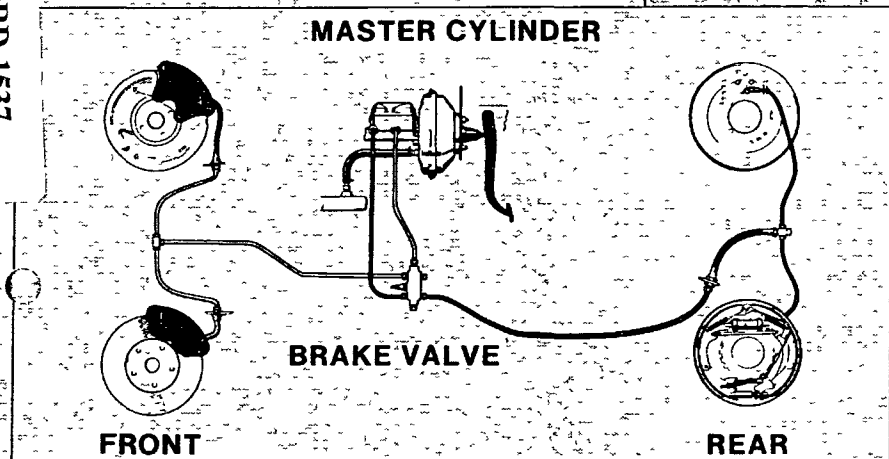


Certified Training Program

CTP 78



DIAGNOSIS OF HYDRAULIC BRAKES

INCLUDES: Master Cylinder
Brake Valve
Disc/Drum Brakes
Hydro-Boost
Diagnosis Guide
Reference Information

CTP-1978-4



Ford Parts and Service Division
Training and Publications Department

TABLE OF CONTENTS

TABLE OF CONTENTS

INTRODUCTION	1
DUAL MASTER CYLINDER OPERATION	2
BRAKE VALVE OPERATION	5
DISC BRAKE OPERATION	8
REAR DISC BRAKE SERVICE	12
DRUM BRAKE OPERATION	16
HYDRO-BOOST OPERATION	17
HYDRO-BOOST DIAGNOSIS	20
NORMAL BRAKE OPERATION	24
• Pedal	24
• Warning Light	25
DIAGNOSTIC TEST	
1 Air Entrapment Test	27
2 Master Cylinder By-Pass Test	28
3 Master Cylinder Non-Pressure Leak Test	29
4 External Leak Test	30
5 Master Cylinder Compensator Port Test	31
6 Power Brake Function Test	32
DIAGNOSIS OF PROBLEM CONDITIONS	34
• Low Pedal, Brake Light On	34
• Low Pedal, Brake Light Off	35
• Erratic Pedal, Brake Light Off	36
• Excessive Pedal, Brake Light Off	36
• Spongy Pedal	36
• Brakes Pull	37
• Brake Fluid Low	38
BLEEDING BRAKE SYSTEM	39
TECHNICAL SERVICE INFORMATION	43
SPECIFICATIONS AND TOOL LIST	44
ANSWERS TO SELF CHECKS	45

NOTE: The recommendations and suggestions contained in this publication are made to assist the dealer in improving his dealership parts and/or service department operations. These recommendations and suggestions do not supersede or override the provisions of the Warranty and Policy Manual and in any cases where there may be a conflict, the provisions of the Warranty and Policy Manual shall govern.

The descriptions, testing procedures and specifications in this handbook were in effect at the time the handbook was approved for printing. Ford Motor Company reserves the right to discontinue models at any time or change specifications, design or testing procedures without notice and without incurring obligations.

INTRODUCTION

ABOUT THIS BOOKLET

This booklet contains information for understanding brake hydraulic system operation, testing in case of malfunction and accurate diagnosis based on test results

DIRECTION

To complete this program booklet

- Study the brake system operation
- Study the diagnostic tests
- Study the procedures for specific problem conditions
- Study the brake bleeding procedures
- Perform the self-instruction exercises on vehicles

SELF CHECK QUESTIONS

The booklet contains self check questions. Check your answers at the back of the booklet. Review the material for any questions answered incorrectly.

FINAL TEST

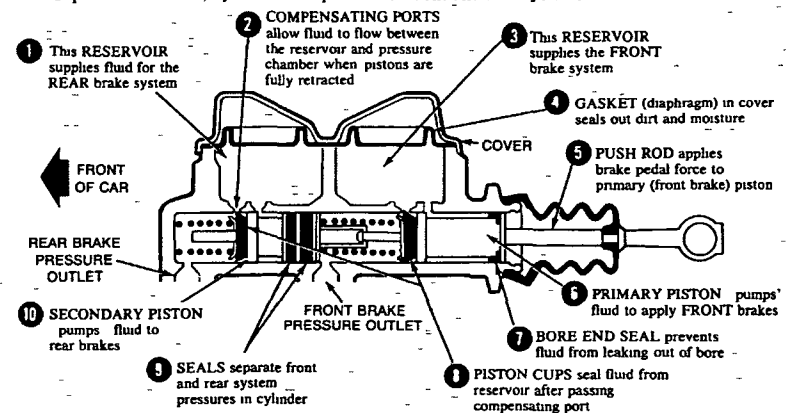
This course will be completed when you show your service manager that you can perform the following

- Identify components of brake hydraulic systems and explain what each does
- Identify normal or correct brake operation
- Perform the following diagnostic tests and interpret results
 - 1 Air Entrapment Test
 - 2 Master Cylinder By-Pass Test
 - 3 Master Cylinder Non-Pressure Leak Test
 - 4 External Leak Test
 - 5 Master Cylinder Compensator Port Test
 - 6 Vacuum Power Brake Function Test
 - 7 Hydro-Boost Function Test
 - 8 Accumulator or Brake Reserve System Test (Hydro-Boost)
- Choose appropriate tests from these for specific problem conditions
- Bleed a brake hydraulic system
- Rebuild a caliper

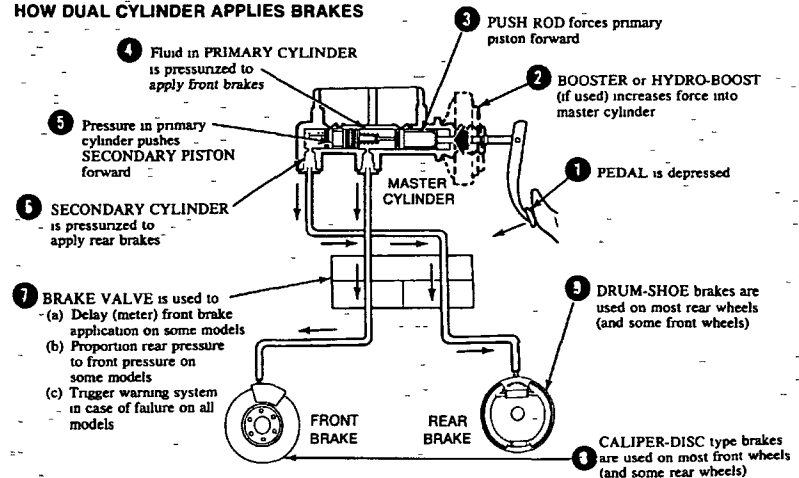
DUAL MASTER CYLINDER OPERATION

DESCRIPTION OF DUAL MASTER CYLINDER

- Separate reservoirs, cylinders and pistons for front and rear systems



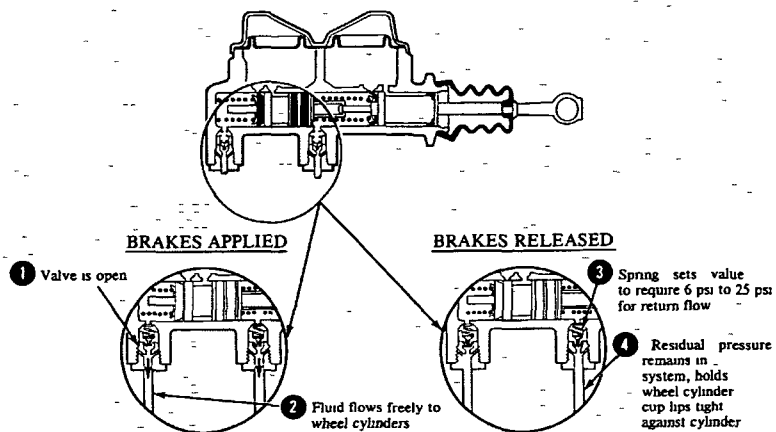
HOW DUAL CYLINDER APPLIES BRAKES



DUAL MASTER CYLINDER OPERATION

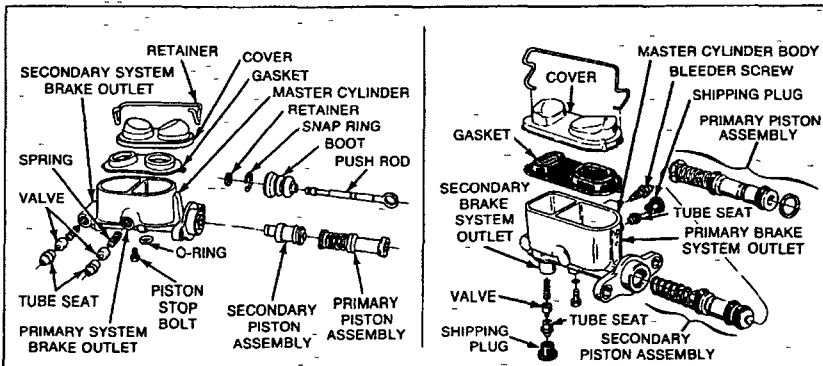
RESIDUAL (OUTLET) CHECK VALVES

- Not used on 1972 and later cars
- Not used with disc brakes or drum brakes with piston cup expanders



