POWER STEERING (Continued)

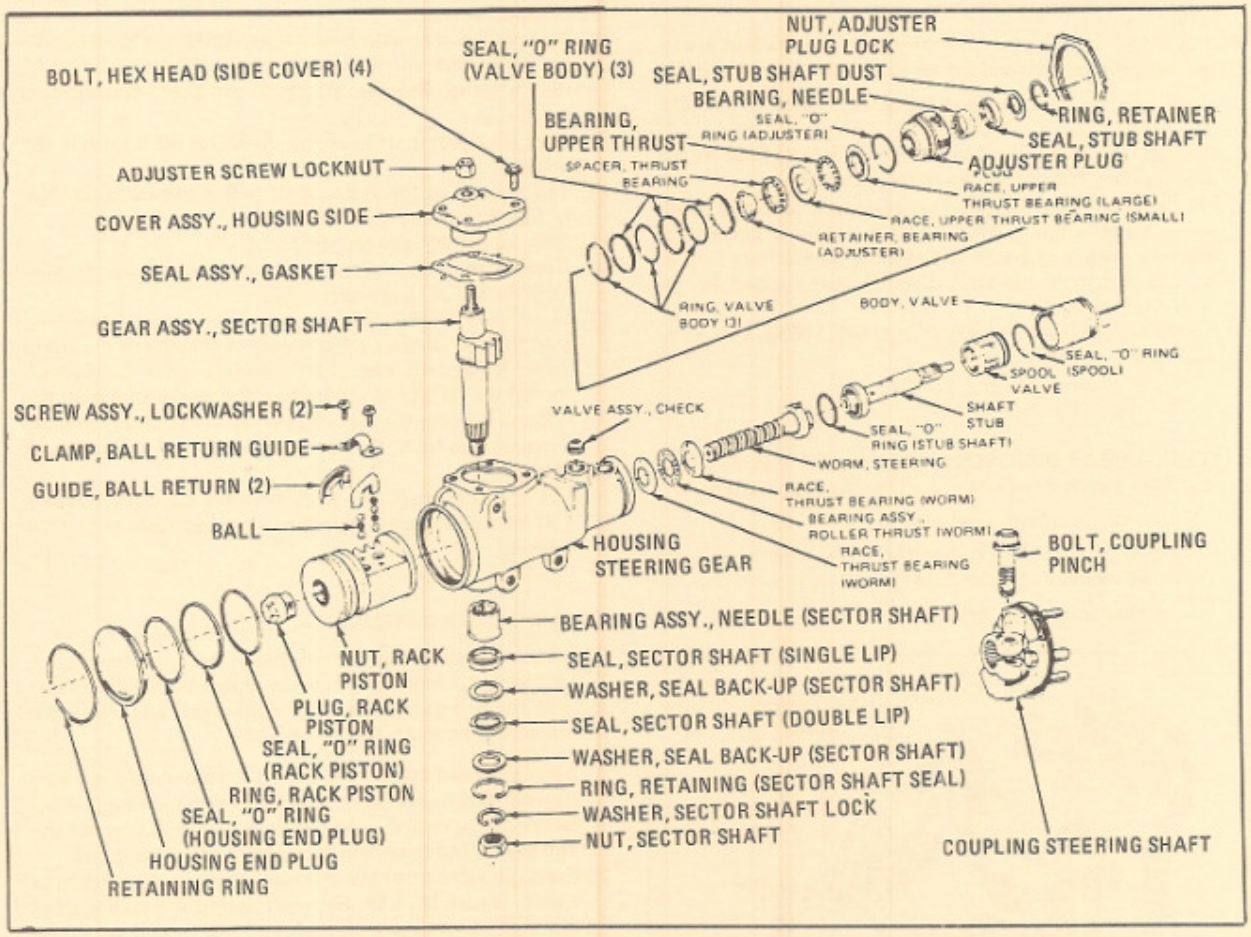


Figure 142 – Steering Gear Disassembled

sector shaft cover.

9. Thread the sector shaft cover onto the adjusting screw until it bottoms, then back it off one and one-half turns.
10. Install the sector shaft so the center gear tooth meshes with the center groove in the rack-piston. Be sure the cover gasket is in place before pushing the cover down on the housing.
11. Install the cover screws and lockwashers and tighten to 54-68 ft.-lbs.
12. Install a new adjuster lock nut halfway on the mesh adjusting screw adjuster screw.
13. Install the rack piston end plug in the rack-piston. Tighten the plug to 80-140 ft.-lbs.
14. Lubricate a new housing end plug O-ring with power steering fluid, C1AZ-19582-A, C, D, or equivalent and install it in the housing.
15. Place the housing end-plug in the gear housing and seat it against the O-ring seal. It may be necessary to tap the end plug lightly with a soft-faced mallet to seat it properly.
16. Snap the retainer ring in place with the fingers. Tap lightly on the ring to be sure it is securely bottomed in the housing.
17. Adjust the overcenter mesh load of the sector according to the procedure given under Adjustments.
18. After obtaining proper mesh load, tighten the sector shaft adjusting screw lock nut to 27-37 ft.-lbs.

STEERING GEAR HOUSING – Disassembly and Assembly.

1. Remove the snap ring (figure 142) that secures the sector shaft seals in the lower end of the housing. Remove the lower spacer washer.
2. Remove the lower seal (double lip), spacer washer, and upper seal (single lip) using Tools T58L-101-A puller attachment and T59L-100-B, slide hammer.
3. Check the selector shaft bearing for wear and damage and remove if necessary. Working from the lower end of the

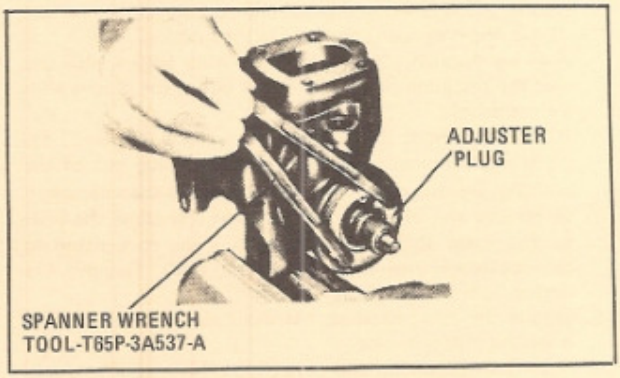


Figure 143 – Removing Adjuster Plug

POWER STEERING (Continued)

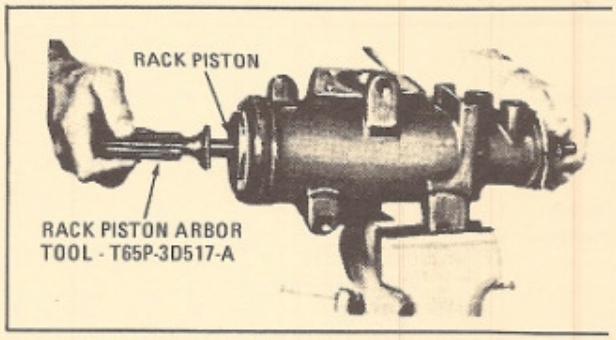


Figure 144 — Removing Rack Piston

housing (figure 144), press the bearing out of the housing. Discard the bearing.

4. Working from the upper end of the housing, press in a new bearing until the upper end is 0.76 mm (0.030 inch) below the housing bore. When installing the bearing, be sure to press only on the identification (stamped) end.
5. Lubricate the new sector shaft seals in ESW-M2C33-F (C1AZ-19582-A, C, or D) automatic transmission fluid or equivalent. Install the single lip seal first, then a back-up washer. Using Tool T65P-3D642-A, sector shaft seal installer, drive the seal and the washer in only far enough to provide clearance for the other seal and the back-up washer and the retaining ring. **Do not let the seal bottom on the end of the counterbore.** Install the double lip seal and back-up washer. Using Tool T65P-3D642-A drive the seal and washer in only far enough to provide clearance for the retaining ring. Install the sector shaft seal retaining ring with snap ring pliers, making certain that the ring seats properly.

CHECK VALVE REMOVAL AND INSTALLATION — If the inlet port check valve requires service, refer to figure 142.

ADJUSTER PLUG — Disassembly and Assembly.

1. Lift the adjuster plug off the stub shaft (see figure 145).
2. Pry the thrust bearing retainer off the adjuster plug as shown in figure 145. **Be careful not to score the roller bearing bore.** Discard the retainer.
3. Lift the spacer, thrust bearing, races and O-ring, off the plug. Discard the O-ring.

