FUEL SYSTEM

TILLOTSON CARBURETOR - 1970-71 MODELS

DESCRIPTION (See Figure 3-57)

The Model HD carburetor is a dual-venturi, diaphragm-type carburetor with an automatic economizer and accelerating pump.

The fuel inlet needle is operated through a compression-spring balanced lever that is controlled by the diaphragm to regulate the flow of fuel into the metering chamber. The amount of fuel going into the carburetor metering chamber is exactly equal to the amount of fuel being used by the engine.

This type of fuel supply control operates at any tilt angle and is resistant to any vibration which could cause a poor fuel-air mixture or flooding.

The small primary venturi is offset to the bottom of the large secondary venturi where the main nozzle outlet protrudes from the metering chamber. The accelerating pump discharges into the small venturi to take advantage of the venturi pressure drop that breaks up the solid stream of accelerating-pump fuel.

The accelerating unit is a positive-acting plunger type pump that is connected to the throttle shaft through a cam lever. The pump plunger is a spring-loaded leather cup that operates in a smooth plastic cylinder, and draws its fuel directly from the metering chamber to provide extra fuel for accelerating.

The automatic economizer is a hydraulically-operated enrichment valve that controls the main-nozzle fuel mixture at very low engine speeds. The valve opens an auxiliary fixed main jet as the venturi air flow decreases, allowing the fuel mixture to be maintained at a full-power richness. As the air flow through the carburetor increases, or as the engine speed increases, the valve closes to prevent an over-rich mixture at intermediate speeds.

OPERATION

Starting Operation (Figure 3-58)

Choke is in the closed position and the throttle in a slightly open position. As the engine is cranked, the entire metering system - idle, intermediate, and nozzle - is subjected to engine suction which is transmitted to the fuel chamber via the metering channels, creating a low pressure on the fuel.
the mixing passage between the throttle shutter and the air cleaner is at nearly atmospheric pressure. The engine suction is transmitted through the primary idle discharge port to the fuel chamber side of the metering diaphragm via the bypass chamber, idle fuel supply channel, intermediate adjustment channel, nozzle well, main fuel jet, and main fuel supply channel, creating a sub-atmospheric pressure, in the fuel chamber. The metering diaphragm is forced upward by atmospheric pressure, moving the inlet control lever to overcome the inlet compression spring pressure, allowing fuel to enter the fuel chamber through the inlet needle and seat. The fuel flows through the main fuel supply, main fuel jet, nozzle well, intermediate adjustment channel (where it mixes with air from the idle air-bleed) idle fuel supply channel, to the bypass chamber, where it mixes with air from the secondary idle discharge ports, and on out into the carburetor mixing passage through the primary idle discharge port. The mixture of well-atomized fuel and air then travels through the manifold and into the engine combustion chamber.

Acceleration (Figure 3-60)

Acceleration is accomplished by the use of a positive-action accelerating pump that is actuated from the throttle shaft by a cam lever. The pump cylinder is filled when the pump is raised to the top of its stroke. Fuel is drawn from the fuel chamber, through the accelerating pump inlet channel, past the inlet check valve. The outlet check valve is closed to prevent air from being drawn into the accelerating pump system. As the accelerating pump is depressed, the pressure of the fuel closes the inlet check valve, the fuel flows through the pump channels, past the outlet check valve, through the accelerating pump outlet channel, and through the boost venturi into carburetor mixing passage.

Intermediate or Cruise Operation (Figure 3-61)

Fuel is delivered into the carburetor as described in idle operation, and the same fuel channels are in use. As the throttle shutter opens to increase engine speed, the secondary idle discharge ports are exposed to engine suction, and fuel is delivered from both the primary and secondary idle discharge ports to supply the additional fuel demand by the engine. As the throttle shutter is opened farther, the air velocity through the boost venturi increases, creating a low pressure area at the nozzle outlet. Fuel flows from the fuel channel through the nozzle outlet via the nozzle well, main fuel jet, main fuel supply channel, and economizer valve when the pressure at the nozzle outlet is less than the pressure in the fuel chamber. At the idle and lower intermediate speeds, the check ball in the economizer valve is away from the valve seat, allowing free flow from the fuel chamber through the economizer valve to the nozzle well and nozzle outlet. Fuel flow from the primary and secondary idle ports decreases as fuel flow from the nozzle outlet increases.

Figure 3-58. Starting

During hot weather, or after an engine has been run long enough to reach stable operating temperatures, and then shut off for a short period of time, a small amount of fuel vapor may form in the fuel lines or in the fuel chamber of the carburetor. The vapor in the fuel lines will enter the fuel inlet and rise out of the vapor outlet, to be vented back into the fuel tank. The vapor that forms in the fuel chamber must escape through the metering system because there is no other vent to the fuel chamber. Starting a warm engine where vapor may be in the system, is most easily accomplished by placing the choke in the half-closed position, and starting as described above. The choke helps to get the vapor quickly out of the fuel system so that the fuel flowing through the carburetor and fuel line can cool the system to a normal temperature.

Starting is always more easily accomplished using the choke – full choke for a cold engine, and half choke for a warm engine.

Idle Operation (Figure 3-59)

The throttle shutter is slightly open when the engine is idling and the carburetor mixing passage on the engine side of the throttle shutter is exposed to engine suction, while
High-Speed Operation (Figure 3-62)

Fuel flow from the nozzle outlet increases as the shutter is opened past the intermediate position to the fully-open position. The fuel is delivered through the nozzle outlet from the fuel chamber via the main fuel supply channel and the main fuel jet. The increased pressure difference between the small venturi and the metering chamber, plus the force of fuel flowing through the economizer valve, causes the check ball to seat, stopping the flow of fuel from this part of the main metering system. This gives increased economy at high speeds. The diaphragm action and the method of fuel delivery to the fuel chamber is the same as previously described.
ADJUSTING (See Figure 3-63)

The carburetor, once properly adjusted, requires little if any readjustment. It should not be necessary to adjust the low speed needle (1) more than 1/8 turn and the intermediate speed needle (2) more than 1/4 turn, richer or leaner, to correct the mixture for a change in weather conditions.

Before attempting to correct faulty engine performance through carburetor adjustment, check over “LOCATING OPERATING TROUBLES,” Section 1. In addition be sure air cleaner element is not blocked with dirt and check manifold connections to be sure they are tight and not leaking air.

Inlet fitting (7) and vent fitting (8) have strainer screens located in threaded holes in carburetor body. If faulty carburetion indicates fuel flow is restricted, remove elbow fittings (7 and 8) from body, extract both screens with a bent wire, and blow out passages with an air hose. Replace screens and elbows, being sure that screens are not bent or damaged so as to allow dirt to pass through.

Check to see that carburetor vent line hose leading from fitting (8) to gas tank is not blocked off. Also see that gas tank cap vent is not plugged. Either condition will restrict fuel flow.

The fuel supply for low engine speed is completely regulated by the low speed needle. The fuel supply for intermediate engine speed is also regulated by an adjustable needle. A fixed jet supplies the high speed fuel requirements.

Operating conditions, such as at high altitudes or hard service, may require other than the standard main fuel fixed jet. The following main jet orifice sizes are available: .055, .057 (standard), .059, .061 and .063.

Both the intermediate speed needle and low speed needle turn inward (to right) to make mixture leaner at the respective speeds for which they adjust. Backing them out (to left) makes mixture richer. Closed throttle idling speed of engine is adjusted with idle speed stop screw (3).

Correct adjustment can be determined in the shop and verified by road test according to the following procedure:
1. Make sure carburetor control wire is adjusted so throttle lever (4) fully closes and opens with handle-bar grip movement.
2. Turn both the low speed needle (1) and the intermediate speed needle (2) all the way in (to right). Do not close off either needle too tightly or damage to needle and seat may result.
3. Back up (to left) both needles about 7/8 turn. With needles in this position, engine will start, but low speed mixture will probably be too rich.
4. Start the engine and after it has reached operating temperature and the choke has been moved to the open position, adjust throttle control so engine runs at approximately 2000 rpm.
5. Without changing throttle setting, turn intermediate needle slowly in direction which produces highest engine speed (rpm). Engine should not miss or surge at this adjustment position.
6. Back off intermediate needle 1/8 turn to slightly richer mixture. This is the correct intermediate needle adjustment.
7. Readjust idle needle and idle speed stop screw to produce a smooth idle at desired idle speed (900 to 1100 rpm).

NOTE

Use of an electric tachometer is recommended.

8. Changing either mixture setting also affects the other setting to some degree. Therefore, it will be necessary to re-check the low speed mixture after the intermediate mixture final setting is obtained.

CHECK LIST

The following check list should be used to correct the most common carburetor defects.
1. Check accelerator pump operation.
2. Blow out passages through high speed screw plug hole.
3. Tighten cover screws and pressure-test inlet valve.
4. Check intermediate adjustment spring, needle, and needle seating.
5. Test main nozzle ball check valve with tool.
6. Inspect idle needle and seat.
7. Inspect choke relief disc.
8. Inspect and clean discharge ports, diaphragms and gaskets, screens and passages. Diaphragm plate must not turn.
9. Check inlet lever setting – must be flush to 1/64 inch above floor of casting. Lever and needle must be the shackled type.
10. Test economizer ball check valve with tool.
11. Check assembly order – gasket next to body, then diaphragm, last cover.

NOTE
A more detailed guide is given at the end of this section.

INSPECTING AND TESTING PRIOR TO REMOVAL OF CARBURATOR FROM ENGINE (Figure 3-64)

(Checks and tests for carburetor performance)

NOTE
All inspections and tests should be performed, in the sequence shown below, before further disassembly or repairs are made.

1. The accelerator pump should be inspected for proper operation first. Remove air cleaner, prime carburetor by inserting a toothpick through small hole in bottom of plastic pump cover and gently working diaphragm several times. Operate the throttle lever both rapidly and slowly several times, with the fuel valve turned on. The pump should deliver a strong and constant jet of fuel with each stroke. Failure to do so indicates diaphragm valves or pump plunger as being defective.

2. In cleaning of high, intermediate and low speed channels, the following procedure, most likely, will dislodge any loose dirt lodged in the passages.

Remove high speed screw plug located on rear side of carburetor, opposite intermediate adjustment needle. Lightly seat intermediate needle and apply air hose pressure (90 pounds maximum) to screw plug hole. Open intermediate and idle needles three or four turns and again apply 90 pounds maximum air pressure. Reset both adjustment screws (see "ADJUSTING CARBURETOR"). Evaluate carburetor’s performance by road testing.

3. Check inlet needle and seat for leakage, as follows:
See that all plastic cover screws are tight. Remove fuel and vent lines, install Bulb Tester, Part No. 94760-68, to carburetor fuel inlet fitting, plug vent fitting with finger and pressurize tester noting any leakage. A moistened needle and seat should hold 1 to 1-1/2 pounds approximately, and release at approximately 3 to 5 pounds. A dry needle and seat will not hold as well as a moist one. See Figure 3-64.

Figure 3-64. Checking Inlet Needle and Seat for Leakage

NOTE
Remove carburetor but do not disassemble.

4. Inspect intermediate adjustment needle and spring to see if spring coils are binding before needle seats. If needle does not seat grind a small amount of material from each end of spring. You can check to see if needle is seating by applying blue dye to needle taper and screwing down lightly into seat and noting mark on needle taper.

5. Check main nozzle ball check valve for leakage, as follows:
Seal one side of venturi with finger and apply alternate pressure and vacuum by mouth using grommet end of tool, Part No. 96960-68, seated in venturi as shown in Figure 3-65.

Vacuum should release ball, and pressure should seat ball in nozzle assembly.

Figure 3-65. Checking Main Nozzle Ball Check Valve for Leakage
If leakage is evident, carburetor must be disassembled and main nozzle check valve assembly replaced.

To replace main nozzle, puncture welch plug with pointed tool, avoiding center, as shown in Figure 3-66. Remove nozzle welch plug and use stepped end of punch, Part No. 96962-68, on nozzle, tapping it through into venturi using plastic hammer. See Figure 3-67. Use larger end of tool to install the new check valve in the same manner. See Figure 3-68.

6. Inspect idle needle and seat in carburetor bore for any distortion or a cracked casting.

7. Inspect choke relief disc (upper half of choke) for distortion or stress cracks at the area rotating on choke shaft.

**NOTE**

Replace damaged parts only after completing all tests.

8. Remove plastic diaphragm cover. Inspect accelerator pump lever for fold-over or coil spring out of correct position.

Check accelerator pump outlet ball check valve to see that ball is free.

Inspect gasket and diaphragm for distortion or misplacement on carburetor body. Diaphragm must not be stretched or have a rippled appearance particularly within the valley portion which should be uniform in shape. (Gaskets should be assembled next to body.)

Lightly make attempt to rotate metal diaphragm washer, riveted to upper side of diaphragm. If diaphragm plate rotates freely with no drag, replace diaphragm assembly. Diaphragm plate should not be loose.

Prior to removal of the inlet lever the initial needle seat leakage test should be performed 10 to 12 times with the bulb tester, as follows: Close bulb valve. Apply pressure to the inlet, sealing the vent fitting. Open bulb valve and again apply pressure. This repetition checks the seating of the needle in the seat ensuring that it is not sticking open at lever pin or at groove in needle.

9. Inspect inlet needle lever for correct adjustment. It should be flush with surrounding floor of carburetor body. Tighten seat to 45 in-lbs torque. See Figures 3-69.

