### Table 1 TRANSMISSION SERVICE SPECIFICATIONS

<table>
<thead>
<tr>
<th>Clutch face clearance</th>
<th>New in. (mm)</th>
<th>Service Limit in. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainshaft 4th and 2nd gear</td>
<td>0.040 (1.02)</td>
<td>0.080 (2.03)</td>
</tr>
<tr>
<td>Mainshaft 3rd and 2nd gear</td>
<td>0.040 (1.02)</td>
<td>0.080 (2.03)</td>
</tr>
<tr>
<td>Clutch gear needle bearing journal diameter</td>
<td>0.7495-0.7500 (19.037-19.050)</td>
<td>0.7485 (19.012)</td>
</tr>
</tbody>
</table>

**Countershaft**

<table>
<thead>
<tr>
<th>Needle bearing journal diameter</th>
<th>Early style gears</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access door</td>
<td>0.7500-0.7495 (19.050-19.037)</td>
</tr>
<tr>
<td>Right crankcase side or end</td>
<td>0.6875-0.6870 (17.463-17.450)</td>
</tr>
<tr>
<td>Countershaft end play</td>
<td>0.004 (0.10)</td>
</tr>
<tr>
<td>1st gear needle bearing journal diameter</td>
<td>0.6875-0.6870 (17.463-17.450)</td>
</tr>
</tbody>
</table>

**Gear face clearance**

<table>
<thead>
<tr>
<th>Countershaft 1st and 3rd gear</th>
<th>Early style gears</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.040 (1.02)</td>
<td>0.080 (2.03)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Countershaft 2nd and 3rd gear</th>
<th>Early style gears</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.040 (1.02)</td>
<td>0.080 (2.03)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mainshaft end play</th>
<th>Early style gears</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.006 (0.15)</td>
<td>0.020 (0.51)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mainshaft 3rd gear end play</th>
<th>Early style gears</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.006-0.020 (0.15-0.51)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mainshaft and countershaft runout</th>
<th>Early style gears</th>
</tr>
</thead>
<tbody>
<tr>
<td>–</td>
<td>0.003 (0.08)</td>
</tr>
</tbody>
</table>

### Table 2 EARLY AND LATE STYLE GEAR OUTSIDE DIAMETERS

<table>
<thead>
<tr>
<th>Gear</th>
<th>Number or teeth</th>
<th>Outside diameter in. (mm)</th>
</tr>
</thead>
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<tr>
<td>Early style gears</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Countershaft 2nd gear</td>
<td>20</td>
<td>2.448-2.452 (62.18-62.28)</td>
</tr>
<tr>
<td>Countershaft 3rd gear</td>
<td>23</td>
<td>2.648-2.657 (67.26-67.49)</td>
</tr>
<tr>
<td>Mainshaft 2nd gear</td>
<td>23</td>
<td>2.648-2.657 (67.26-67.49)</td>
</tr>
<tr>
<td>Mainshaft 3rd gear</td>
<td>20</td>
<td>2.448-2.452 (62.18-62.28)</td>
</tr>
<tr>
<td>Late style gears</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Countershaft 2nd gear</td>
<td>20</td>
<td>2.423-2.428 (61.54-61.67)</td>
</tr>
<tr>
<td>Countershaft 3rd gear</td>
<td>23</td>
<td>2.622-2.627 (66.60-66.73)</td>
</tr>
<tr>
<td>Mainshaft 2nd gear</td>
<td>23</td>
<td>2.622-2.627 (66.60-66.73)</td>
</tr>
<tr>
<td>Mainshaft 3rd gear</td>
<td>20</td>
<td>2.423-2.428 (61.54-61.67)</td>
</tr>
</tbody>
</table>

### Table 3 GEAR RATIOS

<table>
<thead>
<tr>
<th>Gear</th>
<th>1986 models</th>
<th>1987-1990 models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal gear ratios</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st</td>
<td>2.52</td>
<td>2.29</td>
</tr>
<tr>
<td>2nd</td>
<td>1.82</td>
<td>1.66</td>
</tr>
<tr>
<td>3rd</td>
<td>1.38</td>
<td>1.25</td>
</tr>
<tr>
<td>4th</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

(continued)

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*Classic Cycles Technical Resources*
### Table 3 GEAR RATIOS (continued)

<table>
<thead>
<tr>
<th>Overall gear ratios</th>
<th>1986 models</th>
<th>1987-1990 models</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>10.00</td>
<td>9.12</td>
</tr>
<tr>
<td>2nd</td>
<td>7.25</td>
<td>6.59</td>
</tr>
<tr>
<td>3rd</td>
<td>5.48</td>
<td>4.98</td>
</tr>
<tr>
<td>4th</td>
<td>3.97</td>
<td>3.97</td>
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</table>

### Table 4 COUNTERSHAFT GEAR SPACER SELECTION CHART

<table>
<thead>
<tr>
<th>Measurement (in.)</th>
<th>Number of washers</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.335-0.339</td>
<td>1</td>
<td>35860-86</td>
</tr>
<tr>
<td>0.330-0.334</td>
<td>2</td>
<td>35865-86</td>
</tr>
<tr>
<td>0.325-0.329</td>
<td>1</td>
<td>35865-86</td>
</tr>
<tr>
<td>0.320-0.324</td>
<td>1</td>
<td>35864-86</td>
</tr>
<tr>
<td>0.315-0.319</td>
<td>1</td>
<td>35864-86</td>
</tr>
<tr>
<td>0.310-0.314</td>
<td>2</td>
<td>35863-86</td>
</tr>
<tr>
<td>0.305-0.309</td>
<td>1</td>
<td>35863-86</td>
</tr>
<tr>
<td>0.300-0.304</td>
<td>1</td>
<td>35862-86</td>
</tr>
<tr>
<td>0.295-0.299</td>
<td>1</td>
<td>35862-86</td>
</tr>
<tr>
<td>0.290-0.294</td>
<td>2</td>
<td>35861-86</td>
</tr>
<tr>
<td>0.285-0.289</td>
<td>1</td>
<td>35861-86</td>
</tr>
<tr>
<td>0.280-0.284</td>
<td>2</td>
<td>35860-86</td>
</tr>
<tr>
<td>0.275-0.279</td>
<td>1</td>
<td>35864-86</td>
</tr>
<tr>
<td>0.270-0.274</td>
<td>2</td>
<td>35863-86</td>
</tr>
<tr>
<td>0.265-0.269</td>
<td>3</td>
<td>35863-86</td>
</tr>
<tr>
<td>0.260-0.264</td>
<td>1</td>
<td>35863-86</td>
</tr>
<tr>
<td>0.255-0.259</td>
<td>2</td>
<td>35862-86</td>
</tr>
<tr>
<td>0.250-0.254</td>
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<td>35862-86</td>
</tr>
<tr>
<td>0.245-0.249</td>
<td>2</td>
<td>35861-86</td>
</tr>
<tr>
<td>0.240-0.244</td>
<td>3</td>
<td>35861-86</td>
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<tr>
<td>0.235-0.239</td>
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<td>35861-86</td>
</tr>
<tr>
<td></td>
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<td>35860-86</td>
</tr>
</tbody>
</table>

### Table 5 COUNTERSHAFT WASHERS

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.055 in.</td>
<td>35860-86</td>
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<tr>
<td>0.050 in.</td>
<td>35861-86</td>
</tr>
<tr>
<td>0.045 in.</td>
<td>35862-86</td>
</tr>
<tr>
<td>0.040 in.</td>
<td>35863-86</td>
</tr>
<tr>
<td>0.035 in.</td>
<td>35864-86</td>
</tr>
<tr>
<td>0.030 in.</td>
<td>35865-86</td>
</tr>
</tbody>
</table>
### Table 6 MAINSHAFT END PLAY THRUST WASHER SELECTION

<table>
<thead>
<tr>
<th>End play</th>
<th>Washer thickness</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.114-0.108 in.</td>
<td>0.099-0.094 in.</td>
<td>35380-84</td>
</tr>
<tr>
<td>0.107-0.102 in.</td>
<td>0.093-0.088 in.</td>
<td>35381-84</td>
</tr>
<tr>
<td>0.101-0.097 in.</td>
<td>0.087-0.082 in.</td>
<td>35382-84</td>
</tr>
<tr>
<td>0.096-0.092 in.</td>
<td>0.082-0.077 in.</td>
<td>35383-84</td>
</tr>
<tr>
<td>0.091-0.086 in.</td>
<td>0.081-0.070 in.</td>
<td>35384-84</td>
</tr>
<tr>
<td>0.085-0.079 in.</td>
<td>0.070-0.065 in.</td>
<td>35385-84</td>
</tr>
</tbody>
</table>

### Table 7 COUNTERSHAFT END PLAY THRUST WASHER SELECTION

<table>
<thead>
<tr>
<th>Measurement (in.)</th>
<th>Number of washers</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.172-0.176</td>
<td>3</td>
<td>35860-86</td>
</tr>
<tr>
<td>0.167-0.171</td>
<td>1</td>
<td>35861-86</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>35860-86</td>
</tr>
<tr>
<td>0.162-0.166</td>
<td>1</td>
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</tr>
<tr>
<td></td>
<td>2</td>
<td>35861-86</td>
</tr>
<tr>
<td>0.157-0.161</td>
<td>3</td>
<td>35861-86</td>
</tr>
<tr>
<td>0.152-0.156</td>
<td>1</td>
<td>35862-86</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>35861-86</td>
</tr>
<tr>
<td>0.147-0.151</td>
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<td>35862-86</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>35861-86</td>
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<tr>
<td>0.142-0.146</td>
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<tr>
<td>0.137-0.141</td>
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<tr>
<td></td>
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<tr>
<td>0.132-0.136</td>
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<td>35862-86</td>
</tr>
<tr>
<td>0.127-0.131</td>
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</tr>
<tr>
<td>0.117-0.121</td>
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<td>0.112-0.116</td>
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</tr>
<tr>
<td></td>
<td>1</td>
<td>35860-86</td>
</tr>
<tr>
<td>0.107-0.111</td>
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<td>35861-86</td>
</tr>
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<td>0.102-0.106</td>
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<td>35862-86</td>
</tr>
<tr>
<td></td>
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<tr>
<td>0.097-0.101</td>
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</tr>
<tr>
<td>0.092-0.096</td>
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<td>35863-86</td>
</tr>
<tr>
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<td>35862-86</td>
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<tr>
<td>0.087-0.091</td>
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<td>0.082-0.086</td>
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<tr>
<td>0.067-0.071</td>
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<td>35861-86</td>
</tr>
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<td>0.052-0.056</td>
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</tr>
<tr>
<td>0.047-0.051</td>
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<td>35863-86</td>
</tr>
<tr>
<td>0.042-0.046</td>
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<td>35864-86</td>
</tr>
</tbody>
</table>

### Table 8 TRANSMISSION TORQUE SPECIFICATIONS

<table>
<thead>
<tr>
<th></th>
<th>ft.-lb.</th>
<th>in.-lb.</th>
<th>N•m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission access door bolts</td>
<td>14-19</td>
<td>–</td>
<td>19-26</td>
</tr>
</tbody>
</table>
This chapter covers the five-speed transmission, internal gearshift assemblies and shift mechanism. Tables 1 and Table 2 are at the end of this chapter.

When the clutch is engaged, the mainshaft is driven by the clutch hub, which is driven by the primary chain sprocket/clutch outer housing. Power flows from the mainshaft through the selected gear combination to the countershaft, which drives the main drive gear and transmission sprocket.

To gain access to the transmission and internal shift mechanism, it is not necessary to remove the engine or disassemble the crankcase. The transmission components are contained behind an access door on the left crankcase half.

TRANSMISSION

Removal

Refer to Figure 1.
1. Remove the exhaust system (Chapter Eleven).
2. Drain the transmission oil (Chapter Three).
3. Remove the drive sprocket and drive chain or belt (Chapter Thirteen).
4. Remove the engine sprocket, clutch and primary drive chain (Chapter Eight).
5. Shift the transmission into first gear.
6. Disconnect the detent lever spring (Figure 2) from the post groove.
7. Remove the snap ring (A, Figure 3) from the groove in the end of the shift drum. Discard the snap ring as a new one must be installed during reassembly.
8. Slide the detent plate (B, Figure 3) off the shift drum pins.
9. Loosen the two shift shaft locknuts (A, Figure 4). Then remove the locknuts and washers.
10. Remove the shift shaft assembly (B, Figure 4) from the crankcase.
11. Remove the countershaft retainer screw (Figure 5). Then remove the screw and countershaft retainer collar (Figure 6).
12. Remove the transmission access door mounting bolts (Figure 7).
13. Remove the access door with the transmission and shift mechanism attached. See Figure 8.
14. Remove the two dowel pins (Figure 9).
15. If further disassembly is necessary, perform the following as described in this chapter:
   a. Shift Forks and Shift Drum.
   b. Mainshaft and Countershaft.
16. If necessary, remove the main drive gear as described in Main Drive Gear in this chapter.
1. Shift shaft assembly
2. Locknut
3. Washer
4. Right crankcase half
5. Detent plate snap ring
6. Detent plate
7. Detent screw
8. Spring
9. Detent arm
10. Shifter drum locating plate
11. Reinforcing plate
12. Washer
13. Locknut
14. Countershaft bearing
15. Mainshaft bearing
16. 4th gear shift fork
17. Shift fork pins
18. Cotter pins
19. 1st and 2nd gear shift fork
20. 3rd and 5th gear shift fork
21. Shift drum
22. Pin (neutral indicator)
23. Access door
Inspection

1. Clean the transmission cavity (Figure 9) with cleaning solvent and dry with compressed air.
2. Inspect the access door bearings as described in this chapter.
3. Remove all thread sealant residue from the drive sprocket nut and main drive gear threads.

Installation

A No. 32 (0.116 in.) drill bit will be required when installing the transmission assembly.

Refer to Figure 1.

1. If the shift forks, shift drum and transmission were removed and disassembled, assemble them onto the access door as described in the following sections in this chapter:
   a. Mainshaft and Countershaft.
   b. Shift Forks and Shift Drum Assembly.
2. If removed, install the main drive gear as described in Main Drive Gear in this chapter.
3. Lubricate the transmission gears and shifter assembly with new transmission oil prior to installation.
4. Install the two dowel pins (Figure 9), if removed.
5. Align the transmission assembly with the access door opening and install the transmission/shifter assembly (Figure 8) while noting the following:
a. The mainshaft (Figure 10) should enter fifth gear (Figure 11).
b. The drum shift shaft and countershaft should enter their respective crankcase bearings.

6. Apply threadlock (Loctite 242 or equivalent) to the transmission access door mounting bolts prior to installation. Install the bolts (Figure 7) and washers and tighten to 156-204 in.-lb. (18-23 N•m).

7. Install the countershaft retainer collar (Figure 5) as follows:
   a. The retainer collar has one flat side and one beveled side.
   b. Install the retainer collar, with its beveled side facing out, onto the countershaft (Figure 6).
   c. Shift the transmission into first gear.
   d. Apply threadlock (Loctite 242 or equivalent) onto the retainer collar screw prior to installation. Install the countershaft retainer collar screw and tighten to 156-204 in.-lb. (18-23 N•m).

8. Install the shift shaft assembly by first lifting the shift pawl (Figure 12) over the shift drum pins and then aligning the shift shaft mounting holes with the two crankcase studs (A, Figure 4). Install the washers and nuts (A, Figure 4); hand tighten the nuts only.

9. Connect the detent arm spring onto the post groove as shown in Figure 2.

10. Make sure the shift pawl spring is connected to the pawl (Figure 13).

11. Install the detent plate onto the shift drum, aligning the holes in the plate with the pins in the drum (Figure 14).

12. Install a new detent plate snap ring (Figure 15) into the groove in the end of the shift drum. Use the installation tool (TRUARC part No. PR-0310 or equivalent) to install the new snap ring. Make sure the snap ring is correctly seated in the shift drum groove.

13. Adjust the shifter pawl as follows:
   a. Shift the transmission into third gear.
   b. Install a No. 32 drill bit (0.116 in.) through the hole in the detent plate and between the shift pawl and drive pin at the end of the shift drum shaft as shown in Figure 12 and A, Figure 16.
NOTE

Pressing down on the shift shaft crank helps to align the shift pawl with the shift drum pins. However, do not push excessively as this may cause the shift drum to rotate.

c. Press down on the top of the shift shaft crank (Figure 12) to remove all clearance between the drill bit and shift pawl.
d. While applying pressure to the shift shaft crank, tighten the lower shift shaft locknut (B, Figure 16) to 90-110 in.-lb. (10-12 N-m).
e. Tighten the upper shift shaft nut (C, Figure 16) to 90-110 in.-lb. (10-12 N•m).
f. Remove the drill bit.

14. Install the engine sprocket, clutch and primary drive chain (Chapter Eight).
15. Refill the transmission oil (Chapter Three).
16. Install the drive sprocket and the drive chain or drive belt (Chapter Thirteen).
17. Install the exhaust system (Chapter Eleven).
18. Start the engine and check for oil leaks.
19. Test drive the motorcycle slowly, checking that the transmission shifts properly.

SHIFT FORKS AND SHIFT DRUM

Disassembly

Refer to Figure 1.
1. Remove the transmission assembly as described in Transmission in this chapter.
2. Secure the transmission access door in a vise with soft jaws. Then remove the following parts:
   a. Detent nut and washer (A, Figure 17).
   b. Reinforcing plate (B, Figure 17).
   c. Detent screw, arm and spring (C, Figure 17).
   d. Shift drum locating plate (Figure 18).
3. Remove the cotter pin (Figure 19) from each shift fork. Discard the cotter pins.
4. Remove the shift fork pin from each shift fork (Figure 20).
5. Slide the shift drum (Figure 21) out of the access door and remove it.
6. Remove the three shift forks (Figure 22).

