

POWER BRAKE BOOSTERS

When the Hydro-Boost Emits Unfamiliar Hissing Sounds

Hissing, squeaking and squawking sounds can be frustrating symptoms to diagnose, especially when they relate to the braking system. The word squeak, when associated with a braking system, usually means that the friction is the first suspect. And the last component to be evaluated may well be the power brake booster. Be prepared to discuss what should be considered normal brake sounds, especially with a light truck or SUV owner who may expect their vehicle to ride and drive like a car and be quiet about it. The hydro-boost noises may or may not be accompanied by other brake performance symptoms. When they are accompanied by other symptoms, further attention to the system will be necessary.

A NORMAL CHARACTERISTIC

Certain noises will be associated with the operation of the hydro-boost and there is nothing that can be done to prevent them. Identifying the difference between normal and abnormal noises and explaining that to the customer can be a challenge. Operating noises such as hissing, clunking and clattering are considered normal hydro-boost noises that can occur when the braking system is applied in a manner not associated with everyday driving and braking conditions.

For example, the hydro-boost will emit normal hissing sounds when above-normal brake pedal pressures are applied. This would include pedal effort in the 40 lb. range and higher. The noises are especially noticeable when the brakes are applied in this pressure range with the vehicle not in motion, and the system's operating temperature at an increased level. A quick release of the brake pedal with applied pedal pressures in the range of 50-100 lbs. may exhibit clicking, clunking or clat-

tering noises, and should be considered a normal characteristic. Hissing sounds at or below a pedal pressure range of 20-25 lbs. should be explored. **Caution:** Do not keep the brakes in the applied position with a pedal force of 100 lbs. for longer than 5 seconds at a time.

Invented by Bendix, the hydro-boost system offers many advantages over the vacuum boost assisted systems. Its compact size has solved some of the design challenges of downsized vehicles, vans and SUVs. The system does not utilize a vacuum source, which makes the use of the system favorable to diesel powered vehicles or turbo-charged applications. Its boost to the braking system is much higher than that of a vacuum assisted system, so it has a definite advantage when fitted to special applications, such as trucks, which may require greater master cylinder pressures, or vehicles fitted with four wheel disc brakes. The braking system is basically the same, except it is a hydraulic boosted system, instead of a vacuum boost assist.

The system utilizes the power steering pump as a source of pressure to operate the booster. The master cylinder is fitted to the output rod of the booster. The three systems that basically make up the hydro-boost system are the applied, release and the reserve system. Their purpose is as follows:

APPLIED ... When the brake pedal is depressed, the pedal moves the pedal rod and spool valve. The fluid return to the power steering pump is restricted, forcing fluid into the boost chamber from the pressure port. An increase in the valve movement restricts fluid flow between the power steering pump and the power steering gear. The increase of fluid pressure in the boost chamber forces the piston forward, engaging the piston in

the master cylinder, applying the brakes. If power steering assist is required during the braking mode, the power steering pump pressure will rise and the spool valve will shift open, directing an increase in fluid flow to the power steering gear.

RELEASED ... When the brake pedal is released, the return spring in the spool valve pushes the valve to its normal released position. The fluid pressure is prevented from entering the boost chamber. The boost chamber is vented through the spool valve to the pump return port and back to the power steering pump.

RESERVE ... As a safety system in case of a loss of power steering pump pressure, the system incorporates a reserve system allowing 2-3 brake applications with power assist. The reserve system consists of a charging valve, accumulator valve and a spring-loaded accumulator. The charging valve incorporates an orifice and a check valve. Fluid from the power steering pump passes through the orifice in the valve, unseats the ball check valve and enters the accumulator. The check valve prevents a reversal of the fluid flow. The accumulator valve is a poppet type valve, held closed by the accumulator pressure. If there is no pressure available from the power steering pump, an actuator on the spool valve sleeve opens the accumulator valve. Fluid pressure can also enter the accumulator from the boost chamber through the accumulator valve, when the boost chamber pressure exceeds the accumulator pressure. A pressure relief valve vents the accumulator to the pump return port when the pressure in the accumulator exceeds 1600 psi. **Caution:** Even though the engine may not be running, the system can still contain excessive pressure in the accumulator. The accumulator pressure must be bled off prior to opening the hydraulic system. This is accomplished by pumping the brake pedal with the engine off.

When replacing a hydro-boost, both Ford and GM recommend drilling a 1/16 inch hole in the end of the accumulator prior to disposal. This procedure will release the nitrogen gas, so make certain you wear safety glasses. When handling a hydro-boost, it should not be carried by the accumulator and definitely not dropped on it. Do not expose the unit to excessive heat.

