

DESCRIPTION

DUAL BRAKE SYSTEM

A dual brake system, incorporated in all models, provides increased safety. The system consists of a dual master cylinder and a brake control valve assembly. The control assembly may consist of a pressure differential valve, a metering valve and a proportioning valve. A switch on the differential valve activates a brake warning light on the instrument panel if unequal hydraulic pressure occurs.

The master cylinder reservoir closest to the dash panel is used to supply brake fluid to the front wheel brakes. The reservoir closest to the radiator is used to supply brake fluid to the rear wheels.

CONTROL VALVE ASSEMBLY—(PRESSURE DIFFERENTIAL, METERING, AND PROPORTIONING VALVES)

The brake control valve assembly (Fig. 1) may consist of a pressure differential valve, a metering valve, and a proportioning valve. These valves are housed within a single cast-iron valve body (housing). The pressure differential and metering valves are located in the central bore of the valve body. The proportioning valve is located in a separate angular or vertical bore.

Pressure Differential Valve

The pressure differential valve (Fig. 1) senses unbalanced pressure between the front and rear brakes. A pressure loss in either the front or rear brake system, upon pedal application, will move the piston off center, causing the warning light to come on. After repairs are made, and the brake system properly bled, the piston will center itself upon brake application and the warning light will shut off.

The brake warning light switch is mounted on the top of the valve body casting. When the piston is in the centralized position, the spring-loaded switch plunger fits into the tapered shoulder groove, and the switch contacts are open.

Metering Valve

The metering valve is located in the front end of the control valve central bore between the front brake system inlet port and the front brake outlet ports. Its function is to regulate the hydraulic pressure to the front disc brakes. The metering valve location at the front end of the housing center bore provides easy accessibility to the valve bleeder rod during bleeding of the front brake system (see Brake System Bleeding—this Part).

Proportioning Valve

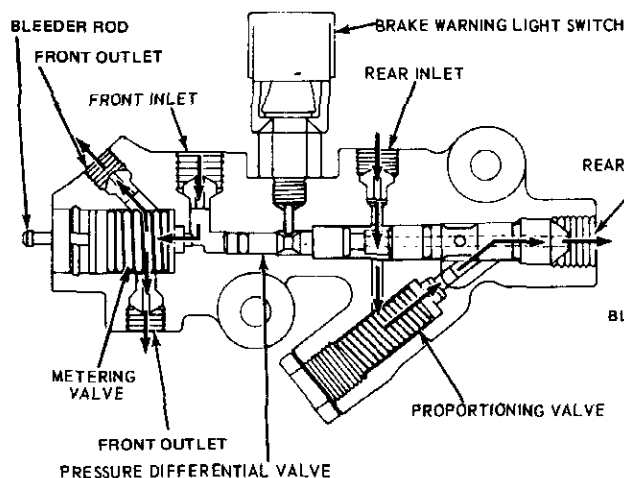
The proportioning valve assembly is installed in a separate angular or vertical bore at the bottom of the valve body casting between the rear brake system inlet and outlet ports. The proportioning valve functions to regulate rear brake system hydraulic pressure.

PRESSURE DIFFERENTIAL AND PROPORTIONING VALVE

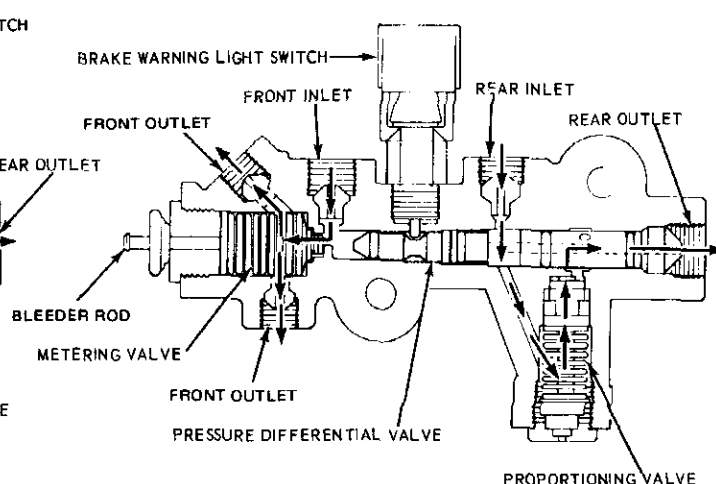
Pressure Differential Valve

The brake warning light switch is mounted at the center of the valve body with the spring-loaded plunger fitting into a tapered shoulder groove in the center of the piston. With the piston in a centralized position the switch contacts remain open.

Should there be a loss of pressure in either the front or rear brake system, when the brake pedal is applied, the piston will move off center, closing the switch contacts and turning on the warning light.

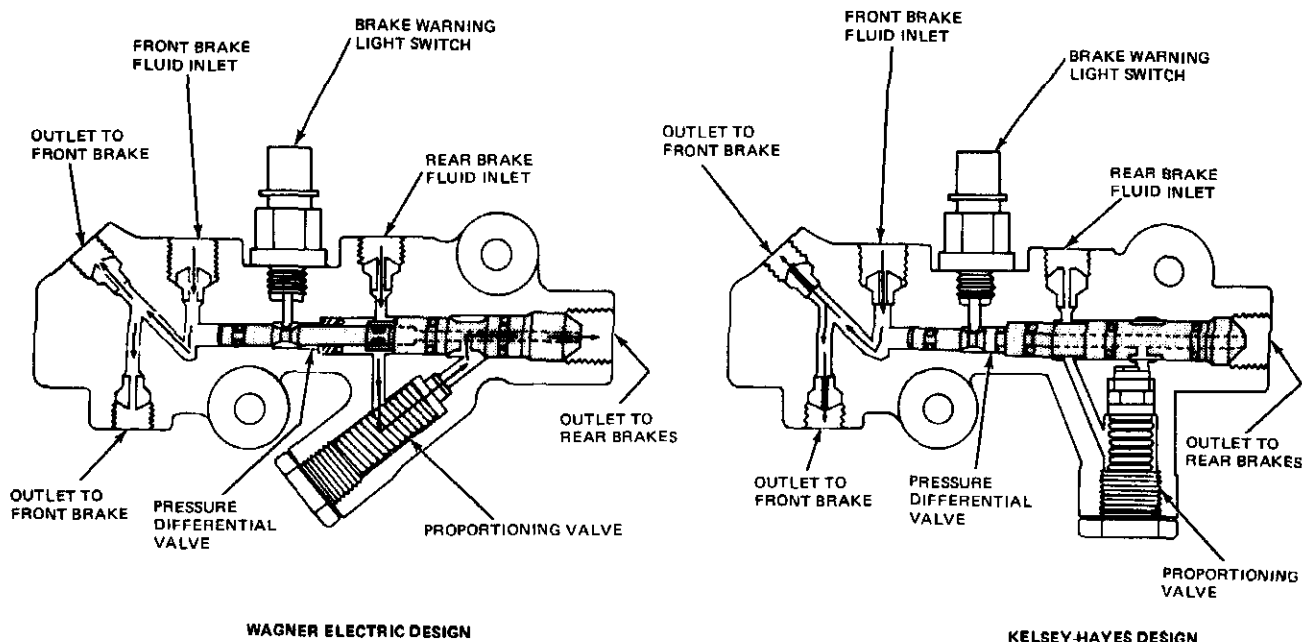


WAGNER ELECTRIC DESIGN



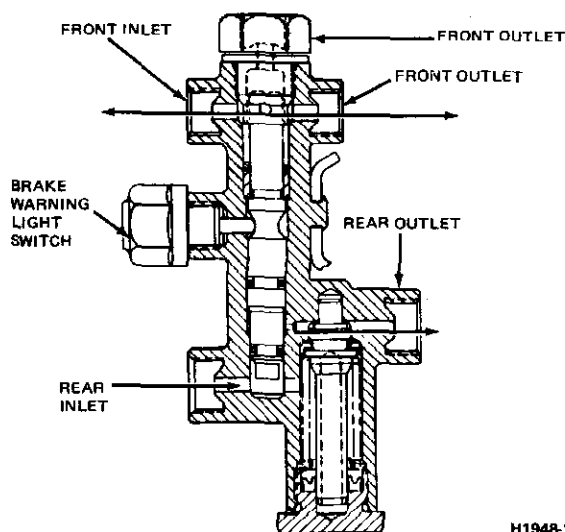
KELSEY-HAYES DESIGN

FIG. 1 Control Valve Assembly—Disc/Drum Brakes



H2477-2B

FIG. 2 Control Valve Assembly—4-Wheel Disc Brakes



H1948-1B

FIG. 3 Pressure Differential and Proportioning Valve

After repairs are made and the brake system bled, the piston will center itself upon brake application and the switch contacts will open, turning off the warning light.

Proportioning Valve

The proportioning valve regulates the rear brake system hydraulic pressure and is located between the rear brake system inlet and outlet ports (Fig. 3).

When the brake pedal is applied, the full rear brake fluid pressure passes through the proportioning valve to the rear brake hydraulic system until the valve split point is attained. Above the split point, the proportioning valve reduces hydraulic pressure to the rear brakes for balanced braking. The proportioning split point and slope are listed in the Specification Section of this Part.

DIAGNOSIS AND TESTING

GENERAL BRAKE SYSTEM DIAGNOSIS

Diagnosis of the combined mechanical and hydraulic problems associated with the brake system is covered in the General Brake System Diagnosis Guide in this Section.

In addition to the General Brake System Diagnosis Guide, further specific Diagnosis Guides are furnished

for the Master Cylinder, Brake Control Valve and the Hydro-Boost Power Brake.

Always check the fluid level in the master cylinder before performing the test procedures. If the fluid level is not within 1/4 inch of the top of the master cylinder reservoirs, add Brake Fluid — Ford Part No. C6AZ-19542-A or DOT 3 equivalent for all brake applications.

GENERAL BRAKE SYSTEM DIAGNOSIS GUIDE

COMPLAINT	POSSIBLE CAUSE	RESOLUTION
Brakes do not apply.	- Insufficient brake fluid. - Binding or damaged brake pedal linkage. - Binding or damaged brake booster linkage.	- Add fluid, bleed system, check for leaks. - Repair as required. - Repair as required.
Excessive pedal travel or pedal goes to floor.	- Air in system. - Malfunctioning master cylinder. - Drum brakes — improperly adjusted. - On disc brakes, misaligned anchor plate.	- Bleed system. - See Master Cylinder Diagnosis Guide. - Check adjustment. Inspect brakes. Repair as required. - Check anchor plate.
Excessive pedal effort to stop car.	- Binding or damaged pedal linkage. - Engine vacuum loss. - Booster or hydro-boost inoperative. - Malfunctioning master cylinder. - Worn linings. - Brake system.	- Inspect. Repair as required. - Check engine vacuum, and vacuum at check valve to booster. Repair as required. - Perform power brake function test. - See Master Cylinder Diagnosis Guide. - Inspect. Replace if necessary. - Inspect wheel cylinders or caliper pistons, restricted lines or hoses, contaminated brake fluid, improper operation of proportioning or metering valve. Repair as necessary.
Spongy pedal.	- Air in system. - Loose or improper brake pedal, pedal support, booster, master cylinder attachment. - Brake system.	- Bleed system. - Repair as required. - Inspect for damaged or distorted parts in brake caliper assemblies, cracked brake drums, mis-machined anchor plates.

CH2561-2B

FIG. 4 General Brake System Diagnosis Guide

GENERAL BRAKE SYSTEM DIAGNOSIS GUIDE

COMPLAINT	POSSIBLE CAUSE	RESOLUTION
Brakes drag, slow or incomplete release.	- Parking brake cable out of adjustment or binding. - Front wheel bearings out of adjustment. - Blocked master cylinder compensator ports. - Brake adjustment (rear). - Restriction in hydraulic system. - Wheel cylinders or caliper piston seizure. - Brake system.	- Check cables for correct adjustment or bind. - Check bearings for adjustment, wear, damage or bind. - See Master Cylinder Diagnosis Guide. - Check and adjust. - Check and repair. - Check and repair. - Inspect and repair.
Noise at wheels when brakes are applied — snap or clicks.	- On drum brakes in 3 places — brake shoes binding at backing plate ledges. - On drum brakes in 3 places — back-in plate ledges worn. - On disc brake — rust on front edge of inboard shoes. - On disc brakes — loose or missing anti-rattle clip. - Other brake system components: Loose outer shoe crimping, defective caliper support spring or retaining key, cracked welds at shoe web. - Loose outer shoe retaining clip.	- Lubricate. - Replace, and lubricate ledges. - Inspect. Lubricate, replace if necessary. - Replace. - Inspect. Repair or replace. - Inspect, Repair or Replace.
Noise at wheels when brakes are applied — scrape or grind.	- Worn brake linings. - Brake shoe interference with back of drum. Binding at backing plate guide ledges. - Caliper to wheel or rotor interference. - Other brake system components: Warped or bent brake backing plate or splash shield, cracked drums or rotors. - Tires rubbing against chassis or body.	- Replace. Refinish drums or rotors if heavily scored. - Inspect. Replace as necessary. Lubricate. - Replace as required. - Inspect and repair. - Inspect and repair.

CH2561-2B1

FIG. 5 General Brake System Diagnosis Guide Cont'd.