**Inspection**

1. Clean all of the parts in solvent, except the access door bearings, and dry with compressed air.
2. Inspect each shift fork (Figure 23) for severe wear, cracks, bending or other damage. Check that each shift fork slides on the shift drum smoothly (Figure 24).
3. Check for any arc-shaped wear or burned marks on the shift forks. This wear pattern indicates that the shift fork has come in contact with the gear. The fork fingers have become excessively worn and the fork must be replaced.
4. Check the shift drum grooves (A, Figure 25) for wear or roughness. If any groove profile shows excessive wear or damage, replace the shift drum.
5. Check the shift drum pins (Figure 26) for cracks or severe wear.
6. Check the shift fork pins for cracks or severe wear.
7. Roll the shift drum on a flat surface, such as a piece of plate glass, and check it for any warp or damage.
8. Inspect the shift shaft assembly (Figure 27) for the following defects:
   a. Bent shift shaft (A, Figure 27).
   b. Damaged shift shaft splines (B, Figure 27).
c. Worn or damaged shift pawl (Figure 28).
d. Weak or damaged return springs.

9. Inspect the detent arm assembly (Figure 29) for the following defects:
   a. Worn or damaged detent screw (A, Figure 29).
   b. Worn or damaged detent arm (B, Figure 29).
   c. Worn or damaged shift drum locating plate (C, Figure 29).
   d. Worn or damaged reinforcing plate (D, Figure 29).

10. Check the detent plate (Figure 30) for severe wear or damage.

11. Refer to Access Door Bearings in this chapter to clean, inspect and replace bearings.

12. Replace worn or damaged parts as required.

Assembly

Refer to Figure 1.

1. Clamp the transmission access door in a vise with soft jaws.

2. Lubricate each shift fork bore with new transmission oil prior to installation.

   \textit{NOTE} \\
   Refer to Figure 31 when identifying and installing the shift forks.

3. Install shift fork No. 1 (third and fifth gear), with its flat side facing toward the access door, into the mainshaft second gear groove (A, Figure 32).

4. Install shift fork No. 2 (first and second gear), with its flat side facing away from the access door, into the countershaft third gear groove (B, Figure 32).

5. Install shift fork No. 3 (fourth gear), with its flat side facing away from the access door, into the mainshaft first gear groove (C, Figure 32).

6. Align the shift drum, with its neutral indicator pin (B, Figure 25) facing up, with the shift forks. Then insert the shift drum (Figure 21) through the shift forks and the bearing in the access door.

7. Lubricate the shift fork pins with new transmission oil prior to installation.
CAUTION

The cotter pins must be installed through the shift forks as shown in Figure 33. Otherwise, the cotter pins may be damaged during transmission operation.

8. Align the lower shift drum groove (A, Figure 34) with the pin hole in shift fork No. 3 (fourth gear); refer to C, Figure 32. Install the shift fork pin through the shift fork so it drops into the shift drum groove; turn the shift drum while pushing on the pin with a small screwdriver. Then install a new cotter pin.

9. Align the center shift drum groove (B, Figure 34) with the pin hole in shift fork No. 2 (first and second gear); refer to B, Figure 32. Install the shift fork pin through the shift fork so it drops into the shift drum groove; turn the shift drum while pushing on the pin with a small screwdriver. Then install a new cotter pin.

10. Align the upper shift drum groove (C, Figure 34) with the pin hole in shift fork No. 1 (third and fifth gear); refer to A, Figure 32. Install the shift fork pin through the shift fork so it drops into the shift drum groove; turn the shift drum while pushing on the pin with a small screwdriver. Then install a new cotter pin.

NOTE

Refer to Figure 33 and Figure 35 for the correct installation of the shift fork cotter pins.
11. Install the shift drum locating plate (Figure 36) into the shift drum groove, making sure the hole in the plate fits over the roll pin in the access door (Figure 37).

12. Install the reinforcing plate (A, Figure 38) on top of the shift drum locating plate, making sure to engage the notch in the reinforcing plate with the roll pin in the access door.

13. Slide the detent screw (A, Figure 39) through the detent arm (B, Figure 39). Then insert the detent screw through the access door and through the two plates previously installed; see Figure 38. Install the washer and nut (B, Figure 39). Tighten the detent screw to 156-204 in.-lb. (18-23 N•m).

**NOTE**
Do not install the detent plate (6, Figure 1) and snap ring (5) at this time. These parts are installed during transmission installation and shift pawl adjustment.

14. Install the transmission as described in this chapter.

**MAINSHAFT AND COUNTERSHAFT**

Refer to Figure 40.

**Disassembly**

**NOTE**
Identify and store all parts as they are disassembled so they will be installed in their same locations.

1. Remove the transmission as described in this chapter.
2. Remove the shift forks and shift drum as described in this chapter.
3. Clamp the transmission in a vise with soft jaws as shown in Figure 41. The transmission shafts are identified as follows:
   a. Countershaft (A, Figure 41).
   b. Mainshaft (B, Figure 41).
4. Remove the snap ring (Figure 42) positioned next to countershaft fifth gear.
5. Remove the following gears in order:
   a. Countershaft fifth gear (Figure 43).
   b. Mainshaft second gear (Figure 44).
   c. Countershaft second gear (Figure 45).
6. Remove the countershaft second gear split bearing (Figure 46).
7. Remove the countershaft thrust washer (A, Figure 47).
8. Remove the snap ring (B, Figure 47) positioned next to countershaft third gear.
9. Remove countershaft third gear (Figure 48).
10. Remove the snap ring (Figure 49) and thrust washer located next to mainshaft third gear. See Figure 50.
11. Remove the mainshaft third gear (Figure 51).
12. Remove the mainshaft third gear split bearing (Figure 52).
13. Remove the mainshaft thrust washer (Figure 53).
14. Press the countershaft out of its access door bearing as follows:
   a. Remove the access door from the vise and install the countershaft gear support plate (part No. HD-37404) under countershaft fourth gear as shown in Figure 54.
   b. Support the countershaft gear support plate on some metal blocks in a press so the countershaft can be pressed out without any interference. Center the countershaft under the press ram. See Figure 55.
   c. Place a mandrel on top of the countershaft and press the countershaft out of the access cover. Catch the countershaft assembly (Figure 56) so it does not fall onto the floor.
15. Remove the following components from the countershaft:
   a. Bevel spacer (Figure 57).
   b. Countershaft fourth gear (Figure 58).
   c. Snap ring (A, Figure 59) and thrust washer (B) positioned next to first gear.
   d. Countershaft first gear (C, Figure 59).
   e. Split bearing (A, Figure 60).
   f. Thrust washer (B, Figure 60).
   g. Snap ring (C, Figure 60).
16. Remove the snap ring and mainshaft first gear (Figure 61).
17. Press the mainshaft out of its access door bearing as follows:
   a. Support mainshaft fourth gear in a press as shown in Figure 62. Make sure the mainshaft can be pressed out without any interference. Center the mainshaft under the press ram.
   b. Place a mandrel on top of the mainshaft and press the mainshaft out of the access cover. Catch the mainshaft so that it does not fall to the floor.
18. Remove the following components from the mainshaft:
   a. Spacer (19, Figure 40).
   b. Mainshaft fourth gear (18, Figure 40).
   c. Split bearing (16, Figure 40).
   d. Thrust washer (14, Figure 40).
   e. Snap ring (13, Figure 40).

Inspection

The manufacturer does not provide dimensional or service specifications.
Replace parts that are excessively worn or damaged as described in this section.

1. Clean all components in solvent and dry with compressed air.

NOTE
Defective gears should be replaced. It is a good idea to replace the mating gears as a set.

2. Check each gear tooth for excessive wear, burrs, galling and pitting. Check each gear for missing teeth. Make sure the gear lugs are in good condition.
3. Install each splined gear (Figure 63) on its respective shaft and check for excessive play or binding.
4. Check each sliding gear (Figure 64) for scoring, galling or seizure marks. Spin the gear on its shaft; it should turn freely.
5. Check the groove in each sliding gear (Figure 63) for severe wear or damage. If the groove is worn or damaged, check the mating shift fork for damage. Replace the gear if necessary.
6. Check the bearing surface on each shaft. These surfaces must be smooth. See Figure 65 and Figure 66.
7. Check the shaft splines (Figure 67) for severe wear or damage.
8. Inspect the snap ring grooves (Figure 68) in each shaft. Each groove must have sharp square shoulders. If any are worn or damaged, the shaft(s) must be replaced. See the damaged splines in Figure 69.
9. Check the split bearings (Figure 70) for severe wear or damage.
10. Check the thrust washers for galling, scoring, cracks or other damage. If the washers are not smooth, replace them.
11. Check the countershaft (Figure 65) and mainshaft (Figure 66) for bending, damaged splines or other abnormal wear.

Assembly

Refer to Figure 40.

CAUTION
Replace all snap rings to ensure proper gear alignment and engagement. Do not expand a snap ring more than necessary to slide it over the shaft.

1. Apply a light coat of new transmission oil to all sliding gear and shaft sliding surfaces and split bearings (Figure 70) prior to installing any part.
2. If removed, install the access door bearings as described in this chapter.
3. Press the mainshaft into its bearing as follows:

CAUTION
The bearing driver must press against the inner bearing race or bearing damage results.

   a. Place a bearing driver (A, Figure 71) in a press that matches the mainshaft bearing inner race diameter. Place the bearing inner race on the driver so that the access door inner surface faces up as shown in B, Figure 71.
TRANSMISSION

1. Drive sprocket
2. Oil seal
3. Spacer (drive belt)
4. Quad ring
5. Snap ring
6. Bearing
7. Right crankcase half
8. Seal
9. Needle bearing
10. Main drive gear
11. Needle bearing
12. Mainshaft second gear
13. Snap ring
14. Thrust washer
15. Mainshaft third gear
16. Split bearing
17. Mainshaft first gear
18. Mainshaft fourth gear
19. Spacer
20. Mainshaft
21. Access door
22. Bushing
23. Bearing
24. Snap ring
25. Spring washer
26. Mainshaft nut
27. Countershaft needle bearing
28. Shift shaft needle bearing
29. Countershaft fifth gear
30. Countershaft second gear
31. Countershaft third gear
32. Countershaft
33. Countershaft first gear
34. Countershaft fourth gear
35. Beveled washer
36. Bearing
37. Snap ring
38. Retainer collar
39. Screw
b. Insert the mainshaft splined end (C, Figure 71) through the bearing and center it with the press ram (Figure 72).

c. Press the mainshaft into the bearing until the mainshaft shoulder bottoms out against the bearing.

d. Remove the mainshaft/access door assembly from the press and support it in a vise with soft jaws.

4. Slide the spacer (Figure 73) down the mainshaft and seat it against the bearing (A, Figure 74).

5. Install the mainshaft fourth gear split bearing and seat it next to the spacer (B, Figure 74)
6. Install mainshaft fourth gear with its shoulder (Figure 75) facing toward the access door bearing. Slide the gear over the bearing (Figure 76).

7. Install the thrust washer (Figure 77) and snap ring. Seat the snap ring in the groove next to 4th gear (Figure 78). Because of the gear’s recess, push the snap ring into its groove with a screwdriver.

8. Install mainshaft first gear (Figure 79) so the gear dogs face toward the access door.

9. Install a snap ring into the second countershaft groove on the end of the shaft with the internal threads (Figure 80).
10. Install the thrust washer next to the retaining ring (A, Figure 81).

11. Install the split bearing next to the thrust washer (B, Figure 81).

12. Install the countershaft first gear so the gear’s shoulder faces toward the open snap ring groove. Slide the gear (Figure 82) over the bearing.

13. Install the thrust washer (A, Figure 83) and seat it next to the gear.

14. Install the snap ring (B, Figure 83) into the groove next to the thrust washer. See Figure 84.

15. Install countershaft fourth gear (A, Figure 85) so the side with the single radial groove faces the thrust washer installed in Step 14.

16. Install the bevel washer (B, Figure 85) over the countershaft so its beveled side faces away from the gear. Seat the washer next to fourth gear.

17. Press the countershaft (Figure 86) into its access door bearing as follows:

   a. Support the countershaft in a press so that the assembled gear end faces up. Place the bottom of the countershaft on a press block. See A, Figure 87.

   b. Place the access door (B, Figure 87) countershaft bearing over the countershaft while at the same time meshing the countershaft and mainshaft gears. Hold both gear shafts straight up.
CAUTION
The bearing driver must press against the inner bearing race or bearing damage will result.

c. Place a bearing driver (C, Figure 87) over the inner countershaft bearing race. Center the bearing driver underneath the press ram.
d. Bring the press ram into position over the countershaft, checking that both shafts are straight up and that both gear sets are properly meshed, then press the bearing onto the countershaft until the beveled spacers bottom out against the bearing.
e. Release the press ram and check countershaft fourth gear. When properly installed, countershaft fourth gear should have no end play.

18. Secure the access door in a vise with soft jaws.
19. Install the snap ring and thrust washer (Figure 88) onto the main shaft. Seat the snap ring in the groove next to main shaft first gear.
20. Install the main shaft third gear split bearing (Figure 89) next to the thrust washer.
21. Install main shaft third gear (Figure 90) over the split bearing so that the gear dogs face up.
22. Install the thrust washer and snap ring. Seat the snap ring (Figure 91) in the groove next to main shaft third gear.
23. Install countershaft third gear (Figure 92) so its gear dogs face away from the access cover.
24. Install the countershaft snap ring (A, Figure 93) and thrust washer (B). Seat the snap ring in the groove next to the countershaft third gear.
25. Install the countershaft split bearing (Figure 94) next to countershaft third gear.
26. Install countershaft second gear (Figure 95) over the split bearing. Install the gear so its gear dogs face the access cover.
27. Install main shaft second gear (Figure 96) so that the side with the shift fork groove is toward the access cover.
28. Install countershaft fifth gear (Figure 97).
29. Install the snap ring into the groove next to countershaft fifth gear (Figure 98).
30. Install the shift forks and shift drum as described in this chapter.

**MAIN DRIVE GEAR**

Two tools are required to remove and install the main drive gear located in the right crankcase half. Removing the main drive gear without these tools, may cause crankcase and/or main drive gear damage.

1. Main drive gear remover and installer (part No. HD-35316A). See Figure 99 and A, Figure 100.
2. Cross plate (part No. HD35316-91). See B, Figure 100.
Refer to Figure 101.

Removal

1. Remove the transmission as described in this chapter.
2. Remove the spacer ring (A, Figure 102) and quad ring (B) from the main drive gear.
3. Tap out the seal (A, Figure 103) that is mounted in the end of the main drive gear. Use a drift inserted through the main drive gear as shown in B, Figure 103. Discard the seal.
4. Assemble the main drive gear remover and installer and the cross plate as shown in Figure 104. Refer to Figure 105 and Figure 106.
CAUTION
Whenever the main drive gear is removed, the main drive gear bearing must be replaced.

NOTE
Insert the two cross plate pins into the pin holes in the transmission housing. This will center the cross plate over the main drive gear.

5. Tighten the puller nut (B, Figure 106) to push the main drive gear from the main drive gear bearing. Remove the nut and puller bolt, and then remove the main drive gear (Figure 107) from the transmission portion of the engine crankcase. Disassemble and remove the puller and cross plate assembly. Discard the bearing.

6. Pry the main drive gear oil seal (2, Figure 101) out of the right crankcase half.

7. Replace the main drive gear bearing as described in Right Transmission Case Bearings in this chapter.

Inspection

1. Clean the main drive gear in solvent and dry with compressed air.
2. Check each gear tooth (Figure 108) for excessive wear, burrs, galling and pitting. Check for missing gear teeth.
3. Check the gear splines for severe wear, galling or other damage.
4. Inspect the two main drive gear needle bearings (Figure 109) for severe wear or damage. Insert the mainshaft into the main drive gear to check bearing wear. If necessary, replace the bearings as described in this section.

Main Drive Gear Needle Bearing Replacement

Both mainshaft drive gear needle bearings (9, Figure 101) must be installed to a specific depth (Figure 110). Bearing installation can be aided with the inner/outer main drive gear needle bearing installation tool (part No. HD-37842 for 1991-1994 models and part No. HD-37842A for 1995-2003...
models). This tool installs the bearing to the specified depth. If not using the tool, it is necessary to measure bearing depth when installing the new bearings.

Always replace both main drive gear needle bearings at the same time.

**CAUTION**

*Do not install a main drive gear needle bearing that has been removed. Removal damages the bearings.*

1. Support the main drive gear in a press and press out both needle bearings.

2. Clean the bearing bore in solvent and dry thoroughly.

**NOTE**

*Install both needle bearings with their manufacturer’s name and size code facing out.*

3A. The inner/outer main drive gear needle bearing installation tool is stamped with two sets of numbers. The side stamped 0.080 is for pressing in the inner end bearing and is the same for all years. The side stamped 0.285 (1991-1994 models) or 0.315 (1995-2003 models) is for pressing the outer end bearing. Figure 110 identifies the main drive gear inner and outer ends.

   a. Install the main drive gear in a press with the outer end facing up. Align the new bearing with the main drive gear and install the installation tool. Be sure the side stamped 0.285 (1991-1994 models) or 0.315 (1995-2003 models) is inserted into the bearing. Press the bearing until the tool bottoms.

   b. Turn the main drive gear over so that the inner end faces up. Align the new bearing with the main drive gear and install the installation tool with the side marked 0.080 inserted into the bearing. Press the bearing until the tool bottoms.

3B. If bearing installation tools are not available, perform the following. Figure 110 identifies the main drive gear inner and outer ends.
a. Using a suitable mandrel, press in the outer end bearing to the depth indicated in Figure 110.
b. Using a suitable mandrel, press in the inner end bearing to a depth of 0.080 in. (2.032 mm). See Figure 110.

Main Drive Gear Installation

1. Replace the main drive gear bearing (6, Figure 101) as described in Right Transmission Case Bearings in this chapter.
2. Coat the oil seal lips with transmission oil prior to installation.
3. Slide the oil seal (2, Figure 101), with its lips facing toward the crankcase, over the spacer. Tap the oil seal (Figure 111) into the crankcase until its outer surface is flush with or slightly below (0.030 in. [0.76 mm] maximum) the oil seal bore inside surface.
4. Insert the main drive gear (Figure 107) into the main drive gear bearing in the transmission portion of the engine crankcase as far as it will go (Figure 112). Then hold it in place and assemble the main drive gear remover and installer tool as shown in Figure 113 and A, Figure 114.

CAUTION
Note how the installer cup, shown in Figure 115, supports the main drive gear bearing inner race. If using a different tool setup, make sure the inner bearing race is supported in the same way. Otherwise, the bearing will be damaged when the main drive gear is pressed into place.

