SHOP TIPS FROM Autolite Ford

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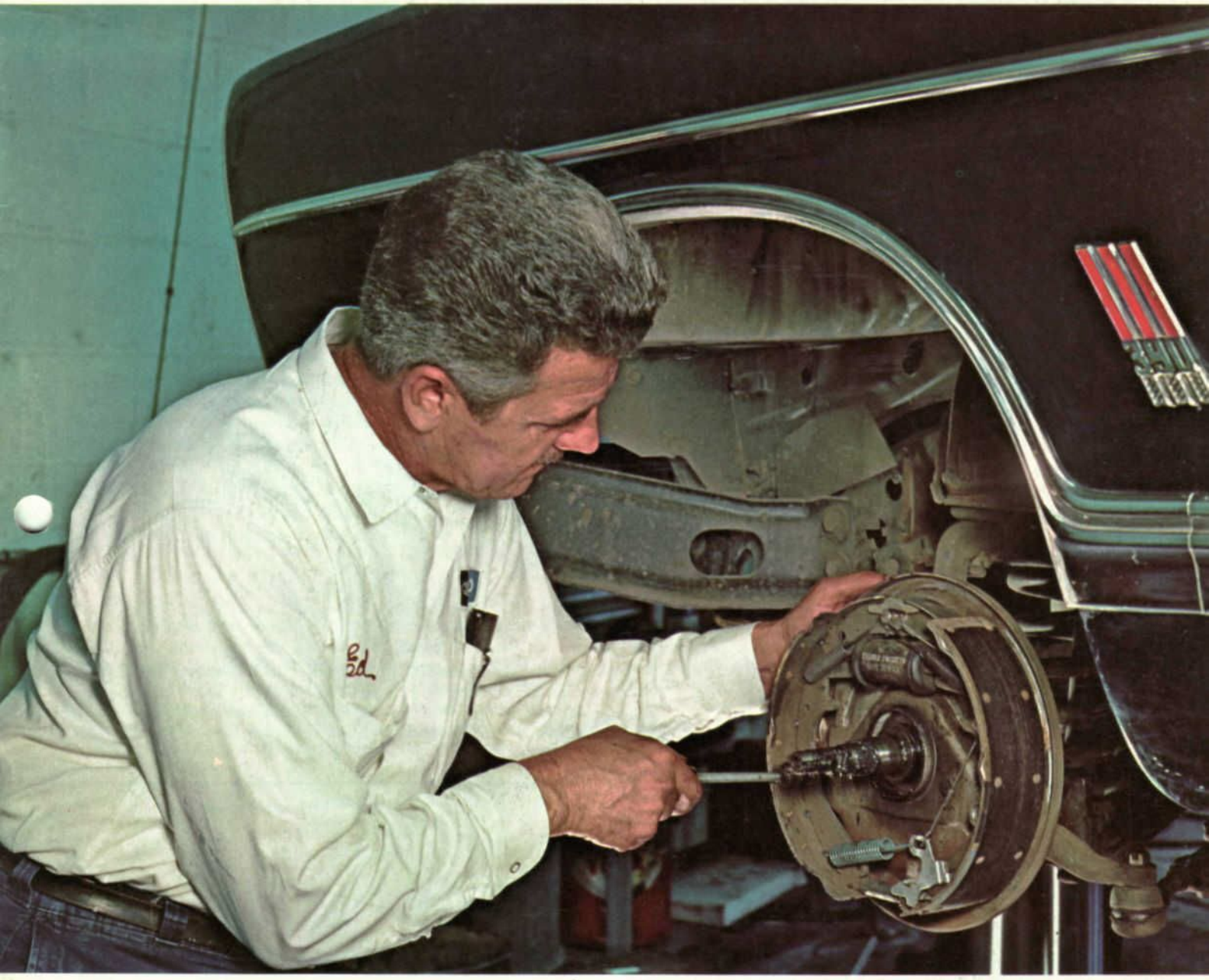

Technical parts and service information published by the Autolite-Ford Parts Division and distributed by Ford and Lincoln-Mercury dealers to assist servicemen in Service Stations, Independent Garages and Fleets.

SERVICING . . . FORD BRAKE SYSTEMS

SERVICING FORD

The mark of a good brake job, it's been said, is not one you'll stand behind, but rather, one you'll stand in front of! No one, of course, should take the saying too literally; that is, check the quality of their work by standing in front of a vehicle. It does, however, make a valid point. After you service a customer's brake system, you should share the owner's faith in the car's ability to stop.

IN THIS ISSUE

Be sure and file this and future bulletins for ready reference. If you have any suggestions for additional information that you would like to see included in this publication, please write to: Autolite-Ford Parts Division of Ford Motor Company, Merchandising Services Dept., P.O. Box 3000, Livonia, Michigan 48151.

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Autolite Ford

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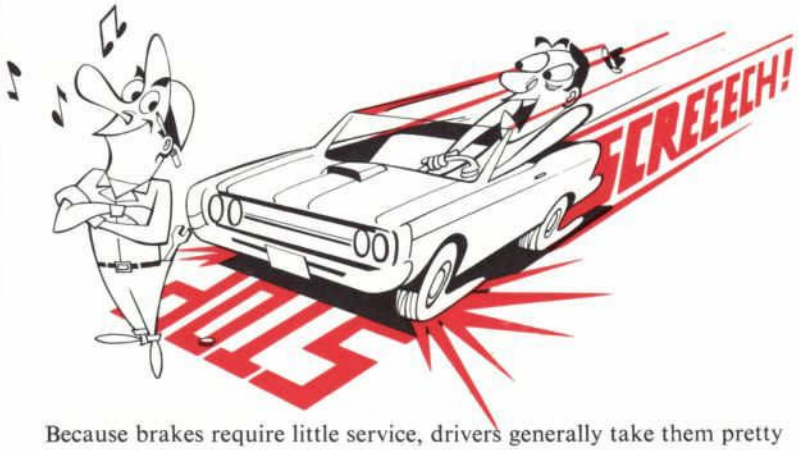


Because brakes require little service, drivers generally take them pretty much for granted. Few know when their brakes need service. They expect them to go on, month after month, providing all the stopping power they need. Unlike other components that may malfunction, it only takes ONE instance with brakes to perhaps result in serious consequences. For that reason, brake service must be performed correctly. To help you in this vital service, "Shop Tips" presents Part I of a two-part article on Ford Motor Company passenger car brakes. Next month, February Shop Tips will contain Part II which will include Servicing Cortina Brake Systems.

FORD BRAKE SYSTEMS MAJOR COMPONENTS & OPERATION

DRUM BRAKES

Because of their exclusive use until recently, most late model Ford-built cars use drum brakes (Fig. 1) both front and rear. They feature a duo servo, self-energizing brake shoe design. To see how it works, let's look at a right-hand brake assembly as the vehicle is moving forward and the brakes are applied.

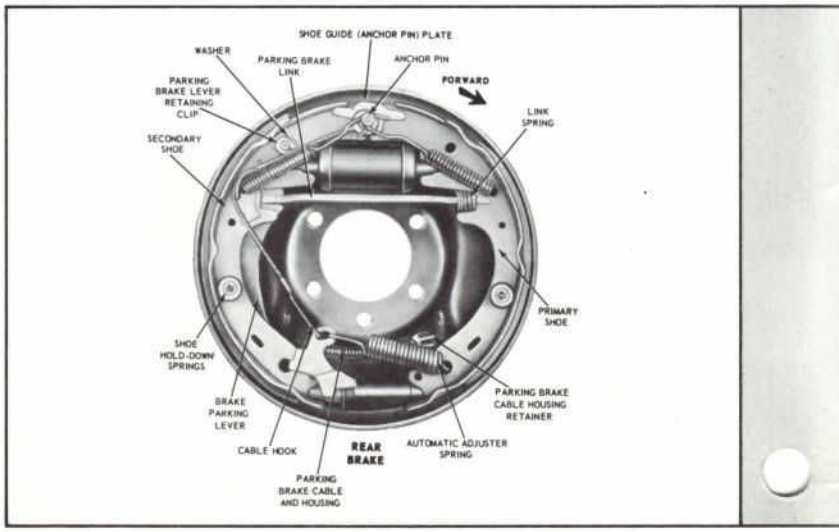
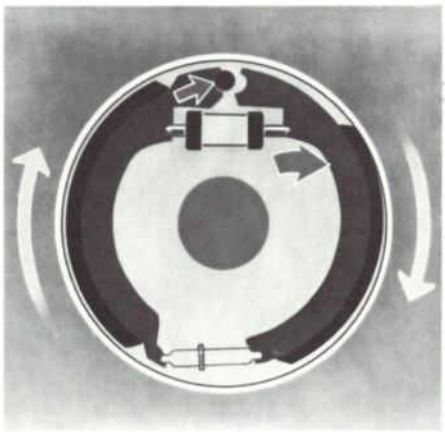


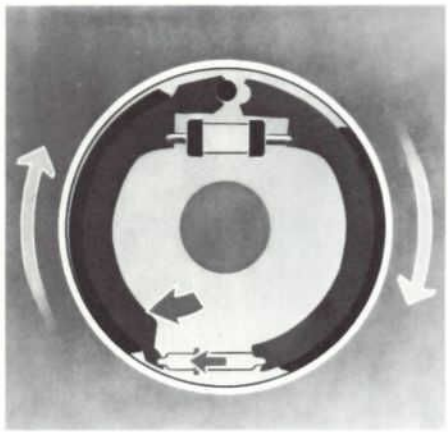
Figure 1—Duo Servo Brake Assemblies with Self Adjusting Mechanisms

BRAKE SYSTEMS . . . PART I

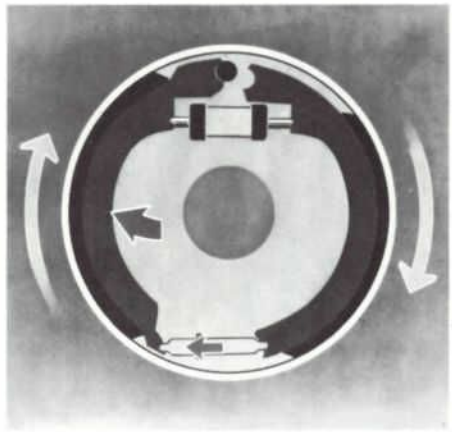
Self Energizing Brakes



(1) Hydraulic pressure forces the wheel cylinders outward, moving the primary shoe against the rotating drum. Friction causes the primary shoe to shift downward (clockwise) in the direction of drum rotation, as far as the anchor pin permits through the adjustor and secondary shoe. The primary shoe tends to resist, and in so doing, makes even further contact with the drum. This is called "self-energizing," or *servo* action. But there's more.