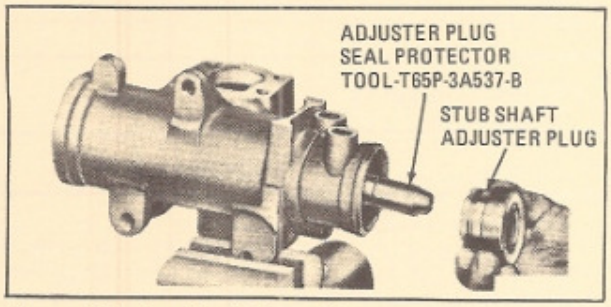


Figure 146 — Installing Adjuster Plug

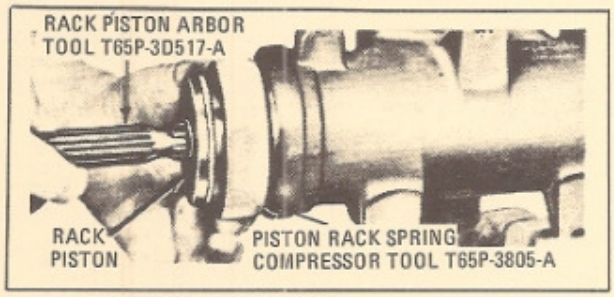


Figure 147 — Installing Rack Piston

4. If the roller bearing must be replaced, remove the dust seal retaining ring. Working from the spacer end of the adjuster plug, remove the roller bearing, oil seal and dust seal.

   Do not remove the roller bearing if it is not damaged. Pry the dust seal and oil seal off the adjuster plug with a screwdriver.
5. Place a **new** roller bearing on Tool T65P-3D525-A, adjuster plug bearing tool with the bearing manufacturer's identification facing toward the tool.

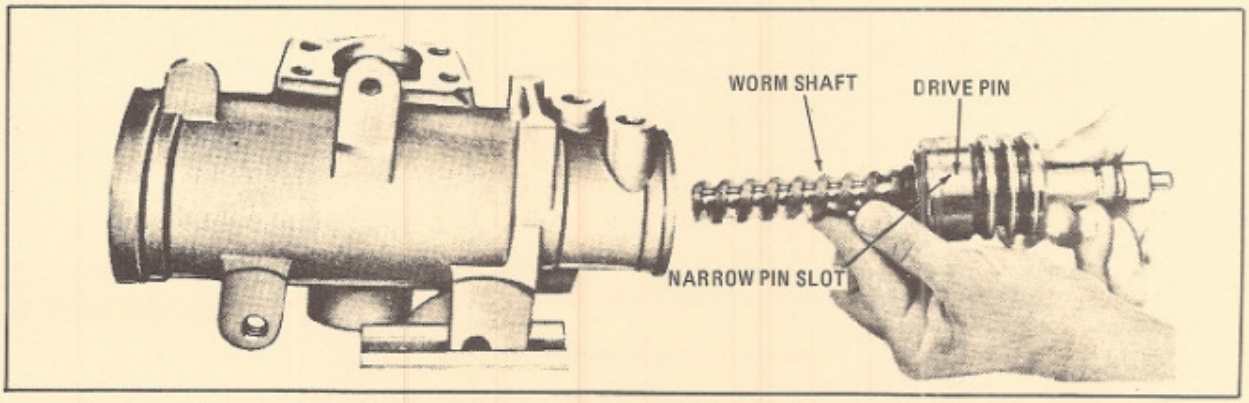


Figure 145 — Installing Valve and Worm Shaft Housing

POWER STEERING (Continued)

STEERING DIAGNOSIS		
CONDITION	**POSSIBLE CAUSE**	**CORRECTION**
Wanders side to side—Loose steering	Power Steering 1. Vehicle overloaded or unevenly loaded. 2. Improper (mismatched) tires and wheels. 3. Tire pressure. 4. Loose steering gear mounting. 5. Front and rear suspension components for looseness, wear, or damage. 6. Steering linkage connections for looseness, wear, or damage. 7. Loose wheel lug nuts. 8. Bellcrank binding. 9. Front wheel bearing adjustment. 10. Steering gear conditioning and adjustments. 11. U-joint coupling fractured. 12. Incorrect toe setting.	1. Correct as required. 2. Install correct tire and wheel combination. 3. Adjust air pressure in tires. 4. Adjust to specification. 5. Tighten or replace as necessary. 6. Tighten or replace as necessary. 7. Tighten to specifications. 8. Lubricate bellcrank. 9. Adjust to specification. 10. Adjust to specification. 11. Replace as required. 12. Set to specifications.
Pulls to one side	Power steering 1. Check tire sizes of each wheel to be sure they are the same size and type. 2. Tire pressure. 3. Vehicle unevenly loaded. 4. Improper brake operation or adjustment. 5. Front wheel bearing adjustment or faulty rear wheel bearing. 6. Broken or sagging springs on front and/or rear suspension. 7. Loose steering gear mountings. 8. Loose, worn or damaged steering linkage. 9. Bent spindle or spindle arm. 10. Bent rear axle housing and/or loose, worn or damaged spring, shock absorber and suspension arm attaching points. 11. Frame or underbody out of alignment. 12. Front wheel alignment. 13. Belted tires (misaligned belts). 14. Steering gear valve binding or out of adjustment (Integral Power Steering).	1. Install correct tire and whee combination. 2. Adjust air pressure in tire. 3. Correct as required. 4. Inspect, adjust, and correct as required. 5. Adjust or replace as required. 6. Inspect and replace as required. 7. Tighten to specification. 8. Tighten and replace as required. 9. Inspect and replace as required. 10. Inspect, tighten and replace as required. 11. Correct as required. 12. Set to specification. 13. Replace as required. 14. Clean and replace as necessary.
Returnability poor	1. Tire pressure. 2. Steering column alignment. 3. Steering linkage for a binding condition or lack of lubrication. 4. Steering gear adjustment. 5. Tight bellcrank. 6. Bind in idler arm. 7. Glazed, loose or broken power steering pump belt. 8. Kinked return hose or tube. 9. Obstruction within steering gear or lines. 10. Scored piston bore in housing (Integral Power Steering). 11. Excessively worn power steering pump parts.	1. Adjust air pressure in tires. 2. Align or adjust as required. 3. Lube, adjust or replace as required. 4. Adjust to specification. 5. Lube, correct as required. 6. Lube, correct as required. 7. Inspect, adjust or replace as required. 8. Inspect and repair or replace as required. 9. Inspect, remove obstructions, and repair or replace. as required. 10. Inspect, correct as required. 11. Replace as required.

BRAKES

BRAKES – The following note applies to one or more steps in the assembly procedure of components in this portion of the manual as indicated at appropriate location by the terminology "See Note on page XX of this section."

NOTE: This fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

CAUTION: When servicing wheel brake parts, do not create dust by grinding or sanding brake linings or by cleaning wheel brake parts with a dry brush or with compressed air. (A water dampened cloth should be used.) Many wheel brake parts contain asbestos fibers which can become airborne if dust is created during servicing. Breathing dust containing asbestos fibers may cause serious bodily harm."

BRAKES – GENERAL DESCRIPTION – All vehicles are equipped with a dual hydraulic brake system. The split system consists basically of two separate brake systems. When a failure is encountered on either, the other is adequate to stop the vehicle. If one system is not functioning, it is normal for the brake pedal lash and pedal effort to substantially increase. This occurs because of the design of the master cylinder which incorporates an actuating piston for each system. When the rear system loses fluid, its piston will bottom against the front piston. When the front system loses fluid, its piston will bottom on the end of the master cylinder body. The pressure differential in one of the systems causes an uneven hydraulic pressure balance between the front and rear systems. The combination valve (near the master cylinder) detects the loss of pressure and illuminates the brake alarm indicator light on the instrument panel. The pressure loss is felt at the brake pedal by an apparent lack of brakes for most of the brake travel and then, when failed chamber is bottomed, the pedal will harden.

If a vehicle displays these symptoms, it is a good indication that one of the systems contains air or has failed, and it is necessary to bleed or repair the brakes.

MASTER CYLINDER – The system is designed with a separate hydraulic system for the front and rear brakes using a dual master cylinder. The cylinder has two separate reservoirs and outlets in a common body casting.

COMBINATION VALVE – All REVCON vehicles have a combination valve. The front and rear hydraulic lines are routed through this combination "metering" and "brake failure warning switch" to their appropriate wheel cylinders or caliper.

The metering portion of the combination valve tends to "hold off" front hydraulic pressure until the rear brake system overcomes the pull back springs; then pressure is allowed to flow with the result being a good distribution of braking effort.

The brake failure warning switch portion of the combination valve "senses" a loss of hydraulic pressure, if a failure should occur, and turns "on" a red light in the dash to warn the operator of the failure.

DISC BRAKES FRONT – All models have disc brakes on the front. The one piece caliper mounts on the steering knuckle/steering arm, which is also a one piece casting, and astride the brake disc. The caliper is the dual piston design which is said to be a sliding caliper sliding piston. No front brake adjustment is necessary once the system is in operation and the pedal has been stroked to "seat" the shoes to the caliper.

DRUM BRAKES REAR – The rear brakes are duo servo and self adjusting. Brake adjustment takes place when the brakes are applied with a firm pedal effort while the vehicle is backing up. Applying the brakes moves the actuator which turns the star wheel and lengthens the adjuster screw assembly. This action moves the shoes outward until clearance between the lining and drum is within proper limits.