10. Test economizer ball check for leakage and correct operations as follows:

Using hose end of tool, Part No. 96960-68, place it over economizer welch plug hole so it seals off surrounding area. With alternate pressure and vacuum applied with mouth, as shown in Figure 3-70, ball check should release and seal. Replace any defective parts.

After plastic cover has been removed, remove welch plug at idle adjuster, all gaskets, diaphragms, needle and seat, and high speed nozzle before cleaning carburetor in a causti
carburetor cleaner, since the caustic cleaner will damage gasket material and the high speed nozzle plastic check ball. Only gaskets which are in perfect condition should be reused. The metal parts may also be cleaned in lacquer thinner with a small brush and blown dry.

Inspect by attempting to rotate, or move all welch plugs in body. A close inspection of wall area around welch plugs can disclose a leaking condition. Whenever a welch plug is removed, a new one should be reinstalled. If leakage is suspected due to rough or damaged welch plug seat in casting, apply a small amount of Harley-Davidson "Seal-All" to edge of welch plug after installing it in recess.

After carburetor has been reassembled, recheck accelerator pump per item 1 under TESTS.

DISASSEMBLING CARBURETOR
(See Figure 3-71)

Remove idle (24) and intermediate (35) fuel adjustments.

Remove two throttle shutter screws (43) and the throttle shutter (47). The sides of the shutter are tapered 15° to conform to the throttle bore. Observe the direction of this taper and the position of the shutter so that it can be reassembled later in the correct position.

Remove the accelerating-pump-lever retaining screw (3) and pull the throttle-shaft assembly (42) out of the carburetor body. Remove compression spring (46), washers (45), and shaft dust seals (44).

Remove six screws and washers (20) and the body cover (18).

Remove accelerating pump plunger assembly (1).

Remove channel plug screw (19).

Remove metering diaphragm (17).

Remove metering-diaphragm gasket (21). Note that the gasket is assembled next to the body casting.

Remove fulcrum-pin retaining screw (31), fulcrum pin (30), inlet control lever (29), and metering spring (34).

Remove the inlet needle (32).

Remove the inlet seat and cage assembly (32), using a 3/8 in. thin wall hex socket wrench. Note the position of the inlet seat insert with the contoured side toward the outside of the cage and the smooth side toward the inside of the cage.

Remove the inlet seat gasket (33), using a small tap or bent wire.

Remove plug screw (40).

Remove fixed main jet (39) and gasket (39A).

Remove main-nozzle welch plug (6) by drilling 1/8 in. diameter hole off center and just breaking through the welch plug. Do not drill deeper than the welch plug because this would probably damage the nozzle assembly. Pry out the welch plug with a small punch, being careful not to damage the casting counterbore edges around the plug.

Remove idle-port welch plug (6), using the same procedure described above.

Remove welch plug (8) and economizer check ball (22). Pry out the welch plug carefully, using a small punch.

Remove two choke-shutter screws (16) and the bottom half of the choke shutter (15).

Pull the choke-shaft assembly (13) out of the body. This will release the top half of the choke shutter (11), the spring (12), the choke friction ball (9), and friction ball spring (10).

Remove the choke-shaft dust seal (14).

CLEANING, INSPECTING AND REPAIRING

The carburetor body can be cleaned in commercial carburetor solvent such as Hydroseal to remove varnish from the channels and metering chamber.

NOTE

All gaskets, rubber gaskets, seals and plastic parts, including items 18, 22 and 41, should be removed and only metal parts cleaned in Gunk Hydroseal cleaning solution.
1. Accelerating pump
2. Accelerating pump lever
3. Accelerating pump lever screw
4. Accelerating pump lever screw L.W.
5. Channel plug (2)
6. Welch plug
7. Welch plug
8. Welch plug
9. Choke shaft friction ball
10. Choke shaft friction spring
11. Choke shutter (top)
12. Choke shutter spring
13. Choke shaft assembly
14. Choke shaft dust seal
15. Choke shutter (bottom)
16. Choke shutter screws
17. Diaphragm
18. Cover
18A. Accelerating pump check ball retainer
18B. Accelerating pump check ball
19. Diaphragm cover plug screw
20. Diaphragm cover screws (6)
21. Diaphragm cover gasket
22. Economizer check ball
23. Fuel filter screen (2)
24. Idle adjustment screw
25. Idle adjustment screw spring
26. Throttle stop screw
27. Throttle stop screw cup
28. Throttle stop screw spring
28A. Throttle stop screw spring washer
29. Inlet control lever
30. Inlet control lever pin
31. Inlet control lever screw
32. Inlet needle and seat
33. Inlet needle seat gasket
34. Inlet control lever tension spring
35. Intermediate adjusting screw
36. Intermediate adjusting screw packing
37. Intermediate adjusting screw spring
38. Intermediate adjusting screw washer
39. Main jet
39A. Main jet gasket
40. Main jet plug screw
41. Main nozzle check valve
42. Throttle shaft assembly
43. Throttle lever wire block screw
44. Dust seal (2)
45. Washer (2)
46. Throttle shaft spring
47. Throttle shutter
48. Throttle shutter screws
49. Gasket overhaul set
50. Overhaul repair kit

Figure 3-71. Model HD Carburetor - Exploded View - 1970-71 Models

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All channels and orifices in the carburetor and pump-body castings should be cleaned with compressed air. DO NOT use wires or drills to clean small holes. These might cause burrs or change the size of the holes.

Examine all parts for wear or damage paying particular attention to the following:

Examine pump body casting for breaks and cracks.

The inlet control lever must rotate freely on the fulcrum pin and forked end must engage slot in inlet needle (see Figure 3-71). The spring (34) should not be stretched or distorted.

Inspect the inlet needle (32) cone point for wear and scratches. Inspect the lever (29) contact end for burrs and wear.

ASSEMBLING CARBURETOR (See Figure 3-71)

Make certain that all parts are kept clean during reassembly. Do not use cloths to wipe or dry parts. Lint or threads can easily block small orifices. Welch plugs should be seated with a flat-end punch of a slightly smaller diameter than the Welch plug. The seated plug should be flat, not concave, to assure a tight fit around the circumference.

The metering spring (34) should be seated into the counterbore in the body casting, and located on the protrusion on the inlet control lever (29). The lever should be adjusted flush with the floor of the metering chamber by bending diaphragm end of lever as necessary.

Two torque values are important: (1) the inlet seat assembly (32) should be tightened to 40-45 in-lbs; and (2) the accelerating-pump channel plug (19) should be tightened to 33-38 in-lbs.

TROUBLESHOOTING GUIDE (See Figure 3-71)

The following symptoms and possible causes with corrective service can be used as a guide in servicing the carburetor.

A. Idle System

1. Idle operation too lean.
   a. Dirt in idle fuel channels – blow out with compressed air.
   b. Intermediate adjustment (35) closed or adjusted too lean – readjust.
   c. Welch plug (6) or channel plugs (5) missing or not tightly sealed – reseat or replace plugs.
   d. Nozzle check valve (41) not seating – blow out with compressed air or replace. (See “CHECK LIST” No. 5.)

2. Idle operation too rich.
   a. Carburetor flooding – see item E.
   b. Idle adjustment screw (24) point damaged – replace the adjustment.
   c. Idle adjustment hole damaged, forced oversize, or casting cracked in the idle port area – replace carburetor.

B. Intermediate System

1. Lean operation at steady speeds between 15 and 65 mph.
   b. Dirt in intermediate fuel ports or supply channels – remove welch plug (6) and channel plugs (5) and blow out with compressed air.
   c. Welch plug (6) or channel plugs (5) not tightly sealed – reseat or replace plugs.
   d. Nozzle check valve (41) not seating – blow out with compressed air, or replace. (See “CHECK LIST” No. 5.)
   e. Intermediate adjustment packing (36) missing or damaged – replace.
   f. Economizer check ball (22) stuck closed – remove welch plug (8) and check ball (22) and blow out channel with compressed air. (See “CHECK LIST” No. 10.)

2. Rich operation at steady speeds between 15 and 65 mph.
   a. Intermediate adjustment (35) adjusted too rich – readjust.
   b. Fixed main jet (39) too large, not tightly in place or missing – seat firmly, or replace jet.
   c. Carburetor flooding – see item E.
   d. Nozzle check-valve welch plug (6) not tightly sealed – reseat or replace.
   e. Choke valve partially closed – see that choke friction spring (10) and choke friction ball (9) are correctly assembled.

C. Nozzle System

1. Lean operation at speeds above 60 mph.
   a. Dirt in nozzle system – remove main fuel jet plug screw (40) and blow channels out with compressed air.
   b. Main fuel jet (39) too small or damaged – replace.
   c. Main fuel jet plug screw (40) not tightly sealed – tighten to stop air leak.
   d. Nozzle check valve (41) damaged – replace. (See “CHECK LIST” No. 5.)
   e. Nozzle check valve (41) not seated correctly in casting – reseat flush with nozzle-well surface.

2. Rich operation at speeds above 80 mph.
   a. Main jet (39) too large, not tightly in place or missing – seat firmly or replace.
   b. Carburetor flooding – see item E.
   c. Economizer check ball (22) not seating – remove welch plug (8) and check ball (22) and blow channel out with compressed air. (See “CHECK LIST” No. 10.)
D. Accelerating Pump System
1. Lean acceleration.
   a. Incorrect carburetion adjustment – readjust idle (24) and intermediate adjustments (35).
   b. Dirt in acceleration fuel channels – blow out all channels in diaphragm cover (18) and the accelerating pump discharge channel in the body casting. (See “CHECK LIST” No. 1.)
   c. Accelerator pump assembly (1) damaged or worn – replace assembly. (See “CHECK LIST” No. 1.)
   d. Diaphragm cover plug screw (19) loose or missing – tighten or replace.
   e. Diaphragm (17) flap check valves damaged or worn – replace diaphragm.
   f. Economizer check ball (22) stuck closed – remove welch plug (8) and check ball (22) and blow channel clean with compressed air. (See “CHECK LIST” No. 10.)

E. Carborator Flooding
1. Dirt in inlet needle and seat assembly (32) – remove and clean, or replace. (See “CHECK LIST” No. 3.)
2. Inlet seat gasket (33) missing or damaged – replace.
3. Inlet control lever (29) not correctly adjusted – readjust lever flush with metering chamber wall. (See "CHECK LIST" No. 9.)
4. Diaphragm (17) incorrectly installed – replace or correct installation.
5. Inlet control lever pin (30) loose or not correctly installed – tighten retaining screw (31) and correct installation.
6. Inlet control lever (29) tight on lever pin (30) – replace damaged part, or clean dirt from these parts.
7. Inlet needle or seat (32) damaged or worn – replace the assembly.

F. General Operation
1. Lean operation in all speed ranges.
   a. Filter screens (23) plugged or dirty – clean or replace.
   b. Inlet control lever (29) incorrectly adjusted – readjust lever flush with wall of metering chamber. (See “CHECK LIST” No. 9.)
   c. Diaphragm cover plate (18) loose – tighten six screws (20).
   d. Air leak in metering system – all channel plugs, plug screws, and lead plugs to be tightly sealed.
   e. Inlet tension spring (34) stretched or damaged – replace.
2. Rich operation in all speed ranges.
   a. Carborator flooding – see item E.
   b. Choke valve not staying fully open – see that choke friction spring (10) and friction ball (9) are assembled correctly.

BENDIX CARBURETOR
1972 TO EARLY 1976 MODELS

DESCRIPTION
The Model 16P12 carburetor is a horizontal plain tube type with a fuel bowl, a single ring-shaped float, an accelerating pump, idle mixture adjusting needle and a throttle stop screw for idle speed adjustment.

The throttle body casting contains an integral venturi and a fuel valve seat that is pressed into the body. The underside of the throttle body contains a long boss. The main jet and discharge tube assembly screws into the boss with the end of the tube projecting up into the venturi.

OPERATION
Fuel Supply System, Figure 3-72
Fuel under pressure enters the float chamber through the fuel inlet and fuel valve (needle and seat). The fuel level in the bowl is automatically maintained by the float which opens and closes the needle valve to supply the varying fuel flow demands of the engine as shown. A clip attached to the end of the needle valve engages a tab of the float assembly.

Accelerating System, Figure 3-72
The accelerating pump controls the amount of additional fuel that is discharged into the air system upon sudden throttle opening.

![Figure 3-72: Fuel Supply and Accelerating Systems](image-url)
The accelerating system consists of a pump assembly, accelerating jet, a check valve and the mechanical linkage that connects to the throttle shaft.

The accelerating pump has three adjustment holes in pump shaft to provide variable acceleration mixture.

Idle System, Figure 3-73

The fuel for idle is drawn from the main metering well through the idle tube and is mixed in the channel leading to the idle discharge holes with air entering through the idle air bleed. At slow idle speed, the throttle plate is positioned as shown in Figure 3-73 to expose only the No. 1 idle discharge hole to engine vacuum. Air is admitted to the idle channel through the No. 2, No. 3 and No. 4 (late 1972 and later) idle holes. The air mixes with the fuel-air mixture in the channel and is discharged through the No. 1 idle hole.

As the throttle plate is opened, the No. 2 idle hole and the No. 3 hole and finally the No. 4 hole begin to discharge fuel-air mixture to supply the increased fuel required at the higher engine speed.

The idle adjusting needle regulates the fuel-air mixture flowing through the No. 1 idle discharge hole. Turning the needle IN (clockwise) results in a leaner mixture. Turning it OUT (counterclockwise) provides a richer mixture. The idle speed is set by adjusting the throttle stop screw – not the idle adjusting needle.

