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Ford

1988 CAR SHOP MANUAL

Vol. A Body/Chassis/Electrical

Lincoln Town Car
Ford Crown Victoria
Mercury Grand Marquis

VOL A

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Ford Parts and Service Division
Training and Publications Department

GROUP

BRAKES 12

(2000)

SECTION 12-01 Brakes, Hydraulic—Service

VEHICLE APPLICATION

Lincoln Town Car, Ford Crown Victoria/Mercury Grand Marquis.

DESCRIPTION

WARNING: DO NOT INHALE DUST FROM BRAKES, CLUTCHES OR ASSOCIATED COMPONENTS. INHALATION OF DUST CONTAINING ASBESTOS FIBERS CAN BE INJURIOUS TO YOUR HEALTH AND COULD CAUSE CANCER OR ASBESTOSIS. COMPRESSED AIR OR BRUSHES MUST NOT BE USED TO CLEAN BRAKES, BRAKE DRUMS, CLUTCHES AND ASSOCIATED COMPONENTS. A VACUUM CLEANER EQUIPPED FOR THIS PURPOSE SHOULD BE CAREFULLY USED TO REMOVE ANY DUST. ADHERENT DUST SHOULD BE REMOVED WITH A DAMP CLOTH. ANY DUST SHOULD BE CONTAINED IN A SEALED AND LABELED BAG FOR DISPOSAL. WEAR AN APPROVED HIGH EFFICIENCY CARTRIDGE OR AIR LINE RESPIRATOR AND USE EXTRA CAUTION TO AVOID BREATHING THIS DUST. USE NON-ASBESTOS REPLACEMENT PARTS WHENEVER POSSIBLE.

Lincoln Town Car

Brake System—Dual

These vehicles have a dual brake system consisting of a dual master cylinder and a 3-way brake control valve assembly.

The master cylinder has two hydraulic supply reservoirs; the reservoir that is nearest to the dash panel furnishes brake fluid to the front wheel brakes, while the other, closest to the radiator, is used to supply fluid to the rear wheel brakes.

The 3-way brake control valve assembly consists of a pressure differential valve, metering valve and a proportioning valve in an aluminum body.

If unequal hydraulic pressure occurs between the front and rear brakes, the pressure differential valve will sense the condition, activate the brake warning lamp switch, and turn on the warning lamp at the instrument panel. The metering valve regulates the hydraulic pressure to the front disc brakes. The pressure to the rear brakes is controlled by the proportioning valve.

Pressure Differential Valve

As previously stated, the pressure differential valve senses an unbalanced hydraulic pressure condition between the front and rear brake system. When there is a pressure loss in either system during a brake application, the valve piston will move off center, causing the brake warning lamp to come on. The pressure differential valve is located in the central bore of the control valve body. The warning lamp will shut off when the brake system is accurately serviced, properly bled, and the brakes are applied to center the piston.

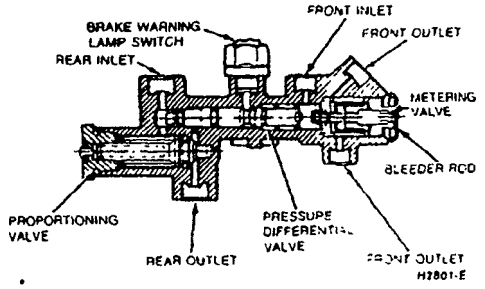
The brake warning lamp switch is mounted on top of the control valve body. Under normal conditions when the differential valve piston is centrally located, the spring-loaded, warning switch plunger fits into the piston's tapered groove leaving the contacts of the warning switch open.

Metering Valve

The metering valve limits the hydraulic pressure to the front disc brakes until a predetermined front hydraulic pressure has been reached. It is found in the forward end of the control valve's central bore between the front brake inlet port and the two outlet ports. This location provides an access to the valve's bleeder rod for purging the front brake system after performing brake service. Refer to Hydraulic System Bleeding.

Proportioning Valve

The proportioning valve regulates the hydraulic pressure in the rear brake system. It is located between the rear brake system inlet and outlet ports on the control valve. When the brake pedal is applied, the full rear brake fluid pressure passes through the proportioning valve to the rear brake system until the valve split point is reached. Above its split point, the proportioning valve begins to reduce the hydraulic pressure to the rear brakes, creating a balanced braking condition between the front and rear wheels. The proportioning valve's split point and slope performance is listed in Specifications.



DESCRIPTION (Continued)

Ford Crown Victoria/Mercury Grand Marquis

Brake System—Dual

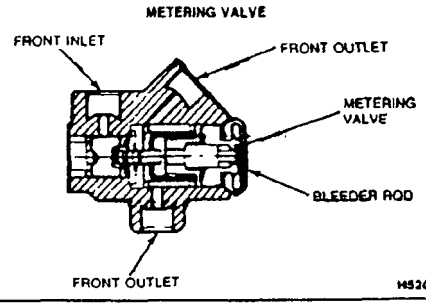
The dual hydraulic brake system is a conventional, pedal-actuated system with a master cylinder, pressure control valve, brake tubes and hoses. The dual system is comprised of front brakes in one hydraulic circuit and the rear brakes in another. The master cylinder has a common reservoir, brake pressure control valve, and a fluid level indicator, all combined in one assembly.

Pressure Control Valves

The valve is screwed into the master cylinder. It limits the pressure level at the rear brakes to minimize rear wheel skidding during hard braking. The sedan and station wagon use the same valve.

Metering Valve

The metering valve limits the hydraulic pressure to the front disc brakes until a predetermined front hydraulic pressure has been reached. The valve has a bleeder rod for purging the front brake system after performing brake service. Refer to Hydraulic System Bleeding.



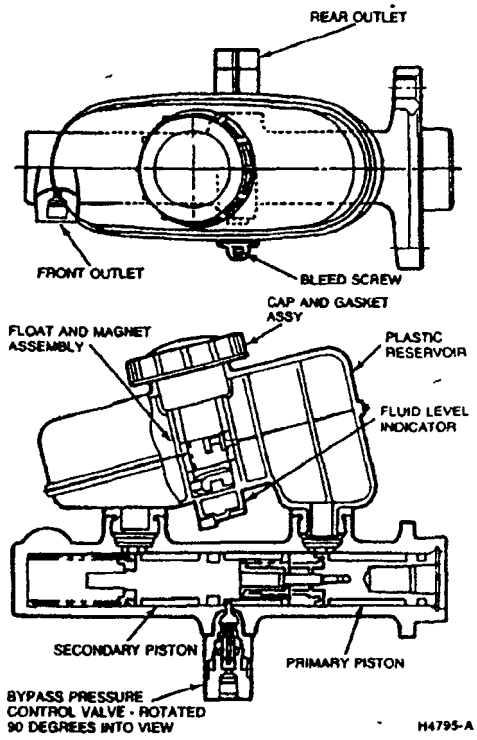
Master Cylinder

The master cylinder has a plastic reservoir, screw-in pressure control valve, and a fluid level indicator combined in one assembly. It is a front/rear split system master cylinder, with the rear outlet in the primary side (nearest to the dash panel) and the front outlet in the secondary side. There is a bleed screw opposite the rear outlet to be used for bleeding the primary side. **Do not bleed through the pressure control valve.** The secondary outlet can be bled in the usual manner.

The fluid level indicator replaces the pressure differential valve and is contained inside the plastic reservoir. When the reservoir fluid level is low, the fluid level indicator switch activates the brake warning lamp.

The pressure control valve is threaded into the master cylinder body and regulates hydraulic pressure level at the rear brakes to minimize rear wheel skidding during hard braking. Also included is a bypassing feature that allows full rear brake pressure during a front brake system failure.

NOTE: For service of the master cylinder, the pressure control valve must be removed prior to removal of the snap ring and pistons. Failure to remove the valve first will result in loss of bypass function and may damage the bore, internal seals, and pistons. To determine whether bypass function is intact, check for extension of plastic poppet (refer to illustration). During reassembly, the valve must be installed after the pistons and snap ring.



Fluid Level Indicator

The fluid level indicator replaces the pressure differential valve used in the previous brake systems. It is contained inside the body of the master cylinder plastic reservoir and activates the brake warning lamp whenever fluid level is low.

DIAGNOSIS AND TESTING

Lincoln Town Car

Brake System Diagnosis

Brake System Diagnosis charts are provided to assist in a broad diagnosis of the brake system's mechanical and hydraulic problems. In addition to these charts, there are specific component diagnosis charts that cover the Master Cylinder and Brake Control Valve Assembly.

DIAGNOSIS AND TESTING (Continued)

Always check the fluid level in the master cylinder before performing the test procedures. If the fluid level is not within 3.18mm (.12-inch) of the top of the master cylinder reservoirs, add Heavy Duty Brake Fluid C6AZ-19542-A or DOT-3 equivalent.

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 System

Two major problems can occur in hydraulic brake systems: internal and external leaks. Hydraulic brake systems and their components, the master cylinder and valves, do not cause the vehicle to vibrate or pull, the brakes to grab or squeal, or the brake pedal to pulse. In most cases, they will not even make the brakes drag. The sources of these problems are found elsewhere in the brake system, but it is always a good policy to first check the entire hydraulic system for leaks before continuing to diagnose any other brake problems.

Master Cylinder

Usually, the first and strongest indicator of anything wrong in the brake system is a feeling through the brake pedal. In diagnosing the condition of the master cylinder, the Master Cylinder Diagnosis charts not only make use of pedal feel as evidence of a brake problem, but also employ two other problem indicators, such as the illumination of the brake warning lamp and the brake fluid level in the master cylinder reservoirs.

Note that the procedures refer to the use of diagnostic techniques. These techniques (Numbers 1 through 6) 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 front disc/rear drum 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 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 diagnosis procedures and techniques in this Section use brake pedal feel, the warning lamp illumination, and brake fluid level as indicators in diagnosing brake system complaints.

Condition 1: Pedal goes down fast. This could be caused by an external or internal leak.

Condition 2: Pedal eases down slowly. This could be caused by an external or internal leak.

Condition 3: Pedal is low and/or feels spongy. This condition may be caused by no fluid in the reservoir, reservoir cap vent holes clogged, rear brakes out of adjustment, or air in the hydraulic system.

Condition 4: Pedal effort excessive. This may be caused by a bind or obstruction in pedal/linkage, or insufficient booster vacuum.

Condition 5: Rear brake lockup during light pedal force. This may be caused by wrong tire pressure, grease or fluid on linings/damaged linings, improperly adjusted parking brakes, or damaged/contaminated proportioning valve.

Condition 6: Erratic pedal effort. This condition could be caused by brake booster malfunction, or extreme caliper piston knock back.

NOTE: *Prior to performing any diagnosis, ensure the brake system warning lamp is functional.*

The diagnosis techniques and service procedures are referenced in the Brake Master Cylinder Diagnosis charts. Refer to these charts for proper use of diagnosis techniques in diagnosing brake hydraulic system problems.

Diagnostic Techniques

Technique No. 1

Air Trapped in Brake System

1. Remove master cylinder reservoir cap and verify that both reservoir chambers are filled with fluid.
2. Place the cap loosely on the master cylinder

DIAGNOSIS AND TESTING (Continued)

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 15cm (6 inches) high will spout from the reservoir if the system has 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.

Technique No. 2

Master Cylinder Bypass Condition—Check

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.

   If the fluid level in a reservoir rises while the pedal goes down and drops when the pedal is released but the overall fluid level in the reservoir remains unchanged, the master cylinder is bypassing. Service the master cylinder.

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 because of improper positioning of the gasket and cap. Reposition the cover and gasket assembly.

Type 2: An external leak may occur at the mounting end of the master cylinder because of a bore end seal leak. Service such a master cylinder.

Technique No. 4

External Fluid Leaks—Check

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 if the reservoir level is actually dropping. Locate and correct the external leak.

Technique No. 5

Brake Pedal Reserve—Check

Vacuum-Powered Brakes

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 an 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 if 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.

Technique No. 6

Checking the Master Cylinder for Open Compensator Port(s)

1. Push brake pedal, and observe the fluid in master cylinder reservoirs.
2. A small spout should appear in one or both reservoirs upon brake application.
3. If no spout appears, loosen the master cylinder attaching bolts 6.0mm (.25 inch), hold the master cylinder out, and check for open compensator port(s) as above.
4. If compensation now occurs, verify booster push rod length and adjust if required. If not, service master cylinder.

Always check the fluid level in the master cylinder before performing the test procedures. If the fluid level is not within 3.18mm (.12 inch) of the top of the master cylinder reservoirs, add Heavy Duty Brake Fluid C6AZ-19542-A or DOT-3 equivalent.

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

DIAGNOSIS AND TESTING (Continued)

Ford Crown Victoria/Mercury Grand Marquis

Brake System Diagnosis

Diagnosis of mechanical and hydraulic problems associated with the brake system is covered in this Section.

In addition to the Brake System Diagnosis charts, further specific diagnosis charts are furnished for the master cylinder, brake control valve and the vacuum brake booster.

Always check the fluid level in the master cylinder before performing the test procedures. If the fluid level is not at the "MAX" line on the master cylinder reservoirs, add Heavy Duty Brake Fluid (ESA-M6C25-A) C6AZ-19542-A or DOT-3 equivalent.

CAUTION: Use of any other than the approved DOT 3® brake fluid will cause permanent damage to brake components and will render the brakes inoperative.

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

Master Cylinder

Normal Conditions

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

Condition 1: New brake systems are not designed to produce as hard a pedal effort as in the past. Complaints of light pedal efforts should be compared to pedal efforts on another vehicle, same model and year.

Condition 2: A trace of brake fluid existing on the booster shell below the master cylinder mounting flange. This results from the normal lubricating action of the master cylinder bore end seal.

Condition 3: Fluid level will decrease with pad wear.

Abnormal Conditions

Changes in brake pedal feel or travel are indicators that something could be wrong in the brake system. The following conditions use brake pedal feel and the warning lamp along with reservoir fluid level, as indicators in diagnosing brake system complaints.

Condition 1: Pedal goes down fast. This could be caused by an external leak or internal leak.

Condition 2: Pedal eases down slowly. This could be caused by an external leak or internal leak.

Condition 3: Pedal is low and/or feels spongy. This condition may be caused by: no fluid in the reservoir, reservoir cap vent holes clogged, rear brakes out of adjustment, or air in the hydraulic system.

Condition 4: Pedal effort excessive. This may be caused by a bind or obstruction in pedal/linkage or insufficient booster vacuum.

Condition 5: Rear brake lockup during light pedal force. This may be caused by wrong tire pressure, grease or fluid on linings/damaged linings, improperly adjusted parking brakes, or damaged/contaminated pressure control valve.

Condition 6: Erratic pedal effort. This condition could be caused by brake booster malfunction, damaged fluid control valve, or extreme caliper piston knock back.

Condition 7: Brake warning lamp ON: This may be caused by low fluid level, ignition wire routing too close to fluid level indicator assembly, or float assembly damage.

NOTE: Prior to performing any diagnosis, ensure that the brake system warning lamp is functional.

The diagnosis techniques and service procedures are referenced in the Brake Master Cylinder Diagnosis charts. Refer to these charts for proper use of diagnosis techniques in diagnosing brake hydraulic system problems.

Diagnostic Techniques

Technique No. 1

External Fluid Leaks—Check

It is possible that all evidence of fluid leakage may have washed off, if the vehicle has been operated in rain or snow, as brake fluid is water soluble. Refill system, bleed, and apply the brakes several times. Examine the system to verify that the reservoir fluid level is actually dropping. Locate and correct the external leak. If fluid level drops and no external leak can be found, check for a master cylinder bore end seal leak.

Technique No. 2

Master Cylinder Bypass Condition Check

1. Check fluid in master cylinder. Fill reservoir if low or empty.
2. Observe fluid level in reservoir. If after several brake applications the fluid level remains the same, measure wheel turning torque required to rotate wheels with brakes applied as follows:
   - Place transmission in NEUTRAL and raise front wheels off the ground.
   - Apply brakes with a minimum of 445N (100 lbs) and hold for approximately 15 seconds. With brakes still applied, exert torque on front wheels to 101 N·m (75 lb-ft). If either wheel rotates, check internals of master cylinder and replace damaged parts.

Technique No. 3

Reservoir Sealing Points—Check

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

DIAGNOSIS AND TESTING (Continued)

Type 1: An external leak may occur at the master cylinder reservoir cap because of improper positioning of the gasket and cap. Reposition cap and gasket.

Type 2: An external leak may occur at the reservoir mounting grommets. Service such a leak by installing new grommets.

Technique No. 4

Brake Pedal Reserve—Check

Where a low pedal or the feel of a bottomed out condition exists, check for brake pedal reserve.

1. Operate engine at idle with the transmission in either PARK or NEUTRAL position.
2. Depress brake pedal lightly three to four times.
3. Allow 15 seconds for vacuum to replenish booster.
4. Apply brake pedal until it stops moving downward or an increased resistance to the pedal travel occurs.

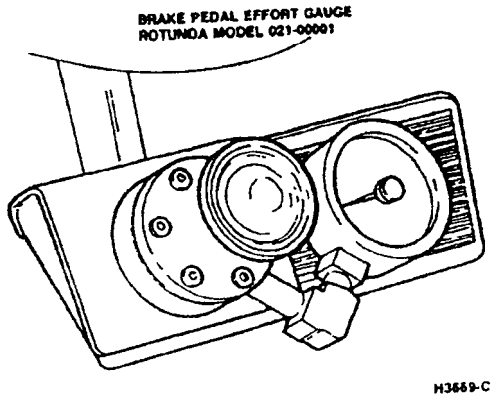
   NOTE: This increased resistance may feel like something has bottomed out.
5. Hold pedal in applied position and raise the engine speed to approximately 2,000 rpm.
6. Release accelerator pedal and observe that brake pedal moves downward as engine returns to idle speed.

   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 rundown. This means that additional stroke is available in the master cylinder, and the brake system is not bottoming out as a customer may believe.

Brake Pedal Free Height Measurements

Lincoln Town Car, Ford Crown Victoria/ Mercury Grand Marquis

1. With the engine running for full power brake operation and the parking brake fully released, measure the brake pedal free height.



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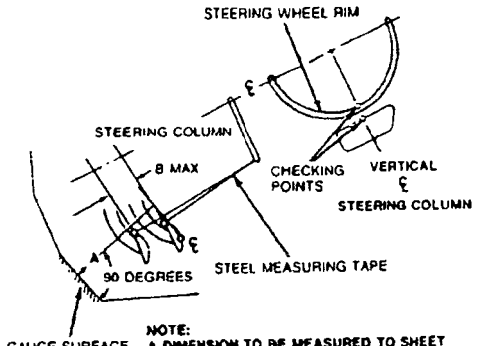
2. Insert a slender, sharp-pointed prod through the carpet and sound deadener to the dash panel metal. Measure the distance to the center on top of the brake pedal pad.



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 111.2 N (25 LBS) LOAD APPLIED TO THE CENTERLINE OF THE BRAKE PEDAL PAD. (CHECKS ON POWER BRAKE VEHICLES MADE WITH ENGINE RUNNING).

VEHICLE	PEDAL FREE HEIGHT "A" (REF. ONLY)		MAXIMUM PEDAL TRAVEL (INCHES) "B"
	MAX.	MIN.	
LINCOLN TOWN CAR FORD CROWN VICTORIA/ MERCURY GRAND MARQUIS	208.28mm (8.2 INCHES)	187.96mm (7.4 INCHES)	76.2mm (3.5 INCHES)
FORD CROWN VICTORIA/ MERCURY GRAND MARQUIS — POLICE ONLY	218.4mm (8.6 INCHES)	198.12mm (7.8 INCHES)	78.2mm (3.5 INCHES)

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3. 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.
4. 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.

DIAGNOSIS AND TESTING (Continued)

Brake Pedal Travel Measurement

1. Install the Brake Pedal Effort Gauge 021-00001 or equivalent on the brake pedal pad and check as follows. Refer to the illustration under Brake Pedal Free Height Measurements, Step 1.
2. Hook a steel measuring tape to the brake pedal. 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. Refer to the illustration under Brake Pedal Free Height Measurements, Step 2.
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 111 N (25 lb) load to the center of the pedal. Maintain the pedal load and 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 111 N (25 lb) load should be 124mm (3.5 inches) maximum.
5. If the pedal travel is more than the maximum dimension specification, make several reverse stops with a forward stop before each. Move the vehicle in reverse and forward for approximately 10 feet. Then, apply the brakes holding 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. If the second series of stops does not bring brake pedal travel within specification, remove brake drums, and check the brake adjusters to ensure they are functioning. Check brake linings for wear or damage. Service or replace all worn or damaged parts and non-functioning adjusters. Adjust the brake lining outside diameter to the approximate inside diameter of the brake drum with Brake Adjustment Gauge D81L-1103-A or equivalent. Refer to Section 12-02.
7. If all the drum brake adjusters, brake drums, and brake shoe linings are functional and brake travel is not within specification, check pedal assembly for missing or worn bushings or loose attachments.
8. If the above Steps do not bring the brake travel within specification, bleed the brake system.