BRAKE DIAGNOSIS

INSPECTION AND TESTING BRAKES – New linings must be protected from severe use for several hundred miles. Brakes should be tested on dry, clean, reasonably smooth and level roadway. A true test of brake performance cannot be made if roadway is wet, greasy, or covered with loose dirt so that all tires do not grip the road equally. Testing will also be adversely affected if roadway is crowned so as to throw weight of vehicle toward wheels on one side or if roadway is so rough that wheels tend to bounce.

Test brakes at different vehicle speeds with both light and heavy pedal pressure; however, avoid locking the wheels and sliding the tires on roadway. Locked wheels and sliding tires do not indicate brake efficiency since heavily braked but turning wheels will stop vehicle in less distance than locked wheels. More tire-to-road friction is present with a heavily braked turning tire than with a sliding tire.

External Conditions That Affect Brake Performance:

1. **Tires** – Tires having unequal contact and grip on road will cause unequal braking. Tires must be equally inflated and tread pattern of right and left tires must be approximately equal.
2. **Vehicle Loading** – When vehicle has unequal loading, the most heavily loaded wheels require more braking power than others. A heavily loaded vehicle requires more braking effort.
3. **Rear Wheel Bearings** – A loose rear wheel bearing permits the drum to tilt and have spotty contact with the brake shoe linings causing erratic action.
4. **Front End Alignment** – Misalignment of the front end, particularly in regard to limits on camber and caster pin inclination, will cause the brakes to pull to one side.

HYDRO-BOOST – Prior to performing the Booster Function Tests, or the Accumulator Leakdown Test, the following preliminary checks must be made:

NOTE: The power steering fluid and brake fluid cannot be mixed. If brake seals contact steering fluid or steering seals contact brake fluid, seal damage will result.

BRAKES (Continued)

1. Check all power steering and brake lines and connections for leaks and/or restrictions.
2. Check and fill brake master cylinder with brake fluid.
3. Check and fill power steering pump reservoir with power steering fluid. Be sure fluid is not aerated (air mixed with fluid).
4. Check power steering pump belt for tension and/or damage. Adjust if necessary.
5. Check engine idle speed and adjust if necessary.
6. Check steering pump pressure.

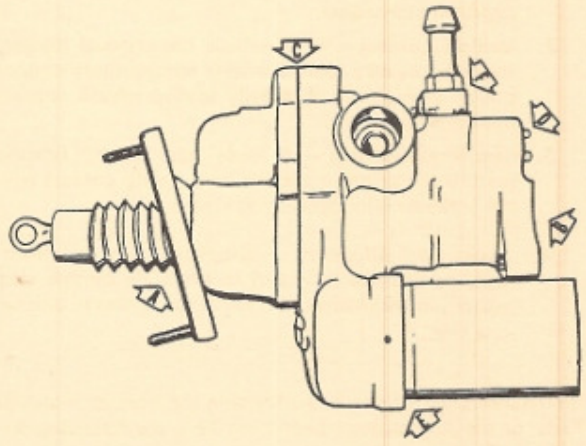
SEAL LEAK DIAGNOSIS

1. **Input Rod Seal** – A damaged seal will show up as a fluid leak from the mounting bracket vent hole. The booster must be removed from the vehicle and disassembled. The input rod bore should be checked for any scratches that may cause the leak. If scratches are present, housing cover must be replaced. If no excessive scratches are present, then the booster seal kit can be used to replace the appropriate seals.
2. **Power Piston Seal** – Power piston seal damage will be noticed by fluid leaking out at the common master cylinder-brake booster vent and possible reduction in power assist. The booster must be removed from the vehicle and disassembled. The piston should be checked for any scratches that may be the cause of the leak. If scratches are present, then the input rod and power piston assembly must be replaced. If no excessive scratches are present, then the booster seal kit can be used to replace the appropriate seals.
3. **Housing Seal** – If the housing seal is damaged, fluid will leak out from between the two housings. The booster must be removed from the vehicle and disassembled. The booster seal kit should be used to replace the housing and input rod and power piston seals.
4. **Spool Valve Plug "O" Ring Seal** – Damage to this seal will be noticed by fluid leaking out past the plug. The booster need not be removed from the vehicle. The master cylinder should be disconnected from the booster. Press in on spool plug, insert a small screwdriver between snap ring and housing bore. This unseats one side of the spool plug snap ring from its groove in the bore. Then remove the snap ring from the bore.
5. **Accumulator "O" Ring Seal** – Damage to this seal will result in fluid leakage past the accumulator cap. The seal can be replaced while the booster is installed on the vehicle. A catch basin should be placed under the booster to catch the fluid when the accumulator or spring cap is removed.

CAUTION: Before removing the cap, the brake pedal must be pumped 4-5 times to deplete accumulator pressure. Refer to "Pneumatic Accumulator On-Vehicle Service Procedure."

6. **External Leakage at the Return Port Fitting** – Tighten fitting to 7 lb. ft. (10 N·m). If it continues to leak, replace "O" ring under fitting..
7. **External Leakage at the High Pressure Gear or Pump** – Torque tube nut to 30 lb. ft. (40 N·m). If it continues to leak, check for damaged tube flares; if OK, replace tube seats.

HYDRO-BOOST TROUBLE SHOOTING AND TESTING – The Hydro-Boost differs from vacuum brake boosters not only in the source of power (hydraulic versus vacuum) but in the fact that it is also a part of another major sub-system of the vehicle - - the power steering system. Therefore, problems or malfunctions in the steering system may affect the operation of the booster, just as a problem in the booster may affect the



HYDRO— BOOST SEAL LEAKAGE

A. INPUT SEAL LEAK — Fluid leakage from housing cover end of booster near reaction bore. Replace seal(s).

B. PISTON SEAL LEAK — Fluid leakage from vent at front of unit near master cylinder. Replace seal.

C. HOUSING — Fluid leakage between the housing and housing cover. Replace seal.

D. SPOOL VALVE SEAL — Fluid leakage near plug area. Replace seal.

E. ACCUMULATOR CAP SEAL — Fluid leakage from accumulator area. Replace seal.

F. RETURN PORT FITTING SEAL — Replace seal.

Figure 148 – Seal Leakage Diagnosis (Backside of Booster)

BRAKES (Continued)

steering system. The following noises are associated with the Hydro-boost system and may or may not be cause for customer complaint. Some are normal and for the most part temporary in nature. Others may be a sign of excessive wear or the presence of air in either the booster or the steering system.

1. Moan or low frequency hum usually accompanied by a vibration in the pedal and/or steering column may be observed during parking maneuvers or other very low speed maneuvers. This may be caused by a low fluid level in the power steering pump or by air in the power steering fluid due to holding the pump at relief pressure (steering wheel held all the way in one direction) for an excessive amount of time (more than 5 seconds). Check the fluid level and fill to mark. System must sit for 1 hour to remove the air. If the condition persists, this may be a sign of excessive pump wear and the pump should be checked.
2. At or near power runout, (brake pedal near fully depressed position) a high speed fluid noise (faucet type) may be heard. This is a normal condition and will not be heard except in emergency braking conditions, or with vehicle stopped and pedal pushed near fully depressed position.
3. Whenever the accumulator pressure is used, a slight hiss may be noticed. It is the sound of the hydraulic fluid escaping through the accumulator valve, and is completely normal.
4. After the accumulator has been emptied, and the engine is started again, another hissing sound may be heard during the first brake application or the first steering maneuver. This is caused by the fluid rushing through the accumulator charging orifice. It is normal and will only be heard once after the accumulator is emptied. However, if this sound continues, even though no apparent accumulator pressure assist was made, it could be an indication that the accumulator is not holding pressure and should be checked using the procedure for "Accumulator Leakdown Test."
5. After bleeding, a "gulping" sound may be present during brake applications as noted in the bleeding instructions.

CHECKING THE RESERVE SYSTEM

1. Start engine and charge accumulator by applying the brake pedal or by turning the steering wheel from stop to stop. Turn off engine and let vehicle sit for one hour. After one hour there should be at least two power assisted applications with the engine off.
2. If the reserve system will not retain a charge for one hour, but functions normally immediately following charging, the accumulator valves are at fault and the booster must be disassembled and the accumulator valves replaced.
3. If the accumulator can be heard charging and discharging, but it does not hold a charge, disassemble the booster and replace the accumulator valves.
4. Deplete the accumulator by pressing the brake pedal 4 or 5 times. If the accumulator can has lost its gas charge, it is possible to rotate or wobble the accumulator can with respect to the housing. Replace the accumulator assembly.

BOOSTER FUNCTIONAL TEST – With the engine off, apply the brake pedal several times until the accumulator is completely depleted. Depress the brake pedal (approximately 40 pounds/180 N pedal force) and start the engine. The pedal should fall and then push back against driver's foot.

ACCUMULATOR LEAKDOWN TEST – Start engine and charge accumulator by either applying the brake pedal (approximately 100 pounds/450 N force) or by turning the steering wheel from stop to stop. Turn off engine and let vehicle sit for one hour. After one hour there should be two power assisted applies with engine stopped.

BRAKES ON-VEHICLE SERVICE

PEDAL TRAVEL – At reasonably frequent intervals, the brakes should be inspected for pedal travel, which is the distance the pedal moves toward the floor from a fully-released position. Inspection should be made with the brake pedal firmly depressed (approximately 90 lbs.) while the brakes are cold.