Choke System, Figure 3-73

Before cranking the engine, the throttle should be opened to expose all three idle holes. The choke plate should be held fully closed during the cranking. After the engine starts, open the choke slightly. A hole in the choke plate helps to prevent over-choking when the engine is started. The choke should be moved to wide open when the engine is partially warmed up.

High Speed (Main Metering) System, Figure 3-74

The fuel for engine operation from off-idle to full throttle range is supplied from the fuel bowl through the main metering jet, metering well and discharge tube. As the fuel flows through the metering well and tube, it mixes with air entering through the well vent to provide the correct fuel air mixture ratio for all engine speeds and loads. A series of air bleed holes in the discharge tube permits the air from the well vent to enter the bowl below the level of the fuel in the float chamber. This reduces the average density of the fuel and enables it to flow freely at low suction. At high engine speeds (and high suction), the proportion of air to fuel through the main metering system is reduced to provide the richer mixture needed for peak performance.

Figure 3-74. High Speed System

ADJUSTING CARBURETOR (See Figure 3-75)

Before attempting to correct faulty engine performance through carburetor adjustment, check over “LOCATING TROUBLES,” Section 1. In addition, be sure air cleaner element is clean, and check carburetor and manifold connections to be sure they are tight and not leaking air.

The low speed needle, Figure 3-75, should be turned clockwise, or in, to make leaner mixture, and counterclockwise, or out, to make mixture richer. Needle is held to whatever position set by a spring.

Carburetor may be adjusted as follows:
NOTE FOR 1973 AND EARLIER

The change letter A or B is stamped near the Basic Bendix carburetor part number 13609 on the carburetor body boss, (Figure 3-75) for identifying carburetors with modifications. Idle tube 27749-72 (marked A) is standard on carburetors marked with change letter A. Idle tube 27750-72 (marked B) is standard on carburetors marked with change letter B.

There are three holes in accelerating pump shaft to provide more or less fuel upon acceleration – bottom hole for pump shaft pin (37, Figure 3-76) provides richest setting – top hole, leanest setting.

DISASSEMBLING CARBURETOR (Figure 3-76)

Bowl
1. Remove pump lever screw (1) to loosen pump lever (2) from end of throttle shaft. Disengage accelerating pump (3) with boot from fuel bowl assembly and remove pump with lever. Compress piston shaft spring and rotate lever (2) 90 degrees to disengage from shaft roll pin.
2. Remove idle tube (4) and gasket (5). Remove the jet and tube assembly (6) to free bowl (9). Remove fiber washer (7) and O-ring (8) from tube.

Throttle Body
1. Use scriber or heavy wire to press float pin (11) out of float hinges.
2. Remove float assembly (12), float spring (13) and float valve assembly (14) from throttle body.
3. Remove bowl to body gasket (15).
4. Remove idle mixture needle (16) and spring (17). Then remove throttle stop screw (18) and spring (19).
5. Close choke disc (20) and remove screws (21). Remove disc from air intake opening and slide choke shaft and lever (22) out of shaft hole, plunger and spring (22A and 22B) will be released.
6. Remove seal retainer (23) and seal (24) from inside choke shaft opening only if they are to be replaced. Do not remove cup plug (25) from other choke shaft opening unless the plug is damaged and is to be replaced.
7. Close throttle disc (26) and remove two small screws (27). Then remove throttle disc and shaft and lever (28). Remove spring (29) from throttle shaft.
8. Remove retainers (30 and 31) and seals (32 and 33) from throttle shaft bosses only if they are to be replaced.

CLEANING AND INSPECTION (Figure 3-76)

Thoroughly clean all metal parts in a metal parts cleaner and rinse in a solvent. Blow out all passages and channels in the castings with compressed air. Reverse the air flow through each passage to ensure removal of all dirt particles. NEVER USE A WIRE OR DRILL TO CLEAN OUT THE JETS.

Inspect all parts and replace any that are damaged or worn. Always use the correct repair parts.
Figure 3-76: Bendix Carburetor - Exploded View - 1972 to Early 1976 Models
ASSEMBLING CARBURETOR (Figure 3-76)

Throttle Body

1. Position throttle return spring (29) on throttle shaft. Slide throttle shaft and lever (28) into seal retainer (31) and seal (33). Insert shaft in throttle shaft hole from side shown. Guide shaft into hole on opposite side of bore and press seal and retainer firmly against shaft hole boss.

2. Slide seal (32) and retainer (30) over end of throttle shaft and seat firmly against shaft hole boss.

3. Rotate throttle shaft until flat center section faces toward manifold opening. Install throttle disc (26) loosely with screws (27). Snap disc open and shut several times to center disc, and then tighten screws holding the throttle disc seated in the casting. Be sure the disc is held tightly closed.

4. Insert seal (24) and retainer washer (23) in choke shaft hole. Use a small punch to stake retainer in place.

5. Slide choke shaft and lever (22) through retainer and seal and seat shaft in hole in opposite side of air intake. Install plunger and spring (22A and 22B) at this time.

6. Rotate choke shaft until flat center section faces toward intake opening. Install choke disc (20) loosely with screws (21). Snap disc open and shut, and then tighten screws using the same procedure as for throttle.

7. If choke cup plug (25) was removed, install new plug in choke shaft hole on opposite side of throttle body.

8. Place throttle body with fuel bowl side up and install bowl to body gasket (15).

9. Insert fuel valve assembly (14) in fuel valve seat. Assemble float spring (13) and float (12) and install float pin (11). Be sure that fuel valve clip is attached to the float tab. If necessary, bend clip to provide minimum clearance with tab (approximately .010 in.).

10. With the carburetor inverted (inlet needle seated), bottom surface of float should be 3/16 in. from gasket surface at point opposite hinge. A 3/16 in. drill can be used as a gauge as shown in Figure 3-77. It adjustment is required, use long nosed pliers to bend the tab that contacts the fuel valve. Be careful to avoid damage to the fuel valve or seat.

11. Install throttle stop screw (18) and spring (19). Adjust screw to open throttle slightly but not far enough to uncover the No. 1 idle discharge hole.

12. Install idle mixture needle (16) and spring (17). Screw needle IN until it seats lightly against the No. 1 idle discharge hole, then back it out 1-1/2 turns as a preliminary idle adjustment.

Bowl

1. Carefully guide cup of accelerating pump (3) into pump well. Seat accelerating pump boot around top of accelerating pump boss.

2. Assemble washer (7) on main jet and discharge tube (6) and assemble O-ring (8) in groove near end of discharge tube.

3. Hold carburetor inverted (with float up) and rotate the long end of the spring upward so that it is against the float.

Carefully position the fuel bowl on the throttle body releasing the float spring so that the long end of the spring presses against the side of the bowl (refer to Figure 3-77). Be sure that the accelerating jet fits properly in the hole in the throttle body.

4. Assemble main jet and tube (6) through hole in bottom of bowl and into throttle body boss.

5. Assemble gasket (5) on idle tube (4) and insert tube in throttle body. Carefully guide tube through bore and into discharge tube on opposite side of venturi. Tighten idle tube and main jet.

6. Attach accelerating pump lever (2) on top of accelerating pump. Other end of lever goes on rectangular end of throttle shaft. Install pump lever screw (1) in end of throttle shaft.

KEIHIN CARBURETOR - LATE 1976 AND LATER MODELS

DESCRIPTION

The Keihin carburetor is a horizontal type with a fuel bowl, a single ring-shaped float, an accelerating pump, idle mixture adjusting needle and a throttle stop screw for idle speed adjustment.

The throttle body casting contains an integral venturi and a fuel valve seat that is pressed into the body. The underside of the throttle body contains a boss. The main jet screws into the boss and holds the bleed tube in place.

OPERATION

The float system is shown in Figure 3-80. Fuel from gas tank passes through fuel valve (21) onto float chamber (29). The fuel entering causes float to rise until it shuts off fuel valve stopping flow at a level predetermined by float level setting.
Figure 3-78. Keihin Carburetor - Exploded View - Late 1976 and Later Models

1. Screw and washer
2. Bracket
3. Screw
4. Screw
5. Pin, float
6. Screw
7. Rod
8. Boot
9. O-ring
10. Screw, throttle stop
11. Spring
12. Screw, low speed mixture
13. Spring
14. Screw and washer
15. Bracket
16. Spring
17. Lever, throttle
18. Washer
19. Nut
20. O-ring
21. Valve, fuel
22. Clip
23. Float assy.
24. Nozzle, main
25. Jet, slow
26. Jet, main
27. Plug
28. O-ring
29. Float bowl
30. O-ring (2)
31. Diaphragm
32. Spring
33. Housing
34. Screw and washer (5)
35. Screw and washer
36. Clip
37. Hose
38. Fitting
39. Spacer (not standard)
40. Plate, choke
   (not shown)
41. Lever, choke
42. Flange, mtg.
43. Lever, accel. pump
44. Rocker arm
45. Spring, rocker arm
3. Screw  
10. Screw, throttle stop  
12. Screw, low speed mixture  
17. Lever, throttle  
38. Fitting  
40. Plate, choke  
41. Lever, choke  
42. Flange, mfg.  
43. Lever, accel. pump  
44. Rocker arm  
45. Spring, rocker arm

**Figure 3-79. Keihin Carburetor - Late 1976 and Later**

The Slow System (Figure 3-81)

It functions at idle, low, and intermediate speeds when throttle valve is closed or only partially open. At idle, fuel enters main jet (26) and, after being metered there, enters slow jet (25) where it is metered again. The fuel from jet (25) enters slow jet bleed tube where it mixes with air through slow air passage. The fuel mixture is regulated by adjusting screw (12). When throttle valve is closed, fuel mixture flows into venturi almost entirely through idle port. As throttle valve gradually opens, fuel mix discharge is transferred to bypass. Note that slow jet bleed tube is actually a part of slow jet (25).

The Main System (Figure 3-81)

The main system functions at intermediate and high speeds as the throttle valve opens further. The fuel is metered by main jet (26) and enters main jet bleed tube where it mixes with air entering through main jet air passage. This fuel air mixture then exits from main nozzle (24) into venturi.

**Figure 3-80. Carburetor Float System**

The Accelerating Pump System (Figure 3-82)

It works with sudden throttle openings (rapid accelerations) to quickly inject fuel into carburetor to provide extra fuel for accelerating.

**Figure 3-81. Carburetor Slow and Main System**
Adjust throttle stop screw (10) to make engine idle at desired speed with throttle closed. Turning screw clockwise opens throttle plate for faster idle. Never set idle adjustment to slowest possible speed. An extremely slow idle causes bearing wear, oil consumption, and slow speed accelerating difficulties. Recommended idle speed is 700 to 900 rpm.

Make final readjustment on low speed mixture screw (12) after engine is warm. First turn screw in, then out, to see if engine picks up speed or runs more smoothly. Starting and all around performance will be better with mixture adjustment set slightly richer than leaner. If necessary, make further adjustment on throttle stop screw (10) to obtain correct engine idling speed.

During high speed operation, fuel is metered by a main jet (26) which has no adjustment. Operating conditions, such as high altitudes or hard service, may require a different size main jet other than the standard. The following main jet sizes are available:

<table>
<thead>
<tr>
<th>Main Jet Size</th>
<th>1.85mm</th>
<th>1.70mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.80mm</td>
<td>1.65mm</td>
<td></td>
</tr>
<tr>
<td>1.75mm</td>
<td>1.60mm</td>
<td></td>
</tr>
</tbody>
</table>

The amount of fuel injected by the accelerating pump is adjusted by means of the rocker arm adjusting screw (3). Factory adjustment is 6 mm (approximately 1/4 in.) between end of screw and stop. Back screw out for more fuel volume; in for less. The rocker arm spring (45) controls stroke duration and is adjustable by means of three locating notches in the accelerator pump rocker arm (44). Center notch is standard adjustment.

**DISASSEMBLING (Figure 3-78)**

Disconnect throttle wire and choke wire from their respective operating levers. Detach carburetor from engine by removing nuts and washers from mounting studs.

Disassemble accelerating pump parts as follows. Remove accelerating pump housing (33) by removing three sets of screws and washers (34 and 35). Remove spring (32), diaphragm (31) and two O-rings (30), taking care when lifting off housing (33) to catch spring (32). Also, be careful not to damage housing mounting surface to prevent fuel leakage when reassembled.

Disassemble float chamber as follows. Detach float chamber (23) from body by removing three sets of screws and washers (34). Remove screw (6) which retains float pin (5). Remove float pin (5) and remove float (23). Slip off fuel valve (21) from metal clip on float. If needed, remove clip (22) from fuel valve (21). Take care not to damage rubber needle portion of fuel valve (21). Also be careful not to damage pump nozzle and overflow pipe which are built into the float chamber. Remove O-ring (28) from slot in float chamber wall.

The removal of the float chamber will allow pump rod (7) and boot (8) to be removed next.
Disassemble carburetor body as follows. Pull plug (27) out of tube above slow jet (25). Unscrew slow jet (25) and main jet (26). Tip body and let main nozzle (24) slide out of main tube.

Remove O-ring (20) from slot in body mounting flange. Unscrew and remove nut (19) along with washer (18). This will free throttle lever (17) and spring (16) so they can be pulled off throttle shaft.

Unscrew throttle stop screw (10) and low speed mixture screw (12) along with associated springs (11) and (13), respectively.

As required, remove brackets (2) and (15) by removing screws and washers (1) and (14), respectively.