GENERAL BRAKE SYSTEM DIAGNOSIS GUIDE

COMPLAINT	POSSIBLE CAUSE	RESOLUTION
Noise at wheels when brakes are applied — squeaks, squeals, or chatter. NOTE: Brake friction materials inherently generate noise and heat in order to dissipate energy. As a result, occasional squeal is normal, and is aggravated by severe environmental conditions such as cold, heat, wetness, snow, salt, mud, etc. <i>This occasional squeal is not a functional problem and does not indicate any loss of brake effectiveness.</i>	- Brake drums and linings, rotors and pads worn or scored. - On disc brakes — missing or damaged brake pad insulators. - On disc brakes — burred or rusted calipers. - Dirty, greased or glazed linings. - Improper lining parts. - On drum brakes — loose lining rivets, weak, damaged or incorrect shoe retracting springs, loose or damaged shoe retaining pins, springs and clips, and grooved backing plate ledges.	- Inspect, repair or replace. - Replace. - Clean or deburr. - Clean or replace. - Inspect for correct usage. Replace. - Inspect, repair or replace.
Noise at wheels, brakes not applied — squeak or squeal.	- Wheel cover attachment. - Loose wheel attaching lug nuts. - Bent or warped backing plate causing interference with drum or rotor. - Improper machining of drum, causing interference with backing plate or shoe. - Other brake system components: - Loose or extra parts in brakes. - Drum or rear disc brake adjustment too tight causing lining to glaze. - Worn, damaged, or insufficiently lubricated wheel bearings. - On drum brakes — weak, damaged or incorrect shoe retracting springs. - On drum brakes — grooved backing plate ledges. - Improper positioning of shoe in caliper. - Outside diameter of rotor rubbing caliper housing. - Lack of correct lubricant on disc brake caliper slides. - Improper installation of rear disc brake anti-rattle clip.	- Seat covers with a rubber mallet. Repair flanges or replace cover. - Tighten to correct torque. Replace wheel if stud holes are damaged. - Repair or replace. - Replace drum. - Inspect, repair, replace as required.

CH2561-2B2

FIG. 6 General Brake System Diagnosis Guide Cont'd.

GENERAL BRAKE SYSTEM DIAGNOSIS GUIDE

COMPLAINT	POSSIBLE CAUSE	RESOLUTION
Noise at wheels, brakes not applied — growling, click or rattle.	- Stones or foreign material trapped inside wheel covers. - Loose grease cap. - Loose wheel lug nuts. - Disc brake caliper — loose or missing anti-rattle clips and support spring, or crimping on outer shoe. - Drum brakes — loose or extra parts. - Worn, damaged or dry wheel bearings.	- Remove stones, etc. - Repair or replace. - Tighten to correct torque. Replace if stud holes are elongated. - Inspect, repair or replace. - Inspect, remove or repair. - Inspect, lubricate or replace.
Brakes pull to one side.	- Unequal air pressure in tires. - Grease or fluid on linings. Glazed linings. - Loose or missing disc brake caliper attaching bolts. - Improper size or type lining on one wheel. - Stuck or seized wheel cylinders or calipers. - Restricted brake lines or hoses. - Other brake system components: - Improper adjustment of drum or rear disc brakes. - Improper positioning of disc brake shoe and lining in the caliper. - Improperly adjusted, damaged or worn wheel bearings. - Distorted drum brake linings. - Missing, broken or stretched retracting or retaining springs and clips in drum brakes.	- Inflate tires to correct pressure. - Replace. - Replace missing bolts. Tighten to proper torque. - Replace with correct brake lining in axle sets. - Repair or replace. - Repair or replace. - Inspect, repair or replace as required.

CH2561-2B3

FIG. 7 General Brake System Diagnosis Guide—Cont'd.

GENERAL BRAKE SYSTEM DIAGNOSIS GUIDE

COMPLAINT	POSSIBLE CAUSE	RESOLUTION
Brakes grab or lock-up when applied.	- Tires worn or incorrect pressure. - Grease or fluid on linings – damaged linings. - Improper size or type of linings. - Other brake system components: - Bolts for caliper attachment loose or missing. - Worn, damaged or dry wheel bearings. - Improperly adjusted parking brake.	- Inflate tires to correct pressure. Replace tires with worn tread. - Inspect, repair or replace. - Replace with correct brake in axle sets. - Inspect, repair or replace as required.
Brake warning light on.	- Hydraulic system. - Shorted light circuit. - Parking brake not returned. - Brake warning switch.	- See Master Cylinder Diagnosis Guide. - Correct short in warning circuit. - See "Parking brake will not release or fully return" below. - Replace.
Intermittent loss of pedal.	Stop light switch.	- Perform Master Cylinder Diagnosis test. - Perform steps under "Excessive pedal travel or pedal travel goes to floor".
Rough engine idle or stall, brakes applied – power brakes only.	- Vacuum leak in neutral switch. - Vacuum booster.	- Check lines for leaks. Repair or replace as required. - Check vacuum booster for internal leaks. Replace if required.
Parking brake control will not latch (manual release).	- Kinked or binding release cable. - Control assembly.	- Inspect, repair or replace. - Inspect, repair or replace.
Parking brake control will not latch (automatic release).	- Vacuum leak. - Vacuum switch. - Control assembly.	- Repair as required. - Test. Replace if necessary. - Repair or replace.
Parking brake will not release or fully return (manual release).	- Cable disconnected. - Control assembly binding. - Parking brake linkage binding. - Rear brakes.	- Connect cable or replace. - Repair or replace. - Repair or replace. - Check rear brakes shoe retracting springs and parking brake levers. On rear disc brakes verify levers return fully to released position. Adjust cables or repair caliper as required.
Parking brake will not release or fully return (automatic release).	- Vacuum line leakage or improper connections. - Neutral switch. - Control assembly.	- Inspect and repair. - Adjust or replace. - Repair or replace.

CH2561-2B4

FIG. 8 General Brake System Diagnosis Guide—Cont'd.

GENERAL BRAKE SYSTEM DIAGNOSIS GUIDE

VIBRATION WHEN BRAKES ARE APPLIED

ROAD TEST VEHICLE FOR THE FOLLOWING:

- 25 TO 55 MPH FOR VEHICLE VIBRATION WITHOUT APPLYING BRAKES PER PROCEDURE IN TRAINING HANDBOOK (0910-013).
- 55 TO 25 MPH FOR BRAKE VIBRATION WITH LIGHT AND MEDIUM APPLICATION ON THE PEDAL.
- 50 TO 20 MPH FOR REAR BRAKE VIBRATION WITH MEDIUM APPLICATION ON THE PARKING BRAKE ONLY. (NOTE: WITH MANUAL RELEASE PARKING BRAKE CONTROL, HOLD THE PARKING BRAKE RELEASE IN RELEASE POSITION DURING PARKING BRAKE APPLICATION.)

NOT OK

REPAIR VIBRATION AS REQUIRED PER PROCEDURE IN TRAINING HANDBOOK (0910-013) VEHICLE VIBRATION AND DIAGNOSIS.

IF VEHICLE VIBRATION IS PRESENT WITHOUT BRAKE APPLICATION, REPAIR THIS PROBLEM FIRST, THEN RE-EVALUATE FOR BRAKE VIBRATION ON BOTH SERVICE BRAKE AND PARKING BRAKE.

OK

IF BRAKE VIBRATION IS PRESENT ON THE SERVICE BRAKE, BUT NOT ON THE PARKING BRAKE (REARS).

IF BRAKE VIBRATION IS PRESENT ON THE PARKING BRAKE (REARS) BUT NOT ON THE SERVICE BRAKES.

IF BRAKE VIBRATION IS PRESENT ON BOTH THE SERVICE BRAKE AND THE PARKING BRAKE.

CHECK FRONT ROTORS FOR EXCESSIVE RUNOUT. REFINISH OR REPLACE AS REQUIRED. REFER TO TS8 NO. 50 DATED AUG. 17, 1974 FOR SERVICE PROCEDURE.

CHECK REAR DRUMS FOR EXCESSIVE WEAR OR RUNOUT. CHECK REAR ROTORS FOR EXCESSIVE WEAR, RUNOUT AND/OR THICKNESS VARIATION. REFINISH OR REPLACE AS REQUIRED.

OK

CHECK BOTH FRONT AND REAR DRUMS AND/OR ROTORS FOR EXCESSIVE WEAR, RUN-OUT OR THICKNESS VARIATION (ROTORS ONLY). REFINISH OR REPLACE AS REQUIRED.

OK

OK

VIBRATION CAN ALSO BE CAUSED BY:

- WORN OR IMPROPERLY ADJUSTED WHEEL BEARINGS.
- CRACKED ROTORS.

CH2561-285

FIG. 9 General Brake System Diagnosis Guide—Cont'd.

MASTER CYLINDER DIAGNOSIS GUIDE

Brake Pedal Feel Conditions	Diagnostic Action
Condition 1 – Pedal goes down fast and brake light comes on.	Pump brake pedal rapidly: If the brake pedal height builds up and holds, check for the presence of air. (Use Diagnostic Technique No. 1.) If the brake pedal height builds up and then sinks down, check for an external leak (Use Diagnostic Technique No. 4) or a master cylinder by-pass (Use Diagnostic Technique No. 2.) If the brake pedal height fails to build up, check the fluid level in the master cylinder reservoir: If a reservoir is empty, add fluid; bleed the system; and check for external leak. (Use Diagnostic Techniques No. 3 and No. 4.) If the reservoirs are full, check for a gross master cylinder by-pass. (Use Diagnostic Technique No. 2.)
Condition 2 – Pedal eases down slowly and brake light comes on.	This condition could be caused by an external leak in the brake system or an internal by-pass in the master cylinder. Apply the brakes several times while observing the fluid levels in the reservoirs: If the net fluid level in a reservoir eases down with each stroke cycle, check for an external leak. (Use Diagnostic Technique No. 4). If the fluid level in a reservoir rises while the pedal eases down and drops when the pedal is released, but the net fluid level remains unchanged, then repair or replace the master cylinder for a fluid by-pass condition. NOTE: All master cylinders in warranty must be replaced.
Condition 3 – Pedal is low and brake light does not come on.	This condition may be caused by: air in the hydraulic system, or no fluid in one reservoir. If the reservoir is empty, add fluid, bleed, and check the system for external leaks. (See Diagnostic Technique Nos. 3 and 4). If the reservoir is full, check for the presence of air in the hydraulic system. (Use Diagnostic Technique No. 1). If this condition happens occasionally on a disc brake equipped car, check the front wheel bearings for looseness. (Loose front wheel bearings allow the disc rotor to knock the caliper piston back, creating excess lining clearance.)

FIG. 10 Master Cylinder Diagnosis Guide

MASTER CYLINDER DIAGNOSIS GUIDE (Cont'd.)

Brake Pedal Feel	Diagnostic Action
Condition 4 – Pedal feels spongy.	This may be normal as modern brake systems are not designed to produce as hard a pedal as in the past. To verify this, compare the pedal feel with another like car. Check for the presence of air in the hydraulic system. (Use Diagnostic Technique No. 1).
Condition 5 – Pedal goes down fast and brake light does not come on.	Prior to diagnosing, verify that the brake system warning light is functional. Pump the brake pedal rapidly: If the brake pedal height fails to build up, check the fluid level in the master cylinder reservoirs: If both reservoirs are empty, add fluid, bleed the system, and check for external leaks. (Use Diagnostic Techniques No. 3 and No. 4). If the reservoirs are full, check for air in the hydraulic system. (Use Diagnostic Technique No. 1). Or check for brake pedal reserve. (Use Diagnostic Technique No. 5). If the brake pedal height builds up, check for insufficient drum brake adjustment.
Condition 6 – Pedal erratic – no light.	This may be caused by incomplete brake release, loose wheel bearings, incorrect parking brake adjustment or blocked compensator holes in the master cylinder. To verify, check wheel rotation and bearing free play, parking brake tension and refer to Diagnostic Technique No. 6 for master cylinder compensator hole check.
Condition 7 – Pedal effort excessive – no light.	This may be caused by a bind or obstruction in the pedal/linkage, insufficient booster vacuum or hydroboost pressure. To verify, detach master cylinder from dash or booster and stroke pedal fully. Check vacuum or hydroboost pressure per procedure.

CH2295-2B**FIG. 11 Master Cylinder Diagnosis Guide—Cont'd.**

BRAKE CONTROL VALVE DIAGNOSIS GUIDE

Complaint	Diagnosis and Resolution
1. Premature front brake lock-up on wet or icy road during light pedal application and cold engine fast idle operation.	1. Check tires and tire pressures. 2. Check brake linings for fluid, grease or other contamination. 3. Check and adjust engine idle for normal driving. 4. On vehicles equipped with a metering valve, check it by installing pressure gauges in front and rear bleed screws. Apply 200 psi to the system. Front brake system should read 100 to 150 psi while rear system reads 200 psi. 5. Replace the brake pressure control valve if out of specification.
2. Rear brake lock-up during light brake pedal force.	1. Check tires and tire pressures. 2. Check brake linings for fluid, grease or other contamination. 3. Install pressure gauges in the front and rear bleeder screw ports and apply 1,000 psi to the front brake system. The rear brake system pressure must be approximately 550 to 750 psi. 4. Replace brake pressure control valve assembly if rear brake pressure is not within specification.
3. No rear brake lock-up under heavy brake pedal force.	1. Check tires and tire pressures. 2. Check brake linings for fluid, grease or other contamination. 3. Install pressure gauges in the front and rear wheel cylinder bleeder screw ports and apply 1,000 psi to the front brake system. The rear brake system pressure must be approximately 550 to 750 psi. 4. If no pressure is obtained, check for damaged tubing. 5. Replace the brake pressure control valve assembly if rear brake pressure is not within specifications.