(2) This is also a *duo,* or double, servo brake. That's because the frictional force of the primary shoe through the adjusting screw assembly, and the friction on both shoes, helps press or wedge the secondary shoe against the drum.

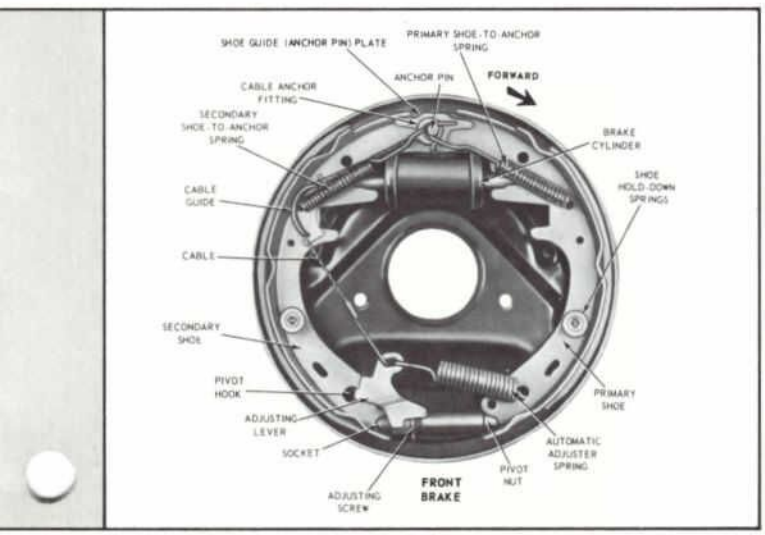


(3) So while the primary shoe is energized by its own frictional force, the secondary shoe is energized by its own friction, AND by the force of the primary shoe. As a result, the secondary shoe has about twice the braking effect as the primary. That's why secondary shoe linings are longer. To even out wear, lining material for the primary shoe usually has a higher coefficient of friction than secondary shoe lining.

Self Adjustment Mechanism

Beginning with 1961 models, Ford-built cars incorporate a self-adjusting mechanism to keep brake shoes adjusted to the proper gap from the drum. This adjustment occurs automatically when the car moves backward and the brakes are applied. The linings tend to follow the rotating drum counterclockwise (Fig. 2). This "wrap around" action forces the upper end of the primary shoe against the anchor pin.

At the same time, the wheel cylinder pushes the upper end of the secondary shoe and cable guide outward, away from the anchor pin (Fig. 3). This movement of the secondary shoe causes the cable to pull the adjusting lever upward, and AGAINST THE END OF THE TOOTH ON THE ADJUSTING SCREW STAR WHEEL. As lining wear increases, the upward travel of the adjusting lever increases.



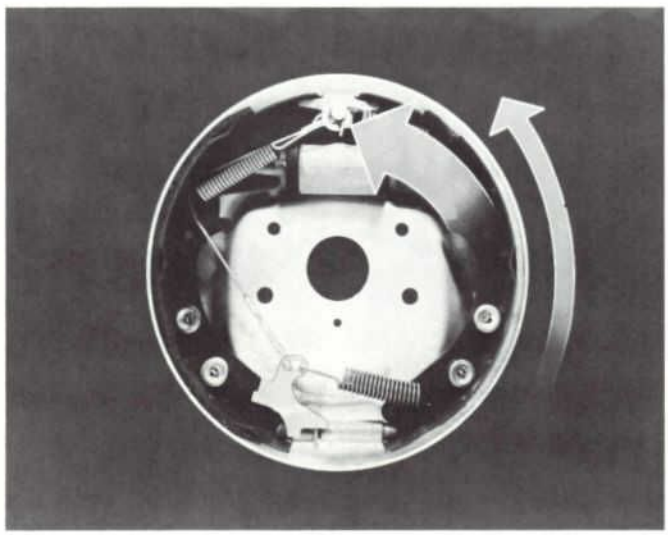


Figure 2—Self Adjustors Operate When Brakes Are Applied In Reverse

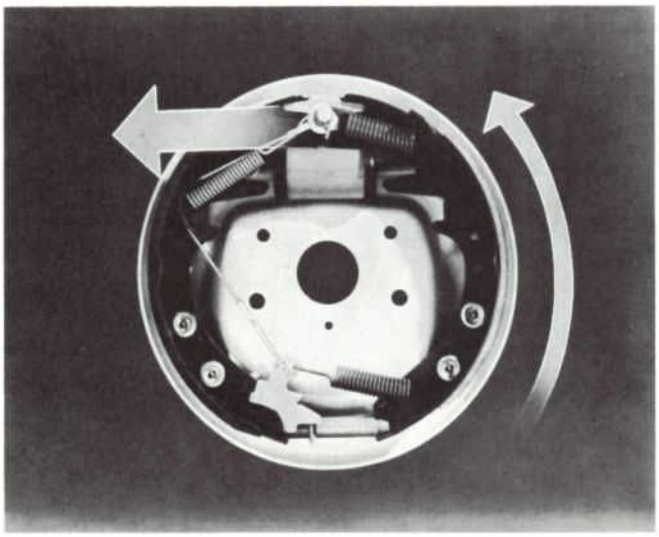


Figure 3—Secondary Shoe Movement Pulls Adjusting Lever Upward

When the lever can move upward far enough, it passes over the end of the tooth and engages it. When the brake is released, the adjuster spring pulls the adjuster lever *downward*. The lever turns the star wheel causing the shoes to expand. The star wheel turns one tooth at a time as the linings wear. If the lever can not move upward far enough to make an adjustment, it slides down the end of the star wheel tooth until the linings have worn enough to allow the lever to move up far enough to engage the tooth.

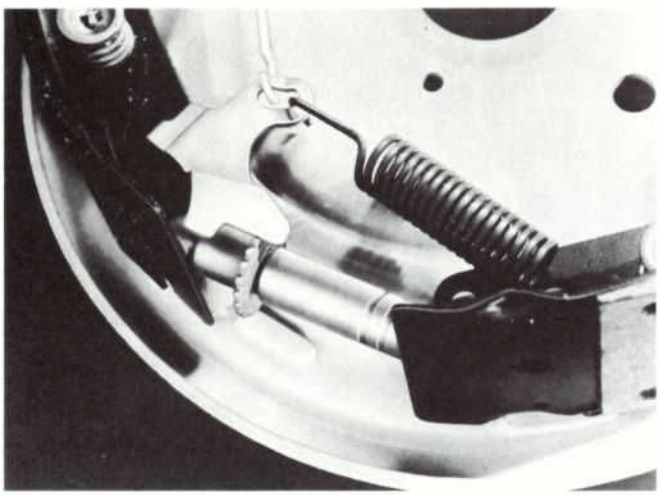


Figure 4—Adjusting Lever Moves Downward To Turn Star Wheel

DISC BRAKES

Ford introduced front disc brakes in 1965 on Mustang, Thunderbird and Lincoln Continental models. They have been made available on more models each succeeding year, until all 1968-69 passenger cars have them as either standard or optional equipment. F-250 (4x2) and F-350 trucks also use front disc brakes. As with passenger cars, rear brakes are drum type.

Fixed Caliper

Fixed caliper disc brakes are used on all Ford Motor Company cars from 1965 thru 1967. Cortina models (Fig. 5) and Lincoln Continental models (Fig. 6) continue to use a fixed caliper brake on 1968-69 models. This brake is called a "fixed" caliper type because the *complete* caliper assembly is rigidly bolted to the steering wheel spindle. The caliper assembly consists of two caliper halves bolted together. Each half has a pair of pistons (Fig. 7).

Square cross-section seals around each piston perform three important functions:

1. Hydraulically seal piston and cylinder.
2. Return pistons to released position when hydraulic pressure is released.
3. Maintain shoes in correct adjustment at all times (much like drum brake automatic adjusters). More about this under floating caliper disc brakes.

Internal passages in the caliper housing and an external transfer tube between the two caliper halves hydraulically connect the cylinders. Each caliper assembly has one bleeder screw and fluid inlet fitting.

Shoe and lining assemblies are located between parallel machined abutments within the caliper. Tabs on the outer ends of the shoe assemblies radially support the shoes. The shoes slide axially in the caliper abutments by means of the tabs, which ride on machined ledges (bridges) when hydraulic pressure is applied to the pistons. The shoes thus squeeze against the rotor to stop the wheel. Clips (Fig. 8) attached to the top of the caliper retain the shoe and lining assemblies. The lining is either riveted or bonded to a metal plate (shoe). It is replaced as a unit.

The cast iron rotor has forty fins for ventilation. It's attached to, and rotates with, the wheel hub. A splash shield bolts to the spindle to prevent road contaminants from contacting the inboard rotor and lining surfaces. The wheel protects the outboard surfaces.