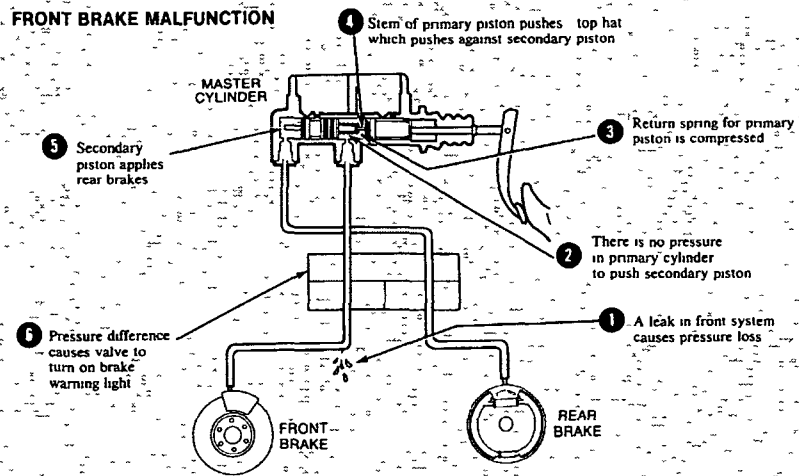
TYPICAL MASTER CYLINDER COMPONENTS

- Disc brakes require larger reservoirs

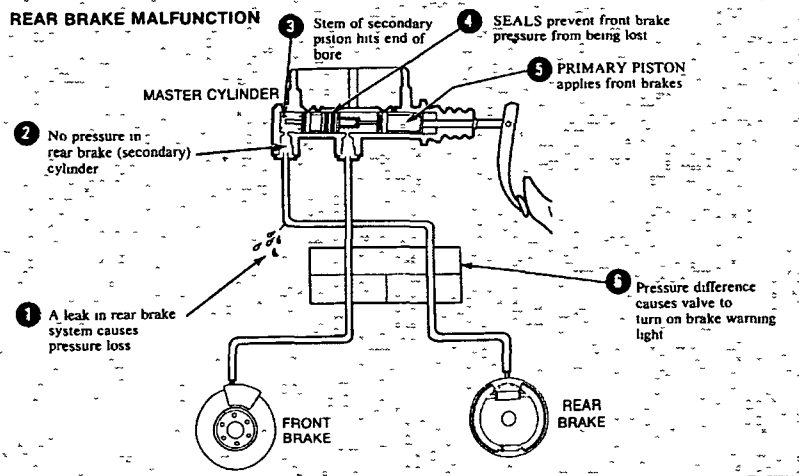


DUAL MASTER CYLINDER OPERATION

FRONT BRAKE MALFUNCTION



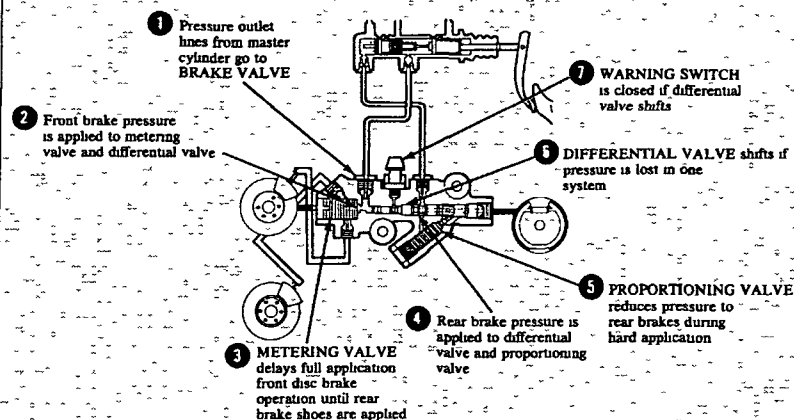
REAR BRAKE MALFUNCTION



BRAKE VALVE OPERATION

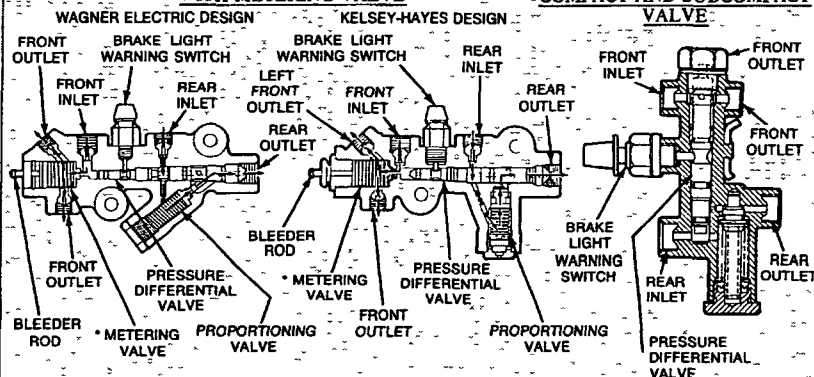
GENERAL DISCRIPTION OF BRAKE VALVE

- 3 valves contained in one body for front disc /rear drum operation
- Metering valve not used in all systems



TYPICAL BRAKE VALVES

WITH METERING-VALVE



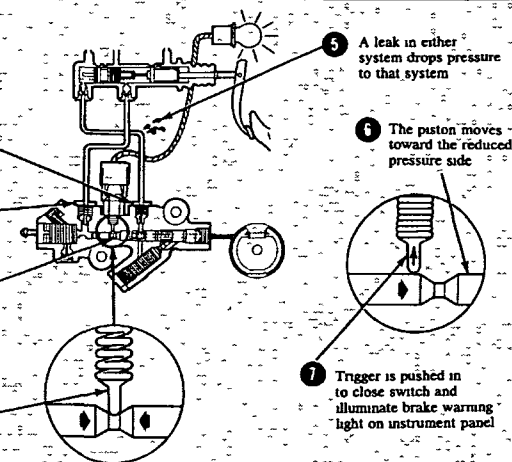
* Metering valve not used on 4-wheel disc brakes

BRAKE VALVE OPERATION

PRESSURE DIFFERENTIAL VALVE

NORMAL OPERATION

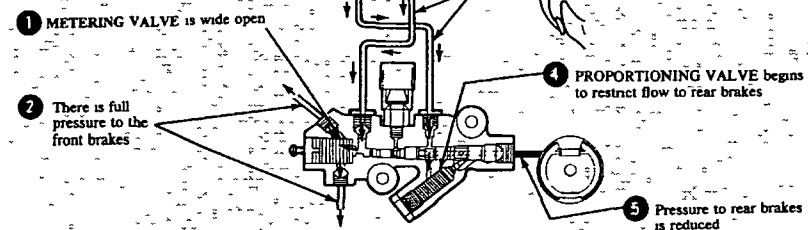
- 1 Rear brake pressure is applied here
- 2 Front brake pressure is applied here
- 3 PISTON is normally held centered by equal pressure at both ends
- 4 Switch trigger extends into groove and switch is open



PROPORTIONING VALVE

- Used on front disc — rear drum brake and 4-wheel disc
- In heavy application, reduces pressure to rear brakes
- Reduces possibility of early rear lockup, proportions less braking effectiveness to rear brakes

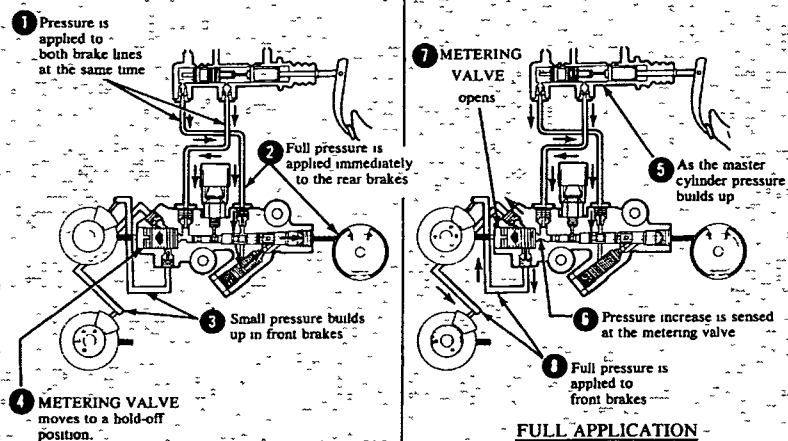
WITH HEAVY BRAKE APPLICATION



BRAKE VALVE OPERATION

METERING VALVE

- Delays full effectiveness of front disc brakes until rear brakes are applied



SELF-INSTRUCTION

- 1 Disassemble a dual master cylinder and familiarize yourself with its parts and how they go together
- 2 Locate a brake valve on a vehicle and trace the pressure lines from the master cylinder and to the front and rear brakes
- 3 Identify the brake warning switch and electrical wiring to the warning light

SELF CHECKS

Answer the following and check your answers at the back of the book

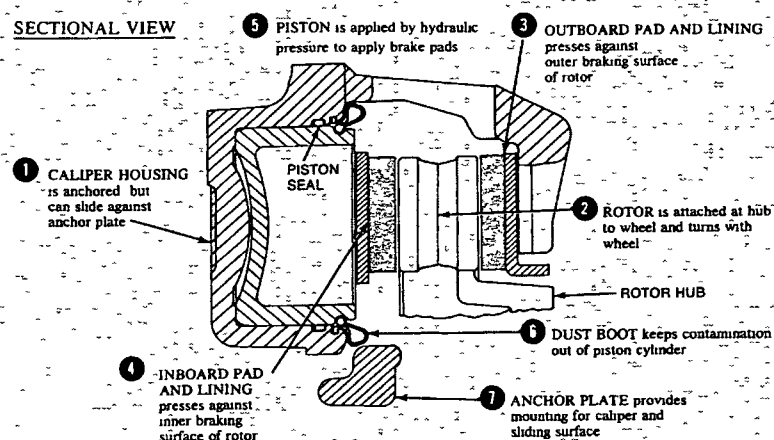
- 1 What is a master cylinder compensating port?
- 2 How does the primary piston in the master cylinder actuate the secondary piston in normal operation?
- 3 If the brake system leaks, what happens? (Give two occurrences)

DISC BRAKE OPERATION

FRONT DISC BRAKE OPERATION

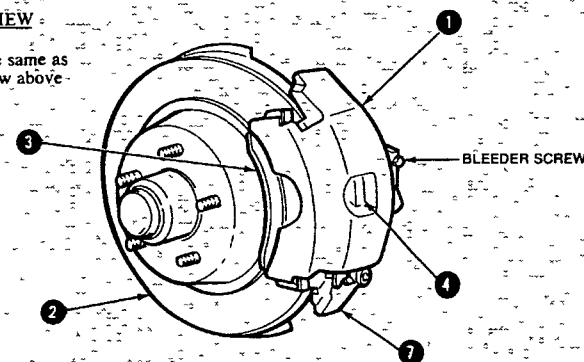
SLIDING CALIPER DESCRIPTION — (Applies to Ford, Mercury, Granada, Monarch, Lincoln Continental, Continental Mark IV and Versailles)

SECTIONAL VIEW



ASSEMBLED VIEW

- Numbers are same as sectional view above



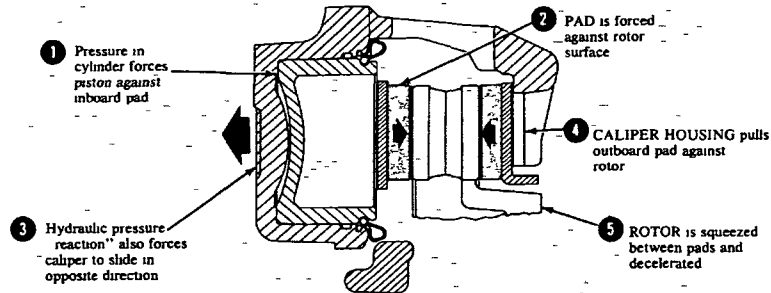
DISC BRAKE OPERATION

FRONT DISC BRAKE OPERATION

SLIDING CALIPER OPERATION

HOW THE CALIPER APPLIES BRAKES

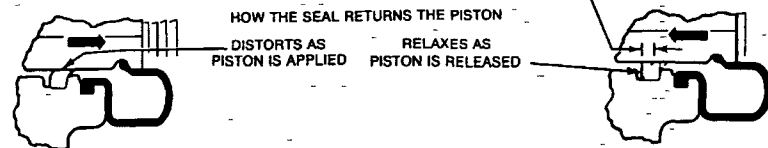
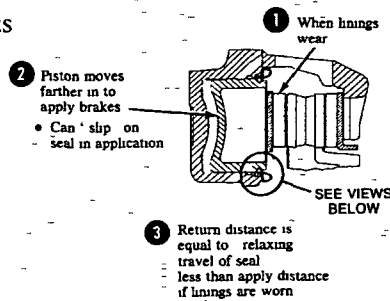
- One piston applies both pads (with fixed caliper, two pistons are required)



HOW THE PISTON SEAL ADJUSTS BRAKES

PISTON SEAL HAS 3 FUNCTIONS

- 1 Seal pressure in the cylinder
- 2 Return "spring" for the piston
- 3 Automatic adjustment for lining wear on front caliper brake system

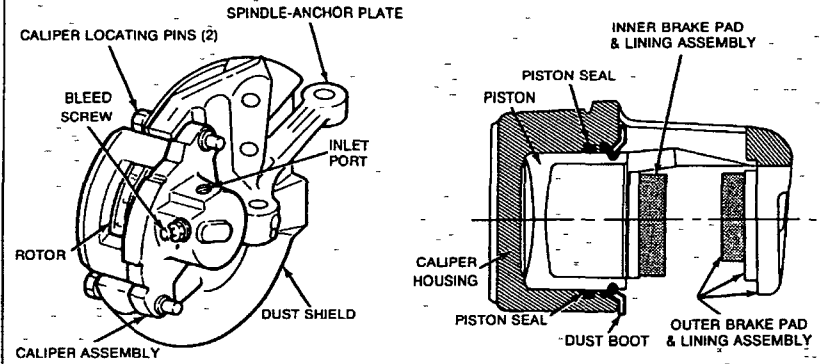


DISC BRAKE OPERATION

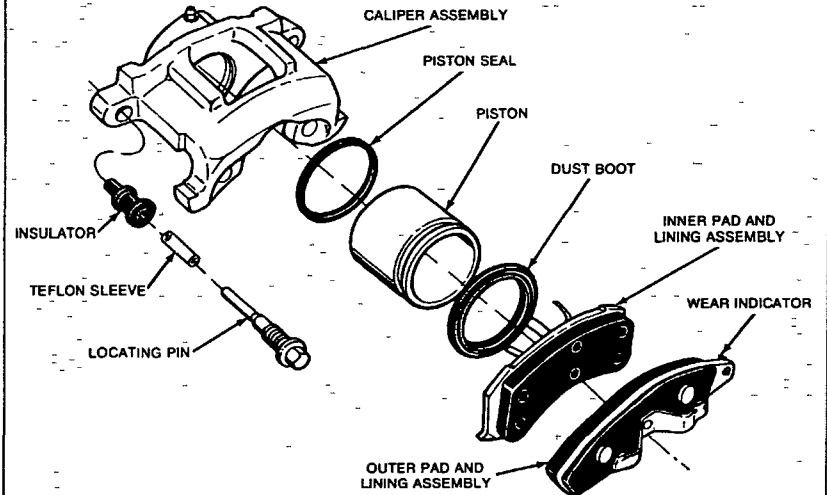
FRONT DISC BRAKE OPERATION

PIN SLIDER CALIPER OPERATION — (Applies to Fairmont and Zephyr)