CH2296-2C

FIG. 12 Brake Control Valve Diagnosis Guide

HYDRO-BOOST POWER BRAKE DIAGNOSIS GUIDE

Complaint	Possible Causes	Resolution
Excessive Brake Pedal Effort (Poor power steering assist in both directions also) at idle speed.	1. Loose or broken steering pump belt. 2. Power steering fluid reservoir low or empty. 3. Power steering hose leaking. 4. Leaking at tube fittings — power steering or booster connections. 5. Low idle speed. 6. Restriction in pressure hose to booster. 7. Low power steering pump pressure.	1. Tighten or replace belt. 2. Fill reservoir and check for leaks. 3. Replace hose. 4. Tighten fitting. If it still leaks, check tube flare. Replace hose if flare is damaged. Check tube seat, repair if damaged. 5. Adjust idle speed to specification. 6. Replace hose. 7. Perform pump pressure test.
Excessive Brake Pedal Effort (Power steering normal in both directions at idle speed).	1. Binding in pedal and/or pedal linkage. 2. Contamination. 3. Nicked/burred spool valve.	1. Repair and lubricate as required. 2. Hold steering wheel against stop (maximum five (5) seconds) and apply brake pedal sharply several times. If contamination is dislodged, flush system. 3. Replace hydro-boost.
Slow or Incomplete Brake Pedal Return.	1. Binding in the pedal and/or pedal linkage. 2. Restriction in return line from booster to pump reservoir. 3. Internal restriction in the hydro-boost fluid return system.	1. Repair and lubricate as required. 2. Replace return hose. 3. Replace the hydro-boost.
Brake Pedal Chatter, Pulsation	1. Power steering pump belt slipping. 2. Power steering pump reservoir fluid low. 3. Power steering pump. 4. Spool valve dimensional error.	1. Tighten belt. 2. Fill reservoir, check for leaks. 3. Repair pump. 4. Replace hydro-boost.
Oversensitive Braking	1. Binding in the pedal and/or pedal linkage. 2. Faulty spool action.	1. Repair and lubricate as required. 2. Replace hydro-boost.
Noise	1. Power steering pump fluid level low or empty. 2. Power steering fluid aerated. 3. Power steering pump belt loose. 4. Restriction in hoses.	1. Fill reservoir. 2. Bleed system. 3. Tighten belt. 4. Replace hose.

CH2259-2C

FIG. 13 Hydro-Boost Power Brake Diagnosis Guide

If a brake is locked and the vehicle must be moved, open a bleeder screw on front and rear wheels to let out enough fluid to relieve the pressure. This bleeding operation will release the brakes but will not correct the cause of trouble.

HYDRAULIC SYSTEMS DIAGNOSIS

There is only one major problem which occurs in the hydraulic brake system and that is **LEAKS**, internal or external. Hydraulic brake systems, including master cylinder and valves, **DO NOT** cause pulling, grabbing, vibrations, pulsating pedals, squeaks, squeals, clunks, or, in most cases, dragging brakes.

It is therefore a good policy to first check the entire system for leaks when diagnosing a brake problem.

MASTER CYLINDER DIAGNOSIS AND TESTING

Pedal feel is usually the first indicator that something is wrong in the brake system. The Master Cylinder

Diagnosis Guide (Figs. 10 and 11) use the brake pedal feel, the warning light and the brake fluid level as the indicators in diagnosing master cylinder conditions.

Note that the procedures refer to the use of diagnostic techniques. These techniques (Numbers 1 through 5) follow the diagnostic procedures.

Normal Conditions —The following conditions are considered normal and are not indications that the master cylinder is in need of service:

Condition 1—Unequal brake fluid levels in master cylinder reservoirs on disc brake vehicles. This condition is caused by displacement of fluid from the reservoir into the calipers to compensate for normal lining wear. Top off the reservoirs.

Condition 2—A momentary or slight squirt of brake fluid from one or both master cylinder reservoir chambers upon application of the brake pedal. This condition is caused by the fluid displacement through the reservoir compensating port(s)

as the master cylinder pistons move forward in the bore when the brakes are applied.

Condition 3—A slight turbulence in the reservoir fluid occurring when the brake pedal is released. Turbulence occurs as brake fluid returns to the master cylinder after releasing the brakes.

Condition 4—A trace of brake fluid exists on booster shell below the master cylinder mounting flange. This condition results from the lubricating action of the master cylinder wiping seal.

Abnormal Conditions —Changes in brake pedal feel or travel are indicators that something could be wrong in the brake system. The following diagnostic procedures and techniques use brake pedal feel, the warning light illumination and brake fluid level, as indicators in diagnosing brake system complaints.

NOTE: Prior to performing any diagnosis, make certain that the brake system warning light is functional.

DIAGNOSTIC TECHNIQUE NO. 1

Air Entrapment in Brake System

1. Check the fluid level in the master cylinder. Fill the reservoir if it is low or empty.
2. Place the cap loosely on the master cylinder.
3. With one technician acting as an observer at the master cylinder, and another technician applying the brakes, pump the brakes **rapidly** 20 times.
4. On the final application, hold the pedal in the applied position.
5. Remove the cap and observe the fluid in the reservoirs. Quickly release the brake pedal. A geyser up to six (6) inches high will spout from the reservoir of a system with air in it.

NOTE: Pumping the brake pedal compresses trapped air. When the brake pedal is released, the compressed air expands, forcing brake fluid back into the master cylinder with sufficient force to form a geyser.

6. Bleed the system in which the geyser occurs.

DIAGNOSTIC TECHNIQUE NO. 2

Procedure for Checking a Master Cylinder By-pass Condition

1. Remove the master cylinder reservoir cap and verify that both reservoir chambers are filled with fluid.
2. With the reservoir cap removed, observe the fluid levels in both chambers when the brake pedal is slowly depressed for one stroke and then quickly released.
 - a. If the fluid level in a reservoir rises while the pedal goes down and drops when the pedal is released, but the net (overall) fluid level in the reservoir remains unchanged, the master cylinder is by-passing. Replace such a master cylinder.

DIAGNOSTIC TECHNIQUE NO. 3

Checking the Cause of an Empty Reservoir Without an External Pressure Leak

An empty reservoir condition may be caused by two types of non-pressure external leaks.

Type 1 —An external leak may occur at the master cylinder reservoir cap due to improper positioning of the gasket and cap or a rust formation, between the cap gasket and the reservoir sealing surfaces. Replace the cover and gasket assembly. Remove any rust formations from the master cylinder.

Type 2 —An external leak may occur at the mounting end of the master cylinder due to a bore end seal leak. Replace such a master cylinder.

DIAGNOSTIC TECHNIQUE NO. 4

Checking for External Fluid Leaks in the Brake System

It is possible that all evidence of fluid leakage may have been washed off, if the vehicle has been operated in rain or snow, as brake fluid is water soluble. Refill the system, bleed, and apply the brakes several times. Examine the system to verify that the reservoir level is actually dropping. Locate and correct the external leak.

DIAGNOSTIC TECHNIQUE NO. 5

Checking for Brake Pedal Reserve—Vacuum-Power Brake Equipped Car Lines

On vacuum-power brake equipped vehicles where a low pedal or the feel of a bottomed out condition exists, check for brake pedal reserve using the following procedure:

1. Operate the engine at idle with the transmission in either Park or Neutral position.
2. Apply the brake pedal until it stops moving downward or increased resistance to the pedal travel occurs.

NOTE: A clunk may be felt as the pedal reaches this point.

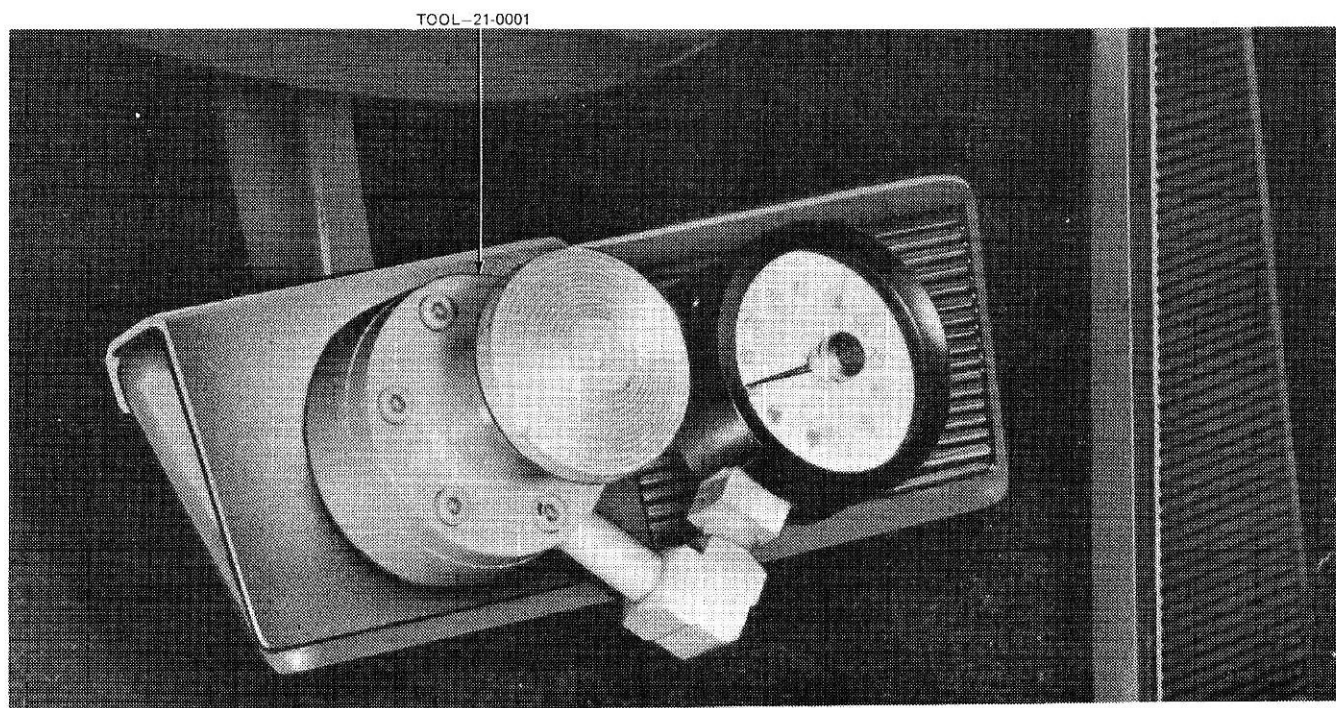
3. Hold the pedal in the applied position and raise the engine speed to approximately 2,000 RPM.
4. Release the accelerator pedal and observe that the brake pedal moves downward as the engine returns to idle speed.

NOTE: The additional movement of the brake pedal is the result of the increased engine manifold vacuum which exerts more force on the brake booster during engine run down. This means that additional stroke is available in the master cylinder, and the brake system is not bottoming out as a customer may believe.

DIAGNOSTIC TECHNIQUE NO. 6

Checking the Master Cylinder for Open Compensator Port(s)

1. Push brake pedal and observe fluid in master cylinder reservoirs.
2. A small geyser or ripple should appear in one or both reservoirs upon brake application.
3. If no geyser or ripple appears, loosen the master cylinder attaching bolts 1/4 inch, hold the master cylinder out and check for open compensator port(s) as above.
4. If compensation now occurs, verify booster pushrod length per procedure and adjust if required (except



H1525-2A

FIG. 14 Brake Pedal Effort Gauge Installed

Fairmont and Zephyr). If not, replace master cylinder.

5. If the booster push rod length is incorrect on Fairmont/Zephyr, using the push rod gauge, replace the booster.

BRAKE PEDAL FREE HEIGHT MEASUREMENTS

With the engine running for full power brake operation and the parking brake fully released, measure the brake pedal free height, and check the brake pedal travel with the use of the Brake Pedal Pressure Gauge, Tool 21-0001 (Fig. 14) as follows:

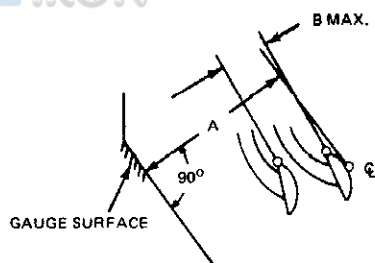
1. Insert a slender, sharp-pointed prod through the carpet and sound deadener to the dash panel metal, and measure the distance to the center on top of the brake pedal (Fig. 15) pad.
2. If the position of the pedal is not within specification, check the brake pedal for missing, worn, or damaged bushings, or loose attaching bolts, and replace them, if required.
3. If the pedal free height is still out of specification, check the brake pedal, booster or master cylinder to be sure the correct parts are installed. Replace the worn or damaged parts as necessary.

BRAKE PEDAL TRAVEL MEASUREMENT

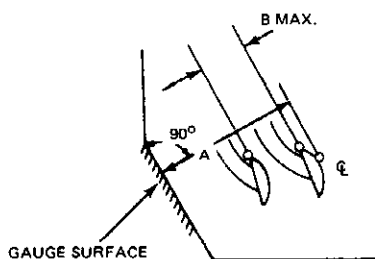
1. Install a Brake Pedal Effort Gauge (21-0001) on the brake pedal pad (Fig. 14).
2. Hook a steel measuring tape to the brake pedal as in Fig. 15. Measure and record the distance from

the brake pedal free height position to the reference point, which is at the six o'clock position on the steering wheel rim.