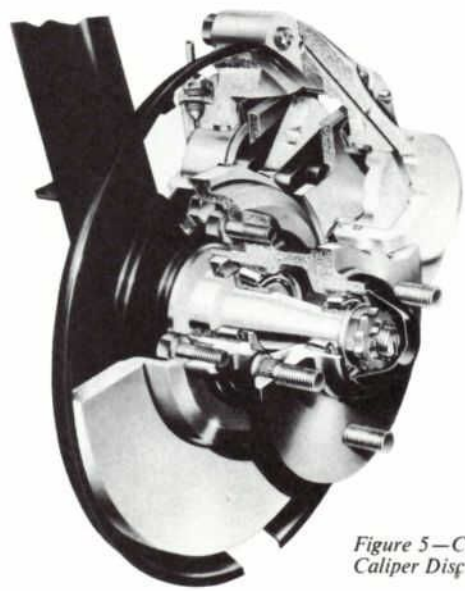


Figure 5—Cortina Fixed Caliper Disc Brake

BRAKE SYSTEMS . . . PART I

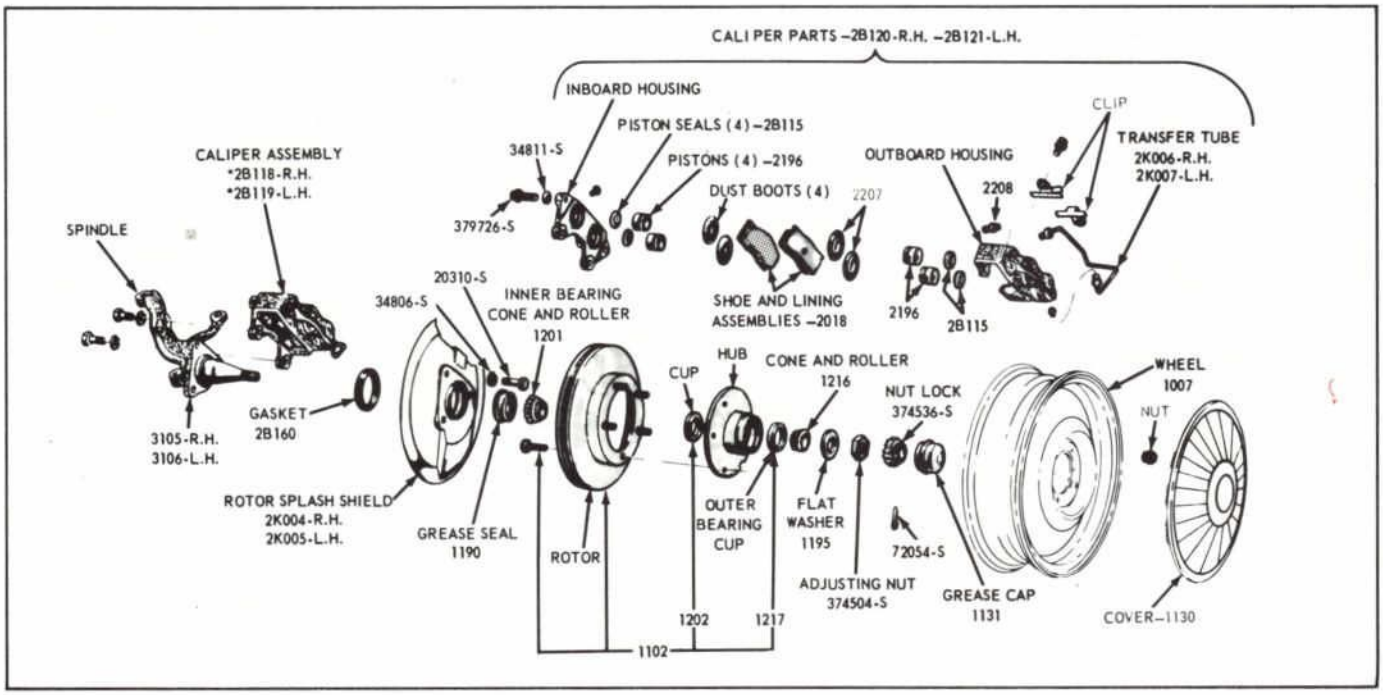


Figure 6—Fixed Caliper Disc Brake—Exploded View With Basic Part Numbers

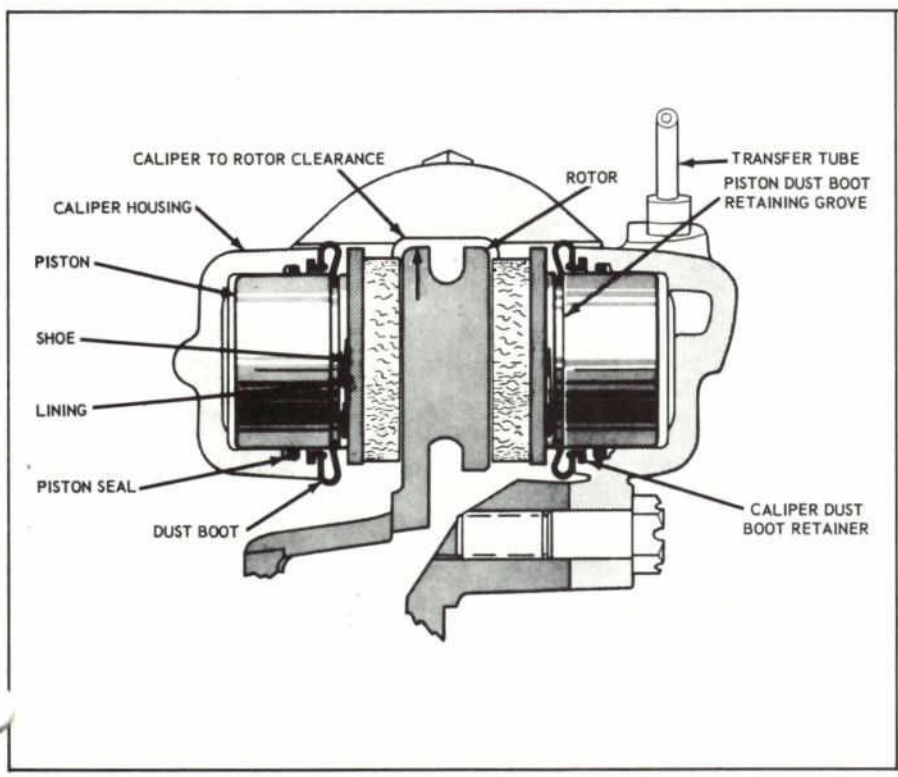


Figure 7—Fixed Caliper—Sectional View

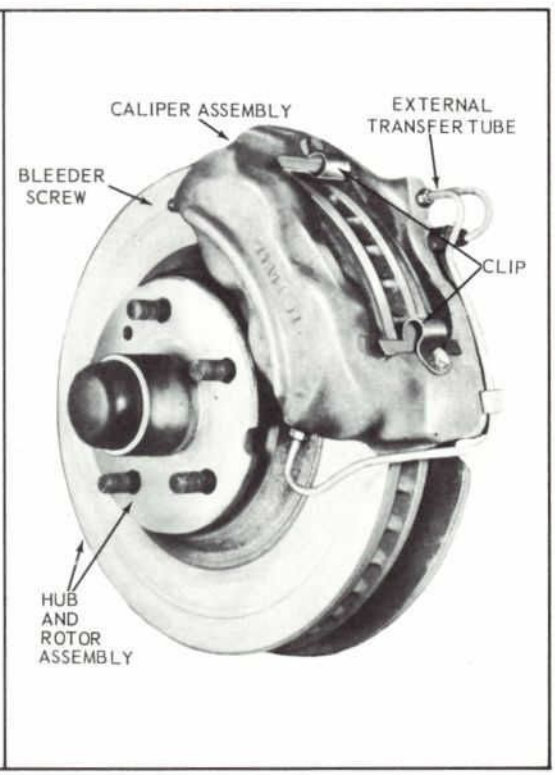


Figure 8—Fixed Caliper Disc Brake Assembly

Floating Caliper

All 1968-69 Ford Motor Company cars, except Cortina and Lincoln-Continental models, utilize a "floating" caliper disc brake (Fig. 9). It functions much differently than the fixed type. The caliper consists of a one-piece housing—not a two-piece assembly. And it's not bolted to the wheel spindle—it's free to move inboard and outboard (float) parallel to the spindle axle, as the brakes are applied and released. Only one piston is used instead of four.

The one-piece caliper housing slides in and out a fraction of an inch on two caliper locating pins that screw into ears on the caliper housing, and pass through insulators fitted into holes in the anchor plate. The anchor plate bolts to the wheel spindle. Stabilizers control the caliper's position in relation to the rotor. Two types of stabilizers are used as shown in Figure 9. They are fastened to the caliper by the caliper locating pins and to the anchor plate by two cap screws.

The single piston fits into a bore in the inner portion of the caliper (Fig. 10). The inner brake shoe and lining assembly fits against the piston and has ears on the outer ends that rest on the anchor plate bosses. Two hold-down clips, bolted to the anchor plate, hold the shoe in position. The outer shoe and lining, which is longer, attaches to the outer legs of the caliper.

The floating caliper brake works something like a "C" clamp. When the brakes are applied, hydraulic pressure forces the piston *outward*, moving the inboard shoe and lining into contact with the rotor. No appreciable braking effect occurs, however, until more hydraulic fluid enters behind the piston. It does not exert greater pressure force on the piston, but because the caliper can "float," the additional hydraulic pressure develops a reaction force that moves the *caliper inward*, forcing the outboard shoe and lining against the rotor (Fig. 11). Additional hydraulic pressure forces both linings to grip the rotor in a "sandwiching" action to stop the wheel.

