operation of brake lamp with the rear brake applied and the ignition/light switch turned ON.

# REAR BRAKE LINKAGE AND SPROCKET COVER

## REMOVAL (Figure 2-49)

1. Remove exhaust system. See EXHAUST SYSTEM, REMOVAL.
2. Remove screw (9) and clip (10) to free rear brake line from sprocket cover (18).
3. Remove two socket head screws (5) and lockwashers (6) to free rear brake master cylinder from sprocket cover (18).
4. Loosen locknut (8). Turn push rod (7) at flats until free of rod end (19).
5. Remove three sprocket cover screws (11) and washers (12). As a single assembly, remove sprocket cover (18), footrest mount (15), rear brake pedal (16) and master cylinder stiffener (17).
6. Remove cotter pin (13) and nut (14) from inboard side of sprocket cover. Discard cotter pin. Remove footrest mount, rear brake pedal and master cylinder stiffener.

## INSTALLATION (Figure 2-49)

1. Install removed components in the reverse order of the removal procedures, and in accordance with the following special installation instructions:

**⚠WARNING**

**Footrest mount must be installed in the orientation which allows footrest to fold up at a 45° angle (from vertical) toward rear of motorcycle. This angle allows footrest to fold up if it accidently strikes the ground when making a sharp turn. Failure to set footrest to the proper fold-up angle could result in personal injury.**

- Tighten footrest mount nut (14) to 35-40 ft-lbs (47-54 Nm) torque.
- Install a **new** cotter pin (13) through nut (14) and footrest mount (15). Bend ends of cotter pin outward to secure.
- Tighten three sprocket cover screws (11) to 90-110 **in-lbs** (10.2-12.4 Nm) torque.
- Tighten two master cylinder screws (5) to 155-190 **in-lbs** (17.5-21.5 Nm) torque.
- Adjust rear brake pedal. See REAR BRAKE MASTER CYLINDER, ADJUSTMENT, BRAKE PEDAL.
- Install exhaust system. See EXHAUST SYSTEM, INSTALLATION.

1. **Bolt**
2. **Nut**
3. **Wave washer**
4. **Footrest**
5. **Socket screw (2)**
6. **Lockwasher (2)**
7. **Push rod**
8. **Locknut**
9. **Screw**
10. **Clip**
11. **Socket screw (3)**
12. **Washer (3)**
13. **Cotter pin**
14. **Nut**
15. **Footrest mount**
16. **Rear brake pedal**
17. **Master cylinder stiffener**
18. **Sprocket cover**
19. **Rod end**

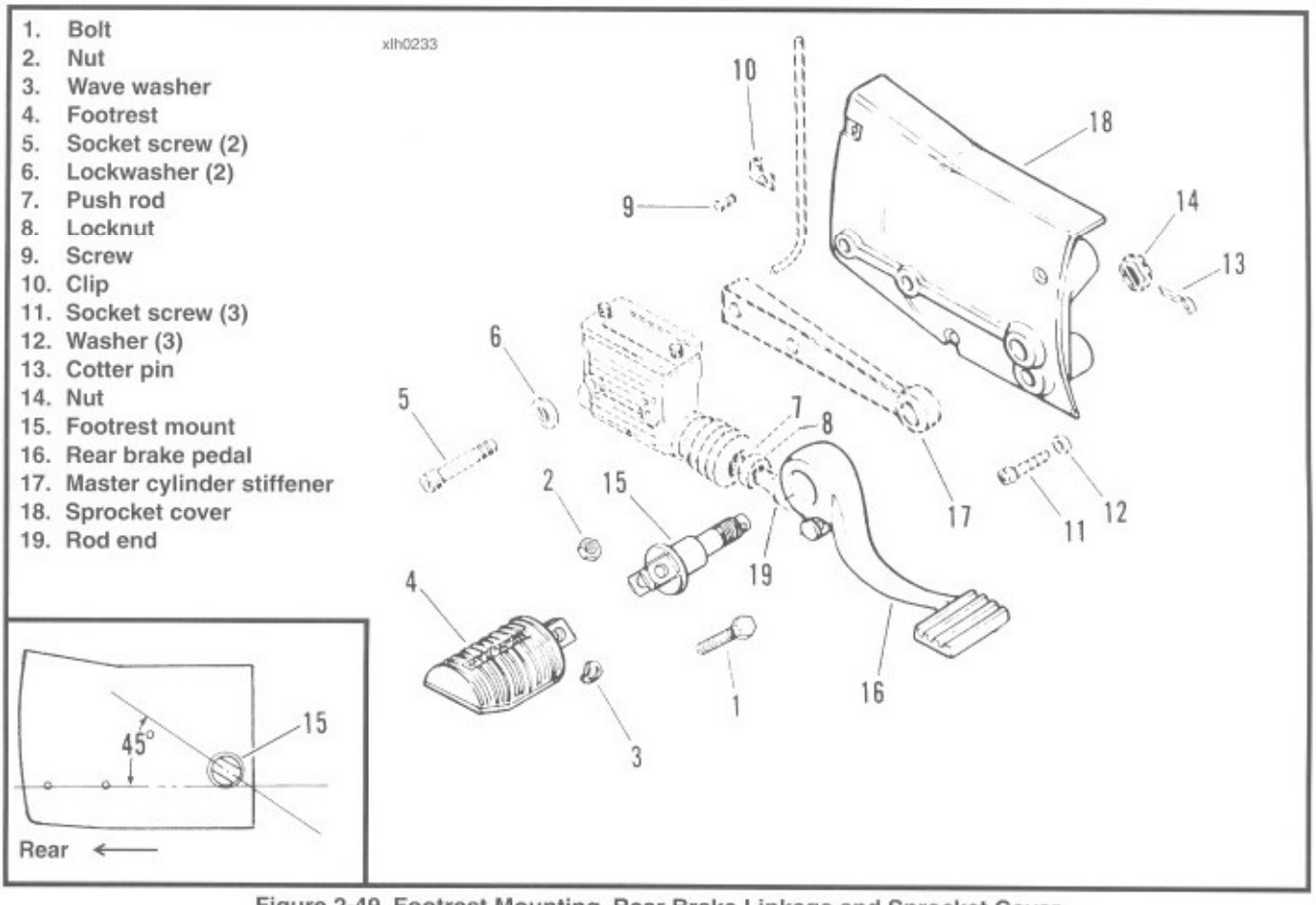



**Figure 2-49. Footrest Mounting, Rear Brake Linkage and Sprocket Cover**

# FRONT BRAKE CALIPER

## REMOVAL/DISASSEMBLY (Figure 2-50)

1. Remove upper mounting screw (1) and lower mounting pin (2) to release caliper assembly (16).
2. Remove banjo fitting bolt and steel/rubber washers to disconnect brake line from caliper. Discard washers.
3. Move caliper assembly to bench area. Remove retainer screw (15), pad retainer (14) and inboard pad (9).
4. Remove pad holder (7) with attached outboard pad (9) and spring clip (8). Push pad free from pad hold-down spring clip (8) to remove pad (9) from pad holder (7).
5. Insert a small screwdriver into notched groove at bottom of piston bore to pry out retaining wire (13). Remove dust boot (12) and discard.

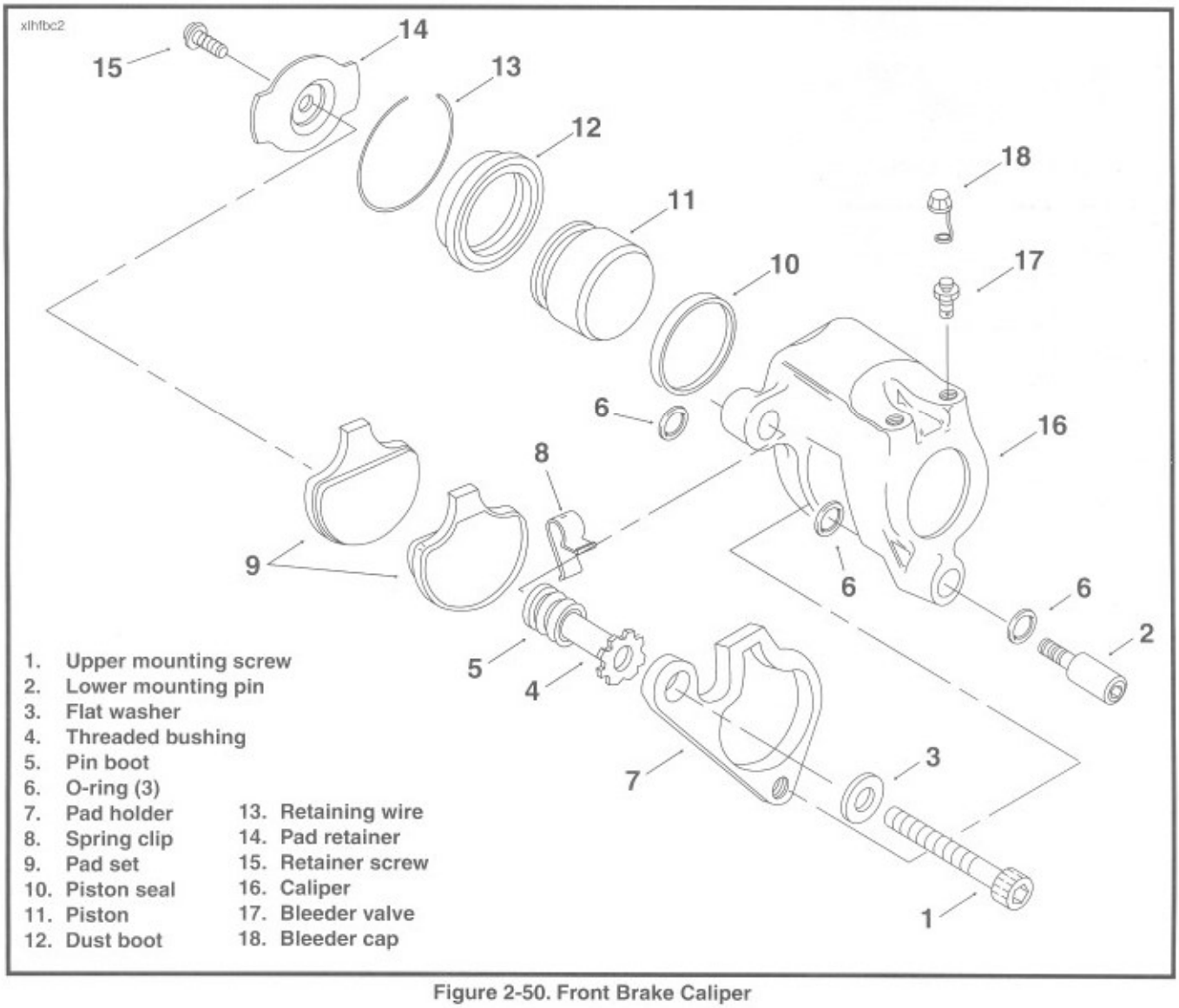
**⚠WARNING**

**Wear safety glasses when removing piston from caliper using air pressure, piston may be ejected with considerable force. Wear heavy gloves or hold piston with heavy towel to prevent personal injury.**

**⚠CAUTION**

**Exercise care to avoid dropping piston on hard surface. Damage to surface may result in a sticking piston or fluid leakage.**

6. Apply low air pressure to hydraulic brake line inlet to remove piston.
7. Pull threaded bushing (4) out of bushing bore. Remove pin boot (5) from groove in caliper.
8. Pry piston seal (10) and three O-rings (6) out of their respective grooves. Discard piston seal and O-rings.




1. Upper mounting screw
2. Lower mounting pin
3. Flat washer
4. Threaded bushing
5. Pin boot
6. O-ring (3)
7. Pad holder
8. Spring clip
9. Pad set
10. Piston seal
11. Piston
12. Dust boot
13. Retaining wire
14. Pad retainer
15. Retainer screw
16. Caliper
17. Bleeder valve
18. Bleeder cap

Figure 2-50. Front Brake Caliper

## CLEANING, INSPECTION AND REPAIR (Figure 2-50)

**⚠WARNING**

- **Clean brake system components using denatured alcohol. Do not use mineral-base cleaning solvents such as gasoline or paint thinner. Use of mineral-base solvents causes deterioration of the rubber parts that continues after assembly and can result in improper and unsafe brake operation leading to personal injury. Do not allow brake fluid, solvents, lubricants, etc. to contact brake disc or brake pad friction material; reduced vehicle braking ability will otherwise occur, possibly resulting in personal injury. Thoroughly clean any foreign substances from brake disc. Replace brake pads (in sets only) which have been exposed to substances such as brake fluid, solvents, lubricants, etc.**
- **ALWAYS wear safety glasses when cleaning with solvents or using compressed air to blow dry components.**

1. Thoroughly clean brake system components using denatured alcohol. Blow dry using compressed air. Carefully inspect all components. Replace any parts that appear damaged or worn. Do not hone caliper piston bore.
2. Inspect brake disc. Replace if warped or badly scored. Minimum acceptable disc thickness is stamped on disc.
3. Inspect brake pads for damage or wear. Replace both pads as a set if the friction material of either pad is worn to 1/16 in. (1.6 mm) or less.

**⚠WARNING**

**Always replace brake pads in complete sets for correct and safe brake operation. Never replace just one pad. Inconsistent brake operation may result, leading to personal injury.**

## ASSEMBLY

1. See Figure 2-50. Install **new** seal (10) in groove of caliper piston bore (16). Install **new** O-ring (6) in groove of threaded bushing bore. Install **new** O-rings (6) in each groove of lower mounting pin bore. Apply DOW CORNING 44 GREASE (tube marked "PIN LUBE" in service parts kit) to interior cavity of pin boot (5). Insert flanged end of pin boot in groove of threaded bushing bore.
2. Install dust boot (12), with its concave side facing piston (11), over top of piston. Seat the inner lip of dust boot in groove at top of piston.
3. Apply light coat of NovaGard silicone grease (marked "PISTON LUBE" in service parts kit) to piston O.D., including chamfer. Apply a light coat to caliper piston bore (16) and I.D. of installed piston seal (10). Install piston (with dust boot) into caliper piston bore. Use a "C" clamp to press in piston, if necessary.

*NOTE*

*To ensure proper brake pad-to-brake disc clearance when the caliper is installed, piston must be pressed all the way into the bore whenever new brake pads are used.*

4. Install outer lip of dust boot (12) into caliper piston bore (16). With the gap at the top, compress and install retainer wire (13) within caliper piston bore. Press retainer wire firmly against piston dust boot.
5. Apply light coat of DOW CORNING 44 GREASE (marked "PIN LUBE" in service parts kit) to the following:

- I.D. of caliper (16) threaded bushing bore (upper)
- O.D. of threaded bushing (4)
- I.D. of caliper (16) mounting pin bore (lower)

6. Insert threaded bushing (4) through the installed pin boot (5) and O-ring (6) of the caliper threaded bushing bore. Press threaded bushing into bore until free end of pin boot seats in groove next to flanged head of threaded bushing.