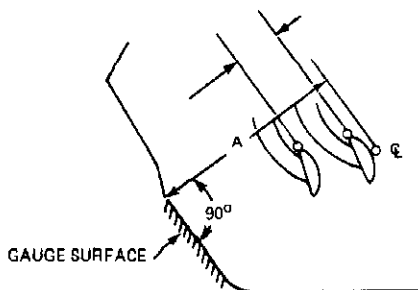
3. With the steel tape still hooked to the brake pedal, depress the brake pedal by pressing downward on the brake pedal effort gauge. Apply a 25-pound load to the center of the pedal. While maintaining the pedal load, measure the distance from the brake pedal to the fixed reference point on the steering wheel rim parallel to the centerline of the steering column.
4. The difference between the brake pedal free height and the depressed pedal measurement under a 25-pound load should be within the specified maximum pedal travel service specification B in Fig. 15.
5. On self-adjusting drum brakes, if the pedal travel is more than the maximum, as specified in Fig. 15, dimension B, make several reverse stops with a forward stop before each. Move the vehicle in reverse and forward for approximately ten feet; then, apply the brakes and hold the brake pedal down until the vehicle is completely stopped. This will actuate the brake self-adjusters. If these stops do not bring the brake pedal travel within specification, make several additional forward and reverse stops as outlined above.
6. On self-adjusting drum brakes, if the second series of stops does not bring brake pedal travel within specification, remove brake drums and check the brake adjusters to make sure they are functioning. Check brake linings for wear or damage. Repair or replace all worn or damaged parts and non-functioning adjusters. Adjust the brake lining



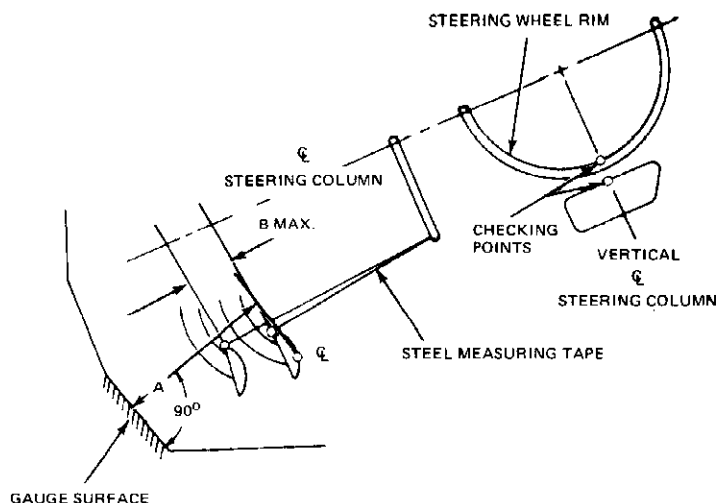
LTD II - COUGAR - MARK V - THUNDERBIRD
MEASURED FROM CENTERLINE OF CURVED PEDAL TO FLOOR
PANEL AT EDGE OF WIRING TROUGH (ACCELERATOR SIDE)



FAIRMONT - ZEPHYR - PINTO - BOBCAT - MUSTANG II



GRANADA - MONARCH - VERSAILLES



FORD - MERCURY - LINCOLN

NOTE: "A" DIMENSION TO BE MEASURED TO SHEET
METAL FROM TOP CENTER OF PAD.

"B" DIMENSION TO BE MEASURED PARALLEL
TO THE VERTICAL CENTERLINE OF THE
STEERING COLUMN WITH A 25 LB. LOAD
APPLIED TO THE CENTERLINE OF THE BRAKE
PEDAL PAD. (CHECKS ON POWER BRAKE
VEHICLES MADE WITH ENGINE RUNNING).

Vehicle	Type	Pedal Free Height "A" (Inches)		Maximum Pedal Travel (Inches) "B"
		Max.	Min.	
Pinto, Bobcat	Power Disc	7.3	6.4	2-1/4
Pinto, Bobcat	Non-Power Disc	9.0	7.75	2-3/4
Fairmont, Zephyr	Power Disc	7.0	6.0	2.0
Fairmont, Zephyr	Non-Power Disc	8.8	7.6	3.0
Mustang II	Power Disc	7.4	6.6	2-1/4
Mustang II	Non-Power Disc	8.8	7.5	203/4
Granada, Monarch	Power Disc	7.5	6.6	2-3/8
Granada, Monarch	Non-Power Disc	9.1	7.8	2-1/2
Granada, Monarch	4-Wheel Disc	7.5	6.7	2-1/4
LTD II, Cougar	Power Disc	7.8	7.0	2-1/2
LTD II, Police	Power Disc	8.0	7.2	2-1/2
Thunderbird	Power Disc	7.8	7.0	2-1/2
Ford, Mercury	Disc/Drum (Vacuum)	8.7	7.8	2-1/2
Ford, Mercury	Disc/Drum (Hydro-Boost)	8.6	7.6	2-1/4
Ford, Mercury	4-Wheel Disc	8.6	7.6	2-1/2
Continental Mark V	4-Wheel Disc	7.8	6.9	2-1/2
Lincoln	Disc/Drum	9.1	8.2	2-1/4
Lincoln	4-Wheel Disc	9.1	8.2	2-1/2
Versailles	4-Wheel Disc	7.5	6.7	2-1/4

NOTE: Vehicles close to the maximum pedal travel specification may be improved by bleeding the brake system.

H1630-20

FIG. 15 Brake Pedal Height and Travel Measurements

outside diameter to the approximate inside diameter of the brake drum with Rotunda Tool 11-0001 or equivalent described in Part 12-02.

7. If all the drum brake adjusters, brake drums and brake shoe linings are functional, and the brake travel is not within specifications, check the pedal assembly for missing or worn bushings, or loose attachments.
8. If the above actions do not bring the brake travel within specifications, bleed the brake system.

POWER BRAKE FUNCTIONAL TEST— VACUUM BOOSTER

When performing the vacuum power brake functional checks a minimum of 12 inches of vacuum (Hg) should be available at the brake booster hose (check valve connection end), with the engine at idle speed and the transmission in gear. Use Rotunda Vacuum Tester 21-0014 or equivalent.

If the vacuum supply is below 12 inches (Hg) check the vacuum available at the engine manifold, with the engine at idle speed and the transmission in gear. If the vacuum supply at the manifold is 12 inches (Hg) or above, there is a leak or blockage in the vacuum supply system.

Inspect all hoses and connections. All unused vacuum connectors should be capped, hose connections properly secured, and hoses in good condition with no holes and no collapsed areas. Inspect the check valve on the power unit for damage.

If the vacuum supply at the manifold is below 12 inches (Hg) perform the necessary engine adjustments to bring the manifold vacuum up to a minimum of 12 inches of Mercury (Hg) check the booster operation as follows:

1. Check the hydraulic brake system for leaks or insufficient fluid.
2. With the transmission in neutral, stop the engine and apply the parking brake. Depress the brake pedal several times to exhaust all vacuum in the system.
3. With the engine shut off and all vacuum in the system exhausted, depress the pedal, and hold it in the applied position. Start the engine. If the vacuum system is operating, the pedal will tend to fall away under foot pressure and less pressure will be required to hold the pedal in the applied position. If no action is felt, the vacuum booster system is not functioning.
4. Remove the vacuum hose from the brake booster check valve connection. Manifold vacuum should be available at the check valve end of the hose with the engine at idle speed and the transmission in neutral. Be sure that all unused vacuum outlets are properly capped, hose connectors properly secured, and that vacuum hoses are in good condition. When it is established that manifold vacuum is available to the booster, connect the vacuum hose to the booster and repeat Step 3. If no downward movement of the brake pedal is felt, replace the brake booster.
5. Operate the engine a minimum of 10 seconds at fast idle. Stop the engine and let the vehicle stand

for 10 minutes; then, depress the brake pedal with approximately 20 pounds of force. The pedal feel (brake application) should be the same as that noted with the engine operating. If the pedal feels hard (no power assist), replace the brake booster.

If the brake pedal movement feels spongy, bleed the hydraulic system to remove air from the system. Refer to Hydraulic System Bleeding, in this Part.

POWER BRAKE FUNCTIONAL TEST— HYDRO-BOOST

The hydro-boost assembly is only one component in the braking system, therefore, servicing of the hydro-boost may involve the power steering hydraulic circuit, the service brakes, or both.

Before performing any testing of the hydro-boost, check and eliminate the following sources that could affect proper operation of the brakes. Figs. 19, 20, 21 and 22 show hydro-boost power brake systems.

Preliminary Checks

Verify the condition by driving the vehicle and comparing to a known quality vehicle for both steering and braking.

The hydro-boost cannot cause noisy brakes, a fading brake pedal, or pulling brakes. If one of these conditions exists, components of the brake system other than the hydro-boost may be the cause.

Check the fluid level in the master cylinder. If the fluid level is not within 1/4 inch of the top of the master cylinder reservoirs, add Brake Fluid—(ESA-M6C25-A) service part No. (C6AZ-19542-A) or DOT-3 equivalent.

Check the power steering pump fluid level with the engine off and the fluid at operating temperature. The fluid level must show on the dipstick. Insufficient fluid will affect both steering and braking power assist.

Check power steering pump belt tension and adjust if required. Also inspect the belt for excessive wear or glazing.

Inspect all power steering system hoses for leaks and kinks. If the fluid smells burned, check hoses or cooler for restrictions.

Check the engine idle speed and adjust to specification.

Check the power steering hydraulic fluid for aeration (shown by bubbles in the fluid). If there is air in the system, bleed the system as follows:

Fill the reservoir to specification (the fluid must be at normal operating temperature—165° to 175°F), turn the steering wheel through its full travel three or four times. Do not hold the wheels against their stops. Recheck the fluid level.

After completing preliminary checks without finding the source of the condition, check the function of the hydro-boost by performing the Hydro-Boost Functional Test covered in this Section.

If the hydro-boost is operating correctly, refer to the Diagnosis Section for service brakes and check those areas in the system that might cause the condition.

If the hydro-boost is not functioning, verify that the power steering is operating normally by performing the Power Steering Pump Flow and Pressure Test procedure detailed in Part 13-01 of this Manual.

If power steering operation is normal, and the hydro-boost is suspect, refer to the Hydro-Boost Diagnosis Guide in this Section and check those items that might cause the problem. If the hydro-boost is not functioning, replace the hydro-boost as a complete assembly.

Hydro-Boost Functional Test

1. Check the hydraulic brake system for leaks or insufficient fluid in the master cylinder reservoir.
2. With the transmission in neutral, stop the engine and apply the brake pedal several times to deplete all accumulator reserve.
3. Hold the pedal depressed with medium pressure (25-35 lbs.), and start the engine. If the unit is operating correctly, the brake pedal will fall slightly and then push back against the foot. If no action is felt, the indication is that the hydraulic booster system is not functioning.

ADJUSTMENTS

BRAKE VACUUM BOOSTER PUSHROD-TO-MASTER CYLINDER

The vacuum booster has an adjustable push rod (output rod) which is used to compensate for dimensional variations in an assembled booster. The push rod length is adjusted after each booster power unit has been assembled in production. **A properly adjusted pushrod that remains within the booster with which it was assembled in production, should never require a service adjustment.**

A booster that is suspected of having an improper pushrod length will indicate either of the following:

1. A pushrod which is too long will prevent the master cylinder piston from completely releasing hydraulic pressure and eventually cause the brakes to drag.
2. A pushrod which is too short will increase brake pedal travel and cause a clunk noise from the booster and master cylinder assembly.

If necessary, a booster pushrod length can be verified with a pushrod gauge (see Fig. 6) using the following procedure:

1. Without disconnecting the brake tubes, disconnect the master cylinder and set it away from the booster power unit. The master cylinder must be supported to prevent damaging the brake tubes.
2. With the engine running, gauge and adjust the pushrod length as shown in Fig. 7. (A force of approximately 5 pounds applied to the pushrod with the gauge will assure that the pushrod is seated within the power unit.)
3. Install the master cylinder on the power unit and alternate tightening the retaining nuts gradually to the torque specified in Part 12-01.
4. With the engine running and the master cylinder reservoir cover removed, observe the fluid surface

Accumulator Leakdown Test

1. Start the engine and operate at idle speed. Turn the steering wheel to the stop. Hold for a maximum of five seconds. Return the steering wheel to center and turn off the engine.
2. Depress and release the brake pedal. Repeat this procedure until a hard pedal is obtained. There should be at least two (2) power assisted brake applications with 20-25 lbs. applied to the brake pedal.
3. Re-start the engine and let it idle. Turn the steering wheel to the stop. There should be a light hissing sound as the accumulator is charged. Hold lightly against stop for a maximum of five seconds. Return the steering wheel to center and turn off the engine.
4. Wait one hour and apply brake pedal (do not re-start the engine). There should still be at least two (2) power mounted brake applications at 20-25 lbs. pedal load before a hard pedal is encountered.

in the reservoirs when the brake pedal is applied rapidly. **Some fluid movement should occur in the forward reservoir. If fluid surface movement did not occur, the pushrod is adjusted too long and the procedure must be repeated to prevent eventual brake drag.**

5. **Fairmont/Zephyr Only** —Fairmont/Zephyr vehicles have the vacuum booster to master cylinder push rod manufactured to a specific length. There is no screw adjustment as found on other vehicle booster installations. No adjustment can therefore be made. However, the length of the push rod can be checked using the gauge shown in Fig. 17. If not within limits, the booster must be replaced.

HYDRAULIC SYSTEM BLEEDING

When any part of the hydraulic system has been disconnected for repair or replacement, air may enter the system and cause spongy pedal action. Bleed the hydraulic system after it has been properly connected, to be sure that all air is expelled.

Manual Bleeding

The primary and secondary (front and rear) hydraulic brake systems are individual systems and are bled separately. Bleed the longest line first on the individual system being serviced. During the complete bleeding operation DO NOT allow the reservoir to run dry. Keep the master cylinder reservoirs filled with Brake Fluid—Extra Heavy Duty (ESA-M6C25-A) Ford Part No. C6AZ-19542 or DOT 3 equivalent. Never re-use brake fluid that has been drained from the hydraulic system or has been allowed to stand in an open container for an extended period of time.