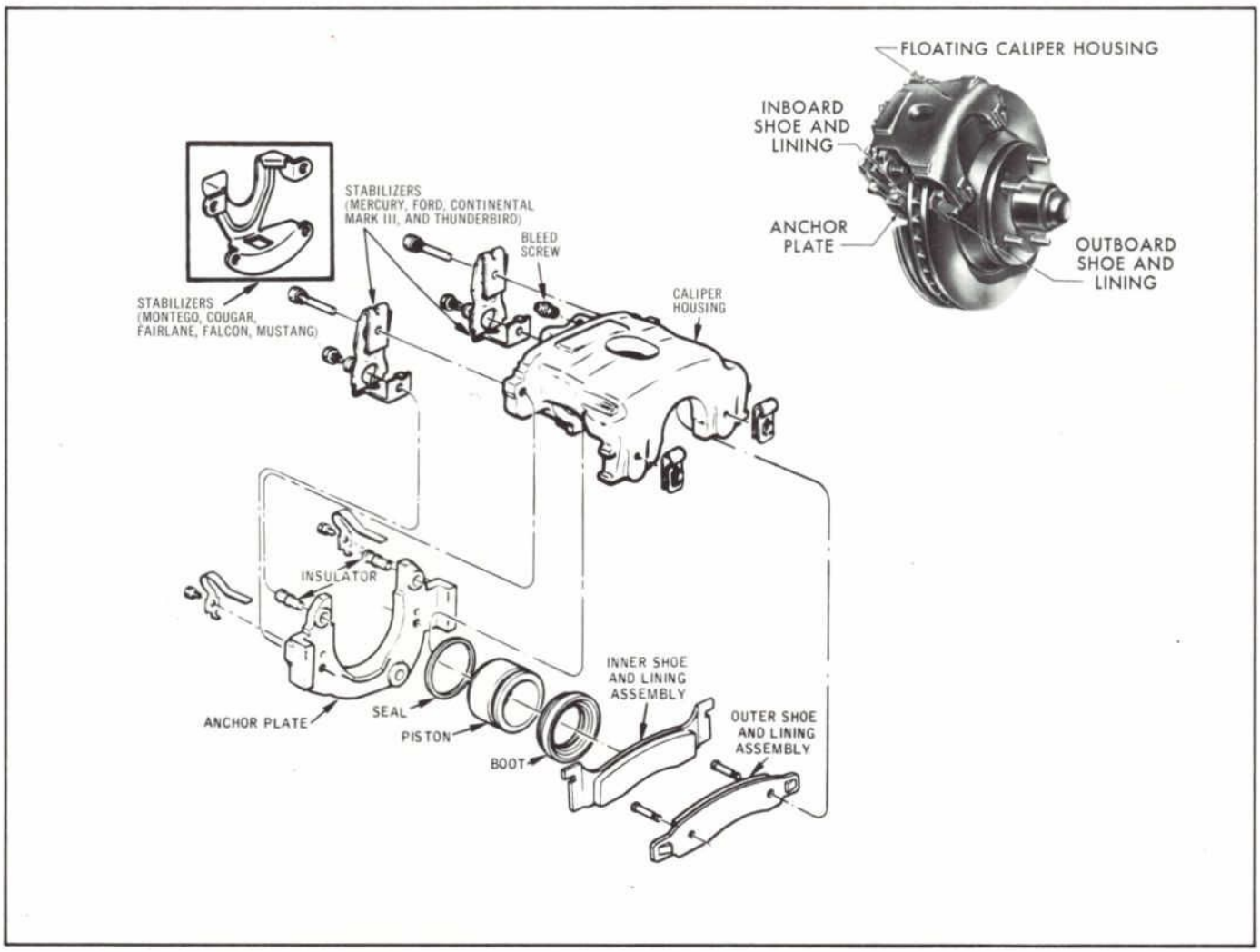


Figure 9—Floating Caliper Brake Assembly

BRAKE SYSTEMS . . . PART I

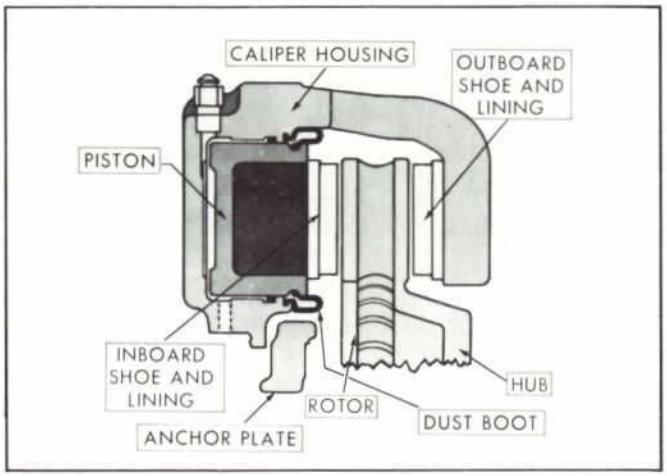


Figure 10—Floating Caliper Assembly—Sectional View

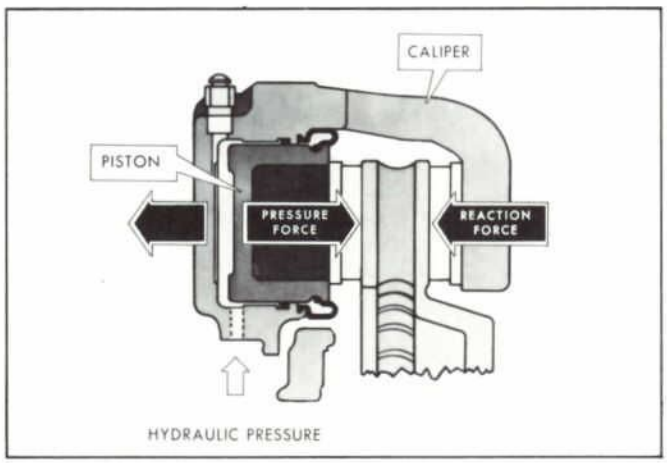


Figure 11—Floating Caliper Operation

Self-Adjusting Disc Brakes

Caliper piston seals (Fig. 12) perform the self-adjusting action on disc brakes, instead of a mechanical set-up such as used in drum brakes. During brake application, the caliper piston seal distorts as hydraulic pressure pushes the piston out for the distance required to press the brake shoes against the rotor. Removing the foot from the brake reduces pressure and the seal returns to a relaxed position. As the seal relaxes, or rolls back, it moves the piston inward in the caliper housing bore. As the piston moves inward, the stabilizers position the caliper housing and outer brake shoe lining assembly on the rotor, to automatically maintain the correct clearance. This retracting action, however, is always limited by rotor runout and amount of seal rollback, or relaxation, that in turn causes the piston to travel back.

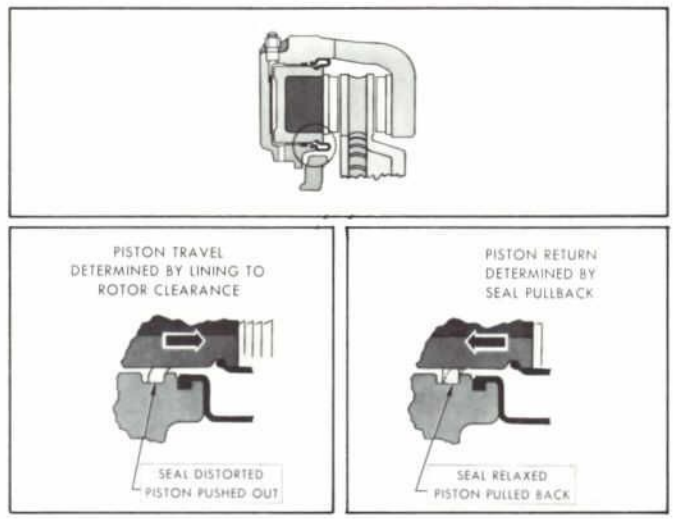


Figure 12—Caliper Piston Seals Control Self Adjustment

Hydraulic System

Since 1967, Ford Motor Company cars have used a dual master cylinder on disc (and drum) brakes. The front cylinder furnishes hydraulic pressure to the rear brakes; the rear cylinder pressure to the front brakes. Thus, if a malfunction occurs in either system (sensed by a differential valve that flashes a red light on the instrument panel when the brakes are applied), the other hydraulic system will still operate and stop the car. All disc brake systems use a proportioning valve (Fig. 13) to provide balanced braking action between the front (disc) and rear (drum) brakes. The proportioning valve reduces pressure at the rear brakes. This reduced pressure balances the self-energizing rear drum brake action with the non-energizing front disc brake action.

Lincoln-Continental and F-250 and 350 Truck models only use metering valve (Fig. 13). It prevents the front disc brakes from applying until master cylinder pressure reaches about 120 psi. This delay prevents the front brakes from performing all the braking action at low-speed stops, thereby increasing the disc brake lining life.

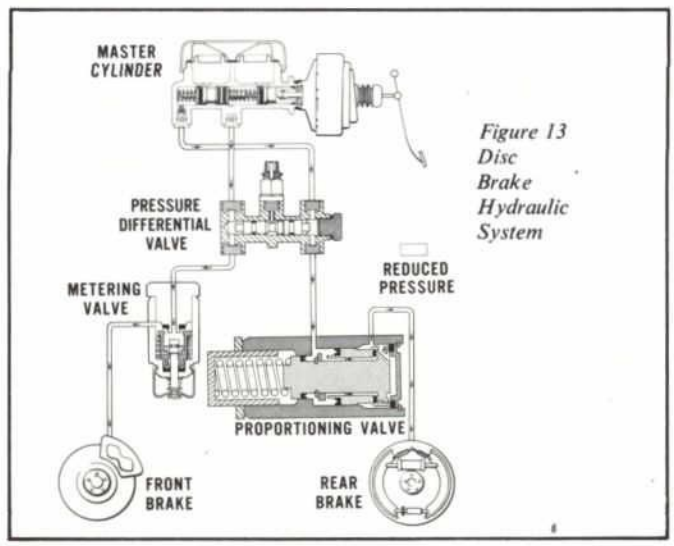
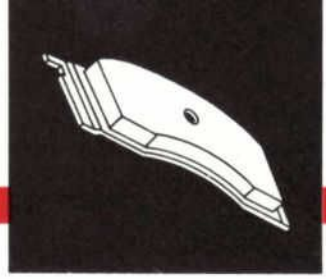


Figure 13 Disc Brake Hydraulic System



SERVICE PROCEDURES

DRUM BRAKES

Cleaning and Inspection

1. Remove the wheel from the drum, then remove the drum from the brake with a gentle rocking motion. If the drum will not come off, knock the rubber plug out of the brake carrier plate with a punch. Insert a narrow screwdriver through the slot and disengage the adjusting lever away from the screw, back off the adjusting screw with a brake adjusting tool (Fig. 14). *Be extremely careful not to burr, chip or damage the notches in the adjusting screw; otherwise the self-adjusting mechanism may not function properly.*

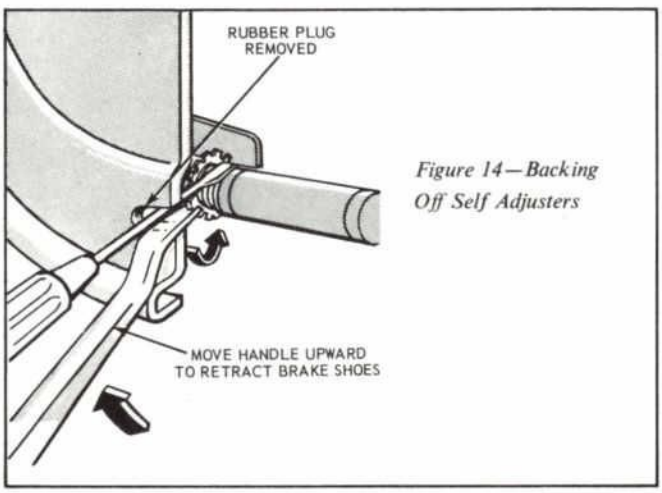


Figure 14—Backing Off Self Adjusters

2. Brush all dust from the backing plates and interior of the brake drums.

3. Inspect brake shoes for excessive lining wear or shoe damage. If the linings are worn within 1/32-inch of the rivet heads or if the shoes are damaged, they must be replaced. Linings contaminated with oil, grease or brake fluid must be replaced. Replace linings in axle sets. Before lining replacement, check drum diameter to determine if oversize linings should be installed.