Power Brake Functional Test

Vacuum Booster

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

Booster Operation Check

1. Check the hydraulic brake system for leaks or insufficient fluid.
2. With the transmission in PARK, stop the engine. Depress the brake pedal several times to exhaust all vacuum in the system.
3. With the engine turned 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 move downward under constant foot pressure. If no motion is felt, the vacuum booster system is not functioning.
4. Remove the vacuum hose from the brake booster check valve. Manifold vacuum should be available at the check valve end of the hose with the engine at idle speed and the transmission in NEUTRAL. Ensure that all unused vacuum outlets are properly capped, hose connectors are properly secured, and 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 89 N (20 lbs) 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 check valve, then repeat the test. If the pedal feels hard, replace the booster.

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

DIAGNOSIS AND TESTING (Continued)

Refer to the Vacuum Brake Booster Diagnosis chart to assist in diagnosis.

BRAKE SYSTEM DIAGNOSIS

CONDITION	POSSIBLE SOURCE	ACTION
• Brakes do not apply.	• Insufficient brake fluid.	• Add fluid, bleed system, check for leaks.
	• Binding or damaged brake pedal linkage.	• Service as required.
• Excessive pedal travel or pedal goes to floor.	• Air in system.	• Bleed system.
	• Loose brake tube end fittings.	• Tighten to specification
	• Malfunctioning master cylinder.	• Refer to Master Cylinder Diagnosis Guide.
	• Drum brakes — improperly adjusted.	• Check adjustment. Inspect brakes. Service as required.
	• Loose wheel bearings — Front.	• Adjust as required.
	• Loose or missing pedal bushings/ fasteners.	• Check and replace as required.
• Excessive pedal effort to stop car.	• Binding or damaged pedal linkage	• Inspect Service as required
	• Engine vacuum loss	• Check engine vacuum, and vacuum at check valve to booster. Service as required.
	• Booster inoperative.	• Perform power brake function test or vacuum booster diagnosis
	• Worn or contaminated linings	• Inspect. Replace if necessary
	• Brake system.	• Inspect wheel cylinders or caliper pistons, restricted lines or hoses, contaminated brake fluid, improper operation of proportioning or metering valve Service as necessary.
• Spongy pedal.	• Air in system.	• Bleed system
	• Loose or improper brake pedal, pedal support, booster, master cylinder attachment.	• Service as required.
	• Brake system	• Inspect for damaged or distorted parts in brake caliper assemblies, cracked brake drums, mis-machined anchor plates

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DIAGNOSIS AND TESTING (Continued)

BRAKE SYSTEM DIAGNOSIS

CONDITION	POSSIBLE SOURCE	ACTION
• Brakes Drag, Slow or Incomplete Release	•• Parking brake cable out of adjustment or binding.	•• Check cables for correct adjustment or bind.
	•• Front wheel bearings out of adjustment.	•• Check bearings for adjustment, wear, damage or bind.
	•• Blocked master cylinder compensator ports.	•• See Master Cylinder Diagnosis Guide.
	•• On front disc brakes — loose or missing innershoe clip.	• Inspect and replace if required.
	•• Brake adjustment (rear)	•• Check and adjust.
	•• On front disc brakes — LH or RH shoes misassembled.	•• Check and service.
	•• Restriction in hydraulic system.	•• Check and service.
	•• Wheel cylinders or caliper piston seizure.	• Check and service.
• Noise at Wheels When Brakes are Applied — Snap or Clicks	• On drum brakes in three places — brake shoes binding at backing plate ledges.	• Lubricate.*
	• On drum brakes in three places — backing plate ledges worn	• Replace, and lubricate ledges.*
	•• On disc brakes — loose or missing inner anti-rattle clip.	•• Replace.
	• On front disc brakes — missing pin insulator.	•• Replace.
	• On front disc brakes — missing or loose pins.	•• Replace.
•• Noise at Wheels When Brakes are Applied — Scrape or Grind	• Worn brake linings	• Replace drums or rotors if heavily scored.
	• Brake shoe interference with back of drum Binding at backing plate guide ledges	•• Inspect. Replace as necessary. Lubricate.
	• Caliper to wheel or rotor interference.	• Replace as required.
	• Other brake system components: Warped or bent brake backing plate or splash shield, cracked drums or rotors.	• Inspect and service.
	• Tires rubbing against chassis or body	• Inspect and service
	• Rotor to spindle interference.	• Replace as required.

*Use Disc Brake Caliper Slide Grease D7AZ-19590-A or equivalent

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DIAGNOSIS AND TESTING (Continued)

BRAKE SYSTEM DIAGNOSIS — Continued

CONDITION	POSSIBLE SOURCE	ACTION
• 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. This occasional squeal is not a functional problem and does not indicate any loss of brake effectiveness.**	• Brake drums and linings, rotors and pads worn or scored.	• Inspect, service or replace.
	• On disc brakes — missing or damaged brake pad insulators.	• Replace.
	• On disc brakes — burred or rusted calipers.	• Clean or deburr.
	• Dirty, greased, contaminated or glazed linings.	• Clean or replace. Lightly sand off glaze.
	• Improper lining parts.	• Inspect for correct usage. Replace.
	• 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, service or replace.
• Noise at Wheels, Brakes Not Applied — Squeak or Squeal	• Wheelcover attachment.	• Seat covers with a rubber mallet. Service flanges or replace cover.
	• Loose wheel attaching lug nuts.	• Tighten to specification. Replace wheel if stud holes are damaged.
	• Bent or warped backing plate causing interference with drum.	• Service or replace.
	• Improper machining of drum, causing interference with backing plate or shoe.	• Replace drum.
	• Other brake system components: • Loose or extra parts in brakes. • Rear drum 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. • Improper installation of disc brake anti-rattle clip.	• Inspect, service or replace as required.

CH2959-D

DIAGNOSIS AND TESTING (Continued)

BRAKE SYSTEM DIAGNOSIS — Continued

CONDITION	POSSIBLE SOURCE	ACTION
• Noise at Wheels, Brakes Not Applied — Growling, Click or Rattle	• Stones or foreign material trapped inside wheelcovers.	• Remove stones, etc.
	• Loose grease cap.	• Service or replace.
	• Loose wheel lug nuts.	• Tighten to specification. Replace if stud holes are elongated.
	• Disc brake caliper — loose or missing anti-rattle clips or support pins.	• Inspect, service or replace.
	• Drum brakes — loose or extra parts.	• Inspect, remove or service.
	• Worn, damaged or dry wheel bearings.	• Inspect, lubricate or replace.
• Brakes Pull to One Side	• Unequal air pressure in tires.	• Inflate tires to correct pressure.
	• Grease or fluid on linings. Glazed linings.	• Replace.
	• Loose or missing disc brake caliper attaching pins.	• Replace missing bolts. Tighten to specification.
	• Improper size or type lining on one wheel.	• Replace with correct brake lining in axle sets.
	• Stuck or seized wheel cylinder or calipers.	• Service or replace.
	• Restricted brake lines or hoses.	• Service or replace.
	• Other brake system components:	• Inspect, service or replace as required.
	• Improper adjustment of drum 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.	

CH2960-D

DIAGNOSIS AND TESTING (Continued)

BRAKE SYSTEM DIAGNOSIS — Continued

CONDITION	POSSIBLE SOURCE	ACTION
• Brakes Grab or Lockup When Applied	• Tires worn or incorrect pressure	• Inflate tires to correct pressure Replace tires with worn tread.
	• Grease or fluid on linings — damaged linings	• Inspect, service or replace.
	• Improper size or type of linings.	• Replace with correct brake in axle sets.
	• Other brake system components: • Pins for caliper attachment loose or missing. • Worn, damaged or dry wheel bearings. • Improperly adjusted parking brake.	• Inspect, service or replace as required.
• Brake Warning Lamp On	• Hydraulic system	• Refer to Master Cylinder Diagnosis Chart.
	• Shorted lamp circuit.	• Correct short in warning circuit
	• Parking brake not returned	• Refer to Parking Brake Will Not Release or Fully Return Below
	• Brake warning lamp switch.	• Replace.
• Intermittent Loss of Pedal	• Loose wheel bearings.	• Adjust as required.
		• 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.	• Check lines for leaks. Service or replace as required.
	• Vacuum booster	• Check vacuum booster for internal leaks Replace if required.
• Parking Brake Control Will Not Latch (Manual Release)	• Kinked or binding release cable.	• Inspect, service or replace
	• Control assemoly	• Inspect, service or replace
• Parking Brake Control Will Not Latch (Automatic Release)	• Vacuum leak.	• Service as required
	• Vacuum switch.	• Test. Replace if necessary
	• Control assembly	• Service or replace
• Parking Brake Will Not Release or Fully Return (Manual Release)	• Cable disconnected.	• Connect cable or replace.
	• Control assembly binding.	• Service or replace.
	• Parking brake linkage binding	• Service or replace.
	• Rear brakes	• Check rear brakes shoe retracting springs and parking brake levers On rear disc brakes verify levers return fully to released position Adjust cables or service caliper as required
• Parking Brake Will Not Release or Fully Return (Automatic Release)	• Vacuum line leakage or improper connections.	• Inspect and service
	• Neutral switch	• Adjust or replace
	• Control assembly.	• Service or replace

CH2961-E

DIAGNOSIS AND TESTING (Continued)

VIBRATION WHEN BRAKES ARE APPLIED — LINCOLN TOWN CAR

TEST STEP		RESULT	ACTION TO TAKE
A0	VERIFY CONDITION		
	• Road test vehicle without applying brakes at 40-80 km/h (25-50 mph).	No vibration ▶	GO to A1.
		Vibration present ▶	REFER to Section 18-01 to service this problem first. REPEAT Step.
A1	REAR BRAKE VIBRATION		
	• Road test vehicle 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.**	(OK) ▶	GO to A2.
		(OK) ▶	CHECK rear drums for excessive wear or runout. REFER to Section 12-02 for rear drum brake procedures. REPEAT Step, or REFER to Section 12-25.
A2	SERVICE BRAKE VIBRATION		
	• Road test vehicle with light and medium application on the pedal.	(OK) ▶	Vehicle OK.
		(OK) ▶	CHECK front rotors for excessive runout or cracks. REFER to Section 12-20 for disc brake rotor procedures. REPEAT Step.

CH3801-B

DIAGNOSIS AND TESTING (Continued)

MASTER CYLINDER DIAGNOSIS — LINCOLN TOWN CAR

Brake Pedal Feel Conditions	Diagnostic Action
Condition 1 — Pedal goes down fast and brake warning lamp 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 warning lamp 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 service the master cylinder for a fluid by-pass condition.**
Condition 3 — Pedal is low and brake warning lamp 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, check the front wheel bearings for looseness. (Loose front wheel bearings allow the disc rotor to knock the caliper piston back, creating excessive lining clearance)
Condition 4 — Pedal feels spongy.	This may be normal as newer 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 vehicle. Check for the presence of air in the hydraulic system. (Use Diagnostic Technique No. 1).
Condition 5 — Pedal erratic — no brake warning lamp.	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.

CH2935-G

DIAGNOSIS AND TESTING (Continued)

BRAKE CONTROL VALVE DIAGNOSIS — LINCOLN TOWN CAR

Condition	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 Check metering valve by installing pressure gauges in front and rear bleed screws. Apply 1379 kPa (200 psi) to the system. Front brake system should read 620-965 kPa (90-140 psi) while rear system reads 1379 kPa (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 6897 kPa (1,000 psi) to the front brake system. The rear brake system pressure must be approximately 3445-4979 kPa (500-650 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 6897 kPa (1,000 psi) to the front brake system. The rear brake system pressure must be approximately 3448-4482 kPa (500-650 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 specification

CH2943-D

DIAGNOSIS AND TESTING (Continued)

EXCESSIVE BRAKE PEDAL EFFORT OR VACUUM LEAKS — LINCOLN TOWN CAR

TEST STEP		RESULT	ACTION TO TAKE
A0	VERIFY CONDITION		
	• With engine off, depress and release brake pedal five times to deplete all vacuum from booster. Depress pedal, hold with light pressure. Start engine.	Pedal falls slightly, then holds (OK)	GO to A1.
		(OK)	GO to A3.
A1	VACUUM BOOSTER LEAK TEST		
	• Run engine to medium speed, release accelerator and turn engine off. Wait 90 seconds and apply brakes. Two or more applications should be power assisted.	(OK)	Vehicle OK.
		(OK)	GO to A2.
A2	POWER SECTION CHECK VALVE TEST		
	• Disconnect vacuum hose for booster check valve at manifold. Blow into hose attached to check valve.	Air passes through check valve	INSTALL new check valve and REPEAT Step A1.
		Air does not pass through check valve	REPLACE booster. REPEAT Step A0.
A3	POWER SECTION TEST		
	• Disconnect vacuum hose from booster check vacuum check valve. Run engine at idle. Check vacuum supply with a vacuum gauge.	Above 40.5 kPa (12 in-Hg) and booster does not operate	REPLACE booster. REPEAT Step A0.
		Below 40.5 kPa (12 in-Hg)	SERVICE or REPLACE vacuum hose and vacuum fittings. Also TUNE or SERVICE engine as required. REPEAT Step A0.

CH3129-D

VACUUM BRAKE BOOSTER NOISE — LINCOLN TOWN CAR

TEST STEP		RESULT	ACTION TO TAKE
B0	VERIFY CONDITION		
	• Run engine at fast idle for 10 seconds or longer. Depress brake pedal and listen for noise. Compare results with known good system.	(OK)	Vehicle OK.
		Noise	GO to B1.
B1	PUSH ROD ADJUSTMENT		
	• Check and adjust booster push rod.	(OK)	BLEED brake system.
		(OK)	REPLACE booster. REPEAT Step B0.

CH3130-E

DIAGNOSIS AND TESTING (Continued)

SLOW OR INCOMPLETE BRAKE PEDAL RETURN — LINCOLN TOWN CAR

TEST STEP		RESULT ▶	ACTION TO TAKE
C0	VERIFY CONDITION		
	• Run engine at fast idle while making several brake applications. Pull brake pedal rearward with approximately 44.5 N (10 lbs) force. Release the pedal and measure the distance to the toe board. Make a heavy brake application. Release the brake pedal and measure the pedal to toe board distance. The pedal should return to its original position.	(OK) ▶	Vehicle OK.
		(OK) ▶	GO to C1.
C1	BRAKE PEDAL BINDING		
	• Check pedal to be sure it is operating freely.	(OK) ▶	REPLACE booster.
		(OK) ▶	CORRECT any sticking or binding. REPEAT Step C1.

CH3131-D

DIAGNOSIS AND TESTING (Continued)

MASTER CYLINDER DIAGNOSIS
PEDAL GOES DOWN FAST — FORD CROWN VICTORIA/MERCURY GRAND MARQUIS

TEST STEP	RESULT ▶	ACTION TO TAKE
A0 VERIFY CONDITION		
• Road test vehicle and depress brake pedal.	(OK) ▶	Vehicle OK.
	(OK) ▶	GO to **A1**.
A1 BRAKE FLUID LEVEL		
• Check master cylinder brake fluid reservoir level.	(OK) ▶	GO to **A2**.
	(OK) ▶	CHECK reservoir sealing points (use Diagnostic Technique No. 3), ADD fluid and BLEED system. REPEAT Test **A0**.
A2 PRESSURIZE SYSTEM		
• Pump brake pedal rapidly (five times).	Pedal height builds up, then sinks. ▶	GO to **A3**.
	Pedal height builds up and holds. ▶	CHECK rear brake adjustment and ADJUST if necessary. If condition still exists, BLEED system for air. REPEAT Test **A0**.
A3 BRAKE SYSTEM LEAKS		
• Check for external brake system leaks (use Diagnostic Technique No. 1).	(OK) ▶	GO to **A4**.
	(OK) ▶	SERVICE as necessary, ADD fluid and BLEED system. REPEAT Test **A0**.
A4 MASTER CYLINDER BY-PASS TEST		
• Test for master cylinder by-pass (use Diagnostic Technique No. 2).	(OK) ▶	System OK.
	(OK) ▶	REPLACE damaged parts, ADD fluid and BLEED system. REPEAT Test **A0**.

CH4800-A

DIAGNOSIS AND TESTING (Continued)

MASTER CYLINDER DIAGNOSIS — Continued
PEDAL EASES DOWN SLOWLY — FORD CROWN VICTORIA/MERCURY GRAND MARQUIS

TEST STEP		RESULT ▶	ACTION TO TAKE
B0	VERIFY CONDITION		
• Check if condition occurs during actual stopping application by depressing the brake pedal while the vehicle is moving.		Condition occurs only when vehicle is stationary. ▶	No action required. (SEE Normal Condition No. 1.)
		Condition occurs while vehicle is moving and braking performance is affected. ▶	GO to B1.
B1	BRAKE SYSTEM LEAKS		
• Check for external brake system leaks. (Refer to Diagnostic Technique No. 1.)		(OK) ▶	GO to B2.
		(OK) ▶	SERVICE as necessary, ADD fluid and BLEED system. REPEAT Test B0.
B2	MASTER CYLINDER BY-PASS TEST		
• Test for master cylinder by-pass. (Refer to Diagnostic Technique No. 2.)		(OK) ▶	System OK.
		(OK) ▶	REPLACE damaged parts, ADD fluid and BLEED system. REPEAT Test B0.

CH5476-A

DIAGNOSIS AND TESTING (Continued)

MASTER CYLINDER DIAGNOSIS
PEDAL IS LOW AND/OR FEELS SPONGY — FORD CROWN VICTORIA/MERCURY GRAND MARQUIS

TEST STEP		RESULT	ACTION TO TAKE
C0	VERIFY CONDITION		
	• Road test vehicle and apply brake pedal	(OK)	Vehicle OK
		(OK) crossed	GO to **C1**.
C1	BRAKE FLUID LEVEL CHECK		
	• Check master cylinder brake fluid reservoir level	(OK)	GO to **C2**.
		(OK) crossed	CHECK reservoir sealing points (USE Diagnostic Technique No. 3), ADD fluid and BLEED system
C2	FILLER CAP VENT CHECK		
	• Check if filler cap vent holes are clogged or dirty	(OK)	GO to **C3**
		(OK) crossed	CLEAN as necessary REPEAT Test **C0**
C3	BLEED BRAKE SYSTEM		
	• Bleed brake system as described in this section.	Condition corrected	Vehicle OK
		Condition persists	GO to **C4**
C4	FRONT WHEEL BEARING AND ROTOR CHECK		
	• Adjust front wheel bearing. Refer to Section 11-10. Road test vehicle.	Condition corrected	Vehicle OK
		Condition persists	CHECK rotor for thickness variation REFER to Section 12-20

CH5201-A

DIAGNOSIS AND TESTING (Continued)

MASTER CYLINDER DIAGNOSIS — Continued
PEDAL EFFORT EXCESSIVE — FORD CROWN VICTORIA/MERCURY GRAND MARQUIS

TEST STEP	RESULT ▶	ACTION TO TAKE
D0 VERIFY CONDITION		
• Depress brake pedal fully several times.	(OK) ▶	Vehicle OK.
	(OK) ▶	GO to D1.
D1 BRAKE PEDAL LINKAGE TEST		
• Detach booster push rod from pedal pin and depress brake pedal fully.	Pedal moves freely. ▶	CHECK booster vacuum availability as described under Vacuum Booster Diagnosis in this Section.
	Condition persists. ▶	SERVICE or REPLACE brake pedal linkage. REPEAT Test D0.

CH5202-A

MASTER CYLINDER DIAGNOSIS — Continued
REAR BRAKE LOCKUP DURING LIGHT BRAKE PEDAL FORCE — FORD CROWN VICTORIA/MERCURY GRAND MARQUIS

TEST STEP	RESULT ▶	ACTION TO TAKE
E0 VERIFY CONDITION		
• Road test vehicle and apply brakes lightly.	(OK) ▶	Vehicle OK.
	Both rear lockup (OK) ▶	GO to E3.
E1 TIRE INSPECTION		
• Check for excessive tire wear or improper tire pressures.	(OK) ▶	GO to E2.
	(OK) ▶	SUBSTITUTE known good tires if worn. INFLATE to proper pressure. REPEAT Test E0.
E2 BRAKE SHOE INSPECTION		
• Inspect rear brake shoe linings for grease or fluid on linings and/or wear problems.	(OK) ▶	GO to E3.
	(OK) ▶	REPLACE if necessary. REPEAT Test E0.
E3 PRESSURE CONTROL VALVE TEST		
• Install pressure gauges in LH front and RH rear bleeder screws. Apply 6895 kPa (1000 psi) in the front brake system. The rear brake pressure must be between 3720-4270 kPa (540-620 psi).	(OK) ▶	INSPECT parking brake and ADJUST as required.
	(OK) ▶	REPLACE valve.