5. Tighten the puller nut (B, Figure 114) to pull the main drive gear through the bearing. Continue until the gear shoulder bottoms against the inner bearing race.
6. Remove the installer tool.
7. Install a new seal (Figure 116) into the end of the main drive gear until its outer surface is 0.03-0.06 in. (0.76-1.52 mm) below the bearing bore inside surface as indicated in Figure 110.
8. Install a new quad ring (A, Figure 117) over the threaded portion of fifth gear and position it next to the gear taper.
9. Slide the spacer (B, Figure 117), with its chamfered end facing the quad ring, over fifth gear and seat it against the bearing. See Figure 118.
10. Install the transmission as described in this chapter.

ACCESS DOOR BEARINGS

The access door is equipped with the following:
1. Mainshaft bearing (A, Figure 119).
2. Countershaft bearing (B, Figure 119).
3. Shift drum bushing (C, Figure 119).

Mainshaft/Countershaft Bearings Inspection

**WARNING**

Do not spin the bearings with compressed air. Compressed air will spin the bearings at speeds in excess of their designed capacity. This may cause the bearing to fly apart, which may cause eye damage or other injuries.

1. Clean both bearings in kerosene. Hold the inner bearing race with your fingers and dry the bearing with compressed air.
2. Turn the inner bearing race slowly. The bearing should turn smoothly with no roughness, binding or excessive play. If these conditions are noted, reclean and dry the bearing. If these conditions still persist, replace the bearing as described in this section.
3. If the bearing does not turn smoothly, check for damage. Also check the bearing fit in the bearing bore; both bearings must be a tight fit. If the bearing is a loose fit, check the access door for cracks or other damage.
4. Replace the bearings, if necessary, as described in this section.
5. If the bearings can be reused, lubricate them thoroughly with new transmission oil, then place the access door in a plastic bag and seal it until transmission reassembly.

Shift Drum Bushing Inspection

1. Clean the bushing (C, Figure 119) with solvent or kerosene. Dry with compressed air.
2. Inspect the bushing for scoring, overheating, galling or excessive wear.
3. Replace the bushing, if necessary, as described in this section.

Mainshaft/Countershaft Bearing Replacement

This procedure can be used to replace both bearings.
1. Remove the bearing circlip.
2. Support the access door, with its inside surface facing up, in a press.
3. Using a suitable mandrel or bearing driver, press the bearing out of the access door.
4. Clean the bearing bore and dry with compressed air.
5. Check the circlip groove for severe wear, cracks or other damage. If the groove is damaged, replace the access door.
6. Support the access door, with its outside surface facing up, in a press.

**NOTE**
*Install both bearings with the manufacturer’s name and size code facing out.*

7. Place a bearing driver on the outer bearing race and press the bearing into the access cover until the bearing bottoms out.

8. Install a new circlip, with the beveled side facing away from the bearing, into the access door groove. Make sure the circlip is fully seated in the groove.
9. Repeat for the opposite bearing.

**Shift Drum Bushing Replacement**

1. Support the access door in a press and press out the bushing from either side.
2. Clean the bushing bore in kerosene and dry with compressed air.
3. Support the access door, with its outside surface facing down, in a press.
4. Press in the bushing until its outer surface is flush with or 0.02 in. (0.51 mm) below the bushing bore inside surface as shown in Figure 120.

**RIGHT TRANSMISSION CASE BEARINGS**

The right transmission case is equipped with the following bearings:
1. Main drive gear bearing (A, Figure 121).
2. Countershaft needle bearing (A, Figure 122).
3. Shift drum needle bearing (B, Figure 122).
   
Each of these bearings can be replaced with the engine crankcase assembled and installed in the frame.

**Main Drive Gear Bearing Inspection**

Because the main drive gear bearing (A, Figure 121) is damaged when the main drive gear is removed, do not attempt to reuse the bearing. Replace the bearing as described in this section.

**Countershaft and Shift Drum Needle Bearings Inspection**

1. Clean both needle bearings (A and B, Figure 122) in kerosene and dry with compressed air.
2. Check the needle bearings for worn, loose or damaged rollers. Check the roller cage and outer shell for damage.
3. Check each bearing for a loose fit in its bore. If the bearing is a loose fit, check the access door for cracks or other damage.
4. Replace the bearings, if necessary, as described in this section.
5. If the bearings can be reused, lubricate them thoroughly with new transmission oil.

**Main Drive Gear Bearing Replacement**

Refer to Figure 101.

1. Pry the main drive gear bearing oil seal (Figure 123) out of the crankcase. Pad the screwdriver to avoid damaging the crankcase.
2. Remove the circlip (B, Figure 121) from the crankcase groove. This circlip is located behind the main drive gear oil seal.

3. Drive the main drive gear bearing out of the crankcase, working from inside the transmission housing, with a suitable bearing driver. Discard the bearing.

4. Clean the bearing bore and dry with compressed air. Check the bore for nicks or burrs. Check the circlip groove for damage.

**NOTE**

The main drive gear remover and installer and cross plate tool, used to remove the main drive gear, are used to install the new bearing. Refer to Main Drive Gear for further information on these tools.

**NOTE**

Install the bearings with the manufacturer’s name and size code facing out.

5. Install the new bearing onto the main drive gear remover and installer and cross plate tools as shown in Figure 124.

**NOTE**

Insert the two cross plate pins into the pin holes in the transmission housing (Figure 125). This will center the cross plate with the main drive gear bearing.

6. Tighten the puller nut to pull the bearing into the crankcase. Continue until the bearing bottoms out against the bearing bore surface.

7. Disassemble and remove the puller tool assembly.

8. Install the circlip, with its beveled side facing into the crankcase groove. Make sure the circlip is fully seated in the groove.

**NOTE**

The main drive gear bearing oil seal is installed during the transmission installation procedure. Refer to Transmission in this chapter.

9. Lubricate the bearing with new transmission fluid.

**Countershaft Needle Bearing Replacement**

1. Drive the countershaft needle bearing (A, Figure 122) out of the crankcase, working from inside the transmission housing, with a suitable bearing driver. Discard the bearing.

2. Clean the bearing bore and dry with compressed air. Check the bearing bore for nicks or burrs.

3. Align the new bearing, with its closed side facing out, with the crankcase bearing bore.

4. Drive in the new bearing until its outer surface is flush with or 0.030 in. (0.76 mm) below the bushing bore inside surface.

5. Lubricate the bearing with new transmission fluid.

**Shift Drum Needle Bearing Replacement**

1. Drive the shift drum needle bearing (B, Figure 122) out of the crankcase, working from inside the transmission housing, with a suitable bearing driver. Discard the bearing.

2. Clean the bearing bore and dry with compressed air. Check the bearing bore for nicks or burrs.

3. Align the new bearing, with its closed side facing out, with the crankcase bearing bore.

4. Drive in the new bearing until its outer surface is flush with or 0.030 in. (0.76 mm) below the bushing bore inside surface.

5. Lubricate the bearing with new transmission fluid.

**SHIFT MECHANISM**

To inspect and service the shift shaft assembly, the transmission must be disassembled as described in this chapter. The shift lever can be removed by loosening the pinch bolt. Tighten the pinch bolt to 90-110 in.-lb. (10-12 N•m).
### Table 1 TRANSMISSION SPECIFICATIONS

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### Table 2 TRANSMISSION TORQUE SPECIFICATIONS

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<th>ft.-lb.</th>
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<td>Transmission access door bolts*</td>
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<td>156-204</td>
<td>18-23</td>
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<tr>
<td>Countershaft retainer collar screw*</td>
<td>–</td>
<td>156-204</td>
<td>18-23</td>
</tr>
<tr>
<td>Detent screw/nut</td>
<td></td>
<td>156-204</td>
<td>18-23</td>
</tr>
<tr>
<td>Shift lever pinch bolt</td>
<td>–</td>
<td>90-110</td>
<td>10-12</td>
</tr>
<tr>
<td>Lower shift shaft locknut</td>
<td>–</td>
<td>90-110</td>
<td>10-12</td>
</tr>
<tr>
<td>Upper shift shaft nut</td>
<td>–</td>
<td>90-110</td>
<td>10-12</td>
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*Apply threadlock (Loctite 242 or equivalent).
This chapter covers fuel, emissions control and exhaust systems. Air filter service is covered in Chapter Three. Table 1 and Table 2 are at the end of the chapter.

Refer to Safety in Chapter One prior to working on the fuel system.

AIR FILTER BACKPLATE

Removal/Installation

Refer to Figure 1.

1. Remove the air filter element (Chapter Three).
2. Remove the three screws (Figure 2).
3. Remove the two bolts (Figure 3) and pull the backplate slightly away from the carburetor.
4. Disconnect the vent hose from the back of the backplate, then remove the backplate.
5. If necessary, replace the carburetor gasket (Figure 4).
6. Install by reversing the preceding steps while noting the following:
   a. Tighten the backplate-to-cylinder head bolts to 120-144 in.-lb. (14-16 N•m).
   b. Tighten the backplate-to-carburetor screws to 36-60 in.-lb. (4-7 N•m).

CARBURETOR

Operation

The carburetor atomizes fuel, and mixes it in correct proportions with the air drawn in through the air intake. At the primary throttle opening (idle), a small amount of fuel is siphoned through the pilot jet by the incoming air. As the throttle is opened further, the air stream begins to siphon fuel through the main jet and needle jet. The tapered needle increases the effective flow capacity of the needle jet as it is lifted, and occupies progressively less of the area of the jet. At full throttle, the carburetor venturi is fully open and the needle is lifted far enough to permit the main jet to flow at full capacity.

The choke circuit is a starting enrichment valve system. The choke knob under the fuel tank on the left side of the engine opens an enrichment valve. In the open position, the slow jet discharges a stream of fuel into the carburetor venturi enriching the mixture when the engine is cold.

The accelerator pump circuit reduces engine hesitation by injecting a fine spray of fuel into the carburetor intake passage during sudden acceleration.

Removal/Installation

1. Remove the air filter backplate as described in this chapter.
2. Turn the fuel supply off and disconnect the fuel line from the carburetor.

3. Remove the fuel tank as described in this chapter.

4. Label and disconnect the vacuum lines from the carburetor (Figure 5).

5. Disconnect the throttle cables from the carburetor (Figure 6).

6. Loosen the choke cable (Figure 7) setscrew at the carburetor and slide it out of its holder.

7. Drain as much of the gasoline from the carburetor assembly as possible. Store the carburetor to keep it clean until it is serviced or reinstalled.

8. Remove the carburetor mounting nuts and washers and remove the carburetor.
9. If necessary, remove the intake manifold as described in this chapter.
10. Cover the exposed manifold opening to prevent the entry of small objects.
11. Install by reversing the removal steps while noting the following:
   a. Tighten the intake manifold-to-carburetor nuts to 180-204 in.-lb. (20-23 N•m).
   b. Adjust the throttle cable (Chapter Three).
   c. Adjust the choke cable as described in Periodic Maintenance in Chapter Three.
   d. Adjust the idle speed as described in Ignition Timing in Chapter Three.

Disassembly/Assembly

Refer to Figure 8.
1. Remove the accelerator pump housing (Figure 9) at the bottom of the float bowl. Then remove the spring (Figure 10) and diaphragm (Figure 11).
2. Remove the O-ring (Figure 12) from the accelerator pump housing cover.
3. Remove the float bowl (Figure 13).
4. Remove the rubber boot (Figure 14) and O-ring (Figure 15) from the float bowl.
5. Remove the main jet (Figure 16).
6. Remove the plug (Figure 17) and remove the pilot jet (Figure 18).
7. Remove the float pin screw (Figure 19) and withdraw the float pin and float (Figure 20) as an assembly.
8. Detach the fuel valve from the float (Figure 21).
9. If necessary, tap the main nozzle (Figure 22) out with a punch.
10. Detach and remove the accelerator pump rod (Figure 23).
11. The throttle (Figure 24) and choke (Figure 25) valve assemblies are matched to the individual carburetor during manufacturing. If these parts are damaged, the carburetor must be replaced. Do not remove them.
12. Installation is the reverse of the preceding steps while noting the following:
   a. Check and adjust the float level before installing the float bowl. Refer to Fuel Level Measurement in this section.
   b. Align the accelerating pump rod with the rubber boot and the pump housing during reassembly. Refer to Figure 26.

Inspection/Cleaning

CAUTION
Do not clean rubber, plastic or other non-metal parts in carburetor cleaner. The chemical will destroy these parts.

1. Clean all metal parts in a suitable carburetor cleaner. Follow the manufacturer’s instructions.
2. Remove all parts from the cleaner and blow dry with compressed air. Make sure all residue has been removed from the float bowl (Figure 27). Blow out the jets with compressed air. Do not use a drill or piece of wire to clean them as minor gouges in a jet can alter the flow rate and the air/fuel mixture.
3. If the float is suspected of leaking, put it in a small container of water and push it down. If the float sinks or if bubbles appear indicating a leak, replace the float.
4. Check the float needle (Figure 28) and seat contact areas. Both contact surfaces should appear smooth without any damage. Replace both needle and seat as a set if any one part is damaged.
### CARBURETOR

1. Screw  
2. Washer  
3. Choke cable bracket  
4. Throttle stop screw  
5. Washer  
6. Spring  
7. Screw  
8. Washer  
9. Throttle cable bracket  
10. Fuel hose  
11. Fitting  
12. Gasket  
13. Gasket  
14. Clip  
15. Washer  
16. Fast idle cam  
17. Screw  
18. Detent ball  
19. Spring  
20. Nut  
21. Lockwasher  
22. Bracket  
23. Spring  
24. Fast idle lever  
25. Screw  
26. Spring  
27. Rocker arm  
28. Washer  
29. Main jet  
30. Low speed jet  
31. Plug  
32. Gasket  
33. Fuel inlet valve  
34. Clip  
35. Float pin  
36. Float  
37. Float pin retaining screw  
38. Screw  
39. Float bowl  
40. Accelerator pump diaphragm  
41. Spring  
42. O-ring  
43. Accelerator pump housing  
44. Screw  
45. Screw  
46. Clip  
47. Overflow hose  
48. Accelerator pump rod  
49. Boot
5. Inspect the accelerator pump diaphragm (Figure 29) for holes and cracks. Replace if necessary.
6. Replace the accelerator pump rod if bent or worn thin at any point.
7. Replace all O-rings. Replace all gaskets.

**Fuel Level Measurement**

1. Remove the carburetor as described in this section.

   **NOTE**
   *It is not necessary to remove the accelerator pump cover (A, Figure 30) when removing the float bowl. However, it is necessary to remove the one long accelerator pump/float bowl screw (45, Figure 8).*

2. Remove the float bowl (B, Figure 30).
3. Turn the carburetor to position the float bowl as indicated in Figure 31. Measure the float height from the float bowl gasket surface to the top float surface. The measurement should be 0.63-0.67 in. (16.0-17.0 mm). If incorrect, perform the following:
   a. Remove the float pin screw (Figure 32) and withdraw the float pin and float (Figure 33) as an assembly.
   b. Detach the fuel valve from the float (Figure 21).
   c. Bend the float tang (Figure 34) to adjust.
   d. Reinstall the float and recheck the float height.
4. Reinstall the float bowl and install the carburetor as described in this section.

**INTAKE MANIFOLD**

**Removal/Installation**

Refer to Figure 35.
1. Remove the carburetor as described in this chapter.

   **NOTE**
   *It may be necessary to use a ball-end type or shortened Allen wrench for access to the intake manifold bolts.*
2. Remove the bolts and nuts securing the intake manifold (Figure 36) to the cylinder heads.

**NOTE**
The front and rear intake manifold flanges are different. If the flanges are not marked (Figure 37), label them with an F and R to reinstall them in the correct location.

3. Remove the intake manifold, flanges and manifold seals.

4. Inspect the intake manifold. Inspect the intake manifold seals (A, Figure 38) for wear, deterioration or other damage. Replace the seals as a set if necessary.

5. Install the carburetor and spacer on the intake manifold. Tighten the intake manifold-to-carburetor mounting bolts to 180-204 in.-lb. (20-23 N•m).

6. Install the flanges and seals onto the intake manifold. Note that the seals (A, Figure 38) and flanges (B) have a tapered side. Fit the seal taper into the flange taper. Be sure the correct flange (F or R) is located at the front or rear of the manifold.

7. Install the intake manifold onto the cylinder head intake ports. The slotted ends of the flanges must point to the left.

8. Make sure the front and rear seals seat squarely against the cylinder head mating surfaces.

9. Install the intake manifold mounting bolts and nuts. Tighten the bolts and nuts to 72-120 in.-lb. (8-14 N•m).
10. Complete carburetor installation as described in this chapter.

**FUEL HOSE AND CLAMPS**

*CAUTION*
Discard removed crimp-type hose clamps. Do not attempt to reuse removed clamps.

The fuel supply hose between the fuel valve and carburetor is secured at the hose ends with non-reusable hose clamps (A, **Figure 39**). Use diagonal pliers or other suitable tool to separate the clamp bands, then remove the clamp. Use hose clamp pliers (part No. HD- 97087-65B or equivalent) to compress the clamp bands during installation. A screw-type hose clamp may be substituted in place of the original equipment hose clamp.

*NOTE*
End cutting pliers (B, **Figure 39**) may be modified to compress the band clamps. Be sure to test the performance of the tool by checking the fit and integrity of the installed clamp.