NOTE: Revcon pedal measurement: 3.5" (90 mm)

Before making pedal travel checks, pump the pedal a minimum of three times with the engine off. This exhausts all vacuum from the power booster.

STOPLIGHT SWITCH ADJUSTMENT – The design of the stoplight switch and valve mounting (see figure 149) provides for automatic adjustment when the brake pedal is manually returned to its mechanical stop, as follows:

1. With brake pedal depressed, insert switch and/or valve assembly into tubular clip until switch body and/or valve assembly seats on tube clip. Note that audible "clicks" can be heard as threaded portion of switch and valve are pushed through the clip toward the brake pedal.
2. Pull brake pedal fully rearward against pedal stop, until audible "click" sounds can no longer be heard. Switch and/or valve assembly will be moved in tubular clip providing proper adjustment.

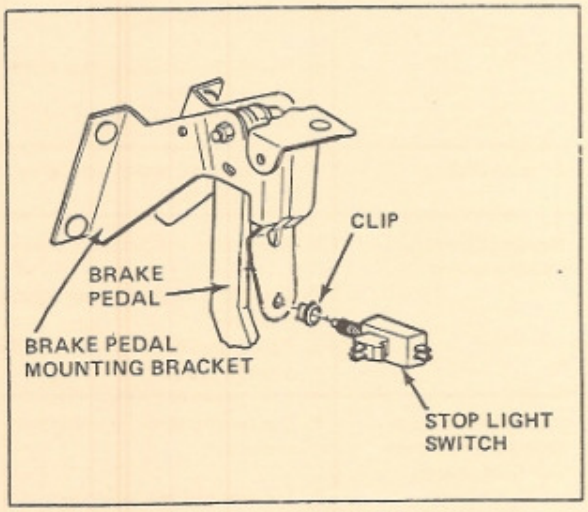


Figure 149 – Stoplight Switch on Brake Pedal

BRAKES (Continued)

3. Release brake pedal, and then repeat step 2 to assure that no audible "click" sounds remain.

BLEEDING AND FLUSHING BRAKE SYSTEM — A bleeding operation is necessary to remove air whenever it is introduced into the hydraulic brake system. It may be necessary to bleed the hydraulic system at all four wheel cylinders if air has been introduced through low fluid level or disconnecting brake lines at the master cylinder. If brake line is disconnected at any wheel cylinder, then that wheel cylinder only need be bled. If lines are disconnected at any fitting located between the master cylinder and wheel cylinders, then all wheel cylinders served by the disconnected line must be bled.

MANUAL BLEEDING OF BRAKE SYSTEM — Initially, deplete the vacuum reserve by applying the brakes several times.

1. Fill the master cylinder with brake fluid and keep at least one-half full of fluid during bleeding operation.

Continued on page 124

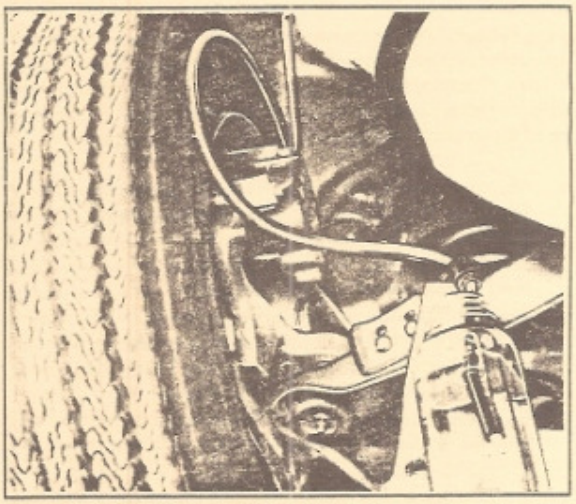


Figure 150 — Bleeding Wheel Cylinder

HYDRO-BOOST DIAGNOSIS

CONDITION	CAUSE	CORRECTION
Excessive Brake Pedal Effort	1. Loose or broken power steering pump belt.	1. Tighten or replace the belt.
	2. No fluid in power steering reservoir.	2. Fill reservoir and check for external leaks.
	3. Leaks in Hydro-Boost.	3. Replace faulty parts.
	4. Leaks at Hydro-Boost tube fittings.	4. Tighten fittings or replace tube seats, if faulty.
	5. External leakage at accumulator	5. Replace "O" ring and retainer.
	6. Faulty booster piston seal causing leakage at booster flange vent.	6. Overhaul with new seal or input rod and piston assembly.
	7. Faulty booster input rod seal with leakage at input rod end.	7. Overhaul with new seal kit.
	8. Faulty booster cover seal with leakage between housing and cover.	8. Overhaul with new seal kit.
	9. Faulty booster spool plug seal.	9. Overhaul with spool plug seal kit.
Slow Brake Pedal Return	1. Excessive seal friction in booster.	1. Overhaul with new seal kit.
	2. Faulty spool action.	2. Flush steering system while pumping brake pedal.
	3. Restriction in return line from booster to pump reservoir.	3. Replace line.
	4. Damaged input rod end.	4. Replace input rod and piston assembly.
Grabby Brakes	1. Faulty spool action caused by contamination in system.	1. Flush steering system while pumping brake pedal.
Booster Chatters - Pedal Vibrates	1. Power steering pump belt slips.	1. Tighten belt.
	2. Low fluid level in power steering pump reservoir.	2. Fill reservoir and check for external leaks.
	3. Faulty spool operation caused by contamination in system.	3. Flush steering system while pumping brake pedal.
Accumulator Leak Down-System does not hold charge	1. Contamination in steering hydro-boost system.	1. Flush steering system while pumping brake pedal.
	2. Internal leakage in accumulator system.	2. Overhaul unit using accumulator rebuild kit and seal kit.

BRAKES (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
Pulls	1. Incorrect tire pressures.	1. Inflate evenly on both sides to the recommended pressures.
	2. Front end out of line.	2. Check and align to manufacturer's specifications.
	3. Unmatched tires on same axle.	3. Tires with approximately the same amount of tread should be used on the same axle.
	4. Restricted brake pipes or hoses.	4. Check for soft hoses and damaged lines. Replace with new hoses and new double-walled steel brake tubing.
	5. Malfunctioning caliper assembly	5. Check for stuck or sluggish pistons, proper lubrication. Remove and rebuild caliper.
	6. Defective or damaged shoe and lining (grease or brake fluid on lining or bent shoe).	6. Install new shoe and lining in complete axle sets.
	7. Malfunctioning rear brakes.	7. Check for inoperative auto adjusting mechanism, defective lining (grease or brake fluid on lining) or defective wheel cylinders. Repair as necessary.
	8. Loose suspension parts.	8. Check and torque all suspension mountings to specifications.
	9. Loose calipers.	9. Check and torque bolts to specifications.
Noise (high pitched squeak without applying brake).	1. Front linings worn out.	1. Replace linings.
Brake roughness or chatter (Pedal Pulsates)	1. Excessive lateral runout.	1. Check per instructions and replace or machine rotor, if not within specifications.
	2. Parallelism not within specifications.	2. Check per instructions and replace or machine the rotor, if not within specifications.
	3. Wheel Bearings not adjusted.	3. Adjust wheel bearings to correct specifications.
	4. Rear drums out of round.	4. Check runout and, if not within specifications, turn the drums (not over maximum of 0.060 on the diameter).
	5. Shoe reversed (steel against iron).	5. Replace shoe and lining and machine rotor within specifications.
Excessive Pedal Effort	1. Malfunctioning power brake.	1. Check power brake and repair if necessary.
	2. Partial system failure.	2. Check front and rear brake system and repair, if necessary. Also, check and repair brake warning light circuit if a failed system is found and light did not function.
	3. Excessively worn shoe and lining.	3. Check and replace in axle sets.
	4. Piston in caliper stuck or sluggish.	4. Remove caliper and rebuild.
	5. Fading brakes due to incorrect lining.	5. Remove and replace with original equipment lining (or equivalent).
Excessive Pedal Travel	1. Partial brake system failure.	1. Check both front and rear system for a failure and repair. Also check and repair warning light circuit. It should have indicated a failure.
	2. Insufficient fluid in master cylinder.	2. Fill reservoirs with approved brake fluid. Check for leaks. Check warning light.
	3. Air trapped in system.	3. Bleed system.
	4. Rear brake not adjusting.	4. Adjust rear brakes and repair auto adjusters.
	5. Bent shoe and lining.	5. Replace axle set of shoe and lining.