CH5203-A

DIAGNOSIS AND TESTING (Continued)

MASTER CYLINDER DIAGNOSIS — Continued
EXCESSIVE AND/OR ERRATIC PEDAL TRAVEL — FORD CROWN VICTORIA/MERCURY GRAND MARQUIS

TEST STEP		RESULT ▶	ACTION TO TAKE
F0	VERIFY CONDITION		
• Road test vehicle and apply brakes slowly.		(OK) ▶	GO to F1.
		(OK) ▶	GO to F2.
F1	ROUGH ROAD TEST		
• Road test vehicle under rough road conditions. Apply brakes slowly.		(OK) ▶	Vehicle OK.
		(OK) ▶	GO to F2.
F2	WHEEL BEARING CHECK		
• Check for loose wheel bearings.		(OK) ▶	CHECK rotor for thickness variances. (REFER to Section 12-20 for front disc overhaul procedures.)
		(OK) ▶	REPLACE wheel bearing if damaged. TIGHTEN wheel bearing assembly to specification. REPEAT Test F0.

CH5204-A

DIAGNOSIS AND TESTING (Continued)

MASTER CYLINDER DIAGNOSIS — Continued
BRAKE WARNING LAMP ON — FORD CROWN VICTORIA/MERCURY GRAND MARQUIS

TEST STEP		RESULT	ACTION TO TAKE
G0	BRAKE FLUID LEVEL		
	• Check master cylinder brake fluid reservoir level.	(OK)	GO to G2.
		(OK)	GO to G1.
G1	BRAKE SYSTEM LEAKAGE		
	• Check reservoir sealing points and external brake system for leakage. (Refer to Diagnostic Techniques No. 1 and 3.)	(OK)	FILL reservoir. GO to G2.
		(OK)	SERVICE as necessary, ADD fluid and BLEED system.
G2	IGNITION WIRING CHECK		
	• Check that ignition wiring is not within a 50.8mm (2 inches) radius of the reed switch Fluid Level Indicator (FLI) assembly.	(OK)	GO to G3.
		(OK)	REROUTE wiring as necessary.
G3	FLOAT ASSEMBLY CHECK		
	• Check if float is stuck or if magnet is dislodged from float.	(OK)	CHECK if ignition prove out circuit is working properly.
		(OK)	REPLACE reservoir assembly.

CH5477-A

ADJUSTMENTS

Brake Vacuum Booster Push Rod-To-Master Cylinder

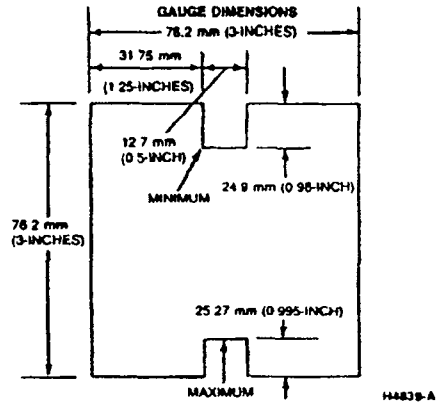
The vacuum booster has an adjustable push rod (output rod) which is used to compensate for dimensional variations in an assembled booster. The push rod length is adjusted after each booster power unit has been assembled in production. **A properly adjusted push rod that remains within the booster after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

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

a. A push rod which is too long will prevent the master cylinder piston from completely releasing hydraulic pressure, eventually causing the brakes to drag.

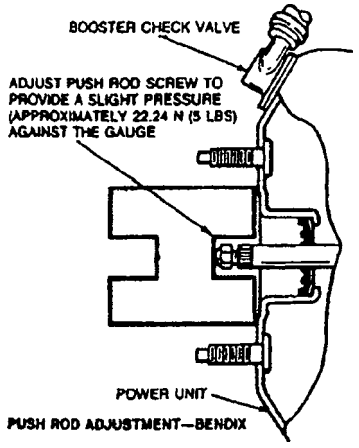
b. A push rod which is too short will increase brake pedal travel and cause a clunk or groaning noise from the booster.

If necessary, a booster push rod length can be verified with a push rod gauge using the following procedure:



ADJUSTMENTS (Continued)

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 idling, gauge and adjust the push rod length. A force of approximately 22.24 N (5 lbs) applied to the push rod with the gauge will ensure that the push rod is seated within the power unit.



PUSH ROD ADJUSTMENT—BENDIX H1871-F

3. Install the master cylinder on the power unit. Gradually alternate the tightening of the retaining nuts to 18-34 N·m (13-25 lb-ft).
4. With the engine idling and the master cylinder reservoir cover removed, observe the fluid surface 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 push rod is adjusted too long and the procedure must be repeated to prevent eventual brake drag.**

Hydraulic System Bleeding

When any part of the hydraulic system has been disconnected for service or replacement, air may enter the system causing a spongy pedal action. Bleed the hydraulic system after it has been properly connected to ensure 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 Heavy Duty Brake Fluid C6AZ-19542-A or DOT-3 equivalent. **Never reuse 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.**

NOTE: On vehicles which have the master cylinder mounted at an angle to the horizontal, bleeding may be better performed if the vehicle is positioned so that the master cylinder is horizontal.

1. 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.**
2. Submerge the free end of the tube in a container partially filled with clean brake fluid, and loosen the bleeder fitting approximately three-quarter turn.
3. Have an assistant 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.
4. When the fluid is completely free of air bubbles, secure the bleeder fitting, and remove the bleeder tube.
5. 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 (cap on Ford Crown Victoria/Mercury Grand Marquis) and gasket. **Ensure 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 3mm (.12-inch) of the top of the reservoir or the MAX line indicated on the reservoir (Ford Crown Victoria/Mercury Grand Marquis).**
6. If the primary (front brake) system is to be bled, repeat Steps 2 through 5 at the right front brake caliper and ending at the left front brake caliper.
7. On Ford Crown Victoria/Mercury Grand Marquis vehicles the master cylinder also has a bleeder fitting. Use the same procedure described in Steps 1 through 4 to bleed the master cylinder.
8. After disc brake service, ensure that the disc brake pistons are returned to their normal positions and the shoe and lining assemblies are properly seated. This is accomplished by depressing the brake pedal several times until normal pedal travel is established.

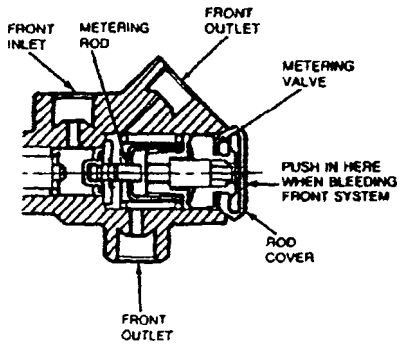
ADJUSTMENTS (Continued)

Pressure Bleeding

For pressure bleeding, use a bladder-type bleeder tank only, such as the Rotunda Brake Bleeder 104-00064 or equivalent. This type bleeder, with a rubber diaphragm, separates the brake fluid from the pressurized air charge.

Bleed the longest lines first. The bleeder tank should contain enough new brake fluid to complete the bleeding operation. Use Heavy Duty Brake Fluid C6AZ-19542-A or DOT-3 equivalent. Never reuse brake fluid that has been drained from the hydraulic system. The tank should be charged with approximately 69-207 kPa (10-30 psi) of air pressure. Never exceed 345 kPa (50 psi) pressure.

1. Clean all dirt from the master cylinder reservoir cover.
2. Remove the master cylinder reservoir cover and rubber gasket. 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 adapter tools can be obtained from various manufacturers.** Follow the instructions of the manufacturer to install the adapter.
3. If the rear wheel cylinders (the secondary brake system) are to be bled, use a suitable box wrench on the bleeder fitting at the right, rear brake wheel cylinder. Attach a bleeder tube **snugly around the bleeder fitting.**
4. Open the valve on the bleeder tank to admit pressurized brake fluid into the master cylinder reservoir.
5. Submerge the free end of the tube in a container partially filled with clean brake fluid, and loosen the bleeder fitting.
6. When air bubbles cease to appear in the fluid at the submerged end of the bleeder tube, close the bleeder fitting. Remove the tube.
7. Repeat Steps 4, 5 and 6 at the left rear wheel cylinder.
8. On front brakes, repeat Steps 4, 5 and 6 starting at the RH front disc caliper and ending at the LH front disc caliper. On metering valves, the release rod must be pushed in and held while bleeding the primary brake system.



9. When the bleeding operation is completed, close the bleeder tank valve, and remove the tank hose from the adapter fitting.
10. After disc brake service, ensure disc brake pistons are returned to their normal positions and the shoe and lining assemblies are properly seated. This is accomplished by depressing the brake pedal several times until normal pedal travel is established.
11. Remove the pressure bleeder adapter tool from master cylinder. Fill the master cylinder reservoir on Lincoln Town Car, or to the MAX line on Ford Crown Victoria/Mercury Grand Marquis. Install the master cylinder cover and gasket. **Ensure the diaphragm-type gasket is properly positioned in the master cylinder cover.**

Pressure Differential Valve—Centralizing

Lincoln Town Car

After any service or bleeding of the primary (front brake) or secondary (rear brake) system, the dual-brake warning lamp switch should be shut off by centralizing the pressure differential valve's piston.

To centralize the pressure differential valve and turn off the warning lamp after a service operation, perform the following procedure:

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

REMOVAL AND INSTALLATION

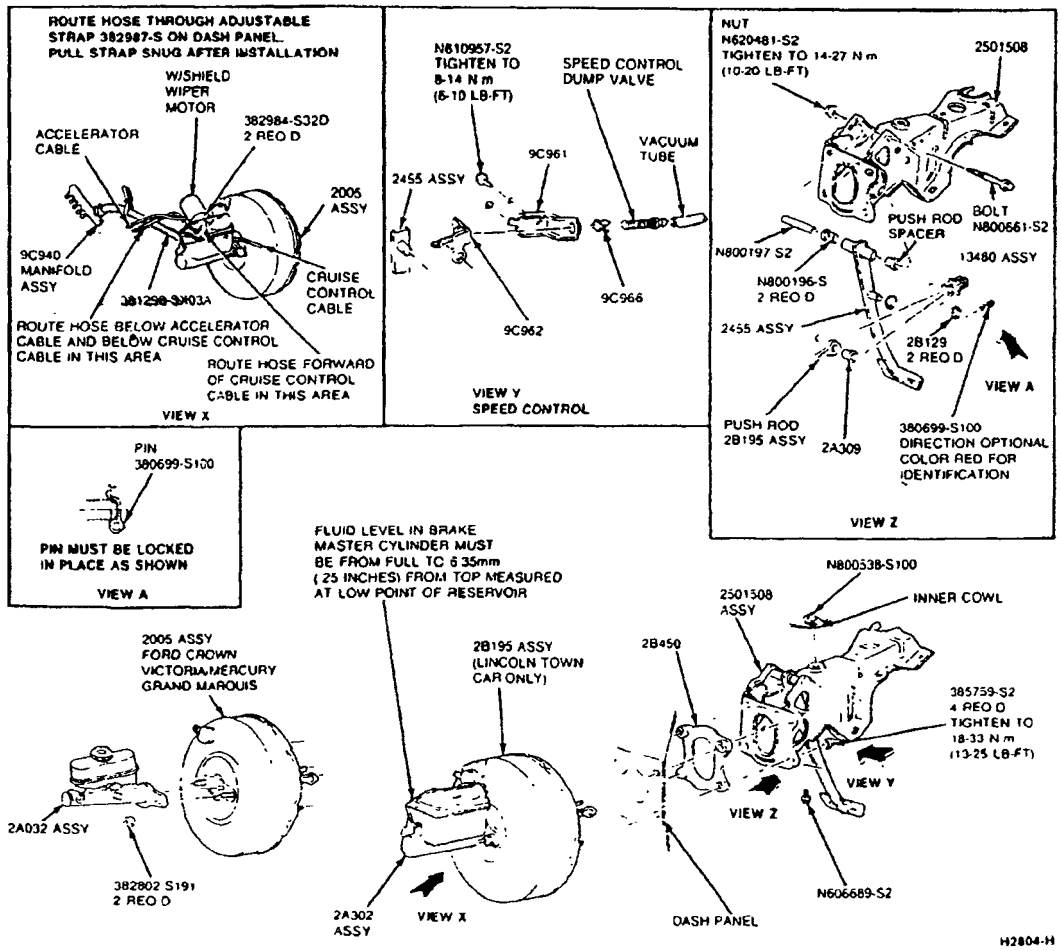
Master Cylinder

Removal

1. Remove the brake tubes from the primary and secondary outlet ports of the master cylinder.
2. Remove the two nuts attaching the master cylinder to the brake booster assembly.
3. Slide the master cylinder forward and upward from the vehicle.

Installation

1. Position the master cylinder assembly onto the two studs on the booster assembly.
2. Install the attaching nuts. Tighten to 18-34 N·m (13-25 lb-ft).
3. Install the front and rear brake tubes to the master cylinder outlet ports. Tighten to 14-24 N·m (10-18 lb-ft).
4. Fill the master cylinder with the specified brake fluid to full or within 3mm (.12-inch) of the top of the dual reservoirs on Lincoln Town Car. Fill to the MAX line on reservoir on Ford Crown Victoria/Mercury Grand Marquis. Use Heavy Duty Brake Fluid C6AZ-19542-A or DOT-3 equivalent.
5. Bleed the master cylinder and the primary and secondary brake systems.
6. Operate the brakes several times, then check for external hydraulic leaks.



REMOVAL AND INSTALLATION (Continued)

Brake Control Valve Assembly

Lincoln Town Car

Removal

1. Disconnect the brake warning lamp switch wire harness connector from the warning lamp switch.
2. Disconnect the front brake system inlet tube and the rear system inlet tube from the brake control valve assembly.
3. Disconnect the LH and RH front brake outlet tubes from the brake control valve assembly.
4. Disconnect the rear system outlet tube from the brake control valve assembly.
5. Remove the screw that retains the brake control valve assembly on the frame. Remove the assembly from the vehicle.

   The brake control valve assembly is serviced only as an assembly.

Installation

1. Position the brake control valve assembly on the frame. Install one mounting screw for frame mounting. Tighten to 10-14 N·m (7-11 lb-ft).
2. Connect the rear brake outlet tube to the control valve assembly. Tighten the tube nut to 13.5-24 N·m (10-18 lb-ft).
3. Connect the rear brake inlet tube to the control valve assembly. Tighten the tube nut to 13.5-24 N·m (10-18 lb-ft).
4. Connect the right front brake outlet tube to the brake control valve assembly. Tighten the tube nut to 13.5-24 N·m (10-18 lb-ft).
5. Connect the left front brake outlet tube to the brake control valve assembly. Tighten the tube nut to 13.5-24 N·m (10-18 lb-ft).
6. Connect the front brake inlet tube to the brake control valve assembly. Tighten the tube nut to 13.5-24 N·m (10-18 lb-ft).
7. Connect the brake warning lamp switch wiring harness connector to the brake warning lamp switch. Verify connection by turning ignition switch to START position; lamp must come on. Also, confirm that the two locking fingers on the connector are locked into the switch.
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 pushed in (pressure bleeding).

Metering Valve Assembly

Ford Crown Victoria/Mercury Grand Marquis

Removal

1. Disconnect the front brake system inlet tube and the rear system inlet tube from the brake control valve assembly.
2. Disconnect the LH and RH front brake outlet tubes from the metering valve assembly.
3. Remove the screw that retains the brake control valve assembly on the frame. Remove the assembly from the vehicle.

   The metering valve assembly is serviced only as an assembly.

Installation

1. Position the metering valve assembly on the frame. Install one mounting screw for frame mounting. Tighten to 10-14 N·m (7-11 lb-ft).
2. Connect the right front brake outlet tube to the brake control valve assembly. Tighten the tube nut to 13.5-24 N·m (10-18 lb-ft).
3. Connect the left front brake outlet tube to the brake control valve assembly. Tighten the tube nut to 13.5-24 N·m (10-18 lb-ft).
4. Connect the front brake inlet tube to the brake control valve assembly. Tighten the tube nut to 13.5-24 N·m (10-18 lb-ft).
5. Bleed the brake system.

   NOTE: During the brake system bleeding operation the metering valve bleeder rod must be pushed in (pressure bleeding).

Brake Pedal

Removal

1. Disconnect battery ground cable.
2. Disconnect the stoplamp switch wire connector from the switch.
3. Loosen the booster nuts approximately 6.35mm (1/4-inch) at the pedal support. Remove the push rod retainer and nylon washer. Slide the stoplamp 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 stoplamp switch bushing from the push rod.
4. Slide the push rod and nylon washer off the pedal pin.
5. Remove the locknut and then remove the pivot bolt, brake pedal, pivot spacer, and bushings from the pedal support.

REMOVAL AND INSTALLATION (Continued)

Installation

1. Apply a coating of SAE 10W40 engine oil to the bushings. 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 locknut. Tighten the nut to 14-27 N·m (10-20 lb-ft).
3. Install the inner nylon washer (if the vehicle is not equipped with speed control), the master cylinder push rod, and the black stoplamp switch bushing on the brake pedal pin. Position the stoplamp switch so that it straddles the push rod 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 retainer securely.
4. Tighten the booster attaching nuts to 18-34 N·m (13-25 lb-ft).
5. Connect the stoplamp switch wire to the switch.
6. Connect battery ground cable.
7. Check the brake pedal free height and travel measurements, as outlined.

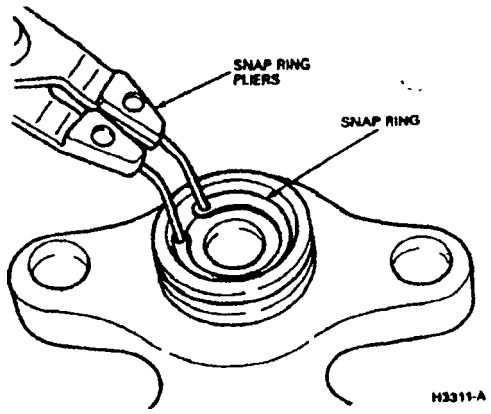
OVERHAUL

Master Cylinder

Disassembly

1. Clean the outside of the master cylinder thoroughly. Remove the cover and diaphragm on Lincoln Town Car (cap and gasket on Ford Crown Victoria/Mercury Grand Marquis). Always discard brake fluid.
2. On Ford Crown Victoria/Mercury Grand Marquis remove pressure control valve by unscrewing from master cylinder. The master cylinder internals cannot be removed unless the pressure control valve is removed.
3. Depress the primary piston, and remove snap ring from retaining groove at the open end of the bore.

NOTE: If master cylinder is to be put into vise to aid in disassembly, mount into vise by flange only to avoid damage to bore or reservoir areas.

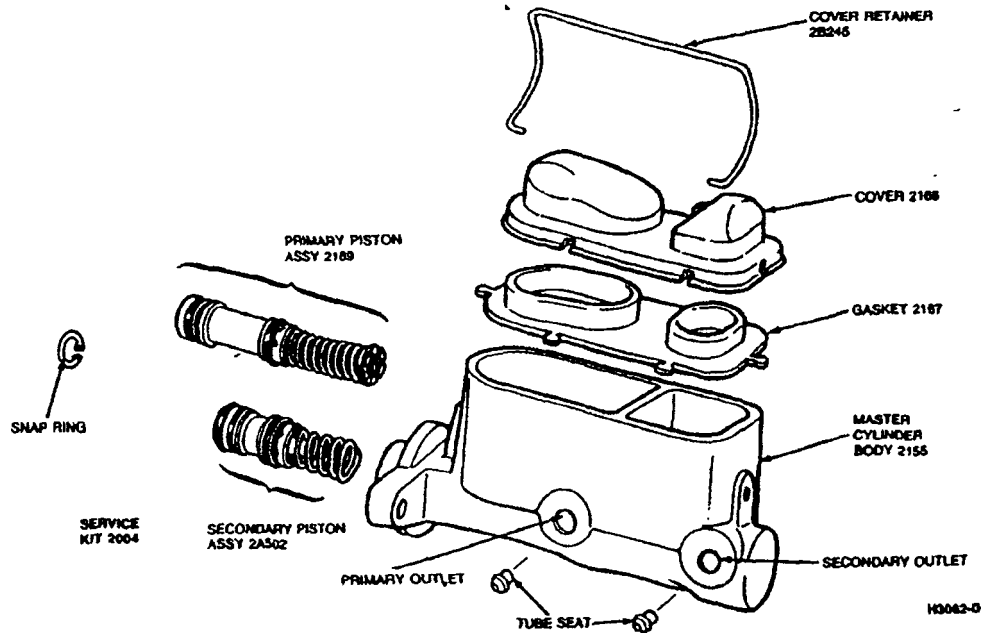


OVERHAUL (Continued)

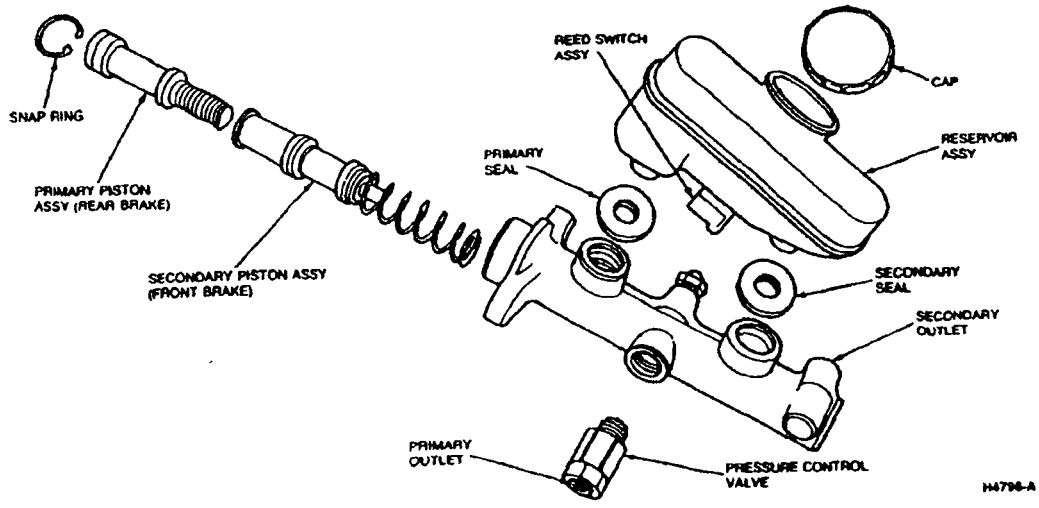
4. Remove primary and secondary piston assemblies from master cylinder. Tap open end of cylinder on bench to remove pistons. If secondary piston does not readily come out, apply air pressure to secondary outlet port to assist removal.

