BENDIX HYDRO-BOOST

Ford Motor Co.
General Motors
Diesel Models Only

DESCRIPTION

System utilizes power steering pump fluid pressure to operate booster. Assembly contains an open center spool valve which controls pump pressure magnitude during braking, a lever mechanism to control position of valve and a boost piston to provide force necessary to operate master cylinder. Unit also has reserve system which stores sufficient fluid under pressure to provide at least one braking application (two on Ford cars) in case fluid flow from power steering pump is not available. Brakes can also be applied manually if reservoir system is depleted.

NOTE – *General Motors brake booster consists of an open center spool valve and hydraulic cylinder combined into a single housing and is called "Hydro-Boost II".*

OPERATION

RELEASED POSITION (NO BRAKING)

In this position, spool valve return spring holds spool valve open. In open position, spool valve provides unrestricted fluid flow between power steering pump and power steering gear. Fluid pressure is blocked from entering boost pressure chamber by lands on spool valve. As fluid pressure increases with steering demand, it has no effect on boost pressure chamber. Boost pressure chamber is vented through spool valve, to pump return port, and back to power steering pump.

BRAKING POSITION

As brake pedal is depressed, it moves pedal rod and initiates movement of spool valve. This closes fluid return port to pump from boost chamber, and admits fluid into boost chamber from pressure port. Additional valve movement restricts flow between pump and steering gear, causing pump to increase fluid pressure to maintain flow rate to steering gear. As fluid pressure increases in boost chamber, it forces piston forward actuating master cylinder piston, resulting in brake application. If fluid pressure is required for steering while braking, pump pressure will rise and spool valve will shift in an open direction allowing more fluid to flow to steering gear.

RESERVE SYSTEM

1) System consists of a charging valve, accumulator valve, and a compressed gas accumulator. System is open to pressure port of booster unit. Charging valve has an orifice and ball check. Fluid from pump passes through orifice in valve, and if pressure exceeds pressure in accumulator, it unseats ball check valve and enters accumulator. Ball check valve prevents reverse flow when accumulator pressure is greater than pump pressure.

2) Accumulator valve is a poppet type valve held closed by pressure stored in accumulator. An actuator on spool valve sleeve opens accumulator valve when a stop with no pump pressure is made that requires use of reserve pressure. Fluid pressure can also enter accumulator from boost chamber through accumulator valve, when boost chamber pressure exceeds accumulator pressure. A pressure relief valve vents accumulator to the pump return port when pressure in accumulator exceeds 1600 psi (1400 psi on Ford Motor Co. vehicles).

TESTING

NOTE – *Hydro-Boost cannot cause noisy brakes, fading brake pedal, or pulling brakes. If one of these conditions exists, other components of brake system may be the cause.*

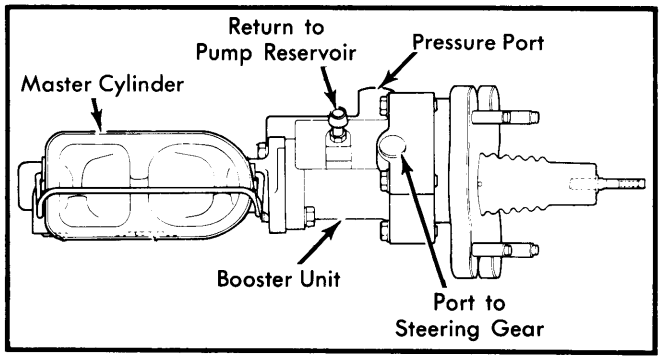

Fig. 1 Ford Motor Co. Hydro-Boost Power Brake Unit (Versailles Shown)

PRELIMINARY CHECKS

Make the following checks, and repair if necessary, before performing any test on the Hydro-Boost system:

- Fluid levels in master cylinder & power steering pump.
- Power steering pump drive belt.
- Power steering hoses for leaks or kinks.
- Air in brake fluid or power steering fluid.
- Engine idle speed.
- Steering pump pressure.

NOTE – *If problem cannot be found in preliminary steps, make following tests. If unit is found to be operating properly, check areas of brake system that might cause condition. See Hydraulic Brake Trouble Shooting in this section.*

HYDRO-BOOST FUNCTIONAL TEST

1) Make all preliminary checks.