The throttle valve assembly and choke valve assembly (shaft, valve, plate and associated parts) usually are not disassembled. These parts are matched to the individual carburetor during manufacture. In both cases, screws securing plates to shafts have peened ends, the threads of which would be destroyed if screws are removed. In the case of throttle assembly, the position of bypass hole was positioned precisely to match lip of valve and would be changed if taken apart and reassembled. If problems arise involving these assemblies, the complete carburetor is usually replaced.

This completes disassembly of carburetor. Clean and inspect before reassembling.

CLEANING AND INSPECTING (Figure 3-78)

Clean carburetor body in solvent such as "GUNK" to remove varnish and carbon stains from fuel and air passages. Blow body dry with compressed air. Reverse air flow through each passage to ensure removal of all dirt particles. Never scrape carbon deposits from carburetor parts with knife or other steel instrument. Also, do not use wires or drills to clean small holes. To do so may cause burrs or change hole sizes. This is particularly important to observe when cleaning jet openings.

Inspect all parts and replace any that are damaged or worn. The most important checks are as follows.

Check accelerating pump. Inspect diaphragm (31) for pinholes, cracks or deformation and replace if necessary. Inspect rod (7) for bending and boot (8) for cracks. Any dirt in accelerating pump passage should be blown out from side opposite nozzle or check valve will close, making cleaning impossible.

Check for dirt clogging overflow hose (37). If clogged, fuel may not flow out and instead flood engine, causing poor starting.

Check low speed mixture screw (12). Inspect for carbon lodging on tip and for damage to taper or screw itself.

ASSEMBLING CARBURETOR (Figure 3-78)

Assembling the carburetor is essentially the reverse of the disassembly procedure outlined previously. An added step, however, is the adjustment of the float level. Refer to Figure 3-83.

As shown in the figure, two positions of the float valve must be set: the valve fully closed (upper portion of figure) and the valve fully open (lower portion of figure).

These adjustments are made by carefully bending the two tabs of the metal clip on the float.

Float Level Gauge, Part No. 94752-77 shown in Figure 3-83 can be used to check the float setting.

INSTALLING CARBURETOR ON MOTORCYCLE

Mount the carburetor on the motorcycle as follows. Check O-ring (30), Figure 3-78, on the mounting flange to see that it is okay and in its groove. Position carburetor on two engine mounting studs and secure with nuts and washers.

Insert throttle wire through slot in bracket (15) and wrap around into groove in throttle lever (17). Place throttle wire end ferrule into hole in lever. Check operation by twisting throttle control on handlebar. Throttle should open and close fully with handlebar grip movement.

Attach choke wire to choke lever (41) and confirm operation of choke by operating carburetor choke knob.

Attach fuel line from gas tank to fitting (38) on carburetor body. Position overflow tube (37) downward so any fuel overflow will drip away from hot engine. Open fuel valve. Install air cleaner.
Figure 3-83. Carburetor Float Setting
# KEIHIN CARBURETOR TROUBLE CHART

(Refer to Figure 3-78)

## Overflow

<table>
<thead>
<tr>
<th>Check for</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Worn fuel valve (21) or dirty fuel valve seat.</td>
<td>1. Replace valve (21) or clean valve seat.</td>
</tr>
<tr>
<td>3. Worn float (23) mounting tabs.</td>
<td>3. Replace float (23).</td>
</tr>
<tr>
<td>4. Worn float pin (5) or loose screw (5).</td>
<td>4. Replace pin (5) or tighten screw (6).</td>
</tr>
</tbody>
</table>

## Poor Idling

<table>
<thead>
<tr>
<th>Check for</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Idling improperly adjusted.</td>
<td>1. Adjust idle.</td>
</tr>
<tr>
<td>3. Clogged bypass or idle port.</td>
<td>3. Clean.</td>
</tr>
<tr>
<td>6. Air leaking into system.</td>
<td>6. Replace O-ring (20) and tighten mounting screws.</td>
</tr>
<tr>
<td>7. Excessive fuel from accelerating pump.</td>
<td>7. Check accelerating pump rod (7) length.</td>
</tr>
</tbody>
</table>

## Poor Fuel Economy

<table>
<thead>
<tr>
<th>Check for</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fuel level too high.</td>
<td>1. Adjust level of float (23).</td>
</tr>
<tr>
<td>2. Clogged bleed tubes (24) and (25).</td>
<td>2. Clean.</td>
</tr>
<tr>
<td>3. Loose jets.</td>
<td>3. Tighten.</td>
</tr>
<tr>
<td>5. Choke not opening fully.</td>
<td>5. Inspect choke and choke wire and adjust.</td>
</tr>
<tr>
<td>7. Excessive fuel from accelerating pump.</td>
<td>7. Adjust fuel flow. Check accelerating pump rod (7) length.</td>
</tr>
</tbody>
</table>

## Poor Acceleration

<table>
<thead>
<tr>
<th>Check for</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Slow system improperly adjusted.</td>
<td>3. Adjust slow system.</td>
</tr>
<tr>
<td>4. Clogged slow jet (25) or bleed tube.</td>
<td>4. Clean.</td>
</tr>
<tr>
<td>5. Fuel level too low.</td>
<td>5. Adjust level of float (23).</td>
</tr>
</tbody>
</table>

## Hard Starting

<table>
<thead>
<tr>
<th>Check for</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Choke valve (41) not operating properly.</td>
<td>1. Adjust choke system.</td>
</tr>
<tr>
<td>2. Idling improperly adjusted.</td>
<td>2. Adjust idle.</td>
</tr>
<tr>
<td>4. Loose carburetor mounting nuts.</td>
<td>4. Tighten mounting nuts.</td>
</tr>
<tr>
<td>5. Fuel overflow.</td>
<td>5. Inspect float (23) and fuel valve (21) and adjust or replace.</td>
</tr>
</tbody>
</table>

*3-64*
## KEIHIN CARBURETOR TROUBLE CHART (CONT.)

### Poor Performance On Road

<table>
<thead>
<tr>
<th>Check for:</th>
<th>Remedy:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Idling improperly adjusted.</td>
<td>1. Adjust idle.</td>
</tr>
<tr>
<td>2. Fuel overflow.</td>
<td>2. Inspect float (23) and fuel valve (21) and adjust or replace.</td>
</tr>
<tr>
<td>3. Main jet (26) loosened.</td>
<td>3. Inspect main jet (26) and tighten.</td>
</tr>
<tr>
<td>5. Faulty operation of accelerating pump.</td>
<td>5. Correct rod (7) length.</td>
</tr>
</tbody>
</table>

### Poor High Speed Performance

<table>
<thead>
<tr>
<th>Check for:</th>
<th>Remedy:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Loose main jet (26).</td>
<td>1. Inspect main jet (26) and tighten.</td>
</tr>
<tr>
<td>3. Dirt lodged in strainer in fuel tank.</td>
<td>3. Clean strainer.</td>
</tr>
<tr>
<td>4. Clogged main jet (26) or main jet air passage.</td>
<td>4. Clean.</td>
</tr>
</tbody>
</table>

### Abnormal Combustion (Fuel Mixture)

<table>
<thead>
<tr>
<th>Check for:</th>
<th>Remedy:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Incorrect fuel mixture.</td>
<td>1. Adjust carburetor.</td>
</tr>
<tr>
<td>2. Generally dirty carburetor.</td>
<td>2. Disassemble and clean.</td>
</tr>
<tr>
<td>3. Dirty or clogged fuel line.</td>
<td>3. Clean fuel line or replace.</td>
</tr>
<tr>
<td>4. Air leaking into system.</td>
<td>4. Check mounting nuts for tightness or replace O-ring (20).</td>
</tr>
</tbody>
</table>

### Lose of Power (Fuel Insufficient)

<table>
<thead>
<tr>
<th>Check for:</th>
<th>Remedy:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Clogged fuel line.</td>
<td>2. Clean.</td>
</tr>
<tr>
<td>3. Dirty fuel tank.</td>
<td>3. Clean.</td>
</tr>
<tr>
<td>4. Air leaking into system.</td>
<td>4. Check mounting nuts for tightness or replace O-ring (20).</td>
</tr>
<tr>
<td>5. Accelerating pump not working.</td>
<td>5. Repair and adjust.</td>
</tr>
</tbody>
</table>

### Loss of Power (Air Insufficient)

<table>
<thead>
<tr>
<th>Check for:</th>
<th>Remedy:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dirty air cleaner.</td>
<td>1. Clean air cleaner.</td>
</tr>
<tr>
<td>2. Throttle cable not working.</td>
<td>2. Check and repair throttle cable.</td>
</tr>
</tbody>
</table>
AIR CLEANER

The air cleaner consists of a back plate, filter element and cover, arranged so all air drawn into carburetor passes through the filter. A mesh element traps all air borne dust to keep it from entering carburetor and engine.

1970-71 Metal Mesh Type Filter Element

In normal service on hard surfaced roads, remove air cleaner mesh, wash in non-flammable solvent, and saturate with engine oil at least every 1,000 miles, or more often under dusty service conditions. In extremely dusty service, clean and oil filter mesh every 100 miles or at least once a day. Use the same oil as used in the engine.

1972 and Later Plastic Foam Type Filter Element

Remove air cleaner cover and inspect filter element at least every 1000 miles, or more often under dusty service conditions. The need for servicing is indicated by the appearance of the outside surface of the filter. Filter should be cleaned and recoiled if a film of dirt has built up covering the surface pores, or if light spots show on the surface which means that dust is drying out the oil. A dirty, dark appearance is normal, as long as pores in the filter remain open and covered with an oil film.

To clean filter, remove it from screen and wash it in a non-flammable petroleum solvent or detergent and water. Allow to dry thoroughly and saturate with same weight oil as recommended for engine crankcase. Apply oil to element liberally working in with hands and fingers until element is uniform in color indicating uniform saturation. After excess oil has drained off, replace element on screen so that three grooves are toward screen, and reinstall in engine.

FUEL TANK

GENERAL

The fuel tanks are of welded steel construction.

Fuel tanks are treated to resist rusting. However, when motorcycle stands unoperated for any reasonable length of time, tanks should be drained and the tank interior bathed with an oil-fuel mixture of equal proportions. The fuel will evaporate leaving a protective oil film on tank walls. Moisture formation and subsequent damage may also be avoided by using only “premium grade” fuels with moisture absorbing additives.

REPAIRING LEAKING TANKS

Many tank leaks may be repaired with epoxy type materials. Follow manufacturers instructions.

Tank leaks may be argon welded, gas welded or soldered. However, only firms or persons qualified to make such repairs should be entrusted with the operation.

WARNING — IF ALL traces of fuel are not purged, an open flame repair may result in a tank explosion. Extreme caution in all tank repair is recommended.

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FUEL SUPPLY VALVE

The fuel supply valve is located under the fuel tank. Two types are used: type A (1974 and earlier) and type B (1975 and later). Both are covered below under separate headings.

TYPE A VALVE (1974 AND EARLIER)

(Figure 3-84)

![Diagram of Type A Fuel Supply Valve and Strainer]

The valve has two handles; one is marked “reserve” and the other is unmarked. Fuel to carburetor is shut off when both handles are in horizontal position. Turning the unmarked handle to vertical position turns on main fuel supply; turning “reserve” handle to vertical position turns on reverse supply.

If the handle is too loose, add enough .006 in. thick Shims, Part No. 6160P, to provide only slight clearance when valve is closed.

The fuel strainer is located on top of the supply valve inside the fuel tank. If the supply of fuel is impeded, as indicated by irregular carburetion, remove the supply valve from the tank and thoroughly clean the strainer. Be sure to drain the tank before removing the supply valve.

Before installing supply valve, coat threads with a fuel sealer.

TYPE B VALVE (1975 AND LATER)

(Figure 3-85)

Gasoline to carburetor is shut off when handle is in horizontal position. Turning the handle down to vertical position turns on main gasoline supply; turning handle up to vertical position turns on reserve supply. Valve should always be closed when engine is not running.
Figure 3-85. Single Handle Type Fuel Supply Valve and Strainer
**TOOLS**

Fits 1 in. hex.

Part No. 94545-26 Crankpin Nut and Sprocket Nut Wrench

Used to check inlet valve and internal leakage.

Part No. 94760-68 Carburetor Leakage Tester

Fits 1-5/16 in. and 1-3/16 in. nuts.

Part No. 94546-41 Flywheel Shaft Nut Wrench

Part No. 94752-77 Carburetor Float Gauge

Used for reaming pistons and upper connecting rod bushings.

Part No. 94800-26 Spiral Expansion Reamer

Part No. 94589-29A Head Bolt Wrench (9/16 in.)

One piece rear intake cam gear cover bushing reamer.

Part No. 94803-67 Rear Intake Cam Shaft Bushing Reamer

Part No. 94590-73 Cylinder Head Bolt Socket Handle (3/8 in. Square Drive)
Used to line ream replacement rocker arm bushings to correct size.

Part No. 94804-57 Rocker Arm Bushing Reamer

9/16 in. reamer.

Part No. 94806-57 Idler Gear Bushing Reamer

Used to size pinion shaft cover bushings.

Part No. 94812-37A Pinion Shaft Bushing Reamer

Has center adapter for pulling parts from a small diameter shaft.

Part No. 95635-46 All Purpose Claw Puller

Used in combination with claw puller for pulling close fitting gears or bearings.

Part No. 95637-48 Wedge Attachment for Claw Puller

Used to pull tappet guide from crankcase after tappet body adjusting screw is removed.

Part No. 95724-57 Tappet Guide Puller

For removing bushings and bearings.