BRAKES (Continued)

Dragging Brakes (A very light drag is present in all disc brakes immediately after pedal is released.)	1. Master cylinder pistons not returning correctly. 2. Restricted brake pipes or hoses. 3. Incorrect parking brake adjustment on rear brakes. 4. Check valve installed in outlet to front disc brakes. 5. Incorrect installation of inboard shoe and lining.	1. With reservoir cover off, check for fluid spurt at bypass holes as pedal is depressed. Adjust push rod, if necessary, or rebuild master cylinder. 2. Check for soft hoses or damaged pipes and replace with new hoses and new double-walled steel brake tubing. 3. Check and readjust to correct specifications. 4. Check master cylinder outlet and remove check valve if present. 5. Refer to caliper installation in this section.
Grabbing or uneven Braking Action	1. All conditions listed under "PULLS." 2. Malfunction of combination valve. 3. Malfunction of power brake unit. 4. Binding brake pedal mechanism.	1. All corrections listed under "PULLS." 2. Replace and bleed system. 3. Check operation and repair, if necessary. 4. Check and lubricate, if necessary. Possible replace pedal bushing and/or spacer.
Pulsation (roughness) Felt during normal brake application.	1. Uneven pad wear caused by caliper not sliding due to improper clearance or dirt. 2. Uneven rotor wear causing a thickness variation between the two braking surfaces.	1. Remove caliper and correct as necessary. 2. Machine rotors as follows: a. Machine rotors to obtain a circumferential thickness variation no greater than .0005" in 360° and a lateral runout no greater than .004" (max. rate of change not to exceed .001" in 30°). b. Check caliper freeness. With rotor removed, install caliper and mounting bolts (pins). Check for .005" - .012" clearance at both top and bottom of caliper. If less than .005" is found, file with a flat file until at least .005" is obtained. DO NOT EXCEED A MAXIMUM of .012" per end or .024" total clearance. Caliper clearance to inboard and outboard reaction pads must be equal within .004" both at the top and bottom of the caliper. This is to ensure correct alignment of caliper to knuckle during a brake application. c. Remove caliper after freeness check. Clean pins and sleeves, replace "O" rings, and apply a light coating of silicone grease or equivalent to all contact points and "O" rings.

BRAKES (Continued)

CAUSE / Symptom	Excessive Brake Pedal Travel	Brake Pedal Travel Gradually Increases	Excessive Brake Pedal Effort	Excessive Braking Action	Brakes Slow to Respond	Brakes Slow to Release	Brakes Drag	Uneven Braking Action (Front to Rear)	Uneven Braking Action (Side to Side)	Scraping Noise from Brakes Application	Brakes Squeak During Stop	Brakes Chatter (Roughness)	Brakes Groan at End of Stop	Brake Tell-Tale Glows During Stop
Leaking Brake Line or Connection	X	XX							X					XX
Leaking Wheel Cylinder or Piston Seal	X	XX		X				X						X
Leaking Master Cylinder	X	XX												X
Air in Brake System	XX								X					XX
Contaminated or Improper Brake Fluid					X	X	X							X
Worn out Brake Lining - Replace			X	X				X	X	X	X	X		X	
Uneven Brake Lining Wear Replace and Correct	X			X				X	X	X	X	XX		X	X
Grazed Brake Lining			XX		X			X	X		X	X			
Incorrect Lining Material - Replace			X	X				X	X			X		X	
Contaminated Brake Lining - Replace				XX				XX	XX	X	X	X		X	
Linings Damaged by Abusive Use - Replace			X	XX				X	X	X	X	X		X	
Corrosive Brake Lining Dust			X	XX				XX	XX		X	XX		X	
Heat Spotted or Scored Brake Drums or Rotors				X				X	X		X	X	XX	X	
Out-of-Round or Vibrating Brake Drums												X	XX		
Out-of-Parallel Brake Rotors													XX		
Excessive Rotor Run-Out													X		
Faulty Automatic Adjusters	X							X	X	X					X
Incorrect Wheel Cylinder Sizes			X	X					X	X					
Weak of Incorrect Brake Shoe Retention Springs				X		X	XX	X	X	XX	X	XX			
Brake Assembly Attachments-Missing or Loose	X						X	X	X	X		X	X	X	
Insufficient Brake Shoe Guide Lubricant						X	X	X	X	XX	XX				
Restricted Brake Fluid Passage or Sticking Wheel Cylinder Piston		X	X		X	X	X	X	X						
Faulty Metering Valve	X		X	X	X	X	X		X						X
Brake Pedal Linkage Interference or Binding			X		X	XX	XX								
Improperly Adjusted Parking Brake							X								
Drums Tapered or Threaded										XX					
Incorrect Front End Alignment								XX							
Incorrect Tire Pressure								X	X						
Incorrect Wheel Bearing Adjustment	X									X			X		
Loose Front Suspension Attachments								X		XX			X	X	
Out-of-Balance Wheel Assemblies													XX		
Operator Riding Brake Pedal	X	X	X				X		X					X	
Improperly Adjusted Master Cylinder Push Rod	X					X	XX								X
Sticking Wheel Cylinder or Caliper Pistons			X			X	X	X	X						
Faulty Proportioning Valve			X		X	X	X								

X - Indicates causes XX - Indicates more probable cause(s)

BRAKES (Continued)

Bleed right rear brake, left rear brake, right front and left front brake.

2. With the proper size box-end wrench or tool J-21472 over bleeder valve, attach bleeder tube to valve and allow tube to hang submerged in brake fluid in a clean glass jar (see page 120).
3. Open the bleeder valve and fully depress the brake pedal.
4. Close bleeder valve and release brake pedal.
5. Repeat steps 3 and 4 until all air is evacuated.

NOTE: Check and refill master cylinder reservoir as required to prevent air from being drawn through master cylinder.

6. Repeat the bleeding procedure at all wheels if the entire system is to be bled.
7. Check the brake pedal, feeling it for "sponginess." Repeat entire bleeding procedure, if necessary.

PRESSURE BLEEDING BRAKE SYSTEM – Pressure bleeding equipment must be of the diaphragm type. That is, it must have a rubber diaphragm between the air supply and the brake fluid to prevent air, moisture, oil, and other contaminants from entering the hydraulic system.

1. Install pressure bleeding adapter (J-23518) to the master cylinder.
2. Make sure the pressure tank is at least 1/3 full of Supreme No. 11 brake fluid or its equivalent. The bleeder ball must be re-bled each time fluid is added.
3. Charge the bleeder ball to between 20 and 25 psi (140 and 170 kPa).
4. When ready to begin bleeding, connect hose to master cylinder bleeder adapter and open the tank valve.
5. Disc brakes require a manual override of the front brake metering or combination valve to permit flow to the front wheels. Therefore, it will be necessary to hold the valve stem open manually for pressure bleeding. To hold the metering valve open to bleed the front brakes, the valve stem must be either pushed in or pulled out. Install metering valve actuator J-23709.
6. Bleed the brakes in the following sequence: right rear, left rear, right front, and left front.
7. With the proper size wrench over the bleeder valve, attach bleeder tube. The discharge end must hang submerged in a clean container partially filled with brake fluid.
8. Open the bleeder valve at least 3/4 turn and allow flow to continue until no air is seen in the fluid.
9. Close the bleeder valve. Be sure it seals.
10. Repeat steps 7 through 9 for the remaining bleeder valves (see step 6 for proper sequence).
11. Check the pedal feel for "sponginess' and repeat the entire procedure , if necessary.
12. Dispose of all removed brake fluid.
13. Remove metering valve actuator tool J-23709 from the combination valve and tighten the mounting bolt.
14. Disconnect bleeder equipment from the brake bleeder adapter.
15. Remove bleeder adapter. Wipe all areas dry if fluid was spilled during adapter removal.
16. Fill master cylinder reservoir(s) to proper level and install master cylinder diaphragm and cover.

FLUSHING BRAKE HYDRAULIC SYSTEM – It is recommended that the entire hydraulic system be thoroughly flushed with clean brake fluid whenever new parts are installed in the hydraulic system. Flushing is also recommended if there is any doubt as to the grade of fluid in the system. If fluid has been used which contains the slightest trace of mineral oil, all rubber parts that have been subjected to the contaminated fluid should be replaced.

HYDRO-BOOST BLEEDING PROCEDURE – Whenever the booster is removed and reinstalled, the steering system should be bled as outlined below.

NOTE: Power steering fluid and brake fluid cannot be mixed. If brake seals contact steering fluid or steering seals contact brake fluid, seal damage will result.

1. Fill oil reservoir to proper level and let oil remain undisturbed for at least two minutes.
2. Start engine and run momentarily.
3. Add oil, if necessary.
4. Repeat above procedure until oil level remains constant after running engine.
5. Raise front end of vehicle so that wheels are off the ground.
6. Turn the wheels (off ground) right and left, lightly contacting the wheel stops.
7. Add oil if necessary.
8. Lower the vehicle.
9. Start engine and depress the brake pedal several times while rotating the steering wheel from stop to stop.
10. Turn engine off and then pump brake pedal 4 to 5 times to deplete accumulator pressure.
11. Check oil level and refill as required.
12. If oil is extremely foamy, allow vehicle to stand a few minutes with engine off and repeat above procedure.
    a. Check belt tightness and check for a bent pulley.
    b. Check to make sure hoses are not touching any other parts of the vehicle, particularly sheet metal.
    c. Check oil level, filling to proper level if necessary, following steps 1 through 10. This step and step "d" following are extremely important as low oil level and/or air in the oil are the most frequent causes of objectionable pump noises.
    d. Check the presence of air in the oil. Air will show up as milky appearing oil. If air is present, attempt to bleed system as described in steps 1 through 10. If it becomes obvious that the pump will not bleed after a few trials, proceed as outlined under Power Steering System Test Procedure, page 110.
13. The presence of trapped air in the system will cause the fluid level in the pump to rise when the engine is turned off. Continue to bleed system until this condition no longer occurs.