4. Check brake shoes, retracting springs, hold-down springs and drum for signs of overheating. If shoes have a slight blue coloring, indicating overheating, it's advisable to replace the retracting and hold-down springs. *Overheated springs lose their pull and if not replaced, could cause the new lining to wear prematurely.*

5. If the vehicle has 30,000, or more, miles of operation on the brake linings, or if there are signs of overheating when relining the brakes, disassemble the wheel cylinders and inspect for wear and dirt. Replace the cylinder cups, to avoid the possibility of premature future problems.

6. Inspect all other brake parts and replace those that appear worn or damaged.

7. Inspect the brake drum for roughness. If necessary, refinish. If contaminated with dirt, oil or grease, wipe clean with cloth soaked in denatured alcohol.

Brake Drum Refinishing

Minor scores on a brake drum can be removed with sandpaper. However, an excessively scored drum, or one with a total indicator runout over 0.007-inch should be turned down. Remove only enough metal to eliminate the scores and true up the drum. The refinished drum diameter must not exceed 0.060-inch oversize.

Check the inside diameter of the brake drum with an accurate brake drum micrometer tool (such as Rotunda FRE 1431). If the drum diameter is less than 0.030-inch oversize after refinishing, install standard size lining. If the drum diameter is 0.030-0.060-inch oversize after refinishing, oversize linings must be installed. After turning down drum, wipe the refinished surface with a cloth soaked in clean denatured alcohol. If one drum is turned down, the opposite drum on the same axle should also be cut down to the same size.

Installing New Brake Drums

If a brake drum must be replaced with a new one, be sure to remove the protective coating from the new drum. Use a solvent such as carburetor degreaser. Then, sandpaper to insure no residue remains. Wipe the drum with a cloth soaked in denatured alcohol. Install new bearings and a new grease seal in front drums.

Brake Shoe Relining

Brake linings worn to within 1/32-inch of the rivet head, or less than 0.030-inch thick (bonded linings), or linings contaminated with brake fluid, grease or oil must be replaced. Worn linings will score the drum and cause additional repairs. *When it's necessary to replace linings on one wheel, they must also be replaced on the wheel on the opposite side of the vehicle.*

Inspect brake shoes for distortion, cracks, or looseness. If any of these conditions exist, the shoe must be replaced. *Do not attempt to repair a defective brake shoe.*

Linings may be replaced by either installing new linings on the shoes, or using new linings already attached to the shoes. *Both new Ford linings and Ford Authorized Remanufactured linings are pre-ground and no further grinding is required to match drum surfaces.* If new linings are to be attached to shoes, use the following procedure:

1. Wash brake shoes thoroughly in a clean solvent. Remove all burrs or rough spots from shoes.

2. Check the inside diameter of the brake drum with a brake drum micrometer (such as Rotunda FRE 1431). If the diameter is less than 0.030-inch oversize, standard size linings may be installed. If the diameter is 0.030-0.060-inch oversize, then oversize linings must be installed.

3. Position the new lining on the shoe. Starting in the center, insert and secure the rivets, working alternately towards each end.

4. Check the clearance between the shoe and lining. The lining must seat tightly against the shoe with not more than 0.008-inch clearance between any two rivets.

Brake Shoe Installation and Adjustment

Since they contain similar parts (except for the parking brake components in rear brakes), front and rear brakes are assembled much the same way. The self-adjusters require manual adjustment only after brake shoes have been relined, replaced, or when the length of the adjusting screw has been changed while performing some other service operation.

Installation

1. Before installing the rear brake shoes, assemble the parking brake lever to the secondary shoe and secure with the spring washer and retaining clip.

2. Apply a light coating of high-temperature grease at the points where the brake shoes contact the backing plate.

3. Position the brake shoes on the backing plate and secure the assembly with the hold down springs. On the rear brake, install the parking brake link and spring, back off the parking brake adjustment then connect the parking brake cable to the parking brake lever (Fig. 1).

4. Install the shoe guide (anchor pin) plate on the anchor pin when so equipped.

5. Place the cable eye over the anchor pin with the crimped side toward the backing plate.

6. Install the primary shoe to anchor spring (Fig. 15).

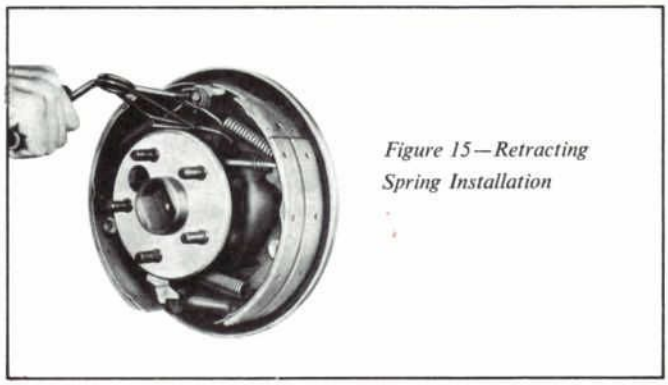


Figure 15—Retracting Spring Installation

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. 1).

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 with the tool shown in Fig. 15.

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. Remove the brake-cylinder clamp.

9. Apply high-temperature molybdenum disulfide grease (Ford Part No. CIAZ-19590-B) to the threads and the socket end of the adjusting screw. Turn adjusting screw into adjusting pivot nut to the limit of the threads and then back off ½ 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. 16). The adjusting pivot nuts can be distinguished by the number of grooves machined around the body of the nut. Two grooves on the nut indicate a right thread: one groove indicates a left thread.

10. Place the adjusting socket on the screw and install this assembly between the shoe ends with the adjusting screw toothed wheel nearest the secondary shoe.

11. 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 right or left brake assembly (Fig. 16).

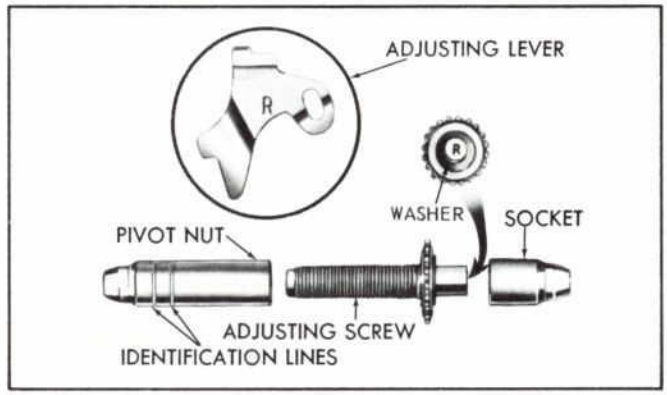


Figure 16—Adjusting Screw and Lever Identification

12. Position the hooked end of the adjuster spring completely into the large hole in the primary shoe web. The last coil of the spring should be at the edge of the hole. Connect the loop end of the spring to the adjuster lever hole.

13. Pull the adjuster lever, cable and automatic adjuster spring down and toward the rear to engage the pivot hook in the large hole in the secondary shoe web (Fig. 1).

14. After installation, check the action of the adjuster by pulling the section of the cable between the cable guide and the anchor pin 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 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 the position of the lever on the adjusting screw toothed wheel. With the brake in a vertical position (anchor at the top), the lever should contact the adjusting wheel $\frac{3}{16}$ inch (plus or minus $\frac{1}{32}$ 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 as the lever is actuated by the cable.

To determine the cause of this condition:

a. 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.

b. Check the cable length. On Ford, Mercury, Thunderbird, Continental Mark III, and Lincoln Continental models, the cable should measure 11⅛ inches (plus or minus $\frac{1}{64}$ inch) from the end of the cable anchor to the end of the cable hook. On Fairlane, Montego, Falcon, Mustang, and Cougar models the cable should measure $8\frac{13}{32}$ inches on 9 inch brakes or 9¾ inches on 10 inch brakes from the end of the cable anchor to the end of the cable hook.

c. 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.

d. 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.

e. See that the adjusting screw socket is properly seated in the notch in the shoe web.

When adjusting the rear brake shoes, check the parking brake cables for proper adjustment. Make sure that the equalizer operates freely.

To adjust the brake shoes:

1. Use a tool such as Rotunda Tool HRE 8650, (Fig. 17) to determine the inside diameter of the drum braking surface.
2. Reverse the tool as shown in Fig. 17 and adjust the brake shoe diameter to fit the gauge. Hold the automatic adjusting lever out of engagement while rotating the adjusting screw, to prevent burring the screw slots. Make sure the adjusting screw rotates freely. If necessary, lubricate the adjusting screw threads with a thin, uniform coating of high temperature molybdenum disulfide grease.
3. Rotate Tool HRE 8650 around the brake shoes to be sure of the setting.
4. Apply a small quantity of high temperature molybdenum disulfide grease 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 Tinnerman 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 50 lbs. pressure on the pedal 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 while operating in a forward direction.

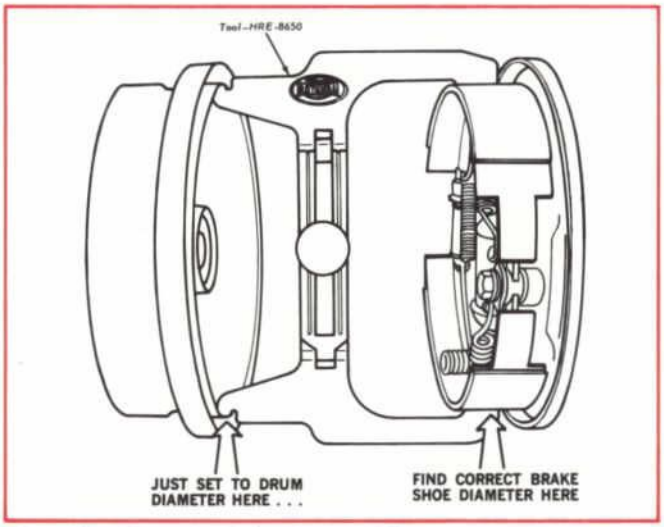


Figure 17—Measuring Brake Drum and Shoe

Wheel Cylinders

Wheel cylinders should not be disassembled unless they are leaking or unless new cups and boots are to be installed. It is not necessary to remove the brake cylinder from the backing plate to disassemble, inspect, or hone and overhaul the cylinder. Removal is necessary only when the cylinder is damaged or scored beyond repair.

Disassembly

1. Remove the links and the rubber boots from the ends of the brake cylinder. Remove the pistons, cups, and return spring from the cylinder bore (Fig. 18).
2. Remove the bleeder screw from the cylinder.