ASSEMBLED AND SECTIONAL VIEW



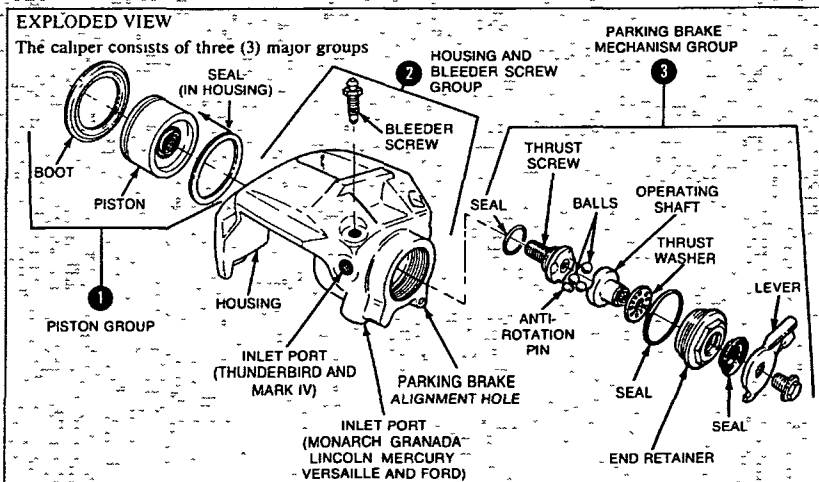
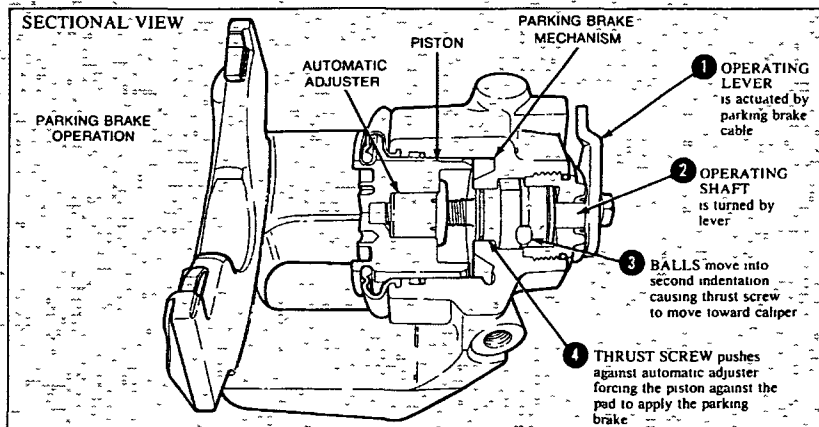
EXPLODED VIEW



DISC BRAKE OPERATION

REAR DISC BRAKE OPERATION — (Applies to Continental Mark IV and Versailles, optional on Lincoln Continental, Ford, Mercury, Granada and Monarch)

- Brakes are applied same as front disc brakes
- Rear parking brakes are adjusted automatically by an adjuster within the piston

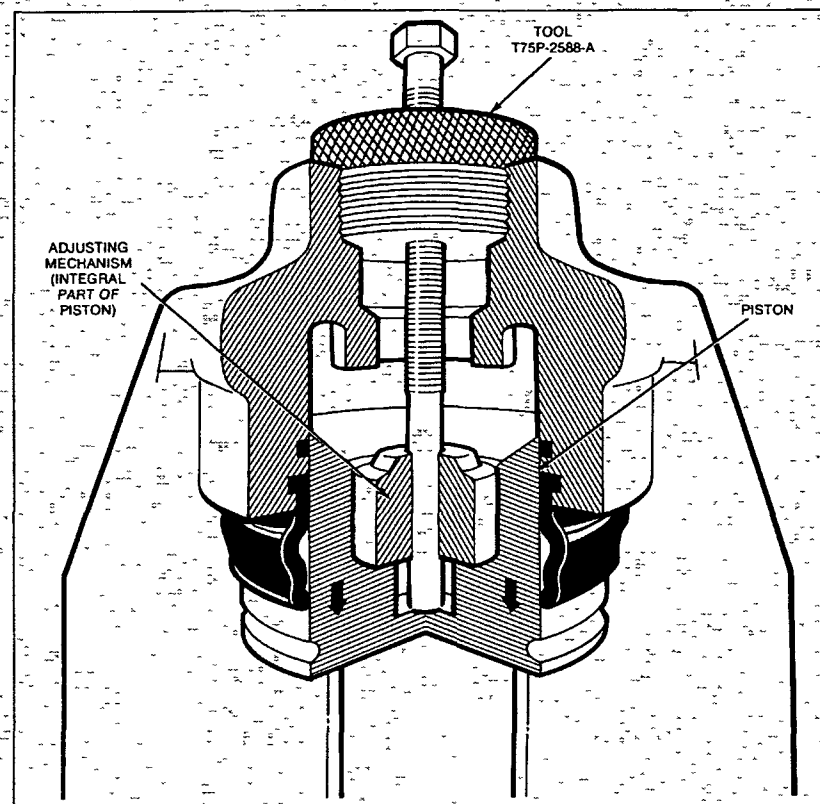


REAR DISC BRAKE SERVICE

PISTON REMOVAL

The rear disc brake piston is removed differently than the front disc brake piston

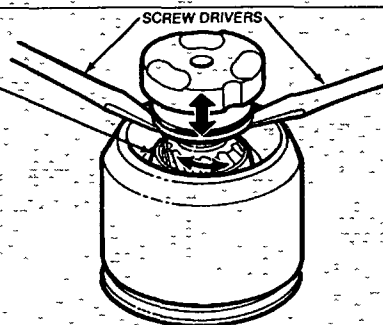
- With the caliper assembly removed, remove the parking brake lever end retainer, operating shaft and balls. Remove the anti-rotation pin with a magnet. Remove the thrust screw with an allen-head wrench. **DO NOT POUND ON THE THRUST SCREW TO REMOVE THE PISTON**
- To remove the piston, use special tool T75P-2588-A. Screw the special tool in the end retainer threads. By turning the bolt in the tool, the piston will be pressed out evenly and smoothly without any piston damage



REAR DISC BRAKE SERVICE

ADJUSTER INSPECTION

- 1 Inspect can for
 - Loose
 - Visible damage
- 2 Insert thrust screw in adjuster until it bottoms
- 3 Insert two screwdrivers under thrust screw and pry up under the thrust screw. The nut should rotate in one direction and the thrust screw move outward.



RESULTS REQUIRED

- NUT TURNS
- THRUST SCREW MOVES OUTWARD

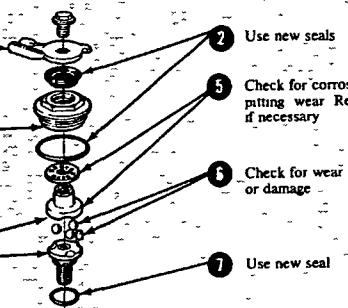
NOTE

Adjuster is not serviced separately. Replace piston assembly if

- Adjuster is loose or high in piston (not bottomed)
- Adjuster is damaged
- Fails test 3
- Brake adjustment is regularly too tight, loose or doesn't work
- Thrust screw is marked RIGHT or LEFT. The piston and thrust screws are not interchangeable

PARKING BRAKE MECHANISM INSPECTION

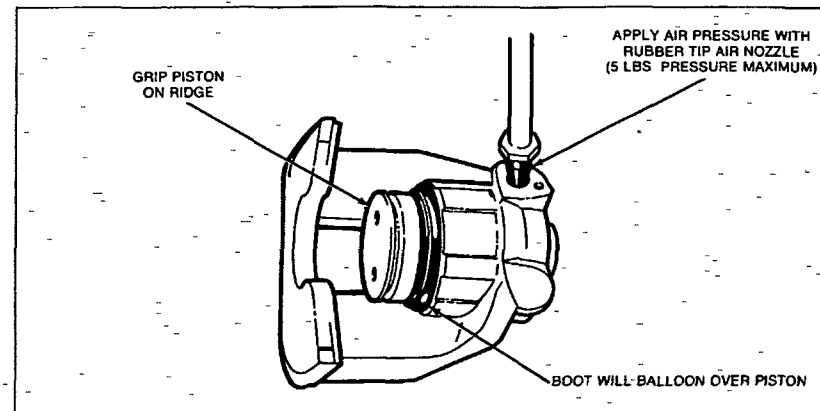
- 1 Replace if damaged or bent
- 2 Use new seals
- 3 Check bearing surface for wear, brinelling (polished OK if no wear)
- 4 Check ball pockets for wear (polished OK if not worn)
- 5 Check for corrosion, pitting, wear. Replace if necessary
- 6 Check for wear or damage
- 7 Use new seal



REAR DISC BRAKE SERVICE

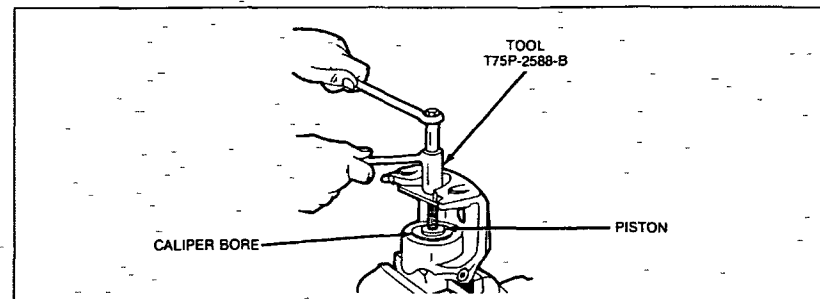
INSTALLING BOOT ON PISTON

An easy way to install the boot on the piston is with low pressure compressed air (5 lbs). Lubricate the boot and seal with brake fluid. Install the end retainer shaft actuator and parking brake lever bolt in the empty caliper bore. Grip the piston by the ridge at the top. Place the piston on the boot. With an air nozzle shoot low pressure compressed air (5 lbs) in the brake line inlet (a pressure gauge can be placed on the bleeder screw to safely regulate the air). The boot will balloon out on the piston. Move the piston until the boot seats on the piston. Stop the air flow. DO NOT ATTEMPT TO PUSH THE PISTON IN THE BORE. REMEMBER TO USE ONLY LOW PRESSURE AIR (5 LBS).