BRAKE LINES REPLACEMENT –

CAUTION: Never use copper tubing because copper is subject to fatique cracking and corrosion which could result in brake failure.

1. Procure the recommended tubing and steel fitting nuts of the correct size. (Outside diameter of tubing is used to specifiy size.)
2. Cut tubing to length required. Correct length may be determined by measuring the old line using a cord and

BRAKES (Continued)

adding 1/8" (3 mm) for each double flare.

3. Double flare tubing ends using a suitable flaring tool such as J-23530. Follow instructions included in tool set. Make sure fittings are installed before starting second flare.

CAUTION: Double flaring tool must be used as single flaring tools cannot produce a flare strong enough to hold the necessary pressure.

4. Bend line assembly to match old line, using tubing bender. Clearance of .75" (19 mm) must be maintained to all moving or vibrating parts.

BRAKE HOSES INSPECTION — The flexible hydraulic hoses which transmit hydraulic pressure from the steel brake line on the frame to the rear axle and to the calipers should be inspected every four (4) months or 6000 miles (9600 km). The brake hose assembly should be checked for road hazard damage, for cracks and chafing of the outer cover, and for leaks and blisters. A light and mirror may be needed for an adequate inspection. If any of the above conditions are observed on the brake hoses, it will be necessary to replace it.

NOTE: Replace a flexible brake hose if it shows signs of softening, cracking, or other damage. When installing a new brake hose, position the hose to avoid contact with other vehicle parts. Whenever a brake hose is disconnected from a wheel cylinder or brake caliper, install a new copper washer connecting the hose.

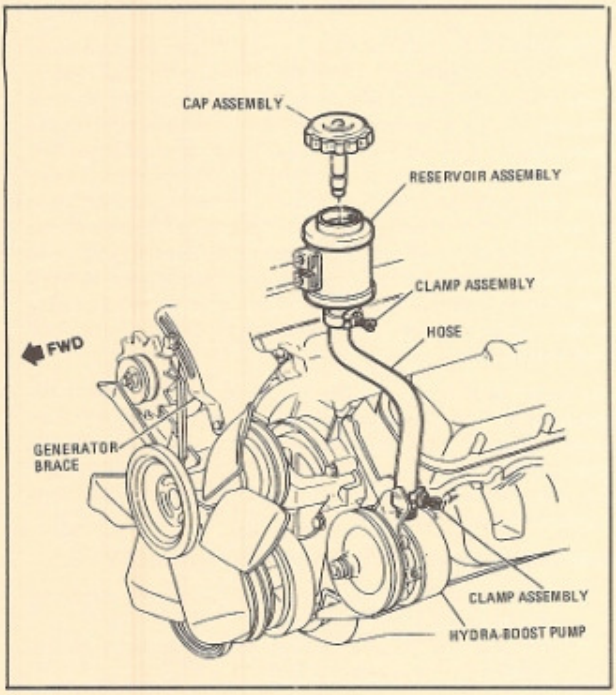


Figure 151 — Hydra-Boost Reservoir

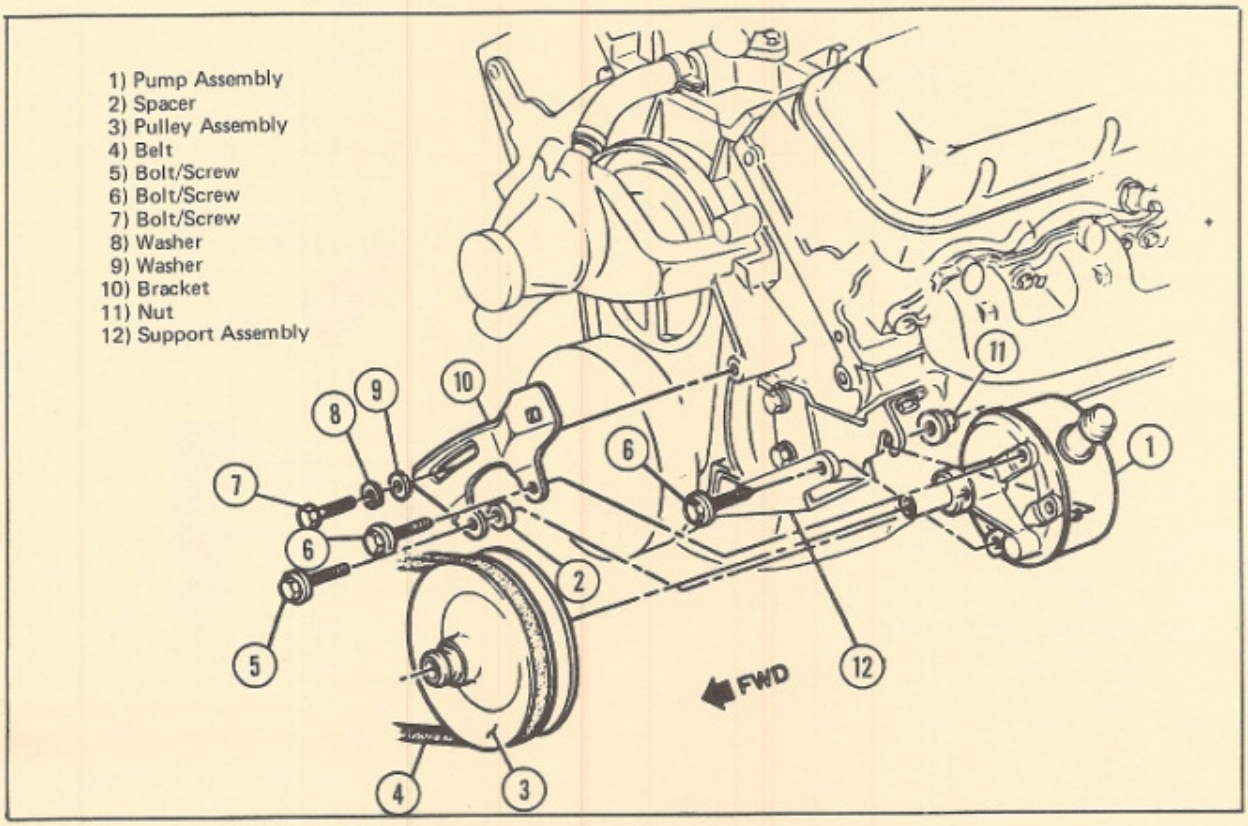


Figure 152 — Power Steering Pump Mounting

BRAKES (Continued)

HYDRO-BOOST SYSTEM – The brake system diagram for a Hydro-Boost installation is illustrated in figure 153. The Hydro-Boost is normally mounted on the front side of the firewall and used with a suspended brake pedal. The Hydro-Boost is either mounted directly to the firewall or to brackets attached to the firewall. In addition to mechanical connections to the pedal or input rod, four (4) hydraulic connections also need to be made. One connection is from the supply pump to the booster inlet port. A second connection delivers the hydraulic flow from the booster gear port to the steering gear. A third hose returns internal leakage and fluid from the boost cavity to the pump reservoir. The fourth connection returns fluid from the steering gear.

The hydro-boost unit includes a nitrogen charged pneumatic accumulator. The accumulator provides two or more reserve power assisted brake applications in the event of pressure supply loss, such as when the engine dies, or the belt breaks, etc. The number of reserve stops varies with the severity and duration of the applications.

BENDIX MINI-MASTER CYLINDER DISASSEMBLY

1. Remove the reservoir cover and diaphragm, and drain the fluid from the reservoir.
2. Remove the four bolts that secure the body to the reservoir using Socket J-25085.
3. Remove the small "O" ring and the two compensating valve seals from the recessed areas on the bottom side of the reservoir.

   Do not remove the two small filters from the inside of the reservoir unless they are damaged and are to be replaced.
4. Depress the primary piston using a tool with a smooth rounded end. Then remove the compensating valve poppets and the compensating valve springs from the compensating valve ports in the master cylinder body.
5. Using a small screwdriver, remove the snap ring at the end of the master cylinder bore. Then release the piston and remove the primary and secondary piston assemblies from the cylinder bore. It may be necessary to plug the front outlet port and to apply low air pressure to the front compensating valve port to remove the secondary piston assembly.

BENDIX MINI-MASTER CYLINDER ASSEMBLY

1. Lubricate the secondary piston assembly and the master cylinder bore with clean brake fluid.
2. Assemble the secondary spring (shorter of the two springs) in the open end of the secondary piston actuator, and assemble the piston return spring (longer spring) on the projection at the rear of the secondary piston.