**THROTTLE AND IDLE CABLES**

**Removal/Installation**

Refer to **Figure 40**.
1. Remove the fuel tank as described in this chapter.
2. Remove the air filter backplate as described in this chapter.
3. Loosen the two cable adjuster locknuts and turn the cable adjusters (**Figure 41**) to obtain as much cable slack as possible.
4. Remove the throttle housing screws and separate the upper and lower housings.
5. Unhook the cables from the throttle grip and lower housing. Account for the ferrules from the ends of both cables.
6. Disconnect the throttle cables at the carburetor. See **Figure 42**.
7. Tie a piece of heavy string or cord to the end of the throttle cable at the carburetor. Wrap this end with masking or duct tape. Do not use an excessive amount of tape as it will be pulled through the frame loop during removal. Tie the other end of the string to the frame. The piece of string attached in the next step will be used to pull the new throttle cable back through the frame so it can be routed in the exact same position.
8. Pull the cable and attached string out through the frame loop, past the electrical harness and from behind the headlight housing. Make sure the attached string follows the same path as the cable through the frame.
9. Remove the tape and untie the string from the old cable.
10. Tie the string to the new throttle cable and wrap it with tape.
11. Pull the string back through the frame, routing the new cable through the same path as the old cable.
12. Remove the tape and untie the string from the cable and the frame.
13. Lubricate the new cables as described in the Periodic Lubrication in Chapter Three.
14. Slip the cable in through the carburetor bracket. Then, while holding the lever up with one hand, engage the cable at the carburetor lever.
15. Attach the throttle cables to the throttle/switch housing and install the housing.
16. Repeat for the other cable.
17. Operate the throttle grip and make sure the carburetor throttle linkage is operating correctly and with no binding. If operation is incorrect, check that the cables are attached correctly and there are no tight bends in the cables.
18. Adjust the throttle cables as described in Chapter Three.
19. Install all throttle attaching bolts or brackets.
20. Install the fuel tank.
21. Start the engine and turn the handlebar from side-to-side. Do not operate the throttle. If the engine speed increases as the handlebar assembly is turned, the throttle cables are routed incorrectly. Remove the fuel tank and re-check the cable routing.
22. Install the air filter backplate.

CHOKE CABLE

Removal/Installation

1. Remove the fuel tank as described in this chapter.
2. Remove the air filter backplate as described in this chapter.
3. Loosen the choke cable (Figure 43) setscrew on the carburetor and slide it out of its holder.
4. Loosen the choke nut at the choke knob (Figure 44) and remove the nut and choke knob.
5. Remove the choke cable.
6. Install by reversing the preceding steps.
7. Adjust the choke cable as described in this section.

Adjustment

1. Remove the air filter backplate as described in this chapter.
2. Check that the choke valve (Figure 45) operates in the positions shown by the choke knob in Figure 46.
3. If necessary, adjust the choke by loosening the nuts at the choke knob and adjusting the length of the cable. Tighten the nuts and recheck.
FUEL TANK

WARNING
Some fuel may spill from the fuel tank hose during this procedure. Because gasoline is extremely flammable and explosive, perform this procedure away from all open flames, including appliance pilot lights and sparks. Do not smoke or allow anyone to smoke in the work area, as an explosion and fire may occur. Always work in a well-ventilated area. Wipe up any spills immediately. Refer to Safety in Chapter One.

WARNING
Route the fuel tank vapor hoses so they cannot contact hot engine or exhaust components.

Removal/Installation

Refer to Figure 47.

1. Disconnect the battery negative lead (Chapter Twelve).
2. Turn the fuel valve (Figure 48) to the off position.
3. Remove the hose clamp and disconnect the fuel hose from the valve.
4. Drain the fuel tank as follows:
   a. Connect a drain hose to the fuel valve and secure it with a hose clamp. Insert the end of the drain hose into a gas can.
   b. Turn the fuel valve (Figure 48) to the reserve position so the fuel will start to flow into the gas can.
   c. When fuel stops flowing through the hose, turn the fuel valve off and disconnect the drain hose.
5. Remove the front mounting bolt and washer (Figure 49).
6. Remove the rear mounting bolt and washer (Figure 50).
7. Lift and remove the fuel tank.

WARNING
Store the fuel tank in a safe place away from open flames or where it could be damaged.

8. Drain any remaining fuel into a gas can.
9. Inspect the fuel tank as described in this section.
10. Installation is the reverse of removal while noting the following:
    a. Tighten the front and rear mounting bolts to 19 ft.-lb. (26 N•m).
    b. Reconnect the fuel hose to the fuel valve and secure it with a new hose clamp as described in this chapter.
    c. Refill the tank and check for leaks.

Inspection

1. Inspect the fuel hose and vent hose for cracks, deterioration or damage. Replace damaged hoses with the same type and size materials. The fuel lines must be flexible and able to withstand engine heat and vibration.
2. Check the fuel hose insulating sleeve for damage. Replace if necessary.
3. Check for damaged mounting brackets.
4. Inspect the fuel tank for leaks.
5. Remove the filler cap and inspect the tank for rust or contamination. If present, thoroughly flush and clean the tank. Replace the tank, if necessary.

FUEL SHUTOFF VALVE

The fuel shutoff valve is mounted on the left side of the fuel tank (Figure 48). A replaceable fuel filter is mounted at the top of the fuel shutoff valve.

Removal

Refer to Figure 51.

1. Remove the fuel tank as described in this chapter.
2. Place the fuel tank on a protective pad and position it so fuel will not spill out when removing the fuel shutoff valve.
3. Loosen the fuel valve nut and remove the fuel shutoff valve from the fuel tank. Drain residual gasoline from the tank after valve removal.
Cleaning and Inspection

1. Inspect the filter strainer mounted on top of the fuel valve (Figure 51). Remove contamination from the filter. Replace the filter if it is damaged.
2. Install a new filter gasket before installing the filter onto the fuel valve.
3. Remove all sealant residue from the fuel tank and fuel valve threads.

Installation

1. Install a new filter gasket onto the fuel shutoff valve, then install the filter.
51. \[ \text{Strainer} \]

52. \[ \text{RES} \]

53. \[ \text{ON} \]

54. \[ \text{OFF} \]

55. \[ \text{Nut} \]

56. \[ \text{Clamp} \]

57. \[ \text{Hose} \]
2. Coat the fuel valve threads with pipe sealant.
3. Insert the fuel valve into the tank and tighten the nut securely.
4. Install the fuel tank as described in this chapter.

EXHAUST SYSTEM

Removal/Installation

1. Place the motorcycle on the sidestand.
2. Loosen the muffler clamps and brackets (Figure 52).
3. Remove the muffler mount bolts (Figure 53).
4. Slide the mufflers (Figure 54) off the exhaust pipes.
5. Loosen and remove the exhaust pipe nuts from the cylinder head studs (Figure 55).
6. Remove the exhaust pipe assembly (Figure 56).
7. Install by reversing the preceding removal steps while noting the following:
   a. Replace the exhaust port gaskets (Figure 57) if worn or damaged. During installation, make sure the gaskets are installed in the cylinder heads correctly.
   b. Install all parts and finger tighten fasteners only. Then tighten the exhaust nuts at the cylinder head and work back to the mufflers. This will minimize exhaust leaks at the cylinder heads. Make sure all fasteners are tightened securely.

Inspection

1. Inspect all pipes for rust or corrosion.
2. Remove all rust from exhaust pipes and muffler mating surfaces.
3. Replace rusted or damaged exhaust system components.
4. Replace damaged exhaust pipe snap rings.
5. Replace damaged heat shields.

EVAPORATIVE EMISSION CONTROL SYSTEM (CALIFORNIA MODELS)

The evaporative emission control system prevents gasoline vapor from escaping into the atmosphere. When the engine is not running, the system directs the fuel vapor from the fuel tank through the vapor valve and into the carbon canister.

When the engine is running, these vapors are drawn through a purge hose and into the carburetor where they burn in the combustion chambers. The vapor valve also prevents gasoline vapor from escaping from the carbon canister if the motorcycle falls onto its side.

Carbon Canister Inspection

Refer to Figure 58 and Figure 59 for component placement and hose routing. Before removing the hoses from any of the parts, mark the hose and fitting.
WARNING
Make sure the fuel tank vapor hoses are routed so they cannot contact hot engine or exhaust components.

1. Check all emission control lines and hoses to make sure they are correctly routed and connected.
2. Make sure there are no kinks in the lines or hoses. Also inspect the hoses and lines routed near engine hot spots for excessive wear or burning.
3. Check the physical condition of all lines and hoses in the system. Check for cuts, tears or loose connections. These lines and hoses are subjected to various temperatures and operating conditions, and eventually become brittle and crack. Replace damaged lines and hoses.
4. Check all components in the emission control system for damage, such as broken fittings.
5. If canister replacement is required, mark the hoses and prior to disconnecting the hoses from the canister.

Vapor Valve Replacement

The vapor valve (7, Figure 58) is part of the fuel pressure relief system. The fuel tank vapor expands as the fuel tank temperature rises. The vapor valve relieves excess pressure within the tank.

The lower hose is connected to the carbon canister.
1. Label the upper hose and lower hose where they are connected to the vapor valve fittings.
2. Disconnect the hoses from the vapor valve and remove the vapor valve.

WARNING
The vapor valve must be mounted in a vertical position in order to operate correctly.

3. Position the vapor valve with the long neck fitting at the top and attach the upper and lower hoses to the vapor valve.
### Table 1 CARBURETOR SPECIFICATIONS

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<td>Float height</td>
<td>0.63-0.67 in. (16.0-17.0 mm)</td>
<td>0.63-0.67 in. (16.0-17.0 mm)</td>
</tr>
</tbody>
</table>

### Table 2 FUEL, EMISSION CONTROL AND EXHAUST SYSTEM TORQUE SPECIFICATIONS

<table>
<thead>
<tr>
<th></th>
<th>ft.-lb.</th>
<th>in.-lb.</th>
<th>N•m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backplate-to-carburetor screws</td>
<td>–</td>
<td>36-60</td>
<td>4-7</td>
</tr>
<tr>
<td>Backplate-to-cylinder head bolts</td>
<td>–</td>
<td>120-144</td>
<td>14-16</td>
</tr>
<tr>
<td>Fuel tank mounting bolts</td>
<td>19</td>
<td>–</td>
<td>26</td>
</tr>
<tr>
<td>Intake manifold mounting bolts and nuts</td>
<td>–</td>
<td>72-120</td>
<td>8-14</td>
</tr>
<tr>
<td>Intake manifold-to-carburetor nuts</td>
<td>–</td>
<td>180-204</td>
<td>20-23</td>
</tr>
</tbody>
</table>
CHAPTER ELEVEN

FUEL, EMISSION CONTROL AND EXHAUST SYSTEMS (1988-2003 MODELS)

This chapter covers fuel, emissions control and exhaust systems. Air filter service is covered in Chapter Three. Tables 1 and Table 2 are at the end of the chapter.

Refer to Safety in Chapter One prior to working on the fuel system.

AIR FILTER BACKPLATE

Removal/Installation

NOTE
Early models are equipped with a foam-type filter. Later models are equipped with a paper-mesh filter as shown in Figure 1.

1. Remove the air filter element (Chapter Three).
2. Remove the backplate bolts (A, Figure 2).

CAUTION
Do not remove the screws from the backplate unless the backplate requires replacement. Completely removing the screw damages the backplate insert sleeve threads.

3. Loosen the screws (B, Figure 2) 1 or 2 turns at a time in a crisscross pattern until they disengage from the carburetor holes. Remove the backplate and screws.

4. On California models, label and then disconnect the hoses from the backplate (Figure 1). Disconnect the butterfly valve solenoid wiring 4-pin connector.
5. If necessary, replace the carburetor gasket.
6. Install by reversing the preceding steps while noting the following:
   a. Install the backplate-to-carburetor screws first to align the backplate, but do not tighten the screws. On HDI models, use the air filter retaining screws, which also serve to secure the backplate to the carburetor.
   b. After aligning the backplate to the carburetor, loosely install the backplate-to-cylinder head bolts.
   c. Tighten the backplate-to-carburetor screws to 36-60 in.-lb. (4-7 N•m). On HDI models, tighten the air filter retaining screws to 20 in.-lb. (2 N•m).
   d. Tighten the backplate-to-cylinder head bolts to 120-144 in.-lb. (14-16 N•m).

CARBURETOR

Operation

The carburetor atomizes fuel in correct proportions with the air drawn in through the air intake. At the primary throttle opening (idle), a small amount of fuel is siphoned through the pilot jet by the incoming air. As the throttle is opened further, the air stream begins to siphon fuel through
the main jet and needle jet. The tapered needle increases the effective flow capacity of the needle jet as it is lifted, and occupies progressively less of the area of the jet. At full throttle, the carburetor venturi is fully open and the needle is lifted far enough to permit the main jet to flow at full capacity.

The choke circuit is a starting enrichment valve system. The choke knob under the fuel tank on the left side of the engine opens an enrichment valve. In the open position, the slow jet discharges a stream of fuel into the carburetor enriching the mixture when the engine is cold.

The accelerator pump circuit reduces engine hesitation by injecting a fine spray of fuel into the carburetor intake passage during sudden acceleration.

Removal/Installation

1. Remove the air filter (Chapter Three).
2. Remove the air filter backplate as described in this chapter.
3. Turn the fuel valve off.
   
   **NOTE**
   It is easier to remove the enrichener cable while it is attached to the carburetor.

4. Remove the enrichener bracket mounting screw (Figure 3) and allow the bracket to rest on top of the intake manifold.
5. Push the rubber boots (Figure 4) off the throttle cable adjusters.
6. Loosen the throttle friction screw.
7. Loosen both throttle cable adjuster jam nuts (A, Figure 5), then turn the cable adjusters (B).

**NOTE**
Refer to Fuel Hose And Clamps in this chapter when disconnecting the fuel hose.

8. Label and then disconnect the fuel supply hose from the carburetor fitting.
9A. On 1988-1990 models, loosen the hose clamp, then pull the carburetor out of the manifold.
9B. On 1991-2003 models, twist and pull the carburetor off the seal ring and intake manifold.
10. Identify and label all carburetor hoses for correct reinstallation. Then disconnect the hoses from the carburetor.
11. There are two different throttle cables. Label the two cables at the carburetor before disconnecting them. One is the throttle control cable (A, Figure 6) and the other is the idle control cable (B). Disconnect the throttle control cable and the idle control cable from the carburetor cable guide and the throttle pulley.
12. Drain the gasoline from the carburetor.
13. If necessary, service the intake manifold as described in this chapter.
14. Inspect the manifold seal ring (Figure 7) for wear, hardness, cracks or other damage. Replace if necessary.
15. Cover the intake manifold opening.

**Installation**

1. If removed, seat the manifold seal ring (Figure 7) onto the intake manifold. Make sure it is correctly seated to avoid a vacuum leak.
2. Route the starting enrichment valve cable between the cylinders and towards the mounting bracket on the left side.
3. Connect the idle cable to the carburetor as follows:
   a. The idle cable has the small spring (C, Figure 6) on the end of the cable.
   b. Insert the idle cable sheath into the rear cable bracket guide on the carburetor.
   c. Attach the end of the idle cable (B, Figure 6) to the throttle pulley.
4. Connect the throttle cable to the carburetor as follows:
   a. Insert the throttle cable sheath into the front cable bracket guide on the carburetor.
   b. Attach the end of the throttle cable (A, Figure 6) to the throttle pulley.
5. Operate the throttle a few times. Make sure the throttle pulley operates smoothly with no binding. Also make sure both cable ends are seated squarely in the cable bracket guides and in the throttle pulley.
6. Connect any disconnected hoses to the carburetor.

**CAUTION**
The carburetor must fit squarely onto the intake manifold. If it is misaligned, it may damage the manifold seal ring, resulting in a vacuum leak.

**NOTE**
To ease installation of the carburetor, apply a light coat of liquid dish soap to the carburetor spigot before insertion into the manifold seal ring.

7A. On 1988-1990 models, insert the enrichener cable (Figure 3) between the cylinders and above the intake man-
ifold. Install the hose clamp around the carburetor spigot, then install the carburetor into the intake manifold until it bottoms (Figure 8). Position the carburetor so it sits square and vertical with the manifold. Tighten the hose clamp.

7B. On 1991-2003 models, insert the enrichener cable (Figure 3) between the cylinders and above the intake manifold. Align the carburetor with the intake manifold and push the carburetor into the manifold seal ring until it bottoms (Figure 8). Position the carburetor so it sits square and vertical with the manifold.

8. Secure the enrichener bracket to the cylinder head bracket with its mounting screw (Figure 3).

9. Install the air filter backplate as described in this chapter.

WARNING
Make sure that all evaporative emission control hoses are routed so they cannot contact any hot engine or exhaust component. These hoses contain flammable vapors. If a hose melts from contacting a hot part, leaking vapors may ignite, causing severe motorcycle damage and rider injury.

CAUTION
Interchanging the vacuum hose connections will reduce engine performance

10. On California models, reconnect all evaporative emission control system hoses following notes made prior to disassembly. Refer to the Evaporative Emissions Control System in this chapter to confirm the correct connection of each hose.

11. Adjust the throttle and enrichener cables (Chapter Three).

Disassembly

Refer to Figure 9.

1. Unscrew and remove the enrichener cable (Figure 10).
2. If not previously removed, remove the throttle cable bracket screw and lockwasher and remove the bracket (Figure 11).

3A. On 1988 models, remove the float bowl from the carburetor. Account for the float bowl O-ring.

NOTE
An accelerator pump is installed on 1989-2003 models. Note the position of the throttle and pump rods when removing the float bowl.

3B. On 1989-2003 models, remove the float bowl as follows:
   a. Remove the screws and washers securing the float bowl (Figure 12) to the carburetor. Remove the float bowl from the carburetor while allowing the pump rod (Figure 13) to withdraw from the boot on the bowl.
   b. Disconnect the pump rod from the lever assembly on the carburetor (Figure 14).
   c. Pull the boot (Figure 15) off the float bowl.

4A. On 1988-1991 models, remove the float pin (Figure 16) and lift off the float and needle valve assembly (Figure 17).

4B. On 1992-2003 models, remove the float pin (Figure 18) and lift off the float and needle valve assembly (Figure 19).

5. The main jet is screwed into the top of the needle jet holder. Either remove the main jet (Figure 20) and then the needle jet holder with the main jet attached.

6. Remove the needle jet from the needle jet bore (Figure 22) in the carburetor.

CAUTION
If the screwdriver used to remove the pilot jet is too small it may damage the top of the jet. If necessary, grind a screwdriver tip to fit.

7. Remove the pilot jet (Figure 23).

8. Remove the remaining cover screws and washers and remove the cover (Figure 24) and spring (Figure 25).

9. Remove the vacuum piston (Figure 26) from the carburetor housing. Do not damage the jet needle sticking out of the bottom of the vacuum piston.