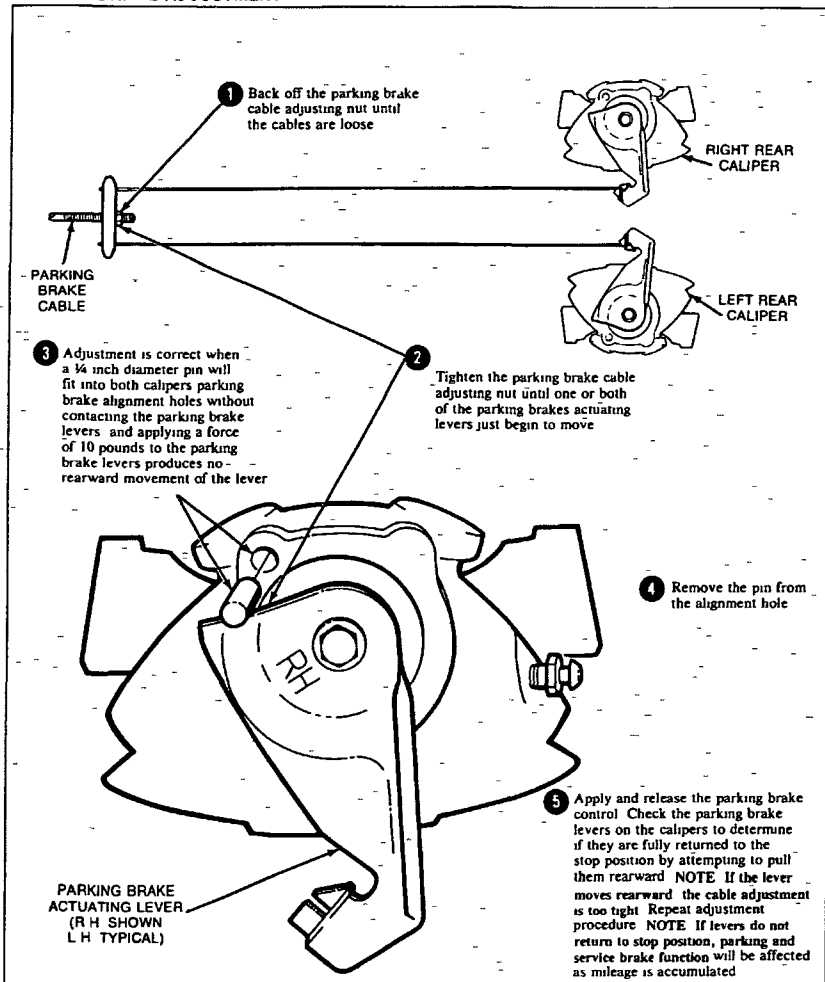
BOTTOMING PISTON IN CALIPER BORE

Bottom the piston in the caliper bore assembly with special tool T75P-2588-B. This will install the piston smoothly and evenly without damage.



REAR DISC BRAKE SERVICE

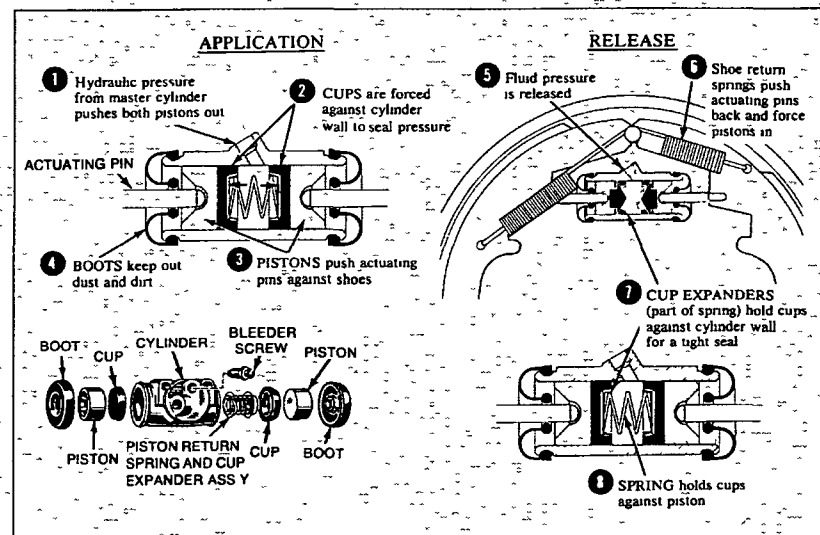
PARKING BRAKE ADJUSTMENT



15

DRUM BRAKE OPERATION

WHEEL CYLINDER OPERATION



SELF INSTRUCTION

- 1 Locate caliper brakes and familiarize yourself with their components
- 2 Observe on-car operation of the rear parking brake linkage to the caliper
- 3 Familiarize yourself with the wheel cylinder and related components of a drum brake system
- 4 Disassemble and assemble a rear disc brake caliper

SELF CHECKS

- 4 When pressure is released from a caliper piston, how is the piston returned? _____
- 5 Which part of the disc brake assembly is attached to the wheel? _____

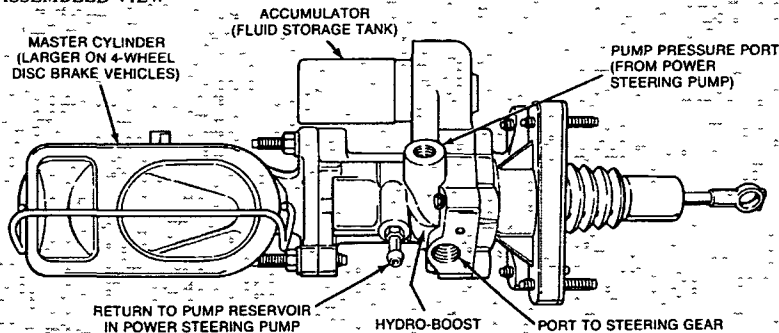
16

HYDRO-BOOST OPERATION

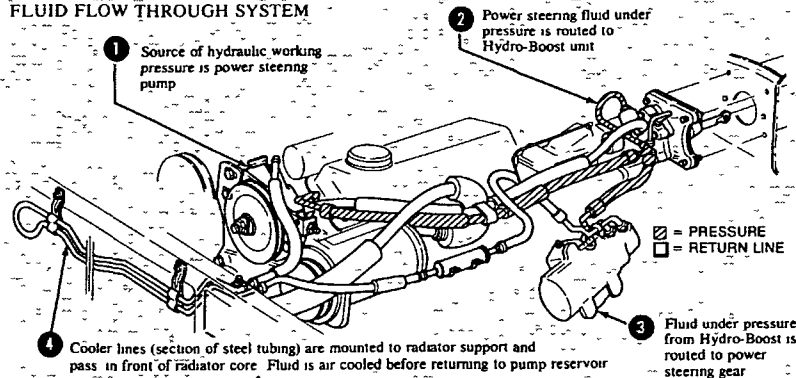
DESCRIPTION

The Hydro-Boost brake booster replaces the brake vacuum booster for brake assist on some vehicles. The power steering pump provides the fluid pressure to operate both the Hydro-Boost unit and the power steering gear. The Hydro-Boost assembly contains an open center spool valve which controls pump pressure magnitude during braking, a lever mechanism to control the position of the valve, and a boost piston to provide the force necessary to operate a conventional master cylinder which is attached to the front of the booster. The Hydro-Boost also has a reserve system which is designed to store sufficient fluid under pressure to provide a brake application in the event that fluid flow from the power steering pump is not available. The brakes can also be applied manually if the reserve system is depleted. The Hydro-Boost unit is not repairable and is replaced as a unit.

ASSEMBLED VIEW



FLUID FLOW THROUGH SYSTEM



HYDRO-BOOST OPERATION

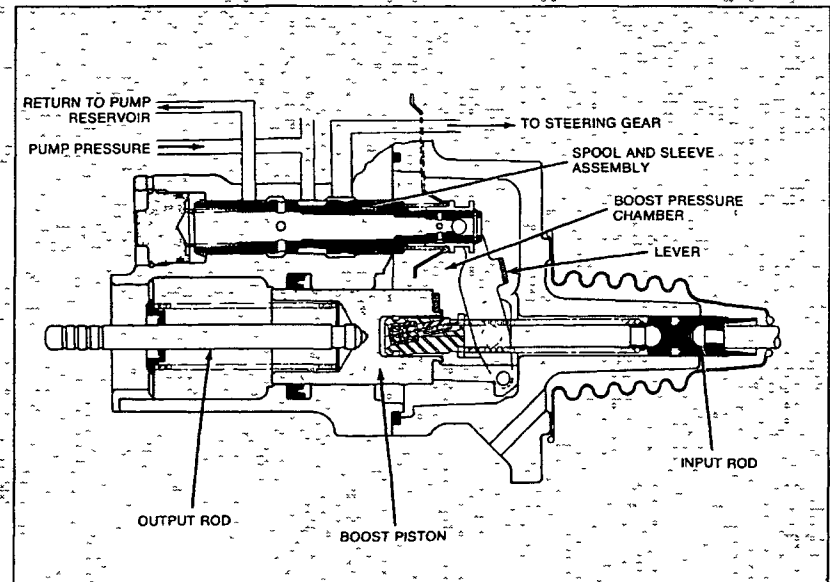
RELEASED POSITION-NO BRAKING

When the brake pedal is in released position (no braking) the spool valve return spring holds the spool valve open. In the open position, the spool valve provides an unrestricted fluid flow between the power steering pump and the power steering gear. Fluid pressure is blocked from entering the boost pressure chamber by lands on the spool valve. Therefore, as fluid pressure increases with steering demand, it has no effect on the boost pressure chamber. The boost pressure chamber is vented through the spool valve to the pump return port and back to the power steering pump.

BRAKING POSITION

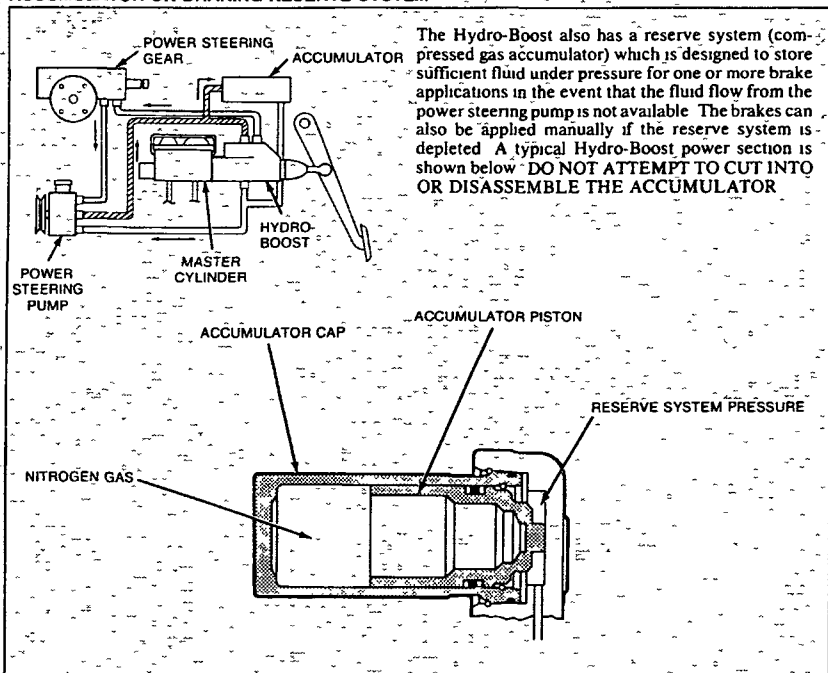
As the brake pedal is depressed, it moves the pedal rod and initiates movement of the spool valve. This preliminary movement of the valve closes the fluid return port to the pump from the boost chamber and admits fluid into the boost chamber from the pressure port. Additional valve movement restricts fluid flow between the pump and steering gear, causing the power steering pump to increase fluid pressure to maintain essentially the same flow rate to the power steering gear. As the fluid pressure increases in the boost chamber, it forces the piston forward actuating the master cylinder piston, resulting in brake application.

If, while braking, fluid pressure is required for steering, pump pressure will rise and the spool valve will shift in an open direction allowing more fluid to flow to the steering gear. Even under extremes of braking, the fluid flow to the steering gear is fully sufficient for steering the car.



HYDRO-BOOST OPERATION

ACCUMULATOR OR BRAKING RESERVE SYSTEM



SELF CHECKS

6. How is the Hydro-Boost system serviced?

SELF INSTRUCTION

1. Locate a vehicle equipped with Hydro-Boost and familiarize yourself with the components
2. Trace the path of fluid flow in the Hydro-Boost system

HYDRO-BOOST DIAGNOSIS

Before beginning any Hydro-Boost diagnostic tests

- Note the condition and compare it to a known good system

Normal Hydro-Boost brake units will produce certain characteristic booster noises that current technology cannot correct. These noises occur, for the most part, when the brake pedal is manipulated in a manner not associated with everyday braking or driving habits. The general category of normal operating noises are (1) hissing noises and (2) clunk, click or chatter noises.

The Hydro-Boost will emit normal hissing noises when above normal brake pedal efforts are applied (40 lbs. pedal effort and up). The hiss sounds are particularly noticeable with the vehicle motionless and will increase in intensity as pedal pressures increase above 40 lbs. and system operating temperature increases. Loud hissing sounds at or below normal (20-25 lbs.) pedal effort warrants investigation and possible correction.