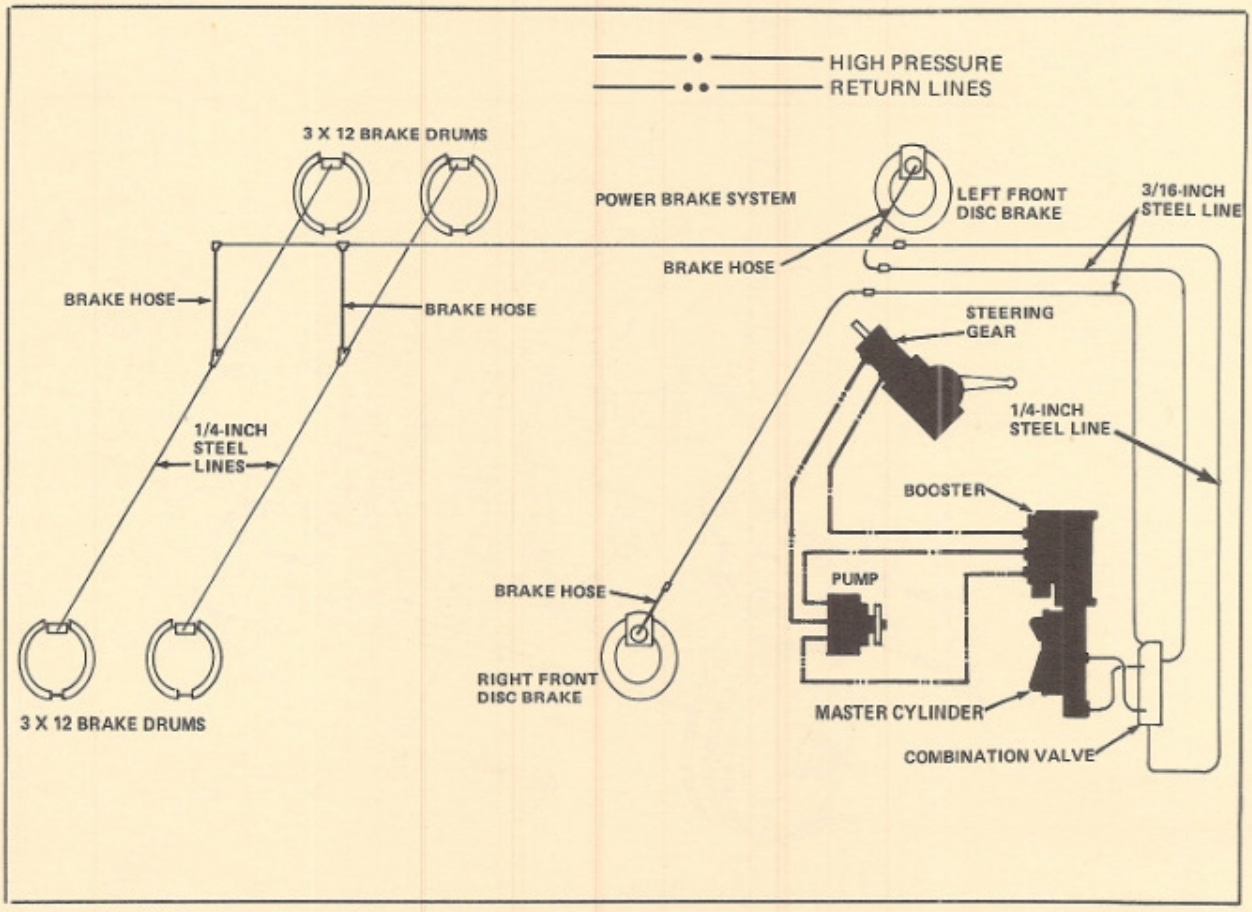


Figure 153 – Hydro-Boost System Schematic

BRAKES (Continued)

3. Insert the secondary piston assembly, actuator end first, into the master cylinder bore, and press assembly, actuator end first, into the master cylinder bore, and press assembly to the bottom of the bore.
4. Lubricate the primary piston assembly with clean brake fluid. Insert the primary piston assembly, actuator end first, into the bore.
5. Place the snap ring over a smooth round ended tool and depress the pistons in the bore.
6. Assemble the retaining ring in the groove in the cylinder bore.
7. Assemble the compensating valve seals and the small "O" ring seal in the recesses on the bottom of the reservoir. Be sure that all seals are fully seated.
8. While holding the pistons depressed, assemble the compensating valve springs and the compensating valve poppets in the compensating valve ports.
9. Holding the pistons compressed, position the reservoir on the master cylinder body and secure with the four mounting bolts. Tighten the bolts to 12-15 lb. ft. (16-20 N·m).

RAIL SLIDER CALIPER, BRAKE SHOES AND LININGS REMOVAL AND INSTALLATION – Replace shoe and lining assemblies as follows when the lining is worn to a minimum thickness of 1/32" (0.794 mm) above the backing plate. Always replace all shoes and lining assemblies on an axle. Never service one wheel only.

1. To avoid fluid overflow when the caliper pistons are pressed into the caliper cylinder bores, siphon or dip part of the brake fluid out of the larger master cylinder reservoir, (connected to the front disc brakes). Discard the removed fluid.
2. Raise the vehicle and install safety stands. Remove the the front wheel and tire assembly.
3. Remove the key retaining screw (see figure 155).
4. Using a brass rod and light hammer, drive out the key and spring, (see figure 156). It is not necessary to disconnect the hydraulic line to the caliper.
5. Remove the caliper from its support assembly by rotating the key and spring end out and away from the rotor. Slide the opposite end of the caliper clear of the slide in the support and off the rotor. Lay the caliper on the tie rod or axle.

NOTE: Do not let the caliper hang with its weight on the brake hose or the hose may become stretched or twisted.

6. Remove the caliper brake shoe anti-rattle spring and the inner and outer shoe and lining assemblies.
7. Thoroughly clean the areas of the caliper and support that contact during the sliding action of the caliper and apply lubricant D7AZ-19590-A or equivalent to the contact areas.

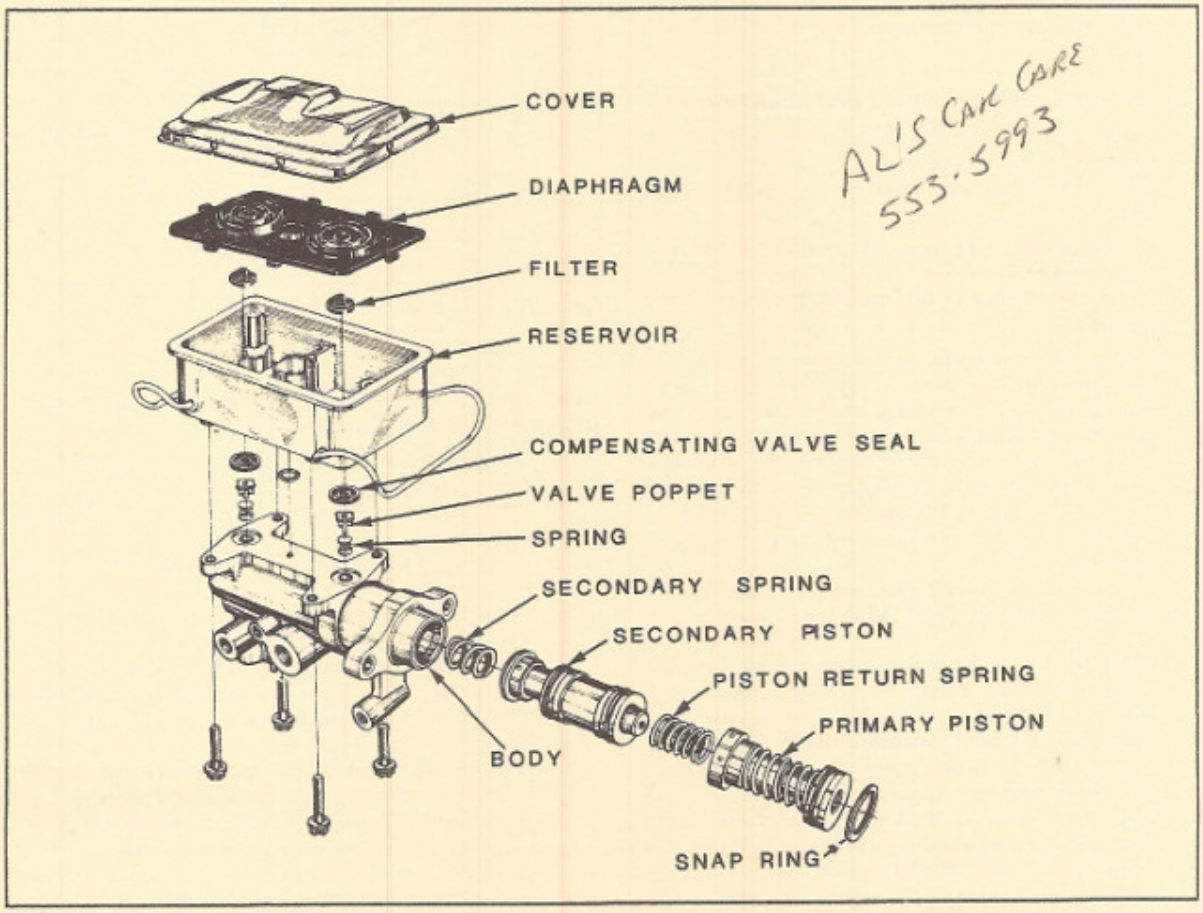


Figure 154 – Bendix Mini-Master Cylinder – Exploded View

BRAKES (Continued)