10. Remove the spring seat (A, Figure 27) and jet needle (B) from the vacuum piston.

11. On 1989-2003 models, remove the accelerator pump diaphragm using the following procedure:
   a. Remove the screws and lockwashers holding the pump cover (Figure 28) to the float bowl and remove the cover.
**CARBURETOR**

1. Screw  
2. Lockwasher  
3. Flat washer  
4. Cover  
5. Spring  
6. Spring seat  
7. Jet needle  
8. Vacuum piston  
9. Cable guide  
10. Spring  
11. Enrichener valve  
12. Body  
13. Vacuum fitting  
14. Idle adjustment screw  
15. Washers  
16. Spring  
17. Screw  
18. Throttle cable bracket  
19. Lockwasher  
20. Screw  
21. Needle jet  
22. Needle jet holder  
23. Main jet  
24. Fuel valve and clip  
25. Float  
26. Pin  
27. Pilot jet  
28. Overflow pipe  
29. O-ring  
30. Lockwasher  
31. Screw  
32. Float bowl  
33. Hose (1988 models)  
34. Clamp (1988 models)  
35. Fuel overflow fitting (1988 models)  
36. Cotter pin  
37. Washer  
38. Roller  
39. Pump lever assembly  
40. Lockwasher  
41. Screw  
42. E-clip  
43. Throttle rod  
44. Pump rod  
45. Washers  
46. Spring  
47. Boot  
48. Drain screw  
49. O-ring  
50. Diaphragm  
51. Spring  
52. O-ring  
53. Cover  
54. Lockwasher  
55. Screw  
56. O-ring  
57. Accelerator pump nozzle  
58. Float bowl
b. Remove the pump cover O-ring (Figure 29).

c. Remove the spring (A, Figure 30) and diaphragm (B).

**NOTE**
Replacement parts are not available for the throttle plate (Figure 31) assembly. Do not loosen the screws or remove the throttle plate.

**Inspection**

**CAUTION**
Do not clean rubber, plastic or other non-metal parts in carburetor cleaner. The chemical will destroy these parts.
1. Clean all metal parts in carburetor cleaner. Follow the manufacturer’s instructions.

2. Remove all parts from the cleaner and blow dry with compressed air. Blow out the jets (Figure 32) with compressed air. Do not use a piece of wire or small drill bit to clean them, as minor gouges in a jet can alter the flow rate and upset the air/fuel mixture.

3. Make sure the needle jet holder (Figure 32) bleed tube orifices are clear.

4. Make sure all fuel and air openings are clear. Blow them out with compressed air if necessary.

5. Check the float assembly for leaks; see A, Figure 33 (1988-1991 models) or Figure 34 (1992-2003 models). Place the float in a container full of water and push it down. It should float and there should be no bubbles. Replace the float assembly if it leaks.

6. Check the float needle (B, Figure 33) and seat (Figure 35) contact areas closely. Both contact surfaces should be smooth with no gouging or other damage. Replace the needle if damaged. The seat is a permanent part of the carburetor housing; if damaged, replace the housing.

7. A damaged accelerator pump diaphragm (Figure 36) will cause poor acceleration. Hold the diaphragm up to a strong light and check the diaphragm for pin holes, cracks or other damage. Replace if necessary.
8. Remove the accelerator pump nozzle (A, Figure 37) and O-ring (B) from the float bowl. Clean the nozzle with compressed air.

9. Replace the pump rod if bent or worn.

10. Inspect all O-rings and replace if necessary. When replacing an O-ring, make sure the new O-ring fits in its groove properly. See Figure 38, typical.

11. Inspect the pilot jet (Figure 32) for wear or damage. Check the slot in the top of the jet for cracks or breaks. Replace if damaged.

12. Inspect the vacuum piston (Figure 39) as follows:
   a. Check the spring (Figure 25) for fatigue, stretching, distortion or other damage.
   b. Check the vacuum passage through the bottom of the piston for contamination. Clean passage if blocked.
   c. The sides of the piston ride in grooves machined in the carburetor bore. Check these sides for roughness, nicks, cracks or distortion. If the piston sides are damaged, check the mating grooves in the carburetor for damage. Minor roughness can be removed with emery cloth or by buffing. If the sides are severely damaged, replace the vacuum piston.
   d. Hold the vacuum piston up to a light and check the diaphragm (Figure 40) for holes, tearing, cracks, age deterioration or other damage. Check the diaphragm where it is mounted against the piston. If the diaphragm is damaged, replace the vacuum piston.
e. Check the jet needle (B, Figure 27) for bending or
damage.

13. Inspect the enricher system as follows:
   a. Check for a rough or damaged enricher valve.
      Check the needle (Figure 41) on the end of the
      enricher valve for bending or contamination.
   b. Check the enricher valve spring for fatigue,
stretching or distortion.
   c. The enricher valve chamber (A, Figure 42) in the
      carburetor must be clean. Clean the chamber, making
      sure the enricher valve air inlet and the air/fuel pas-
      sages are clear.
   d. Check the enricher valve cable (Figure 43) for
      kinks or other damage.

14. Check the throttle rod (Figure 44) and all external car-
buretor components for missing or damaged parts.

15. Check that the throttle valve shaft E-clip (B, Figure
42) is properly secured in the groove on the end of the
shaft.

Assembly

Refer to Figure 9.

1. Prior to assembly, refer to Inspection in this section.
Clean all parts before assembly.
NOTE
Before installing new jets, check the jet size and compare it to the old jet. Refer to Table 1 for original equipment jet sizes.

2. Place the pilot jet (Figure 45) into the passage and tighten it with the same screwdriver used during removal.
3. The needle jet has two different sides and can be installed incorrectly. Install the needle jet into its passage (Figure 46) so that the end with the larger opening faces up toward the vacuum piston chamber.
4. Install the needle jet holder (Figure 47) into the main jet passage and tighten it securely.
5. Install the main jet (Figure 48) onto the end of the needle jet holder and tighten securely.

6A. On 1988-1991 models, install the float as follows:
   a. Install the fuel valve onto the float (Figure 49) and position the float onto the carburetor so the valve drops into its seat.
   b. Align the float pivot arm with the two carburetor mounting posts and slip the pin through the float pivot arm and mounting posts (Figure 50).

6B. On 1992-2003 models, install the float as follows:
   a. Install the fuel valve onto the float (Figure 51) and position the float onto the carburetor so the valve drops into its seat.
   b. Align the float pivot arm with the two carburetor mounting posts and slip the pin through the float pivot arm and mounting posts (Figure 52).
7. Check float level as described in this section.

8A. On 1988 models, assemble and install the float bowl using the following procedure:
   a. Install a new O-ring onto the float bowl.
   b. Install the float bowl onto the carburetor.
   c. Install the retaining screws and lockwashers. Tighten the screws securely in a crisscross pattern.

8B. On 1989-2003 models, assemble and install the float bowl using the following procedure:
   a. Insert the accelerator pump nozzle into the float bowl. Install the O-ring onto the nozzle. See Figure 53.
   b. Install the rubber boot (A, Figure 54) and O-ring (B) onto the float bowl.
   c. Connect the pump rod onto the lever assembly on the carburetor (Figure 55).
   d. Insert the pump rod through the boot on the float bowl while installing the float bowl (Figure 56) onto the carburetor. Then check that the pump rod is still attached to the lever assembly as shown in Figure 57. Check also to see if the pump rod is visible through the hole in the pump chamber in the float bowl (Figure 58). If not, remove and reinstall the float bowl and pump rod.
   e. Install the float bowl screws and washers and tighten securely in a crisscross pattern.

9. On 1989-2003 models, install the accelerator pump diaphragm assembly using the following procedure:
a. Insert the accelerator pump diaphragm into the bottom of the float bowl. Make sure the diaphragm (Figure 59) seats around the bowl groove evenly.
b. Install the spring (Figure 60) into the center of the accelerator pump diaphragm.
c. Install the O-ring (Figure 61) into the cover passage-way hole.
d. Align the cover assembly with the diaphragm and bowl and install the cover assembly. Install the screws (Figure 62) and lockwashers and tighten securely.

10. Insert the jet needle (B, Figure 63) through the center hole in the vacuum piston. Place the spring seat (A, Figure 63) over the top of the needle to secure it.

11. Align the slides on the vacuum piston with the grooves in the carburetor bore and install the vacuum piston (Figure 64). The slides on the piston are offset, so the piston can only be installed one way. When installing the vacuum piston, make sure the jet needle enters the needle jet.

12. Seat the outer edge of the vacuum piston into the groove at the top of the carburetor piston chamber.

13. Insert the spring (Figure 65) into the vacuum piston so that the end of the spring fits over the spring seat.

14. Align the free end of the spring with the carburetor top and install the top onto the carburetor, compressing the spring.

15. Hold the carburetor top in place and lift the vacuum piston with a finger. The piston should move smoothly. If
the piston movement is rough or sluggish, the spring may be improperly installed. Remove the top and reinstall the spring.

16. Install the top carburetor screws, lockwashers and flat washers securely.

17. Install the throttle cable bracket (A, Figure 66) onto the carburetor so that the end of the idle speed screw engages the top of the throttle cam stop (B). Hold the bracket in place and install the bracket’s side mounting screw and washer; tighten the screw securely. Then install the upper bracket mounting screw (Figure 67), lockwasher and flat washer finger-tight. Tighten the remaining carburetor cap screw securely.

18. Align the enrichener valve needle (Figure 68) with the needle passage in the carburetor and install the enrichener valve. Tighten the valve nut securely.

19. Install the float bowl overflow hose and secure it with the clamp.

**Float Level Adjustment**

*1988-1991 models*

An incorrect float level can cause flooding as well as poor fuel economy and acceleration.

The carburetor must be removed and partially disassembled for this adjustment.

1. Remove the carburetor as described in this section.

2. Remove the float bowl as described in *Disassembly* in this section.

3. One-piece floats are used in the carburetor. Before checking the float level, check that both float halves (Figure 69) are aligned at an equal height with each other. If the float halves are not in alignment, remove the float and check it for damage.

4. Turn the carburetor to position the float bowl as shown in Figure 70. Measure the float height from the face of the bowl mounting flange surface to the bottom float surface. Do not apply pressure to the float when measuring. The correct float height is 0.725-0.730 in. (18.4-18.5 mm).
5. If the float level is incorrect, remove the float pin and float. Bend the tab on the float hinge that contacts the fuel valve.
6. Reinstall the float and the float pin and recheck the float level. Repeat until the float level is correct.
7. Reinstall the float bowl as described in Assembly in this section.
8. Reinstall the carburetor as described in this chapter.

An incorrect float level can cause flooding as well as poor fuel economy and acceleration.

The carburetor must be removed and partially disassembled for this adjustment.
1. Remove the carburetor as described in this chapter.
2. Remove the float bowl as described in Disassembly in this chapter.
3. One-piece floats are used in the carburetor. Before checking the float level, check that both float halves (Figure 71) are aligned at an equal height with each other. If the float halves are not in alignment, remove the float and check it for damage.
4. Place the carburetor intake spigot on a flat surface as shown in Figure 72. This is the measuring position.
5. Tilt the carburetor 15° to 20° as shown in Figure 73. At this position, the float tab will contact the fuel valve pin without compressing the internal fuel valve spring.

**NOTE**
*If the carburetor is tilted less than 15° or more than 20°, the following carburetor measurements will be incorrect.*

6. Measure from the carburetor flange surface to the top of the float as shown in Figure 73. When measuring float level, do not compress the fuel valve internal spring. The correct float level measurement is 0.413-0.453 in. (10.5-11.5 mm).
7. If the float level is incorrect, remove the float pin and float. Bend the tab on the float hinge that contacts the fuel valve.
8. Reinstall the float and the float pin and recheck the float level. Repeat until the float level is correct.
9. Reinstall the float bowl as described in Assembly in this section.
10. Reinstall the carburetor as described in this chapter.

INTAKE MANIFOLD

Removal/Installation

1988-1989 models

Refer to Figure 74.
A rubber intake manifold is used on these models. A hose clamp secures the carburetor spigot in the manifold.
1. Remove the carburetor as described in this chapter.

NOTE
It may be necessary to use a ball-end type or shortened Allen wrench for access to the intake manifold bolts.

2. Remove the bolts and nuts securing the intake manifold to the cylinder heads.

NOTE
The front and rear intake manifold flanges are different. If the flanges are not marked (Figure 75), label them with an F (front) and R (rear) so they will be reinstalled in the correct location.

3. Remove the intake manifold, flanges and manifold seals.
4. Inspect the intake manifold.
5. Inspect the intake manifold seals (A, Figure 76) for wear, deterioration or other damage. If damaged, replace the seals as a set.
6. Install the flanges and seals onto the intake manifold. Note that the seals (A, Figure 76) and flanges (B) have a tapered side. Fit the seal taper into the flange taper. Be sure the correct flange (F or R) is located at the front or rear of the manifold.
7A. Early 1988 models are not equipped with molded bosses on the intake manifold. On those models, position the manifold so the parting line is 1/8 in. (3.2 mm) past the cast boss on each flange.
7B. On late 1988-1989 models, align the molded boss on each tube of the intake manifold with the cast boss on each flange (Figure 77).
8. Install the intake manifold onto the cylinder head intake ports. The slotted ends of the flanges must point to the left.
9. Make sure the front and rear seals seat squarely against the cylinder head mating surfaces.

CAUTION
Do not attempt to align the intake manifold after tightening the bolts. This will damage the manifold seals.

10. Install the intake manifold mounting bolts and nuts. Tighten the bolts and nuts to 72-120 in.-lb. (8-14 N•m).
11. Install the carburetor as described in this chapter.

**1990-2003 models**

Refer to Figure 78.

An aluminum intake manifold is used on these models. The air filter backplate secures the carburetor in the manifold.

1. Remove the carburetor as described in this chapter.

**NOTE**

It may be necessary to use a ball-end type or shortened Allen wrench for access to the intake manifold bolts.

**NOTE**

On 1990 models the left side of the intake manifold is secured by studs and nuts. On later models, Allen bolts secure both sides of each manifold flange.

2. Remove the bolts (A, Figure 79) and, if used, nuts securing the intake manifold (B) to the cylinder heads.

**NOTE**

The front and rear intake manifold flanges are different. If the flanges are not marked (Figure 76), label them with an F (front) and R (rear) so they will be reinstalled in the correct location.

3. Remove the intake manifold, flanges and manifold seals.

4. Inspect the intake manifold.

5. Inspect the intake manifold seals (A, Figure 76) for wear, deterioration or other damage. If damaged, replace the seals as a set.

6. Install the flanges and seals onto the intake manifold. Note that the seals (A, Figure 76) and flanges (B) have a tapered side. Fit the seal taper into the flange taper. Be sure the correct flange (F or R) is located at the front or rear of the manifold.

7. Install the intake manifold onto the cylinder head intake ports. The slotted ends of the flanges must point to the left.

8. Make sure the front and rear seals seat squarely against the cylinder head mating surfaces.

9. Tighten the intake manifold fasteners finger-tight.

10. Install the carburetor as described in this chapter.

11. Install the air filter backplate and air filter as described in this chapter.

12. Tighten the intake manifold fasteners to 72-120 in.-lb. (8-14 N•m).

**FUEL HOSE AND CLAMPS**

**CAUTION**

Discard removed crimp-type hose clamps. Do not reuse removed clamps. The clamping ability of the clamp is destroyed during removal.
The fuel supply hose between the fuel valve and carburetor is secured at the hose ends with non-reusable hose clamps (A, Figure 80). Use diagonal pliers or other suitable tool to separate the clamp bands, then remove the clamp. Use hose clamp pliers (part No. HD-97087-65B or equivalent) to compress the clamp bands during installation. A screw-type hose clamp may be substituted in place of the crimp-type hose clamp.

**NOTE**

End cutting pliers (B, Figure 80) may be modified to compress the band clamps. Make sure to test the performance of the tool by checking the fit and integrity of the installed clamp.

**THROTTLE AND IDLE CABLES**

**Removal/Installation**

Refer to Figure 81.

1. Remove the air filter backplate as described in this chapter.
2. Before removing the cables, compare the routing of both cables with the routing path shown in Figure 82. If necessary, make a diagram of the routing path for reassembly.
3. Slide the rubber boot (Figure 83) on each cable away from each cable adjuster.
4. Loosen the cable adjusting nuts and turn the cable adjusters (A and B, Figure 84) to obtain as much cable slack as possible.
5. Remove the screws securing the upper and lower right switch/throttle housing (Figure 85) together. Separate the housing from the handlebar.
6. Loosen the cable locknuts at the lower switch housing.
7. Unhook the cables from the throttle grip and remove the ferrule from the end of each cable.
8. Unscrew each cable and remove it from the lower housing assembly.
9. At the carburetor, hold the lever up with one hand and disengage the cable end. Slip the cable out through the carburetor bracket. Repeat for the other cable. Figure 86 shows the throttle cables with the carburetor removed for clarity.

10. Pass both cables through the retaining clip. On 1989-1994 models, the clip is on the fuel tank mounting bolt (Figure 87). On 1995-2003 models, it is on the ignition switch.

11. Remove the cables from the motorcycle.

12. Clean the throttle grip in solvent and dry thoroughly. Check the throttle cable slots for cracks or other damage. Replace the throttle grip if necessary.

13. The friction adjust screw is secured to the lower switch housing with a circlip. If necessary, remove the friction spring, circlip, spring and friction adjust screw. Check these parts for wear or damage. Replace damaged parts. Reverse removal to install. Make sure the circlip seats in the friction screw groove completely.
14. Clean the throttle area on the handlebar with solvent or electrical contact cleaner.

15. LIGHTLY Wipe the throttle area on the handlebar with graphite.

**NOTE**
The throttle cable (A, Figure 84) uses a 5/16-18 in. threaded cable adjuster.

16. Screw the throttle cable into the lower switch housing and fit the ferrule onto the end of the cable. Then insert the ferrule into the right anchor slot at the top of the throttle.