Clunk, clatter or clicking noises will be heard when the brake pedal is quickly released from hard (45-80 lbs.) pedal efforts. The noise is similar to the linkage noises on manual brakes under the same circumstances, only more pronounced. A combination of Hydro-Boost and Sure-Track brake systems will produce more obvious clunks or clicks including a possible double clunk under extreme pedal action. Due to the quick release for hard application requirement for the noises, they will most likely be heard with the vehicle motionless or during a fast stop-start condition.

- Verify that the proper power steering hose connections exist as per the Shop Manual

1. ERRATIC OPERATION, STICKING, BINDING OR GRABBING CONDITION OF HYDRO-BOOST

MEASURE DISTANCE HERE

1. Run engine at fast idle
2. Pull brake pedal rearward with approximately 10 lbs. force. Release the pedal and measure the distance to the floor board.
3. Make a heavy brake application, release the brake pedal and again measure the distance between pedal and floor board. The pedal should return to the normal position.

IF PEDAL DOES NOT RETURN FREELY

- Check for binding conditions in pedal linkage
- Check for obstruction in return line and connections between Hydro-Boost and power steering pump reservoir

FLUID MOVEMENT OR SPOUT

MINOR SPOUTING

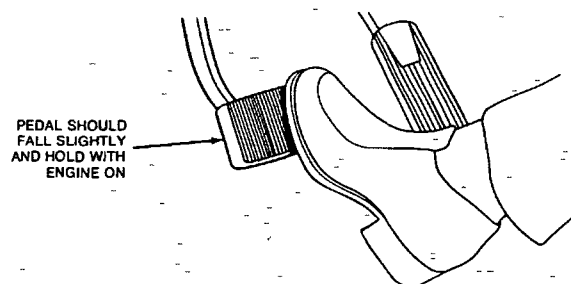
- Remove master cylinder cover. Observe fluid in reservoir while depressing pedal one inch. In the forward reservoir, there should be some fluid movement or spout, and in the rear reservoir, there should be some minor movement.
- If no spouting or fluid movement occurs, Hydro-Boost unit is defective and must be replaced.

HYDRO-BOOST DIAGNOSIS

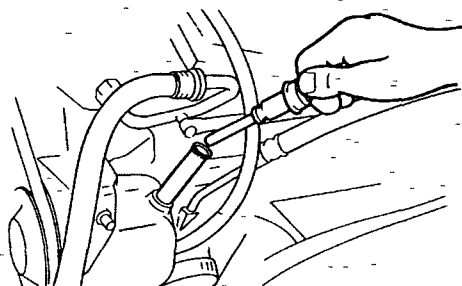
2 EXCESSIVE BRAKE PEDAL EFFORT, BRAKE PEDAL CHATTER AND PULSATION AND/OR LEAKS

BASIC TEST

- 1 Engine off Depress and release brake pedal five times to deplete all hydraulic pressure from Hydro-Boost
- 2 Depress pedal and hold with light pressure Start the engine
- 3 If system is operating correctly pedal will fall slightly and hold Less pressure will be needed to hold pedal down



IF NOT OPERATING CORRECTLY, CHECK POWER STEERING PUMP RESERVOIR FLUID LEVEL



IF FLUID LEVEL OK

- Check power steering belt tension and condition
- Check idle speed and engine tuning
- Check power steering pump flow and relief pressure test
- If all checks are good, the Hydro-Boost unit must be replaced

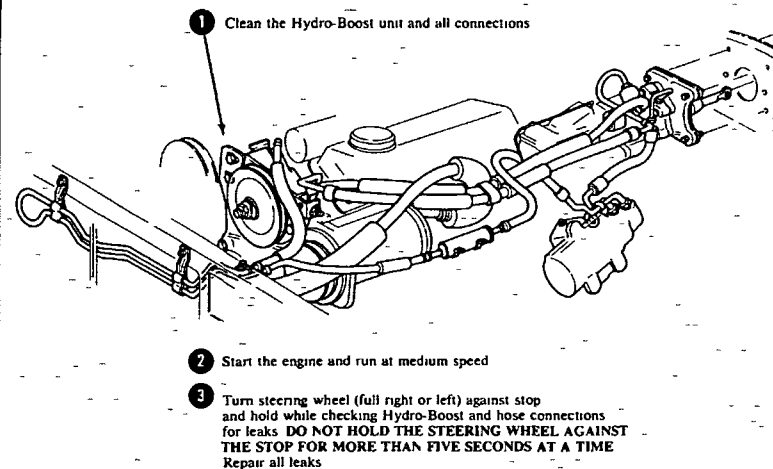
HYDRO-BOOST DIAGNOSIS

2 EXCESSIVE BRAKE PEDAL EFFORT BRAKE PEDAL CHATTER AND PULSATION AND/OR LEAKS (CONTINUED)

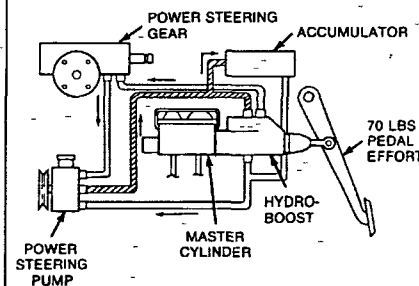
IF FLUID LEVEL NOT OK

- Fill reservoir to specifications and perform Hydraulic Steering Leak Test

HYDRAULIC STEERING LEAK TEST



IF HOSE FITTINGS DO NOT LEAK, CHECK HYDRO-BOOST UNIT FOR LEAKS



- Apply brake pedal with approximately 70 lbs effort and hold while checking Hydro-Boost unit for leaks **DO NOT HOLD FOR MORE THAN FIVE SECONDS AT 70 LBS OR MORE BRAKE PEDAL EFFORT**
- If Hydro-Boost leaks, it is defective and must be replaced

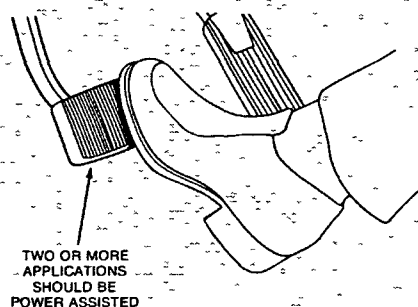
HYDRO-BOOST DIAGNOSIS

2. EXCESSIVE BRAKE PEDAL EFFORT, BRAKE PEDAL CHATTER AND PULSATION AND/OR LEAKS (CONTINUED)

IF BASIC TEST IS OK PERFORM ACCUMULATOR PRESSURE RETENTION TEST

ACCUMULATOR PRESSURE RETENTION TEST

- Run engine to medium speed. Turn steering wheel (full right or full left) against stop and hold for NOT MORE THAN FIVE SECONDS
- Stop engine
- Wait 90 seconds and apply brakes. Two or more brake applications should be power assisted
- If applications are not power assisted, Hydro-Boost unit is defective and must be replaced



IF APPLICATIONS ARE POWER ASSISTED, PERFORM HYDRAULIC STEERING LEAK TEST (REFER TO PAGE 22)

IF SYSTEM PASSES HYDRAULIC STEERING LEAK TEST, PERFORM BRAKE SYSTEM EXTERNAL LEAK TEST (REFER TO PAGE 30)

SELF-INSTRUCTION

- On a vehicle equipped with Hydro-Boost, perform all the Hydro-Boost Diagnostic Tests

NORMAL BRAKE OPERATION

Changes in brake pedal feel or travel are usually the first indicators that something could be wrong in the brake system

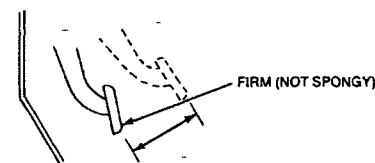
The following diagnostic procedures are based on

- Pedal feel
- Pedal travel
- Warning light illumination
- Master cylinder fluid level

Before going into diagnosis, be sure you can identify normal conditions as follows

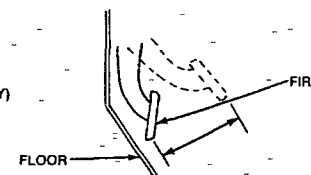
NORMAL PEDAL ACTION

WITHOUT POWER ASSIST



NORMAL PEDAL

- System is probably okay



LOW PEDAL

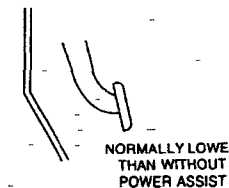
- May be a leak if warning light comes on
- May need rear adjustment - Try several firm reverse stops to actuate automatic adjusters



HEIGHT OKAY BUT SPONGY

- May need air bled from system
- May be normal, compare with a known - good car

WITH POWER ASSIST

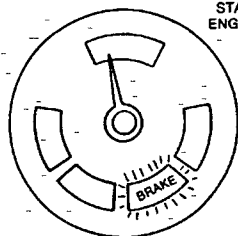


IF AN ABNORMAL CONDITION EXISTS, PERFORM THE APPROPRIATE DIAGNOSTIC TEST (S) IN THE NEXT SECTION

NORMAL BRAKE ACTION

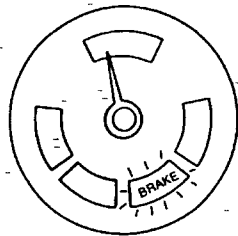
WARNING LIGHT OPERATION

CHECKING LIGHT



- Check light circuit if not functional
- Important Repair before making diagnostic test

WARNING INDICATION



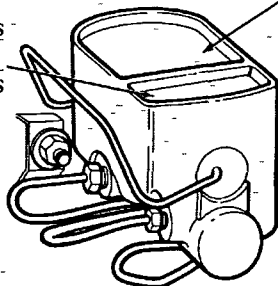
- Illuminates if a brake problem exists

BRAKE FLUID LEVEL

- Wipe off top of cylinder before removing cap

NORMAL IF $\frac{1}{4}$ INCH FROM TOP ON HORIZONTAL MASTER CYLINDERS OR IF $\frac{1}{2}$ INCH FROM TOP ON INCLINED MASTER CYLINDERS MEASURED AT THE REAR OF EACH RESERVOIR

- System is probably leak-free
- Perform leak test procedures if fluid is low



CALIPER SYSTEM (LARGE RESERVOIR)

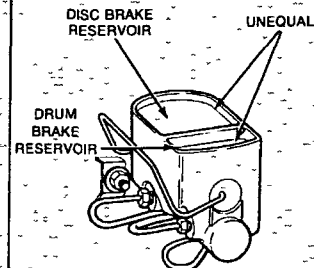
- Lowers as piston adjusts to lining wear
- Add fluid to $\frac{1}{4}$ inch from top on horizontal master cylinders or to $\frac{1}{2}$ inch from top on inclined master cylinders

IF AN ABNORMAL CONDITION EXISTS, PERFORM THE APPROPRIATE DIAGNOSTIC TEST(S) IN THE NEXT SECTION

NORMAL BRAKE ACTION

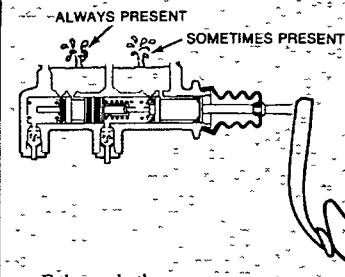
CONDITIONS THAT DO NOT REQUIRE CORRECTION

UNEQUAL FLUID LEVELS ON DISC BRAKE VEHICLES



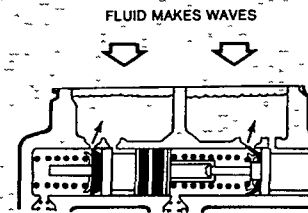
- Fluid in large reservoirs displaced into caliper cylinder with brake shoe wear
- Add fluid to proper level

SQUIRT OR GEYSER WHEN PEDAL IS APPLIED



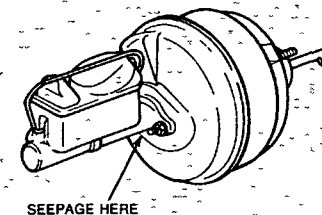
- Either or both reservoirs
- Caused by fluid pushed through compensating ports