**⚠WARNING**

**Wear safety glasses when installing the spring clip. The spring clip can fly outward with great force resulting in personal injury.**

7. See Figure 2-50 and 2-51. Lay down pad holder (7) on a firm flat surface with upper mounting screw (threaded bushing) hole positioned at the upper right.
8. Hook lip on looped end of clip (8) under inside edge of pad holder at top. Holding pad holder down, raise clip to snap in place on pad holder. Pick up pad holder to verify that clip is firmly attached. Lay pad holder back down in the same orientation.
9. With black insulator backing facing pad holder, center outboard pad (9) within pad holder. In this position, tang of pad rests on clip loop while bottom of pad slightly enters opening of pad holder. Push down on tang until pad lies flat. Pick up pad holder to verify that pad is firmly attached. One lip on clip should be caught on pad holder, the other on tang of pad.

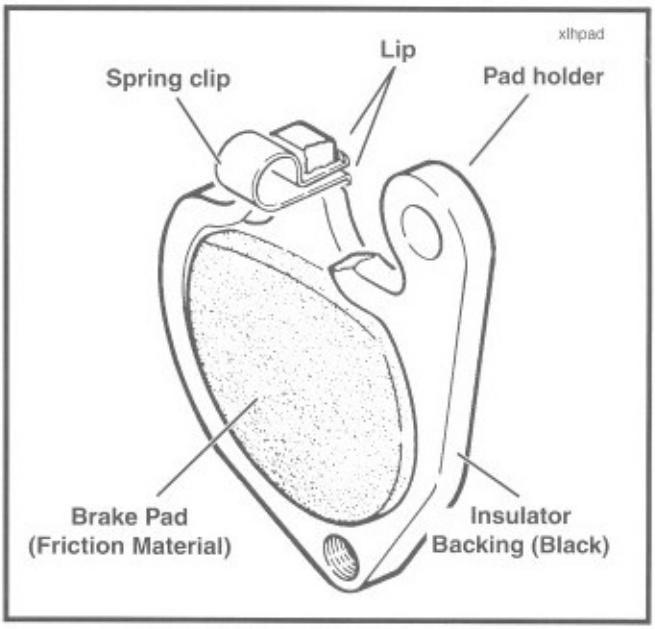



**Figure 2-51. Spring Clip Installation**

10. See Figure 2-50. Insert the assembly (outboard pad, pad holder and spring clip) into place on caliper (16) with insulator side of pad against face of piston (11).

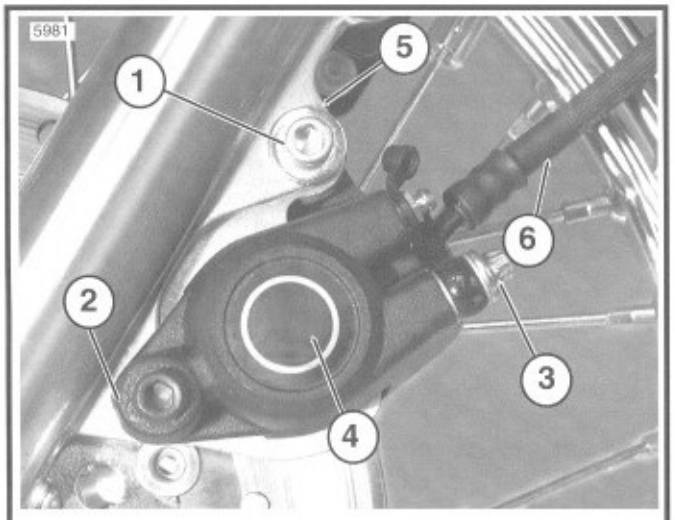
*NOTE*

*The spring clip loop and friction material must face away from the piston. If it is not, then remove the pad holder and reassemble the parts correctly.*

11. Place inboard pad (9) (pad without insulator) in recessed seat machined into caliper (16).
12. Position pad retainer (14) within counterbore at inboard end of caliper. Insert self-tapping retainer screw (15) through center hole in pad retainer and thread into hole in pad. Tighten screw to 40-50 **in-lbs** (4.5-5.6 Nm).

## INSTALLATION

1. See Figure 2-50. Apply light coat of DOW CORNING 44 GREASE (marked "PIN LUBE" in service parts kit) to O.D. of lower mounting pin (2).
2. See Figure 2-52. Position caliper (4) so that brake disc is situated between friction pads and lower mounting hole in caliper is aligned with lower mounting lug on front fork.




| | | | |
|---|---|---|---|
| 1. | **Upper mounting screw** | 4. | **Caliper** |
| 2. | **Lower mounting pin** | 5. | **Upper mounting lug** |
| 3. | **Banjo bolt** | 6. | **Brake line** |

**Figure 2-52. Front Brake Caliper Mounting**

**⚠WARNING**

**Verify that caliper bushings are installed in the mounting lugs on the fork. Installing caliper without bushings will result in improper caliper location and possible locked brake leading to personal injury.**

**⚠CAUTION**

**See Figure 2-53. Position the flange of the threaded bushing beneath the rivet on the pad holder. The rivet body must engage one of the U-shaped notches on the edge of the flange. If the bushing is not properly positioned, damage to the rivet will occur when the caliper mounting fasteners are tightened.**

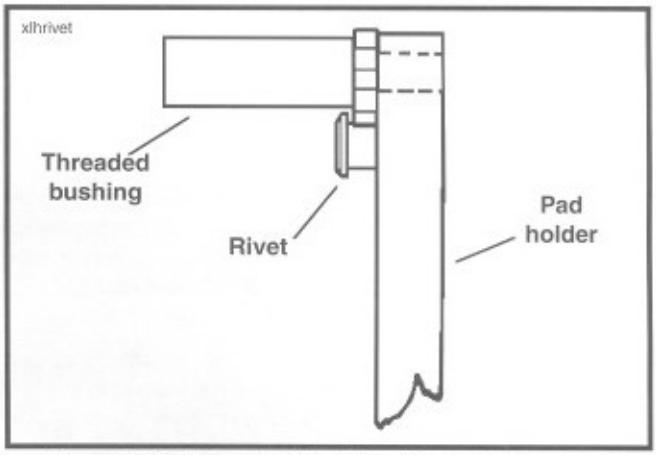



**Figure 2-53. Threaded Bushing/Rivet Engagement**

3. See Figure 2-50. Insert lower mounting pin (2) through caliper (16) and front fork lower mounting lug. Thread pin into tapped hole at lower end of pad holder (7). Tighten pin to 25-30 ft-lbs (34-41 Nm) torque.
4. Align upper mounting hole in caliper (with threaded bushing) with front fork upper mounting lug.
5. Install upper mounting screw (1) with spacer washer (3) through front fork upper mounting lug and pad holder (7). Thread the screw into threaded bushing (4). Tighten screw to 25-30 ft-lbs (34-41 Nm) torque.
6. Install bleeder valve (17) and valve cap (18), if removed. Tighten valve to 80-100 **in-lbs** (9.0-11.3 Nm) torque.
7. See Figure 2-52. Connect brake line (6) to caliper using **new** steel/rubber banjo washers. Tighten banjo fitting bolt (3) to 17-22 ft-lbs (23-30 Nm) torque.
8. With the master cylinder in a level position, verify that the brake fluid level in the reservoir is 1/8 in. (3.2 mm) from the top. Add D.O.T. 5 SILICONE HYDRAULIC BRAKE FLUID if necessary.

**⚠WARNING**

**A plugged or covered relief port can cause brake drag or lockup, which may result in loss of vehicle control and possible personal injury.**

9. Verify proper operation of the master cylinder relief port. Actuate the brake lever with the reservoir cover removed. A slight spurt of fluid will break the surface if all internal components are working properly.
10. Install cover gasket, cover and screws.
11. Depress front brake lever several times to set brake pads to proper operating position within caliper. Bleed brake system. See BLEEDING HYDRAULIC SYSTEM in this section.
12. Remove master cylinder cover. Verify proper fluid level-see Step 8. Reinstall master cylinder cover. Tighten screws to 10-15 **in-lbs** (1.1-1.7 mm) torque.
13. Test operation of brake lamp with the front brake applied and the ignition/light switch turned ON.

*NOTE*

*To allow new brake pads to "wear in" properly with the brake disc, avoid making hard stops for the first 100 miles (160 km).*

# REAR BRAKE CALIPER

## REMOVAL/DISASSEMBLY (Figure 2-54)

1. Remove pin bolts (11). Retract piston (6) slightly within bore of caliper (10) by pushing caliper inward toward wheel. Carefully lift caliper (10) off brake disc and brake pads (4).
2. Remove retainer clip (2). Slide outside brake pad outboard toward shock absorber and off mounting bracket (1). Slide inside brake pad inboard toward wheel and off mounting bracket.
3. Remove pad shims (3).

*NOTE*

*Do not remove pistons from caliper unless there are signs of hydraulic fluid leakage or piston is not operating properly. If piston must be removed, proceed to steps 4 and 5.*

4. Pump brake lever until piston reaches its full travel. Remove banjo fitting bolt and steel/rubber washers to disconnect brake line from caliper. Discard washers.
5. Remove retaining ring (8), dust boot (7), piston (6) and seal (5). Discard dust boot and seal. If piston will not come loose, proceed to step 6.

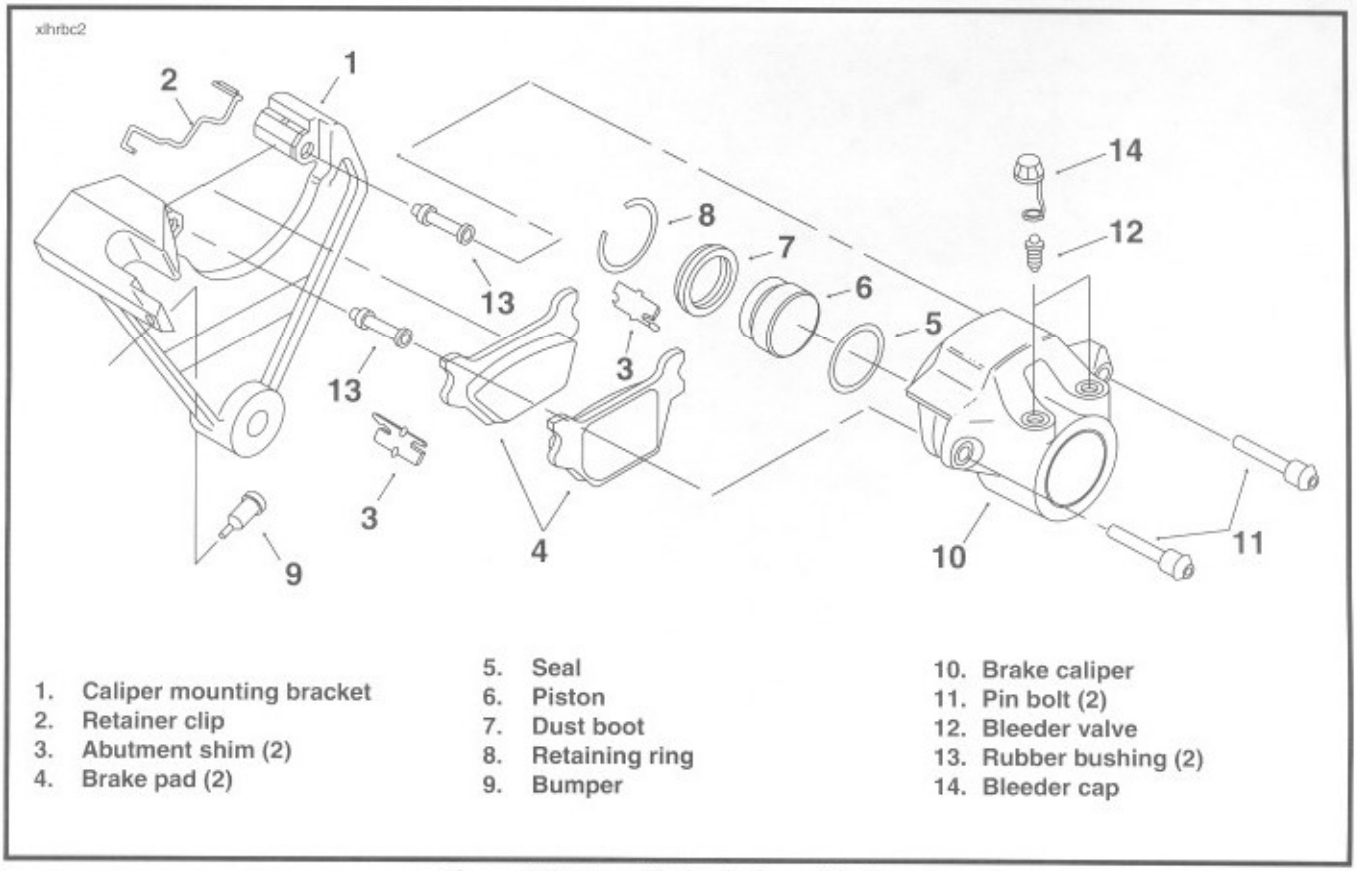
**⚠WARNING**

**Always wear safety glasses when air pressure is used to remove piston from caliper, piston may be ejected with considerable force. Wear heavy gloves or hold piston with heavy towel to prevent personal injury.**

**⚠CAUTION**

**Exercise care to avoid dropping piston on hard surface. Damage to the piston surface may result in a sticking piston or fluid leakage.**

6. Hold caliper with piston facing downward. Place a clean shop towel under piston. Apply low air pressure to hydraulic brake line inlet hole until piston is forced out caliper bore. If piston is tight in bore, tap lightly around caliper while applying air pressure.




1. Caliper mounting bracket
2. Retainer clip
3. Abutment shim (2)
4. Brake pad (2)
5. Seal
6. Piston
7. Dust boot
8. Retaining ring
9. Bumper
10. Brake caliper
11. Pin bolt (2)
12. Bleeder valve
13. Rubber bushing (2)
14. Bleeder cap

Figure 2-54. Rear Brake Pads and Caliper

## CLEANING, INSPECTION AND REPAIR (Figure 2-54)

**⚠WARNING**

- **Clean brake system components using denatured alcohol. Do not use mineral-base cleaning solvents such as gasoline or paint thinner. Use of mineral-base solvents causes deterioration of rubber parts that continues after assembly and can result in improper and unsafe brake operation leading to personal injury. Do not allow brake fluid, solvents, lubricants, etc. to contact brake disc or brake pad friction material or reduced vehicle braking ability will occur, possibly resulting in personal injury. Thoroughly clean all foreign substances from brake disc. Discard brake pads if they have been exposed to brake fluid, solvents, lubricants or similar substances.**
- **ALWAYS wear safety glasses when cleaning with solvents or using compressed air to blow dry components.**

1. Clean brake system components using denatured alcohol. Blow dry using compressed air. Carefully inspect all components. Replace any parts that appear damaged or worn. Replace rubber bushings (13) if damaged or worn. Do not hone caliper piston bore.
2. Inspect brake disc. Replace disc if warped or badly scored. Measure disc thickness for excessive wear. Minimum acceptable thickness is stamped on side of disc.
3. Inspect brake pads for damage or excessive wear. Replace both pads as a set if friction material of either pad is worn to 1/16 in. (1.6 mm) or less.