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

Used to hold connecting rod firmly so accurate work can be done when fitting piston pin bushing without disassembling crankcase.

Part No. 95952-33 Connecting Rod Clamping Tool

Used to remove and replace piston pin bushings without removing connecting rod from crankcase.

Part No. 95970-32A Piston Pin Bushing Tool

Used to pull bearing inner roller race.

Part No. 96015-52 (1976 and earlier)
96015-77 (1977 and 1978)
Sprocket Shaft Timken Bearing Inner Race Puller
Used to remove sprocket shaft extension.

Part No. 96015-56 (1976 and earlier)
96015-77 (1977 and 1978)
Sprocket Shaft Extension and Bearing Puller

Used with arbor press for separating flywheels. Also to press Timken bearing onto sprocket shaft.

Part No. 96137-52A Flywheel Support Plate

Used on assembled crankcase to determine if a connecting rod is out of true. 5935 (2) spacers used on studs for 61 OHV engine.

Part No. 96181-26 Piston Squaring Plate

Special pliers for removing and replacing retaining rings. 96215-49 Small. 96216-49 Large.

Internal Lock Ring Pliers

Used to insert pistons with rings into cylinders. Tool compresses rings to bore size.

Part No. 96331-57 Piston Inserter Ring Tools

For checking valve seat location. Tool consists of 2 intake valves and one exhaust valve, and intake and exhaust gauges having a step to show limits to which valve seat should be ground.

Part No. 96489-63 Valve Seating Gauge Set – Sportster

Used to rotate valve when grinding or lapping seat surfaces.

Part No. 96550-36 Valve Grinding Tool

Used to compress valve springs while removing or installing valves.

Part No. 96600-36 Valve Spring Compressor

Used to true flywheel shaft alignment. Measures and indicates alignment to .001 in.

Part No. 96650-30 Truing Stand

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Aligns right and left main bearing races as well as lapping to size.

Part No. 96710-40 Crankcase Main Bearing Lap

Special fixture with adjustable platform used with Torque Wrench, Part No. 96795-47.

Part No. 96796-47 Valve Spring Tester

Used to lap connecting rod bearing races when fitting new rollers.

Part No. 96740-36 Connecting Rod Lapping Arbor

Used to install and remove pinion gear.

Part No. 96830-51 Pinion Gear Puller and Collars

Used to install spiral piston pin lock rings.

96781-72 plug for 1972 larger dia. piston.

Part No. 96780-58A Piston Pin Lock Ring Tool

Used to check oil pump pressure under actual operating conditions. Attaches to motorcycle. Graduated 0-60 pounds. Includes adaptor to attach hose fitting to 1/8 NPT thread oil pump outlet.

Part No. 96921-52 Oil Pressure Gauge

Part No. 96795-47 Torque Wrench
Part No. 96960-68 Carburetor Check Valve Test Tool

For Tillotsen diaphragm carburetor.

Part No. 96962-68 Carburetor Main Nozzle Punch

For Tillotsen diaphragm carburetor.

Tool for installing inner race on pinion shaft.

Part No. 97080-77 Bearing Guide (1977 and Later)

Used to assemble camshaft needle bearings.

Part No. 97273-60 Needle Bearing Tool

Used for tightening band type metal clamps on oil lines.

Part No. 97087-65 Hose Clamp Pliers

Part No. 97100-77 Sleeve for 1977 and Later

Tool for installing flywheel assembly into crankcase Timken bearing.
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</table>
GENERAL

SPECIFICATIONS

CLUTCH

Type (1970) .................. Dry-multiple disc
Type (1971 and later) .......... Wet-multiple disc
Capacity (1971 and later) ........ 1900 in-lbs
Set up Spring Pressure
1970 .......................... 150 lbs
1971 .......................... 234 lbs
1972 .......................... 257 lbs
Spring adjustment
1970 .......................... 3/16 in. from inner surface of spring
tension adjusting plate to outer surface
of spring cup flange
1971 to 1973 ............ 11/32 in. from outer surface
of outer drive plate to outer surface
of releasing disc
Late 1974 and later .......... Fixed spacers std.
length 1.530 in.
Clutch bearing ................. .0005-.0029 in. loose
Clutch cover (1970) ......... Must be leakproof,
Do not coat gasket with sealer
Clutch release rod movement
1970 .......................... .095-.115 in.

PRIMARY CHAIN

Type ....................... 3/8 in. pitch triple chain
Looseness .................. 5/8 to 7/8 in. slack (cold engine)
3/8 to 5/8 in. slack (hot engine)

KICK STARTER

Minimum clearance between clutch
teeth on starter clutch ratchet
gear and starter ratchet on clutch
shell ........................... .040 in. with starter
 crank in up position
Crankshaft endplay ............. .001-.007 in.

GEAR BOX

Shifter mechanism .............. Must operate freely
in all positions

MAINSHAFT GROUP

Clutch gear ball bearing
in access cover .............. .0001-.0012 in. loose
Ball bearing on clutch
gear .......................... .0001 in. loose -- .0009 in. tight
Clutch gear bushing on
mainshaft ........................ .001-.002 in. loose
Mainshaft right side
roller bearing .................. .0006-.0014 in. loose
Mainshaft end play ............. .003-.009 in.
(with all axial play removed)
Third gear
On shaft ........................ .002-.003 in. loose
End play ...................... .012-.030 in.

COUNTERSHAFT GROUP

Countershaft end bearings .......... Retained needle
roller bearing
Bearing fit on shaft ends ....... .0005-.0029 in. loose
Bearing fit in case .............. press
End play ........................ .004-.009 in.
Second gear ........................
On shaft ........................ .001-.0025 in. loose
Low gear ........................
On shaft ........................ .0005-.0016 in. loose
End play ...................... .004-.009 in.
Drive gear ........................
On shaft ........................ .0005-.0030 in. loose
End play ...................... .004-.009 in.

CLEARANCE BETWEEN CLUTCH FACES

Countershaft low and third gear ........ .038-.058 in.
Countershaft second and
third gear ...................... .038-.058 in.
Mainshaft clutch gear and
second gear ........................ .043-.063 in.
Mainshaft third gear and
second gear ........................ .043-.063 in.
Shifter shaft end play (1976 and earlier) . .010-.030 in.

DESCRIPTION

GENERAL

The transmission consists of three major assemblies including the clutch, starter and gear box.

CLUTCH

The purpose of the clutch is to disengage and engage the engine from the transmission for starting, stopping and shifting gears.

The Sportster clutch is a multiple disc clutch with steel plates and fiber (friction) plates set alternately in the clutch shell and sprocket housing. The friction plates are keyed to the clutch shell and the steel plates to the clutch hub and through it, to the transmission and rear wheel. The plates driven by the engine are called drive plates, those connected to the clutch hub, the driven plates.

When the clutch is fully engaged, springs force the plates together and cause them to turn as a unit, with the result that the power transmitted through the engine sprocket, primary drive chain and clutch is transferred to the rear wheel through the transmission.

STARTER

On the XLCH Model a kick starter provides a means of starting an engine by manual power. When the lever is moved in downward stroke, ratchet teeth of starter clutch gear and starter clutch are engaged, transmitting the force to clutch sprocket, primary drive chain and to engine sprocket.
On the XLH model, an electric starter motor and solenoid activated drive pinion engages a ring gear on the clutch to crank the engine.

GEAR BOX

The Sportster gear box is a 4-speed constant mesh type, (contained in an extension of the crankcase), that permits the rider to vary the ratio of engine speed to the rear driving wheel speed in order to meet the varying conditions of operation.

The transmission is foot operated by the gear shifter lever which transmits the force through a gear shifter shaft, actuating a pawl carrier, pawls and gear shifter cam. The shifter cam moves shifter forks which slide a series of gear clutches on the mainshaft and countershaft into mesh with the various gears to obtain the desired gear ratios.
# CLUTCH

## GENERAL

### DIAGNOSIS CHART

<table>
<thead>
<tr>
<th>Effect</th>
<th>Cause (Check in following order)</th>
<th>Remedy</th>
</tr>
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<tbody>
<tr>
<td>Clutch slips</td>
<td>Incorrect clutch release adjustment</td>
<td>Check and adjust clutch release mechanism as described under “ADJUSTING CLUTCH RELEASE MECHANISM.”</td>
</tr>
<tr>
<td></td>
<td>1970: Sticking release worm and lever</td>
<td>Check for binding clutch control cable, binding release ramp. See “REPLACING CLUTCH CONTROL CABLE AND COIL” and “ASSEMBLING CLUTCH RELEASE MECHANISM.”</td>
</tr>
<tr>
<td></td>
<td>1971: Sticking release ramp and lever</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insufficient clutch spring tension</td>
<td>Check and adjust clutch spring tension as described under “ADJUSTING CLUTCH SPRING TENSION.”</td>
</tr>
<tr>
<td></td>
<td>1970: Worn or oil-soaked friction discs</td>
<td>Replace friction discs. See “INSPECTING AND REPAIRING CLUTCH.”</td>
</tr>
<tr>
<td></td>
<td>1971: Worn friction discs</td>
<td></td>
</tr>
<tr>
<td>Clutch drags</td>
<td>Incorrect clutch release adjustment</td>
<td>Check and adjust clutch release mechanism as described under “ADJUSTING CLUTCH RELEASE MECHANISM.”</td>
</tr>
<tr>
<td></td>
<td>Worn clutch release ramps or worm and lever</td>
<td>Replace release ramps or worm and lever cover. See “INSPECTING CLUTCH RELEASE MECHANISM.”</td>
</tr>
<tr>
<td></td>
<td>Excessive clutch spring tension</td>
<td>Check and adjust clutch spring tension as described under “ADJUSTING CLUTCH SPRING TENSION.”</td>
</tr>
<tr>
<td></td>
<td>1970: Gummy clutch friction plates</td>
<td>Replace or clean friction plates. See “INSPECTING AND REPAIRING CLUTCH.”</td>
</tr>
<tr>
<td></td>
<td>1971: Incorrect oil</td>
<td>Use correct oil for temperature.</td>
</tr>
<tr>
<td></td>
<td>Warped clutch steel plates</td>
<td>Replace clutch steel plates. See “INSPECTING AND REPAIRING CLUTCH.”</td>
</tr>
<tr>
<td></td>
<td>Badly worn or damaged clutch sprocket splines</td>
<td>Replace clutch sprocket. See “INSPECTING AND REPAIRING CLUTCH.”</td>
</tr>
</tbody>
</table>

## 1970 CLUTCH CONTROLS

### ADJUSTING CLUTCH RELEASE MECHANISM

(Figure 4-1)

Loosen clutch release rod adjusting screw locknut (6) and back off (counterclockwise) clutch release rod adjusting screw (7). Clutch release worm (4) inside transmission sprocket cover (2) should seat against its stop (13) when clutch hand lever is in its fully extended position. If lever does not fully seat, check to see if cable is binding in housing.

Adjust cable length by turning clutch cable adjusting sleeve (hand lever end of cable housing) so that clutch releasing worm does not quite return against its stop. This will hold clutch hand lever in its fully extended position at all times. Turn clutch release rod adjusting screw (7) inward until clutch hand lever has 1/8 of its full movement free before clutch starts to release. This can be checked by a slight increase in tension on the clutch hand lever as it is being moved to the released position. Tighten clutch release rod adjusting screw locknut (6), without disturbing the setting of the adjusting screw.

### ADJUSTING CLUTCH SPRING TENSION

**CAUTION — On Electric Start XLH Models, remove battery cover and disconnect ground wire from battery (-) terminal to prevent accidental starter operation.**
See Figure 4-2 and proceed as follows. Remove left footrest (1), and rear brake foot lever (2). Place an oil drain pan under clutch and remove front chain cover screws (3), cover (4) and gasket (not shown).

See Figure 4-7. Remove twelve clutch cover screws (1), six retainers (2), clutch cover (3) and gasket (4).

Loosen cover evenly in several places. Do not pry cover loose at one point as cover may be sprung out of shape and will not be oil-tight when reassembled.

With clutch cover (3) removed, the clutch releasing disc (10), clutch springs (8), spring tension adjusting plate (7) and six spring adjusting nuts are in view. Three of the spring tension adjusting nuts (5) have 7/16 in. hex heads and three nuts (6) have 1/2 in. hex heads. All spring tension adjusting nuts are recessed to conform to raised portion of spring tension adjusting plate which provides a lock for the nuts.

Tighten each of the six nuts one half turn at a time. The nuts must always remain in their locked positions after adjustment is made.

Tightening the spring tension adjusting nuts moves the spring tension adjusting plate (7) closer to the outside surface of the clutch releasing plate (10). The inner surface of the spring tension adjusting plate should measure 3/16 in. from the outer surface of the flange on the clutch spring cups (9) for normal clutch spring tension adjustment. When increasing spring tension, do not diminish above distance to less than 7/64 in. or clutch will not release.

REPLACING CLUTCH CONTROL CABLE AND COIL
(Figure 4-1)

Remove starter crank (if used), exhaust pipe and muffler. Remove right front footrest and transmission sprocket cover bolts (1). With a mallet, lightly tap cover (2), at the same time working cover off starter shaft. Loosen adjust-
blining cable terrule in hand lever anchor pin with side slot, be sure slot is toward inside as shown. Earlier type pin with slotted end should have open end facing downward. Insert felt seal retainer (14) and felt seal (16) on lower cable end. Insert cable end (3) on cable, 7-11/16 in. from lower ferrule as shown in Figure 4-1. Cut cable off at end (3). Spread cable strands in cable end countersunk hole and flow a hard solder in hole to securely join together. Engage cable end with fingers of lever. Install sprocket cover (2) with bolts (1). Install footrest, exhaust pipe and muffler and starter crank. Adjust clutch release mechanism as described under “ADJUSTING CLUTCH RELEASE MECHANISM.”