TURBULENCE WHEN PEDAL IS RELEASED AFTER BEING PUMPED SEVERAL TIMES



- Caused by fluid returning to reservoir

TRACE OF FLUID ON VACUUM BOOSTER SHELL AT CYLINDER MOUNT



- Caused by lubricating action of master cylinder bore end seal
- Brake fluid does not go into booster because of seal on push rod

THESE NORMAL CONDITIONS REQUIRE NO CORRECTION

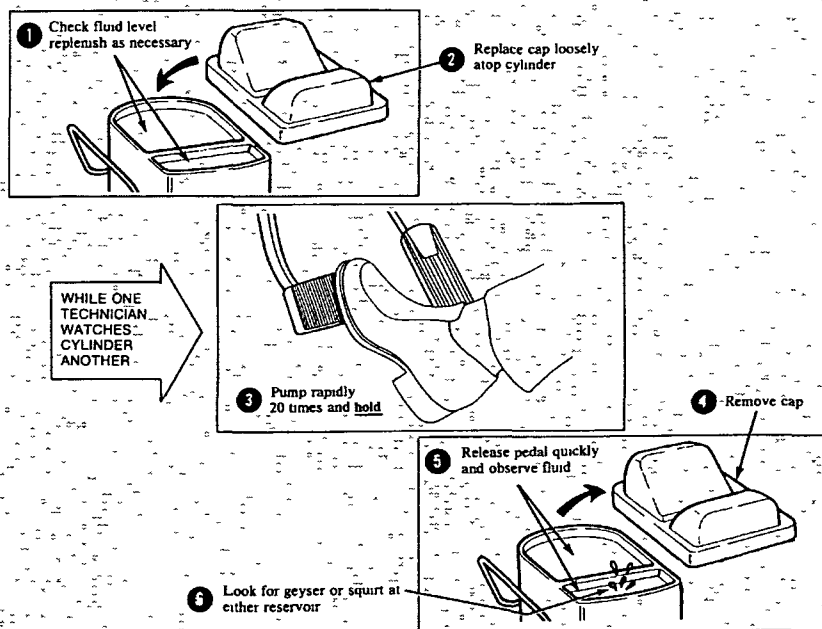
DIAGNOSTIC TESTS

ABOUT DIAGNOSTIC TESTS

- Learn how to perform and interpret the tests on the next few pages
- Usually the abnormal condition will indicate which test(s) to perform
- If in doubt, refer to the diagnosis sequences in the following section, with reference to the specific conditions noted

1 AIR ENTRAPMENT TEST

- Air may be indicated by spongy pedal, low pedal or bottoming pedal



RESULTS

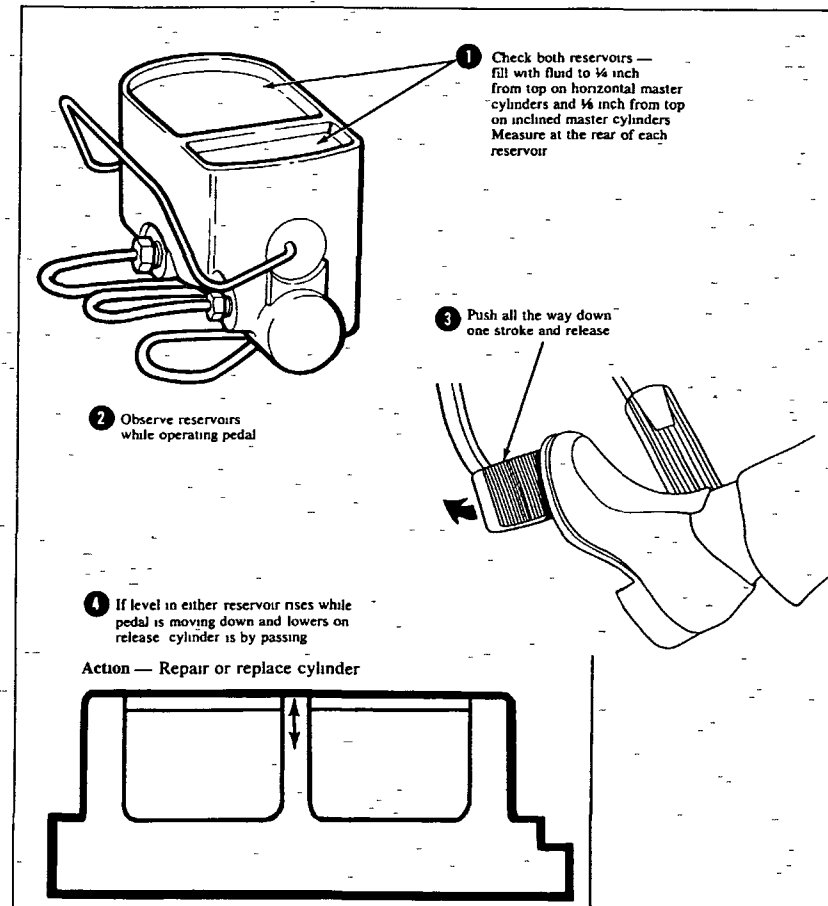
Geyser from reservoir — This indicates air trapped in the system. It is compressed by pumping and causes a squirt when released. (If pedal is low, rear brake misadjustment can also cause a geyser on release)

Action — bleed the affected system or systems. If one reservoir only, you need not bleed the other

DIAGNOSTIC TESTS

2 MASTER CYLINDER BY-PASS TEST

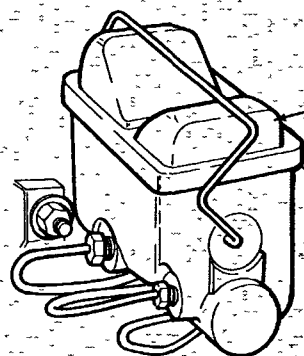
- Check for internal leakage in master cylinder
- While pressing lightly, pedal goes down slowly and warning light comes on, but no indication of loss of reservoir fluid



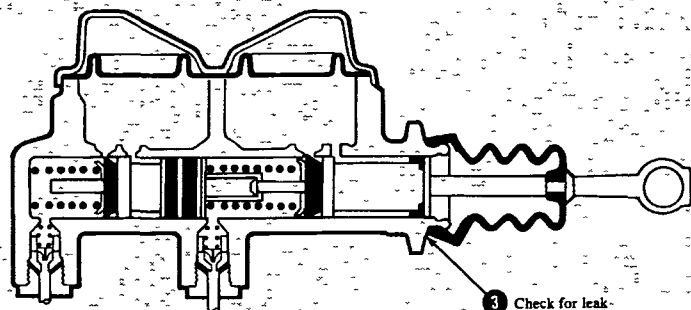
DIAGNOSTIC TESTS

3 MASTER CYLINDER NON-PRESSURE EXTERNAL LEAK TEST

- Reservoir empties, but no external pressure leak (Test-No. 4)



- 1 Check cap and gasket for being properly seated and locked in place
 - Correct if necessary
- 2 Look for rust formation between gasket and top of master cylinder
 - Clean cylinder surface
 - Replace cap and gasket or scrape rust from gasket



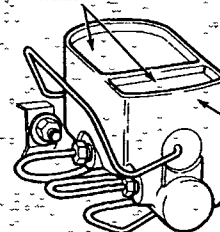
- 3 Check for leak (more than slight seepage)
 - Indicates bore end seal leak
 - Repair or replace cylinder

DIAGNOSTIC TESTS

4 EXTERNAL LEAK TEST

- Pedal low, warning light on
- Fluid level low or reservoir empty
- Evidence of leak may be washed away, fluid is soluble in water

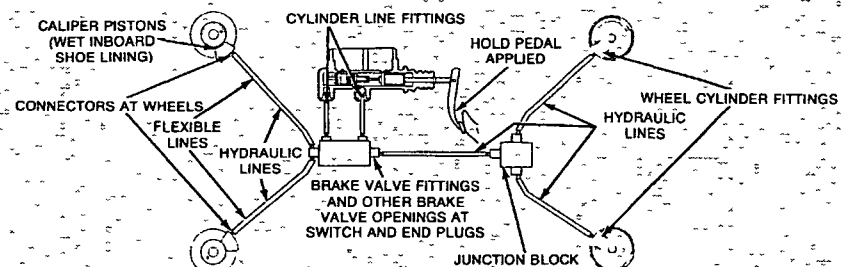
- 1 Fill to proper level and bleed brakes



- 2 Apply several times
 - Will go to floor if system is leaking

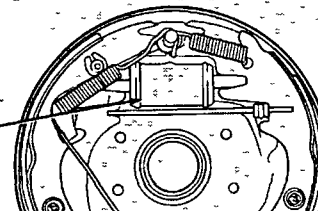
- 3 Check that fluid level is dropping with each pedal stroke
 - Losing fluid — external leak

- 4 Check all possible leak points
 - Repair where leakage is noted
 - Bleed system



IF STILL NOT LOCATED

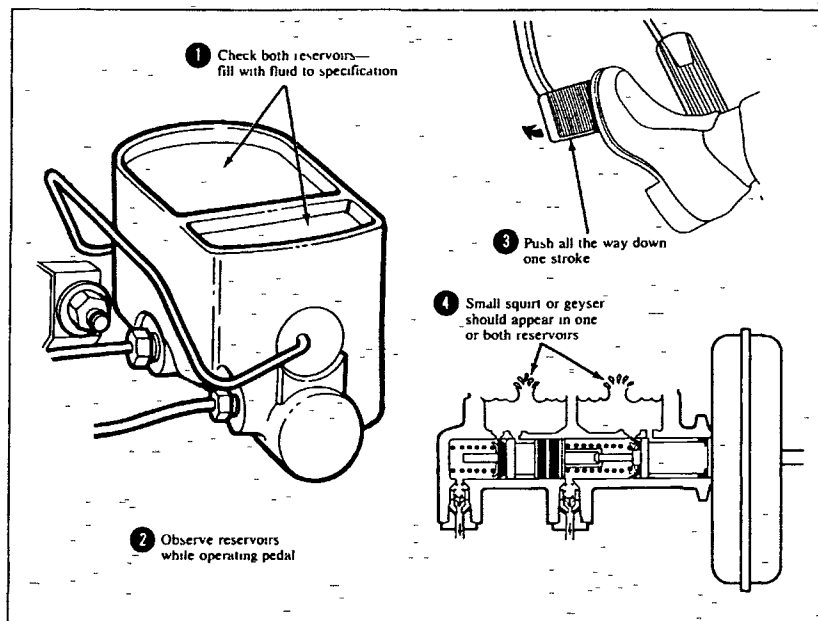
- 5 Remove drums
- 6 Check wheel cylinders
 - Rebuild or replace as necessary
 - Bleed system



DIAGNOSTIC TESTS

5 MASTER CYLINDER COMPENSATOR PORT TEST

- Check for open compensator ports in master cylinder



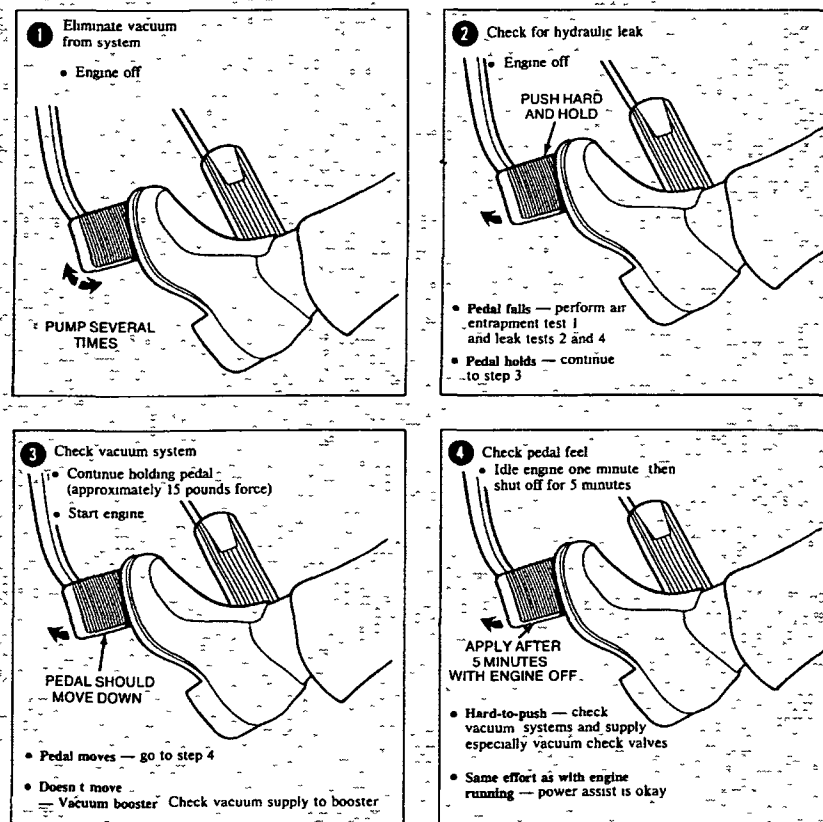
RESULTS

No Squirt or Geyser from Reservoir — Loosen master cylinder attaching nuts $\frac{1}{4}$ inch, hold master cylinder away from booster and repeat steps 2 through 4 above. If a squirt or geyser appears from reservoir, adjust booster pushrod per Shop Manual procedure. If squirt or geyser still does not appear, replace master cylinder.