**⚠WARNING**

**Always replace brake pads in complete sets for correct and safe brake operation. Never replace just one brake pad. Improper or unsafe brake operation could result in personal injury.**

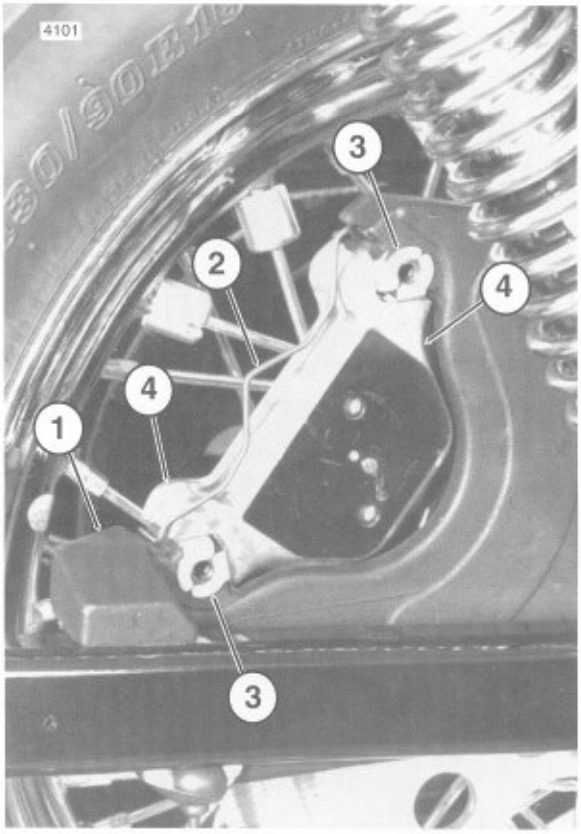
## ASSEMBLY (Figure 2-54)

1. Install **new** seal (5) within groove in piston bore of caliper (10).
2. Install **new** dust boot (7), with its concave side facing piston (6), over top of piston. Seat the inner lip of dust boot in groove at top of piston.
3. Apply light coat of NovaGard silicone grease (marked "PISTON LUBE" in service parts kit) to piston O.D., including chamfer. Apply a light coat to caliper piston bore (10) and I.D. of installed piston seal (5). Install piston (with dust boot) into caliper piston bore. Use a "C" clamp to press in piston, if necessary.

*NOTE*

*To ensure proper brake pad-to-brake disc clearance when the caliper is installed, piston must be pressed all the way into the bore whenever new brake pads are used.*

4. Install outer lip of dust boot (7) into caliper piston bore (10). With the gap at the top, compress and install retainer wire (8) within caliper piston bore. Press retainer wire firmly against piston dust boot.
5. Apply light coat of DOW CORNING 44 GREASE (marked "PIN LUBE" in service parts kit) to I.D. of rubber bushings (13).




1. **Caliper mtg. bracket**
2. **Retainer clip**
3. **Abutment shim (2)**
4. **Brake pad (2)**

**Figure 2-55. Install Retainer Clip and Abutment Shims**

## INSTALLATION (Figures 2-54 and 2-55)

1. Position abutment shims (3) onto upper and lower rails of caliper mounting bracket (1). Position retaining loops of shims against outboard side of mounting bracket rails. Hold both shims in place.
2. With friction material facing brake rotor, install rear brake pads (4) onto abutment shims (3) on mounting bracket (one pad against outboard side of brake rotor, the other pad against inboard side).

**⚠CAUTION**

**Both shims must be correctly positioned on mounting bracket and both rear brake pads must be correctly installed onto abutment shims or rear brake pad drag, uneven pad wear and/or damage to mounting bracket can result.**

3. Position rear brake caliper (10) onto mounting bracket (1) so that caliper straddles brake pads (4). Align mounting holes in caliper with mounting holes in bracket. Apply light coat of DOW CORNING 44 GREASE (marked "PIN LUBE" in service parts kit) to O.D. of two pin bolts (11). Insert pin bolts into mounting holes of caliper and mounting bracket. Tighten pin bolts to 15-20 ft-lbs (20-27 Nm) torque.
4. Install bleeder valve (12) if removed. Tighten valve to 80-100 **in-lbs** (9.0-11.3 Nm) torque. Install bleeder cap (14).
5. Position **new** steel/rubber washers on each side of banjo fitting. Insert bolt through washers and banjo fitting into caliper. Tighten banjo fitting bolt to 17-22 ft-lbs (23-30 Nm) torque.
6. With the master cylinder in a level position, add brake fluid until the fluid level in the reservoir is 1/8 in. (3.2 mm) from the top. Use D.O.T. 5 SILICONE HYDRAULIC BRAKE FLUID.

**⚠WARNING**

**A plugged or covered relief port can cause brake drag or lockup, which may result in loss of vehicle control and possible personal injury.**

7. Verify proper operation of the master cylinder relief port. Actuate the brake pedal with the reservoir cover removed. A slight spurt of fluid will break the surface if all internal components are working properly.
8. Install master cylinder cover gasket, cover and screws.
9. Depress rear brake pedal several times to set brake pads to proper operating position within caliper. Bleed brake system. See BLEEDING HYDRAULIC SYSTEM in this section.
10. Remove master cylinder cover. Verify proper fluid level-see Step 7.
11. Reinstall master cylinder cover. Tighten screws to 10-15 **in-lbs** (1.1-1.7 mm) torque.
12. Turn ignition/light switch to ON and apply rear brake to test operation of brake lamp.

*NOTE*

*To allow new brake pads to "wear in" properly with the brake disc, avoid making hard stops for the first 100 miles (160 km).*

# BRAKE LINES

## FRONT BRAKE LINE (Figure 2-56)

1. Open bleeder nipple cap on front brake caliper. Install end of a length of plastic tubing over caliper bleeder valve, while placing free end in a suitable container. Open bleeder valve about 1/2-turn. Pump brake lever to drain brake fluid.
2. Remove screw (1) and lockwasher (2) to detach brake line clamp (3) from front fork upper bracket (right side).
3. Remove socket head screw (4), flat washer (5), clamp (6) and wire form (7) to detach brake line from stem at bottom of front fork lower bracket.
4. Remove banjo fitting bolt (8) and steel/rubber washers (9) to detach brake line from master cylinder body. Discard washers.
5. Remove banjo fitting bolt (8) and steel/rubber washers (9) to detach brake line from front brake caliper. Discard washers.
6. Carefully inspect the brake line for dents, cuts or other defects. Replace the brake line if any damage is noted.
7. Note that one end of the brake line is mostly thin tube construction, while the other end is flexible hose. Position **new** steel/rubber washers (9) on each side of the banjo fitting on the tube side. Insert bolt (8) through washers and banjo fitting. Loosely install bolt into master cylinder.
8. From the master cylinder, the brake line runs downward in front of the right handlebar, where it turns inboard at the front fork upper bracket. Loosely install clamp (3), lockwasher (2) and screw (1) to attach front brake line to right side of front fork upper bracket.
9. Continue running the brake line downward crossing to the left side of the vehicle under the front fork lower bracket (triple tree).
10. Loosely install wire form (7), clamp (6), flat washer (5) and socket head screw (4) to attach brake line to stem at bottom of front fork lower bracket.
11. Position **new** steel/rubber washers (9) on each side of banjo fitting at free end of brake line. Insert bolt (8) through washers and banjo fitting. Loosely install bolt into caliper.
12. Tighten clamp screw (4) at bottom of front fork lower bracket to 4-10 ft-lbs (5-14 Nm) torque.
13. Tighten banjo fitting bolt (8) into master cylinder to 17-22 ft-lbs (23-30 Nm) torque.
14. Tighten banjo fitting bolt into brake caliper to 17-22 ft-lbs (23-30 Nm) torque.
15. Tighten clamp screw (1) to front fork upper bracket to 15-21 **in-lbs** (1.7-2.4 Nm) torque.

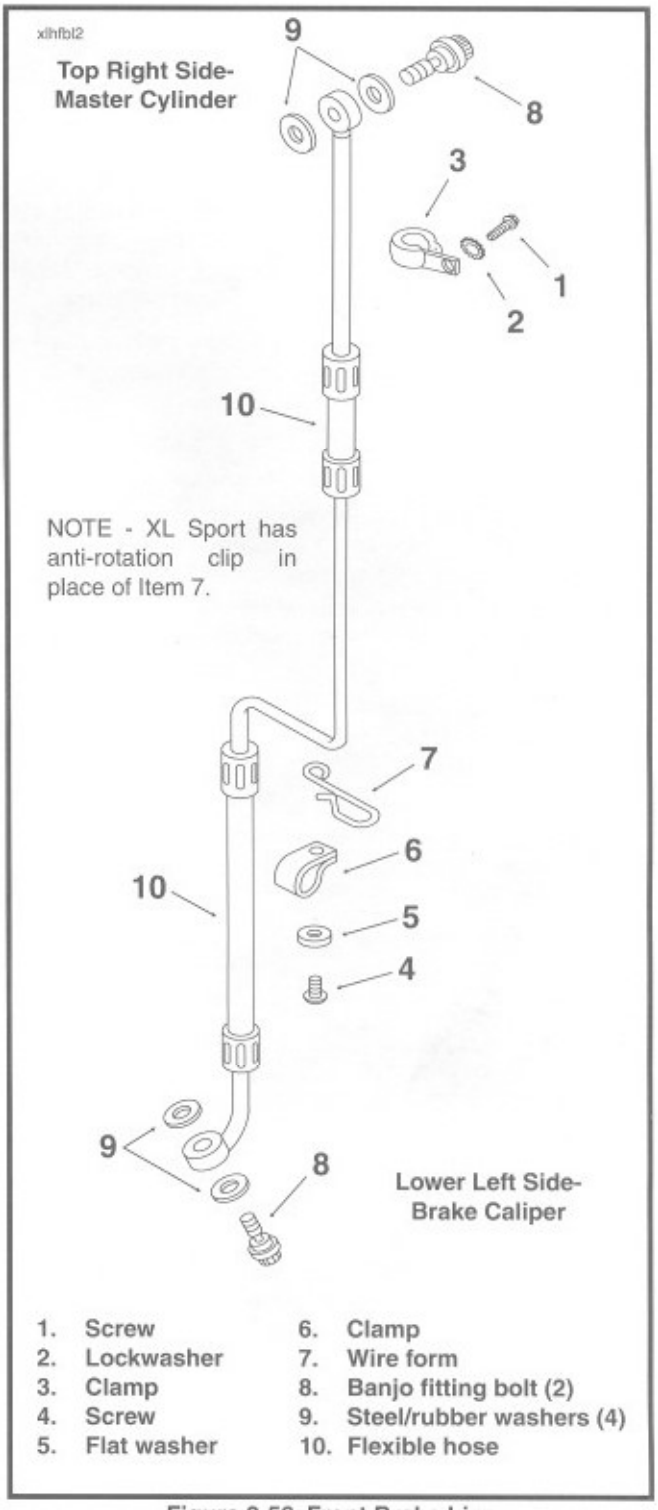
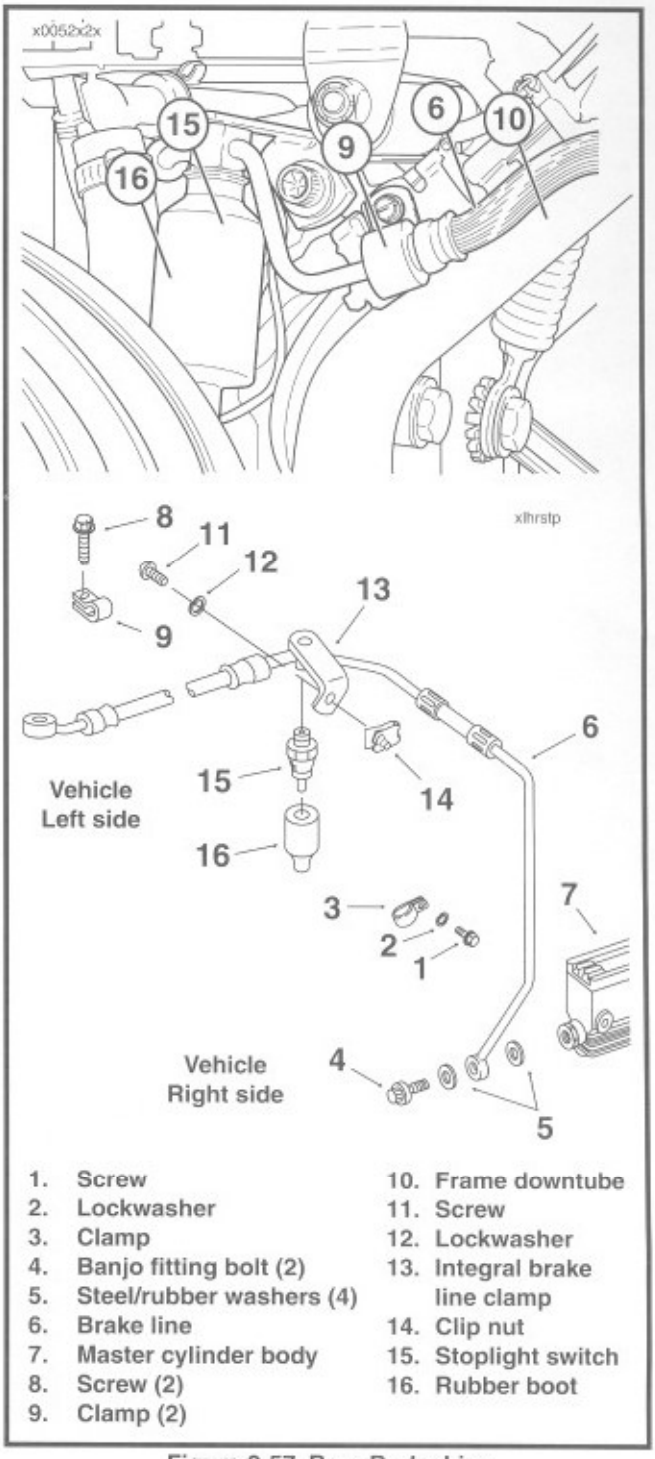



**Figure 2-56. Front Brake Line**

16. Install bleeder valve if removed. Refill master cylinder and bleed brakes. See BLEEDING HYDRAULIC SYSTEM in this section. Test operation of brake lever.
17. Tighten bleeder valve to 80-100 **in-lbs** (9.0-11.3 Nm) torque. Install bleeder cap.
18. Test operation of brake lamp with the front brake applied and the ignition/light switch turned ON.