**NOTE**
The idle cable (B, Figure 84) uses a 1/4-20 in. threaded cable adjuster.
17. Screw the idle cable into the lower switch housing and fit the ferrule onto the end of the cable. Then insert the ferrule into the left anchor slot at the top of the throttle.
18. Assemble the upper and lower switch housings and slide the throttle grip onto the handlebar. Install the housing screws and tighten securely. Operate the throttle and make sure both cables move in and out properly.
19. Route the throttle cables from the throttle grip to the carburetor as shown in Figure 82 or as noted during removal. Pass both cables through the retaining clip (Figure 87).
20. Install the throttle cable (A, Figure 84) into the shorter, outboard cable guide on the carburetor bracket; see A, Figure 86.
21. Install the idle cable (B, Figure 84) into the longer, inboard cable guide on the carburetor bracket; see B, Figure 86.
22. Operate the throttle grip and make sure the carburetor throttle linkage is operating correctly and with no binding. If operation is incorrect or there is binding, carefully check that the cables are attached correctly and there are no tight bends in the cables.

**WARNING**

*Do not ride the motorcycle until the throttle cables are properly adjusted.*

23. Adjust the throttle and idle cables as described in Chapter Three.
24. Start the engine and allow it to idle in neutral. Then turn the handlebar from side-to-side. Do not operate the throttle. If the engine speed increases as the handlebar assembly is turned, the throttle cables are routed incorrectly. Recheck cable routing and adjustment.

**STARTING ENRICHMENT VALVE (CHOKE) CABLE REPLACEMENT**

**Removal/Installation**

1. Remove the air filter backplate as described in this chapter.
2. Remove the enrichener bracket mounting screw (Figure 88) and allow the bracket to rest on top of the intake manifold.
3. Unscrew the enrichener from the carburetor. Figure 89 shows the enrichener cable with the carburetor removed from the motorcycle for clarity.
4. Remove the enrichener cable (Figure 90) from the motorcycle.
5. Remove the bracket from the enrichener cable.
6. Reverse the removal steps to install the enrichener cable while noting the following:
   a. Align the enrichener valve needle (Figure 91) with the needle passage in the carburetor and install the enrichener valve. Tighten the valve nut securely.
   b. Adjust the enrichener cable as described in Chapter Three.

**FUEL TANK**

The fuel tank is bolted to the upper frame tube. A 3-way fuel shutoff valve is mounted on the bottom of the tank on the right side.

Depending on model year and state, fuel tank venting is as follows:
1. On 1988-1991 non-California models, the filler cap is equipped with a pressure/vacuum relief valve for fuel tank venting.
3. On 1992-2003 models, the fuel tank is vented through a standpipe installed inside the fuel tank. A hose is connected
to the standpipe nozzle (Figure 92) at the bottom of the tank. This tube is routed along the frame and connected to a vapor valve (Figure 93) mounted to the frame and located between the battery and oil tank.

a. On non-California models, a hose connected to the bottom of the vapor valve connects to a fitting in the hollow frame member.

b. On California models, a hose connected to the bottom of the vapor valve connects to the carbon canister.

**Removal/Installation**

**WARNING**

Some fuel may spill from the fuel tank hose during this procedure. Because gasoline is extremely flammable and explosive, perform this procedure away from all open flames, including appliance pilot lights, and sparks. Do not smoke or allow anyone to smoke in the work area, as an explosion and fire may occur. Always work in a well-ventilated area. Wipe up any spills immediately.

**WARNING**

Make sure the fuel tank vapor hoses are routed in such a way that they cannot contact any hot engine or exhaust component. These hoses contain flammable vapors.

**CAUTION**

When removing the fuel tank in the following procedure, keep track of all fasteners and rubber bushings so they may be installed into their original mounting positions. Incorrect fastener assembly can cause tank damage.

Refer to Figure 94 or Figure 95.

1. Disconnect the negative battery cable (Chapter Twelve).

2A. On 1988-1994 models, drain the fuel tank as follows:

a. Turn the shutoff valve to off.

b. Disconnect the fuel supply hose (Figure 96) from the fuel shutoff valve.

c. Connect a longer hose to the shutoff valve fitting and place the open end of the hose into a gas can.

d. Turn the shutoff valve to reserve and drain the fuel into the tank. Account for the fuel line insulator.

2B. On 1995-2003 models, drain the fuel tank as follows:

**NOTE**

A vacuum-operated fuel valve is installed on all models. A hand-operated vacuum pump is required to drain the fuel tank.

a. Turn the shutoff valve to off.

b. Connect the drain hose to the fuel valve and secure it with a hose clamp. Insert the end of the drain hose into a gas can.

c. Disconnect the vacuum hose from the fuel valve.

d. Connect a hand-operated vacuum pump to the fuel valve vacuum hose fitting.

e. Turn the fuel valve to the reverse position.

**CAUTION**

Do not apply more vacuum than 25 in. (635 mm) Hg or the fuel valve diaphragm will be damaged.

f. Operate the vacuum pump handle and apply a maximum of 25 in. (635 mm) Hg of vacuum. Once the vacuum is applied, the fuel will start to flow into the gas can.

g. When fuel stops flowing through the hose, turn the fuel valve off and release the vacuum. Disconnect the vacuum pump and drain hose.
FUEL TANK (1988-1992 MODELS)

1. Cap
2. Fuel tank
3. Bolt
4. Washer
5. Throttle cable clip
6. Ignition coil bracket
7. Horn ground wire (883 models)
8. Horn bracket (883 models)
9. Nut
10. Lockwasher (early 883 models)
11. Spacer (883 models)
12. Bolt
13. Washer

FUEL TANK (1993-2003 MODELS)

1. Bolt
2. Washer
4. Spacer flange
5. Rubber grommet
10. Locknut
11. Fuel tank
12. Filler cap and gasket
13. Bolt
14. Washer
3. Remove the front (Figure 97) and rear (Figure 98) fuel tank mounting fasteners.
4. Disconnect the vapor vent hose from the fitting on the bottom of the fuel tank (Figure 92), if so equipped.
5. Remove the fuel tank.

WARNING
Store the fuel tank in a safe place, away from open flame.

6. Drain any remaining fuel left in the tank into a gas can.
7. Installation is the reverse of removal. Note the following:
   a. Tighten the front and rear bolts to the tightening torque specified in Table 2.
   b. On all 883 models, make sure the horn does not contact the frame or ignition coil bracket.
   c. Reconnect the fuel hose (Figure 96) to the fuel valve and secure it with a new hose clamp as described in Fuel Hose And Clamps in this chapter.
   d. Refill the tank and check for leaks.

Inspection
Refer to Figure 94 or Figure 95.
1. Inspect all of the fuel and vent lines for cracks, age deterioration or damage. Replace damaged lines with the same type and size materials.
2. Check the fuel line insulator for damage.
3. Check for damaged or missing rubber dampers.
4. Remove the filler cap and inspect the inside of the tank for rust or contamination. If there is a rust buildup inside the tank, remove it as described in this chapter and flush the tank to remove all rust and debris.
5. Inspect the fuel tank for leaks.

FUEL SHUTOFF VALVE
(1988-1994 MODELS)

The fuel shutoff valve is mounted on the left side of the fuel tank. A replaceable fuel filter is mounted at the top of the fuel shutoff valve.

Removal
Refer to Figure 99.
1. Disconnect the battery negative cable (Chapter Twelve).
2. Turn the fuel valve off.
3. Disconnect the fuel supply hose (Figure 96) at the fuel shutoff valve. Account for the fuel line insulator. Connect a longer hose to the shutoff valve fitting and place the open end of the hose into a gas can. Turn the shutoff valve to reserve and drain the fuel into the tank.
4. Loosen the shutoff valve fitting and remove the shutoff valve from the fuel tank. Catch any gas that may leak from the tank after the valve is removed.

Cleaning and Inspection

1. Inspect the filter mounted on top of the fuel valve. Remove contamination from the filter. Replace the filter if it is damaged.
2. Install a new filter gasket before installing the filter onto the fuel valve.
3. Remove all sealant residue from the fuel tank and fuel valve threads.

Installation

1. Install a new filter gasket onto the fuel shutoff valve, then install the filter.
2. Coat the fuel valve threads with pipe sealant.
3. Insert the valve into the tank. Securely tighten the valve nut.
4. Remove the drain hose from the fuel tank and reconnect the fuel supply hose. Secure the fuel supply hose with a new hose clamp as described in Fuel Hose And Clamps in this
chapter. Make sure the insulator is placed over the fuel supply hose before reconnecting it.
5. Refill the fuel tank and check for leaks.

5. Loosen the fuel valve nut and remove the fuel shutoff valve from the fuel tank. Drain gasoline remaining in the tank after valve removal.

Cleaning and Inspection
1. Inspect the filter mounted on top of the fuel valve. Remove contamination from the filter. Replace the filter if it is damaged.
2. Install a new filter gasket before installing the filter onto the fuel valve.
3. Remove all sealant residue from the fuel tank and fuel valve threads.

Installation
1. Install a new filter gasket onto the fuel shutoff valve, then install the filter.
2. Coat the fuel valve threads with pipe sealant.
3. Insert the fuel valve into the tank, then start the hex fitting onto the fuel tank threads two turns.
4. Hold the hex fitting and start the fuel valve into the fitting by turning it counterclockwise two turns.
5. Hold the fuel valve and tighten the hex fitting securely.
6. Reconnect the fuel hose to the fuel shutoff valve and secure it with a hose clamp. Secure the fuel supply with a new hose clamp as described in Fuel Hose and Clamps in this chapter.
7. Reconnect the vacuum hose to the valve.
8. Refill the fuel tank and check for leaks.

FUEL SHUTOFF VALVE
(1995-2003 MODELS)

The 1995-2003 models are equipped with a vacuum-operated fuel shutoff valve mounted on the left side of the fuel tank. A replaceable fuel filter is mounted at the top of the fuel shutoff valve.

2003 models are equipped with a three-way vacuum-operated fuel shutoff valve.

To troubleshoot this valve, refer to Fuel System in Chapter Two.

Removal
1. Disconnect the negative battery cable (Chapter Twelve).
2. Turn the fuel shutoff valve to the off position.
3. Drain the fuel tank as described in the Fuel Tank in this chapter.
4. Disconnect the vacuum hose from the fuel shutoff valve.

EXHAUST SYSTEM
(ALL MODELS EXCEPT 883R MODELS)

Removal
Refer to Figure 100.
1. Secure the motorcycle on a suitable stand.
2. Remove the heat shields.
3. Remove the nuts and washers securing the front and rear exhaust pipes to the cylinder heads (Figure 101, typical).
4. To remove the front muffler nut (Figure 102), perform the following:
   a. Remove the master cylinder mounting bolts (Figure 103) and lift the brake pedal upward.
   b. Remove the front muffler nut (Figure 102).
5A. On 1988-1991 models, remove the nut, washer and bolt securing the rear muffler to the muffler support bracket.
5B. On 1992-2003 models, remove the locknut (Figure 104) and bolt attaching the rear muffler to the muffler support bracket.
CAUTION
A bowed exhaust flange (Figure 105) may wedge against the exhaust studs preventing removal. If a flange is tight, remove one of the cylinder head studs; refer to Service Methods in Chapter One. Replace or flatten a distorted flange.

6. Slide the exhaust pipe flanges (Figure 106) away from the cylinder head studs.
7. Remove the exhaust as an assembly (Figure 107).
8. Remove and discard the exhaust port gaskets (Figure 108).

NOTE
To reduce the possibility of an exhaust leak, muffler clamps should be replaced if removed.

9. Loosen the muffler clamp bolts and remove the mufflers from the exhaust pipes.
10. Inspect the exhaust system as described in this section.

Installation

1. Before installing the new exhaust port gaskets, remove all carbon residue from the gasket and pipe fitting surfaces. Wipe the port with a rag, then align the new gasket with the port and push it into place. The new gasket should fit snugly in the port (Figure 109). Repeat for the other exhaust port and gasket.
2. If an exhaust stud was removed, install the stud now. Refer to the Service Method in Chapter One.
3. Before installing the exhaust pipes, check that the snap rings (Figure 110) holding the flanges on the exhaust pipes fit tightly in the pipe grooves.
4. Position the exhaust pipe assembly, without mufflers, so that the front and rear exhaust pipes fit into the front and rear cylinder head exhaust pipes. Slide the flanges onto the mounting studs and install a washer and nut (Figure 101) onto each stud. Install the nuts finger-tight only.
5. Install new muffler clamps and their fasteners over the end of the exhaust pipes as shown in Figure 100. Then slide each muffler onto its respective exhaust pipe.
6. Turn the front muffler so that its mounting tab engages the stud as shown in Figure 100 and Figure 102. Install the locknut finger-tight.

7A. On 1988-1991 models, align the rear muffler tab with the muffler support bracket and install the bolt, washer and nut finger-tight only.

7B. On 1992-2003 models, align the rear muffler tab with the muffler support bracket and install the bolt and locknut (Figure 104) finger-tight only.

**NOTE**
Be sure to install the rear muffler mounting bolt assembly in the direction shown in Figure 100.

8. Tighten the exhaust fasteners in the following order to the torque specified in Table 3:
   a. Cylinder head flange nuts (Figure 101).
   b. Front and rear muffler clamp nuts (Figure 111).
   c. Front muffler locknut (Figure 102).
   d. Rear muffler fasteners (Figure 104, typical).
   e. Rear master cylinder mounting bolts (Figure 100).

9. Wipe the exhaust pipes and mufflers with a clean rag to remove all traces of oil and grease.

10. Install the heat shields and secure with the mounting clamps.

11. Start the engine and check for leaks. Some smoke will be evident after starting, especially if rust penetrant was used on the hose clamps or if oil and grease residue was not wiped off of the exhaust pipes and mufflers.

**Inspection**

1. Check the exhaust pipe for cracks or spots that have rusted through. Replace a damaged or leaking pipe.

2. Remove all rust from all pipe and muffler mating surfaces.

3. Check all of the clamps for damage or severe rusting. Clean or repair clamps as required.

4. If the exhaust flange is distorted (Figure 105), repair or replace it before reinstalling it. Perform the following:
   a. Each exhaust flange is secured to its exhaust pipe with a snap ring (Figure 110). Pry the ring out of its groove and remove the flange. Discard the ring. See Figure 112.
b. Examine the flange for distortion or other damage; the flange must be flat to fit properly onto the exhaust studs. Distortions may be flattened out, but make sure the edges or holes in the flange are not deformed when straightening it. Replace a damaged or bent flange.

c. Check the fit of the flange on the cylinder head studs before installing it onto the pipe.

d. Clean the end of the pipe to remove all rust and other debris. If reinstalling a used flange, clean the inside of the flange thoroughly.

e. Slide the flange on the exhaust pipe so the shoulder on the flange faces toward the snap ring groove. Install a new snap ring and check its fit; it must be secure in its groove.

f. Repeat for the other exhaust pipe and flange, if required.

5. Replace worn or damaged heat shield clamps as required.
6. Store the exhaust pipes in a safe place until they are reinstalled.

**EXHAUST SYSTEM**

**883R MODELS**

**Removal**

Refer to Figure 113.

1. Secure the motorcycle on a suitable stand.
2. Remove the heat shields.
3. Remove the nuts and washers securing the front and rear exhaust pipes to the cylinder heads (Figure 101, typical).
4. Remove the bolts securing the muffler to the support bracket.

**CAUTION**

* A bowed exhaust flange (Figure 105) may wedge against the exhaust studs preventing removal. If a flange is tight, remove one of the cylinder head studs; refer to Service Methods in Chapter One. Replace or flatten a distorted flange.

5. Slide the exhaust pipe flanges (Figure 106) away from the cylinder head studs.
6. Remove the exhaust as an assembly.
7. Remove and discard the exhaust port gaskets (Figure 108).
8. Loosen the muffler clamp bolts and remove the muffler from the exhaust pipes.
9. Inspect the exhaust system as described in this section.

**Installation**

1. Before installing the new exhaust port gaskets, remove all carbon residue from the pipe fitting surfaces in the exhaust port. Wipe the port with a rag, then align the new gasket with the port and push it into place. The new gasket should fit snugly in the port (Figure 109). Repeat for the other exhaust port and gasket.

2. If an exhaust stud was removed, install the stud now. Refer to the Service Methods in Chapter One.
3. Before installing the exhaust pipes, check that the snap rings (Figure 110) holding the flanges on the exhaust pipes fit tightly in the pipe grooves.
4. Position the exhaust pipe assembly, without the muffler, so the front and rear exhaust pipes fit into the front and rear cylinder head exhaust pipes. Slide the flanges onto the mounting studs and install a washer and nut onto each stud (Figure 101). Install the nuts finger-tight only.
5. Install a new muffler clamp and fastener onto the end of the exhaust pipes.
6. Slide the muffler onto the exhaust pipe.
7. Turn the muffler so that mounting holes in the muffler align with the bolt holes in the support bracket. Install, but do not tighten, the mounting bolts.
8. Tighten the fasteners in the following order:
   a. Tighten the cylinder head flange nuts (Figure 101) to 72-96 in.-lb. (8-11 N•m).
   b. Tighten the Torca clamp bolt on the muffler to 35-40 ft.-lb. (48-54 N•m).
   c. Tighten the muffler mounting bolts to 120-180 in.-lb. (14-20 N•m).
9. Wipe the exhaust pipes and mufflers with a clean rag to remove all traces of oil and grease.
10. Install the heat shields and secure with the mounting clamps.
11. Start the engine and check for leaks. Some smoke will be evident after starting, especially if rust penetrant was used on the hose clamps or if oil and grease residue was not wiped off the exhaust pipes and mufflers.

**Inspection**

Follow the steps described in Exhaust System (All Models Except 883R Models) in this chapter.

**EVAPORATIVE EMISSION CONTROL SYSTEM**

**(CALIFORNIA MODELS)**

All of the California models covered by this manual are equipped with an evaporative emission control system. This system is used to prevent gasoline vapors from escaping into the atmosphere. When the engine is not running, fuel vapor from the fuel tank is routed through the vapor valve and stored in a carbon canister. When the engine is running, these vapors are drawn through a purge hose and into the carburetor where they are burned in the combustion chambers. The vapor valve also prevents gasoline vapors from escaping from the carbon canister if the motorcycle should fall onto its side.

Two evaporative emission control systems are used on the California models covered by this manual.
EXHAUST SYSTEM (883R MODELS)

1. Muffler
2. Clamp
3. Rear heat shield
4. Nut
5. Flange
6. Snap ring
7. Gasket
8. Exhaust pipe
9. Front head shield
10. Collector heat shield
11. Torca clamp
12. Support bracket
13. Bolt
Refer to Figure 114 or Figure 115 for the components and the hose routing to the various parts. Before removing the hoses from any of the parts, label the hose and the fitting to identify the hose location.