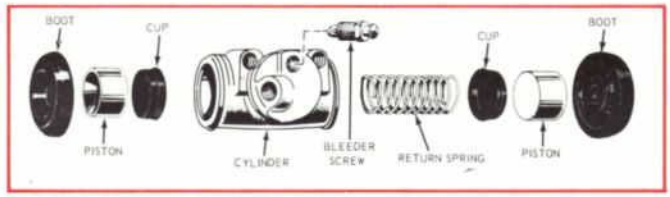


Figure 18—Typical Wheel Cylinder

Inspection

1. Wash all parts in clean brake fluid. Dry with compressed air.
2. Replace scored pistons. Always replace the rubber cups and dust boots.
3. 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 0.003 inch beyond its original diameter.
4. Check the bleeder hole to be sure that it is open.

Assembly

1. Apply a light coating of specified brake fluid to all internal parts.
2. Thread the bleeder screw into the cylinder and tighten securely.
3. Insert the return spring, cups, and pistons into their respective positions in the cylinder bore (Fig. 18). Place a boot and link over each end of the cylinder. Install shoes and return springs. Bleed the brake system.

DISC BRAKES

Fixed Caliper

Cleaning and Inspection

Linings

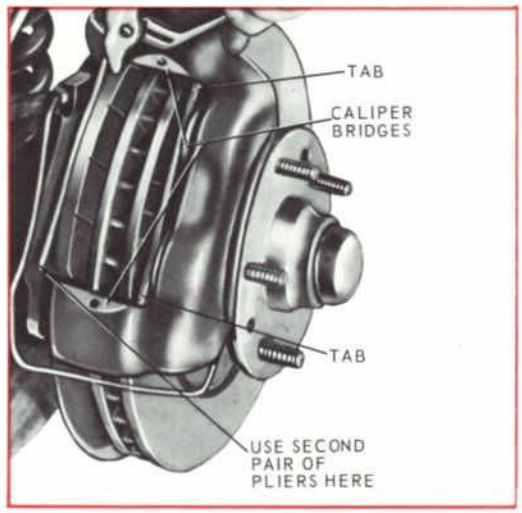


Figure 19—Removing Fixed Caliper Shoe and Lining

Fixed caliper linings can be checked without removing the caliper assembly. After removing the wheel and tire (being careful to avoid damage or interference with the caliper splash shield, bleeder screw fitting or transfer tube), remove the caliper splash shield. Apply a steady inward pressure against each shoe and lining assembly toward its respective caliper housing on each side of the rotor. Maintain pressure for at least a minute. If pistons do not move in easily, force them in with water pump pliers. Grasp the metal flange on the outer end of the shoe with two pairs of pliers and pull the shoe out of the caliper (Fig. 19).

Visually inspect the shoe and lining assemblies. If the lining material has worn below specifications, or if the lining shows evidence of brake fluid contamination, replace shoe and lining assemblies on BOTH front wheels. To check thickness, make three measurements with micrometer across the middle section. Take one reading at each side and one in the center. If the assembly has worn to a thickness of 0.231-inch (shoe and lining together) or 0.066-inch (lining material only) at one of the three measuring locations, replace all (4) shoe and lining assemblies on BOTH front wheels.

Rotor Runout

To check rotor runout, first eliminate all wheel bearing end play by tightening the adjusting nut. Nut should be just loose enough to allow rotor to turn. Clamp a dial indicator to the caliper housing so that the stylus contacts the rotor approximately 1-inch from the outer edge. Rotate the rotor and take an indicator reading. If it exceeds 0.003-inch total lateral runout, replace or resurface the rotor. An *approved* tool for refinishing Ford disc brake rotors is Rotunda Disc Brake Attachment FRE-2249-2. The step-by-step resurfacing procedure provided with the tool must be adhered to.

The finished braking surfaces of the rotor must be flat and parallel within 0.0007-inch; lateral runout must not exceed 0.003-inch total indicator reading, and the surface finish of the braking surface are to be 80/15 micro inches. Figure 20 illustrates minimum limiting dimensions that must be observed when removing material from the rotor braking surface. Dimension "B" is from the inboard bearing cup to the inboard rotor face. Dimension "A" is from the outboard rotor surface to the inboard bearing cup.

After finishing the rotor runout check, be sure to readjust the wheel bearings to prevent bearing failure. Proper wheel bearing adjustment is extremely important with disc brakes, as too much play may cause excessive brake pedal travel and other problems.

Also check the rotor for scoring. Minor scores can be removed with a fine emery cloth. If excessively scored, either refinish or replace the rotor.

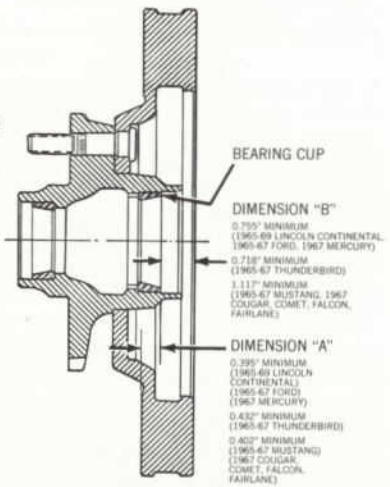


Figure 20—Fixed Caliper Rotor Limiting Dimensions

Caliper

Visually check the caliper. If the caliper housing leaks, 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. The two halves of the caliper assembly must never be separated. Damage or failure of one requires replacement of both as a unit.

Check the caliper to spindle attaching bolts for tightness. Torque to specifications shown in the following chart.

Fixed Caliper to Spindle Attaching Bolt Specifications (Ft. Lbs.)

	1965	1966	1967	1968	1969
Ford, Mercury, Thunderbird and Lincoln Continental,	90-115	90-115	120-130	110-140 (Lincoln only)	110-140 (Lincoln only)
Mustang, Cougar, Fairlane and Comet					
Caliper to Bracket	45-60	45-60	45-60		
Bracket to Spindle	35-45	35-45	35-45		

Brake Hoses

Check brake hoses for signs of cracking, leaks or abrasions. Replace as required.

Removal, Overhaul and Installation

Caliper Removal

1. Remove the wheel and tire assembly from the hub and rotor. Be careful to avoid damage or interference with the caliper splash shield, bleeder screw fitting or transfer tube.
2. Disconnect the steel brake line transfer tube from the caliper. Leave the steel tube connected to the brake hose connector and bracket assembly.
3. Remove the two bolts retaining the brake hose bracket and caliper assembly to the spindle. Take care to avoid loosening the bridge bolts that hold the two halves of the caliper together. Lift the caliper assembly off the rotor.

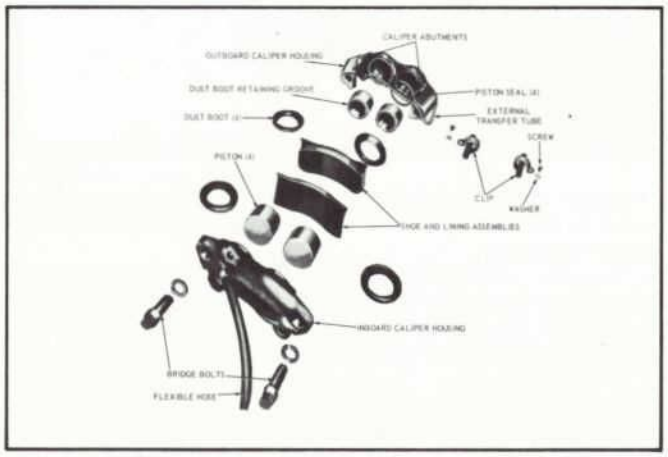


Figure 21—Fixed Caliper Assembly—Exploded View

Caliper Disassembly

NOTE: *Do not remove the bridge bolts that hold the two halves of the caliper together. The caliper is shown separated in Figure 21 for illustrative purposes only.*

1. Remove the two attaching bolts and the caliper splash shield (Fig. 21).
2. If not previously removed, remove the two shoe and lining assemblies.
3. Remove the flexible brake hose from the caliper.
4. Remove the external transfer tube.
5. Remove the four dust boots from the caliper housings and piston grooves.
6. Clamp the caliper in a vise and secure it by the mounting flanges on the inboard housing.
7. Remove the four pistons from the cylinder bores with a special tool, such as the one shown in Figure 22. To prevent cocking, that may cause damage to the piston or bore, rotate the piston with the tool while pulling it outward. *Use care to avoid scratching or damaging the outside diameter surface or dust boot retaining groove of the piston. Such damage causes poor sealing.*

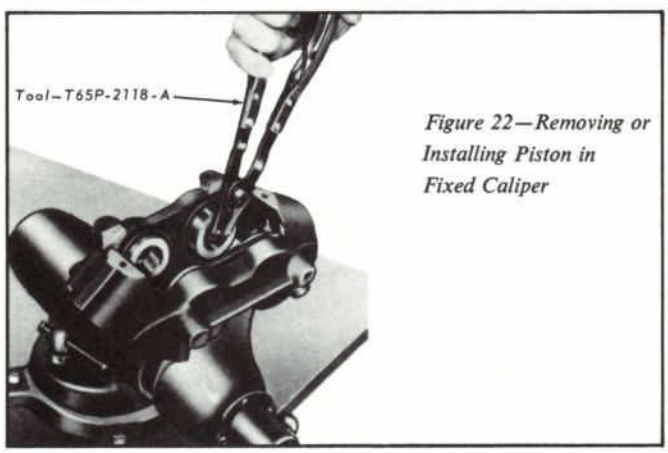


Figure 22—Removing or Installing Piston in Fixed Caliper

If a piston is so completely seized in a cylinder bore that it cannot be removed with the special tool, the caliper housing must be replaced.

If the caliper dust boot retainer or retaining groove is damaged or scratched, pry the retainer out of the caliper housing with screwdrivers. (Does not apply to '68 or '69 models.)

8. Remove the rubber piston seals from the grooves in the cylinder bores by carefully inserting the point of a small knife or other pointed instrument under the seal. Raise the seal up far enough to pull it out with the fingers.

Cleaning and Inspection

Clean all metal parts with isopropyl alcohol or a suitable solvent. Use clean, dry, compressed air to clean out and dry the grooves and passage ways. Be sure the caliper bore and component parts are completely free of any foreign material. Check cylinder bores and pistons for damage or excessive wear. Replace piston if pitted, scored, or the chrome plating is worn off. Check the caliper dust boot retainer for wear or damage.