## REAR BRAKE LINE (Figure 2-57)

1. Open bleeder nipple cap on rear caliper. Install end of a length of plastic tubing over caliper bleeder valve, while placing free end in a suitable container. Open bleeder valve about 1/2-turn. Pump brake pedal to drain brake fluid.
2. Remove screw (1) and lockwasher (2) to detach brake line clamp (3) from sprocket cover. Remove banjo fitting bolt (4) and steel/rubber washers (5) to detach brake line (6) from master cylinder body (7). Discard washers.
3. Remove banjo fitting bolt and steel/rubber washers to detach brake line from rear brake caliper. Discard washers.
4. Remove screws (8) to detach brake line clamps (9) from swing arm and frame downtube (10).
5. Remove screw (11) and lockwasher (12) securing integral brake line clamp (13) to clip nut (14) on flange of frame downtube. Pull terminal sockets from spade connections at bottom of stoplight switch. Unthread switch from tee nut. Remove rubber boot (16).
6. From left side of vehicle, feed **new** brake line beneath oil feed hose, left (forward) of negative battery cable and right (rearward) of positive battery cable to right side of vehicle.
7. Thread stoplight switch (15) to tee nut of brake line. Tighten switch assembly to 7-10 ft-lbs (9-14 Nm) torque. Install boot (16) on stoplight switch. Install terminal sockets on switch spade connections.
8. Install clamp (3), screw (1) and lockwasher (2) to secure rear brake line (6) to sprocket cover. Tighten clamp screw to 45-65 **in-lbs** (5-7 Nm) torque.
9. Install clamps (9), screws (8), to secure rear brake line to swing arm and frame downtube (10). Tighten clamp screws to 15-21 **in-lbs** (1.7-2.4 Nm) torque.
10. Install clip nut (14) on flange of frame downtube. Install screw (11) and lockwasher (12) to secure integral brake line clamp (13) to frame downtube flange. Tighten screw to 5-10 ft-lbs (7-14 Nm) torque.
11. Position **new** steel/rubber washers (5) on each side of banjo fitting. Insert bolt (4) through washers and banjo fitting. Thread bolt into master cylinder and tighten to 17-22 ft-lbs (23-30 Nm) torque.
12. Position **new** steel/rubber washers on each side of banjo fitting. Insert bolt through washers and banjo fitting into caliper. Tighten banjo fitting bolt to 17-22 ft-lbs (23-30 Nm) torque.
13. Install bleeder valve if removed. Refill master cylinder and bleed brakes. See BLEEDING HYDRAULIC SYSTEM in this section. Test operation of rear brake.
14. Tighten bleeder valve to 80-100 **in-lbs** (9.0-11.3 Nm) torque. Install bleeder cap.
15. Test operation of brake lamp with the rear brake applied and the ignition/light switch turned ON.




1. Screw
2. Lockwasher
3. Clamp
4. Banjo fitting bolt (2)
5. Steel/rubber washers (4)
6. Brake line
7. Master cylinder body
8. Screw (2)
9. Clamp (2)
10. Frame downtube
11. Screw
12. Lockwasher
13. Integral brake line clamp
14. Clip nut
15. Stoplight switch
16. Rubber boot

Figure 2-57. Rear Brake Line

# BLEEDING HYDRAULIC SYSTEM

## GENERAL (Figure 2-58)

Bleed the hydraulic brake system anytime a hydraulic brake line, brake master cylinder or brake caliper has been opened, or whenever brake lever/pedal operation feels "spongy." Bleeding evacuates air from the system leaving only incompressible hydraulic fluid.

**⚠WARNING**

- **Harley-Davidson recommends all brake service be performed by a Harley-Davidson dealer or other qualified mechanic.**
- **Brake fluid can cause irritation of eyes and skin and can be harmful if swallowed. In case of skin or eye contact, flush with plenty of water. Seek medical attention for eyes. If fluid is swallowed, administer two tablespoons of salt in a glass of warm water to induce vomiting. Call a doctor immediately. ALWAYS KEEP BRAKE FLUID OUT OF THE REACH OF CHILDREN.**

*NOTE*

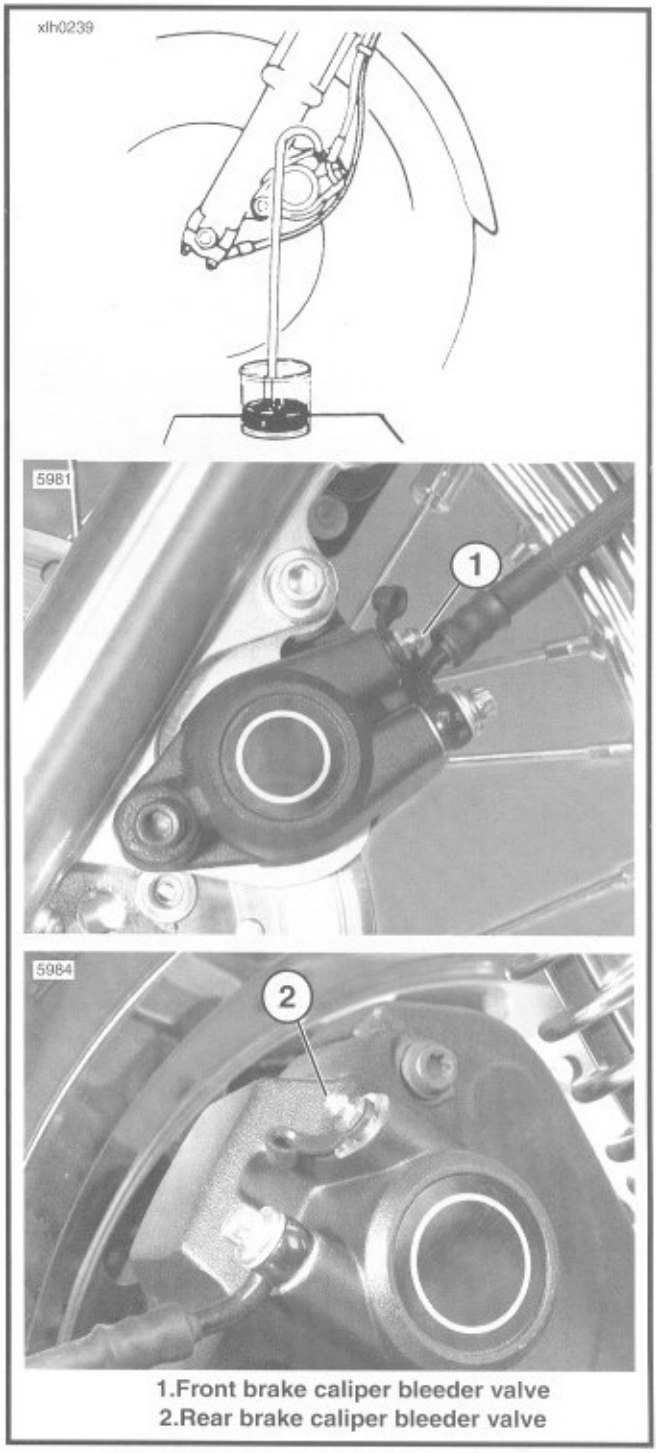
*Hydraulic brake fluid bladder-type pressure equipment can be used to fill brake master cylinders through the bleeder valve. Remove master cylinder reservoir cover so that system cannot pressurize. Do not use pressure bleeding equipment when the hydraulic system is sealed with master cylinder reservoir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

1. Install end of a length of plastic tubing over caliper bleeder valve. Place free end of tube in a clean container. Stand motorcycle upright.
2. Add D.O.T. 5 SILICONE HYDRAULIC BRAKE FLUID to master cylinder reservoir until the fluid level is 1/8 in. (3.2 mm) from the top. Do not reuse brake fluid.
3. Depress and hold brake lever/pedal to build up hydraulic pressure.
4. Open bleeder valve about 1/2-turn. Brake fluid will flow from bleeder valve through tubing. Close bleeder valve when brake lever/pedal has moved 1/2 to 3/4 of its full range of travel. Allow brake lever/pedal to return slowly to its released position.
5. Repeat Steps 2-4 until all air bubbles are purged.
6. Final tighten bleeder valve to 80-100 **in-lbs** (9.0-11.3 Nm) torque. Install bleeder cap. Add brake fluid to master cylinder reservoir until fluid level is about 1/8 in. (3.2 mm) from the top. Do not reuse brake fluid. Final tighten master cylinder reservoir cover screws to 10-15 **in-lbs** (1.1-1.7 Nm) torque.

**⚠WARNING**

**Always test motorcycle brakes at low speed after completing repairs or bleeding the system. Improper or unsafe brake operation could result in personal injury.**

7. Test ride motorcycle. Repeat the above bleeding procedure if brakes feel spongy.




**1.Front brake caliper bleeder valve**
**2.Rear brake caliper bleeder valve**

**Figure 2-58. Bleeding Hydraulic System**

# FRONT FORK

## GENERAL

The front fork consists of two telescoping tube/slider assemblies. Each tube/slider assembly has an internal compression spring, which supports the forward weight of the vehicle/rider and extends and retracts to cushion the ride over rough or irregular road surfaces. An oil-filled damping mechanism controls the telescoping action of each tube/slider assembly.

### Changing the Fork Oil (Figure 2-59)

1. Remove drain screw/washer (4) from bottom of one slider (2). Drain fork oil by repeatedly compressing front suspension.

*NOTE*

*If fork oil is emulsified, aerated or light brown in color, then it has been contaminated by water. Replace fork oil seals (see Steps 1 and 2 of DISASSEMBLY procedure).*

2. Repeat Step 1 for opposite side fork.

3. Block motorcycle under frame so that the front wheel is raised off the ground slightly; this enables front fork to extend fully and allows most of spring (10) preload (compression force) to be relieved.

**⚠WARNING**

**Always wear safety glasses when servicing fork assemblies. Do not attempt to remove tube caps (3) from slider tubes (1) without first relieving spring (10) preload in the manner specified or tube caps and springs might fly outward with great force, possibly resulting in personal injury.**

4. Remove tube cap (3) with O-ring (5) from each slider tube (1). Replace the O-ring if damaged or worn.

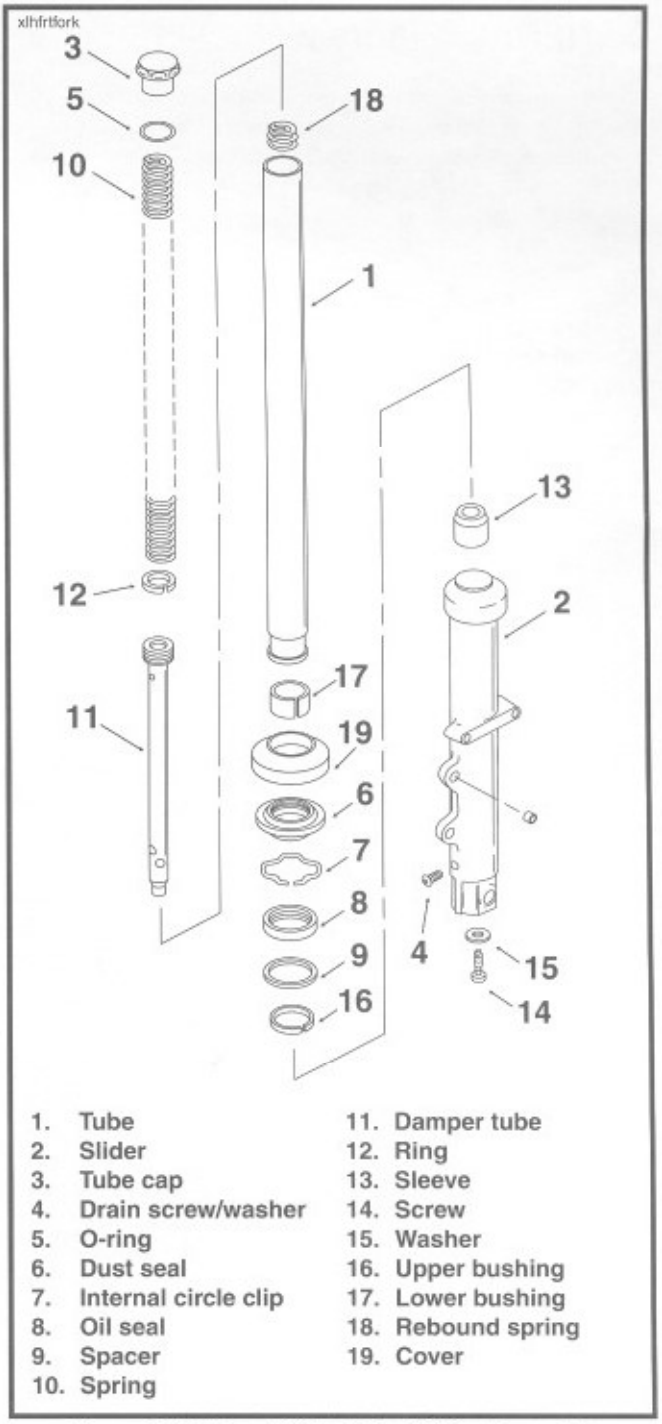
*NOTE*

*A fork that has been disassembled, cleaned and reassembled is considered a "DRY" fork, since its internal components are completely free of oil. A fork that has just been drained of oil, but has not been disassembled and cleaned, is considered a "WET" fork, since its internal components remain coated with a quantity of residual oil. A DRY fork requires more replacement oil than a WET fork.*

5. On all models, except XLH 883 Hugger and XL1200S Sport fill each slider tube/slider assembly with 9.0 fl oz. (266 ml) (WET fork) or 10.2 fl oz. (302 ml) (DRY fork) of TYPE "E" FORK OIL. On XLH 883 Hugger models only, fill each slider tube/slider assembly with 10.7 fl oz. (317 ml) (WET fork) or 12.1 fl oz. (358 ml) (DRY fork) of TYPE "E" FORK OIL.

6. Install each slider tube cap (3) with O-ring (5).

7. Lower motorcycle to the ground.




1. Tube
2. Slider
3. Tube cap
4. Drain screw/washer
5. O-ring
6. Dust seal
7. Internal circle clip
8. Oil seal
9. Spacer
10. Spring
11. Damper tube
12. Ring
13. Sleeve
14. Screw
15. Washer
16. Upper bushing
17. Lower bushing
18. Rebound spring
19. Cover