2) Place transmission in neutral and stop engine.

3) Apply brake several times to deplete accumulator reserve. Hold brake depressed with medium pressure (25-35 lbs. on Ford Motor Co., 40 lbs. on all others).

4) Start engine. Brake pedal should fall slightly then push back against foot.

5) If no action is felt, booster system is not operating properly.

ACCUMULATOR LEAKDOWN TEST

Ford Motor Co. – 1) Start engine and let idle. Turn steering wheel to a lock position and hold for maximum of five seconds. Return steering wheel to center and shut off engine.

BENDIX HYDRO-BOOST (Cont.)

2) Depress and release brake pedal until a hard pedal is obtained. There should be at least two power assisted brake applications with 20-25 lbs. applied to brake pedal.

3) Re-start engine and let idle. Turn steering wheel to a lock position. A light hissing sound should be heard as accumulator is charged. Hold steering wheel in lock position for a maximum of five seconds. Return steering wheel to center and turn off engine.

4) Wait one hour and repeat step **2)**. Results should be the same.

General Motors – 1) Start engine and charge accumulator by either applying service brake with 100 lbs. pedal force or by turning steering wheel from lock to lock.

2) Turn off engine and wait one hour. There should be one power assisted brake application with engine off.

NOTE – *If Hydro-Boost is not functioning, insure power steering system is operating normally before replacing Hydro-Boost unit.*

REMOVAL & INSTALLATION

HYDRO-BOOST ASSEMBLY

NOTE – *Before removing unit, discharge accumulator by making several brake applications until a hard pedal is obtained.*

Removal – 1) From inside vehicle and under instrument panel, proceed as follows:

NOTE – *On General Motors vehicles there is no stop light switch. Pedal pin is removed after booster unit is removed from firewall.*

- Disconnect stop light switch wires to connector.
- Remove hairpin retainer.
- Slide stop light switch off brake pedal pin far enough for switch outer hole to clear pin.
- Remove switch from pin.
- Remove nuts securing booster to firewall.
- Slide push rod, nylon bushing and washers off brake pedal pin.

2) Working from under hood of vehicle, proceed as follows:

- Remove nuts attaching master cylinder to booster.
- Move master cylinder to one side without disconnecting brake fluid lines.
- Disconnect pressure, steering gear and return lines from booster unit.
- Plug all lines and ports.
- Remove retainer and washer from push rod on service brake pedal arm (General Motors).
- Remove nuts securing booster to firewall.
- Remove booster unit by sliding push rod link out from engine side of dash panel.

CAUTION – *Power steering fluid and hydraulic brake fluid CANNOT be mixed. Do not allow power steering fluid to contact brake seals or hydraulic brake fluid to contact power steering seals as seal damage will result.*

Installation – 1) From under hood of vehicle, perform following steps:

- Mount booster to dash panel by sliding push rod through hole in dash panel.
- Install attaching nuts loosely, tighten after completing steps inside vehicle.
- Install master cylinder on booster unit, tighten nuts.
- Position push rod on service brake pedal arm and install washer and retainer.
- Remove plugs and attach fluid lines to booster unit.

2) From inside of vehicle, perform following steps:

- Install inner nylon washer, booster unit push rod and bushing on brake pedal pin.
- Position switch so that it straddles push rod with slot on pin and outer hole just clearing pin.
- Slide switch onto pin and install washer and hairpin retainer.
- Connect stop light switch wires.