5. On Lincoln Town Car vehicles if brass tube seats are not reusable, remove as follows: Using an Easy-Out tool, remove tube seats by threading tool firmly into seat and tapping tool and seat out.

Lincoln Town Car



Ford Crown Victoria/Mercury Grand Marquis



OVERHAUL (Continued)

Inspection

1. Wash master cylinder body, especially bore, along with primary and secondary piston assemblies in clean brake fluid. Denatured or isopropyl alcohol can be used instead.
2. Inspect seals on primary and secondary piston assemblies for cuts, nicks, scratches, or signs of wear and for presence of any blistering or swelling.

   Blistering or swelling indicates contamination of brake fluid by a petroleum-based solvent or oil. In that case, all rubber components in the brake hydraulic system must be inspected and replaced, and the entire system must be flushed with clean brake fluid to prevent recontamination. Replace the following components:

   - Brake control valve (Lincoln Town Car).
   - Metering valve (Ford Crown Victoria/Mercury Grand Marquis.
   - Front brake caliper seals.
   - Rubber front brake hoses.
   - Rear wheel cylinder seals.
   - Rubber rear brake hoses.
   - Master cylinder reservoir diaphragm (Lincoln Town Car).
   - Master cylinder cap gasket (Ford Crown Victoria/Mercury Grand Marquis).
3. Inspect master cylinder bore for pitting, corrosion, or heavy wear. Heavy wear is characterized by scoring or galling of metal.

   NOTE: The aluminum body of the master cylinder is anodized. Some signs of bore wear on the anodized surface, as evidenced by lighter areas of the anodized surface, are normal and not detrimental. **Honing of the bore on aluminum master cylinders is not permitted as the anodic coating and hardness could be removed.**

Assembly

1. On Lincoln Town Car vehicles replace tube seats if they were removed. Tube seats can be replaced by either pressing in with a vise or by rapping in using a suitable sized brass or wood dowel. Be sure to remove any debris or chips which may form. Refer to illustration under Master Cylinder Disassembly, Step 4.
2. Dip replacement piston assemblies in Heavy Duty Brake Fluid C6AZ-19542-A or DOT-3 equivalent for lubrication prior to assembly into cylinder. Attempting to assemble piston assemblies with dry seals can ruin them.
3. Install secondary (smaller) piston assembly into bore, spring end first.
4. Install primary piston assembly, spring end first.
5. Depress primary piston, and install snap ring.
6. On Ford Crown Victoria/Mercury Grand Marquis vehicles install pressure control valve by screwing into master cylinder. Tighten to 13-24 N·m (10-18 lb-ft).
7. On Lincoln Town Car bleed master cylinder, and install plugs into outlet ports. Do not fill reservoir more than half full because the position of master cylinder in vehicle is not horizontal and can cause spillage.
8. Fill and bleed master cylinder on Ford Crown Victoria/Mercury Grand Marquis.
9. Install cap and diaphragm on master cylinder reservoir, and secure with bail wire retainer (Lincoln Town Car).
10. Install cap and gasket on master cylinder reservoir for Ford Crown Victoria/Mercury Grand Marquis vehicles.

CLEANING AND INSPECTION

Disc Brakes

1. Remove the wheel and tire from the hub and rotor.
2. Inspect brake shoes and lining for wear. If the lining is worn to within 3mm (1/8-inch) of the shoe, replace all (four) shoe and lining assemblies (complete axle set) on front wheels as required. The rubber caliper pin insulators must be replaced when linings are replaced.
3. Visually check the caliper. If the caliper housing is leaking, it should be replaced. If a seal is leaking, the caliper must be disassembled and new seals installed. If a piston is seized in the bore, a new caliper housing is required.

   Refer to Section 12-20 for disc brake rotor resurfacing procedure.

Service Precautions

1. Grease or any other foreign material must be kept off the lining surfaces of the rotor and external surfaces of the hub during service operations. In handling the rotor and caliper assemblies, avoid deformation of the brake rotor and nicking or scratching of brake linings.
2. If a caliper piston is removed for any reason, the piston seal must be replaced.
3. During removal and installation of a wheel assembly, exercise care not to interfere with the caliper splash shield or the bleeder screw fitting.
4. Front wheel bearing end play is critical and must be within specification.
5. To avoid bending or damaging the rotor splash shield on full right or left wheel turns, the vehicle must be centered on the hoist before servicing any front end components.
6. Riding of the brake pedal (common on left-foot applications) must be avoided during vehicle operation.
7. The wheel and tire must be removed separately from the brake rotor, unlike drum brakes where the wheel, tire, and drum can be removed as a unit.

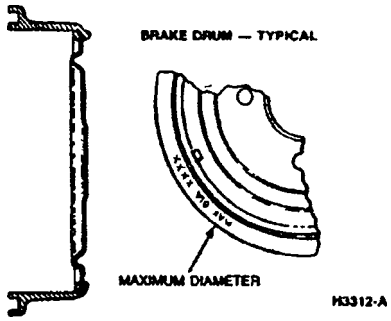
CLEANING AND INSPECTION (Continued)

8. Do not attempt to clean or restore any oil or grease-soaked brake linings. When contaminated linings are found, they must be replaced in complete axle sets.
9. Always replace rubber caliper pin insulators when replacing linings. **Do not lubricate the slide pins.**
10. Caliper slide pins must be hand started into spindle before tightening. This is to ensure that the large diameter of pin is through outer shoe holes to prevent binding or bending. Be careful not to damage the rubber caliper pin insulator when inserting the slide pins.

Drum Brakes

1. Remove the wheel from the drum, and remove the drum. Refer to Section 12-02.
2. Removal of dust and dirt from brake assemblies should be done by using the Rotunda Brake Vacuum 091-00001 or Rotunda Brake Parts Washer 065-00016 or equivalent.

   WARNING: BRAKE ASSEMBLY DUST AND DIRT SHOULD NOT BE REMOVED BY BLOWING OFF WITH AN AIR GUN BECAUSE A HEALTH HAZARD FROM BREATHING ASBESTOS DUST MAY DEVELOP.
3. Inspect the brake shoes for excessive lining wear or shoe damage. If the lining is worn within .794mm (1/32-inch) of the rivet heads or if the shoes are damaged, they must be replaced. Replace any lining that has been contaminated with oil, grease, or brake fluid. Replace lining in axle sets. Prior to replacement of lining, the drum diameter should be checked to determine that the brake drum braking surface diameter is within specification by using the Rotunda Brake Drum Micrometer 010-00010 or equivalent. If the braking surface diameter exceeds specification, the drum must be replaced.
4. Check the condition of brake shoes, retracting springs, hold-down springs, and drum for signs of overheating. If the shoes have a slight blue coloring, indicating overheating, the retracting and hold-down springs should be replaced. **Overheated springs lose their pull and could cause the new lining to wear prematurely, if not replaced. If the brake drums are heat spotted, indicating an overheated condition, they should be replaced.**
5. Inspect all other brake parts, and replace any that are worn or damaged.
6. Inspect the brake drum and, if necessary, refinish. **The maximum inside braking surface diameter is shown on each brake drum.** If the maximum inside braking surface diameter shown on the drum is exceeded either by wear or refinishing, the drum must be replaced. Refer to Section 12-02 for refinishing.



Brake Booster

Check the booster operation as noted under Power Brake Functional Test. If the brake booster is damaged or inoperative, replace it with a new booster. **The brake booster is serviced only as an assembly, including the check valve.**

Brake Tubing

If a section of the brake tubing becomes damaged, the entire section should be replaced with tubing of the same type, size, shape, and length. **Copper tubing should not be used in a hydraulic system.** When bending brake tubing to fit underbody or rear axle contours, be careful not to kink or crack the tube.

Hydraulic Lines

Double wall steel tubing is used throughout the brake system with the exception of the flexible hoses at the front wheels and at the rear axle housing brake tube connection.

Always bleed the applicable primary or secondary brake system after primary or secondary brake system hose or line replacement. Centralize the pressure differential valve after bleeding the system on Lincoln Town Car.

All brake tubing should be properly double flared to provide good leakproof connections. Clean the brake tubing by flushing with clean brake fluid before installation.

When connecting a tube to a hose, tube connector, or brake cylinder, tighten the tube fitting nut to specification.

CLEANING AND INSPECTION (Continued)

Brake Hose

A flexible brake hose should be replaced if it shows signs of softening, cracking, or other damage.

When installing a new front brake hose, position the hose to avoid contact with other chassis parts. Two new sealing washers should be used when a front hose is replaced. For all vehicle lines, engage the opposite end of the hose to the bracket on the frame. Install the horseshoe-type retaining clip, and connect the tube to the hose with the tube nut.

A rear brake hose should be installed, so that it does not touch adjacent chassis parts or body. The white stripe on the hose should show no evidence of twisting. On rear drum brake vehicles, position the hose junction block on the axle, and attach with a bolt and lockwasher. Connect the rear brake tubes to the junction block. Engage the front end of the hose to the bracket on the frame. Install the horseshoe-type retaining clip, and connect the tube to the hose with the tube fitting nut.

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Lincoln Town Car		Ford Crown Victoria/ Mercury Grand Marquis	
	N-m	Lb-Ft	N-m	Lb-Ft
Master Cylinder to Booster	18-34	13-25	18-34	13-25
Booster to Dash Panel	18-34	13-25	18-34	13-25
Pressure Differential (Metering) Valve Bracket Bolts and Nuts	9-15	7-11	9-15	7-11
Wheel Cylinder Bleeder Screw	10-20	7 5-15	10-20	7 5-15
Caliper Bleeder Screw	—	—	8 20	6-15
Brake Hose Connection to Caliper	27-40	20-30	41-61	30-45
Brake Line Connection to Rear Axle Housing, Integral Type	34-45	25-33	34-45	25-33
Hydraulic Tube Connections*				
3/8 x 24	—	—	14-24	10-18
7 16 x 24	—	—	14-24	10-18
1/2 x 20	—	—	14-24	10-18
9-16 x 18	—	—	14-24	10-18
Brake Pedal Pivot Shaft Nut	14-27	10-20	14-27	10-20

*All hydraulic lines must be tightened to the specific torque value and be free of fluid leakage. CH2963-H

Vehicle	Control Valve			
	Type	Pressure Differential	Metering	Proportioning Split Slope
Lincoln Town Car	3-Way	Yes	IN 3-Way	300 9 15mm (36 inch)
Ford Crown Victoria/Mercury Grand Marquis	Master Cylinder	No	Stand Alone	300 10 16mm (40 inch)

CH5209-A

BRAKE BOOSTER APPLICATIONS

Booster Type and Size	Vehicle
Vacuum Single Diaphragm	Lincoln Town Car
	Ford Crown Victoria/Mercury Grand Marquis Sedan
	Ford Crown Victoria/Mercury Grand Marquis Station Wagon

CH2962-E

MASTER CYLINDER BORE DIAMETER

Vehicle	mm	Inch
Lincoln Town Car Ford Crown Victoria Mercury Grand Marquis	25 4	1 0

CH3146-C

SPECIAL SERVICE TOOLS

Tool Number	Description
T71P-1102-A	Disc Rotor Surface Gauge
D81L-1103-A	Brake Adjustment Gauge
TOOL-4201-C	Dial Indicator with Bracketry

CH3140-D

ROTUNDA EQUIPMENT

Model	Description
010-00010	Brake Drum Micrometer
021-00001	Brake Pedal Effort Gauge
091-00001	Brake and Clutch Service Vacuum
065-00016	Brake Parts Washer
104-00064	Brake Bleeder

CH5190-A

SECTION 12-02 Brakes, Drum—Single Cylinder, Dual Piston—Rear

VEHICLE APPLICATION

Lincoln Town Car, Ford Crown Victoria/Mercury Grand Marquis.

DESCRIPTION

WARNING: DO NOT INHALE DUST FROM BRAKES, CLUTCHES OR ASSOCIATED COMPONENTS. INHALATION OF DUST CONTAINING ASBESTOS FIBERS CAN BE INJURIOUS TO YOUR HEALTH AND COULD CAUSE CANCER OR ASBESTOSIS. COMPRESSED AIR OR BRUSHES MUST NOT BE USED TO CLEAN BRAKES, BRAKE DRUMS, CLUTCHES AND ASSOCIATED COMPONENTS. A VACUUM CLEANER EQUIPPED FOR THIS PURPOSE SHOULD BE CAREFULLY USED TO REMOVE ANY DUST. ADHERENT DUST SHOULD BE REMOVED WITH A DAMP CLOTH. ANY DUST SHOULD BE CONTAINED IN A SEALED AND LABELED BAG FOR DISPOSAL. WEAR AN APPROVED HIGH EFFICIENCY CARTRIDGE OR AIR LINE RESPIRATOR AND USE EXTRA CAUTION TO AVOID BREATHING THIS DUST. USE NON-ASBESTOS REPLACEMENT PARTS WHENEVER POSSIBLE.

Brake System, Drum

These vehicles are equipped with front disc brakes and rear drum brakes. The front and rear brakes are actuated by separate hydraulic systems, so if a leak occurs in either system, the remaining system is still operative.

The rear drum brakes utilize internal, hydraulically actuated, expanding brake shoes that are applied against a rotating brake drum.

The most important fact contributing to the effectiveness of the braking force supplied by the drum brake is the brake shoe pressure or force directed against the drum (Fig. 1). With the vehicle moving in either the forward or reverse direction with the brakes applied, the applied force of the brake shoe, pressing against the brake drum, will increasingly multiply itself because the brake's anchor pin acts as a brake shoe stop and prohibits the brake shoe from its tendency to follow the movement of the rotating drum; this results in a wedging action between the brake shoe and brake drum. The wedging action combined with the applied brake force creates a self-multiplied brake force.

Another factor that contributes to the braking force supplied by the brake drum is the servo-action which results when one brake shoe pushes against the other. The brake force of the primary brake shoe is amplified by the force or pressure transmitted from the primary shoe to the secondary shoe through an adjuster screw, which acts as a connecting link between the two shoes (Fig. 2). Forward and reverse servo-action is also provided when the parking brake is applied. The parking brake is mechanically actuated by a cable system that pulls on the parking brake lever, causing the lever to pivot against the parking brake link located between the shoes (Fig. 2). This action expands the brake shoes, pressing them toward the brake drum.

ADJUSTMENTS

Brake Shoes

After any brake service work, obtain a firm brake pedal before moving the vehicle. Adjusted brakes must not drag; wheels must turn freely.

The hydraulic drum brakes are self-adjusting and require a manual adjustment only after the brake shoes have been relined, replaced, or when the length of the adjusting screw has been changed while performing some other service operation. The manual adjustment is performed with the drums removed, using the tool and the procedure detailed below.

When adjusting the rear brake shoes, check the parking brake cables for proper adjustment. Ensure that the equalizer operates freely with the shoes centered on the backing plate.

Ensure that the upper ends of the brake shoes are seated on the anchor pin. The parking brake link should have 0.127-0.64mm (0.005-0.025 inch) end play after overcoming the load of the parking brake link anti-rattle spring.

To adjust the brake shoes:

1. Determine inside diameter of the drum braking surface, using Brake Adjustment Gauge D81L-1103-A or equivalent (Fig. 3).

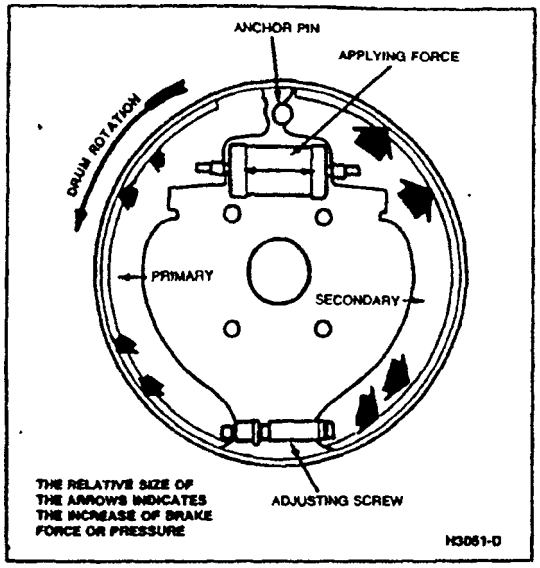


FIG. 1 Brake Shoe Pressure Against Brake Drum

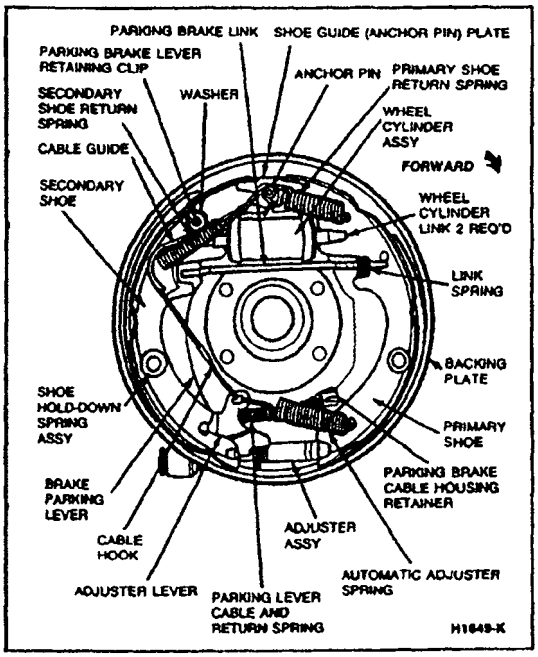


FIG. 2 Brake Drum Assembly—Typical

2. Adjust the brake shoe diameter to fit the gauge (Fig. 3). Hold the automatic adjusting lever out of engagement while rotating the adjusting screw to prevent burring the screw slots. Ensure the adjusting screw rotates freely. If necessary, lubricate the screw threads with a thin, uniform coating of Multi-Purpose Long-Life Lubricant C1AZ-19590-B or equivalent.

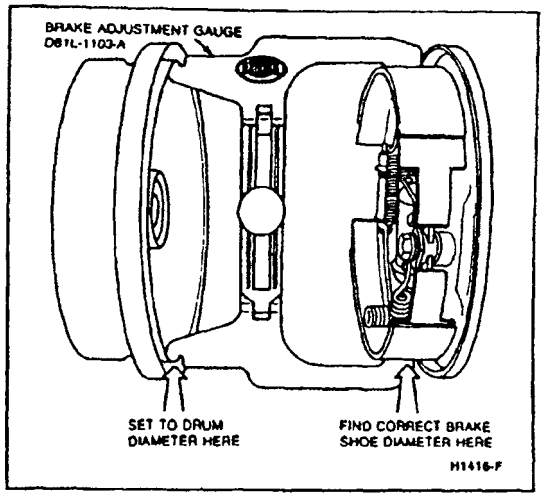


FIG. 3 Brake Shoes Adjustment

3. Rotate Brake Adjustment Gauge D81L-1103-A or equivalent around the brake shoes to be sure of the setting.
4. Apply a small quantity of Disk Brake Caliper Slide Grease D7AZ-19590-A or equivalent to the points where the shoes contact the backing plate, being careful not to get the lubricant on the linings.
5. Install the drums. Install the drum retaining nuts and tighten securely.
6. Install the wheels on the drums, and tighten the nuts to specification.
7. Complete the adjustment by applying the brakes several times with a minimum of 111 N (25 lbs) pressure (power brakes) while backing the vehicle. After each stop, the vehicle must be moved forward.
8. After the brake shoes have been properly adjusted, check the operation of the brakes by making several stops from varying forward speeds.