**Figure 2-59. Front Slider Tube/Slider Assembly**

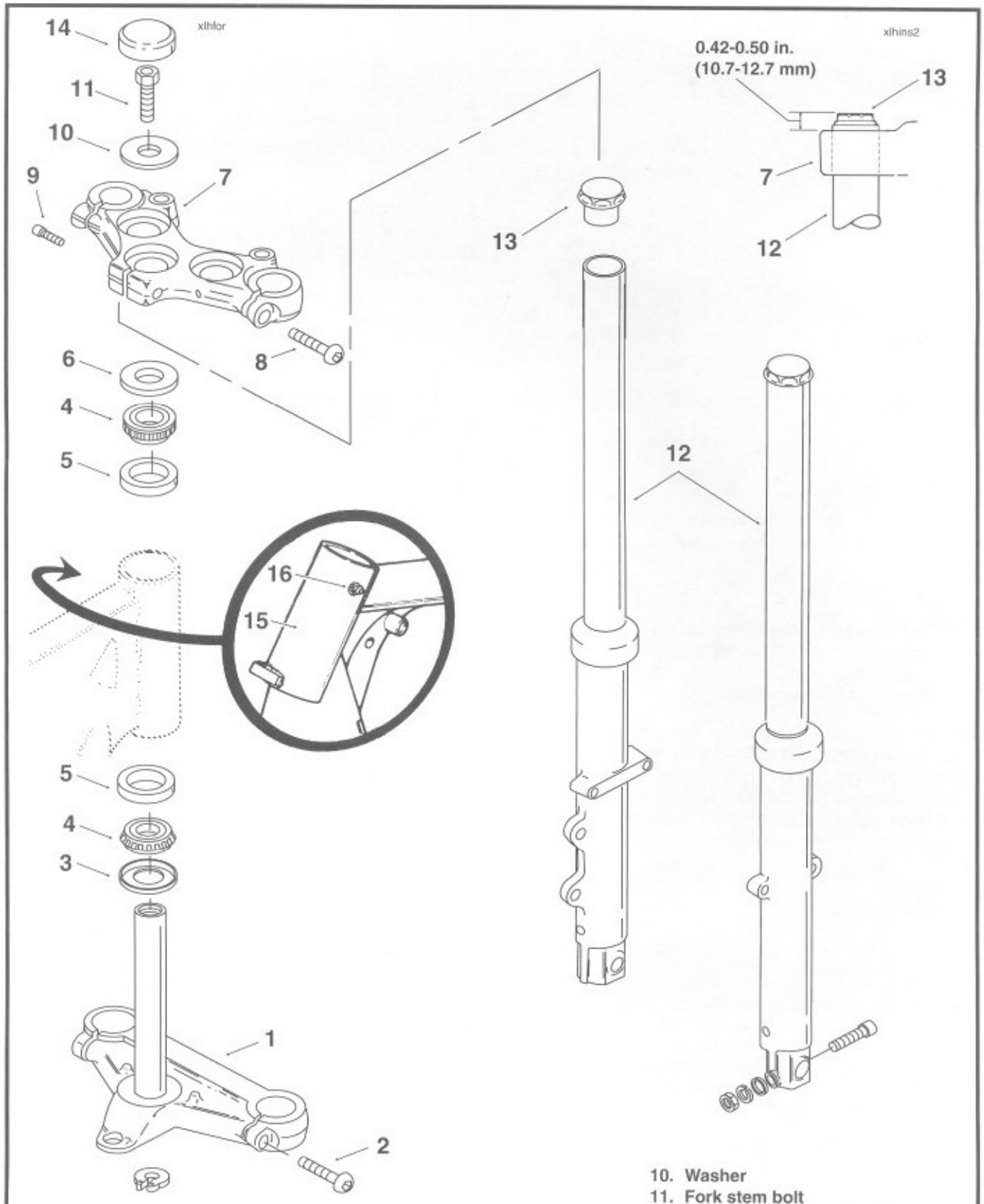
## REMOVAL

1. Remove front wheel assembly and front brake caliper. See FRONT WHEEL in this section.

2. Remove front fender mounting screws and locknuts. Remove fender.

3. See Figure 2-60. Loosen front fork upper and lower bracket pinch screws (8 and 2).

4. Slide fork sides (12) downward to remove from front fork brackets (7 and 1).




1. Front fork lower bracket and stem
2. Pinch screw, lower (2)
3. Dust shield, lower
4. Bearing cone (2)
5. Bearing cup (2)
6. Dust shield, upper
7. Front fork upper bracket
8. Pinch screw, upper (2)
9. Fork stem clamp screw
10. Washer
11. Fork stem bolt
12. Fork (front slider and tube assembly) (RH and LH)
13. Tube cap (2)
14. Stem bolt cap (XLH 1200 only)
15. Steering head (part of frame)
16. Grease fitting

Figure 2-60. Front Fork Assembly

## DISASSEMBLY (Figure 2-59)

1. Remove drain screw/washer (4) from slider (2). Remove tube cap (3) from slider tube (1). Drain fork oil. Remove O-ring (5) from tube cap (3). Remove spring (10) from slider tube (1).
2. Remove cover (19) and dust seal (6). Compress internal circle clip (7). Remove clip from groove in top of slider (2) bore.
3. Remove screw (14) and washer (15) from bottom of slider.

*NOTE*

*Since there is little resistance to damper tube (11) rotation within slider tube (1) when removing screw (14), use an air impact wrench for best results.*

4. Withdraw slider tube (1) from slider (2) until lower bushing (17) on slider tube contacts upper bushing (16) in slider. Use lower bushing on slider tube in a "slide hammer motion" to gently tap out oil seal (8), spacer (9) and upper bushing from slider bore.
5. Remove sleeve (13). Sleeve will be found within slider (2) or on bottom end of damper tube (11).
6. Insert a small diameter rod through opening in bottom of slider tube (1) to remove damper tube (11) assembly.
7. Remove rebound spring (18) from damper tube (11). Remove damper tube ring(s) (12) from damper tube. Remove lower bushing (17) from damper tube only if replacement is necessary.

## CLEANING, INSPECTION, AND REPAIR (Figure 2-59)

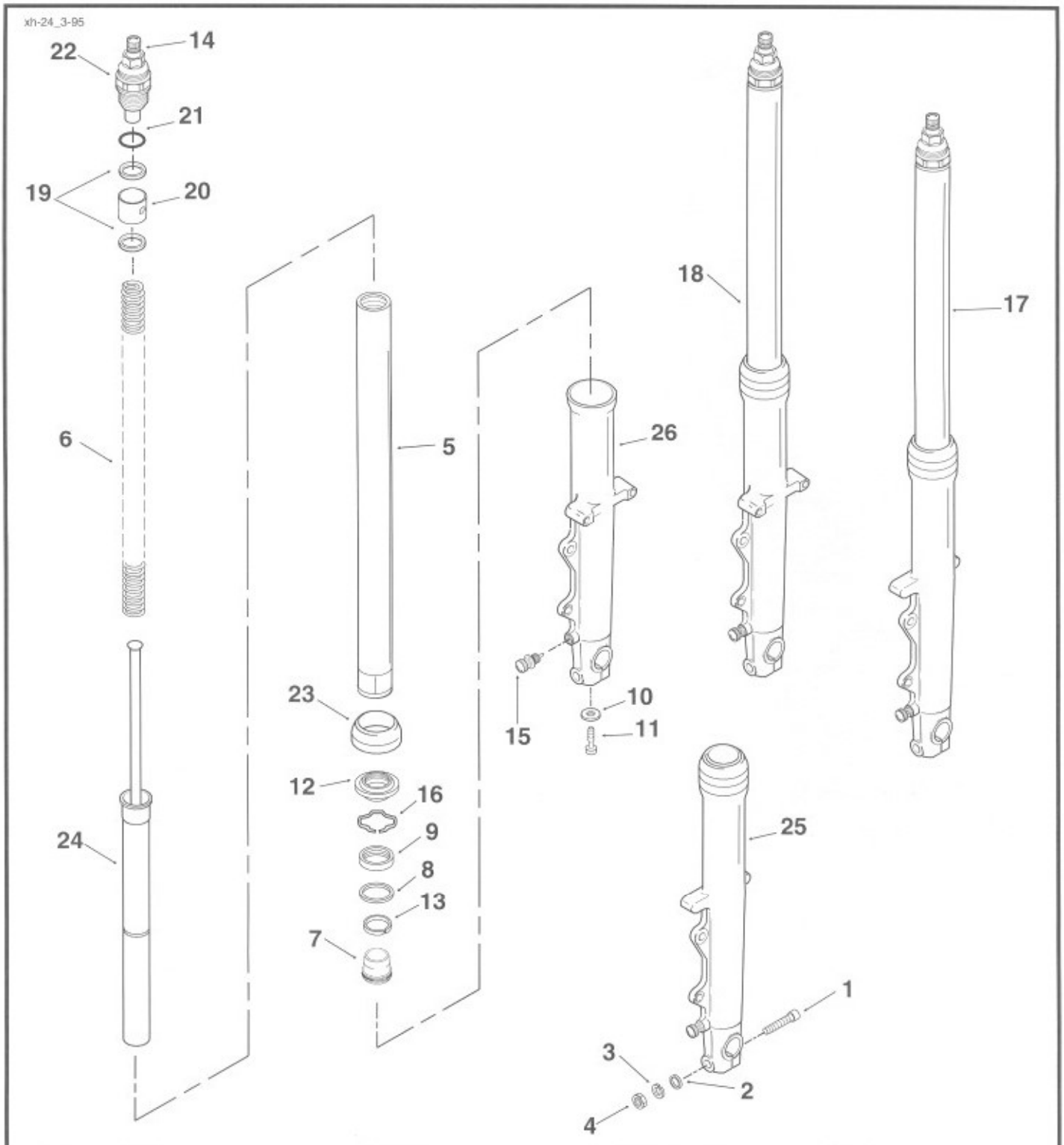
1. Thoroughly clean and inspect all parts. Replace any parts that are bent, broken or damaged.
2. Inspect the O-ring (5) for damage, wear or general deterioration; replace as necessary. Replace all other removed seals.
3. Inspect damper tube ring(s) (12). Replace ring(s) if damaged or excessively worn.
4. Check dust seal (6) where it contacts slider tube (1). Dust seal should provide continuous contact against slider tube and should not show excessive wear. Check slider tube where it is contacted by seal. Tube surface should be shiny, smooth and free of scoring or abrasions.
5. Inspect small hole in groove of slider tube lower end. Verify that hole is unobstructed.

## ASSEMBLY (Figure 2-59)

1. Install new lower bushing (17) in groove of slider tube (1), if removed. Expand bushing only enough to fit over tube.
2. Install damper tube ring(s) (12) into groove(s) of damper tube (11). Place rebound spring (18) over damper tube. Insert damper tube into slider tube (1).
3. Insert spring (10) into slider tube (1) with the tapered end down. Push damper tube (11) through opening at bottom of slider tube using spring (10). Place sleeve (13) over end of damper tube.
4. Install slider tube (1) assembly into slider (2). Install screw (14) with washer (15) at bottom of slider. Move slider tube through its full range of travel within slider several times to verify proper component alignment. Then, applying downward force on spring (10), final tighten screw (14).
5. Place upper bushing (16), spacer (9) (concave side downward), oil seal (8) (lettering side upward) and FORK SEAL AND BUSHING INSTALLATION TOOL (Part No. HD-36583) over slider tube (1). Install bushing, spacer and seal into slider (2) bore by tapping components downward with the installation tool. Install internal circle clip (7) into groove in top of slider bore.
6. Install dust seal (6) and cover (19) at top of slider (2). Install drain screw/washer (4) into lower end of slider.
7. Pour 10.2 fl oz. (302 ml) (all models except XLH 883 Hugger) or 12.1 fl oz. (358 ml) (XLH 883 Hugger models only) of TYPE "E" FORK OIL into top end of slider tube (1). Install slider tube cap (3) with O-ring (5).

## INSTALLATION (Figure 2-60)

1. Insert fork slider (12) through front fork lower (1) and upper (7) brackets. Position slider tubes so that top of each tube cap (13) extends 0.42-0.50 in. (10.7-12.7 mm) above top surface of front fork upper bracket.
2. On models with directional lamps mounted to front fork bracket, hold directional lamp mounting brackets upright. On all models, tighten front fork upper and lower bracket pinch screws (8 and 2) to 30-35 ft-lbs (41-47 Nm) torque.
3. Install front fender using original fasteners. Tighten fasteners to 9-13 ft-lbs (12-18 Nm) torque.
4. Install front wheel assembly and front brake caliper. See FRONT WHEEL in this section.




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

Figure 2-61. XL1200 Sport Front Fork Assembly

## DISASSEMBLY - XL 1200S

1. See Figure 2-62. Remove the stopper ring (1).

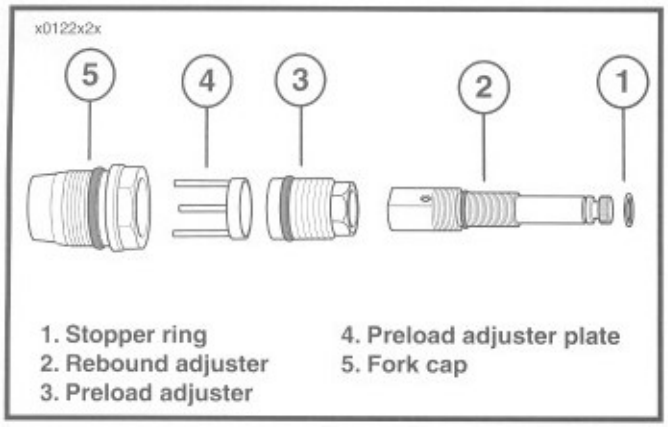



**Figure 2-62.**

2. Remove the spring preload adjuster (3).

*NOTE*

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

3. Unthread the fork cap (5) from the fork tube and allow the fork leg to drop, exposing the spring.

4. See Figure 2-63. Set the Fork Spring Compression tool (HD-41549A) on the spring collar. Turn screws in to engage holes in collar. Compress the spring until the Spring Plate tool (HD-41551) can be positioned between the spacer and the spring collar.

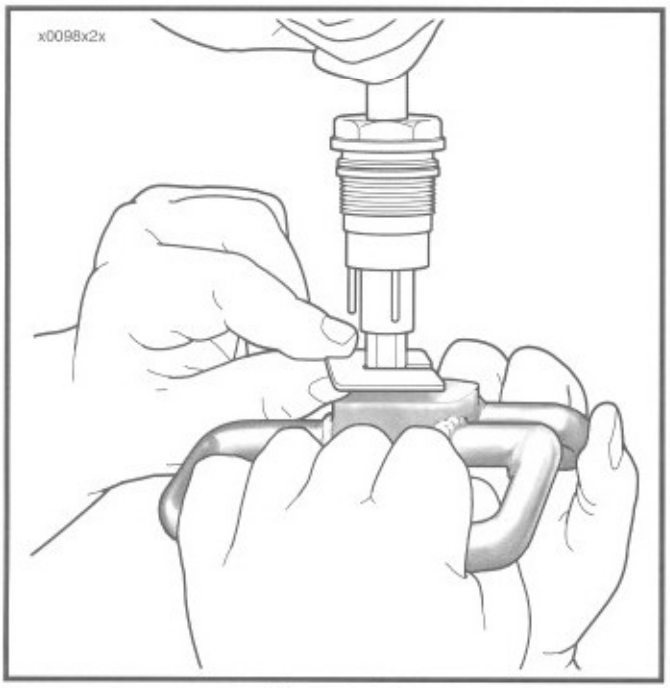



**Figure 2-63.**

5. See Figure 2-64. Hold the fork bolt and compression adjuster. Remove the fork bolt from the compression adjuster. Remove the spring adjuster plate from the fork bolt.