**Inspection/Replacement**

1. Check all emission control lines or hoses to make sure they are correctly routed and properly connected.
2. Make sure there are no kinks in the lines or hoses and that there are no signs of excessive wear or burning on lines routed near engine hot spots.
3. Check the physical condition of all lines and hoses in the system for cuts, tears or loose connections. Damaged lines or hoses should be replaced.
4. Check all components in the emission control system for signs of damage, such as broken fittings or broken nipples on the component.
5. When replacing one or more lines or hoses, refer to the appropriate diagram. Disconnect one end of the line from the component, then connect one end of the new line to the component fitting. Disconnect the other end of the line and connect the other end of the new line. This method lessens the possibility of incorrectly connected and routed hoses.

**Vapor Valve Replacement**

The vapor valve (Figure 116) is mounted on the frame tube between the battery and oil tank.

1. Remove the battery as described in Chapter Twelve.
2. Label the hoses at the vapor valve and then disconnect them.
3. Note that one end of the vapor valve is longer than the other end. The longer end must point up when the vapor valve is installed on the motorcycle. Remove and replace the vapor valve.

**CAUTION**

The vapor valve must be installed in a vertical position with the longer end pointing up or excessive pressure will build in the fuel tank.

4. Install by reversing the removal steps.

**Carbon Canister Replacement**

Refer to Figure 117 or Figure 118.

The carbon canister is mounted on the bottom side of the swing arm.

1. Remove the canister guard mounting screws and remove the guard.
3. Label and then disconnect the hoses from the canister. Plug the open end of each hose to prevent contamination.
4. Press the canister bracket locking tab and slide the canister toward the left side of the motorcycle and off the bracket.
5. If necessary, remove the canister bracket mounting fasteners and mounting plate assembly and remove the canister bracket.

**CAUTION**

_Do not alter the carbon canister position. The canister must be mounted below the carburetor to work correctly._

6. Install by reversing the removal steps.


Whenever the air filter backplate is removed from the motorcycle, check the reed valve assembly for broken reed valves. To replace damaged reed valves, perform the following:

1. Remove the air filter backplate as described in this chapter.
2. Remove the screws securing the reed cover to the reed support and remove the cover (**Figure 119**).
3. Refer to **Figure 120**. Remove the screws securing the reed bottom to the reed support. Then remove the following parts:
   a. Reed bottom.
   b. Reed top.
   c. Reed stop.
4. Check the reeds for cracks or debris that would prevent the reed from closing. Replace worn or damaged parts as required.
5. Refer to **Figure 120**. Attach the reed bottom, reed top and the reed stop to the reed support cover. Secure with the attaching screws.
6. Install the reed support cover onto the reed support and secure with the attaching screws (**Figure 119**).
7. Install the air filter backplate as described in this chapter.


The vacuum-operated valve switch (VOVS) closes off the carburetor float bowl vent passage when the engine is not running. This prevents fuel vapor from escaping when the engine is off.

A hand-operated vacuum pump (part No. HD-23738 or equivalent) is required to test the VOVS.

1. Label and then disconnect the hoses from the VOVS; see **Figure 114** and **Figure 121**.
2. Attach a vacuum pump to port A in **Figure 121**.
3. Apply 1-2 in.HG vacuum to the valve while watching the pump gauge. The vacuum should remain steady. If vacuum reading decreases rapidly, the diaphragm is damaged.
4. If vacuum remains constant, blow into port C; air should pass through the VOVS. If air cannot pass through, the VOVS is damaged.

5. Remove the vacuum pump and blow into port B; air should not pass through the VOVS. If air can pass through, the VOVS is damaged.
6. If the VOVS failed to react as described in Steps 3-5, replace it with a new one.


On 1992-2003 California models, a solenoid-operated butterfly valve is installed in the air filter backplate to seal off the backplate when the ignition switch is off. This valve prevents fuel vapors from escaping into the atmosphere. Turning the ignition switch to the on or ignition position energizes the solenoid hold-in windings. When the start switch is operated, the solenoid pull-in windings are energized. The hold-in windings will keep the butterfly valve open until the ignition switch is turned off.

Test the solenoid-operated butterfly valve if the engine suffers from sluggish acceleration and the engine’s top speed is 40 mph.

1. Make sure all of the hoses are properly connected; see **Figure 115**.
2. If the butterfly valve is not opening and closing properly due to mechanical problem perform the following:
   a. Check the mechanical linkage assembly (**Figure 122**) for corroded, loose, broken or missing components. The butterfly valve linkage and plunger should be cleaned every 5000 miles as described in this section.
   b. Check for a broken solenoid spring (**Figure 122**). If the spring is broken, replace the solenoid assembly. The spring cannot be replaced separately. Replace the assembly as described in this chapter.


Prior to testing the solenoid valve, fabricate the test harness shown in **Figure 123**.
CARBON CANISTER (1988-1989 CALIFORNIA MODELS)

1. Guard
2. Screw
3. Nut
4. Washer
5. Rubber mount
6. Bracket
7. Nuts
8. Washer
9. Bracket
10. Bracket
11. Bolts
12. Carbon canister

CARBON CANISTER (1990-2003 CALIFORNIA MODELS)

1. Screw
2. Guard
3. Bolt
4. Mounting bracket
5. Wellnut
6. Locknut
7. Washer
8. Mounting plate
9. Bracket
10. Bolt
11. Carbon canister
Solenoid winding resistance test

1. Remove the air filter backplate as described in this chapter.
2. Disconnect the solenoid valve electrical connector (**Figure 122**).
3. Check for dirty or loose-fitting terminals and connectors.
4. Connect the solenoid test connector to the solenoid connector (**Figure 124**).
5. Refer to **Figure 125** for test connections and values and compare your meter readings to the stated values. If any of the meter readings differ from the specified values, replace the solenoid as described in this section.
6. If the resistance readings are correct, perform the pull-in coil test as described in this section.

**Pull-in coil test**

A fully charged 12-volt battery is required for this test.
1. Remove the air filter backplate as described in this chapter.
2. Disconnect the solenoid valve electrical connector (**Figure 122**).
3. Check for dirty or loose-fitting terminals and connectors.
4. Connect the solenoid test connector to the solenoid connector (**Figure 124**).
5. Connect a 12-volt battery to the two solenoid test connector wires shown in **Figure 126**. The butterfly valve should open when battery voltage is applied. Disconnect the battery connections and note the following:
   a. If the butterfly valve now opens but did not open when originally connected to the wiring harness, perform Step 6.
   b. If the butterfly valve did not open, check the linkage for corroded, missing or damaged parts. If the linkage assembly appears okay, retest with a new solenoid.
6. Perform the following:
   a. Make sure the ohmmeter is set to the appropriate scale. On 1992-1994 models, check for ground at the gray/black lead in the solenoid connector. On 1995-2003 models, check for ground at the black lead in
lead in the solenoid connector. The ohmmeter should read 1 ohm or less.
b. Reconnect the solenoid 4-prong connector.
c. Switch a voltmeter to the 12 VDC scale.
d. On 1992-1994 models, connect the positive voltmeter lead to the black/red lead in the solenoid connector. On 1995-2003 models, connect the positive voltmeter lead to the green lead in the solenoid connector. Connect the negative voltmeter lead to a good engine ground. Press the start button while reading the voltage indicated on the voltmeter. It should be 12 volts.

7. If any of the meter readings differ from those specified in Step 6, there is a problem in the solenoid wiring harness. Use voltage and resistance checks to locate the damaged wire(s). After repairing the wire(s), repeat the above checks.

8. If the meter readings were correct as performed in Step 7, perform the hold-in test as described in this section.

**Hold-in coil test**

A fully charged 12-volt battery is required for this test.
**SOLENOID TEST CONNECTOR**

Part No. 70292-89

- Black
- Black/red
- Grey/black
- White

Part No. 72038-71

- Black/red
- Black
- Grey/black
- White

**TEST HARNESS 1992-1993 MODELS**

Part No. 70292-89

- Black
- Green
- Black
- White/black

Part No. 72038-71

- Black
- White/black
- Black

**TEST HARNESS 1994-1996 MODELS**

Part No. 73103-96BK

- Green
- White/black
- Black

Part No. 73190-96

- Green
- Black
- To motorcycle harness

**TEST HARNESS 1997-2003 MODELS**

**RESISTANCE TEST**

4 place socket connector

1992-1993 MODELS

- Black
- Black/red
- Gray/black
- White

1994-1996 MODELS

- Black
- Green
- Black
- White/black

1997-2003 MODELS

- White/black
- Black
- Green
- To motorcycle harness
- White/black
- Black
## TEST

<table>
<thead>
<tr>
<th></th>
<th>POSITIVE PROBE (+)</th>
<th>NEGATIVE PROBE (–)</th>
<th>RESISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1992-1993 MODELS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pull-in</td>
<td>Black/Red</td>
<td>Gray/Black</td>
<td>4-6 Ohms</td>
</tr>
<tr>
<td>Hold-in</td>
<td>White</td>
<td>Black</td>
<td>21-27 Ohms</td>
</tr>
<tr>
<td><strong>1994-2003 MODELS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pull-in</td>
<td>Green</td>
<td>Black</td>
<td>4-6 Ohms</td>
</tr>
<tr>
<td>Hold-in</td>
<td>White/Black</td>
<td>Black</td>
<td>21-27 Ohms</td>
</tr>
</tbody>
</table>

### SOLENOID PULL-IN COIL TEST

**1992-1993 MODELS**

- Connect the 12 volt battery to the test connector.
- Check the pull-in resistance: Black/Red, Grey/Black, White.

**1994-1996 MODELS**

- Connect the 12 volt battery to the test connector.
- Check the pull-in resistance: Green, Black, White.

**1997-2003 MODELS**

- Connect the 12 volt battery to the test connector.
- Check the pull-in resistance: Green, White/Black, Black.
1. Remove the air filter backplate as described in this chapter.
2. Disconnect the solenoid valve electrical connector (Figure 122).
3. Check for dirty or loose-fitting terminals and connectors.
4. Connect the solenoid test connector to the solenoid connector (Figure 124).
5. Connect a 12-volt battery to the two solenoid test connector wires shown in Figure 127 and perform the following:
   a. Open the butterfly valve carefully with a screwdriver by pushing inward on the top side of the butterfly valve.
   b. Remove the screwdriver. The butterfly valve should remain open as long as the solenoid hold-in windings are energized.
   c. Disconnect the negative battery cable from the solenoid test connector. The butterfly valve should close.
   d. If the butterfly valve operated as described in substeps b and c, the solenoid hold-in windings are operating correctly.
   e. If the butterfly valve failed to operate properly, perform Step 6.
   f. Disconnect the positive battery cable from the solenoid test connector.
6. If the butterfly valve did not remain open in Step 5, substep b, perform the following:
   a. Switch an ohmmeter to R \times 1 and cross the test leads. Check for ground at the black connector pin in the solenoid connector. The ohmmeter should read 1 ohm or less.
   b. Reconnect the solenoid connector.
   c. Switch a voltmeter to the 12 VDC scale.
d. On 1992-1994 models, connect the positive voltmeter lead to the white lead in the solenoid connector. On 1995-2003 models, connect the positive voltmeter lead to the white/black lead in the solenoid connector. Connect the voltmeter negative lead to a good engine ground. Turn the ignition switch to the on or ignition position and read the voltage indicated on the voltmeter. It should be 12 volts.

7. If any of the meter readings differ from those specified in Step 6, there is a problem in the solenoid wiring harness. Use voltage and resistance checks to locate the damaged wire(s). After repairing the wire(s), repeat the above checks.

8. If the solenoid test readings were correct but the butterfly valve does not work properly, perform the tests in the Solenoid-Operated Butterfly Valve Mechanical (1992-2003) in this section.

9. Remove all test equipment and reconnect the solenoid connector.


Refer to Figure 122.
1. Remove the air filter backplate as described in this chapter.
2. At every 2500 mile (4022 km) interval, inspect the butterfly valve and solenoid for proper operation.
3. At every 5000 mile (8045 km) interval, spray the butterfly valve and plunger with carburetor cleaner. Then, after the carburetor cleaner evaporates, lubricate the linkage and plunger with a dry film spray lubricant.
4. Reinstall the air filter backplate as described in this chapter.


Refer to Figure 122.
1. Remove the air filter backplate as described in this chapter.
2. Remove the plunger mounting screw.
3. Loosen the lever arm setscrew.
4. Slide the solenoid up to free it from the clamp and remove it.

NOTE
An original equipment replacement solenoid does not include the connector housing, pin terminals (3, Figure 122) or the conduit. When replacing the solenoid, install the pin terminals (part No. HD 72039-71) onto the solenoid wires, and reuse the connector housing and conduit from the old solenoid. Make sure each pin terminal is properly seated in the connector housing.

5. Slide the solenoid into the clamp.
6. Apply threadlock (Loctite 242 or equivalent) to the plunger mounting screw and lever arm setscrew threads.

NOTE
When assembling the plunger and plastic link, the slot in the plastic link must face toward the pin on the lever arm.

7. Align the deep flat side on the plunger with the plastic link, then install the plunger mounting screw. Tighten the screw securely.
8. Loosen the solenoid setscrew.
9. Push the plunger up until the butterfly valve opens fully and hold it in this position. Then position the solenoid body inside the clamp.
10. While still lifting the plunger up so the butterfly valve is fully open, press down on top of the solenoid until the bottom of the solenoid just touches the plastic washer. Tighten the solenoid setscrew securely.
11. Release the plunger and check that the solenoid spring closes the butterfly valve completely. If not, readjust the plunger and solenoid.
12. Install the air filter backplate as described in this chapter.

Emission/Carburetor Hose Routing (All Models)

Refer to Figure 121 or Figure 128 for emission hose routing at the carburetor.
Table 1 CARBURETOR SPECIFICATIONS

<table>
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<td><strong>U.S. models (except California)</strong></td>
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<td>1200 and 1200C</td>
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</tr>
<tr>
<td>200S</td>
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<tr>
<td>Pilot jet</td>
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<td></td>
</tr>
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<td>1988 models</td>
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<td><strong>Swiss models</strong></td>
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<tr>
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<td>1996-2003 models</td>
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<tr>
<td><strong>Float height</strong></td>
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<tr>
<td>1988-1991 models</td>
<td>0.725-0.730 in.</td>
<td>0.725-0.730 in.</td>
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<td>(18.4-18.5 mm)</td>
<td>(18.4-18.5 mm)</td>
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<tr>
<td>1992-2003 models</td>
<td>0.413-0.453 in.</td>
<td>0.413-0.453 in.</td>
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<tr>
<td></td>
<td>(10.5-11.5 mm)</td>
<td>(10.5-11.5 mm)</td>
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### Table 2 FUEL SYSTEM TORQUE SPECIFICATIONS

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<th>ft.-lb.</th>
<th>in.-lb.</th>
<th>N•m</th>
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<tr>
<td>Backplate-to-carburetor screws</td>
<td>–</td>
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<tr>
<td>Backplate-to-cylinder head bolts</td>
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<td>120-144</td>
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<td>Fuel tank mounting bolts</td>
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<tr>
<td>1993-2003 models</td>
<td>–</td>
<td>96-192</td>
<td>11-22</td>
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<tr>
<td>Intake manifold mounting bolts and nuts</td>
<td>–</td>
<td>72-120</td>
<td>8-14</td>
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### Table 3 EXHAUST SYSTEM TORQUE SPECIFICATIONS

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<th>in.-lb.</th>
<th>N•m</th>
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<tbody>
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<td>Cylinder head exhaust flange nuts</td>
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<tr>
<td>Front muffler locknut</td>
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<tr>
<td>1993-2003 models</td>
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<td>27-54</td>
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<tr>
<td>Muffler clamp nut</td>
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</tr>
<tr>
<td>1988-1993 models</td>
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<td></td>
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<tr>
<td>Muffler mounting bolts</td>
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<td>120-180</td>
<td>14-20</td>
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<tr>
<td>Rear master cylinder mounting bolts</td>
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<td>Torca muffler clamp bolt</td>
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<td>48-54</td>
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CHAPTER TWELVE

ELECTRICAL SYSTEM

This chapter covers the electrical system. Refer to Chapter Three for spark plug maintenance information.

Tables 1-4 are located at the end of this chapter. Wiring diagrams are located at the end of this manual.

ELECTRICAL COMPONENT REPLACEMENT

Most motorcycle dealerships and parts suppliers will not accept the return of any electrical part. If the exact cause of an electrical system malfunction cannot be determined, have a dealership retest that specific system to verify the test results. This may help avert the possibility of purchasing an expensive, unreturnable part that does not fix the problem.

Consider any test results carefully before replacing a component that tests only slightly out of specification, especially resistance. A number of variables can affect test results dramatically. These include: the testing meter’s internal circuitry, ambient temperature and conditions under which the machine has been operated. All instructions and specifications have been checked for accuracy; however, successful test results depend to a great degree upon individual accuracy.

ELECTRICAL CONNECTORS

Many electrical problems can be traced to damaged wiring, or contaminated or loose connectors.

The locations of the connectors vary by model. Also, if the motorcycle has been serviced previously, the connector may be in a different location.

The electrical system uses three types of connectors. If individual wires or terminals of a particular connector require repair or replacement, refer to Electrical Connectors in this chapter.

Always check the wire colors listed in the procedure or wiring diagrams to verify the location of the components.

Perform the following steps first if an electrical system fault is encountered:

1. Inspect all wiring for fraying, burning and other visual damage.
2. Check the main fuse and make sure it is not blown. Replace it if necessary.
3. Check the individual fuse(s) for each circuit. Make sure it is not blown. Replace it if necessary.
4. Inspect the battery as described in this chapter. Make sure it is fully charged and the battery cables are clean and securely attached to the battery terminals.
5. Clean connectors with an aerosol electrical contact cleaner. After a thorough cleaning, pack multi-pin electrical connectors with dielectric grease to seal out moisture.
6. Disconnect electrical connectors in the suspect circuits and check for bent or damaged terminals. The male and female terminals must connect or an open circuit will result.
7. Make sure the terminals are pushed all the way into the plastic connector. If they are not, carefully push them in with a narrow-blade screwdriver.
8. After everything is checked, push the connectors together and make sure they are fully engaged and locked together.
9. Never pull on the electrical wires when disconnecting an electrical connector. Only pull on the connector plastic housing.