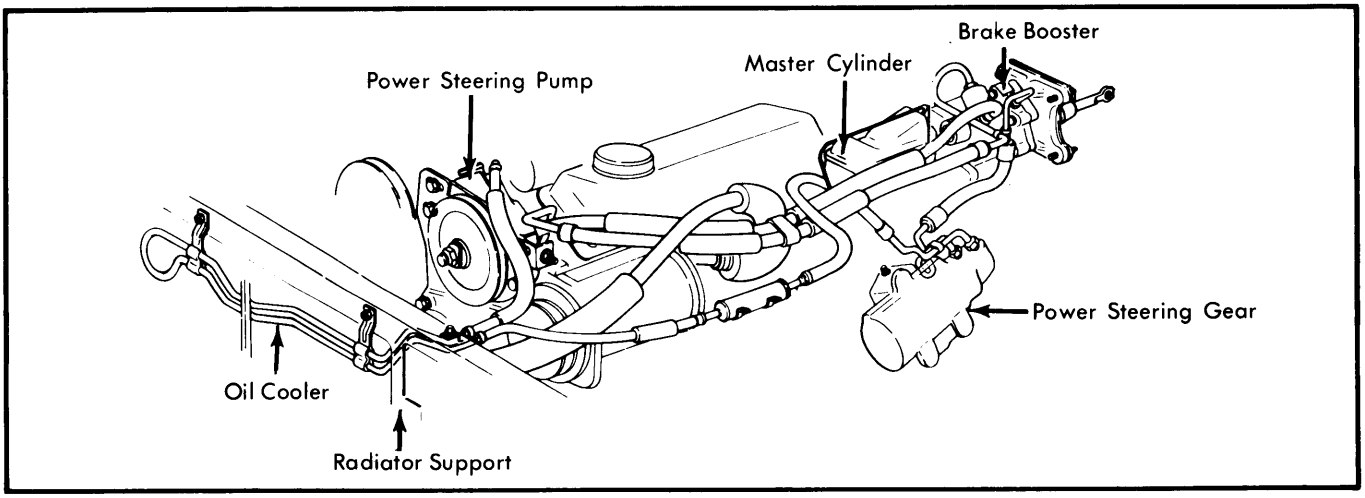

Fig. 2 Typical Hydro-Boost Installation (Ford Shown)

BENDIX HYDRO-BOOST (Cont.)

3) Whenever booster is removed and reinstalled, steering system must be bled as outlined below.

Ford Motor Co. – Remove coil wire so engine will not start. Fill power steering reservoir. Engage starter and apply brakes in pumping action, but do not turn steering wheel. Check power steering fluid level, top off if necessary. Install coil wire, start engine and cycle steering wheel. Apply brake with pumping action and check for fluid leaks.

General Motors – Fill power steering reservoir. Disconnect 12-volt wire from injection pump and engage starter. Check power steering fluid level, top off if necessary. Install 12-volt wire to injection pump and start engine; cycle steering wheel twice. Stop engine and discharge accumulator by depressing brake pedal 4 or 5 times. Check power steering fluid level, top off if necessary. Start engine, cycle steering wheel once and turn engine off. Check fluid level. If foaming occurs, wait one hour and recheck level.

NOTE – *If a whining noise develops following installation of power unit, fluid aeration may be suspected. Air must be removed from system using a suitable power steering pump air evacuator assembly. See Power Steering General Servicing in STEERING Section.*

OVERHAUL

NOTE – *Ford Motor Co. does not recommend overhaul of this unit. If problem is determined to be in booster unit, complete assembly must be replaced. Do not disassemble unit.*

CAUTION – *Power steering fluid and hydraulic brake fluid CANNOT be mixed. Do not allow power steering fluid to contact brake seals or hydraulic brake fluid to contact power steering seals as seal damage will result.*

BRAKE BOOSTER

Disassembly – **1)** Secure booster mounting bracket in vise with pedal rod pointing down.

2) Pump pedal rod until accumulator pressure is depleted.

CAUTION –*Accumulator contains compressed gas and personal injury may result if the following is not heeded:*

- *Wear safety glasses.*
- *Do not apply heat to accumulator.*
- *Do not attempt to repair inoperative accumulator. Replace with new assembly.*
- Before disposing of an inoperative accumulator, drill a 1/8" hole through the end of accumulator can opposite the "O" ring. DO NOT drill through piston end.

3) Using special socket (J-25085), loosen Torx-head bolts securing front housing to rear cover.

NOTE – *Rear cover refers to part of booster that is attached to mounting bracket.*

4) While holding front housing, remove Torx-head bolts. Have pan ready to catch and discard leaking fluid.

CAUTION – *Use care when handling front housing as the accumulator contains a high rate spring in compression.*

5) Carefully lift off front housing leaving spool valve and power piston/accumulator assembly attached to rear cover.