6. Remove spacer, spring collar and spring.

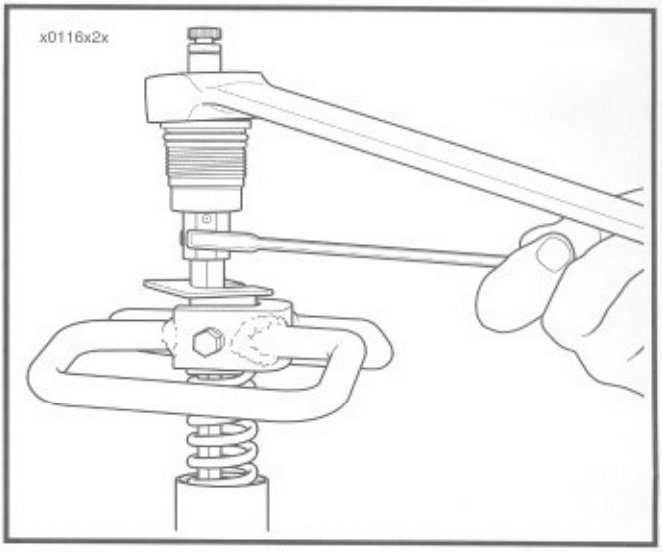



**Figure 2-64.**

7. Pour out the fork oil by pumping the fork leg and rod 8-10 times until rod moves freely.

8. See Figure 2-65 and 2-66. Position fork slider in vise using fork tube holder (HD-41177) to avoid damage.

9. See Figure 2-66. Remove the socket head bolt.

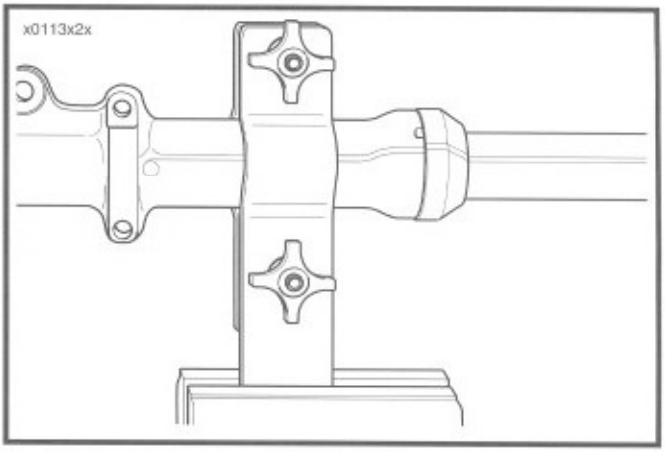



**Figure 2-65.**

10. Remove damper from fork tube.

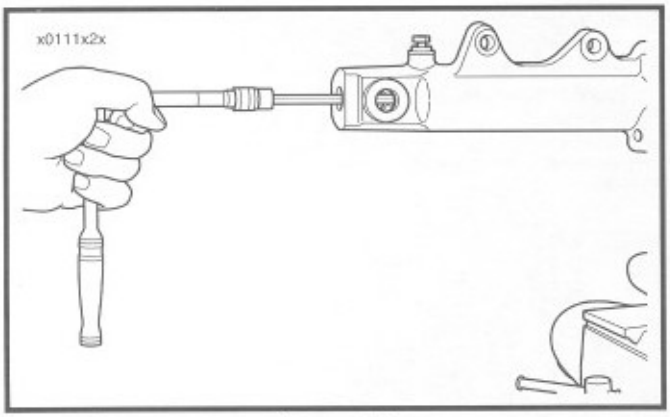



**Figure 2-66.**

11. See Figure 2-67 and 2-68. Remove the cover from the slider. Remove seal and stopper ring.

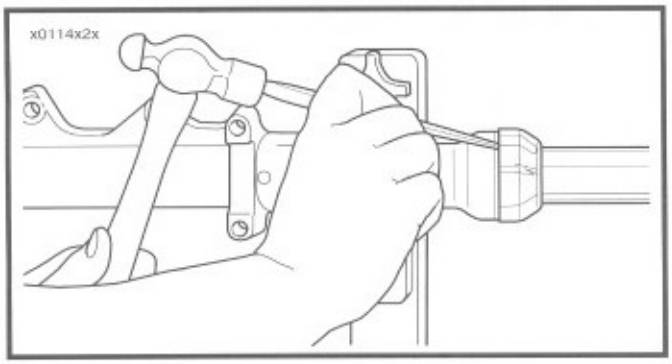



**Figure 2-67.**

12. Pull the fork tube out of the slider.

13. Remove the oil seal, spacer and guide bushing from the fork tube.

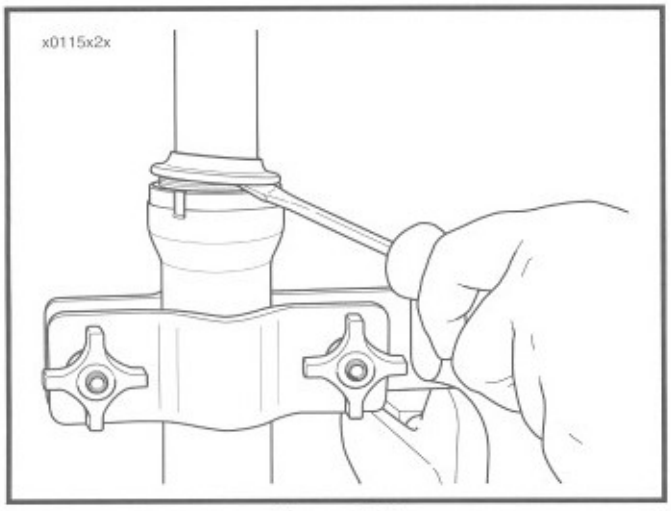



**Figure 2-68.**

## INSPECTION - XL 1200S

1. Measure fork spring free length. Replace spring if it is shorter than 16.02 in (407 mm).
2. Check the fork tube and slider for score marks, scratches or abnormal wear.
3. Check the slide and guide bushings for excessive wear or scratches.
4. Set the fork tube on V-blocks and measure runout. Runout should not exceed .008 in. (0.2 mm).

## ASSEMBLY - XL 1200S

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

*NOTE*

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

4. Slip the slider into the fork tube.
5. Place the slide bushing over the fork tube until it rests on the slider.
6. See Figure 2-69. Drive the guide bushing with the spacer seal into the slider.
7. Lubricate new oil seal with TYPE "E" FORK OIl.
8. Drive the oil seal into the slider using Fork Seal Installer, HD-36583.

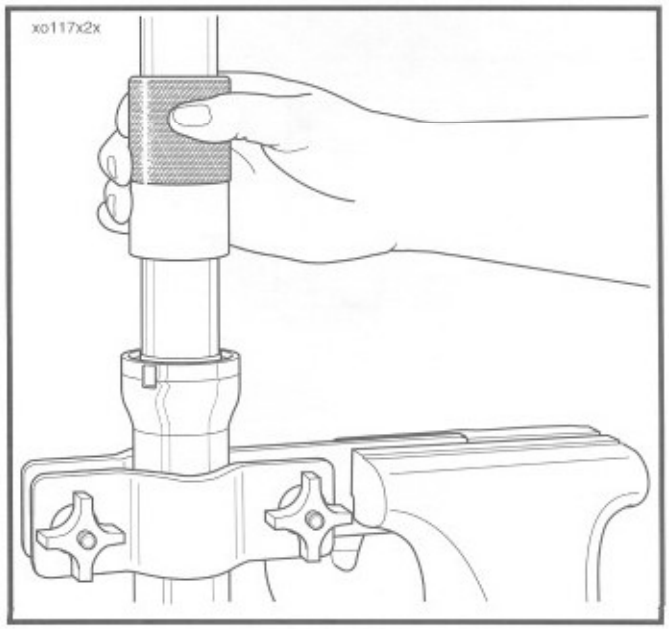



**Figure 2-69.**

9. Install the stopper ring and dust seal.

*NOTE*

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

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

b. See Figure 2-70. Holding thumb on detent spring and ball, back out (turn counterclockwise) rebound adjuster to last "click." Turn down (clockwise) 13 "clicks".

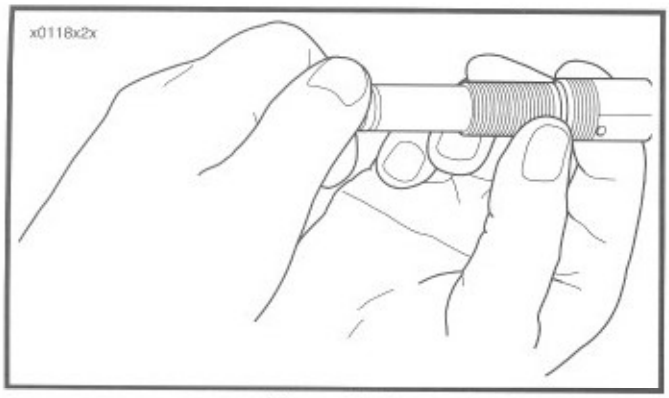



**Figure 2-70**

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

d. See Figure 2-71. Thread locknut on damper rod up to contact base of rebound adjuster and tighten in place.

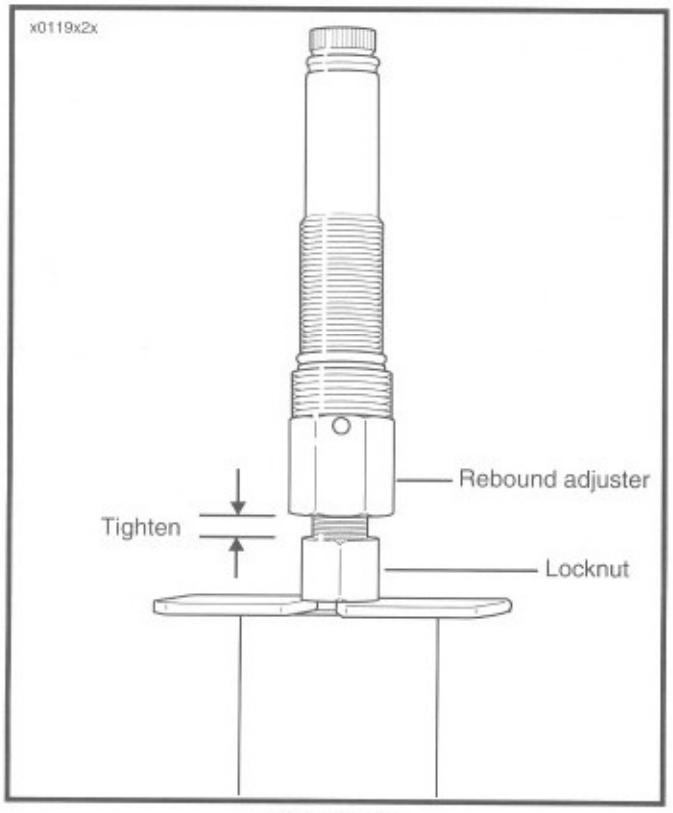



**Figure 2-71**

10. Hold slider in vise taking precautions to avoid damage. Install damper tube into the fork tube. Tighten socket screw and washer. Torque to 22 - 29 ft.lbs (29.8-39.3 Nm).
11. Pour half the TYPE "E" FORK OIL into fork tube.
12. See Figure 2-72. Slowly pump the damper rod 10 or more times.

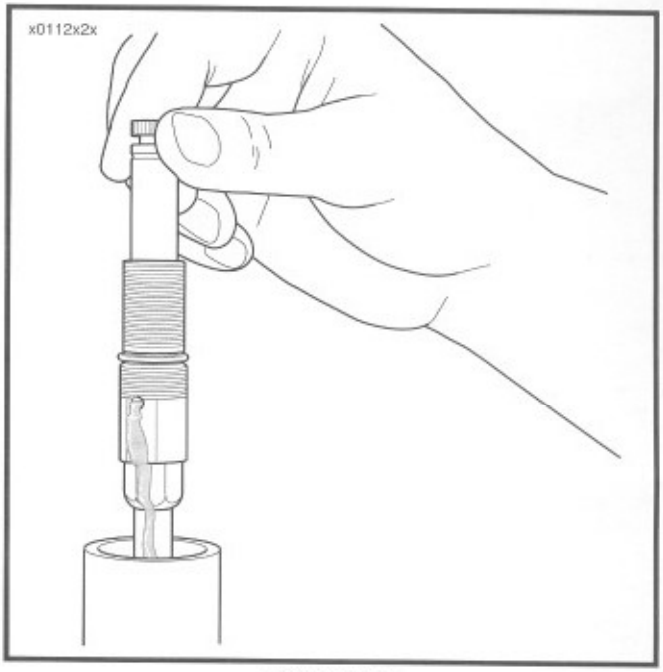



**Figure 2-72.**

13. Position the damper rod in the fully bottomed position.
14. Pour the remaining amount of TYPE "E" FORK OIL into the fork tube.
15. See Figure 2-73. Using the Pro-Level Oil Gauge (HD-59000A) adjust oil level to 5.6 in. (144 mm).
16. Carefully clean and install the spring, spring collar, and spacers.

*NOTE*

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

17. See Figure 2-74. Using Fork Spring Compression Tool (HD-41549A) push spring collar down and place Spring Plate (HD-41551) between spacer and spring collar.
18. Install fork cap and tighten against rebound adjuster.
19. Torque to 22 - 29 ft.lbs (29.8-39.3 Nm).
20. Tighten fork cap on fork tube. Torque to 11 - 22 ft.lb.
21. Install the spring adjuster plate.
22. Replace O-rings on spring preload adjuster and lubricate with fork oil.
23. Install the spring preload adjuster.
24. Install the stopper ring.
25. Carefully drive slider cover into slider.

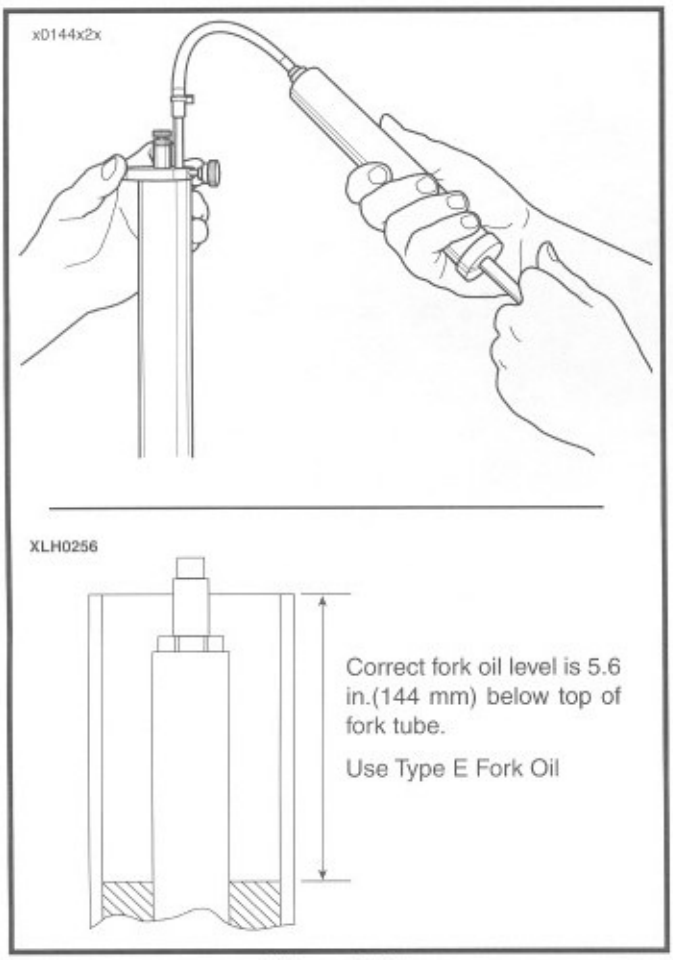



Figure 2-73.

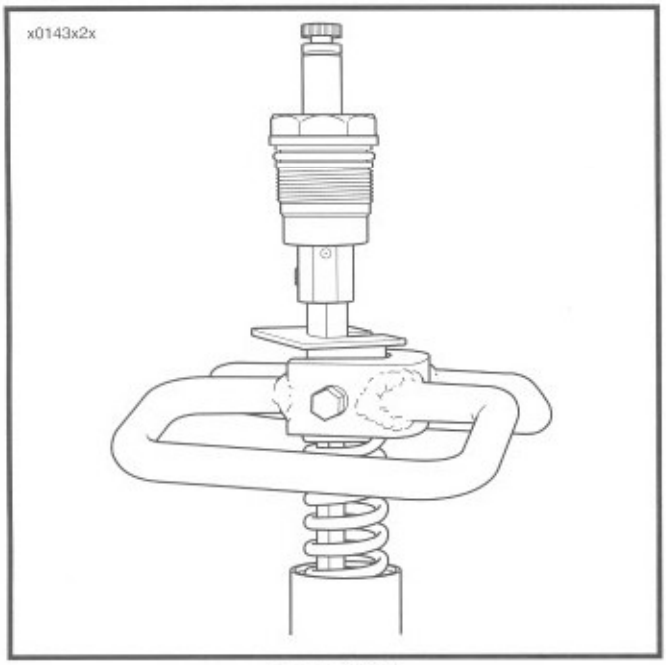



Figure 2-74.