REMOVAL AND INSTALLATION

Brake Drums

Removal

1. Raise the vehicle so the tire is clear of the floor. Refer to the Pre-Delivery manual, Section 50-04.
2. Remove the wheelcover and wheel.
3. Remove the drum retainer nuts, and remove the brake drum.

   If the drum will not come off, pry the rubber plug from the backing plate. Insert a narrow screwdriver through the hole in the backing plate, and disengage the adjusting lever from the adjusting screw (Fig. 4).
4. While holding the adjustment lever away from the screw, back-off the adjusting screw with the brake adjusting tool (Fig. 4).

   Be very careful not to burr, chip, or damage the notches in the adjusting screw, otherwise, the self-adjusting mechanism will not function properly.

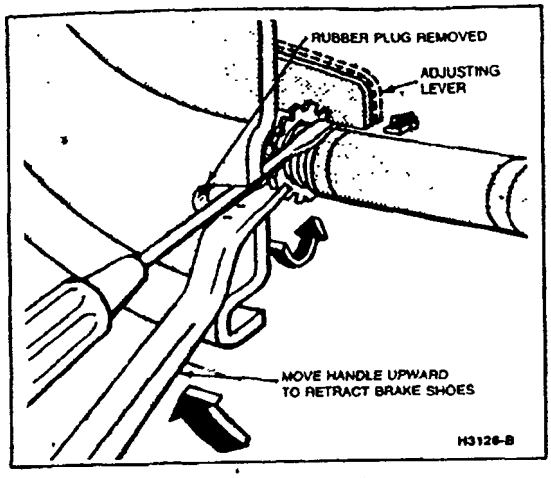


FIG. 4 Backing-Off Brake Adjustment

Installation

1. Remove the protective coating from a new drum with carburetor degreaser. Sand drum lightly and wipe with a cloth soaked with denatured alcohol.
2. Adjust the brakes as outlined under Brake Shoe Adjustments. Place the drum over the brake assembly and into position.
3. Install the drum retainer nuts and tighten securely. Install the wheel on the axle shaft flange studs against the drum, and tighten the attaching nuts to specification. Install wheelcover.
4. Lower vehicle.

Brake Shoes

Removal

1. With the wheel and drum removed, install Brake Cylinder Clamp D81L-1103-B or equivalent over the ends of the brake cylinder (Fig. 5).
2. Remove the shoe-to-anchor springs with Brake Shoe R and R Spring BT-11 or equivalent (Fig. 5), and unhook the cable eye from the anchor pin.
3. Remove the shoe guide (anchor pin) plate (Fig. 2).
4. Remove the shoe hold-down springs, shoes, adjusting screw, pivot nut, socket and automatic adjustment parts.
5. Remove the parking brake link, spring and retainer. Disconnect the parking brake cable from the parking brake lever.
6. After removing the rear brake secondary shoe, disassemble the parking brake lever from the shoe by removing the retaining clip and spring washer (Fig. 2).

Installation

1. Before installing the rear brake shoes, assemble the parking brake lever to the secondary shoe, and secure it with the spring washer and retaining clip.
2. Apply a light coating of Brake Caliper Slide Grease D7AZ-19590-A or equivalent at the points where the brake shoes contact the backing plate. Be careful not to get any lubricant on the brake linings.

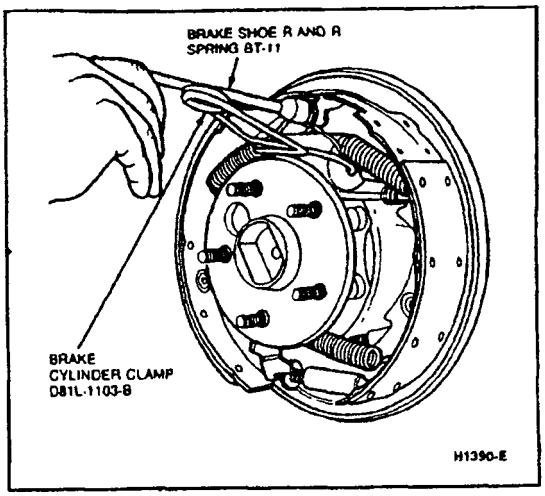


FIG. 5 Retracting Spring—Removal

3. Position the brake shoes on the backing plate. The primary shoe with the short lining faces toward the front of the vehicle. The secondary shoe (long lining) faces rearward. Secure the assembly with the hold-down springs. Install the parking brake link, spring and retainer. Back-off the parking brake adjustment; then, connect the parking brake cable to the parking brake lever (Fig. 2).
4. Install the shoe guide (anchor pin) plate on the anchor pin.
5. Place the cable eye over the anchor pin with the crimped side toward the drum.
6. Install the primary shoe to anchor spring (Fig. 6).
7. Install the cable guide on the secondary shoe web with the flanged hole fitted into the hole in the secondary shoe web. Thread the cable around the cable guide groove (Fig. 2). **It is imperative that the cable be positioned in this groove and not between the guide and the shoe web.**
8. Install the secondary shoe-to-anchor spring (Fig. 6). **Be certain that the cable eye is not cocked or binding on the anchor pin when installed. All parts should be flat on the anchor pin.**
9. Remove the brake cylinder clamp after both shoe-to-anchor springs have been installed.
10. Apply a thin, uniform coat of Multi-Purpose Long-Life Lubricant C1AZ-19590-B or equivalent to the threads and the socket end of the adjusting screw. Turn the adjusting screw into the adjusting pivot nut (Fig. 2) to the limit of the threads, and then back-off one-half turn.

    Interchanging the brake shoe adjusting screw assemblies from one side of the vehicle to the other would cause the brake shoes to retract rather than expand each time the automatic adjusting mechanism operated. To prevent installation on the wrong side of the vehicle, the socket end of the adjusting screw is stamped with an R or L (Fig. 7).
11. Place the adjusting socket on the screw and install this assembly between the shoe ends with the

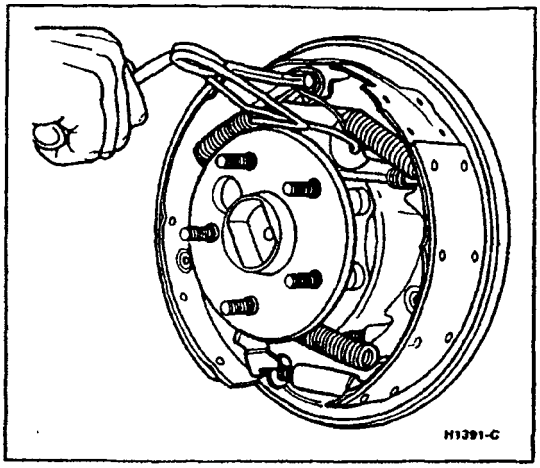


FIG. 6 Retracting Spring—Installation

adjusting screw toothed wheel nearest the secondary shoe.

12. Hook the cable hook into the hole in the adjusting lever. The adjusting levers are stamped with an R or L to indicate their installation on RH or LH brake assembly (Fig. 7).
13. Position the hooked end of the adjuster spring completely into the large hole in the primary shoe web. Connect the loop end of the spring to the adjuster lever hole.
14. Pull the adjuster lever, cable and automatic adjuster spring down and toward the rear, engaging the pivot hook in the large hole of the secondary shoe web (Fig. 2).
15. After installation, check the action of the adjuster by pulling the cable between the cable guide and the adjuster lever toward the secondary shoe web, far enough to lift the lever past a tooth on the adjusting screw wheel. The lever should snap into position behind the next tooth, and the release of the cable should cause the adjuster spring to return the lever to its original position. This return action of the lever will turn the adjusting screw one tooth.

    If pulling the cable does not produce the action described, or if the lever action is sluggish instead of positive and sharp, check position of lever on the adjusting screw toothed wheel (Fig. 4).

    With the brake in a vertical position (anchor at the top), the lever should contact the adjusting wheel 4.763mm ± .794mm (3/16 inch ± 1/32 inch) above the centerline of the screw. If the contact point is below this centerline, the lever will not lock on the teeth in the adjusting screw wheel, and the screw will not be turned.

    Perform brake shoe adjustment.

To determine the cause of this condition:

a. Ensure that the upper or anchor pin end of the cable is pulled toward the cable guide as far as possible and that the end fitting is pointing toward the cable guide.
b. Check the cable end fittings. The cable should completely fill or extend slightly beyond the crimped section of the fittings. If it does not meet this specification, possible damage is indicated, and the cable assembly should be replaced.
c. Check the cable length. Measure from the inside edge of the hook to the far edge of the anchor hole. The cable length for 279mm (11-inch) brakes is 282.6mm (11 1/8-inches). The tolerance on cable length is plus or minus .397mm (1/64-inch).
d. Check the cable guide for damage. The cable groove should be parallel to the shoe web, and the body of the guide should lie flat against the web. Replace the guide if it shows damage.
e. Check the pivot hook on the lever. The hook surfaces should be square with the body of the lever for proper pivoting. Replace the lever if the hook shows damage.
f. Verify that the adjusting screw socket is properly seated in the notch in the shoe web.

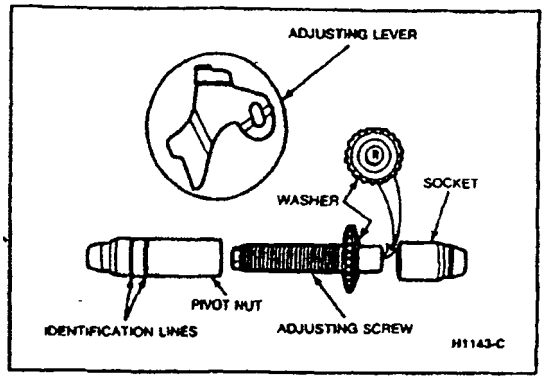


FIG. 7 Adjusting Screw and Lever Identification

16. Ensure that the upper ends of the brake shoes are seated against the anchor pin and that the shoes are centered on the backing plate. If they are not seated, back-off the parking brake system adjustment to obtain 0.127-0.64mm (0.005-0.025-inch) play after overcoming the load of the parking brake link spring.

Wheel Cylinder

Removal

1. Remove the wheel and brake drum.
2. Remove the brake shoe assemblies.
3. Disconnect the brake tube from the brake cylinder at the backing plate. The tube will separate from the cylinder when the cylinder is removed from the backing plate.
4. Remove the wheel cylinder attaching bolts and remove the cylinder.

Installation

Wipe the end(s) of the hydraulic line to remove any foreign matter before making connections.

1. Position the cylinder on the backing plate, and finger-tighten the brake tube to the cylinder.

2. Secure the cylinder to the backing plate by installing the attaching bolts. Tighten bolts to 14-28 N·m (10-20 lb-ft).
3. Tighten the tube fitting nut to 14-24 N·m (10-18 lb-ft) with Tube Nut Wrench 1112-144 or equivalent.
4. Install the links in the ends of the wheel cylinder, and install the shoes and adjuster assemblies.
5. Adjust the brakes. Install the brake drum and wheel. Bleed the brakes.

Brake Backing Plate

Removal

1. Remove the wheel and brake drum. Disconnect the brake line from the brake cylinder.
2. Remove the brake shoes, adjuster assemblies and the wheel cylinder.
3. Remove the axle shaft. Refer to the Powertrain manual, Group 15.
4. Remove the backing plate.

Installation

1. The rear backing plate is mounted on the axle housing flange with four bolts. Tighten to 28-54 N·m (20-40 lb-ft).
2. Install the rear axle shaft, seal, if required, and the new backing plate. Refer to the Powertrain manual, Group 15.
3. Install the wheel cylinder, and connect the brake line as indicated in preceding Steps.
4. Install the brake shoes adjuster assemblies. Connect the parking brake cable to the lever.
5. Adjust the brake shoes, and install the brake drums and wheels. Bleed the brake system, and centralize the pressure differential valve as outlined in Section 12-01.

CLEANING AND INSPECTION

1. Use Rotunda Brake and Clutch Service Vacuum 091-00001 or equivalent to remove all dust from backing plates and interior of brake drums.
2. Inspect brake shoes for excessive lining wear or shoe damage. If lining is damaged or worn within 0.79mm (1/32-inch) of the rivet heads on riveted linings it must be replaced. Replace any lining that has been contaminated with oil, grease or brake fluid. Replace lining in axle sets only. Never replace just one shoe of a brake assembly. Replace both leading and trailing shoes. Prior to replacement of lining, drum diameter should be checked to determine that brake drum diameter is within specification. If braking surface diameter exceeds specification, drum must be replaced.
3. Check condition of brake shoes, retracting spring, hold-down springs, and drum for signs of overheating. If shoes have a slight blue coloring, indicating overheating, retracting and hold-down springs should be replaced. Overheated springs lose their tension and could allow new lining to drag and wear prematurely, if not replaced.
4. Inspect all other brake parts and replace any that are worn or damaged.
5. Inspect brake drum and, if necessary, refinish. The maximum inside diameter is shown on each brake drum. If maximum inside diameter is exceeded either by wear or refinishing, drum must be replaced.

OVERHAUL

Brake Drum Refinishing

Minor scores on a brake drum can be removed with sandpaper. Do not refinish drums to remove score marks. A drum surface which is highly polished can cause the brake to lock-up. This polished condition should be removed either with sandpaper or by refinishing the drum. A drum that is out of round sufficiently enough to cause vehicle vibration or noise when braking, should be refinished. Remove only enough stock to true-up the drum. Brake drum maximum inside diameter is shown on each drum. Refer to Section 12-01. If the maximum inside diameter shown on the drum is exceeded either through wear or refinishing, the drum must be replaced.

Check the inside diameter of the brake drum with Brake Adjustment Gauge D81L-1103-A or Rotunda Brake Drum Micrometer 010-00010 or equivalent.

After a drum is refinished, wipe the refinished surface with a cloth soaked in clean denatured alcohol. If one drum is refinished, the opposite drum on the same axle should also be refinished to the same diameter.

Brake Shoes

Relining

Brake linings that are worn to within 0.79mm (1/32-inch) of a rivet head or have been contaminated with brake fluid, grease or oil must be replaced. Failure to replace worn linings will result in a scored drum. **When it is necessary to replace linings, they must also be replaced on the wheel on the opposite side of the vehicle. Inspect brake shoes for distortion, cracks or looseness. If these conditions exist, the shoe must be discarded. Do not attempt to service a damaged brake shoe.**

1. Wash the brake shoes thoroughly in a clean solvent. Dry thoroughly. Remove all burrs or rough spots from the shoes.
2. Check the inside diameter of the brake drum with Brake Adjustment Gauge D81L-1103-A or Rotunda Brake Drum Micrometer 010-00010 or equivalent.
3. Position the new lining on the shoe. Starting in the center, insert and secure the rivets, working alternately towards each end. **Replacement linings are ground and no further grinding is required.**
4. Check the clearance between the shoe and lining. The lining must seat tightly against the shoe with not more than 0.20mm (0.008 inch) clearance between any two rivets.

Wheel Cylinders

Wheel cylinders should not be disassembled unless they are leaking. Carefully pull lower edges of wheel cylinder boots away from cylinders to see if the interior of the cylinder is wet with brake fluid. Excessive fluid at this point indicates leakage past piston cups and a need for wheel cylinder overhaul.

NOTE: A slight amount of fluid is nearly always present and acts as a lubricant for the piston. It is not necessary to remove the brake cylinder from the backing plate to

disassemble, inspect, hone and overhaul the cylinder. Removal is necessary only if the cylinder is damaged or scored beyond service.

Disassembly

1. Remove the links and the rubber boots from the ends of the brake cylinder. Remove the pistons; cups, and return spring and expander assembly from the cylinder bore (Fig. 8).
2. Remove the bleeder screw from the cylinder.
3. Discard all rubber parts, and wash all other parts in clean denatured alcohol.
4. Inspect pistons for scratches, scoring or other visible damage. Replace if necessary. Always discard the rubber cups and dust boots.
5. Inspect the cylinder bore for score marks or rust. If either condition is present, the cylinder bore must be honed. **However, the cylinder should not be honed more than 0.08mm (0.003-inch) beyond its original diameter.**
6. Wash the cylinder with clean denatured alcohol after honing, and dry it with compressed air.
7. Check the bleeder hole to ensure it is open.

Assembly

Use all parts in the wheel cylinder service kit.

1. Apply a light coating of heavy duty brake fluid to all internal parts.
2. Thread the bleeder screw into the cylinder and tighten to specification.
3. Insert the return spring and expander assembly, cups, and pistons into their respective positions in the cylinder bore (Fig. 8). Place a boot over each end of the cylinder.

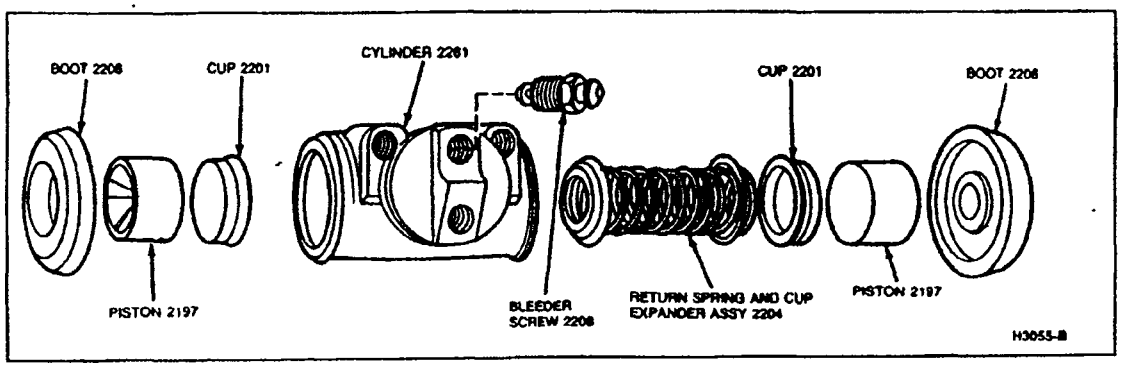


FIG. 8 Brake Wheel Cylinder—Typical

SPECIFICATIONS

BORE DIAMETERS — BRAKE DRUM, WHEEL CYLINDER, AND MASTER CYLINDER

Vehicle	Models	Brake Drum		Rear Wheel Cylinder Bore Diameter
		Inside Diameter	Boring Limit (Max.)①	Rear②
Lincoln Town Car	5.0L (302 CID)	10.000	10.060	0.9375
Ford Crown Victoria/ Mercury Grand Marquis	Station Wagon, Police, Taxi and Trailer Tow	11.030	11.090	0.9375
Ford Crown Victoria/ Mercury Grand Marquis	Sedan Except Police, Taxi and Trailer Tow	10.000	10.060	0.9375

①Max. Runout 0.007 ②Max. Allowable Hone 0.003 CH2909-G

DRUM BRAKE LINING DIMENSIONS (INCHES)

Models	Position	Color Code	Brake Size	Rear Lining Size
Lincoln Town Car, Ford Crown Victoria/Mercury Grand Marquis 5.0L (302 CID)	Primary	Orange-Yellow	10	2.50 x 8.55
	Secondary	Gray-Yellow	10	2.50 x 10.45
All Ford Crown Victoria/Mercury Grand Marquis, Station Wagons and Sedans (Police)	Primary	Orange-Yellow	11	2.25 x 9.38
	Secondary	Gray-Yellow	11	2.25 x 12.12

CH2907-H

TORQUE SPECIFICATIONS

Description	N·m	Lb-Ft
Wheel Cylinder to Backing Plate Screws	14-28	10-20
Rear Brake Backing Plate to Axle Housing	28-54	20-40
Wheel Cylinder Bleeder Screw	10-20	7 5-15
Wheel to Hub and Drum	96-155	70-115

CH2906-E

SPECIAL SERVICE TOOLS

Tool Number	Description
D81L-1103-A	Brake Adjustment Gauge
D81L-1103-B	Brake Cylinder Clamp
D81L-77060-A	Snap Ring Pliers
Milbar 1112-144	Tube Nut Wrench
BT-11 (Snap-On)	Brake Shoe R and R Spring

CH3141-C

ROTUNDA EQUIPMENT

Model	Description
010-00010	Brake Drum Micrometer
065-00016	Brake Parts Washer
091-00001	Brake and Clutch Service Vacuum

CH5192-A

SECTION 12-20 Brakes, Disc—Single Piston, Sliding Caliper—Front

VEHICLE APPLICATION

Lincoln Town Car, Ford Crown Victoria/Mercury Grand Marquis.