TROUBLESHOOTING TIPS

While this article is directed toward noise-related conditions and does not include a full hydro-boost systems test, we have included some troubleshooting tips to aid in diagnosing hydro-boost problems:

Chatter and Pedal Vibration

- ◆ Check power steering belt tension
- ◆ Check power steering fluid level
- ◆ System contamination
- ◆ Defective hydro-boost

Brakes Grab

- ◆ Check power steering belt tension
- ◆ Flush power steering system while pumping brakes
- ◆ Defective hydro-boost

Noise

- ◆ Low power steering fluid level
- ◆ Aerated fluid
- ◆ Internal restriction
- ◆ Check power steering belt tension

No Reserve Assist

- ◆ No reserve assist indicates accumulator leakage...replace hydro-boost

Excessive Pedal Effort

- ◆ Check power steering belt tension
- ◆ Check power steering fluid level
- ◆ Defective hydro-boost
- ◆ Internal restriction
- ◆ Low power steering pump pressure

Slow Pedal Return

- ◆ Check for restriction in return line between hydro-boost and pump reservoir
- ◆ Incorrectly connected return line
- ◆ Defective hydro-boost
- ◆ Binding in linkage

Brakes Self-Apply

- ◆ Return line not connected properly
- ◆ Restriction in return line, or kink in hose between booster and pump
- ◆ Defective hydro-boost

For a complete systems test, refer to a service manual that provides the necessary troubleshooting charts based on given performance symptoms, including the required pump pressures.

FLUSHING THE SYSTEM

Performing a power steering and hydro-boost system flush can eliminate many unwanted symptoms such as brake grabbing, pedal kickback, increased steering effort and “hissing” noises on brake application. This procedure should be performed prior to investing in a new power steering pump or hydro-boost unit. The flushing procedures may vary with the vehicle manufacturers. For example, consider the procedures illustrated by GM and Ford:

General Motors

- 1) Raise the front of the vehicle until the tires and wheels turn freely and support with the safety stands.
- 2) Remove the fluid return hose at the power steering pump inlet connector.
- 3) Plug the inlet connector port on the pump.
- 4) Place a large container under the fluid return hose to catch the draining fluid.
- 5) Run the engine at idle while an assistant fills the pump reservoir with new power steering fluid.
- 6) Turn the steering wheel back and forth to the full left and right position. Do not hold the wheel at a full stop position, as a sudden overflow from the reservoir will occur.
- 7) Reinstall the hoses.
- 8) Fill the system with new power steering fluid and bleed the system, as illustrated in the service manual.

- 9) Start and run the engine for 15 minutes.
- 10) With the engine off, remove the hose at the pump outlet and plug the connection on the pump.
- 11) Refill the reservoir and check the draining fluid for contamination. If foreign material is still found, replace all of the hoses.
- 12) Disassemble and clean the power steering components, or replace components as necessary.
- 13) Do not reuse any drained power steering fluid.

Ford

The following Ford procedure was illustrated in TSB 99-25-8 for servicing 1999 Ford Super Duty trucks with symptoms of a brake grabbing condition or pedal kickback, in addition to a hissing noise during brake application. An increase in the steering effort may also be present, due to contamination in the power steering and hydro-boost system. Other year models may not reflect the same cleaning procedure.

Clean the system on the 1999 Super Duty F Series trucks as follows:

- 1) Attach a pinch-off clamp to the lower power steering hose, approximately six inches from the lower port of the power steering cooler. This will prevent the fluid from emptying out of the system when the hose is disconnected.
- 2) Obtain a 20 micron power steering fluid filter (Ford #F8DZ-3F595-AA). Remove the power steering hose from the lower port of the cooler. Cap off cooler port to minimize fluid leakage and immediately install the temporary filter onto the power steering hose, using hose clamps to secure the filter.
- 3) Attach the other end of the filter to the cooler using the clamps provided.
- 4) Remove the pinch-off clamp from the power steering hose.

Cleaning Cycle:

SET THE PARKING BRAKE

- 1) Start the vehicle and check the power steering fluid.
- 2) Idle the engine for 15 seconds.
- 3) While revving the engine to 2200 rpm, turn the steering wheel lock-to-lock 10 times.
- 4) While revving the engine at 2200 rpm, pump the brake pedal hard to the floor 25 times.
- 5) While revving the engine at 2200 rpm, turn the steering wheel lock-to-lock 5 times.
- 6) Hold engine steady at 2000 rpm for 15 seconds.
- 7) At idle, turn the steering wheel lock-to-lock 3 times without applying the brakes and with the transmission in park. If hard effort or binding is noticed, repeat steps 4-6.
- 8) Road test the vehicle in the parking lot at speeds of 5-10 mph and lightly applying the brakes. Bring the vehicle to a complete stop to verify the operation of the brakes.
- 9) If a brake grabbing condition is not felt and the steering efforts are normal, shut the engine off, remove the filter at the cooler and reconnect the power steering line to the cooler. Discard the filter. Check the power steering fluid level and add accordingly.

If a brake grabbing condition is felt, replace the hydro-boost.

If an increase in steering effort persists, replace the power steering pump.

Certain noises can be expected with normal hydro-boost operation. Noise accompanied by other symptoms is an indication of a problem within the system, or system contamination.

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