# INSTALLATION

*NOTE*

*Rebound adjuster must be turned fully clockwise to the hardest setting before positioning the slider tubes.*

1. Insert fork sides through front fork lower and upper brackets. See Figure 2-75. Position slider tubes so that top of each tube cap extends 1.735-1.745 in. (44.1-44.3 mm) above top surface of front fork upper bracket.
2. On models with directional lamps mounted to front fork bracket, hold directional lamp mounting brackets upright. On all models, tighten front fork upper and lower bracket pinch screws to 30-35 ft-lbs (41-47 Nm) torque.
3. Install front fender using original fasteners. Tighten fasteners to 9-13 ft-lbs (12-18 Nm) torque.
4. Install front wheel assembly and front brake caliper. See FRONT WHEEL in this section.

*NOTE*

*XL Sport suspension adjustment procedures, setting recommenditions and troubleshooting information may be found in the 1998 Harley-Davidson Owner's Manual pages 110-115.*

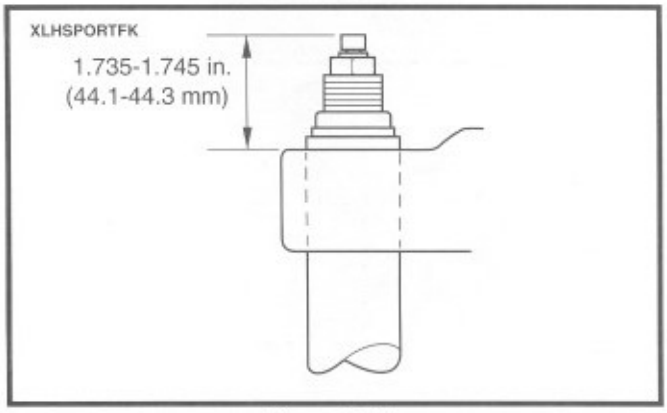



Figure 2-75.

# FORK STEM AND BRACKET ASSEMBLY

## ADJUSTMENT (Figure 2-60)

1. Place suitable blocking under frame to raise front wheel several inches off floor.
2. Remove all items that could interfere with front end swing momentum. If clutch control cable inhibits front end swing, disconnect it.
3. Place a strip of masking tape over tip of front 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 on one side until the front end begins to "fall-away" (i.e., pivot about its steering head center) by itself. Mark the point on the tape where the front end begins to "fall-away." Repeat this procedure in the opposite direction.
6. Measure the distance between the two "fall-away" marks. The distance must be 1-2 in. (25-50 mm) for proper bearing adjustment.
7. If the distance is not correct, loosen the lower bracket pinch screws (2) and the fork stem clamp screw (9). Remove cap (14). Loosen or tighten the fork stem bolt (11) until the "fall-away" distance is 1 to 2 inches (25-50 mm).

*NOTE*

*Loosen fork stem bolt if "fall-away" point is more than 2 in. (50 mm). If "fall-away" point is less than 1 in. (25 mm), tighten fork stem bolt.*

8. Tighten fork stem clamp screw (9) to 30-35 ft-lbs (41-47 Nm) torque. Tighten lower bracket pinch screws (2) to 30-35 ft-lbs (41-47 Nm) torque.
9. Recheck "fall-away."

## LUBRICATION (Figure 2-60)

All XLH models are equipped with a grease fitting (16) on the left side of the steering head (15). This fitting allows greasing of the steering head bearings (4) without disassembly.

At 10,000 miles (16,000 km), and every 10,000 miles (16,000 km) thereafter, grease the steering head bearings with Harley-Davidson WHEEL BEARING GREASE (Part No. 99855-89). Connect grease gun to grease fitting. Inject grease until old grease begins to ooze from top and bottom of steering head.

## REMOVAL/DISASSEMBLY (Figure 2-60)

1. Remove the fork assemblies. See FRONT FORK, REMOVAL.
2. Remove stem bolt cap (14), fork stem bolt (11) and washer (10). Loosen fork stem clamp screw (9). Lift handlebar assembly from steering head with fork upper bracket (7) attached. Carefully position assembly away from work area. Exercise caution to avoid bending control wires.

*NOTE*

*It is not necessary to disconnect clutch and brake handlevers, wiring harnesses or control cables from handlebar, unless the handlebar assembly is to be removed from the motorcycle.*

3. Remove upper dust shield (6) and upper bearing cone (4). Lower the fork stem and bracket assembly (1). The lower bearing cone is a press fit on fork stem. Chisel through outer bearing cage to allow rollers to fall free. Apply heat to remove the remaining portion of bearing cone. Continuously move flame around its entire circumference until bearing falls free. Remove lower dust shield (3).
4. If replacement of bearing cups (5) is necessary, drive cups from steering head using STEERING HEAD BEARING RACE REMOVAL TOOL (Part No. HD-39301A) and UNIVERSAL DRIVER HANDLE (Part No HD-33416).

## CLEANING, INSPECTION, AND REPAIR (Figure 2-60)

Clean the dust shields (6 and 3), bearing cones (4), fork stem and bracket (1) and frame with solvent. Carefully inspect bearing races and assemblies for pitting, scoring, wear and other damage. Replace damaged bearing as a set. Check the fork stem and bracket (1) for damage. Replace damaged fork stem.

## ASSEMBLY/INSTALLATION (Figure 2-60)

1. If removed, install new bearing cups (5) into frame steering head using STEERING HEAD BEARING RACE INSTALLATION TOOL (Part No. HD-39302).
2. Liberally coat the bearing cones (4) with grease. Work the grease into the rollers.
3. Place lower bearing dust shield (3) over fork stem. Find a section of pipe having an inside diameter slightly larger than the outside diameter of the fork stem. Press bearing cone (4) onto fork stem and bracket (1) using the pipe as a press on tool.
4. Insert fork stem and bracket (1) through the steering head. Install the upper bracket bearing (4) and dust shield (6) onto the stem.
5. Install the upper bracket (7) including the handlebar assembly and loosely install fork stem bolt (11) with washer (10).
6. Install fork assemblies (12). See FRONT FORK, INSTALLATION in this section.
7. Tighten the fork stem bolt (11) until the bearings have no free play. Make sure the fork stem turns freely, then tighten the fork stem clamp screw (9). Check bearing adjustment. See FORK STEM AND BRACKET ASSEMBLY, ADJUSTMENT.

# REAR FORK

## REMOVAL/DISASSEMBLY (Figure 2-76)

*NOTE*

*Mark all hardware as it is removed so that it may be returned to its original location.*

1. Remove rear wheel. See REAR WHEEL, REMOVAL.
2. Remove rear brake caliper assembly. See REAR BRAKE CALIPER.
3. Remove rear shock absorber nuts and washers from rear fork.
4. Remove rear belt guard and debris deflector. Remove belt.
5. Remove socket screw (11).
6. Remove pivot bolt (1). Support rear fork and pull fork assembly from frame.

**⚠CAUTION**

**Carefully mark all bearing components as they are removed, so that they may be returned to their original locations. Do not intermix bearing components.**

*NOTE*

*Remove bearing races (8) and pivot bushing (4) only if replacement is required. The complete bearing assembly must be replaced as a unit when replacement is necessary. Do not intermix bearing components.*

7. Carefully press bearing outer races (8) from fork. Remove lock ring (9).

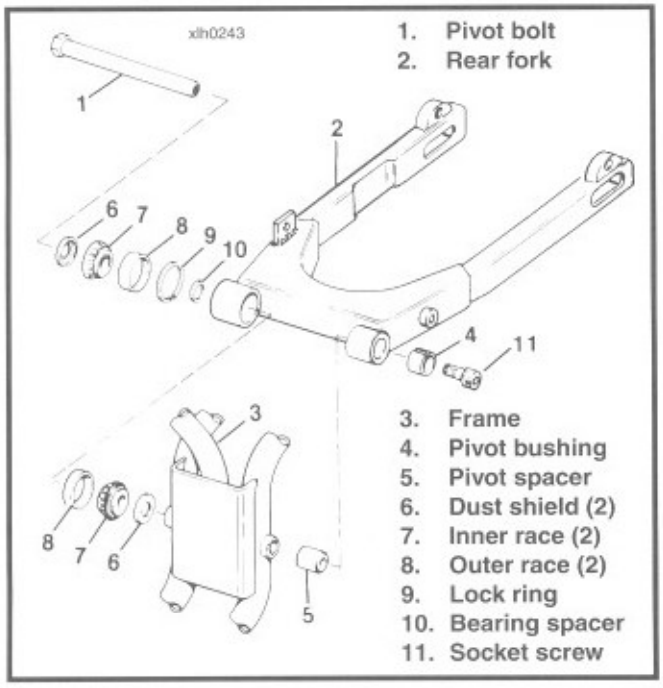



**Figure 2-76.Rear Fork**

8. Remove pivot spacer (5). Press pivot bushing (4) from fork assembly.

## CLEANING AND INSPECTION

1. Clean all components in solvent and blow dry. Carefully inspect all bearing components for wear and/or corrosion. Replace complete bearing assembly if any component is damaged.
2. Check that rear fork is not bent or twisted. Replace if damaged.

## ASSEMBLY (Figure 2-76)

1. If necessary, install new lock ring (9) and press new outer races (8) into position.

*NOTE*

*Roller bearing assemblies are shipped assembled as a unit. Do not intermix components. Mark all components so they may be correctly installed.*

2. Coat bearing components with bearing grease and assemble.

**⚠CAUTION**

**Bearing spacer (10) must be installed between inner races (7) or bearing failure can result.**

3. Press dust shields (6) over bearing inner races (7) with the lipped side in.
4. If pivot bushing (4) must be replaced, press it into rear fork (2).
5. Insert pivot spacer (5) into pivot bushing (4) with chamfered end facing outward toward socket head screw.

**⚠WARNING**

**Pivot spacer (5) must be installed with chamfered end outward toward socket head screw (11) or insufficient clamp load between rear fork pivot and frame may adversely affect handling.**

6. If engine is in frame, insert screw (11) into pivot spacer.

## INSTALLATION (Figure 2-76)

1. Slide rear fork assembly into position.
2. Holding fork assembly in position, install pivot bolt (1). Apply two or three drops of Loctite 242 blue on threads of screw (11). Thread screw into internal threads of pivot bolt (1) and tighten to 50 ft-lbs (68 Nm) torque.
3. Install belt guard and debris deflector.
4. Install shock absorbers onto rear fork. See REAR SHOCK ABSORBER, INSTALLATION in this section.
5. Install rear brake caliper assembly. See REAR BRAKE CALIPER, INSTALLATION in this section.
6. Install rear wheel. See REAR WHEEL, INSTALLATION in this section.

# REAR SHOCK ABSORBER

## ADJUSTMENT (Figure 2-77, 2-78)

The rear shock absorber springs can be adjusted for the weight the motorcycle is to carry. The average-weight solo rider should use the extended spring position. A heavy solo rider might require a slightly compressed spring position.

To adjust the compression of the rear shock absorber spring , turn spring adjusting cam (10) using SPANNER TOOL (Part No. HD-94820-75A). Adjust spring adjusting cams on both shock absorbers to the same position.

**⚠WARNING**

**Both shock absorber spring adjusting cams must be adjusted to the same position or vehicle handling may be adversely affected, resulting in possible personal injury and/or vehicle damage.**

## REMOVAL (Figure 2-78)

1. Raise rear end of motorcycle with stand or suitable blocking underneath frame. If blocking is not available, remove one shock absorber at a time. The remaining shock absorber will hold the rear fork and frame in place.
2. Remove acorn nut (4), one washer (3), stud cover (14) and second washer (3) from end of upper mounting bolt (7). Remove bottom locknut (5), bolt (1) and washer (2). Remove shock absorber assembly.

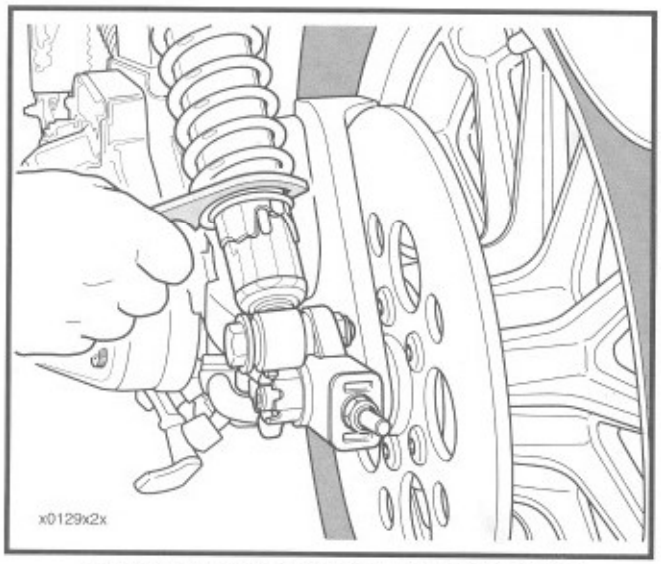



**Figure 2-77.Adjust Shock Absorber Spring Adjusting Cams**

## DISASSEMBLY (Figure 2-78)

1. Note the position of the spring adjusting cam for proper reassembly.
2. With spring seat (8) facing up, place shock absorber in SHOCK ABSORBER TOOL (Part No. HD-97010-52A) or suitable shock or spring compressing tool. Compress spring far enough to remove spring seat (8).
3. Carefully release spring compression. Remove shock absorber from tool. Remove cover (15), spring, spring guide (9) and adjusting cam (10).

## CLEANING AND INSPECTION

Clean and inspect all parts for wear and damage. Check rubber components for wear, cracking and stiffness. Examine shock assembly for signs of leakage. Unit should compress more easily than it extends. If possible, compare with new shock absorber. Replace both shock absorbers as a set if either rear shock absorber assembly is excessively worn, leaking or damaged.