1. **Do not use the secondary piston stop screw (located on the bottom of some master**

cylinders) to bleed the brake system. Loosening or removing this screw could result in damage to the secondary piston or stop screw.

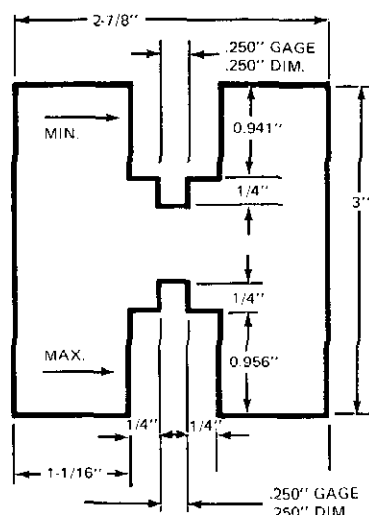
2. To bleed the brake system, position a suitable box wrench on the bleeder fitting on the brake wheel cylinder. Attach a rubber drain tube to the bleeder fitting. **The end of the tube should fit snugly around the bleeder fitting.**
3. Submerge the free end of the tube in a container partially filled with clean brake fluid, and loosen the bleeder fitting approximately 3/4 turn.
4. Have a second person push the brake pedal down slowly through its full travel. Close the bleeder fitting, then return the pedal to the full-released position. Repeat this operation until air bubbles cease to appear at the submerged end of the bleeder tube.
5. When the fluid is completely free of air bubbles, secure the bleeder fitting and remove the bleeder tube.
6. Repeat this procedure at the brake wheel cylinder on the opposite side. Refill the master cylinder reservoir after each wheel cylinder is bled and install the master cylinder cover and gasket. **Be sure the diaphragm-type gasket is properly positioned in the master cylinder cover. When the bleeding operation is completed, the fluid level should be filled to full or within 1/4 inch of the top of the reservoirs on level master cylinders and within 1/8 inch on angled master cylinders.**
7. If the primary (front brake) system is to be bled, repeat Steps 2 through 6 at the right front brake caliper or cylinder and ending at the left front brake caliper or cylinder.
8. On disc brake equipped models, be sure that disc brake pistons are returned to their normal positions, and that shoe and lining assemblies are properly seated by depressing the brake pedal several times until normal pedal travel is established.

Pressure Bleeding—All Models

For pressure bleeding, use a bladder-type bleeder tank only. This type bleeder separates the brake fluid from the pressurized air charge with a rubber diaphragm.

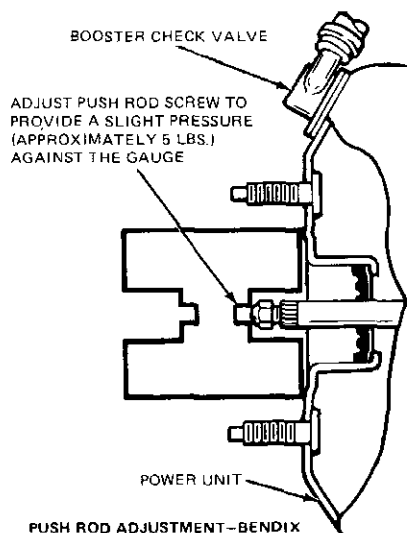
Bleed the longest lines first. The bleeder tank should contain enough new brake fluid to complete the bleeding operation. Use Ford Brake Fluid—Extra Heavy Duty (ESA-M6C25-A) Ford Part No. C6AZ-19542-A or DOT-3 equivalent for all brake applications. Never reuse brake fluid that has been drained from the hydraulic system. The tank should be charged with approximately 10 to 30 pounds of air pressure. Never exceed 50 pounds pressure.

1. Clean all dirt from the master cylinder reservoir cover.
2. Remove the master cylinder reservoir cover and rubber gasket, and fill the master cylinder reservoir with the specified brake fluid. Install the pressure bleeder adapter tool to the master cylinder, and attach the bleeder tank hose to the fitting on the adapter. **Master cylinder pressure bleeder**



H1087-1G

FIG. 16 Push Rod Gauge Dimensions



PUSH ROD ADJUSTMENT—BENDIX

H1871-1D

FIG. 17 Brake Booster Push Rod Measurement—Typical

adapter tools can be obtained from various manufacturers. Follow the instructions of the manufacturer when installing the adapter.

3. **Do not use the secondary piston stop screw, located on the bottom of some master cylinders, to bleed the master cylinder.**
4. If the rear wheel cylinders (the secondary brake system), are to be bled, use a 3/8-inch box wrench on the bleeder fitting on the right rear brake wheel cylinder, and attach a bleeder tube **snugly around the bleeder fitting.**
5. Open the valve on the bleeder tank to admit pressurized brake fluid to the master cylinder reservoir.
6. Submerge the free end of the tube in a container partially filled with clean brake fluid, and loosen the bleeder fitting.

7. When air bubbles cease to appear in the fluid at the submerged end of the bleeder tube, close the bleeder fitting and remove the tube.
8. Repeat Steps 4 through 7 at the left rear wheel cylinder.
9. If the vehicle is equipped with **disc brakes** repeat Steps 4 through 7, starting at the right front disc caliper and ending at the left front disc caliper. On all models with metering valves the release rod must be pulled outward and held a minimum of 1/16 inch (Fig. 18) while bleeding the primary brake system. Remove the tool after bleeding.
10. When the bleeding operation is completed, close the bleeder tank valve and remove the tank hose from the adapter fitting.
11. On disc brake-equipped vehicles, be sure that disc brake pistons are returned to their normal positions, and that shoe and lining assemblies are properly seated by depressing the brake pedal several times until normal pedal travel is established.
12. Remove the Pressure Bleeder Adapter Tool. Fill the master cylinder reservoirs to full or within 1/4 inch of the top. Install the master cylinder cover and gasket. **Be sure the diaphragm-type gasket is properly positioned in the master cylinder cover.**

CENTRALIZING THE PRESSURE DIFFERENTIAL VALVE

After any repair or bleeding of the primary (front brake) or secondary (rear brake) system, the dual-brake warning light switch should be centralized.

REMOVAL AND INSTALLATION

DUAL MASTER CYLINDER

Removal—Non-Power Brakes

Refer to Figs. 19 through 22.

1. Disconnect the negative battery cable.
2. Disconnect the stoplight switch wires at the connector. Remove the spring retainer. Slide the stop light switch off the brake pedal pin just far enough to clear the end of the pin, then remove the switch from the pin. **Use care to avoid switch damage during removal.**
3. Loosen the master cylinder attaching nuts or bolts from the inside of the engine compartment and slide the master cylinder push rod and the nylon washers and bushings off the brake pedal pin.
4. Remove the brake tubes from the primary and secondary outlet ports of the master cylinder.
5. Remove the lock nuts or cap screws and lockwashers that secure the master cylinder to the dash panel and lift the cylinder forward and upward from the vehicle.

Installation—Non-Power Brakes

1. Carefully insert the master cylinder push rod and boot through the dash panel opening and position the master cylinder on the panel.

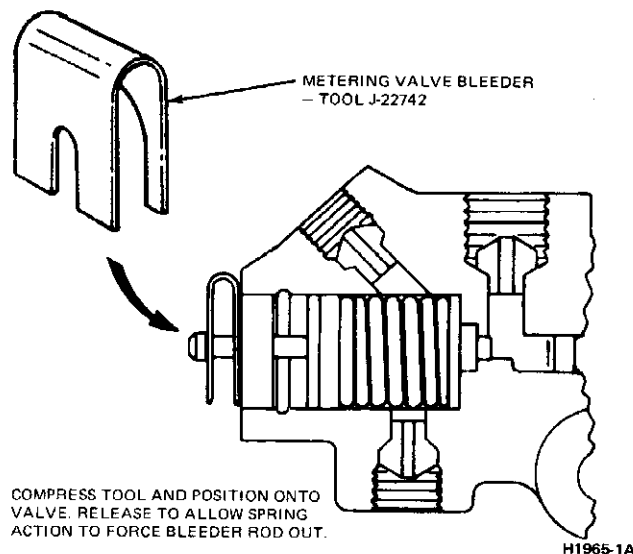
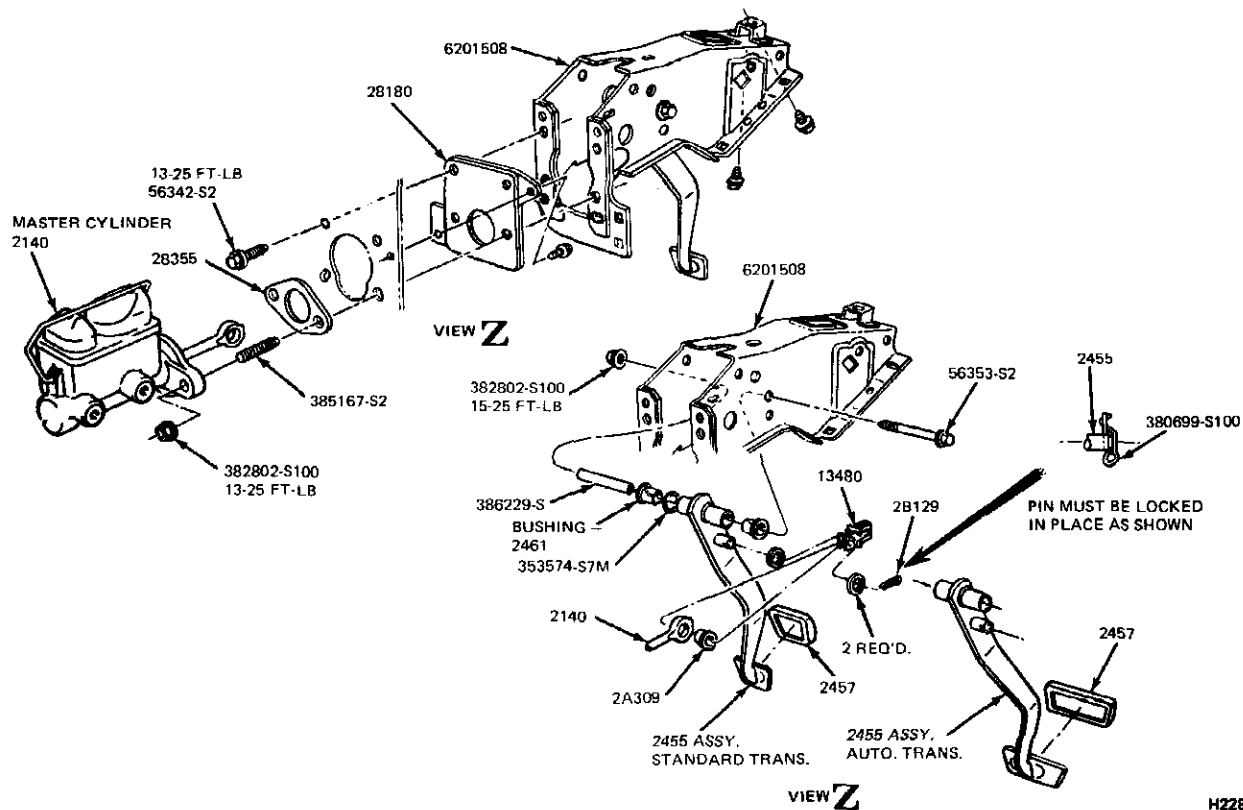


FIG. 18 Disc Brake Metering Valve Bleeding Tool

To centralize the pressure differential valve and turn off the warning light after a repair operation:

1. Turn the ignition switch to the ACC or ON position.
2. Depress the brake pedal and the piston will center itself, causing the brake warning light to go out (if it was illuminated).
3. Turn the ignition switch to the OFF position.
4. Before driving the vehicle, check operation of the brakes and be sure that a firm pedal is obtained.

2. Install the lock nuts or cap screws at the dash panel and leave loose.
3. Coat the nylon bushings with **SAE 10W40 oil**. Install the nylon washer and bushing on the brake pedal pin.
4. Position the stop light switch and master cylinder push rod on the brake pedal pin, install the nylon bushing and washer and secure them in position with the spring retainer.
5. Connect the wires at the stop light switch connector.
6. Tighten the master cylinder attaching nuts or bolts and connect the brake lines to the master cylinder.
7. Fill the master cylinder with the specified brake fluid to full or within 1/4 inch of the top of the dual reservoirs. Use Brake Fluid—Extra Heavy Duty (ESA-M6C25-A) Ford Part No. C6AZ-19542-A or DOT-3 equivalent for all drum brake applications.
8. Bleed the dual master cylinder and the primary and secondary brake systems. Centralize the pressure differential valve. Refer to Hydraulic System Bleeding and Centralizing of the Differential Valve for proper procedure.
9. Operate the brakes several times, then check for external hydraulic leaks.