DISASSEMBLING CLUTCH RELEASE MECHANISM (Figure 4-1)

Remove sprocket cover and disengage clutch cable end from clutch release worm and lever (4) as described under “REPLACING CLUTCH CONTROL CABLE AND COIL.”

To free clutch release worm and lever (4) from sprocket cover, disengage spring (6), remove adjusting screw locknut (6), adjusting screw (7) and clutch release worm cover (8).

If it is necessary to remove clutch release rods, first disassemble clutch parts (1, 2, 3, 4, 5, 6, 7, 8, 9 and 10, Figure 4-7) as described in “1970 CLUTCH ‘DISASSEMBLING.’” Remove clutch release rod - left (9, Figure 4-1). Drift release rods 10, 11 and 12, from clutch side to sprocket side. Roll pin (13) is a press fit in sprocket cover.

INSPECTING CLUTCH RELEASE MECHANISM (Figure 4-1)

Thoroughly wash clutch release parts in cleaning solvent and blow dry with compressed air.

Examine clutch release worm and lever (4) for wear in sprocket cover. Too much play at this point will reduce clutch release considerably, causing clutch to drag. Replace parts if badly worn.

Inspect the fingers of lever (4), for engagement with clutch control cable end (3). If worn excessively, replace parts.

Replace spring (5) if worn or damaged. New spring length is approximately 1-25/32 in.

Inspect the tips of clutch release rods (9, 10, 11 and 12) for scoring or excessive wear. Damage to release rods is usually caused by excessive clutch spring tension.

ASSEMBLING CLUTCH RELEASE MECHANISM (Figure 4-1)

Assembly is essentially the reverse order of disassembly. Dip ends of release rods in oil. Insert clutch release rod - left (9) in clutch gear end. Slip release rods (12, 11 and 10) in place from sprocket side in order shown (see Figure 4-1). Install clutch parts (10-1, Figure 4-7) as described under “1970 CLUTCH ‘DISASSEMBLING.’”

Assemble clutch release lever and worm (4), spring (5), cover (8), adjusting screw (7) and locknut (6). Check lever and worm action by moving lever back and forth. Engage cable (3) end with fingers of lever and install sprocket cover (2) with bolts (1). Inject “Grease-All” grease through fitting to lubricate worm.

NOTE

Clutch hand lever, control coil and cable are available from the factory completely assembled.

When installing new cable, lubricate cable with grease as it is being inserted in coil (hand lever end). Correctly position upper cable end in hand lever anchor pin. When reassem-
Check the operation of the release lever to be sure lever returns to stop pin, when clutch hand lever is released. A sticking worm or clutch control cable causes lever to stop short of pin, thus reducing effective clutch release rod travel, causing clutch to slip.

Install footrest, exhaust pipe, muffler and starter crank. Adjust clutch release mechanism as described under "ADJUSTING CLUTCH RELEASE MECHANISM."

1971 AND LATER CLUTCH CONTROLS

GENERAL

Periodic adjustment of the clutch is required every 2000 miles to compensate for lining wear. The need for attention to clutch and controls will also be indicated by the clutch slipping under load, or dragging in released position. In any case, the first thing to be checked is the adjustment of clutch controls.

ADJUSTING CLUTCH RELEASE MECHANISM (Figure 4-3)

1. Loosen control coil adjuster locknut (13) and turn adjuster (15) inward until there is a large amount of free play at hand lever on handlebar.

2. Remove access plug (1) from primary chain compartment cover.

3. Loosen adjusting screw locknut (3) and turn screw (5) inward until it becomes harder to turn (starts to release the clutch) and continue turning (about 2 more turns) to be sure clutch is disengaged.

4. Adjust all free play out of control cable by turning adjuster (15) outward. Do not put any tension on cable. With all slack in cable eliminated (no play at hand lever), tighten the coil adjuster locknut (13). This is the correct cable adjustment.

5. The clutch release adjustment should then be made with the clutch adjusting screw as follows: Loosen the locknut (3) and back off the adjusting screw (5) until the clutch is engaged (screw turns easier), then turn screw inward until the point where free play has just been eliminated. From this point, turn the adjusting screw outward 1/4 to 1/2 turn to establish correct free play, and tighten locknut. Check cable free play at clutch hand lever. Hand lever should have 1/8 in. free play. If incorrect, adjust sleeve and tighten locknut.

If the clutch continues to slip under load or drag in released position, clutch springs may need adjusting or release mechanism may be defective. See subsequent sections.

ADJUSTING CLUTCH SPRING TENSION (1970 TO EARLY 1974 MODELS) (Figure 4-2)

CAUTION — On Electric Start XLH Models, remove battery cover and disconnect ground wire from battery (-) terminal to prevent accidental starter operation.

Remove left footrest (1), and rear brake foot lever (2). Place an oil drain pan under clutch and remove front chain cover screws (3), cover (4) and gasket (not shown).

See Figure 4-8.

With cover removed, the clutch releasing disc (4), six spring tension adjusting nuts (3), stud retainers (2) and retainer nuts (1) are in view.

If required, adjust each of the six nuts one half turn at a time after removing retainer nuts (1) and retainers (2).

Tightening the spring tension adjusting nuts moves the releasing disc closer to the outside surface of the outer drive plate. This increases the clutch spring pressure on the clutch plates through pressure plate studs.

Outer surface of releasing disc should measure 11 3/8 in. from the outer surface of the outer drive plate for normal clutch spring tension adjustment as shown in Figure 4-8. When increasing spring tension, do not diminish above distance to less than 5/16 in. or clutch may not release.

ADJUSTING CLUTCH SPRING TENSION (LATE 1974 AND LATER MODELS)

Clutch spring tension is determined by the length of six stud spacers as shown in Figure 4-8. To correct clutch slippage caused by worn clutch drive plate linings, a set of shorter than standard spacers can be installed.

Under no circumstances should clearance between releasing disc and outer drive plate be allowed to go under minimum 1/8 in. dimension shown. All spacers should be equal in length.

DISASSEMBLING CLUTCH RELEASE MECHANISM AND CLUTCH CABLE (Figure 4-3)

Remove exhaust system components.

Remove primary chain cover. Remove access plug (1) and O-ring (2) from cover. Remove adjusting screw locknut (3), lockwasher (4) and screw (5). Remove retaining ring (6) using a Tru-arc lock ring pliers. This will free clutch release ramp lever (7) and 3 balls (8). Unless necessary for replacement, do not remove release ramp (9) or washer (10) which is staked into cover recess.

To remove clutch cable, rotate cable coupling 90° from installed position in lever (coupling has a flat which locks it in place in lever). Unhook cable end (12) from coupling (11). Loosen locknut (13) and unscrew adjusting sleeve (15) from cover.

NOTE

Cable and coil (12) with sleeve (15) are available for replacement only as an assembly. Nut (13) and washer (14) are loose parts.

INSPECTING AND REPAIRING CLUTCH RELEASE MECHANISM AND CLUTCH CABLE (Figure 4-3)

Wash clutch releasing parts in clean solvent. Inspect 3 balls (8) and ball socket surfaces of ramps (7) and (9) for wear, pitting or surface breakdown. Check fit of ramp lever (7) hub in ramp (9) and replace both parts if excessive wear exists. To replace ramp (7), pry out old part. Install new ramp against washer (10) and with ear registered in notch of cover boss. Stake cover boss in 3 places to retain ramp in cover. If clutch cable ends are frayed or worn, replace cable.
1. Access plug, clutch release adjusting screw
2. O-Ring (1978)
3. Locknut, adjusting screw
4. Lockwasher, adjusting screw
5. Adjusting screw
6. Retaining ring, Tru-arc
7. Release ramp and lever
8. Ball (3)
9. Release ramp
10. Washer
11. Cable coupling
12. Cable and coil assy.
13. Locknut
14. Washer
15. Adjusting sleeve
16. Primary chain case cover

Figure 4-3. 1971 and Later Clutch Release Mechanism - Exploded View
ASSEMBLING CLUTCH RELEASE MECHANISM AND CLUTCH CABLE (Figure 4-3)

Install cable parts (15, 14, 13 and 12) in cover. Attach cable coupling (11) to cable end and install in lever (7). Grease ball ramps and install ramp parts (10, 9, 8 and 7). Use locking pliers to install retaining ring (6) in groove of ramp lever (7).

Assemble clutch release adjusting screw (5), lockwasher (4) and locknut (3) in cover.

IMPORTANT

Before installing cover on engine clutch, release lever must be correctly adjusted so that 3 balls are centered at bottom of each ramp with no play in clutch cable.

To do this, press down on lever (7) to feel when three balls are centered in ramps, and adjust sleeve (15) to take all slack out of cable. Tighten locknut (13) securely.

Install cover on engine and adjust clutch as described previously under "ADJUSTING CLUTCH RELEASE MECHANISM."

Install footrest, exhaust pipe, muffler and starter crank. Install rear brake lever (1974 and earlier) or gear shift lever (1975 and later), tightening pinch bolts to 90 to 100 in-lbs torque. Install left footrest assembly, tightening mounting nut to 50 to 60 ft-lbs torque.

1970 CLUTCH

DISASSEMBLING (Figure 4-7)

Remove front chain cover and clutch cover as described under "ADJUSTING CLUTCH SPRING TENSION."

Remove the three 7/16 in. hub stud nuts (5), and three 1/2 in. hub stud nuts (6). Remove spring tension adjusting plate (7), springs (8), spring cups (9), releasing disc (10), seven clutch friction drive plates (11), seven clutch steel driven plates (12) and backing plate (13). All plates may be easily removed by tipping engine, or removed individually, using a piece of wire with a hook formed on one end.

See Figure 4-4. Remove front chain adjuster brace and three front chain adjuster capscrews (1). This will leave the chain adjuster (2) loose behind the front chain. Install Sprocket Locking Link Tool (3), Part No. 97200-55, between engine sprocket teeth and clutch sprocket teeth to prevent clutch and compensating sprocket from turning.

Insert Clutch Lock Plate (4), Part No. 97175-55, between clutch hub (5) and sprocket (6) as shown in Figure 4-4. Bend ears of lockwasher (15, Figure 4-7) away from hub nut and remove release rod - left (9, Figure 4-1). Remove clutch hub nut (14, Figure 4-7) using Wrench (7), Part No. 94647-52.

Pry hub nut lockwasher from hub and discard. Pry oil seal (27, Figure 4-7) from clutch drum with screwdriver or release rod end that has been wiped dry. Install clutch Hub Puller (1, Figure 4-5), Part No. 95960-52, and remove clutch hub (16) from splines of clutch drum as shown in Figure 4-5. Remove O-ring (18) from groove in clutch gear (28).

Using Compensating Sprocket Shaft Wrench (2, Figure 4-5), Part No. 94557-55, remove shaft nut as shown in Figure 4-5, and in one move, free clutch shell (6), front chain (8) and engine sprocket (9) as shown in Figure 4-4. Remove clutch hub spacer (20).

INSPECTING AND REPAIRING (Figure 4-7)

Carefully examine clutch cover (3) sealing surface for scratches, distortion or any damage that might result in oil leakage to clutch. Discard gasket (4) and replace with a new one when reassembling clutch.
Inspect clutch springs (8) for damage or collapsed condition. Spring damage usually results from excessive heat. Free length of a new spring is approximately 1-5/8 in. Any that check below this limit should be replaced.

Examine the clutch release disc (10), for excessive wear, grooving or scoring on running surface. Replace if necessary.

Pay particular attention to the seven clutch friction drive plates (11). Plates that are badly worn, grooved, scored or oil soaked, should be replaced. Plates in relatively good condition, can be cleaned and sanded down with a medium grade sandpaper and reused. Do not reuse plates that have been saturated with oil.

Examine the seven clutch driven plates (12) for excessive wear and damage. Plates that are badly worn, grooved, warped, burned or scored should be replaced. Plates that have turned blue from heat only, and are smooth and generally in good condition, can be used again after being thoroughly cleaned.

When reassembling, always replace lockwasher (15) to ensure an oil tight seal between clutch hub and end of clutch gear.

Inspect clutch hub spacer (20) for appreciable shake or play in needle bearings (21). Check for wear in bearing path of inner race and examine needle roller bearings. If bearings are worn, scored or damaged, replacement of part is necessary. Spacer is a slip fit in clutch shell. To replace bearings, see “REPLACING CLUTCH SHELL NEEDLE BEARING AND STARTER CLUTCH.”

Oil seal (17) is a press fit and can be pryed from clutch sprocket. Be very careful not to damage seals during removal operation. Expand rubber exterior of seal and carefully check for hair line cracks in seal surface. If any wear or damage is evident, replace seal to ensure an oil tight closure between clutch sprocket and clutch hub.

Inspect clutch shell (19) for badly worn or loose keys, loose rivets, worn sprocket teeth, damaged ring gear teeth marred or damaged cover sealing surface. If noticeably damaged, replacement clutch shell is recommended. However, if a rivet is loose with no other apparent damage, a new rivet can be installed. On starter clutch side, set rivets until flush to .010 in. (maximum) above face of starter clutch. Seal new rivets on both sides using a solvent proof sealer.

Check starter clutch (23) teeth. If badly worn or damaged replace part as described in “REPLACING CLUTCH SPROCKET NEEDLE BEARING AND STARTER CLUTCH.”