DESCRIPTION

WARNING: DO NOT INHALE DUST FROM BRAKES, CLUTCHES OR ASSOCIATED COMPONENTS. INHALATION OF DUST CONTAINING ASBESTOS FIBERS CAN BE INJURIOUS TO YOUR HEALTH AND COULD CAUSE CANCER OR ASBESTOSIS. COMPRESSED AIR OR BRUSHES MUST NOT BE USED TO CLEAN BRAKES, BRAKE DRUMS, CLUTCHES AND ASSOCIATED COMPONENTS. A VACUUM CLEANER EQUIPPED FOR THIS PURPOSE SHOULD BE CAREFULLY USED TO REMOVE ANY DUST. ADHERENT DUST SHOULD BE REMOVED WITH A DAMP CLOTH. ANY DUST SHOULD BE CONTAINED IN A SEALED AND LABELED BAG FOR DISPOSAL. WEAR AN APPROVED HIGH EFFICIENCY CARTRIDGE OR AIR LINE RESPIRATOR AND USE EXTRA CAUTION TO AVOID BREATHING THIS DUST. USE NON-ASBESTOS REPLACEMENT PARTS WHENEVER POSSIBLE.

Brakes, Disc

Front disc brakes are standard on all vehicles. Drum brakes are used on the rear wheels.

NOTE: Brake friction materials inherently generate noise and heat to dissipate energy. As a result, occasional squeal is possible and it is aggravated by severe environmental conditions such as cold, hot, wet, snow salt, mud, etc

Rotor

The cast iron disc is of the ventilated rotor-type, incorporating non-directional cooling fins, and is integral with the wheel hub. A splash shield bolted to the spindle is used to prevent road contaminants from contacting the inboard rotor surface and to direct cool air to the brakes. The wheel provides protection for the outboard surface of the rotor

Caliper Assembly

The caliper assembly consists of a pin slider-type caliper housing, inner and outer shoe and lining assemblies and a single phenolic piston. The caliper assembly slides on two locating pins which also act to position the caliper and to attach the outer shoe to the combination anchor plate and spindle.

The caliper housing contains a single phenolic piston. The piston has a moulded rubber dust boot on its outer end that attaches to a cylinder bore groove to prevent cylinder contamination. There is also a rectangular section rubber piston seal located in the cylinder bore providing sealing between the cylinder and piston (Fig. 1). A groove is also cut inside the phenolic piston for inner brake shoe clip retention.

The outer brake shoe and lining assembly is longer than the inner shoe and lining assembly. Both inner and outer shoe lining assemblies are attached to the caliper by spring clips. The inner and outer clip are riveted to the lining assembly. The inner shoe is attached to the caliper by installing the spring clip to the inside of the caliper piston. The outer shoe clips directly to the caliper housing. The outer shoes are RH and LH and must not be interchanged. Two rubber caliper pin insulators are installed in the caliper attaching holes. The insulators prevent metal-to-metal contact between the locating pins and the caliper.

Anchor Plate

The anchor plate is an integral part of the spindle. Spindles are RH or LH, and are not interchangeable.

Rotor and Splash Shield

The rotor is a cast iron disc design, similar to existing designs, which attaches to the combination spindle/anchor plate in the same manner as existing front disc rotors. The splash shield is made of a glass filled nylon material. Attachment of the shield to the spindle is accomplished by using three bolts.

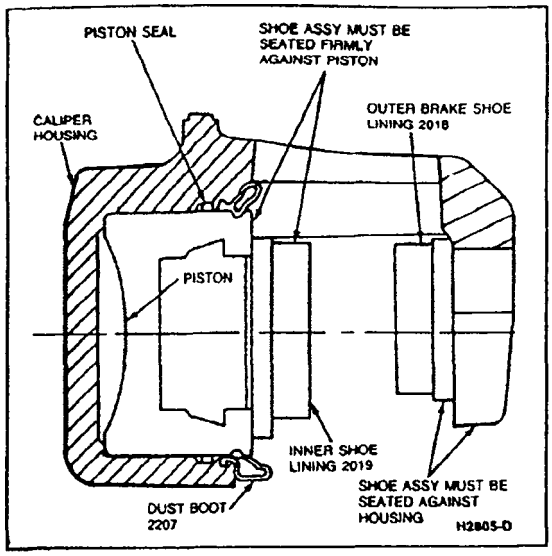


FIG. 1 Caliper Assembly Sectional View

REMOVAL AND INSTALLATION

Service Precautions

1. Grease or any other foreign material must be kept off lining surfaces and braking surfaces of rotor, and external surfaces of hub during service operation. In handling rotor and caliper assemblies, avoid deformation, nicking or scratching of brake linings and rotor.
2. If a caliper piston is removed for any reason, piston seal and dust boot must be replaced. Exercise care not to damage plastic piston by protecting it from contact with any metal or sharp edged objects.
3. During removal and installation of a wheel assembly, exercise care not to interfere with or damage caliper splash shield, if so equipped, or the bleeder screw fitting.
4. Vehicle must be centered on hoist before servicing any front end components to avoid bending or damaging rotor splash shield, if so equipped, on full right or left wheel turns.
5. Do not attempt to clean or restore oil or grease-soaked brake lining. When contaminated linings are found, brake linings must be replaced in complete axle sets and rotor braking surfaces wiped clean.
6. The LH and RH calipers must be installed on the correct side of the vehicle to be sure bleed is in the topmost position for proper purging of air from the front brake system during bleeding.

Caliper Assembly

Removal

1. Remove the wheel and tire assembly from the hub. Use care to avoid damage to, or interference with the bleeder screw fitting during removal.
2. Disconnect the flexible brake hose from the caliper. To disconnect the hose, loosen the tube fitting that connects the hose to the brake tube at the bracket on the frame. Plug the brake tube. Remove the horseshoe-shaped retaining clip from the hose and bracket, disengage the hose from the bracket, then remove the hollow bolt that attaches the hose assembly to the caliper. Mark the LH and RH caliper and hose assemblies with chalk prior to removal from the vehicle so they can be positioned correctly during installation.
3. Remove the caliper locating pins (Fig. 2).
4. Lift the caliper from the integral spindle/anchor plate and rotor.

Installation

1. Install the caliper assembly over the rotor with the outer brake shoe against the rotor's braking surface. This prevents pinching the piston boot between the inner brake shoe and the piston. Make sure the correct caliper is installed on the correct anchor plate according to the way they were marked during disassembly.
2. Ensure the locating pins are free of oil, grease and dirt. Apply Ford Silicone Dielectric Grease D7AZ-19A331-A or equivalent to locating pins and inside of insulators.
3. Connect the locating pins to the integral spindle/anchor plate, the outer shoes and lining and the caliper insulators. Ensure the locating pins are free of oil, grease and dirt. The caliper locating pins must be hand inserted into the outer shoe and hand started. Ensure that the large diameter of the pins goes through the outer shoe holes so that possible binding or bending is prevented. Ensure that the caliper rubber insulators are not damaged during pin insertion.
4. Tighten caliper locating pins to 54-81 N·m (40-60 lb-ft).
5. Install the flexible brake hose to the caliper with hollow bolt and two new sealing washers. Tighten hose fitting to 27-41 N·m (20-30 lb-ft).
6. Position the upper end of the flexible brake hose in its bracket and install the retaining clip. Do not twist the hose. **Remove the plug from the brake tube.** Connect the brake tube to the hose with the tube fitting nut. Tighten to 13-24 N·m (10-18 lb-ft).
7. Bleed the brake system and centralize the brake pressure differential valve.
8. Fill the master cylinder to FULL or within 6.35mm (1/4-inch) from the top of the reservoir.
9. Install the wheel and tire assembly. Tighten wheel attaching nuts to 109-142 N·m (80-105 lb-ft).
10. To position the brake linings, apply the brake pedal several times before moving the vehicle.
11. Road test vehicle.

Brake Shoe and Lining

Removal

1. Remove the master cylinder cap. Check fluid level in the primary (large) reservoir. Remove brake fluid until the reservoir is half full. Discard this fluid.
2. Remove the wheel and tire assembly from the hub. Be careful to avoid damage to, or interference with the caliper splash shield or bleeder screw fitting.
3. Remove the caliper locating pins (Fig. 2).

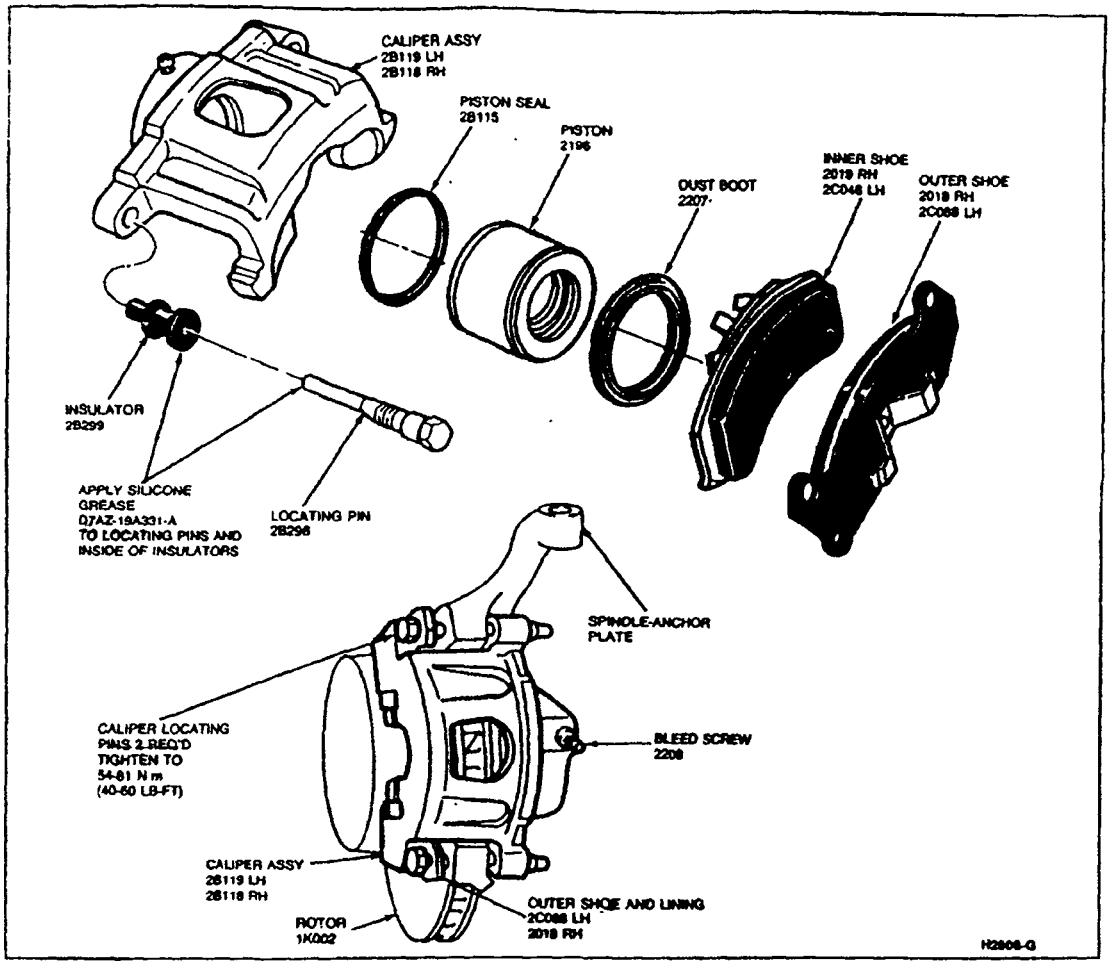


FIG. 2 Brake Components—Disassembly and Assembly

4. Lift the caliper assembly from the integral spindle/anchor plate and rotor. Remove the outer shoe from the caliper assembly.
5. Remove the inner shoe and lining assembly. Inspect both rotor braking surfaces. Minor scoring or buildup of lining material does not require machining or replacement of rotor.
6. Suspend the caliper inside the fender housing. Be careful not to damage the caliper or stretch the brake hose.

Installation

1. Use a 10cm (4 inch) C-clamp and a wood block 7cm (2 3/4-inch) x 2.5cm (1-inch) and approximately 19mm (3/4-inch) thick to seat the caliper hydraulic piston in its bore. Do not apply C-clamp directly to phenolic piston surfaces. This must be done to provide clearance for the caliper assembly to fit over the rotor when it is installed with new linings. Remove the C-clamp from the caliper. (The caliper piston will remain seated in its bore).
2. Install new locating pin insulators in the caliper housing. Check to see if both insulator flanges straddle the housing holes. Do not attempt to install rubber insulators with a sharp edge tool. (Refer to Fig. 3 for installation tool that can help with insulator installation).
3. Install the correct inner shoe and lining assembly in the caliper piston(s). Care should be taken not to bend the shoe clips in the piston, or distortion and rattles can result.
4. Install the correct outer brake shoe and lining assembly (RH/LH), ensuring that the clips are properly seated. The outer shoes are marked LH or RH and must be installed in the proper caliper.
5. Install the caliper to the rotor, and connect the locating pins to the integral spindle/anchor plate, the outer brake shoe and lining, and the caliper insulators. Ensure the locating pins are free of oil, grease, and dirt. The caliper locating pins must be hand inserted into the outer shoe and hand started prior to tightening. Ensure that the large diameter

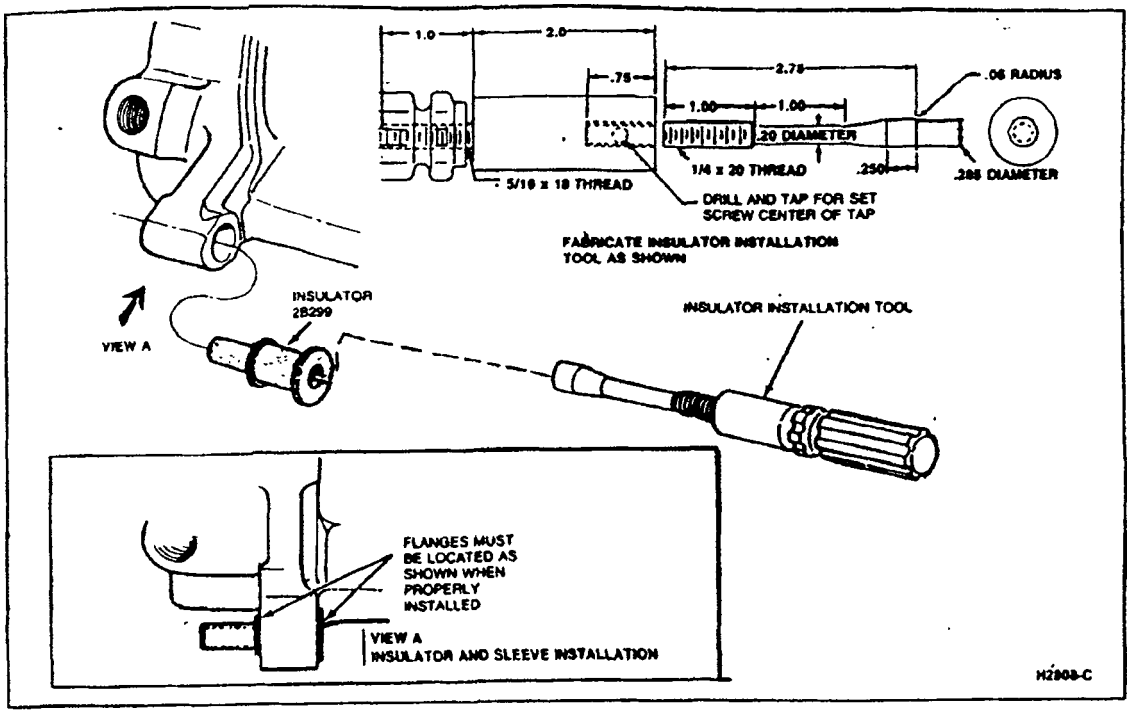


FIG. 3 Insulator and Sleeve Installation

of the pins is through the outer shoe hole to prevent possible binding or bending.

6. Install the wheel and tire assembly. Tighten the wheel attaching nuts to 109-142 N·m (80-105 lb-ft).
7. Pump the brake pedal prior to moving the vehicle to position the brake linings. Refill the master cylinder.
8. Road test the vehicle.

Hub and Rotor

Removal

Refer to Fig. 4.

1. Remove the wheel and tire from the hub. Be careful to avoid damage to, or interference with, the bleeder screw fitting and caliper splash shield.
2. Remove the caliper assembly from the spindle and the rotor as outlined. If the caliper does not require servicing, it is not necessary to disconnect the brake hose or remove the caliper from the vehicle. Position the caliper out of the way, and support it with a wire to avoid damaging the caliper or stretching the hose. Insert a clean, cardboard spacer between the linings to prevent the inner and outer shoes from falling on the floor. Handle the rotor and caliper assemblies to avoid damage to the rotor and nicking, scratching or contamination of the brake linings.
3. Remove the grease cap from the hub. Remove the cotter pin, nut retainer and adjusting nut.
4. Grasp the hub and rotor assembly, and pull it outward far enough to loosen the washer and outer wheel bearing. Push the hub and rotor back onto the spindle, and remove the washer and outer wheel bearing.
5. Remove the hub and rotor assembly from the spindle.

Installation

1. If the rotor is being replaced, remove the protective coating from the new rotor with Carburetor and Combustion Chamber Cleaner D9AZ-19579-B or equivalent. Pack a new set of bearings with Multi-Purpose Long-Life Lubricant C1AZ-19590-B or equivalent, and install the inner bearing cone and roller assembly in the inner cup. Pack grease lightly between the lips of a new grease seal and install the seal.

   If the original rotor is being installed, ensure the grease in the hub is clean and adequate, the inner bearing and grease seal are lubricated and in good condition, and the rotor braking surfaces are clean.
2. Install the hub and rotor assembly on the spindle. Keep the assembly centered on the spindle to prevent damage to the inner grease retainer or spindle threads.
3. Install the outer wheel bearing, washer and start the adjusting nut.
4. Adjust the wheel bearings. Refer to Section 11-10. Then install the nut retainer, cotter pin and grease cap.
5. Install the caliper assembly on the spindle as outlined.
6. Install the wheel and tire assembly. Tighten wheel attaching nuts to 109-142 N·m (80-105 lb-ft).

7. Install wheelcover.
8. Apply the brake pedal several times to properly position the brake shoe and lining assemblies.

Rotor Splash Shield

Removal

Refer to Fig. 4.

1. Remove the caliper and the hub and rotor assembly as outlined. It is not necessary to disconnect hydraulic connections.
2. Remove the three bolts attaching the splash shield to the spindle and remove the shield.
3. Remove and discard the splash shield-to-spindle gasket.

Installation

1. Install a new splash shield-to-spindle gasket.
2. If the shield is bent or damaged, replace it with a straight shield. Position the shield on the spindle. Install the attaching bolts. Tighten to 13-20 N·m (115-177 lb-in).
3. Install the hub and rotor assembly and the caliper as outlined.

   NOTE: The splash shield is made of plastic, and cannot be bent or adjusted (except on Police vehicles).

OVERHAUL

After any service work, pump the brake pedal to obtain a firm brake pedal before moving the vehicle. Riding the brake pedal (common on left-foot application) must be avoided when driving the vehicle.

Caliper

Disassembly

1. Remove the caliper assembly from spindle and rotor as outlined. Do not use screwdriver or similar tool to pry piston back into cylinder bore. Use a C-clamp. Remove outer shoe by slipping down caliper leg until the clip is disengaged. Remove inner shoe by pulling it straight out of piston.

   NOTE: Removal force may be as high as 196-294 N (20-30 lbs).

2. Disconnect the caliper from the hydraulic system, and blow the piston out by using air pressure. Apply air pressure to the fluid port in the caliper with Air Nozzle Assembly Tool 7000-DE or equivalent (Fig. 5) to remove the piston. If the piston is seized and cannot be forced from the caliper, tap lightly around the piston while applying air pressure. Do not use a screwdriver or similar tool to pry the piston out of the bore, because it may result in damage to the piston. Cushion the piston's impact against the caliper iron when blowing it out of the bore by placing shop towels between the piston and caliper bridge.

   Use care because the piston can develop considerable force from pressure buildup.

3. Remove the dust boot from the caliper assembly.
4. Remove the rubber piston seal from the cylinder and discard it.

Cleaning and Inspection

Clean all metal parts with isopropyl alcohol. Then, clean out and dry the grooves and passageways with compressed air. Ensure that caliper bore and component parts are thoroughly clean.

Check the cylinder bore and piston for damage or excessive wear. Replace the piston if it is pitted or scored, or on Police vehicles if the chrome plating is worn off. The piston should also be replaced if it does not meet the requirements in Fig. 6.

Assembly

1. When assembling the caliper, examine the piston for surface irregularities or small chips and cracks (Fig. 6). If necessary, replace the piston. Be sure to clean foreign material from piston surfaces and lubricate them with brake fluid before inserting it into the caliper.
2. When installing the piston back into the bore, use a wood block or another flat stock, like an old shoe lining assembly, between the C-clamp and piston. **Do not apply C-clamp directly to the piston surface,** because this can result in damage to the piston. Ensure the piston is not cocked.
3. Apply a film of clean brake fluid to the new caliper piston seal, and install it in the cylinder bore. Ensure the seal is not twisted but is firmly seated in the groove.
4. Install a new dust boot by setting the flange squarely in the outer groove of the caliper bore.
5. Coat the piston with brake fluid, and install the piston in the cylinder bore. Spread the dust boot over the piston as it is installed. Seat the dust boot in the piston groove.
6. Ensure the dust boot is tight in the boot groove on the piston.
7. To install the inner shoe with its 3-finger clip attached to the shoe into the piston, grab each end of the shoe, making it square with the piston, and push firmly until the shoe clip snaps into the piston. Do not allow the shoe or clip tangs to cock during installation; this avoids bending the clip.
8. Install the caliper over the rotor as outlined.