H2286-2C

FIG. 19 Master Cylinder and Brake Pedal Installation—Non-Power—Pinto and Bobcat

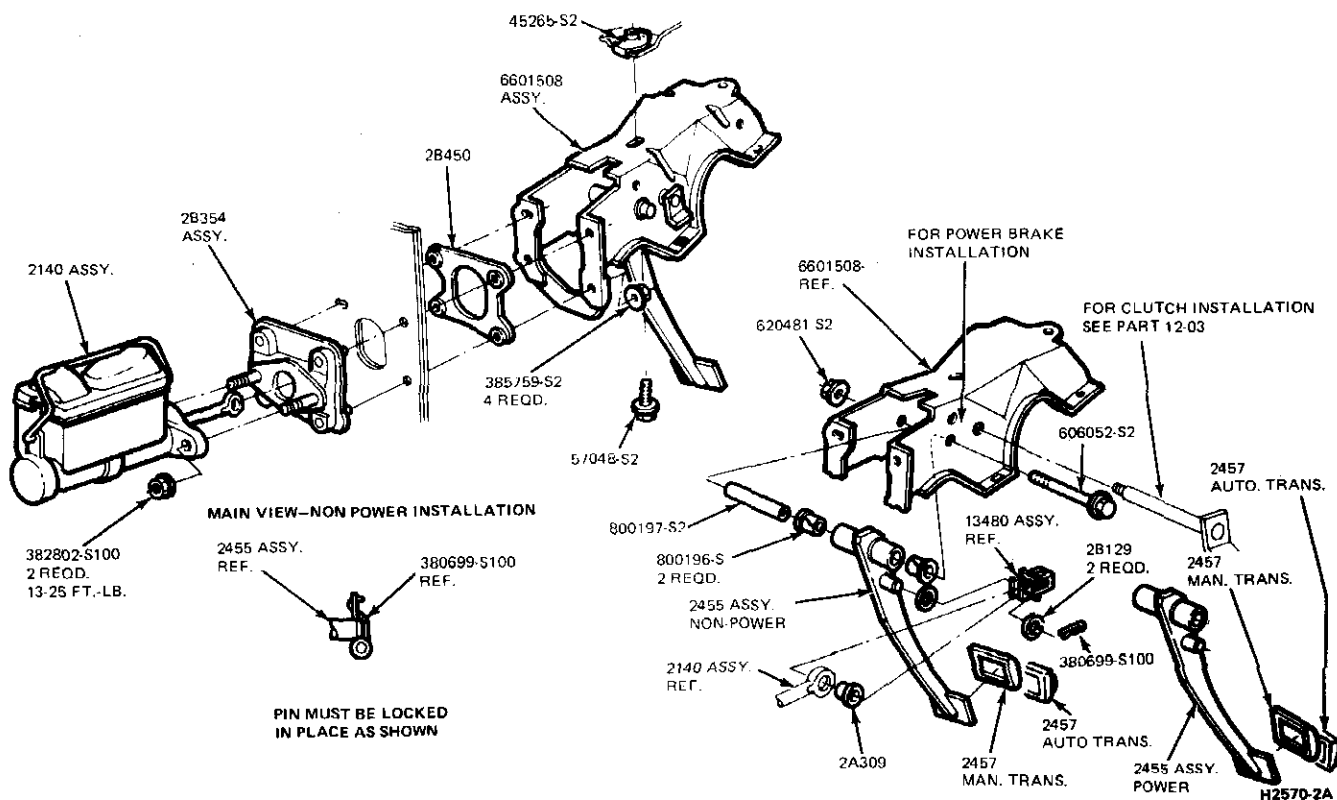


FIG. 20 Master Cylinder and Brake Pedal Installation—Non Power—Fairmont and Zephyr

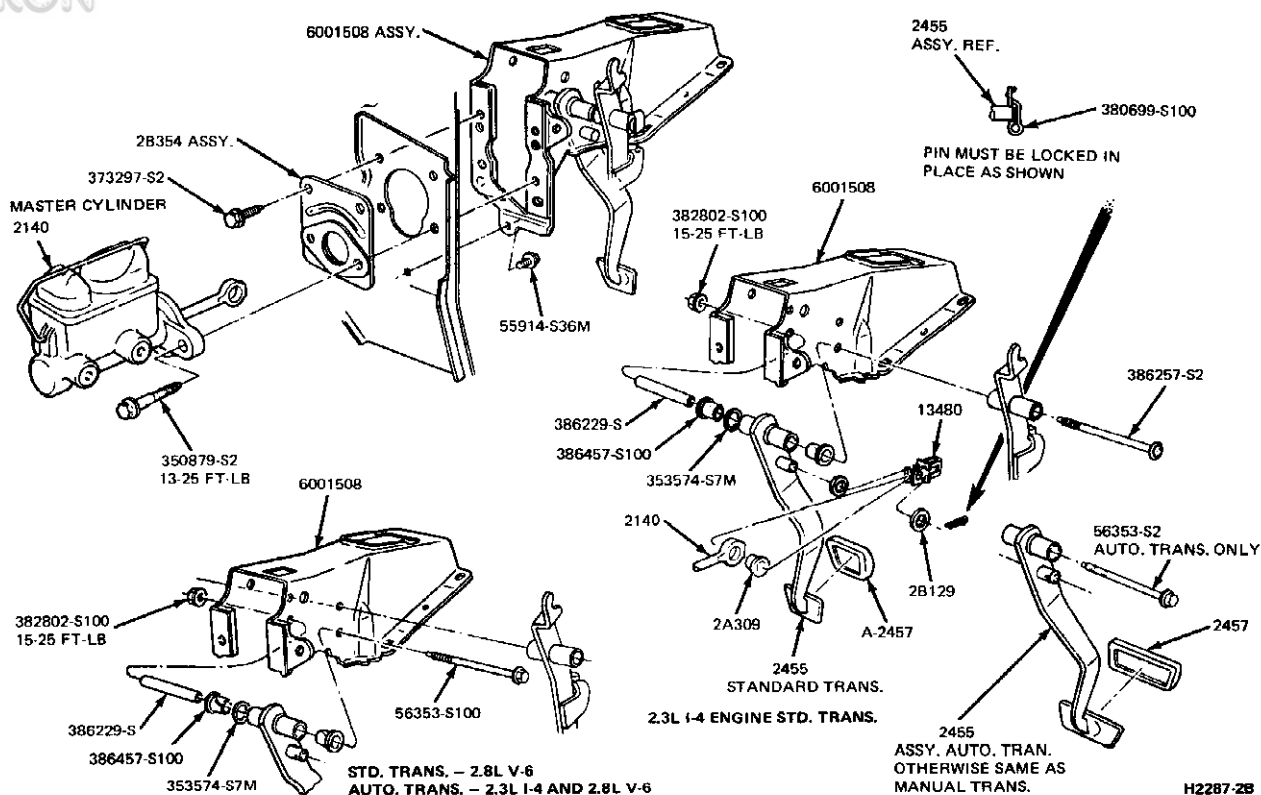


FIG. 21 Cylinder and Brake Pedal Installation—Non-Power—Mustang II

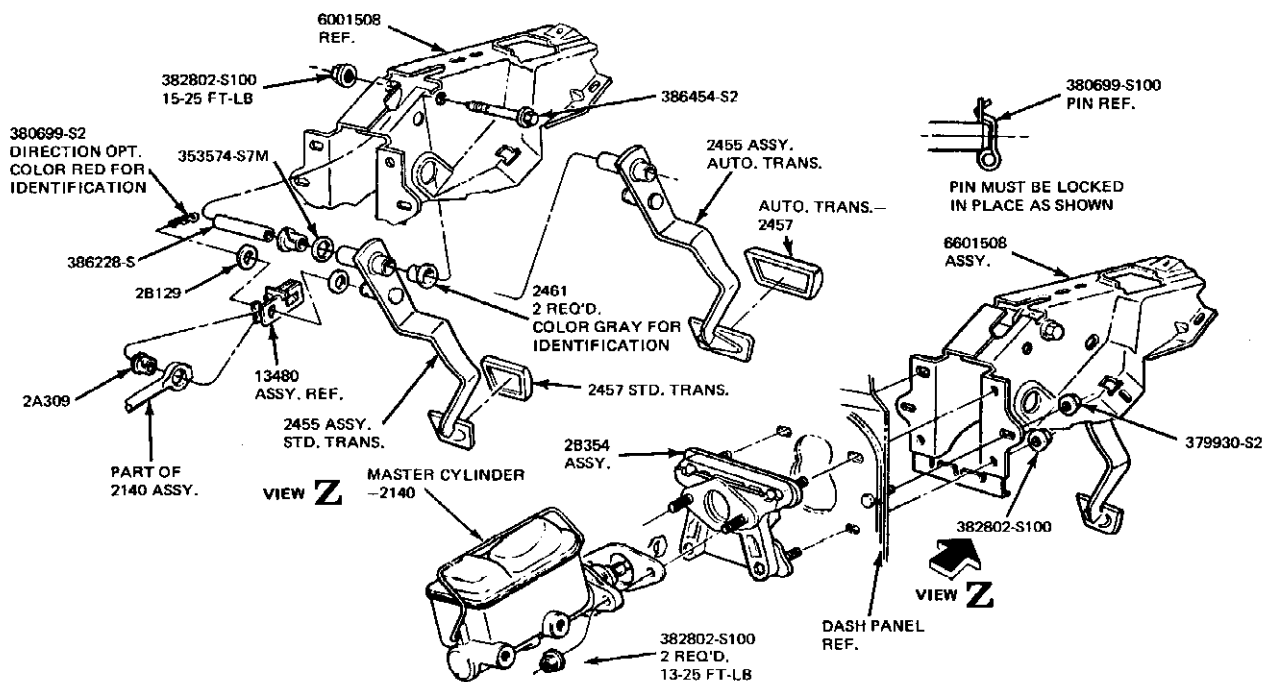


FIG. 22 Master Cylinder and Brake Pedal Installation—Non-Power—Granada and Monarch