**BATTERY**

*(1986-1996 MODELS)*

**WARNING**
Always wear safety glasses when working with batteries. If electrolyte is splashed into the eyes, call a physician immediately, force the eyes open and flood with cool, clean water for approximately 15 minutes.

**WARNING**
When performing the following procedures, protect eyes, skin and clothing.

**CAUTION**
Do not spill battery electrolyte on painted or polished surfaces. The liquid is highly corrosive and will damage the finish. If it is spilled, wash it off immediately with soapy water and thoroughly rinse with clean water.

Clean and inspect the battery at periodic intervals. The original equipment battery on 1986-1996 models is a conventional lead-acid battery.

On all models in this manual, the negative side is the ground. When removing the battery, disconnect the negative cable first, then the positive cable. This minimizes the chance of a tool shorting to ground when disconnecting the battery positive cable.

**Safety Precautions**

When working with lead-acid batteries, use extreme care to avoid spilling or splashing the electrolyte. This solution contains sulfuric acid, which can ruin clothing and cause serious chemical burns. If any electrolyte is spilled or splashed on clothing or skin, immediately neutralize with a solution of baking soda and water, then flush with clean water.

While batteries are being charged, explosive hydrogen gas forms in each cell. Some of this gas escapes through filler cap openings and may form an explosive atmosphere in and around the battery. This condition can persist for several hours. Sparks, open flame or a lighted cigarette can ignite the gas causing an internal battery explosion and possible serious personal injury.

Take the following precautions to prevent an explosion:
1. Do not smoke or permit any open flame near any battery being charged or which has been recently charged.
2. Do not disconnect live circuits at battery terminals because a spark can occur.
3. Take care when connecting or disconnecting any battery charger. Be sure the charger power switch is off before making or breaking connections. Poor connections are a common cause of electrical arcs which cause explosions.
4. Keep all children and pets away from charging equipment and batteries.

For maximum battery life, check the battery periodically for electrolyte level, state of charge and corrosion. During hot weather periods, frequent checks are recommended. If the electrolyte level is below the bottom of the vent well in one or more cells, add distilled water as required—tap water will shorten battery life. To assure proper mixing of the water and acid, operate the engine immediately after adding water. *Never* add battery acid instead of water.

**Cable Service**

1. If the electrical cable terminals are corroded, disconnect them from the electrical system.
2. Clean each connector with a wire brush and a baking soda solution. Rinse thoroughly with clean water and wipe dry with a clean cloth.
3. After cleaning, apply a thin layer of dielectric grease to the battery terminals before reattaching the cables.
4. Reconnect the electrical cables to the electrical system if they were disconnected.
5. After connecting the electrical cables, apply a light coat of dielectric grease to the terminals to retard corrosion and decomposition of the terminals.

**Removal**

1. Remove the seat (Chapter Seventeen).
2. Remove the battery strap (A, Figure 1).
3. Remove the battery top cover (B, Figure 1).
4. Disconnect the negative battery cable from the battery (Figure 2).
5A. On 1986-1993 models, remove the positive battery cable bolt, red wire running from the main circuit breaker, positive battery cable and spacer (Figure 3).
5B. On 1994-1996 models, remove the positive battery cable bolt, positive battery cable and spacer (Figure 4).
6. Disconnect the battery vent tube from the battery.
7. Remove the battery.
Electrolyte Level Check

1. Maintain the electrolyte level between the marks on the battery case (Figure 5).
2. If the electrolyte level must be adjusted, remove the battery as described in this section. Do not add water while the battery is still in the frame as any spilled water along with electrolyte will flow onto the frame and cause corrosion.
3. Be sure all cell caps are in place and tight.
4. If the electrolyte level is correct, reinstall the battery.

Cleaning, Inspection and Adding Water

1. Inspect the battery tray and cushion (A, Figure 6, typical) for contamination or damage. Clean with a solution of baking soda and water.
2. Check the battery case (Figure 7) for cracks, warp, discoloration or other damage.
3. Check the battery hold-down strap for acid damage, cracks or other damage. Replace the strap if required.
4. Check the positive battery cable routing connection in the battery tray. Tighten the bolt, if necessary.

**CAUTION**
Do not allow cleaning solution to enter the battery cells or the electrolyte level will be seriously weakened.

5. Check the battery terminal parts for corrosion or damage. Clean the parts with a solution of baking soda and water. Replace severely corroded or damaged parts.
6. Clean the top of the battery with a stiff bristle brush using the baking soda and water solution.
7. If necessary, remove the battery tray and clean and/or replace damaged parts.
8. Check the battery cable clamps for corrosion and damage. If corrosion is minor, clean the battery cable clamps with a stiff wire brush. Replace worn or damaged cables.

**NOTE**
Do not overfill the battery cells. The electrolyte expands due to heat from charging and
will overflow if the level is above the upper level line.

9. Remove the caps (A, Figure 8) from the battery cells and check the electrolyte level. Add distilled water, if necessary, to bring the level within the upper and lower level lines on the battery case (Figure 7).

Installation

1A. On 1986-1988 models, note in Figure 9 the proper routing of the battery cables. If the positive cable is routed incorrectly, the oil tank may cut the cable insulation and cause electrical short.

1B. On 1989-1996 models, note in B, Figure 6 the proper routing of the positive battery cable. On later models a cable guide secures the cable to the battery tray.

2A. On 1986-1993 models, install the spacer, positive battery cable, red wire and bolt (Figure 3). Tighten the bolt securely.

2B. On 1994-2003 models, install the spacer, positive battery cable and bolt (Figure 4). Tighten the bolt securely.

3. Reposition the battery into the battery tray. Make sure the rubber cushion (A, Figure 6) is installed in the bottom of the tray before installing the battery. Install the battery strap to secure the battery.

**CAUTION**

Be sure the battery cables are connected to their proper terminals. Connecting the battery backward will reverse the polarity and damage the rectifier.
4. Install and tighten the negative battery cable (Figure 2).

5. Coat the battery connections with dielectric grease or petroleum jelly.

6. Place the top cover (B, Figure 1) on the battery.

7. Attach the forward end of the battery strap (A, Figure 1) under the front side of the battery tray. Then lay the strap over and into the groove in the battery top. Insert the threaded stud on the rear end of the battery strap into the hole at the rear side of the battery tray. Install the washer and nut. Tighten the nut securely.

   **WARNING**
   After installing the battery, make sure the vent tube is not pinched. A pinched or kinked tube will allow high pressure to accumulate in the battery and cause the battery to explode. If the vent tube is damaged, replace it.

8. Reconnect the battery vent tube to the battery. If necessary, refer to the Vent Tube Routing in this section.

9. Install the seat (Chapter Seventeen).

**Vent Tube Routing**

The battery vent tube must be routed properly and not touch any moving parts. Proper routing ensures the vent hose outlet (A, Figure 10) is positioned away from all metal components. Replace the vent tube if it is kinked or plugged.

Connect the vent tube onto the battery vent nipple. The vent nipple is on the forward side of the battery (B, Figure 8). Following the transmission housing curve, route the tube past the transmission and insert the hose through the vent hose clip on the frame (B, Figure 10). On California models, continue by inserting the vent tube through the additional vent tube clip mounted on the rear muffler mount. On California models, the vent tube must extend 3 in. (76 mm) down from the bottom of the second clip. On all other models, the vent tube must extend 3.5 in. (89 mm) down from the bottom of the clip.

**Testing**

   **NOTE**
   Do not attempt to test a battery with a hydrometer immediately after adding water to the cells. Charge the battery for 15-20 minutes at a high rate to cause vigorous gassing.

Use a hydrometer with numbered graduations from 1.100 to 1.300 rather than one with color-coded bands to test the battery. To use the hydrometer (Figure 11), squeeze the rubber ball, insert the tip into the cell and release the ball.

Draw enough electrolyte to float the weighted float inside the hydrometer. When using a temperature-compensated hydrometer, release the electrolyte and repeat this process several times to make sure the thermometer has ad-
justed to the electrolyte temperature before taking the reading.

**NOTE**
If a temperature-compensated hydrometer is not used, add 0.004 to the specific gravity reading for every 10° above 80° F (27° C). For every 10° below 80° F (27° C), subtract 0.004.

Hold the hydrometer vertically and note the number in line with the surface of the electrolyte (Figure 11). This is the specific gravity for this cell. Return the electrolyte to the cell from which it came. The specific gravity of the electrolyte in each battery cell is an excellent indication of the condition of the cell. Refer to Figure 11. Charging is necessary if the specific gravity is lower or varies more than 0.050 from cell to cell. After charging, if the specific gravity still varies more than 0.050, replace the battery.

Test the charging system as described in Chapter Two.

**Charging**

A good battery should self-discharge approximately one percent of its given capacity (Figure 12) each day. If a battery not in use and without any loads connected loses its charge within a week of being fully charged, the battery is defective.

If the motorcycle is not used for long periods of time, an automatic charger with variable voltage and amperage outputs is recommended for optimum battery service life.

**WARNING**
During charging, highly explosive hydrogen gas is released from the battery. Only charge the battery in a well-ventilated area away from open flames, including pilot lights on some gas home appliances. Do not allow smoking in the area. Never check the charge of the battery by arcing across the terminals; the resulting spark can ignite the hydrogen gas.

**CAUTION**
Always remove the battery from the motorcycle before connecting the charging equipment.

1. Remove the battery from the motorcycle as described in this section.
2. Set the battery on a stack of newspapers or shop cloths to protect the surface of the workbench.
3. Make sure the battery charger is turned off prior to attaching the charger leads to the battery.
4. Connect the positive charger lead to the positive battery terminal and the negative charger lead to the negative battery terminal.
5. Remove all fill/vent caps (A, Figure 8) from the battery. Set the charger at 12 volts and switch it on. Normally, a battery should be charged at a slow charge rate of 1/10 of the given capacity.
   a. As the battery charges, the electrolyte will begin to bubble (gassing). If one cell does not bubble, it is usually an indication that it is defective. Refer to the Load Testing in this section.
   b. The charging time depends on the discharged condition of the battery. Normally, a battery should be charged at a slow charge rate of 1/10 of the given capacity.

**CAUTION**
Maintain the electrolyte level at the upper level during the charging cycle; check and refill with distilled water as necessary.

6. After the battery has been charged for the predetermined time, turn off the charger, disconnect the leads, and check the specific gravity. It should be within the limits in Figure 13. If it is and remains stable for one hour, the battery is charged.
Initialization

A new battery must be fully charged to a specific gravity of 1.260-1.280 before installation. To bring the battery to a full charge, give it an initial charge. Using a new battery without an initial charge will cause permanent battery damage. That is, the battery will never be able to hold more than an 80% charge. Charging a new battery after it has been used will not bring its charge to 100%. When purchasing a new battery, verify its charge status.

NOTE
Recycle the old battery. When a new battery is purchased, turn in the old one for recycling. Most dealerships will accept the old battery in trade when purchasing a new one. Never place an old battery in the household trash because it is illegal, in most states, to place any acid or lead (heavy metal) contents in landfills.

Load Testing

A load test checks the battery performance under full current load and is the best indication of battery condition.

A battery load tester is required for this procedure. When using a load tester, follow the manufacturer’s instructions.

1. Remove the battery from the motorcycle as described in this section.

NOTE
Let the battery stand for at least one hour after charging prior to performing this test.

2. The battery must be fully charged before beginning this test. If necessary, charge the battery as described in this section.

WARNING
The battery load tester must be turned off prior to connecting or disconnecting the test cables to the battery. Otherwise, a spark could cause the battery to explode.

CAUTION
To prevent battery damage during load testing, do not load-test a discharged battery and do not load-test the battery for more than 20 seconds. Performing a load test on a discharged battery can result in permanent battery damage.

3. Load test the battery as follows:
   a. Connect the load tester cables to the battery following the manufacturer’s instructions.
   b. Load the battery at 50 percent of the cold-cranking amperage (CCA).
   c. After 15 seconds, the voltage reading with the load still applied must be 9.6 volts or higher at 70°F (21°C).

4. If the voltage reading is 9.6 volts or higher, the battery output capacity is good. If the reading is below 9.6 volts, the battery is defective.

5. With the tester off, disconnect the cables from the battery.

6. Install the battery as described in this section.

BATTERY
(1997-2003 MODELS)

WARNING
Always wear safety glasses when working with batteries. If electrolyte is splashed into the eyes, call a physician immediately.
the eyes open and flood with cool, clean water for approximately 15 minutes.

**WARNING**
When performing the following procedures, protect eyes, skin and clothing.

**CAUTION**
Be careful not to spill battery electrolyte on painted or polished surfaces. The liquid is highly corrosive and will damage the finish. If it is spilled, wash it off immediately with soapy water and thoroughly rinse with clean water.

Clean and inspect the battery at periodic intervals. The original equipment battery on 1997-2003 models is a sealed, maintenance-free battery.

On all models in this manual, the negative side is the ground. When removing the battery, disconnect the negative cable first, then the positive cable. This minimizes the chance of a tool shorting to ground when disconnecting the battery positive cable.

**Cable Service**
To ensure good electrical contact between the battery and the electrical cables, the cables must be clean and free of corrosion.

1. If the electrical cable terminals are corroded, disconnect them from the electrical system.
2. Clean each connector with a wire brush and a baking soda solution. Rinse thoroughly with clean water and wipe dry with a clean cloth.
3. After cleaning, apply a thin layer of dielectric grease to the battery terminals before reattaching the cables.
4. Reconnect the electrical cables to the electrical system if they were disconnected.
5. After connecting the electrical cables, apply a light coat of dielectric grease to the terminals to retard corrosion and decomposition of the terminals.

**Removal**
1. Remove the seat (Chapter Seventeen).
2. Remove the battery strap (A, Figure 14).
3. Remove the battery top cover (B, Figure 14).
4. Disconnect the negative battery cable from the battery (A, Figure 15).
5. Remove the positive battery cable bolt, positive battery cable and spacer (Figure 16).
6. Remove the battery.

**Tray**

**Cleaning and Inspection**
1. Inspect the battery tray and cushion (Figure 17, typical) for contamination or damage. Clean with a solution of baking soda and water.
2. Check the entire battery case (Figure 18) for cracks, warp, discoloration or other damage.
3. Check the battery hold-down strap for acid damage, cracks or other damage. Replace the strap if required.
4. Check the positive battery cable routing connection in the battery tray. Tighten the bolt, if necessary.
5. Check the battery terminal parts for corrosion or damage. Clean parts thoroughly with a solution of baking soda and water. Replace corroded or damaged parts. 
6. Clean the top of the battery with a stiff bristle brush using the baking soda and water solution. 
7. If necessary, remove the battery tray and clean it. Replace damaged parts. 
8. Check the battery cable clamps for corrosion and damage. If corrosion is minor, clean the battery cable clamps with a stiff wire brush. Replace severely worn or damaged cables.

Installation

1. Note the proper routing of the positive battery cable (A, Figure 15). 
2. Place the battery into the battery tray. Make sure the rubber cushion (Figure 17) is installed in the bottom of the tray before installing the battery. Install the battery strap to secure the battery. 
3. Install the spacer, positive battery cable and bolt (Figure 16). Tighten the bolt securely. 

**CAUTION**
Be sure the battery cables are connected to their proper terminals. Connecting the battery backward will reverse the polarity and damage the rectifier.

4. Install and tighten the negative battery cable (A, Figure 15). 
5. Coat the battery connections with dielectric grease. 
6. Place the top cover (B, Figure 14) on the battery. 
7. Attach the forward end of the battery strap (A, Figure 14) under the front side of the battery tray. Then lay the strap over and into the groove in the battery top. Insert the threaded stud on the rear end of the battery strap into the hole at the rear side of the battery tray. Install the washer and nut. Tighten the nut securely.

Inspection and Testing

The battery electrolyte level cannot be serviced in a maintenance-free battery. Never attempt to remove the sealing bar cap from the top of the battery. The battery does not require periodic electrolyte inspection or water refilling. Refer to any labels (Figure 19) on the battery, particularly if an aftermarket battery is installed.

Even though the battery is sealed, protect eyes, skin and clothing. The corrosive electrolyte may have spilled out and can cause severe chemical skin burns and permanent injury. The battery case may be cracked and leaking electrolyte. If electrolyte is spilled or splashed on clothing or skin, immediately neutralize it with a baking soda and water solution, then flush with an abundance of clean water.

1. Remove the battery as described in this chapter. Do not clean the battery while it is mounted in the frame.

2. Set the battery on a stack of newspapers or shop cloths to protect the surface of the workbench. 
3. Check the entire battery case for cracks or other damage. If the battery case is warped, discolored or has a raised top, the battery has been overcharged and overheated. 
4. Check the battery terminal bolts, spacers and nuts for corrosion or damage. Clean parts thoroughly with a baking soda and water solution. Replace corroded or damaged parts. 
5. If the top of the battery is corroded, clean it with a stiff bristle brush using the baking soda and water solution. 
6. Check the battery cable ends for corrosion and damage. If corrosion is minor, clean the battery cable ends with a stiff wire brush. Replace worn or damaged cables. 
7. Connect a digital voltmeter between the battery negative and positive leads. Note the following:
   a. If the battery voltage is 13.0-13.2 volts at 68°F (20°C) the battery is fully charged. 
   b. If the battery voltage is 12.0 to 12.5 volts at 68°F (20°C), or lower, the battery is undercharged and requires charging.
8. If the battery is undercharged, recharge it as described in this section. Then test the charging system as described in Chapter Two. 
9. Inspect the battery case for contamination or damage. Clean it with a baking soda and water solution. 
10. Install the battery as described in this section.

Charging

Refer to the Initialization in this section if the battery is new.

To recharge a maintenance-free battery, a digital voltmeter and a charger with an adjustable amperage output are required. If this equipment is not available, have the battery charged by a shop with the proper equipment. Excessive voltage and amperage from an unregulated charger can damage the battery and shorten service life.

The battery should only self-discharge approximately one percent of its given capacity each day. If a battery not in use, without any loads connected, loses its charge within a week after charging, the battery is defective.
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