Examine clutch gear oil seal (27) for wear or damage by expanding seal surface and carefully checking for hair line cracks. If any wear or damage is evident, replace seal to ensure oil tight closure between end of clutch gear and release rod - left.

Replace clutch hub rubber O-ring (18) if worn or damaged.

REPLACING CLUTCH SPROCKET NEEDLE BEARING AND STARTER CLUTCH (Figure 4-7)

To remove clutch sprocket needle bearings (21), washers (24 and 25) and starter clutch (23), remove oil seal (17) and rivets (22) from sprocket. Needle roller bearings (21) and roll pin (26) are press fit.

To reassemble clutch sprocket, press needle roller bearings in place pressing on printed side of bearings only. Press first bearing in to a depth of .010 to .015 in. measuring from clutch shell to inner face of bearing. Then press other bearing flush against first bearing from starter clutch side.

Roll pin (28) correctly positioned, should extend .08 in. from sprocket face to top of pin. Position washer (25) on roll pin. Temporarily select and insert variable sized washer (24) in clutch sprocket. Washers are available in several sizes of .002 in. thickness difference. Lay starter clutch (23) on back plate held down under pressure, insert feeler gauge and measure clearance between variable size washer and starter clutch. Select and try different variable size washers until .001 to .004 in. clearance is obtained.

NOTE

Allow approximately .001 in. for pull of rivets.

When correct clearance between washer and starter clutch is obtained, feed rivets into countersunk holes from inside of sprocket shell. Head rivets until flush to .010 in. maximum above face of starter clutch. Seal rivets on both sides using a solvent proof sealer.

With lip facing in, press oil seal (17) into clutch shell.

ASSEMBLING CLUTCH (Figure 4-7)

Assembly is essentially the reverse order of disassembly. Be certain that all parts are clean, free of oil and dry before reassembling.

Install oil seal (27). Do not forget to insert clutch release rod - left (9, Figure 4-1). Apply a light coat of grease to needle roller bearings, and compensating sprocket shaft extension and install spacer (20) and O-ring (18) on clutch gear. Assemble clutch sprocket, front chain and compensating sprocket in one move. Be sure chain adjuster is positioned loose behind chain. Reassemble compensating sprocket as described under “ASSEMBLING COMPENSATING SPROCKET.”

4-9
Figure 4-7. 1970 Clutch - Exploded View

1. Clutch cover screw (12)
2. Clutch cover screw retainer (6)
3. Clutch cover
4. Clutch cover gasket
5. Hub stud nut (3)
6. Hub stud nut - long (3)
7. Pressure plate
8. Clutch spring (6)
9. Backing plate cup (6)
10. Releasing disc
11. Friction drive plate (7)
12. Driven plate (7)
13. Backing plate
14. Hub nut
15. Hub nut lockwasher
16. Clutch hub assembly
17. Clutch hub oil seal
18. Clutch hub O-ring
19. Clutch shell
20. Clutch hub spacer
21. Needle bearing
22. Sprocket rivet (12)
23. Starter clutch
24. Sprocket bearing washer (variable-size)
25. Sprocket hub washer
26. Sprocket hub washer pin
27. Clutch gear (push rod) oil seal
28. Clutch gear
Install clutch hub on clutch gear splines using Clutch Hub Installing Tool, Part No. 97170-55A, as shown in Figure 4-6. Install Lock Plate, Part No. 97175-55, and Sprocket Locking Link Tool, Part No. 97200-55, as shown in Figure 4-4.

Install a new lockwasher (15) over clutch gear splines and install hub nut (14, Figure 4-7) using Wrench, Part No. 94647-82, as shown in Figure 4-4. Follow up hand tightening by striking wrench handle with a soft mallet to securely seat nut to at least 150 ft-lbs torque. Bend ear of washer (15) against hex head of hub nut. Clutch hub must run free on shaft after tightening.

IMPORTANT

If starter clutch, clutch shell or clutch gear have been replaced, it is obviously necessary to check the clearance between teeth on starter clutch gear and starter clutch as described in "STARTER."

Tighten and adjust front chain tensioner as described under "FRONT CHAIN ADJUSTMENT," Section 2.

See Figure 4-7. Remove locking tools and install backing plate (13) over clutch hub splines, against back side of hub, recessed side facing out.

Place a steel plate (12) next to the recessed plate (13). Place a friction plate (11) into clutch shell and sprocket assembly and push inward against the second metal plate. Alternate with steel plates and friction plates until seven friction plates are in position. This will leave a friction plate on the outside. Make sure all plates have free movement.

Install releasing plate (10) on clutch hub (16) so the clutch hub studs are exactly centered in the clutch spring cup holes. Do this by aligning the larger of the two depressions on the rim of the clutch releasing plate with the notched tooth of the clutch hub.

Install clutch spring cups (9), springs (8) and spring tension adjusting plate (7) into position with the raised surface facing outward. Start three 1/2 in. hub stud (long) nuts (6) on their respective studs. Pull these nuts down evenly until the spring tension adjusting plate is pulled over the remaining three studs a sufficient distance to allow starting the 7/16 in. hex head nuts (5). Draw the six spring tension adjusting nuts down evenly until the inside of the spring tension adjusting plate (7) measures 3/16 in. out from the outside surface of flange of the clutch spring cups (9) at the 6 stud locations. This is proper clutch spring tension adjustment when new clutch plates are used. Install clutch shell and sprocket cover (3), screws (1) and retainers (2), with new gasket (4). Install gasket without sealer, graphite side facing cover. Very lightly stake retainer (2) to lock screw (1).

CAUTION — A heavy blow is very likely to distort cover, disjoining the seal.

See Figure 4-2. Install chain cover (4) and screws (3) with new gasket. If necessary, use gasket seal on both sides of gasket. Assemble rear brake pedal (2), and footrest (1).

With motorcycle standing straight up, remove oil filler plug (5) and oil level plug (6). Add oil through filler plug, (same grade of oil used in engine), until it begins to overflow through oil level hole. Allow excess oil to flow from hole (6) until it ceases to run. This is correct oil level. Reassemble oil level and filler plugs.

1971 AND LATER CLUTCH

DISASSEMBLING (Figure 4-9)

Remove front chain cover as described under "ADJUSTING CLUTCH SPRING TENSION."

Remove hex head retainer nuts (1) and retainers (2 or 2A) (if used). Install Clutch Spring Compressing Tool, Part No. 97178-71, on crankcase by screwing into the crankcase cover screw holes shown in Figure 4-10. Compress releasing disc (4 or 4A) with tool to take pressure off nuts (3) and remove nuts. Back off center screw of tool and remove releasing disc (4 or 4A) and spring (7 and 8). Remove tool. Remove retaining ring (9) from groove in clutch shell (17). All clutch plates (11 or 11A and 12), outer drive plate (10) and pressure plate (13) and stud spacers (4B) (if used) will come out as a unit by pulling on pressure plate studs.

See Figure 4-11. Remove front chain adjuster brace and three front chain adjuster capscrews (1). This will leave the chain adjuster (2) loose behind the front chain. Install Sprocket Locking Link Tool (3). Part No. 97200-55, between engine sprocket teeth and clutch sprocket teeth to prevent clutch and compensating sprocket from turning.

Insert Clutch Lock Plate (4), Part No. 97173-71, between clutch hub (5) and sprocket (6) as shown in Figure 4-11. Bend ears of lockwasher (15, Figure 4-9) away from hub nut. Remove clutch hub nut (14), using Wrench (7), Part No. 94647-52 (see Figure 4-11).

Remove clutch hub (16) from splines of clutch gear. If necessary, use Puller, Part No. 95960-52A and two 1/4-20 x 4 in. long Screws, Part No. 54228B.

Using Compensating Sprocket Shaft Wrench (9, Figure 4-11), Part No. 94557-55, remove shaft nut as shown in Figure 4-11, and in one move, free clutch shell, front chain and engine sprocket.

INSPECTING AND REPAIRING (Figure 4-9)

Inspect clutch springs (7 and 8) for damage or collapsed condition. Spring damage usually results from excessive heat. Free length of a new inner spring is approximately 2 5/16 in., 1970-71 outer spring free length is approximately 1 3/4 in., 1972 and later outer spring free length is approximately 2 1/2 in. Any that check below this limit should be replaced.

Examine the 8 clutch steel discs (11 or 11A) for warpage and excessive wear, grooving or scoring on running surface. Replace if necessary.

Pay particular attention to the 8 clutch friction drive plates (12). Plates that have badly worn, grooved or scored or burned friction surfaces should be replaced. If oil grooves are worn away, replace the friction plates.

Steel plates that have turned blue from heat only, and are smooth and generally in good condition, can be used again after being thoroughly cleaned.
1. Retainer nut (6)
2. Retainer (6)
3. Adjusting nut (beneath retainer) (6)
4. Clutch releasing disc

1971 to early 1974 clutch

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1971 to early 1974 clutch

**Figure 4-8. 1971 and Later Clutch**

Spacer std. length 1.530 in.
Spacer – .040 length 1.490 in.
Spacer – .080 length 1.450 in.

Late 1974 and later clutch
1. Nut, retainer (3) (Early 1971) (6)
   (Late 1971 to early 1974)
2. Retainer (3) (Early 1971)
2A. Retainer (6) (Late 1971 to early 1974)
3. Nut, pressure plate (6)
4. Releasing disc (1971 to early 1974)
4A. Releasing disc (Late 1974 and later)
4B. Stud spacer (6) (Late 1974 and later)
5. Releasing disc collar
6. Releasing disc bearing
7. Spring, inner
8. Spring, outer
9. Retaining ring, outer drive plate
10. Outer drive plate
11A. Driven plate (8) (Late 1974 and later)
12. Drive plate (8)
13. Pressure plate
14. Hub nut
15. Hub nut lockwasher
17. Clutch shell
18. Retaining ring, clutch shell bearing
19. Bearing, clutch shell
20. Rivet, starter clutch (12)
21. Starter clutch

Figure 4-9. 1971 and Later Clutch - Exploded View
When reassembling, always replace lockwasher (15) between clutch hub and end of clutch gear.

Examine bearing (19) in clutch shell (17) for roughness, or excessive play.

If necessary to replace bearing (19), remove retaining ring (18) with a large Tru-arc pliers and press out.

Examine bearing (6) in releasing disc (4) for roughness or excessive play and replace if necessary. Collar (5) can be reused.

Inspect clutch shell (17) for badly worn or loose keys, loose rivets, worn sprocket teeth or damaged ring gear teeth. If noticeably damaged, replacement clutch shell is recommended. However, if a rivet is loose with no other apparent damage, a new rivet can be installed. On kick starter clutch side, set rivets until flush to .010 in. (maximum) above face of starter clutch.

Check kick starter clutch (21) teeth. If badly worn or damaged, replace drill out rivets and install new parts.

ASSEMBLING CLUTCH (Figure 4-9)

Assembly is essentially the reverse order of disassembly. Be certain that all parts are clean before reassembling.

Apply a light coat of grease to compensating sprocket shaft extension. Assemble clutch sprocket, front chain and compensating sprocket in one operation. Be sure chain adjuster is positioned loose behind chain. Reassemble compensating sprocket as described under "ASSEMBLING COMPENSATING SPROCKET."

Install clutch hub on clutch gear splines. Install Lock Plate, Part No. 97173-71, and Sprocket Locking Link Tool, Part No. 97200-55, as shown in Figure 4-11.

Install a new lockwasher (15) over clutch gear splines and install hub nut (14) using Wrench, Part No. 94647-52, as shown in Figure 4-11. Follow up hand tightening by striking wrench handle with a soft mallet to securely seat nut to at least 150 ft-lbs torque. Bend ear of washer (15) against hex head of hub nut. Clutch hub must run free on shaft after tightening.

IMPORTANT

If starter clutch, clutch shell or clutch gear have been replaced on XLCH Model, it is absolutely necessary to check the clearance between teeth on starter ratchet gear and starter clutch as described in "STARTER."

Tighten and adjust front chain tensioner as described under "FRONT CHAIN ADJUSTING," Section 2.

See Figure 4-9. Remove locking tools and install pressure plate (13) over clutch hub splines, against back side of hub, studs side facing out. Install stud spacers (4B) on studs (late 1974 and later).

Place a friction plate (12) next to the pressure plate (13). Place a steel plate (11 or 11A) over studs into clutch shell and sprocket assembly and push inward against the friction plate. Alternate with steel plates and friction plates until 8 of each are in position. This will leave a steel plate on the outside. Install outer drive plate (10) and install retaining ring (9) in clutch shell groove. Make sure all plates have free movement.
On 1970 to early 1974 models, adjust clutch spring tension as described previously under "ADJUSTING CLUTCH SPRING TENSION."

On 1974 and later models, install retainers (2) and nuts (1) and tighten securely.

Install primary chain cover using new gasket, using correct length screws in proper holes. Install rear brake foot lever and left footrest.

Adjust clutch release screw as described previously under "ADJUSTING CLUTCH RELEASE SCREW."

With motorcycle standing straight up, (see Figure 4-2) remove oil filler plug (5) and oil level plug (6). Add oil through filler plug, (same grade of oil used in engine), until it begins to overflow through oil level hole. Allow excess oil to flow from hole (6) until it ceases to run. This is correct oil level. Reassemble oil level and filler plugs.