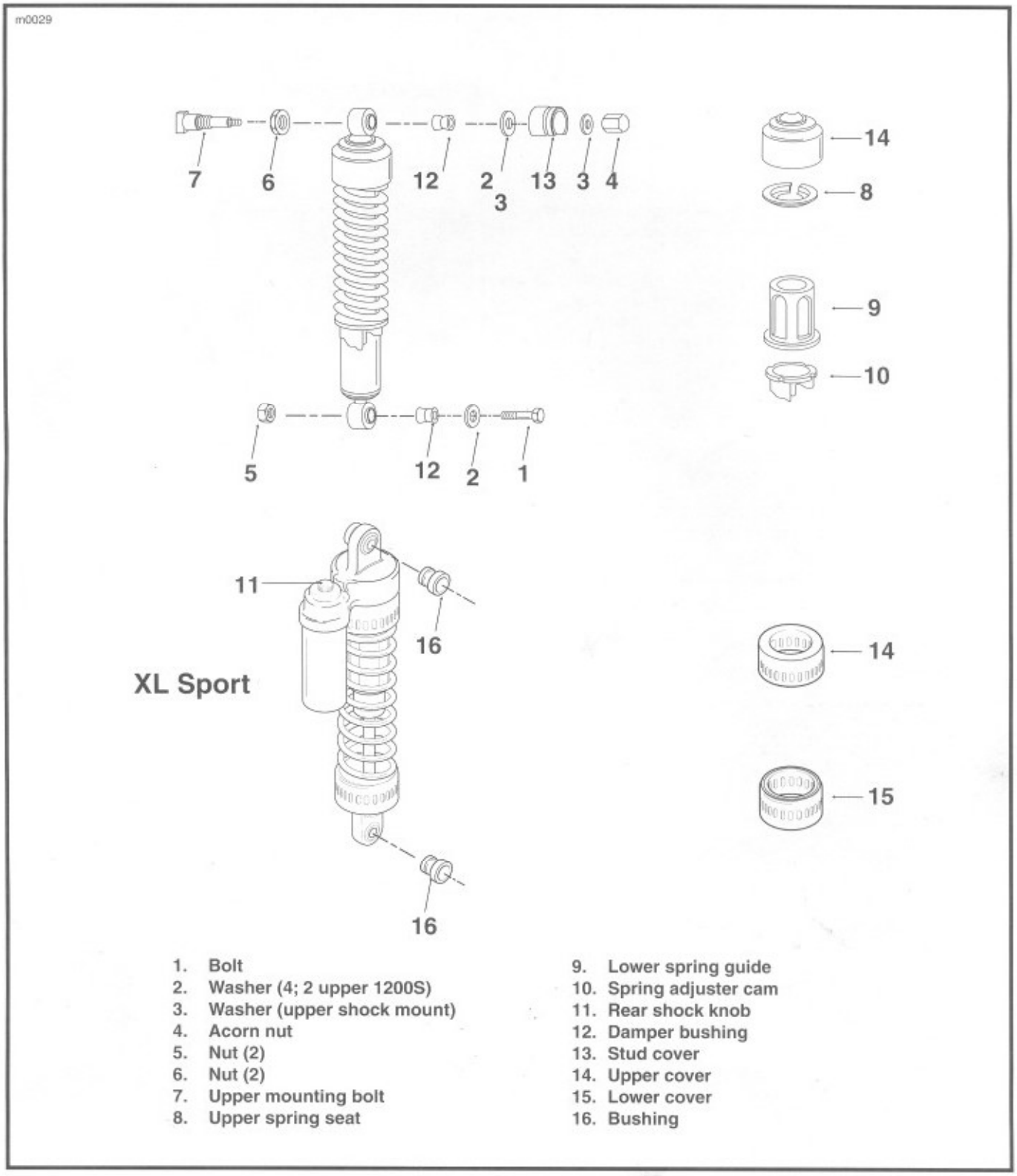
## ASSEMBLY (Figure 2-78)

Assemble the components in the reverse order of the DISASSEMBLY procedures.

Apply a thin coat of grease to each cam surface. Place assembly in tool and compress spring enough to insert spring seat (8). Slowly release spring compression. Be sure to place the spring adjusting cam (10) in the same adjustment position on both shock absorbers.

## INSTALLATION (Figure 2-78)

1. Install shock absorber upper end over upper mounting bolt (7). Locknut (6) secures mounting bolt to frame.
2. Position bottom end of shock absorber against outboard side of rear fork mount. Insert bolt (1) with washer (2) through shock bottom bushing (12) and rear fork mount flange. Install locknut (5) on end of bolt.
3. Apply 2-3 drops of LOCTITE Threadlocker 242 (blue) to threads of upper mounting bolt (7). Install washer (3), stud cover (14), second washer (3) and acorn nut (4) onto upper mounting bolt. Tighten acorn nut to 21-35 ft-lbs (28-47 Nm) torque.
4. Tighten locknut (5) to 30-50 ft-lbs (41-68 Nm) torque.




1. Bolt
2. Washer (4; 2 upper 1200S)
3. Washer (upper shock mount)
4. Acorn nut
5. Nut (2)
6. Nut (2)
7. Upper mounting bolt
8. Upper spring seat
9. Lower spring guide
10. Spring adjuster cam
11. Rear shock knob
12. Damper bushing
13. Stud cover
14. Upper cover
15. Lower cover
16. Bushing

Figure 2-78. Rear Shock Absorbers

# THROTTLE CONTROL

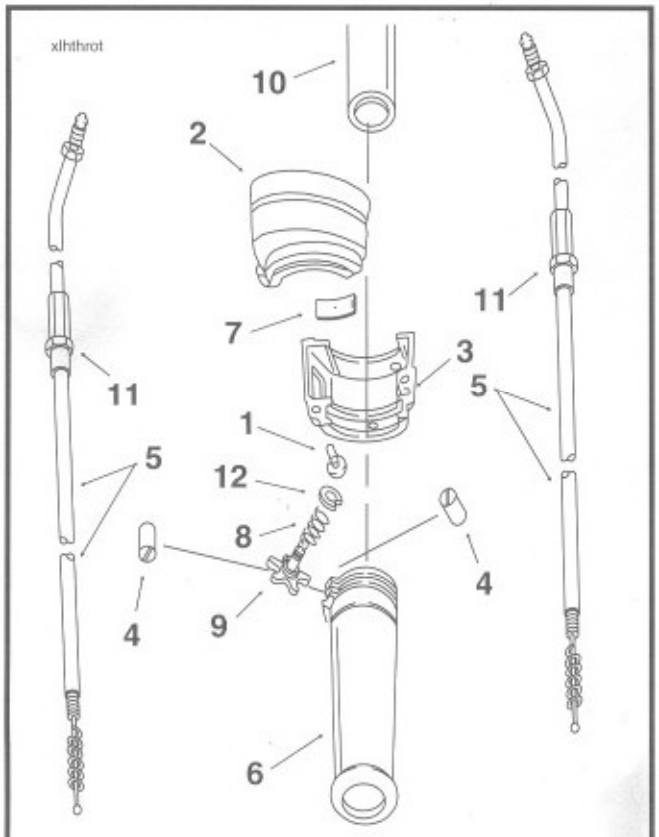
## ADJUSTMENT

**⚠WARNING**

**The throttle control MUST operate freely without binding. Irregular or sticking throttle response could result in loss of control of the vehicle and possible personal injury.**

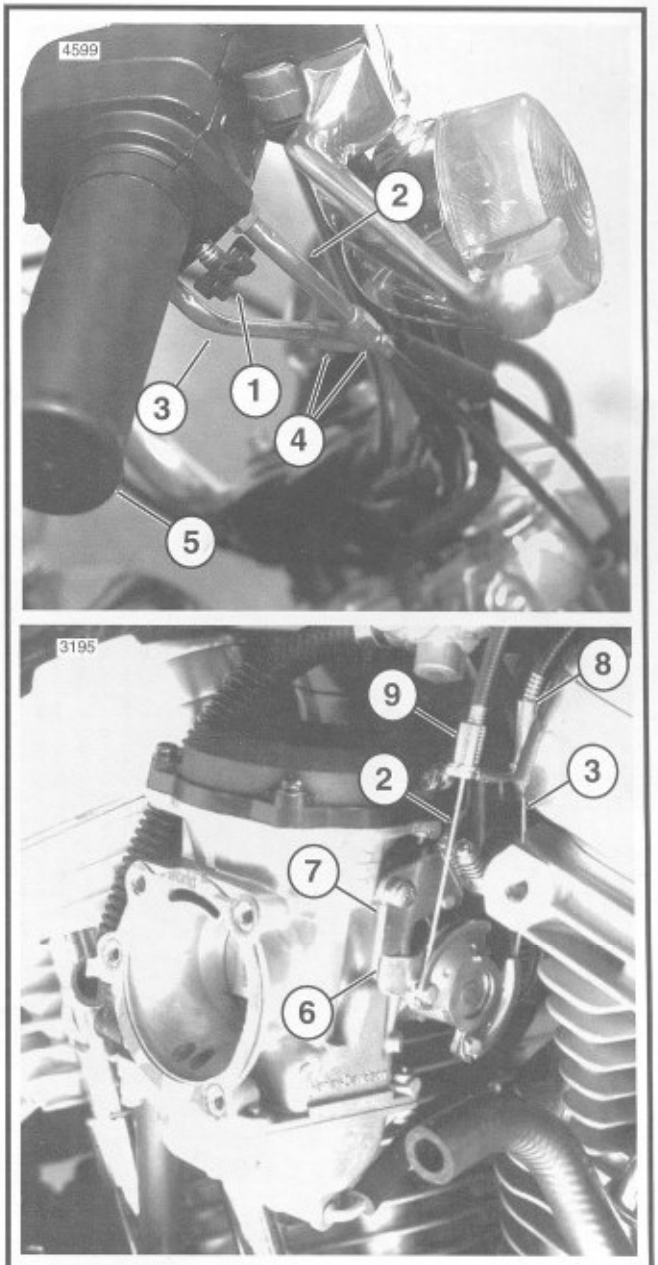
See Figure 2-79. With throttle friction screw (9) backed off, the carburetor throttle must return to the closed (idle) position. Check control cable adjustment. With engine running, turn handlebars through full range of travel. If engine speed changes during this maneuver, adjust control cables according to the following procedure.

1. See Figure 2-80. Loosen throttle friction screw (1).
2. Slide rubber boot off each cable adjuster (4).
3. Loosen jam nut on each adjuster.
4. Turn adjusters in direction which will shorten cable housings to minimum length.
5. Point front wheel straight ahead. Twist throttle control grip (5) to fully open position and hold.




1. Screw (2)
2. Upper housing
3. Lower housing
4. Ferrule (2)
5. Cable assembly (2)
6. Throttle control grip
7. Friction spring
8. Spring
9. Throttle friction screw
10. Right handlebar
11. Cable adjuster (2)
12. Retaining ring

Figure 2-79. Throttle Control – Right Handlebar




1. Throttle friction screw
2. Throttle control (pull-open) cable
3. Idle control (pull-close) cable
4. Cable adjuster (2)
5. Throttle control grip
6. Throttle cam stop
7. Carburetor stop plate
8. Idle control cable guide (on carburetor)
9. Throttle control cable guide (on carburetor)

Figure 2-80. Throttle Control Cable/Idle Control Cable

6. Turn adjuster (4) on throttle control cable (2) until throttle cam stop (6) touches carburetor stop plate (7). Tighten jam nut on throttle control cable adjuster (4). Release throttle control grip (5).

7. Turn handlebars fully to right. Turn adjuster (4) on idle control cable (3) until end of cable housing just touches spring within carburetor cable guide (8).

8. With throttle friction screw (1) loosened, twist and release throttle control grip (5) a few times. Carburetor throttle must return to idle position each time throttle grip is released. If this is not the case, turn adjuster (4) on idle control cable (3) (shortening cable housing) until throttle control functions properly.

9. Tighten jam nut on idle control cable adjuster (4). Recheck operation of throttle control (Step 8).

10. Slide rubber boot over each cable adjuster (4). Recheck engine slow idle speed. Adjust if required.

## REMOVAL/DISASSEMBLY (Figure 2-79)

1. Slide rubber boot off each cable adjuster (11). Loosen jam nut on each adjuster. Turn adjusters in direction which will shorten cable housings to minimum length.

2. Remove two screws (1) and separate upper housing (2) from lower housing (3).

3. Unhook ferrules (4) and cables (5) from throttle control grip (6) and lower housing (3).

4. Remove air cleaner assemby. See AIR CLEANER, REMOVAL in Section 4.

5. Disconnect cables from carburetor.

6. Remove friction spring (7), throttle friction screw (9) and spring (8) from lower housing (3).

## CLEANING, INSPECTION, AND REPAIR

Clean all parts in a non-flammable cleaning solvent. Blow dry with compressed air. Replace cables if frayed, kinked or bent.

## ASSEMBLY/INSTALLATION (Figure 2-79)

1. Apply a light coating of graphite to the handlebar (10) and the inside surface of the switch housings (2 and 3).

2. Install throttle spring (8), throttle friction screw (9) and friction spring (7) in lower housing (3).

3. Attach cable assemblies (5) to lower housing (3). See Figure 2-80. Throttle control cable (2) has a 5/16 in. (7.9 mm) fitting end and is positioned to front of lower housing. Idle control cable (3) has a 1/4 in. (6.3 mm) fitting end and is positioned to rear of lower housing.

4. See Figure 2-79. Install throttle control grip (6) over end of right handlebar (10). Position lower housing (3) onto right handlebar, engaging lower housing with throttle control grip. Position ferrules (4) over cable (5) ball ends, then seat ferrules (with cables attached) in their respective notches of the throttle control grip.

5. Install upper housing (2) over right handlebar (10) and secure to lower housing (3) using screws (1). Tighten screws to 18-24 ft-lbs (24-33 Nm) torque.

6. See Figure 2-81. Route control cables forward from throttle control grip, forward of front fork upper bracket, downward between right slider tube and headlamp, rearward along right side of frame steering head, rearward along right side of frame backbone into retaining clip on ignition switch housing, downward to carburetor.

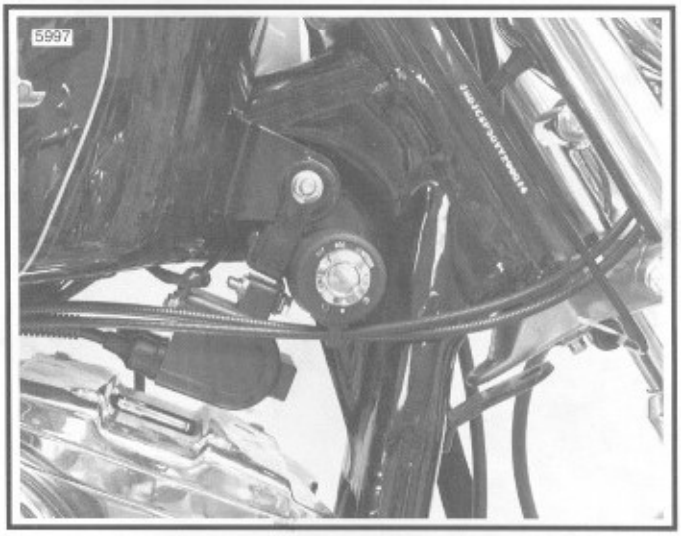



**Figure 2-81. Control Cable Routing**

7. See Figure 2-80. Install idle control cable (3) housing and spring into longer, inboard cable guide (8) on carburetor.

8. Install throttle control cable (2) housing into shorter, outboard cable guide (9) on carburetor.

**⚠WARNING**

**Throttle cables must not pull tight when handlebars are turned fully to left or right fork stops. Be sure wires and throttle cables are clear of fork stops at steering head so they will not be pinched when fork is turned against stops. Steering must be smooth and free with no binding or interference. Improperly adjusted and/or positioned throttle cables could result in loss of control of vehicle resulting in possible personal injury.**

9. Adjust control cables. See THROTTLE CONTROL, ADJUSTMENT.