DIAGNOSTIC TESTS

6 POWER BRAKE FUNCTION TEST

- Vacuum booster only



DIAGNOSTIC TESTS

SELF INSTRUCTION

- Check several brake pedals on vehicles for feel and travel. Note the difference between power and non-power brakes.
- Check the brake warning light operation on several vehicles.
- Check the brake fluid level on at least one vehicle.
- Perform the diagnostic tests 1 through 6 as time and vehicles are available.

SELF CHECKS

7. To check the brake warning light, it should go on when _____.
8. When is a reduced amount of fluid normal in a disc brake master cylinder? _____.
9. When is a geyser okay from the brake reservoir? _____.
10. Fluid moves up and down within a reservoir when you operate the brake pedal, but none is lost. What is the condition? _____.

Not okay? _____

DIAGNOSIS OF PROBLEM CONDITIONS

The following pages give you testing procedures for specific problems, and refer to the tests you have just studied.

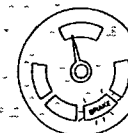
- Be sure you understand and can perform and interpret the tests.
- Pay special attention to the significance of pedal feel and whether or not the brake warning light is on.
- Be sure the brake warning light is operative before you use it as a diagnosis indicator.

DIAGNOSIS OF PROBLEM CONDITIONS

LOW PEDAL — BRAKE LIGHT ON

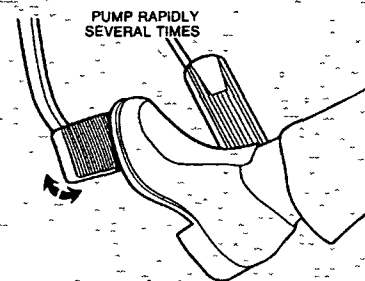


INDICATES FLUID LEAK
MISADJUSTED BRAKES,
OR AIR BEING COMPRESSED



INDICATES PRESSURE
UNBALANCE BETWEEN
SYSTEM ALSO PARKING
BRAKE OR
INOPERATIVE SKID
CONTROL SYSTEM

1 PEDAL FALLS FAST

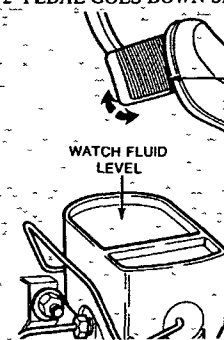


PUMP RAPIDLY
SEVERAL TIMES

RESULTS WITH FOOT PRESSURE APPLIED

- Pedal pumps up and holds — perform Air Entrapment Test 1.
- Pumps up and sinks — perform Master Cylinder By-pass Test 2 and External Leak Test 4.
- Fails to pump up — check fluid level — Empty — fill, bleed and Leak Tests 3 and 4 — Full — Master Cylinder By-pass Test 2.
- Manual Brakes, first application after long shutdown — check for short in stoplight switch.

2 PEDAL GOES DOWN SLOWLY



PUMP ALL THE
WAY DOWN
SEVERAL TIMES

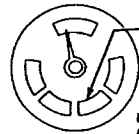
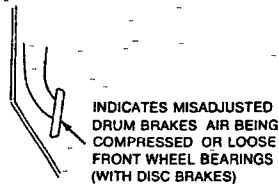
WATCH FLUID
LEVEL

RESULTS

- Fluid level decreases — External Leak Test 4.
- Fluid level rises — If fluid level rises when pedal is stroked and lowers when pedal is released (By-pass Test 2) repair or replace master cylinder.

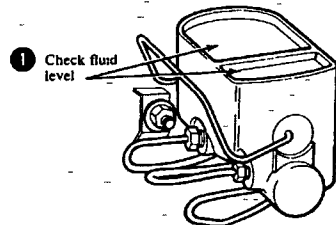
DIAGNOSIS OF PROBLEM CONDITIONS

LOW PEDAL — BRAKE LIGHT OFF



IMPORTANT PERFORM WARNING LIGHT CHECK BEFORE PROCEEDING

PEDAL FALLS SLOWLY

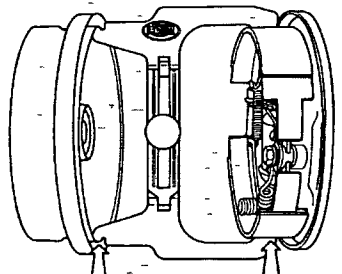


RESULTS

- Empty or low — fill, bleed and perform External Leak Tests 3 and 4
- Full — check for air entrapment, Test 1, especially if pedal is spongy as well as low

IMPORTANT Loose drum brake adjustment also causes geyser on brake release during Test 1 See Step 2 below

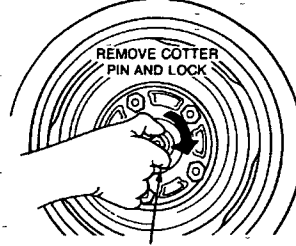
- 2 Remove drum and check drum brake adjustment with Rotunda Tool 11 001. Inspect adjuster mechanism for proper function



SET TO DRUM DIAMETER HERE FIND CORRECT BRAKE SHOE DIAMETER HERE

- 3 Check front wheel bearing on front-disc brake cars

- Loose rotor may force caliper piston back and cause excess lining clearance
- Replace bearing if noisy

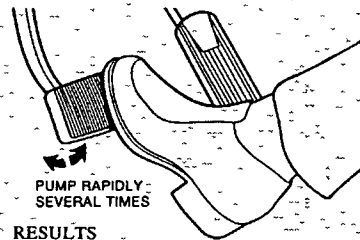


1/6 TURN OR MORE IS TOO LOOSE — PERFORM ADJUSTMENT

DIAGNOSIS OF PROBLEM CONDITIONS

LOW PEDAL — BRAKE LIGHT OFF (CONTINUED)

PEDAL FALLS FAST

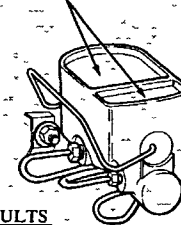


RESULTS

Pedal pumps up — check drum brake adjustment

Doesn't pump up — continue to Step 2

- 2 Check fluid level



RESULTS

Empty — add fluid, bleed, perform External Leak Tests 3 and 4

Full — perform Air Entrapment Test 1 and Power Brake Function Test 6

ERRATIC PEDAL — BRAKE LIGHT OFF CONDITION MAY BE CAUSED BY

- Incomplete brake release
- Loose wheel bearings
- Incorrect parking brake adjustment
- Blocked master cylinder compensator holes

VERIFY BY

- Checking wheel rotation
- Check bearing end play
- Check parking brake tension
- Check for blocked master cylinder compensator holes by performing Test 5

EXCESSIVE PEDAL EFFORT — BRAKE LIGHT OFF

CONDITION MAY BE CAUSED BY

- Bind or obstruction in pedal linkage
- Insufficient booster vacuum or Hydro-Boost pressure

VERIFY BY

- Detach master cylinder from dash or booster and stroke pedal carefully
- Check Hydro-Boost pressures or vacuum by performing Test 6

SPONGY PEDAL

MAY BE NORMAL
• MODERN BRAKES ARE DESIGNED FOR SOFT PEDAL FEEL

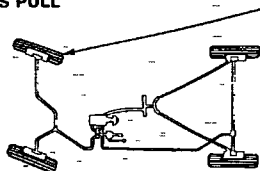


COMPARE WITH ANOTHER LIKE VEHICLE

- Same — probably okay
- Spongy — perform air Entrapment Test 1

DIAGNOSIS OF PROBLEM CONDITIONS

BRAKES PULL



PULLS WHEN BRAKING CAN BE CAUSED BY

- Brakes
- Tires
- Suspension
- Alignment

1 CHECK PEDAL HEIGHT



Low — perform External Leak Test 4 and inspect linings and drums

Normal — Road test vehicle

2 ROAD TEST

CHECK FOR

- Pull when brakes are applied
- Pull in normal driving on level road

RESULTS

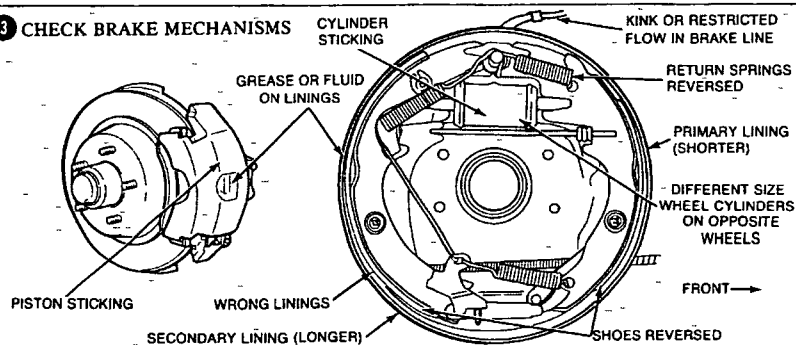
Erratic pull in braking — check alignment, suspension insulators, steering gear adjustment

Pull to same side in braking — check strut insulators, tire pressure, brake drum, rotor, lining brake fluid line restriction (step 3)

No pull with brakes off — probably a brake problem, but may be strut insulator

Pull with brakes off — check alignment, tire pressure radial tire pull, dragging brake shoe

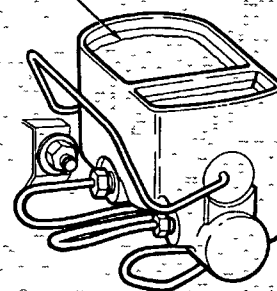
3 CHECK BRAKE MECHANISMS



DIAGNOSIS OF PROBLEM CONDITIONS

BRAKE FLUID LOW

BELOW 1/4 INCH FROM TOP ON HORIZONTAL MASTER CYLINDERS AND 1/2 INCH FROM TOP ON INCLINED MASTER CYLINDERS MAY INDICATE A LEAK



ACTION

Disc system — "top off" if due to lining wear adjustment

Fluid loss — perform External Leak Tests 3 and 4

SELF CHECKS

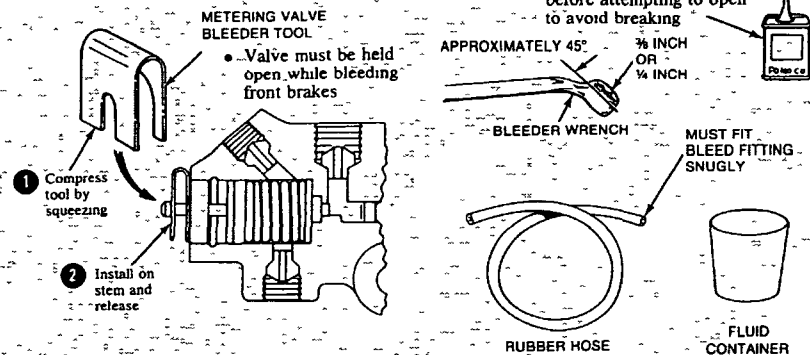
11 Name 3 conditions that can cause the warning light to come on when the service brakes are applied