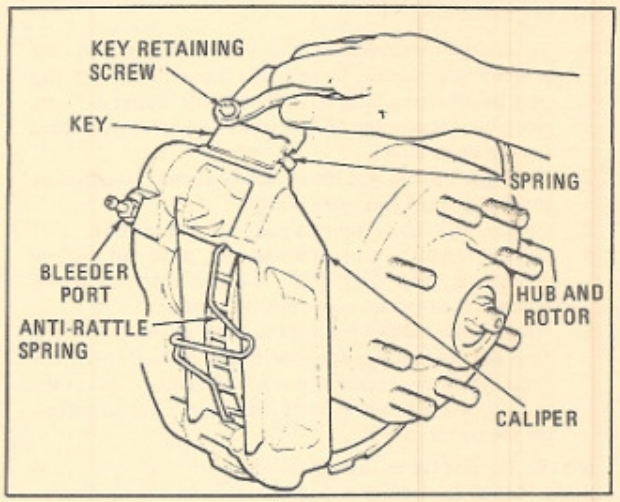


Figure 155 – Removing Key Retaining Screw

8. Place a C-clamp on the caliper housing midway between the piston bores, (see figure 157), and using the old inner shoe and lining over the pistons, tighten the clamp to bottom the caliper pistons in the cylinder bores. Remove the clamp and the inner shoe lining assembly.

BRAKE CALIPER, SHOES, LININGS INSTALLATION –

1. Check to be sure that the caliper pistons are fully bottomed in the cylinder bore.
2. Install new inner and outer shoe. Install anti-rattle spring.

NOTE: Always replace all shoe and lining assemblies on an axle. Never service one wheel only. There is a raised section at one end of each shoe so that installation can be made in one direction only.

3. Position the caliper rail into the slide on the support and rotate the caliper onto the rotor.
4. Position the key and spring, (figure 156), and hand start the subassembly between the caliper and support. Note that the spring is between the key and caliper and that the spring tangs overlap the end of the key, (figure 157). Use a brake adjusting tool or screwdriver to hold up the caliper, if required, against the support assembly.
5. Using a hammer, drive the key and spring into position aligning the correct notch with the existing hole in the support.
6. Secure the key to the support with the key retaining screw, (figure 158). Tighten the screw to 12-20 (lbs.-ft.).
7. After new shoe and lining assemblies and the wheel assemblies have been installed on both front wheels, lower the vehicle. Check the master cylinder reservoirs and fill if necessary with heavy duty brake fluid, C6AZ-19542-A or B (ESA-M6C25-A) or equivalent.
8. Depress the brake pedal firmly several times to seat the linings on the rotor. Do not move the vehicle until the pedal is firm.
9. Bleed the brakes.

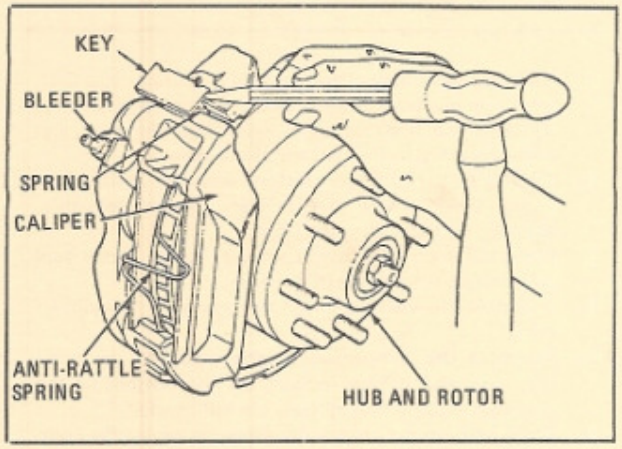


Figure 156 – Removing Spring and Key

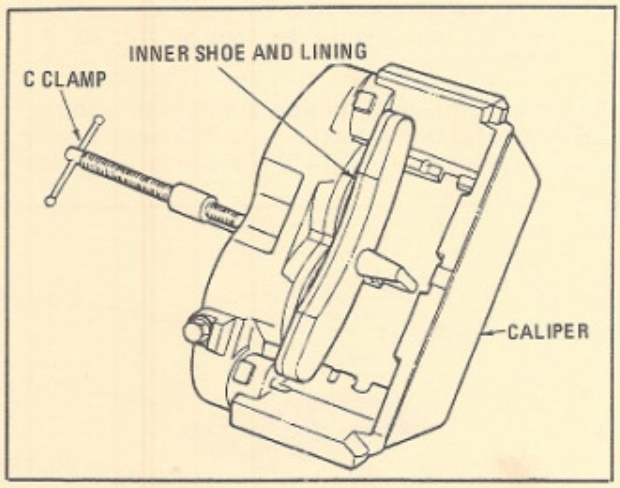


Figure 157 – Bottoming Caliper Pistons

DISC BRAKE CALIPER – RAIL SLIDING CALIPER – DISASSEMBLY AND ASSEMBLY –

1. Disconnect the flexible brake hose and plug the end to prevent brake fluid leakage. Remove the caliper, retaining screw support key and spring and remove the caliper assembly.
2. Remove the brake shoe and lining assemblies and anti-rattle spring.
3. Drain the fluid from the cylinders.
4. Secure the caliper assembly in a vise.
5. Place a block of wood between the caliper bridge and the cylinders, and apply low pressure air to the brake hose inlet. The pistons will be forced out to the wood block,
6. Remove the wood block, and remove the pistons.
7. Remove and discard the piston seals and boots.
8. If the caliper assembly is leaking, replace the piston assemblies. If the cylinder bores are scored, corroded or excessively worn, replace the caliper. Do not hone the cylinder bores. Piston assemblies are not available for oversize bores.

BRAKES (Continued)

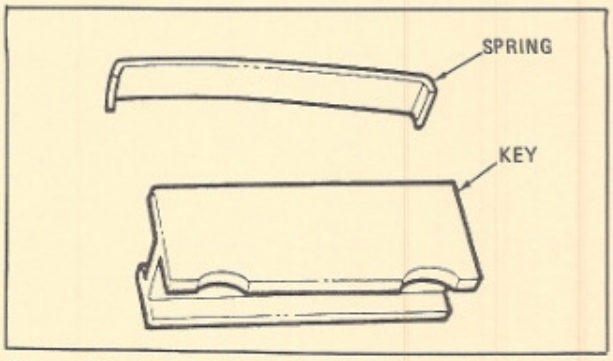


Figure 158 – Caliper Spring and Key

DISC BRAKE CALIPER & RAIL SLIDING CALIPER ASSEMBLY

CAUTION: Never re-use piston seals and dust boots. Install a new set each time the caliper is assembled.

1. Lubricate new piston seals with clean brake fluid C6AZ-19542-A or B or equivalent and install them in the seal grooves in the cylinder bores.
2. Apply a film of clean brake fluid to the cylinder bores.
3. Lubricate the retaining lips of the dust boots with clean brake fluid and install them in the boot retaining grooves in the cylinder bores.
4. Apply a film of clean brake fluid to the pistons.
5. Insert the pistons into the dust boots and start them into the cylinders by hand until they are beyond the piston seals.

NOTE: Be careful not to damage or dislodge the piston seal.

6. Place a wood block over one piston and press the piston into the cylinder being careful not to cock the piston in the cylinder. Install the second piston in the same manner. Make certain that boots are correctly seated.
7. Install the shoe and lining assemblies and anti-rattle clip in the caliper assembly. Place the caliper assembly on the support and install the caliper support spring, key and the key retaining screw. Tighten screw to 12-20 lb. ft.
8. Install the flexible brake hose with new copper washers and tighten to specification.
9. Bleed the brake system.

CAUTION: Do not move the vehicle until a firm brake pedal is obtained.

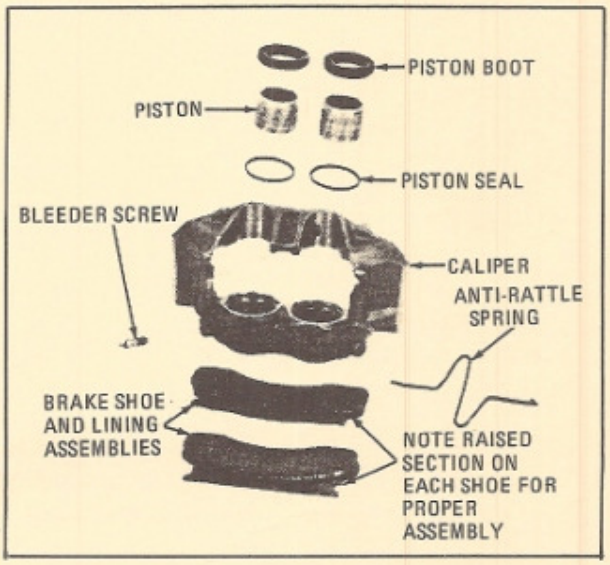


Figure 159 – Front Disc Brake Caliper Disassembled