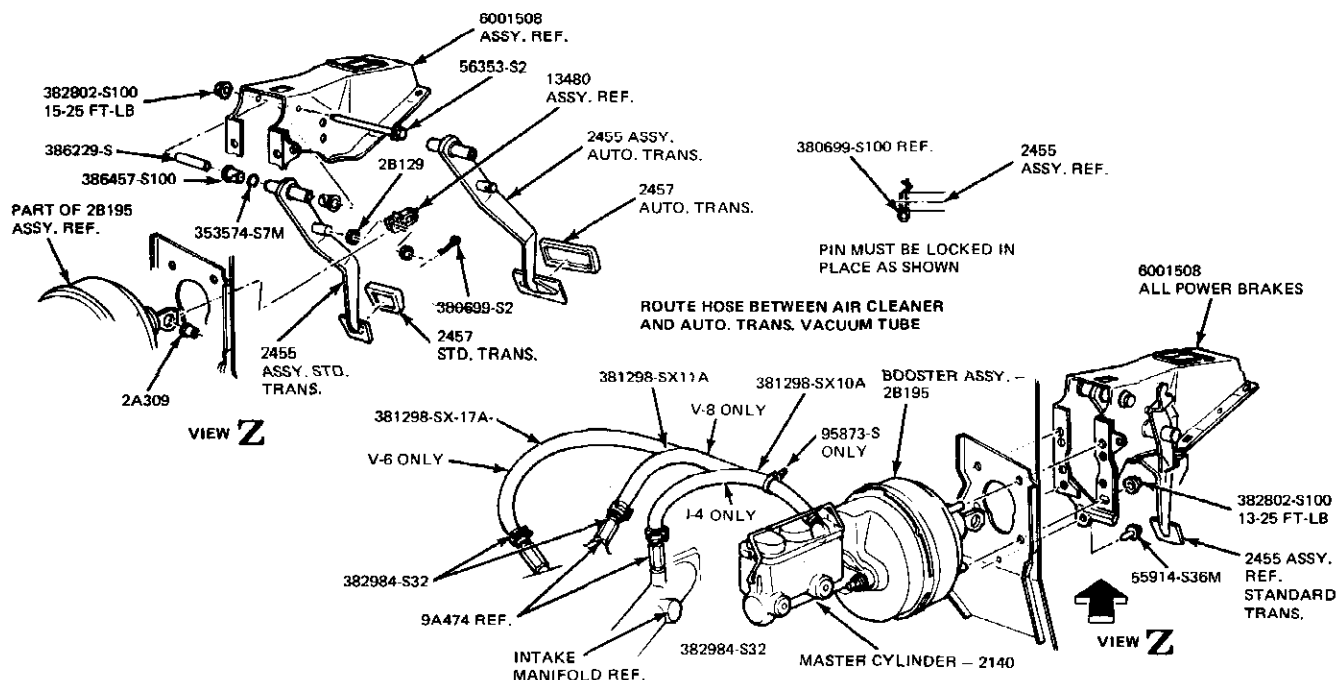


FIG. 24 Master Cylinder and Brake Pedal Installation—Vacuum-Power—Mustang II

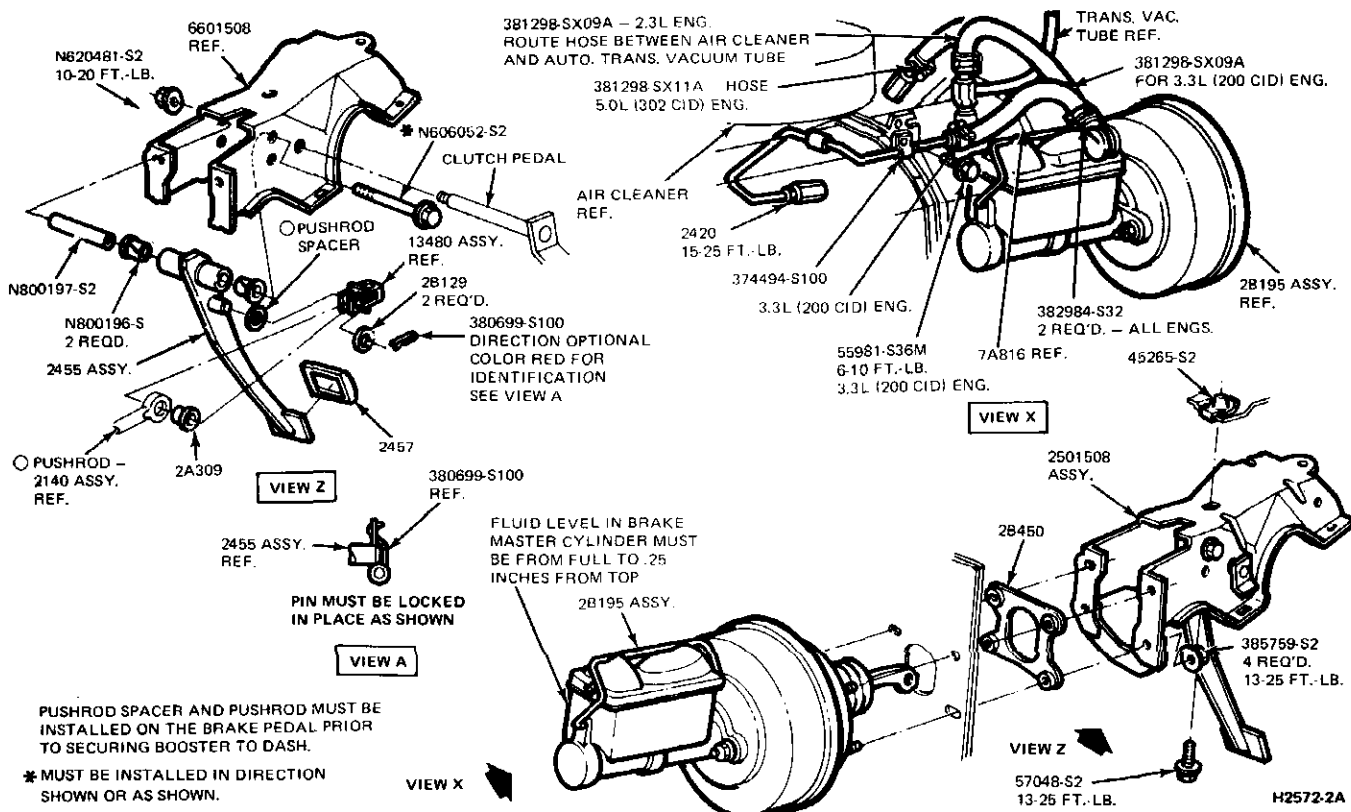


FIG. 25 Master Cylinder and Brake Pedal Installation—Vacuum Power—Fairmont and Zephyr

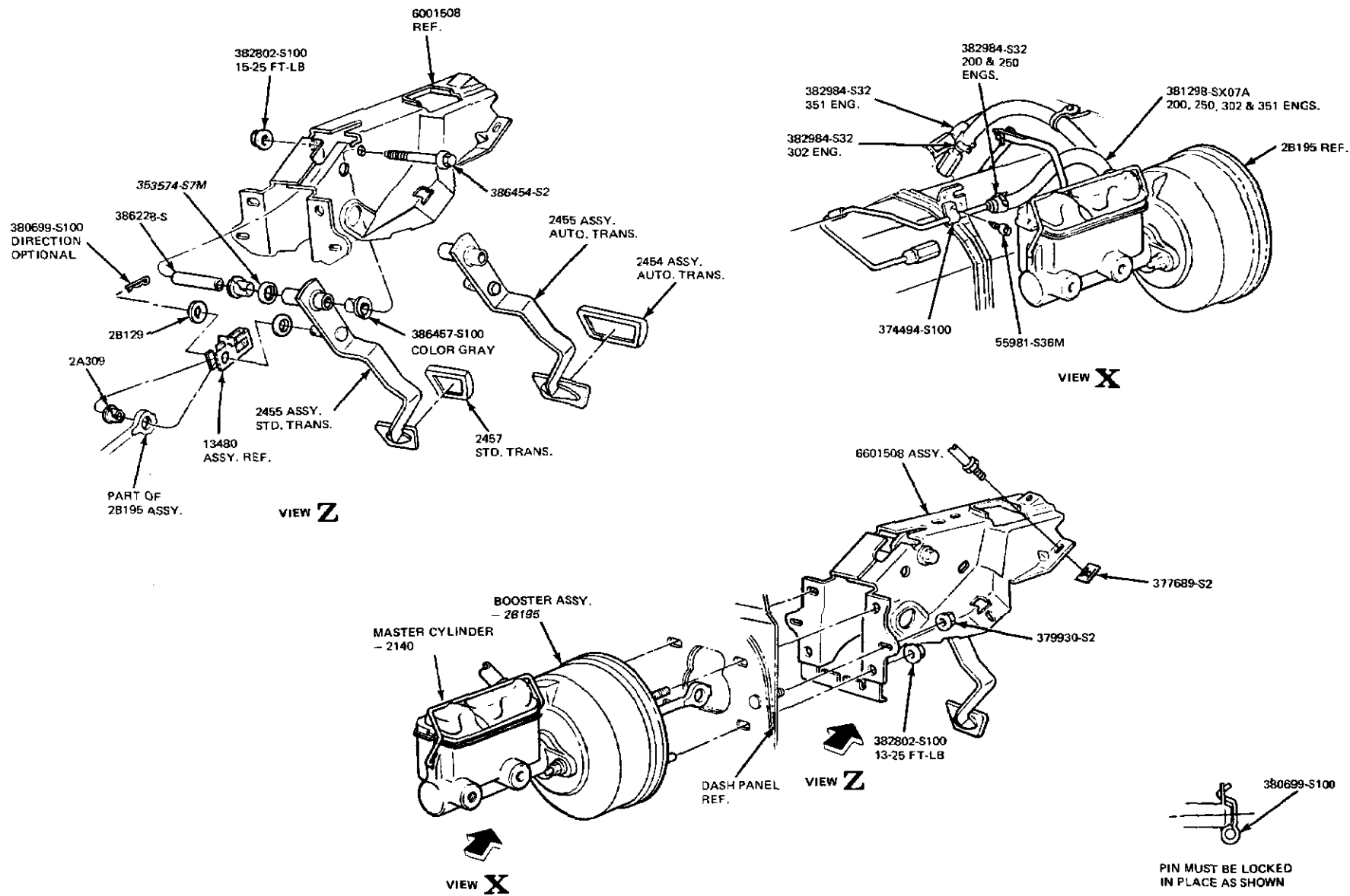
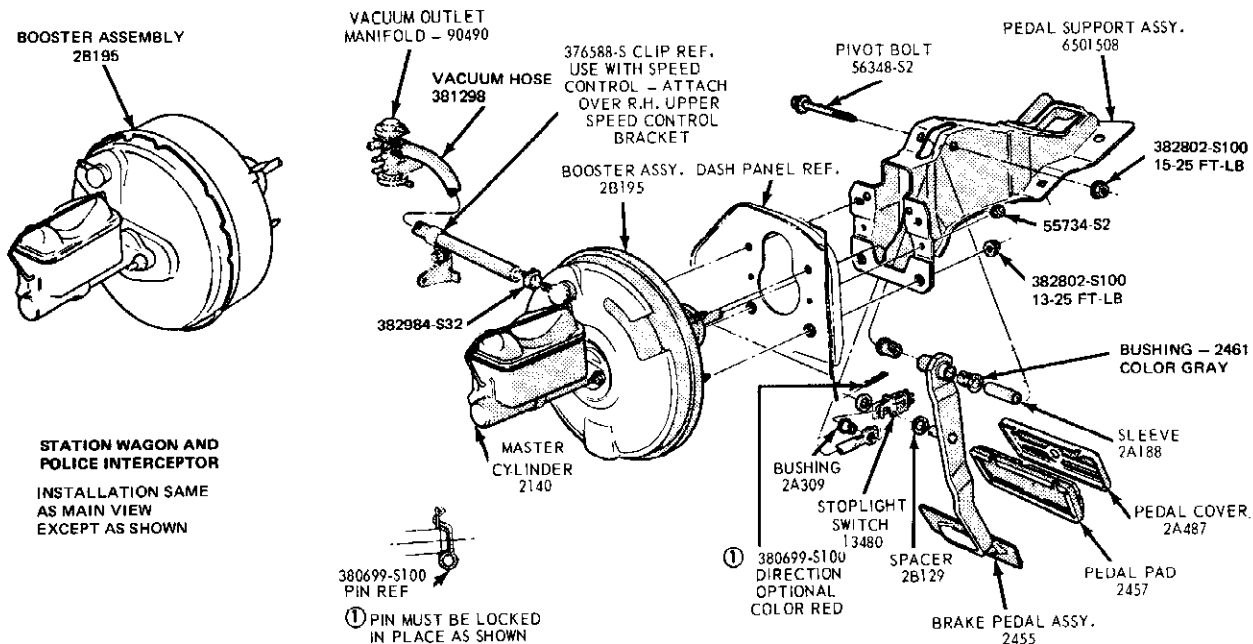
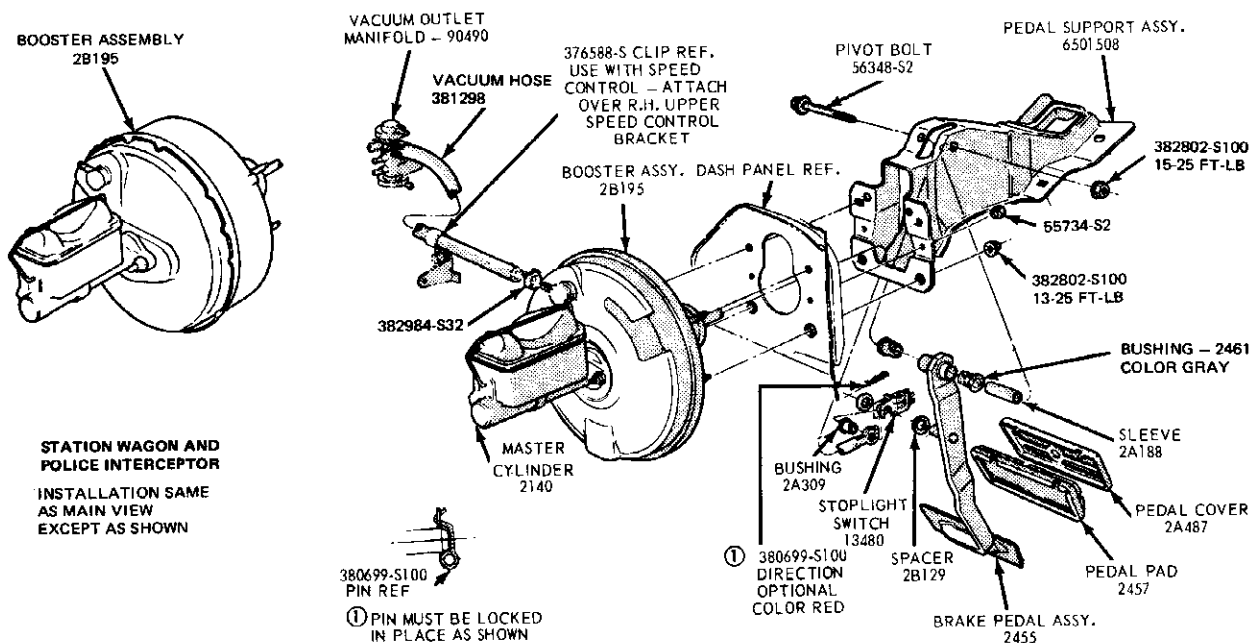


FIG. 26 Master Cylinder and Brake Pedal Installation—Vacuum-Power—Granada and Monarch



H2053-2D

FIG. 27 Master Cylinder and Brake Pedal Installation—Vacuum-Power—LTD II, Cougar and Thunderbird



H2053-2D

FIG. 28 Master Cylinder and Brake Pedal Installation—Vacuum-Power—Ford and Mercury



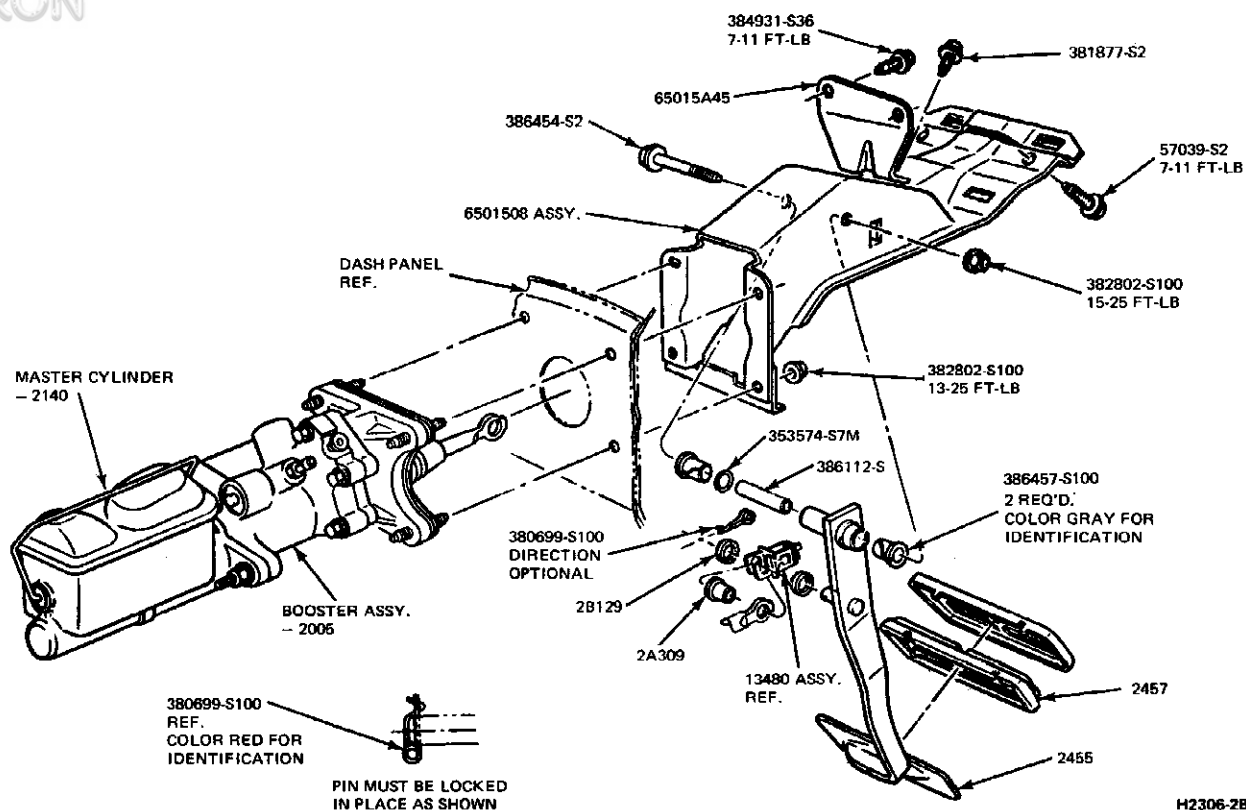


FIG. 31 Master Cylinder and Brake Pedal Installation—Hydro-Boost Power Brake—Lincoln Continental