Rotor Refinishing

Refer to Brake Diagnosis in Section 12-01 for conditions necessitating rotor refinishing.

Brake roughness (vibration or pedal pulsation) that is present during service brake application is caused by either rotor thickness variation or corrosion buildup on the rotor braking surfaces. Check with Rotor Thickness Gauge T75P-1102-B or equivalent. This thickness variation can occur with rotor wear in excess of 19311 km (12,000 miles) use. Rotor turning may thus be necessary beyond the warranty period. The rotors should only be turned as a last resort. The suspension and brake systems of passenger vehicles are designed and built to tolerate rotor thickness variations well above previous brake designs. Rotor replacement should only be required for such circumstances as damaged rotors, bearings, or heavy rotor scoring where rotor turning is not possible.

If pedal pulsation occurs, attempt stopping the vehicle with the transmission in NEUTRAL. If roughness is gone, the drivetrain should be inspected. If the

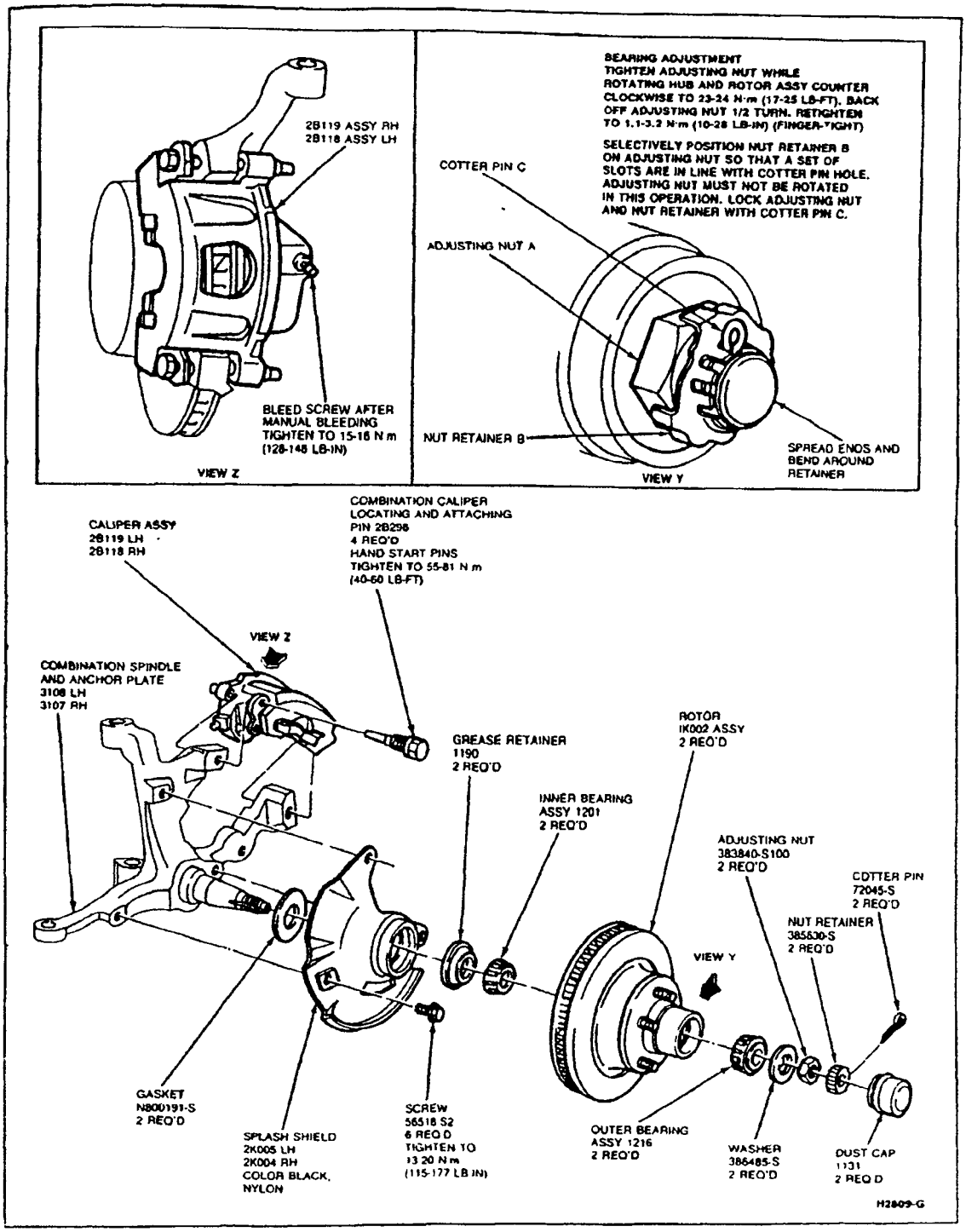


FIG. 4 Caliper, Shield and Rotor Assemblies

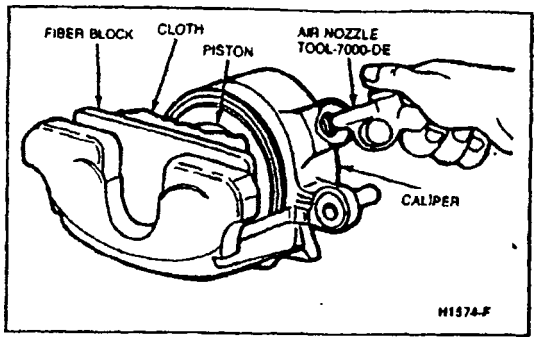


FIG. 5 Piston Removal From Caliper—Typical

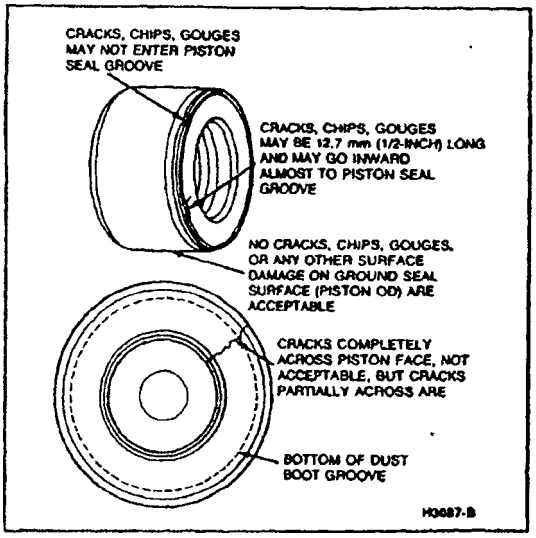


FIG. 6 Surface Irregularities of Phenolic Piston

Vehicle	Base Line Setting 2.25 Ball	Rotor Minimum Thickness①
Ford Crown Victoria/ Mercury Grand Marquis, Lincoln Town Car	.408	.972

①Rotors having a thickness less than shown here must be replaced regardless of the micrometer gauge bar and ball measurements.

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FIG. 7 Front Rotor Micrometer Gauge Bar Baseline Setting—Front Rotor Minimum Thickness

roughness remains, inspect the brakes. If corrosion buildup is the cause, hand sand the brake pads and rotor braking surfaces to remove the scale. If buildup is light, the condition should disappear after a few brake applications.

Rotunda Disc Brake Lathe model 054-00020 or equivalent should be used to refinish disc brake rotors.

Front Rotor

Rotor minimum thickness must not be less than shown in Fig. 7, nor less than the number cast on the inside of the rotor after refinishing. Lateral runout of the braking surfaces must not exceed 0.08mm (0.003 inch), and the surface finish is to be in the 80/15 micro-inch range.

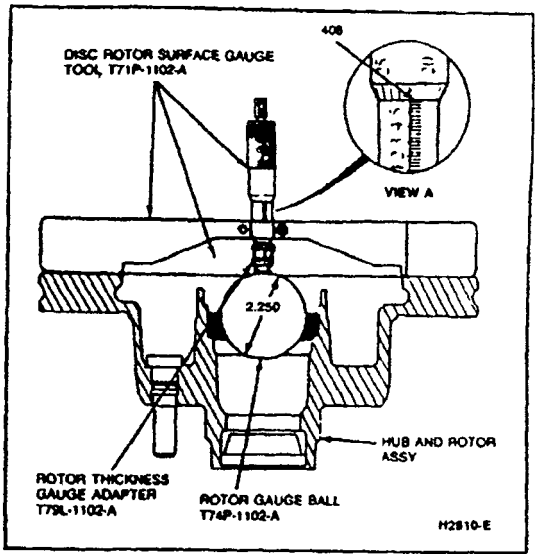

FIG. 8 Gauging Front Rotor Inner Braking Surface

Maximum allowable stock removal of the inner rotor braking surface is determined by the use of Disc Rotor Surface Gauge T71P-1102-A and Rotor Gauge Ball T74P-1102-A or equivalent (Fig. 8) as follows:

1. Remove the inner grease retainer and bearing assembly from the hub and rotor assembly. Wipe the inner and outer bearing cups clean.
2. Carefully place the gauge ball in the inner bearing cup (do not drop).
3. Install Disc Rotor Surface Gauge Adapter T79L-1102-A or equivalent to micrometer, and set the micrometer to the baseline setting dimension (Fig. 7).
4. Position the micrometer gauge bar on the rotor inner braking surface with the micrometer centered over the ball (Fig. 8). To measure the distance between the micrometer baseline setting and the ball, turn the micrometer down to touch the top of the ball, and calculate the difference between that reading and the baseline setting. This distance is equal to the maximum allowable stock removal from the inside braking surface only. If the micrometer end at the baseline setting touches the ball, no additional stock removal is allowed.

   If the micrometer must be retracted from the baseline setting to allow the legs to set on the rotor surface, the rotor has had more than allowable stock removed, and the rotor assembly must be replaced.
5. Check the rotor for the maximum amount of stock that can be removed from the rotor thickness. Measure actual rotor thickness with micrometer, and subtract minimum allowable thickness (cast in individual rotor). Total material removal (combination of both sides) must not exceed this amount.

If the rotor thickness is less than the minimum (Fig. 7), the rotor must be replaced regardless of the gauge bar and ball measurement. Rotor minimum thickness is also shown on each rotor.

6. Position the rotor in the lathe arbor. Never use a lathe that cuts only one face of the rotor at a time; it must be a simultaneous straddle cut. Install a dial indicator to read rotor lateral runout near the center of the rotor face. If runout is 0.05mm (0.002 inch) or below, proceed to machine rotor. If runout is over 0.05mm (0.002 inch), loosen rotor on the arbor, and rotate the rotor 90 degrees. Read the runout, and if it is below 0.05mm (0.002 inch), proceed to machine the rotor. If runout is still over 0.05mm (0.002 inch), again loosen the rotor, and rotate it an additional 90 degrees. Check the runout. If the runout is 0.05mm (0.002 inch) or less, proceed to machine the rotor. If the runout still exceeds 0.05mm (0.002 inch), return the rotor to the best runout position obtained. If the rotor runout can be brought below 0.13mm (0.005 inch), proceed to machine the rotor. If the rotor cannot be brought below 0.13mm (0.005 inch) runout, it must be replaced.
7. Set the cutting tool to contact only the high spot on the rotor, then adjust the cutting tool to the minimum depth required to clean up the rotor face.

   Do not exceed the allowable stock removal for the inner braking surface or total rotor thickness. Before installing the rotor on the spindle, clean all chips from the rotor, and flush new grease through the bearing with a bearing packing tool.

DIAGNOSIS

The diagnosis chart covers service procedures that are common for front disc brake concerns. Using this chart to diagnose brake problems, may virtually eliminate the need for turning or replacing disc brake rotors except for those with extended mileage.

Replacing rotors should be limited to vehicles involved in accidents and rotors extremely scored. Turning of rotors should be limited to rotors experiencing certain wheel bearing problems.

FRONT DISC BRAKE DIAGNOSIS

CONDITION	POSSIBLE SOURCE	ACTION
Grind — A loud, harsh rubbing noise.	• Bound caliper and/or brake shoes.	• Service as necessary.
	• If caliper is not bound, and brake linings are worn to rivets causing rotor to be scored within warranty period, customer abuse (riding brake pedal) is cause.	• This is not a chargeable warranty claim. No warranty claims are to be accepted for lining replacement, rotor replacement, or rotor turning under these conditions. Service and replace as necessary.
	• Wheel bearings not lubricated (verify noise is coming from bearings).	• Lubricate and replace bearings and seals as necessary.
Rattle, Clunk, Knock — A series of sharp short sounds in quick succession.	Bent, loose, missing or worn components: • Caliper support pins • Pin bushings • Inner/outer shoe clips • Dust shield	 • Tighten or replace. • Replace as necessary. • Service or replace as necessary. • Service as necessary.
Roughness — An unsmooth feeling while braking evidenced by a pulsating brake pedal.	• Corrosion buildup on rotor surfaces.	• Hand sand corrosion from rotor braking surfaces and glaze from linings.
	• Wheel/tire imbalance.	• Verify and service as necessary.
	• Drivetrain imbalance.	• Attempt stopping vehicle in NEUTRAL transmission position. If roughness is gone, drivetrain should be inspected.
	• Rear brake roughness.	• Inspect and service as necessary. Diagnose per Section 12-01, service per Section 12-20.
	• Rotor thickness variation.	• Record rotor thickness variation, replace rotor if thickness variation, when removed from vehicle, exceeds 0.020mm (0.0008 inch). Replace rotor.
	• Front wheel bearings misadjusted.	• Inspect and adjust bearing setting as necessary.
Squeal — A loud, sharp, high-pitched moderately prolonged sound that occurs while braking. Occasional or intermittent brake squeal may result from environmental conditions such as cold, heat, wetness, snow, salt, mud, etc. This condition is not a functional one and will not affect braking effectiveness.	• Brake lining and/or rotor surface contamination evidenced by glazed surfaces.	• Remove caliper assembly from spindle and remove inner and outer linings. Rotor removal from rear drive vehicles is not necessary. Hand sand glaze from linings and both braking surfaces of rotor. Use Garnet Paper 100A (medium grit) or aluminum oxide 150J (medium). • Follow the applicable service procedures when replacement of brake pad insulators is necessary, instead of replacing the entire shoe and lining assembly when the pads are not worn.

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SPECIFICATIONS

FRONT DISC BRAKE DIMENSIONS

Description	Lincoln Town Car, Ford Crown Victoria/ Mercury Grand Marquis
Lining Material	Riveted
Lining Size	8.38 x 1.79 outer 5.39 x 1.85 inner
Lining Wear Limit (From Shoe Surface)	.125
Lining to Rotor Clearance (Brakes Released)	0.000-0.010
Caliper Cylinder Bore Diameter	2.88
Master Cylinder Bore Diameter	1.000
Front Rotor Nominal Thickness	1.03
Front Rotor Minimum Thickness①	.972
Front Rotor Diameter	11.08 outside 7.07 inside
Front Rotor Allowable Runout	0.003
Front Rotor Finish (Micro-inches)	10-80
Front Rotor Thickness Variation	0.0005 Max.
Gauge Bar Micrometer Baseline Setting	See Overhaul Section

①Minimum Safe Thickness is shown on each Rotor.

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TORQUE SPECIFICATIONS

Description	N-m	Lb-Ft
Locating Pins to Spindle and Anchor Plate	54-81	40-60
Brake Hose to Caliper	27-41	20-30
Brake Hose to Brake Tube	13-24	10-18
Splash Shield Bolt to Spindle and Anchor Plate	13-20	115-177 (Lb-In)

CH3054-E

SPECIAL SERVICE TOOLS

Tool Number	Description
T71P-1102-A	Disc Rotor Surface Gauge
T74P-1102-A	Rotor Gauge Ball
T75P-1102-B	Rotor Thickness Gauge
T79L-1102-A	Rotor Thickness Gauge Adapter
TOOL-7000-DE	Air Nozzle Assembly

CH3143-C

ROTUNDA EQUIPMENT

Model	Description
054-00020	Disc Brake Lathe

CH5194-A

SECTION 12-50 Brake Booster, Vacuum—Dash Mounted

VEHICLE APPLICATION

Lincoln Town Car, Ford Crown Victoria/Mercury Grand Marquis.

DESCRIPTION

The diaphragm-type brake booster is self-contained and is mounted on the engine side of the dash panel. The vacuum brake booster utilizes engine intake manifold vacuum and atmospheric pressure for its power.

Adjustment of the push rod and replacement of the check valve are the only services permitted on the brake booster.

If any brake booster is damaged or inoperative, replace it with a new booster. The brake booster (including the check valve) is serviced only as an assembly.

ADJUSTMENTS

Brake Booster-To-Master Cylinder Push Rod

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 push rod that remains assembled to the booster with which it was matched in production should never require a service adjustment.**

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

- A push rod that is too long will prevent the master cylinder piston from completely releasing hydraulic pressure, eventually, causing the brakes to drag.
- A push rod that is too short will increase brake pedal travel and cause a groaning noise to come from the booster.

If necessary, booster push rod length can be verified with a push rod gauge (Fig. 1) by 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 push rod length (Fig. 2) A force of approximately 22N (5 lbs) applied to the push rod with the gauge will ensure that the push rod is seated within the power unit.

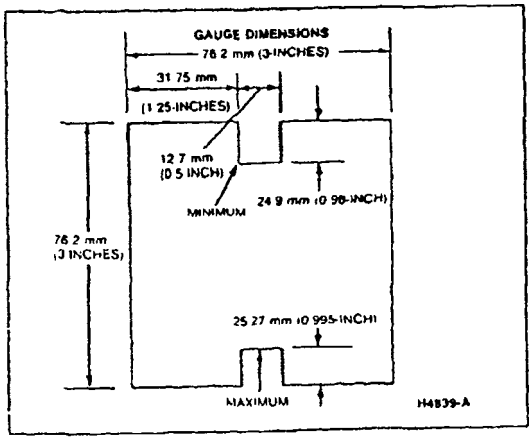

FIG. 1 Push Rod Gauge Dimensions

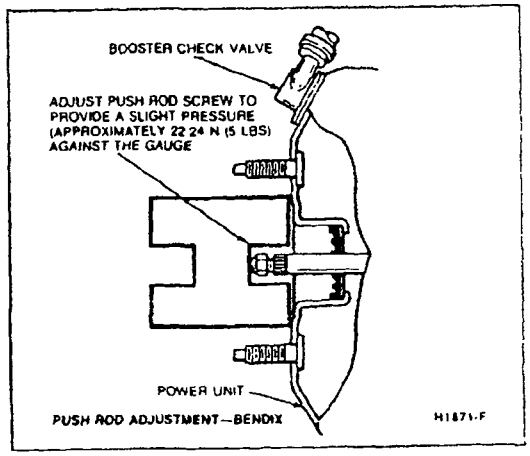

FIG. 2 Brake Booster Push Rod Measurement

3. Install the master cylinder on the power unit. Gradually alternate tightening the retaining nuts to 18-34 N·m (13-25 lb-ft). Refer to Section 12-01.
4. With the engine running and the master cylinder reservoir cover removed, observe the fluid surface in the reservoirs when the brake pedal is applied rapidly.

   NOTE: Some fluid movement should occur in the forward reservoir. If fluid surface movement did not occur, the push rod is adjusted too long, and the procedure must be repeated to prevent eventual brake drag.

REMOVAL AND INSTALLATION

Brake Booster, Vacuum

Removal

Refer to Fig. 3.

1. Working in engine compartment, disconnect battery ground cable. Remove master cylinder from booster. Set it aside without disturbing hydraulic lines. It is not necessary to disconnect brake lines, but care should be taken so brake lines are not kinked. Kinking of brake lines can lead to tube damage.
2. Disconnect manifold vacuum hose from booster check valve.
3. Working inside vehicle, below instrument panel, remove stoplamp switch connector. Remove switch retaining pin. Slide stoplamp switch off from brake pedal pin just far enough for outer plate of stoplamp switch to clear pin, and then remove switch from pin. Be careful not to damage switch during removal.
4. Remove booster-to-dash panel attaching nuts. Slide booster push rod, nylon washers and bushing off brake pedal pin.
5. Remove booster assembly from dash panel by sliding push rod out from engine side of dash panel.

Installation

1. Place booster in position on dash panel.
2. Working inside vehicle, install inner nylon washer, booster push rod and bushing on brake pedal pin. Secure booster to dash panel with self-locking nuts. Tighten to 18-34 N·m (13-25 lb-ft).
3. Position stoplamp switch so that it straddles booster push rod with switch slot toward pedal blade and hole just clearing pin. Slide switch completely onto pin. **Be careful not to bend or deform switch.**
4. Install nylon washer on pin, and secure all parts to pin with hairpin retainer. Make sure retainer is fully installed and locked over pedal pin. Install stoplamp switch wiring connector on stoplamp switch.
5. Connect manifold vacuum hose to booster check valve using hose clamp.
6. Install master cylinder to booster studs. Tighten attaching nuts to 18-34 N·m (13-25 lb-ft).
7. Connect battery ground cable. Start engine and check power brake function.