6) With front housing removed, proceed as follows:

- Remove output rod and piston return spring from power piston/accumulator assembly.
- Remove spool valve spring from valve.
- Remove output rod retainer assembly from front housing.
- Remove spool valve by rotating it out of lever arm.
- Remove and discard large "figure eight" seal from rear cover.
- Remove and discard power piston seal from bore.

7) Inspect spool valve and power piston for wear or scratches. Replace if necessary.

8) Remove power piston by cutting end of connecting pin. Push out pin with a small punch and remove piston.

9) Clean all parts in clean power steering fluid.

NOTE – *Whenever booster is disassembled all seals and damaged tube inserts should be replaced. All accumulator valve components must be replaced if any are lost or damaged. If the spool valve bore is damaged, the entire booster should be replaced as an assembly.*

Reassembly – **1)** Position piston bracket into yoke of lever and install new pin through hole.

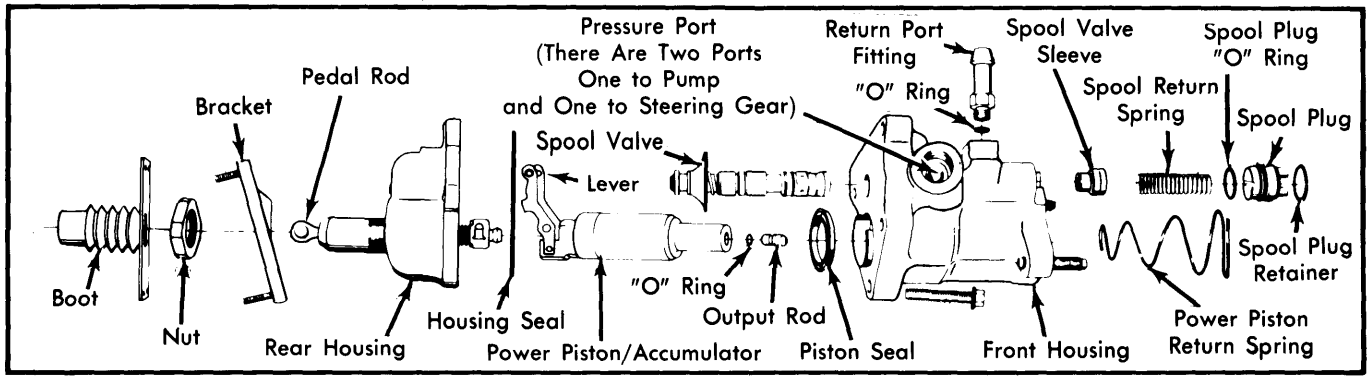

Fig. 3 Exploded View of Hydro-Boost II (Chevrolet Shown)

BENDIX HYDRO-BOOST (Cont.)

2) Use a punch to mushroom end of pin. Make sure lever is free to move with no binding.

3) Install new seal in rear cover groove and new power piston seal in front housing.

4) Insert spool valve spring and spool valve assembly into bore of front housing.

5) Pull up on power piston and extend lever to accept sleeve on spool valve.

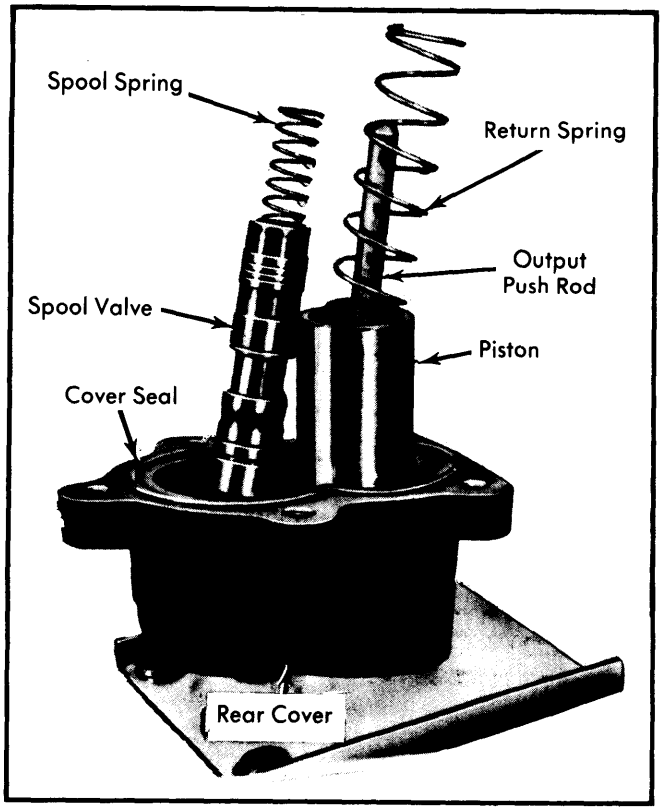

Fig. 4 Booster Rear Cover Assembly Showing Spool Valve and Power Piston (Cadillac Shown)