Caliper Assembly

1. Clamp the mounting flange on the inboard housing in a vise.
2. Apply a film of clean brake fluid to *new* caliper piston seals and install them in the grooves of the cylinder bore. Position the seal at one area in the groove and gently work around the groove. DO NOT INSTALL USED SEALS.
3. Install new dust boots by setting the flanges squarely in the outer grooves of the caliper bores.
4. Coat outside diameter of pistons with brake fluid and install pistons in cylinder bores so that the open end of piston and the boot retaining groove face out of the bore. To avoid cocking, locate piston squarely in bore and apply a slow even pressure. If a piston will not easily go all the way into the bore, remove it and thoroughly inspect cylinder bore, piston seal, and installation of seal. If the piston still will not go in (with bore in good condition and piston seal properly installed), use the tool shown in Figure 22. Rotate the piston with the tool while pushing inward with a steady force.
5. Carefully install four *new* dust boots on caliper housings and pistons. Be sure each boot fully seats in the groove of its respective caliper housing and piston (Fig. 21). DO NOT INSTALL USED DUST BOOTS.

Lining Installation

1. Position a new shoe and lining assembly on each side of rotor so lining faces rotor. Be sure that the tabs on the shoe flanges fully seat against caliper bridges (Fig. 19). If caliper was not disassembled proceed as follows:
2. Install caliper splash shield and secure to caliper with two retaining bolts.
3. Pump brake pedal several times until a firm pedal is obtained, indicating linings have seated properly.
4. Install wheel and tire assembly on hub and rotor.
5. Check and fill master cylinder reservoir with brake fluid as required. Road test the car. NOTE: *It should not be necessary to bleed the system after just a shoe and lining replacement.* However, if caliper has been removed and disassembled, continue installation.

Caliper Installation

1. If the caliper assembly has been replaced, transfer the steel tubing and bleeder screw to the new caliper.

2. Install the flexible brake hose to the caliper.

3. Position the caliper assembly on the rotor, and mate the mounting bolt holes in the caliper with those in the spindle. It may be necessary to push the caliper pistons into the cylinder bores to obtain clearance between the shoe and lining assembly and the rotor. The shoe and lining assemblies should be seated properly on the bridges.

4. Install the caliper to spindle retaining bolts and torque them to specifications shown in chart on page 11. Check to insure the rotor runs squarely and centrally between the two halves of the caliper. There should be approximately 0.090-0.120-inch clearance between the caliper and the rotor outside diameter.

5. Position the steel transfer tube brake hose bracket and caliper assembly to the spindle. Install retaining bolts.

6. Connect front wheel steel transfer tube from the caliper to the front brake hose connector.

7. Bleed brake system and centralize the differential valve. Check the master cylinder fluid level. Add the correct fluid as required. Pump the brake pedal several times to actuate the piston seals and to position the shoe and lining assemblies.

8. Install wheel and tire assemblies, and road test the car.

Floating Caliper

Cleaning and Inspection

Lining

A quick check of floating caliper linings can be made by simply removing the wheel and tire. To make a thorough check, however, the caliper must be removed. When removing the caliper, be sure and cap the brake line hose to prevent brake fluid from leaking from the master cylinder.

To facilitate removal of shoe and lining assemblies, the piston may have to be pushed into its bore. Apply a steady inward pressure against the inner shoe and lining assembly. Maintain pressure for at least one minute. Slide the two outer shoe retaining clips off the retaining pins (Fig. 9). Remove retaining pins from outer shoe and remove shoe from the caliper. Slide the inner brake shoe outward until it's free of the hold-down springs, then remove shoe. Remove caliper locating pins, stabilizer attaching bolts, and stabilizer(s). Remove locating pin insulators from the anchor plate. Discard locating pin insulators and stabilizers from Falcon, Fairlane, Mustang, Montego and Cougar, as these parts must be replaced each time brakes are relined for these models. On Ford, Thunderbird, Continental Mark III and Mercury models, the locating pin insulator must be replaced, but the stabilizers being stainless steel, do not require replacement unless damaged.

Make three thickness measurements with a micrometer across the thinnest section of the shoe and lining. If the assembly has worn to a thickness of 0.230-inch (shoe and lining together) or 0.030-inch (lining material only) at any one of the three measuring locations, or if there is more than 0.125-inch taper from end to end (Fig. 23), or if lining shows evidence of brake fluid contamination, replace all (4) shoe and lining assemblies on BOTH front wheels. The taper wear pattern occurs on floating caliper disc brakes because of the off-center anchor plate abutments. Although this causes the caliper to shift within the anchor plate to assume an angular position, the resulting tapered linings have about the same service life as fixed caliper brakes.

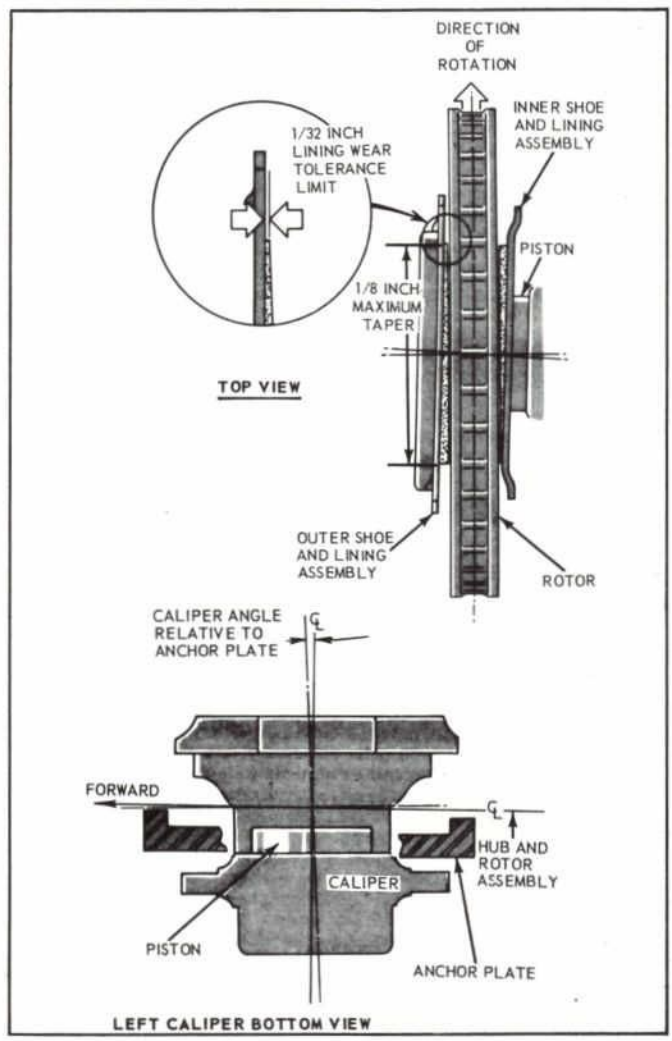


Figure 23—Taper Wear Pattern

Rotor Runout

The rotor runout check information on page 11 for fixed caliper brakes also applies to floating caliper brakes, except for the minimum limiting dimensions for resurfacing. All 1968-69 cars with floating caliper brakes require a ball and gauge bar (Rotunda FRE-70160, or equivalent) to measure wear on the rotor inner braking surface, and to determine the maximum stock removal limit during refinishing. Gauge the rotor on the bench prior to mounting it in a rotor lathe.

Controlled dimension notches are machined in the opposite edges of the gauge bar (Fig. 24) and identified Custom Car (Ford, Mercury, Continental Mark III and Thunderbird) and Light Car (Montego, Fairlane, Falcon, Mustang and Cougar).

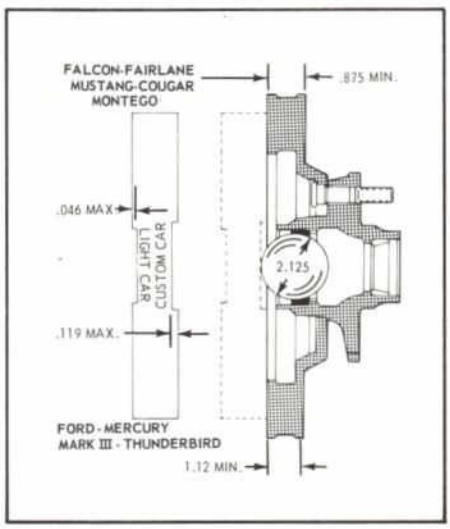


Figure 24—Floating Caliper Rotor Refinishing Limiting Dimensions

The rotor is gauged as follows:

1. Remove inner bearing assembly and grease retainer. Thoroughly clean inner bearing cup and hub bore.
2. Carefully place the gauge ball in the inner bearing cup (DO NOT DROP).
3. Position gauge bar across the rotor inner braking surface and over the gauge ball (Fig. 24). Measure the distance between the gauge bar and ball. This equals the maximum amount of stock that can be removed. *If the gauge bar* touches the ball, no additional stock may be removed. If the gauge bar is below the top of the ball, replace the rotor.
4. Minimum rotor thickness dimensions are shown at both ends of the rotor in Figure 24. Rotors having a thickness less than these specifications must be replaced, regardless of the ball and gauge bar measurements.

Caliper

The cleaning and inspection information for fixed caliper brakes also applies to floating caliper brakes except for the caliper to spindle bolt torque specifications.

The following chart lists torques for 1968-69 cars.

FLOATING CALIPER TO SPINDLE ATTACHING BOLT SPECIFICATIONS

Upper bolt	110-140 ft. lbs.
Lower bolt—Ford, Mercury, Thunderbird, Continental Mark III	90-120 ft. lbs.
Lower bolt—Montego, Falcon, Fairlane, Cougar, Mustang	55-75 ft. lbs.

Brake Hoses

Check for signs of cracking, leaks or abrasions. Replace as required.

Removal, Overhaul and Installation

Caliper Removal

Remove the wheel and tire assembly from the hub and rotor. Use care to avoid damage or interference with the caliper splash shield or bleeder screw fitting. Disconnect the brake hose from the caliper and cap to prevent loss of fluid from the master cylinder. Remove the spindle attaching bolts and lift the caliper assembly from rotor.

Caliper Disassembly

Disassemble the caliper as described under "Linings"—"Cleaning and Inspection" on page 13. This will remove all parts except the piston. To remove piston, apply air pressure to the fluid port in the caliper with a rubber tip nozzle as shown in Figure 25. Place a cloth over the piston before applying air pressure to prevent damage to piston and spraying brake fluid. If the piston is seized and cannot be forced from caliper, tap lightly around the piston while applying air pressure. *Care should be taken because the piston can develop considerable force due to pressure build-up.* Remove the dust boot from the caliper, then the rubber piston seal from the cylinder and discard.