**COMPENSATING SPROCKET (1976 AND EARLIER)**

**REMOVING (Figure 4-12)**

Loosen clutch sprocket and front chain as described in "DISASSEMBLING CLUTCH." Then remove compensating sprocket shaft nut (1), using Shaft Nut Wrench, Part No. 94557-55, as shown in Figure 4-11. Remove spring (2), sliding cam sleeve (3), sliding cam (4), sprocket (5), front chain and clutch shell together. Use Sprocket Shaft Extension Puller, Part No. 96015-56, to remove extension (6) from sprocket shaft if necessary (see Figure 4-13).

**INSPECTING (Figure 4-12)**

Wash all parts in cleaning solvent and blow dry with compressed air. Carefully examine sprocket teeth, shaft splines and sliding cam surfaces for wear or scoring. Replace any parts that show excessive wear or damage.

**NOTE**

Extension (6) and cam (4) are matched at the factory according to spline engagement therefore, they must be used as a set only.

A collapsed or damaged spring (2), will be evident by very turbulent cam action. If this condition exists, install a new spring.

**INSTALLING (Figure 4-12)**

Install sprocket shaft extension (6) on end of sprocket shaft, using Tool Set, Part No. 97081-54, as described in "ASSEMBLING CRANKCASE." Section 3.

Apply a light coat of grease to shaft extension splines and assemble sprocket (5) front chain and clutch shell together. See "ASSEMBLING CLUTCH."

Install sliding cam (4) on extension (6), being very careful to correctly match like splines to ensure free movement of cam on extension. Assemble parts (3, 2 and 1). Tighten sprocket shaft nut (1) securely, using Compensating Sprocket Shaft Wrench, Part No. 94557-55. (See item 9, Figure 4-11).
GENERAL

The kick starter is designed for rugged service and will seldom require attention. However, if any irregularity should develop it is of utmost importance the engine be turned off and starter mechanism serviced immediately.

See Figure 4-14. A service problem will be indicated by starter ratchet gear ratcheting (clicking) with engine running, and starter crank upright as positioned on motorcycle. Ratcheting is caused by the starter ratchet gear (6) teeth making partial contact with starter ratchet (18) teeth, as the result of either a loose starter shaft nut (9), excessive crank shaft (11) end play or a loose starter crank gear cam plate (20).

If the kick starter crank (2) slips or partially engages when crank is rotated through its cycle, check for badly worn starter ratchet teeth (18 and 6), damaged spring (8) or ratchet gear (6) binding on spacer (7).

DISASSEMBLING (Figure 4-14)

Remove starter crank clamp bolt (1), crank (2) from shaft. Press down on end of starter spring (3) and at the same time pry spring off shaft (11). Loosen exhaust pipe and muffler.

Remove right footrest.

Remove transmission sprocket cover screws (4). With a mallet lightly tap cover (5), at the same time pulling cover from shaft.

Remove clutch as described in "DISASSEMBLING CLUTCH."

Rotate kick starter crank gear (12) to free starter ratchet gear (6), spacer (7) and spring (8). Remove crank nut (9) and lockwasher (10). Tap end of kick starter crankshaft (11) with a soft mallet to loosen from gear (12). Remove crankshaft (11), oil seal (13), shims (14), if used, and thrust plate (15).

---

Figure 4-14. Kick Starter - Exploded View

1. Crank clamp bolt, lockwasher and nut
2. Crank and pedal assembly
3. Crank spring
4. Sprocket cover bolt (2)
5. Sprocket cover
6. Starter ratchet gear
7. Clutch sprocket spacer (available in various lengths)
8. Ratchet gear spring
9. Shaft nut
10. Crank gear lockwasher
11. Crankshaft
12. Crank gear
13. Crank oil seal
14. Crankshaft shim - .007"
15. Shaft thrust plate
16. Shaft bushing (2)
17. Spring stud
18. Starter ratchet
19. Crank gear cam plate rivet (5)
20. Crank gear cam plate
21. Crank gear stop pin
22. Crank gear stop pin washer
NOTE

Shims (14) are only used to establish correct crankshaft end play when crankshaft and thrust washer are worn.

INSPECTING AND REPAIRING (Figure 4-14)

Clean all parts in cleaning solvent and blow dry with compressed air.

Inspect and replace starter ratchet gear and starter ratchet (6 and 18), if necessary. Especially check for badly worn or damaged ratchet teeth that may cause partial or no engagement of ratchet (18) and gear (6). To replace starter ratchet (18), see "REPLACING CLUTCH SPROCKET NEEDLE BEARING AND STARTER RATCHET," Section 4. Examine gear (6) bushing face for burred or damaged condition affecting free movement of gear on spacer (7). Recheck for binding by assembling gear on spacer and note action of two parts.

Examine starter ratchet gear spring (8) for collapsed condition or breakage, and compare with new spring, if possible. New spring free length is approximately 1 in.

Inspect kick starter crank shaft (11) for bent condition or badly worn bearing surfaces and particularly for wear on thrust plate (15) and shaft collar faces. Temporarily position shaft (11), seal (13) and plate (15), gear (12), washer (10) and nut (9) in left case and check crankshaft end play with dial indicator. If end play is not within specified limits of .001 to .007 in. it is absolutely necessary to shim crank shaft. Use .007 in. thickness Shim, Part No. 6802, between crankcase and thrust washer to obtain correct fit as shown in Figure 4-15.

Examine starter crank gear assembly (12) for wear and damage. Pay particular attention to cam plate (20) ears for wear or bent condition. Check for loose cam plate rivets (19) that may result in cam plate separating from crank gear. Cam plate may be replaced providing gear (12) is in good condition. When riveting new cam plate to crank gear, insert rivets from gear side.

Check lockwasher (10) and oil seal (13), if worn or damaged, replace parts.

Bronze bushings (16) are a press fit in transmission sprocket cover (5) and left crankcase. Bushings are long life parts and will seldom require replacement, however, if shaft (11) is not badly worn and excessive starter crank shaft radial play is noted, bushings should be replaced. When installing sprocket cover bushes be sure to correctly align hole in bushing with cover grease fitting channel.

Starter gear stop pin (21) and washer (22) ordinarily will not require replacement, and it is recommended procedure to inspect and replace stop pin only with engine removed from chassis. Stop pin is a press fit in crankcase. Washer is locked in place by peening stop pin end.

ASSEMBLING (Figure 4-14)

Install oil seal (13) in left crankcase. Insert crankshaft through hole in motor mount. Slip thrust plate (15) on starter crankshaft (11), flat side of plate up as positioned on motorcycle. Insert steel shims (14) on crankshaft if needed, as described under "INSPECTION AND REPAIR," and install crankshaft in left case engaging notched thrust plate (15) with stop pin washer (22) using grease to hold in place (see Figure 4-15).

Turn starter crankshaft until notch (A, Figure 4-14) is to the rear as positioned on motorcycle. Place starter crank gear on squared end of shaft, recessed portion of cam plate facing down, end of slot against stop pin as shown in Figure 4-16. When positioning crank gear (12) on shaft (11) be extremely careful that thrust plate does not become dislocated from stop pin washer (see Figure 4-15).

Slip lockwasher (10) over crankshaft end (11) engaging prong of washer with hole in crank gear face. Install and securely tighten crank nut (8) to 40-45 ft.-lbs torque, with flat side of nut against washer.

Slip starter ratchet gear (6) over spacer (7), grooved side of gear bushing against lip of spacer collar. Position small end of spring (8) in clutch gear bushing groove.

Place starter ratchet gear assembly on ratchet gear, compressing spring (8) and at the same time turning starter crank gear to permit meshing of gear teeth.

Return starter crank gear to original position as shown in Figure 4-16, with ratchet gear held against cam plate by spring tension.
Figure 4-16. Positioning Starter Crank Gear on Starter Shaft

Check gear (6) and crank gear (12) to see that there is gear lash (play) through range of engagement.

CAUTION — If clutch sprocket spacer only (7), is replaced, the new spacer must be exactly the same length as the old spacer. Spacers are available in lengths shown in chart below for adjustment of clearance. If starter ratchet gear (6), starter ratchet (18), clutch sprocket hub or clutch gear are replaced it is absolutely necessary to check the clearance between teeth on starter ratchet gear (6) and starter ratchet (18) as follows:

1. Measure distance from end of ratchet sprocket spacer to top of starter ratchet gear teeth.
2. On clutch sprocket assembly, measure distance from top of starter teeth to clutch sprocket thrust washer.
3. Subtract the sprocket reading (2) from the ratchet gear reading (1) to obtain clearance.

4. If resulting clearance is less than .040 in. using short spacer (7), install long spacer to obtain .040 in. minimum clearance.

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<tr>
<td>Short Spacer</td>
<td>1.025</td>
<td>1.122</td>
<td>1.153 only</td>
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<tr>
<td>Long Spacer</td>
<td>1.047</td>
<td>1.143</td>
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The following alternate method may also be used:

Using a discarded Clutch Sprocket Assembly, Part No. 37701-57, improvise a gauge to measure clearance between ratchet teeth on starter gear (6) and ratchet (18). Cut a “pie-shaped” section from the clutch shell to permit measurement between teeth with feeler gauge. Temporarily slip improvised clutch shell gauge over ratchet gear and hold firmly against spacer (7). With a feeler gauge measure clearance between ratchet teeth. If measured clearance is less than .040 in. using short spacer (7), install long spacer to obtain .040 in. minimum clearance. See transmission SPECIFICATIONS.

Reassemble clutch as described in “ASSEMBLING CLUTCH.”

Engage clutch cable end with clutch release lever and install transmission sprocket cover (5) and screws (4). Install exhaust pipe and muffler.

Slip spring (3) over squared end of shaft (11), end of spring and notch (A, Figure 4-14) up as positioned on motorcycle. Using a screwdriver rotate spring clockwise and engage with stud (17). Install bolt, lockwasher and nut (1).
ELECTRIC STARTER

DESCRIPTION (Figure 4-17)
The Bendix type drive shaft and gear assembly, located in the starter housing between starting motor and clutch ring gear, provides automatic means of engaging the starter shaft drive pinion with the ring gear on the clutch sprocket for cranking the engine, and for disengaging the drive pinion from the ring gear after the engine starts.

When the starter motor is not operating, the drive pinion is disengaged from the ring gear.

When the starter switch button closes starting circuit, the solenoid armature shaft (1) pulls shifter lever (2). Fingers on lever engage groove in shifting collar (3) which forces pinion gear (4) into engagement with clutch ring gear (5). At the same time, solenoid also closes starter motor circuit thus turning the ring gear and cranking the engine. After the engine starts and switch button is released spring return on solenoid shaft returns lever so that pinion gear disengages from ring gear and starter motor shuts off. There are matching spiral threads on starter shaft (6) and pinion gear (4) so pinion will shift if mating teeth do not line up for going into mesh. If starter button is not released after engine starts, pinion gear will turn freely by means of overrunning clutch (7) to prevent damage to starter.

DISASSEMBLING SOLENOID (Figure 4-18)
Remove solenoid as follows:
Remove battery cover and disconnect battery ground wire from battery terminal post. Remove solenoid cover (1) and disconnect wires from starter solenoid terminals held by nuts and lockwashers (2 and 3).
Remove primary chain housing cover.
WARNING — Whenever primary chain cover is removed, first disconnect battery negative cable to prevent accidental starter operation and possible injury.

Figure 4-17. Starter Drive

Figure 4-18. Starter Shaft, Housing and Solenoid - Exploded View
Depress retainer cup (4), remove pin (5) from hole in plunger shaft (11). Remove spring (6).

Remove solenoid attaching bolts and lockwashers (7) and spacer bar (8). Remove solenoid (13) with boot (9), gasket (10), plunger (11), plunger spring (12).

DISASSEMBLING STARTER DRIVE SHAFT AND HOUSING (Figure 4-18)

Remove starter drive shaft and parts as follows:

Remove solenoid as described above.

Remove clutch as described in "DISASSEMBLING CLUTCH."

Rotate starter pinion lever (25) end forward and disengage lever fingers from pinion gear shifting collar (21). Pull pinion gear and shaft assembly (14) from housing (26). Then remove gear (23) and washer (27) from drive shaft.

To disassemble pinion gear and shaft assembly (14) remove thrust washer (15). Place nut (16) between copper jaws in a vise and unscrew from shaft (22) which has a left hand thread. Remove bearing race (17). Remove pinion and shifter collar assembly (18). Remove lock ring (19) to separate gear (20) and shifter collar (21).

To remove starter shifter lever (25), it is necessary to either remove starter drive housing (26) or remove battery and carrier to gain access to screw (24).

Remove screw (24) and lever (25) from housing (26). Remove starter motor (30) and housing (26) as an assembly by removing two bolts and lockwashers (not shown) from chain housing on left side of crankcase. (See "STARTER MOTOR," Section 5.)

Needle bearings (28 and 29) are pressed into housings at shaft ends. Washer (27) presses out with needle bearing (28).

To service starter motor see Section 5.

ASSEMBLING STARTER AND SOLENOID (Figure 4-18)

Assembly is essentially the reverse of disassembly, except as follows:

Clean needle bearings (28 and 29) and repack with grease. If replaced, needle bearing (28) should be pressed in flush with outside of housing. Stake washer (27). Pinion (20) and shaft (22) should be assembled with no lubrication on worm threads.

Shaft nut (16) should be secured to shaft with Harley-Davidson "Stud and Bearing Mount," Part No. 99626-77. Clean parts in solvent before applying "Stud and Bearing Mount" to threads.

Connect battery cable to longest solenoid terminal stud.

CAUTION — If cables are reversed, the solenoid will remain in battery circuit.
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