- (1) _____
- (2) _____
- (3) _____

12 What is the likely result of brake fluid leaking onto linings? _____

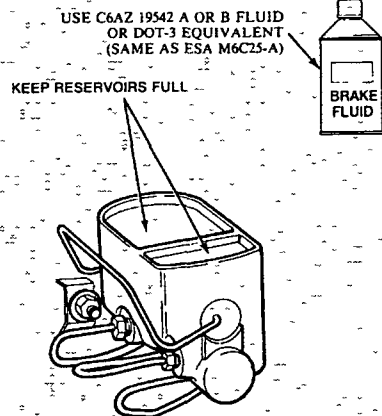
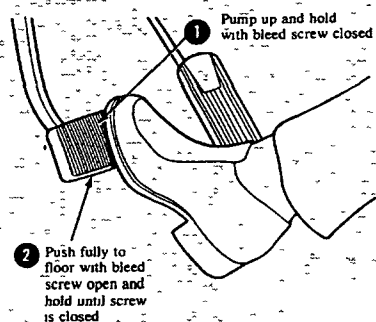
BLEEDING BRAKE SYSTEM

EQUIPMENT FOR BLEEDING



MANUAL BLEEDING

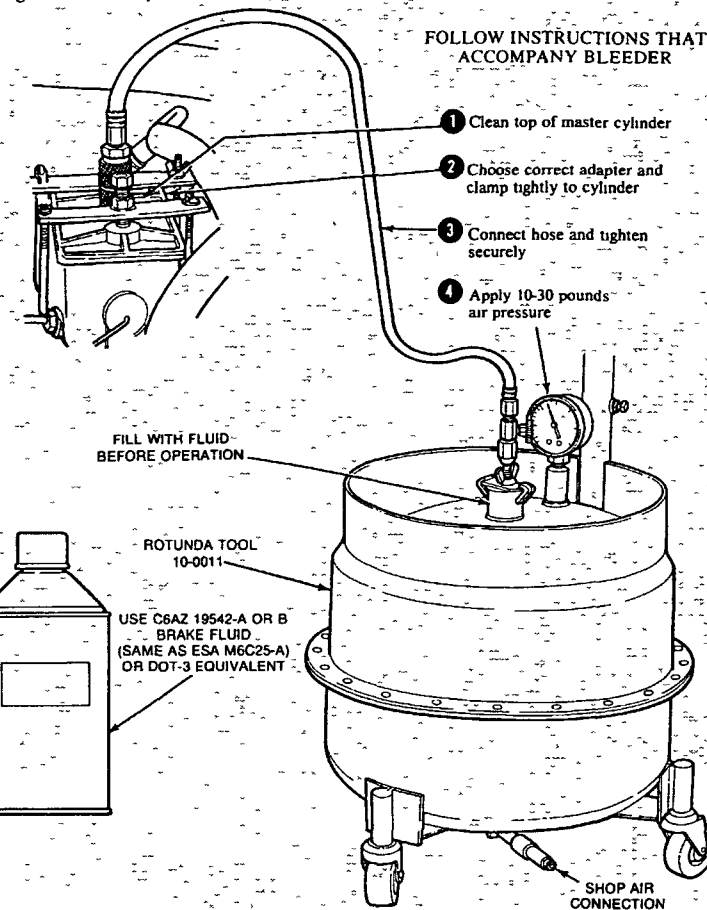
- 2 Man operation



BLEEDING BRAKE SYSTEM

PRESSURE BLEEDING

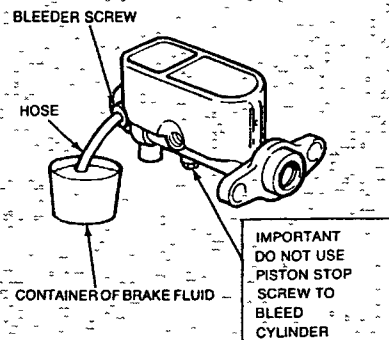
- Diaphragm - type bleeder holds constant pressure
- Replenishes master cylinder reservoirs automatically
- Bleeding is a one-man operation



BLEEDING BRAKE SYSTEM

BLEEDING MASTER CYLINDER

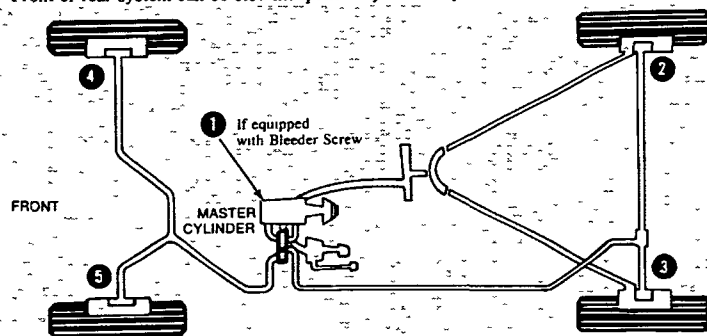
- If equipped with bleeder screw



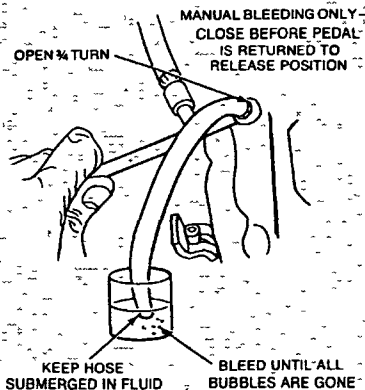
IMPORTANT Do NOT re-use fluid that is bled from system

ORDER FOR BLEEDING

- Farthest from master cylinder, next farthest, and so on
- Front or rear system can be bled independently if both systems aren't affected



BLEEDING WHEEL CYLINDER



BLEEDING BRAKE SYSTEM

HYDRO-BOOST

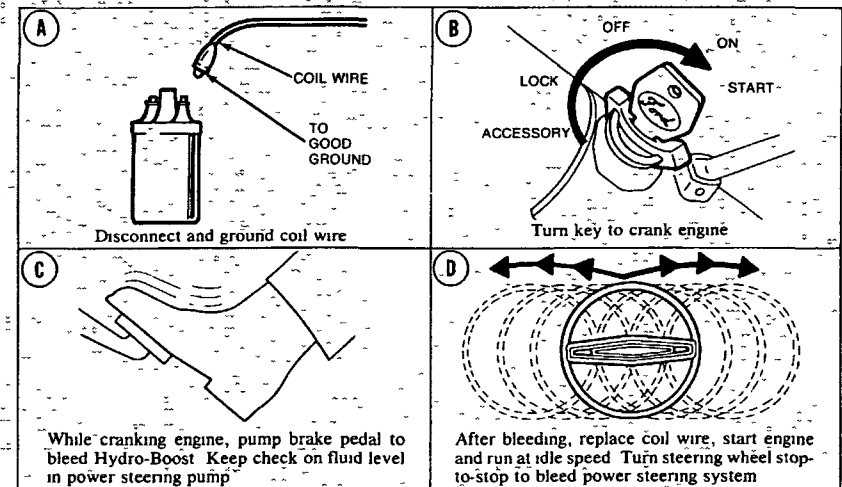
BLEEDING PROCEDURE

Whenever Hydro-Boost power steering pump or power steering gear is removed, serviced, and installed the following bleeding procedure should be used

- Fill power steering pump with approved fluid only

CAUTION

DO NOT CYCLE STEERING WHEEL TO BLEED SYSTEM AT THIS TIME



SELF INSTRUCTION

- Familiarize yourself with brake bleeding equipment in your shop
- If a pressure bleeder is available perform a complete brake bleeding operation on your own car

SELF CHECKS

- 13 If both brake systems must be bled, which system should be bled first? _____
- 14 If only one system is to be bled, which wheel is first? _____

TECHNICAL SERVICE INFORMATION

TECHNICAL SERVICE BULLETINS (TSB)

Description	Year and Model	Bulletin	Date	Article
Brake Asbestos Fiber Dust Removal	All Years — All Car Lines	104	1/23/76	1269-S
Brake Fluid Discoloration	1976 All Car Lines	116	7/19/76	1545
Communication of Certain 1976 Rear Disc Brake Components	1976 Vehicles Equipped with Rear Disc Brakes	101	11/21/75	1306
Disc Brake Caliper Slide Grease	1976 All Vehicles So Equipped	104	1/23/76	1351
Drift Left on Brake Application	1976 Granada Monarch	134	5/9/77	1832
		144	10/6/77	1832 S
New Design Rear Wheel Bolts Axle Shafts and Brake Drums	1976 Torino Ranchero Montego and Cougar	103	12/19/75	1337
New Modified Design Hub and Rotor Assembly and Wheel Stud Design for 1976 Front Disc Brakes	1976 Ford Tonno Elite Mercury Mark IV Lincoln Montego and Cougar	121	10/6/76	1620
Power Brake Booster Diagnosis — Vacuum and Hydro-Boost	1976 Passenger Cars	104	1/23/76	1352
Rear Disc Brake Procedural Clarification — Shop Manual Revision	1976 All Vehicles So Equipped	146	11/4/77	2016
Replacement Hydro-Boost Brake Boosters	1976 Vehicles So Equipped	138	7/6/77	1896
Rear Drum Brake Assemblies Backing Plate Ledge Wear and/or Slow Release of Brakes	1976 All Models with Drum Brakes	104	1/23/76	1354
	1977 Ford LTD Station Wagons and LTD II Police or Taxi Vehicles	146	11/4/77	2015
Drifts Left on Brake Application	1977 Granada Monarch	134	5/9/77	1832
		144	10/6/77	1832 S
Rear Disc Brake Procedural Clarification — Shop Manual Revision	1977 All Vehicles So Equipped	146	11/4/77	2016
Replacement Hydro-Boost Brake Boosters	1977 Vehicles So Equipped	138	7/6/77	1896
Brake Caliper Attaching Bolts	1978 Fiesta	149	12/23/77	2087
Front Disc Brakes Protective Covers	1978 Fiesta	140	8/8/77	1940
Rear Disc Brake Procedural Clarification — Shop Manual Revision	1978 All Vehicles So Equipped	146	11/4/77	2016

TRAINING BOOKLETS

CTP-1974-6 Drum and Disc Brakes (Diagnosis and Repair)
1201-106 Evolution of Brakes

TECHNICAL SERVICE INFORMATION

SPECIFICATIONS

APPLICATION	SPECIFICATION
Residual (outlet) check valve spring pressure	6-25 psi
Air pressure for installing boot on piston	Not more than 5 lbs
Pin size for rear disc parking brake alignment hole during adjustment	1/4 inch
Brake pedal pressure for normal hissing of Hydro-Boost at normal brake pedal application	40 lbs. and up
Brake pedal pressure for loud hissing of Hydro-Boost below normal brake pedal application	20-25 lbs
Brake pedal pressure for clunk, clatter or clicking noises of Hydro-Boost at hard brake pedal application	45-80 lbs
Master cylinder fluid level	1/4 inch from top — horizontal master cylinders 1/8 inch from top — inclined master cylinders
Pressure required on pressure bleeder during brake bleeding	10-30 lbs

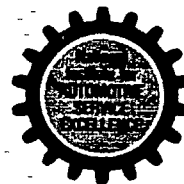
SPECIAL TOOLS

NAME	NUMBER
Rear Disc Brake Caliper Piston Removal Tool	T75P-2588-A
Rear Disc Brake Piston Turning Tool	T75P-2588-B
Drum Brake Adjuster Tool	Rotunda Tool 11-0001
One-Man Diaphragm-Type Bleeder	Rotunda Tool 10-0011

ANSWERS TO SELF CHECKS

Compare your answers with those below. If they do not agree, study the material again until you understand the answers given.

1. A port in the bottom of the reservoir that allows fluid to flow in and out (to and from the brake lines)
2. Through pressure on the fluid in the primary cylinder
3. (1) Front piston mechanically operates the rear piston, so the rear system still operates.
(2) Brake warning light switch is closed by the pressure differential valve
4. By distorting and then relaxing the piston seal
5. The rotor
6. The unit is not servicable. It is replaced as a unit
7. The ignition is in START position with the engine cranking
8. When the disc brake linings are worn
9. When pedal is first applied. Not okay when pedal is pumped rapidly and released
10. Master cylinder is by-passing internally
11. (1) External leak
(2) Master cylinder by-passing
(3) Air entrapment
12. Brakes will pull
13. Rear
14. Farthest from master cylinder



WE SUPPORT VOLUNTARY MECHANIC CERTIFICATION

FPS
APRIL 78 365-450

LITHO IN U.S.A.

COURSE 1201-206