6) While holding lever extended, bring front housing with spool valve directly over rear cover and slide lever pins into slot in sleeve.

7) Install rear cover to front cover as follows:

- Center power piston/accumulator in bore.
- Push housings together and remove seal protector.
- Tighten Torx bolts to 20 ft. lbs.
- Lower front housing down onto rear housing.
- Before housings contact, install seal protector (Cadillac No. J-25053) through piston bore, until seated on piston.

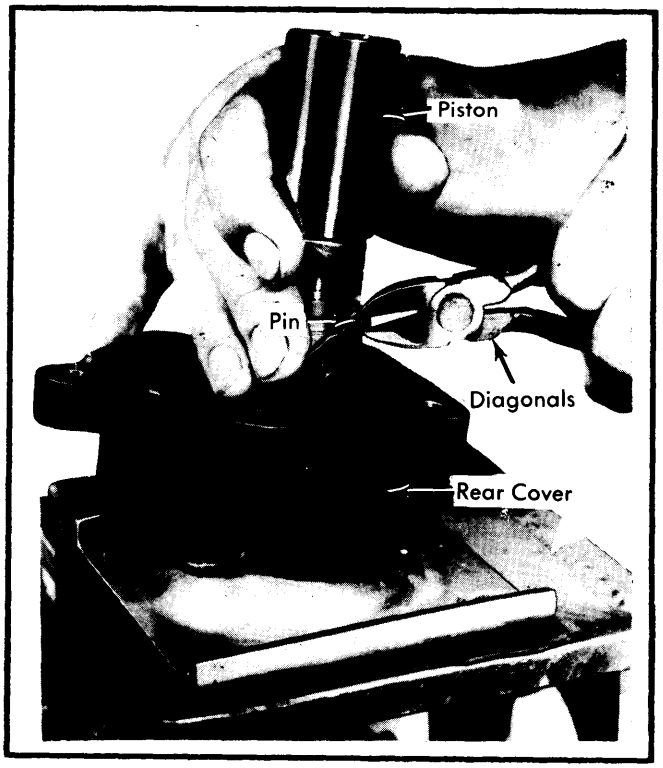

Fig. 5 Using Diagonal Pliers to Remove Booster Power Pin (Cadillac Shown)

8) Install output rod, spring and a new spring retainer.

9) Using a 7/8" deep socket, secure new output rod retainer in place.

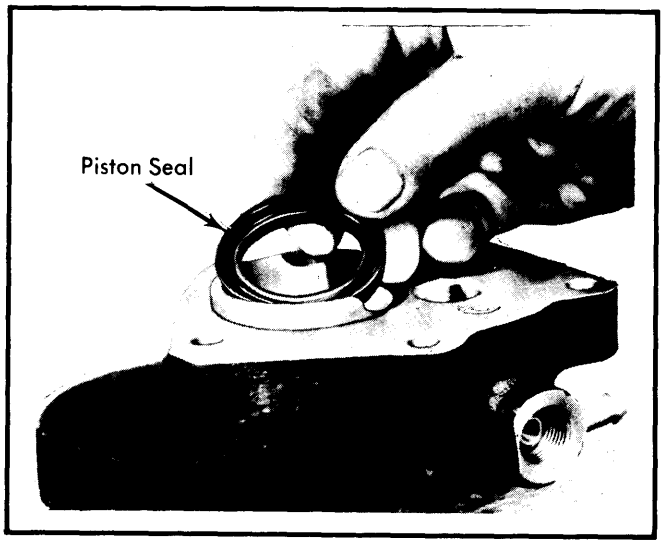

Fig. 6 Installing New Power Piston Seal into Rear Housing (Cadillac Shown)