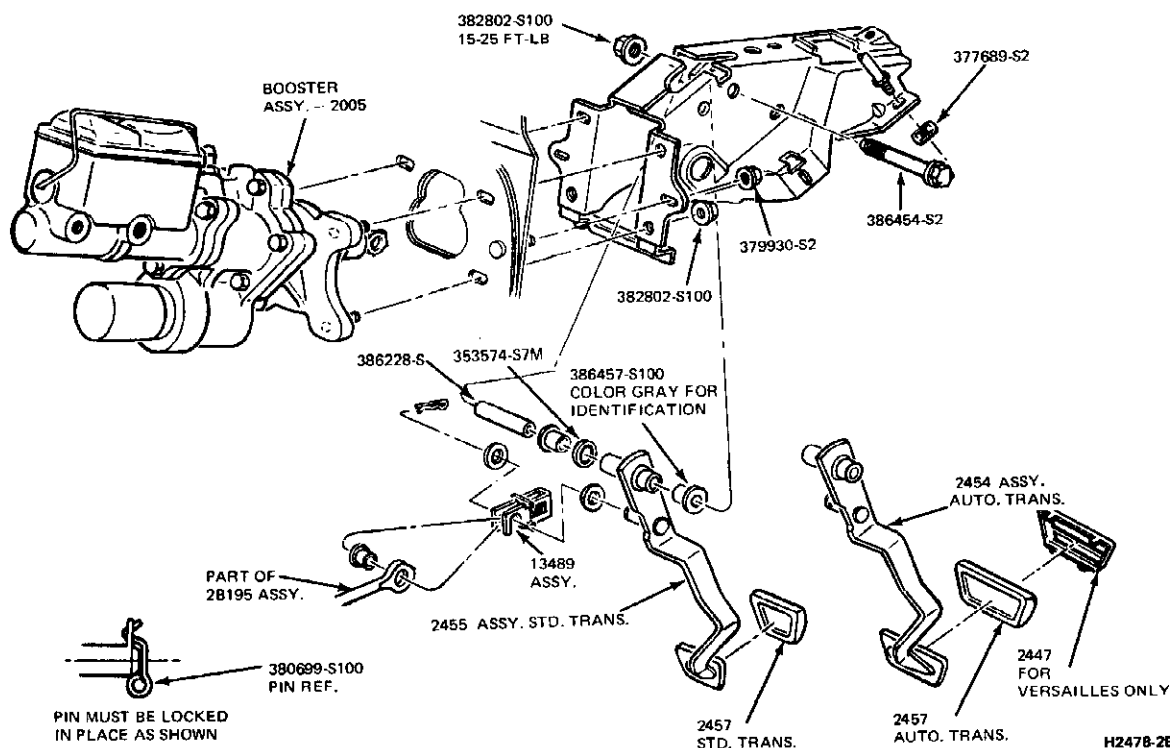


FIG. 32 Master Cylinder and Brake Pedal Installation—Hydro-Boost Power Brake—Granada, Monarch and Versailles

3. Connect the rear brake inlet tube to the control valve assembly and tighten the tube nut to Specification.
4. Connect the right front brake outlet tube to the brake control valve assembly and tighten the tube nut to specified torque.
5. Connect the left front brake outlet tube to the brake control valve assembly and tighten the tube nut to Specification.
6. Connect the front brake inlet tube to the brake control valve assembly and tighten the tube nut to Specification.
7. Connect the brake warning light switch wiring harness connector to the brake warning light switch. Verify connection by turning ignition switch to start position, light must come on.
8. Bleed the brake system and centralize the pressure differential valve.

NOTE: During the brake system bleeding operation on vehicles equipped with a metering valve, the metering valve bleeder rod must be pulled outward a minimum of 1/16th inch.

BRAKE PEDAL

All Car Lines W/Automatic Transmission—
Granada, Monarch, Pinto, Bobcat, Fairmont and
Zephyr—All Transmissions

Removal (Refer to appropriate illustration)

1. Disconnect the negative battery cable.
2. Disconnect the stop light switch wire connector from the switch.
3. Loosen the booster nuts approximately 1/4 inch at the pedal support, remove the push rod retainer and nylon washer and slide the stop light switch outboard along the brake pedal pin just far enough for the outer hole of the switch frame to clear the pin. Remove the switch by sliding it downward. Remove the black stop light switch bushing from the push rod.
4. Loosen the master cylinder bolts in the engine compartment or booster nuts at the pedal support and slide the pushrod and nylon washer off the pedal pin.
5. Remove the lock nut and then remove the pivot bolt, brake pedal, pivot spacer, anti-rattle spring washer and bushings from the pedal support.

Installation (Refer to appropriate illustration)

1. Apply a coating of SAE 10W30 engine oil to the bushings. Slide the anti-rattle spring washer over one bushing. Locate bushings and pivot spacer in the brake pedal hub.
2. Position the brake pedal assembly in the pedal support and install the pivot bolt. Install the lock nut and washer. Torque the nut to 15-25 ft-lb.
3. Install the inner nylon washer, the master cylinder push rod, and the black stop light switch bushing on the brake pedal pin. Position the stop light switch so that it straddles the pushrod, with the slot on the pedal pin, and the switch outer frame hole

just clearing the pin. Slide the switch upward onto the pin and push rod. Slide the assembly inboard toward the brake pedal arm. Install the outer nylon washer and the push rod retainer. Lock the retainer securely.

4. Tighten the master cylinder attaching bolts or the booster attaching nuts (13-25 ft-lb).
5. Connect the stop light switch wire to the switch.
6. Apply SAE 10W30 engine oil to the clutch clevis shaft. Position the clutch cable to the clutch pedal. Install the clevis shaft and clevis retainer.
7. Connect the negative battery cable.
8. Check the Brake Pedal Free Height and Travel Measurements (Fig. 5).

Mustang II W/Manual Transmission

Removal (Refer to Fig. 21)

1. Disconnect the negative battery cable.
2. Remove the clutch cable clevis from the clutch pedal. Refer to Part 16-03 for procedure.
3. Disconnect the stop light switch wire connector from the switch.
4. Remove the pushrod retainer and nylon washer and slide the stop light switch outboard along the brake pedal pin just far enough for the outer hole of the switch frame to clear the pin. Remove the switch by sliding it downward. Remove the black stop light switch bushing from the push rod.
5. Loosen the master cylinder bolts in the engine compartment or booster nuts at the pedal support and slide the push rod and nylon washer off the pedal pin.
6. Remove the lock nut and then remove the pivot bolt, brake pedal, pivot spacer, anti-rattle spring washer and bushings from the pedal support. **NOTE: Cars equipped with 4-cylinder engines and without power brakes have clutch pedal, clutch pivot spacer and bushings attached with a common pivot bolt and lock nut.**

Installation (Refer to Fig. 21)

1. Apply a coating of SAE 10W30 engine oil to the bushings. Slide the anti-rattle spring washer over one bushing. Locate bushings and pivot spacer in the brake pedal hub.
2. **Non-power and 4-cylinder engines only** apply a coating of SAE 10W30 engine oil to the bushings and locate bushings, spacer and pivot bolt in the clutch pedal hub.
3. Position brake pedal assembly in the pedal support and install the pivot bolt on the pivot and clutch pedal assembly. Install lock nut washer and torque to 15-25 ft-lb.
4. Install the inner nylon washer, the master cylinder push rod and the black stop light switch bushing on the brake pedal pin. Position the stop light switch so that it straddles the push rod with the slot on the pedal pin, the switch outer frame hole just clearing the pin. Slide the switch upward onto the pin and push rod. Slide the assembly inboard toward the brake arm. Install the outer nylon washer and the push rod retainer. Lock the retainer securely.

5. Tighten the master cylinder attaching bolts or the booster attaching nuts (13-25 ft-lb).
6. Connect the stop light switch wire to the switch.
7. Attach the clutch cable clevis to the clutch pedal. Refer to Part 16-02 for installation and adjustment procedure.
8. Connect the negative battery cable.
9. Adjust the clutch pedal free play (Part 16-02).
10. Check the Brake Pedal Height and Travel Measurements (Fig. 15).

OVERHAUL

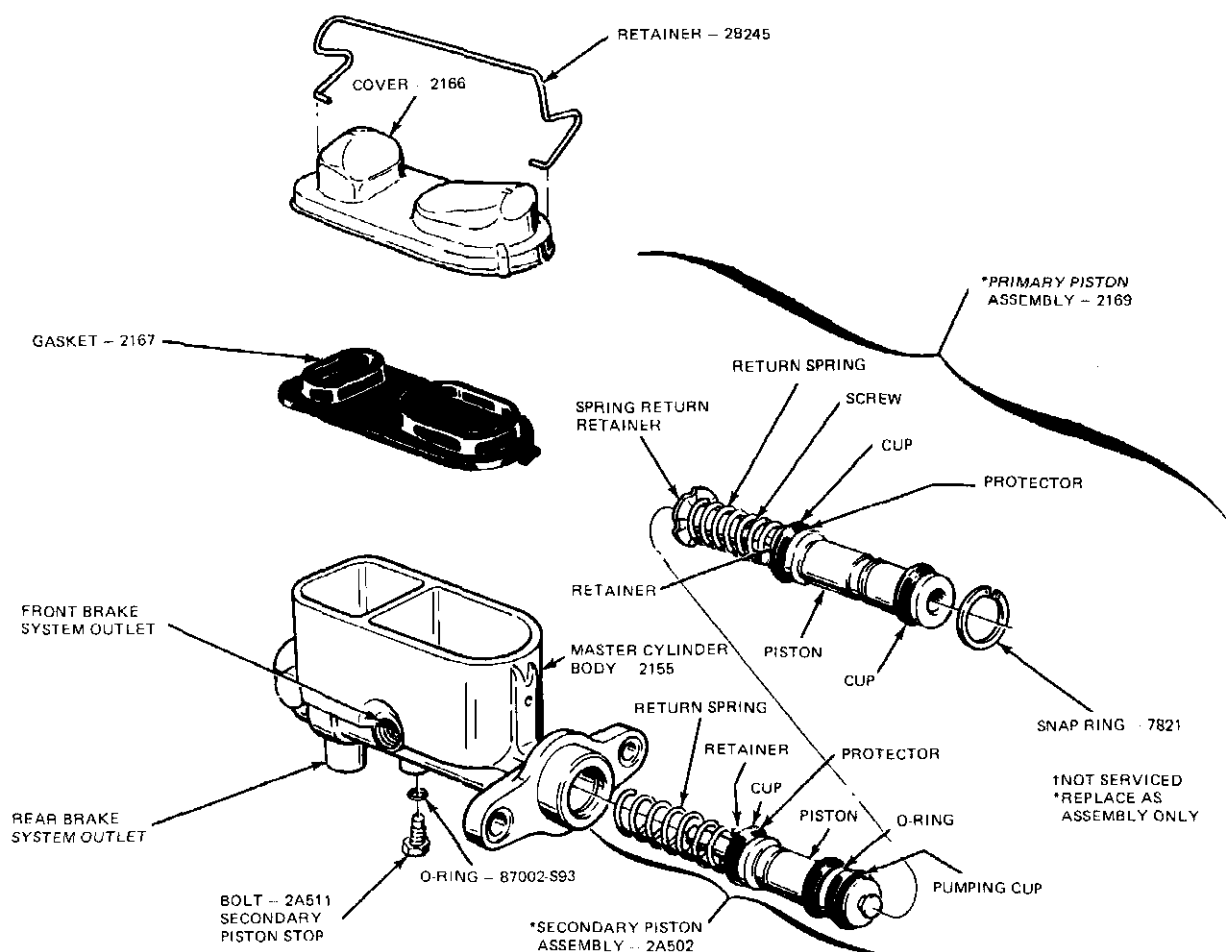
DUAL MASTER CYLINDER

When a repair is necessary on the master cylinder, it is required practice during the warranty period to replace the cylinder as a unit instead of overhauling the cylinder with a service kit.

Disassembly

1. Clean the outside of the master cylinder and remove the filler cover and diaphragm. Drain and discard any brake fluid that remains in the cylinder.

2. Remove the secondary piston stop bolt from the bottom or inside the reservoir (Fig. 33), if so equipped.
3. Depress the primary piston and remove snap ring from retaining groove at the rear of the master cylinder bore (Fig. 34).
4. Remove push rod and primary piston assembly from the master cylinder bore. **Do not remove the screw that secures the primary return spring retainer, return spring, primary cup and protector on the primary piston.** This assembly



H1550-2E

FIG. 33 Dual Master Cylinder—Disassembled