DIAGNOSIS AND TESTING

Refer to Section 12-01.

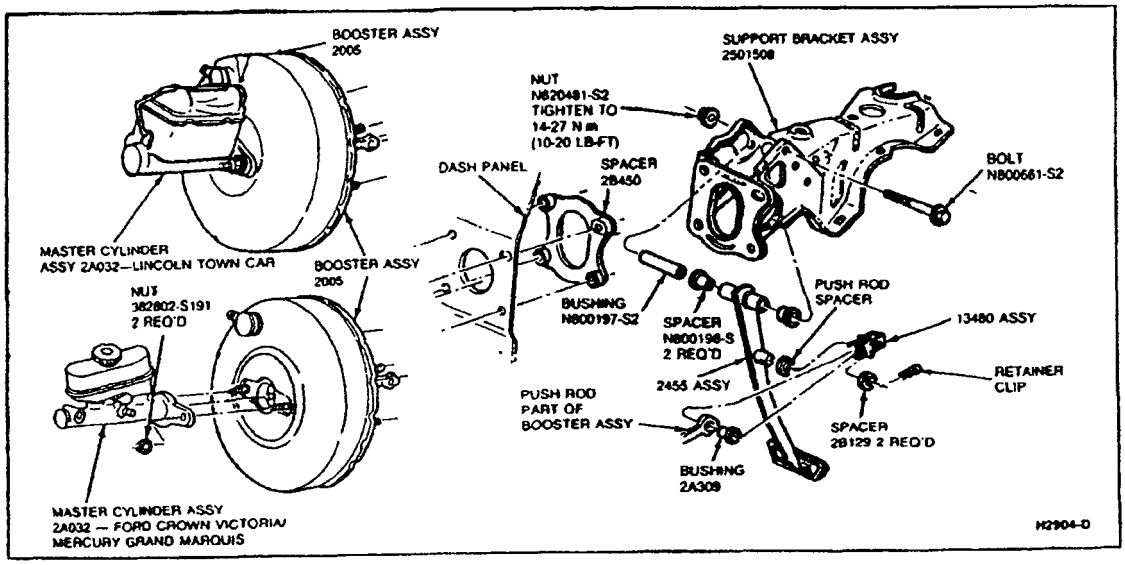

FIG. 3 Vacuum Booster Installation

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	N-m	Lb-Ft
Booster-to-Dash Panel Locking Nut	18-34	13-25
Master Cylinder-to-Booster Locking Nuts	18-34	13-25

CH3052-D

SECTION 12-70 Parking Brake, Cable Actuated—Rear Wheels

VEHICLE APPLICATION

Lincoln Town Car, Ford Crown Victoria/Mercury Grand Marquis.

DESCRIPTION

The parking brake control assembly is shown in Fig. 1. The parking brake systems are shown in Figs. 2 and 3.

Control Assemblies

An independent foot-operated parking brake control actuates the rear wheel brake shoes through a cable system (Fig. 1).

The parking brake warning lamp can be actuated by the parking brake control. It warns the driver to release the parking brake control before driving the vehicle. If the lamp remains lit, a brake malfunction has occurred.

The automatic (vacuum) release-type is standard equipment.

The automatic vacuum-type parking brake system has a vacuum power unit with mounting bracket bolted to the control assembly. The vacuum-actuated diaphragm within the unit is connected by a rod to the upper end of the release lever.

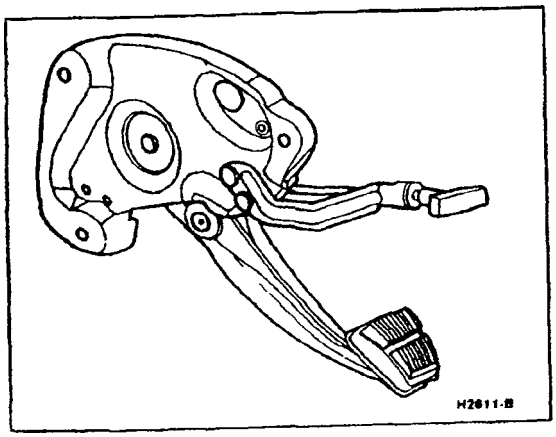

FIG. 1 Parking Brake Control Assembly—Automatic Release—Ford Crown Victoria/Mercury Grand Marquis

Hoses connect the vacuum motor to the engine manifold through a vacuum release switch at the steering column.

The vacuum motor is actuated to release the parking brake whenever the engine is running and the transmission is in a forward driving gear.

The automatic parking brake control has a manual release T-handle which extends from under the LH side of the instrument panel. Pulling this handle releases the parking brake.

DIAGNOSIS AND TESTING

Vacuum Release Parking Brake

Look closely at the operation of the brake linkage as the parking brake pedal is depressed. Then, check the operation of the brake linkage when the manual release lever is activated. These checks will indicate whether the manual parking brake control linkage is operating properly or requires service or adjustment. Adjustment may be necessary if the parking brake is unable to prevent moderate vehicle movement. Perform tests of the parking brake system and controls after making sure the linkage and manual controls operate properly.

When testing a parking brake vacuum release system, a minimum of 34 kPa (10 in-Hg) should be available at all points where vacuum is applied. This can be checked with a gauge, such as Rotunda Vacuum Tester 021-00014 or equivalent.

Failure to maintain 34 kPa (10 in-Hg) during vacuum system tests could be caused by a loose hose connection, resulting in a vacuum leak. When checking for vacuum between two points, trace the hose along its entire routing to ensure it is not crossed with another hose or connected to the wrong connection.

All of the vacuum parking brake control checks are to be performed with the engine running at idle speed.

To detect any leaks in the parking brake hoses or to find disconnected or improperly connected hoses, listen for a hissing sound along the hose routing.

CAUTION: Do not apply air pressure to the vacuum system under any circumstances because the actuator diaphragm in the parking brake vacuum motor may be damaged.

1. Start engine and run it at idle speed. With the transmission shift control in NEUTRAL, depress parking brake pedal to apply parking brake. Move transmission shift control to D range, and observe the parking brake sector to see if the sector returns to its zero travel position when the parking brake releases. If parking brake releases, the parking vacuum control is working properly.

   NOTE: The parking brake vacuum release does not operate with transmission in REVERSE.

2. If parking brake does not release, test for vacuum at the vacuum line connected to the parking brake release vacuum motor. This can be accomplished by removing the hose from each component and attaching it to the vacuum gauge. Vacuum will be available at the vacuum motor only when the transmission selector is in the D range. Connect two distributor tester vacuum hose adapters together with a coupling as a connector attaching the gauge. A minimum of 34 kPa (10 in.-Hg) is required to actuate the parking brake vacuum motor. If a minimum reading is not present when checking each of the above components, they must be replaced.

Operation Test

Check operation of the parking brake with vehicle on a hoist and parking brake fully released. Refer to the Pre-Delivery manual, Section 50-04. If there is any slack in the cables or if rear brakes drag when wheels are turned, adjust as required.

ADJUSTMENTS

Parking Brake

Cable Adjustment

1. Make sure that parking brake is fully released.
2. Place the transmission in NEUTRAL. Raise the vehicle on an axle-type hoist. Refer to the Pre-Delivery manual, Section 50-04.
3. Tighten adjusting nut against cable equalizer, causing a rear wheel brake drag (Figs. 2 and 3).

   Loosen adjusting nut until rear brakes are fully released. There should be no brake drag. If brake cables are replaced in any system having a foot operated control assembly, stroke parking brake control with approximately 450N (100 lbs) pedal effort, then release control and repeat this step.
4. Lower vehicle and check operation of parking brake.

REMOVAL AND INSTALLATION

Control Assembly

Removal

Refer to Figs. 2 and 3.

1. Fully release the parking brake.
2. Remove all tension from the rear cables by backing off the adjusting nut from the equalizer or adjuster.
3. Disconnect vacuum hose from the vacuum release motor.
4. Disconnect wiring connector from the parking brake warning lamp switch.
5. Remove three screws attaching control assembly to cowl side panel.
6. Remove clip and cable end from brake control clevis.
7. Using a 13mm box end wrench to depress retaining tabs on cable fitting, remove conduit from control assembly.
8. Remove control assembly from vehicle.

Installation

1. Position the control assembly in the vehicle.
2. Fit the cable assembly through its mounting hole, and press tabbed retainer into place. Ensure tabs are securely locked into place. Connect the cable end fitting to the control.
3. Install attaching screws to cowl side bracket. Tighten screws to 23-35 N·m (17-26 lb-ft).
4. Connect the vacuum hose to the vacuum release actuator.
5. Connect wiring connector to parking brake warning lamp switch.
6. Check parking brake operation. Adjust as required.

Cable, Front

Removal

1. Raise vehicle on hoist. Refer to the Pre-Delivery manual, Section 50-04.
2. Loosen adjusting nut at adjuster.
3. Disconnect cable from intermediate cable connector located along LH frame side rail.
4. Using a 13mm wrench to depress retaining tabs, remove conduit retainer from frame. At the rear of the fender panel, remove screw holding plastic inner fender apron to the frame.
5. Pull back the fender apron to expose the spring clip retainer that holds the parking brake cable to the frame. Remove the clip.
6. Pull the cable through the frame and let it hang in wheel housing.
7. Lower vehicle and, inside the passenger compartment, remove the cover of sound deadener from the cable at the dash panel. Remove the spring retainer and cable end from the clevis at the parking brake control.
8. Using a 13mm box end wrench, depress the retaining tabs and remove conduit from control assembly.
9. Push the cable down through the dash panel, and remove cable from inside the wheel housing.

Installation

1. Start the cable through the opening in the dash panel inside the passenger compartment.
2. Connect the end of the cable to the parking brake control clevis, and secure it with a spring clip. Press tabbed conduit retainer into parking brake control. Install the sound deadener cover patch at the dash panel.

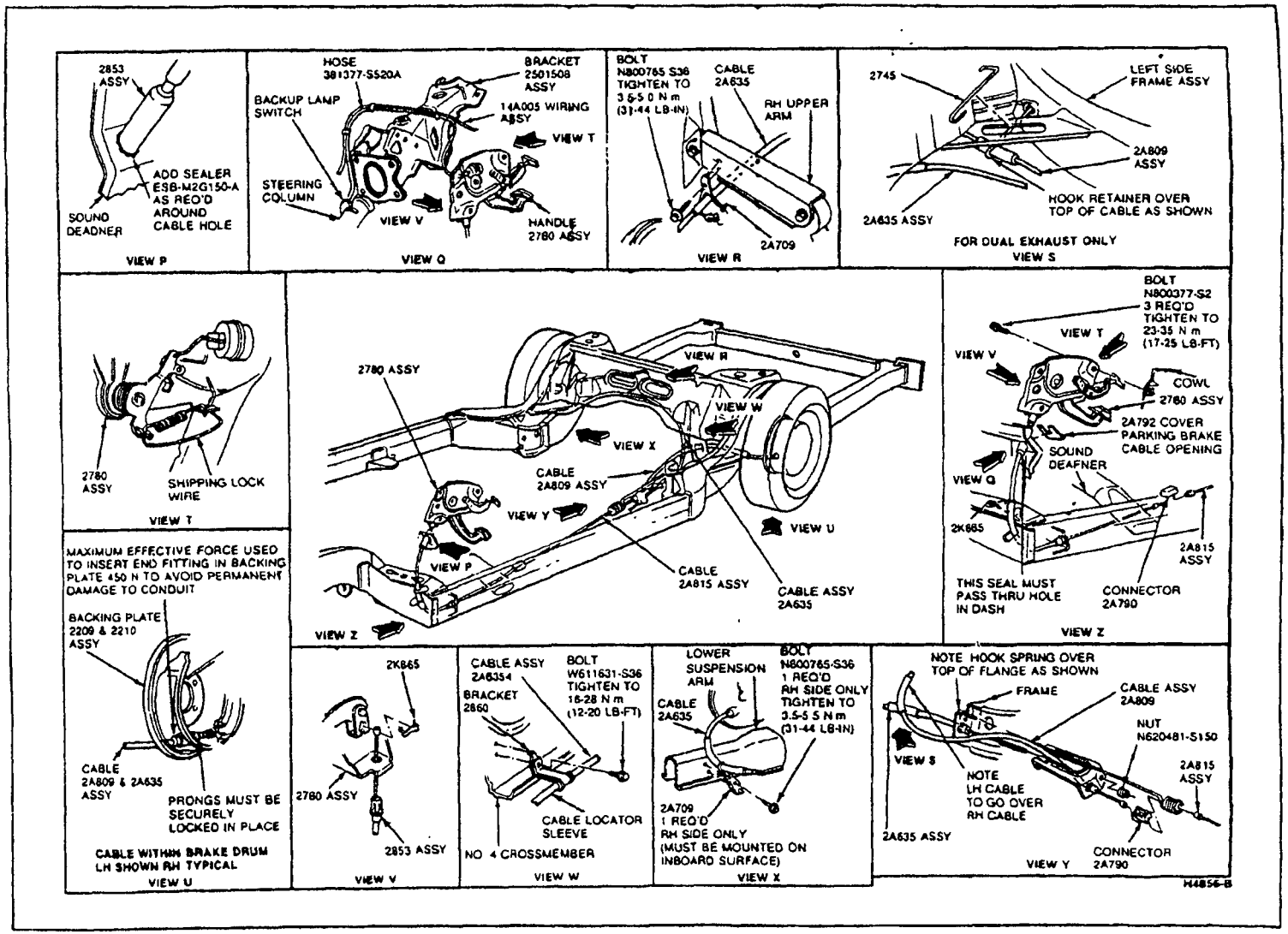

FIG. 2 Parking Brake System, Rear Drum Brakes—Lincoln Town Car

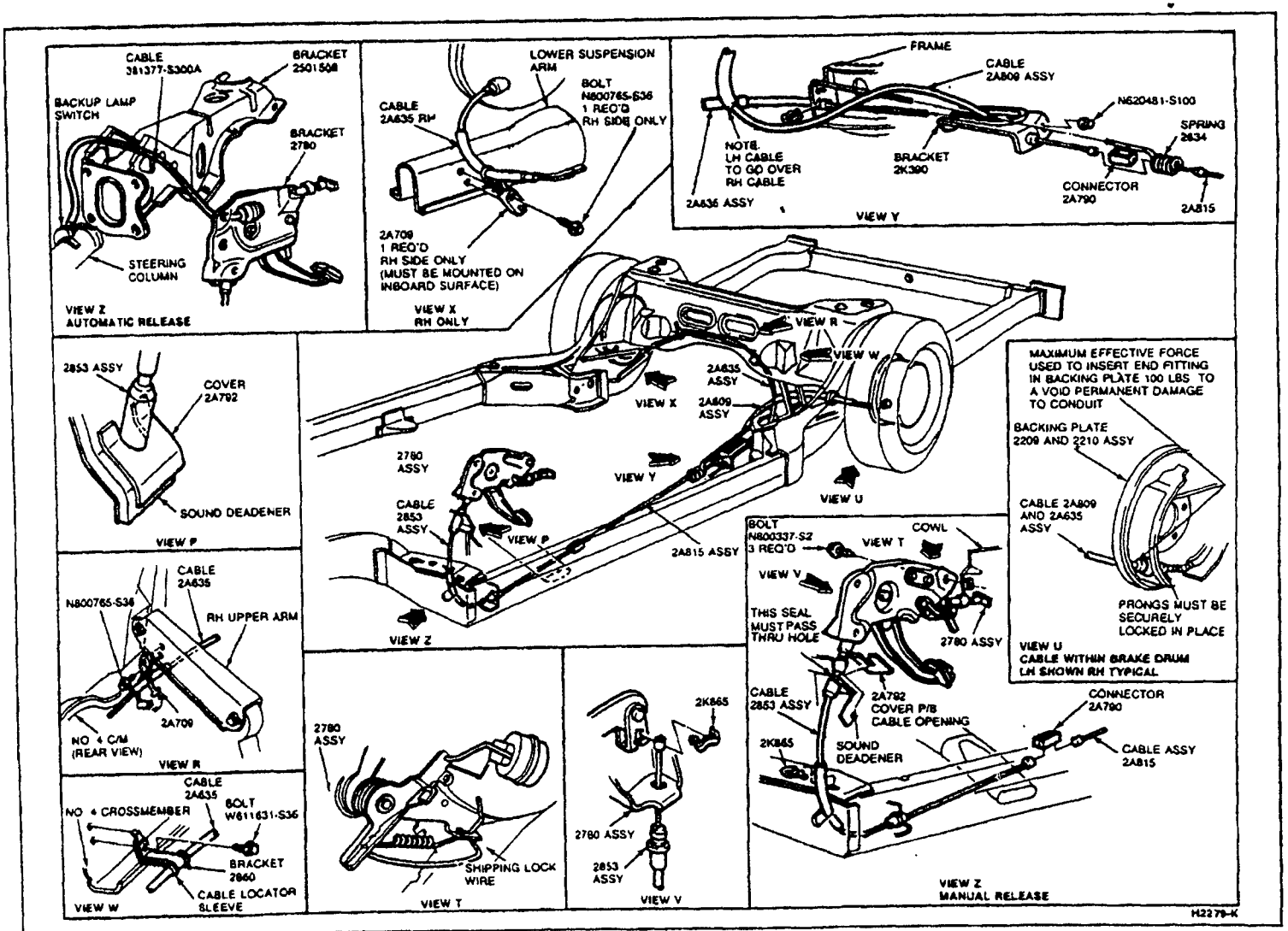

FIG. 3 Parking Brake System, Rear Drum Brakes—Ford Crown Victoria/Mercury Grand Marquis

3. Raise vehicle, and insert the cable through the frame member toward rear of the vehicle. Press the tabbed conduit retainer into frame hole.
4. Behind the fender apron, install the cable-to-frame spring clip retainer.
5. Connect front cable to the intermediate cable connector on the LH side frame rail.
6. Adjust the parking brake.
7. Lower vehicle.

Cable, Intermediate

Removal

1. Raise vehicle on a hoist. Refer to the Pre-Delivery manual, Section 50-04.
2. Loosen the cable adjusting nut.
3. Disconnect parking brake release spring at frame.
4. Disconnect the cable from the cable connectors, and remove it from vehicle.

Installation

1. Attach the intermediate cable to the front and rear cable connectors. Ensure rearward end of cable goes through release spring before attaching cable to the connector.
2. Attach the release spring to frame.
3. Adjust parking brake.
4. Lower vehicle.

Cables, Rear

Removal

1. Raise vehicle. Remove adjuster nut at adjuster.
2. Disconnect parking brake release spring at frame.
3. Disconnect LH cable from the intermediate cable connector.
4. Using a 13mm box end wrench to depress retaining tabs, remove LH conduit retainer from rod adjuster. Remove cable retainer from the LH lower arm.
5. Release RH cable tabbed conduit retainer from the frame. Remove the clip retaining the RH cable to the frame crossmember.
6. Remove cable retainer from RH lower arm, and disconnect cable from retainer on RH upper arm.
7. Remove rear wheels and brake drums.
8. Working on the wheel side of the rear brake, remove the brake automatic adjuster spring. Compress the prongs on the parking brake cable retainer, so they can pass through the hole in the brake backing plate. Pull cable retainer through hole.
9. With the tension off the cable spring at the parking brake lever, lift the cable end out of the slot in the lever. Remove cable through backing plate hole.
10. Remove the cables from the vehicle.

Installation

1. Position the cables approximately in their installed position. Insert enough of the parking brake cable through the brake backing plate hole, so the cable end can be attached to the parking brake lever on the rear brake shoe.
2. Pull the excess slack from the cable wire inside the brake, and push the cable conduit through the backing plate hole until the retainer prongs expand. The prongs must be securely locked in place. Install the automatic brake adjuster spring.
3. Install the brake drums and rear wheels.
4. Attach the RH cable to the RH upper and lower arm, frame crossmember, and through the frame bracket using the existing retaining clips. Press tabbed retainer into crossmember hole until it is securely locked into place.
5. Attach the LH cable to the LH lower arm with retainer, and route cable toward front of vehicle. Be sure to route cable over the RH cable.
6. Install the LH cable through the flanged hole in the adjuster, and press tabbed retainer into place.
7. Connect the LH cable end to the connector at the intermediate cable.
8. Insert the threaded rod of the RH cable through two holes in the adjuster. Loosely attach the adjuster nut.
9. Install the cable release springs to the frame attaching hole.
10. Adjust the parking brake.
11. Lower vehicle.

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	N-m	Lb-Ft
Parking Brake Control Assembly Mounting Nuts and Capscrews	23-35	17-26

CH2918-D

SPECIAL SERVICE TOOLS

ROTUNDA EQUIPMENT

Model	Description
021-00014	Vacuum Tester

CH3076-C