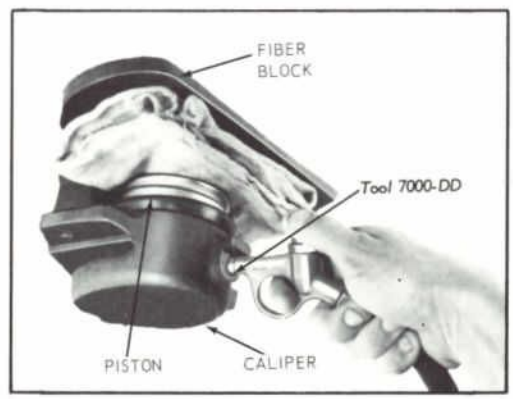


Figure 25—Using Air Pressure to Remove Piston

Cleaning and Inspection

The same information under "Cleaning and Inspection" for fixed caliper brakes, page 12, also applies to floating caliper brakes.

Caliper Assembly

Apply a film of clean brake fluid to a *new* caliper piston seal and install in cylinder bore. Be sure seal does not become twisted and that it seats fully in its groove. Install a *new* dust boot by setting the flange squarely in outer groove of caliper bore. Coat piston with brake fluid and install in cylinder bore. Spread dust boot over piston as it's installed. Seat dust boot in piston groove.

BRAKE SYSTEMS . . . PART I

Lining Installation

When installing new shoes and linings, it is necessary to force the piston to the bottom of its bore. Apply sufficient pressure to overcome the grip of the piston seal on piston. Install *new* caliper locating pin insulators in anchor plate. Position caliper assembly in anchor plate. Position *new* stabilizer or stabilizers (all Falcon, Fairlane, Mustang, Montego and Cougar—if required on Ford, Mercury, Thunderbird and Continental Mark III) and install caliper locating pins to engage approximately four threads. *If the caliper locating pins are rusted or corroded, they should be replaced.* Apply isopropyl alcohol to caliper locating pins before installation. After assembly the alcohol will evaporate and permit the pins to operate in a "dry" condition. *Never use oil, grease or similar lubes.*

Position outer brake shoe on caliper and install the two retaining pins and clips. Install the inner brake shoe so that ears of shoe are on top of anchor plate bosses and under shoe hold-down springs. Position the shoe and linings assemblies so the caliper assembly can be placed over the rotor. Rotate a hammer handle between the linings to reset the stabilizers.

Caliper Installation

Install the caliper assembly over the rotor and on the spindle. It may be necessary to push the caliper piston into the cylinder to obtain clearance between rotor and lining assembly. Install the two caliper attaching bolts, and torque to the specifications in the chart on page 14.

The upper bolt must be tightened first as shown in Figure 26. Install the safety wire and twist the ends at least five turns. Push the ends against spindle to avoid interference with brake hose and steering stop. Install a new copper washer on each side of the brake hose fitting and attach to caliper.

Bleed the brake system and centralize the differential valve. Check master cylinder reservoir fluid level. Add specified brake fluid as required. Pump brake pedal several times to actuate the piston seals and to position the shoe and lining assemblies. Install wheel and tire assembly and road test the car.

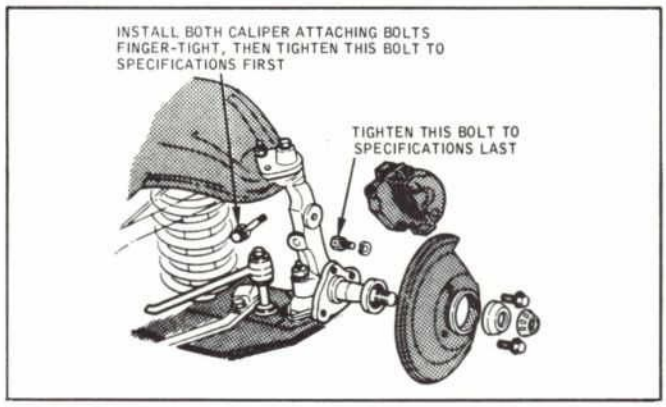


Figure 26—Caliper Attaching Bolt Tightening Procedure

SERVICE PROCEDURES—Hydraulic System

All disc brake systems use a proportioning valve between the pressure differential valve and the rear brake wheel cylinders. *The proportioning valve is serviced as an assembly and is never adjusted or overhauled.*

Metering Valve

Lincoln Continental and F-250 & 350 Truck models only use a metering valve in the front hydraulic system with disc brakes. *It is serviced as an assembly and is never adjusted or overhauled.* During bleeding operations, a release rod at the bottom of the metering valve *must* be held open at least 1/16 inch.

Centralizing Differential Valve of Dual Brake Systems

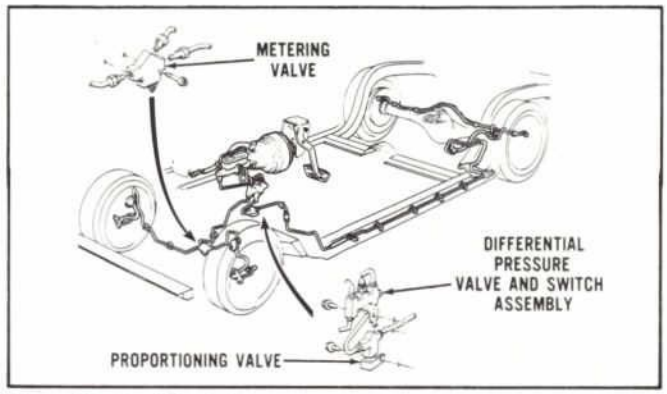


Figure 27—Dual Brake System

After dual brake system (Fig. 27) has been repaired and bled, the warning light on the instrument panel will usually continue to glow because the pressure differential valve is in the off-center position. To centralize the pressure differential valve and turn off the warning light, a pressure differential or unbalance condition must be created in the *opposite brake system from the one that was last repaired or bled.*

Turn ignition switch to ACC or ON position. Loosen the differential valve assembly brake tube nut at the outlet port on the opposite side of the brake system that was last repaired or bled. Depress brake pedal slowly to build line pressure until the pressure differential valve moves to a centralized position and the brake warning light goes out; then, immediately tighten the outlet port tube nut. Check fluid level in master cylinder reservoirs, and fill to 1/4-inch from the top with specified brake fluid, if necessary. Turn ignition switch OFF. Before driving the vehicle, check operation of brakes and be sure that a firm pedal is obtained.

Brake Fluid Specifications

Ford Brake Fluid—Extra Heavy Duty (Part No. C6AZ-19542-A) (Spec. ESA-M6C25-A) or equivalent, is mandatory for all disc brake applications, and recommended for drum brakes. NOTE: All 1968-69 cars are filled with extra heavy duty brake fluid at the factory. Extra heavy duty brake fluid is colored "blue" for identification purposes. Do not mix low temperature brake fluids with it.

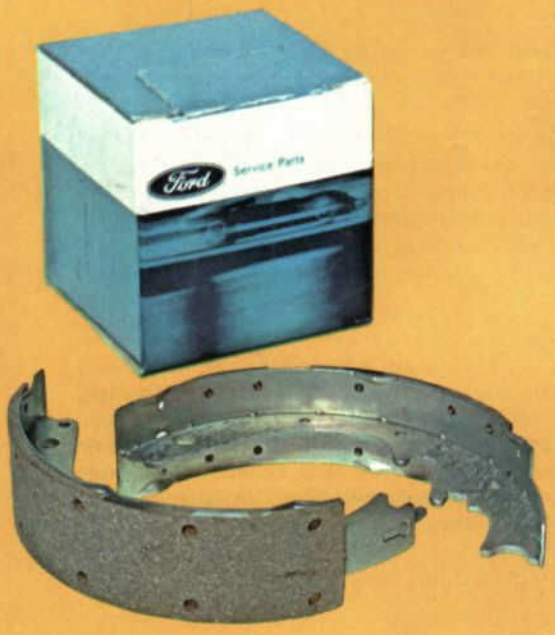
Ford Brake Fluid—Super Heavy Duty (Part No. B7AZ-19542-A) (Spec. SAE J1703), or equivalent, can be used for cars with complete *drum* brake systems only.

DON'T MISS . . . SERVICING FORD BRAKE SYSTEMS—PART II in February Shop Tips—Covering: Adjustments, Bleeding, Parking Brake, Master Cylinder and Power Booster. PLUS . . . Cortina Brake Service.

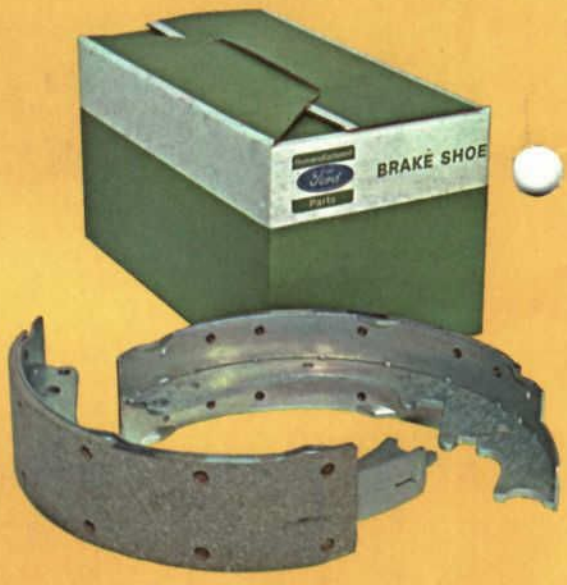
COMPLIMENTS OF

YOUR SOURCE FOR GENUINE FORD AND AUTOLITE ORIGINAL EQUIPMENT PARTS

BOTH Brand-New and Ford Authorized Remanufactured Brake Linings Provide Original Equipment Quality



- Meet all state and federal brake regulations.
- Quality control tested
- Precision pre-ground for smooth, even lining-to-drum contact.
- Scientifically-selected lining material more effectively dissipates heat, to resist brake fade and provide longer wear.



And to keep ALL Ford Quality in Ford brakes . . . Install Ford Wheel Cylinder Repair Kits

- SAME high quality as original equipment cups and boots.
- All-rubber compound is high temperature, wear resistant type.
- Precision molded boots fit tight . . . to seal hydraulic system from dirt and moisture.
- Cups designed to maintain full, continuous sealing for smoother, surer braking.