

BRAKES

UNIT 5: DISC BRAKE DIAGNOSIS AND REPAIR

LESSON 3: SERVICE DISC BRAKE CALIPERS

- I. Terms and definitions
 - A. **Adapter** – A metal component that fastens the caliper to the knuckle. Some brake systems do not use adapters.
 - B. **Attachment hardware** – Metal parts, such as bolts, pins, nuts, etc., that connect the caliper to the knuckle.
 - C. **Banjo fitting** – A hydraulic fitting that uses a hollow bolt to transfer fluid from a brake component to a line or hose.
 - D. **Brake pads** – Replaceable friction surfaces that are forced against the rotor by the caliper piston.
 - E. **Brake rotor** – A metal disc that rotates with the wheel. Many rotors are integral with the wheel hub.
 - F. **Caliper** – A nonrotating disc brake component that forms the cylinder and contains the piston(s) and brake pads. The caliper produces braking action by using hydraulic pressure to cause a clamping action on a rotating disc.
 - G. **C-clamp** – A clamp that is shaped like the letter C used to compress floating caliper pistons.
 - H. **Crocus cloth** – An extremely fine grade of emery cloth that is used to polish metal.
 - I. **Cylinder bore** – A chamber that encloses a piston.
 - J. **Encapsulator** – A device designed to capture and hold asbestos dust during brake work.
 - K. **Hub** – Component on which the wheel is bolted.
 - L. **Independent rear suspension** – A rear suspension system that allows each rear wheel to move independently of the others.
 - M. **Knuckle** – A front-wheel hub component that allows the wheels to be steered.

- N. **Parallelism** – A condition in which both sides of the rotor (i.e., the friction surfaces) run parallel to each other.
- O. **Piston** – A hydraulically activated caliper component that applies the brake pads to the rotor.
- P. **Runout** – A condition in which the brake rotor friction surfaces are not perpendicular to the rotational axis of the rotor. Excessive runout causes the rotor to wobble.
- Q. **Transfer passage** – A passage within a fixed brake caliper. The transfer passage channels the fluid to the outer pistons. Some calipers transfer fluid through an external metal line.

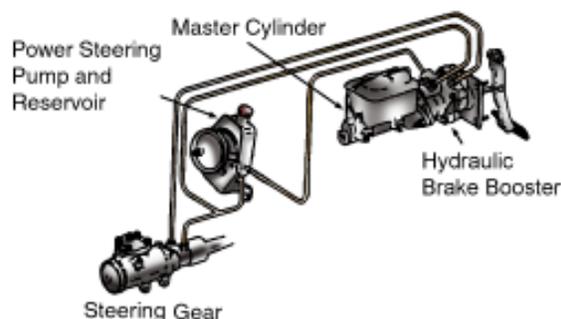
II. Removing disc brake calipers

- A. Always use proper lifting equipment to raise the vehicle.

CAUTION: When lifting a vehicle, always use proper lifting equipment and observe all safety precautions.

- B. Remove the wheels.
 1. Mark the wheels for reinstallation in their original locations.
 2. Inspect the wheels for cracks and check the tires for unusual wear patterns. Store the wheels so that the wheel covers do not become damaged.
 3. Identify whether the calipers to be serviced are fixed or floating. A floating caliper contains only one piston. Fixed calipers usually contain four pistons – two on each side.
 4. Encapsulate and clean all brakes to be serviced.

CAUTION: Asbestos is a cancer-causing substance. Do not breathe asbestos dust or allow it to escape into the air.



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- C. Take off the master cylinder cover and remove a small amount of fluid from each chamber. Doing so prevents fluid overflow when the caliper pistons are compressed.

CAUTION: Brake fluid can harm a vehicle's finish. Do not let the fluid overflow or spill.



- D. Compress the caliper pistons. Outlined below are procedures for compressing pistons on both fixed and floating calipers.
1. Procedures for compressing pistons on fixed calipers
 - a. Compress the fixed caliper pistons one at a time. Insert a small pry bar or similar tool between the brake pads and pry them apart. Doing so forces the pistons into the caliper bores.
 - b. If one piston is stuck in its bore, compress the other three and force the caliper off the rotor.
 - c. If more than one piston is stuck and the stuck pistons are located across from each other, attempt to force the caliper off the rotor.

NOTE: Although it may be difficult to force off a caliper in which three pistons are stuck, make the best effort possible. Forcing the caliper off the rotor is usually the easiest and quickest removal procedure.

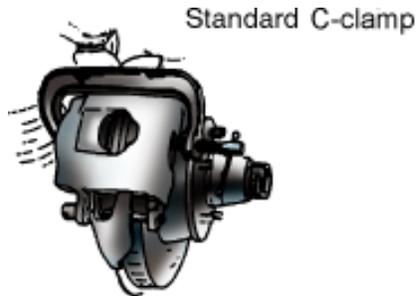
- d. If the rotor is deeply grooved or if the caliper cannot be forced off the rotor, remove the caliper and rotor together.

NOTE: Replace the caliper and rotor if they must be removed together.

2. Procedures for compressing pistons on floating calipers
 - a. Place a large C-clamp on the caliper. Place the clamp screw against the outer brake pad.



- b. Turn the screw so that the outer pad forces against the rotor. As a result, the caliper slides and forces itself against the inside of the rotor. This pad and caliper movement forces the piston into the caliper.

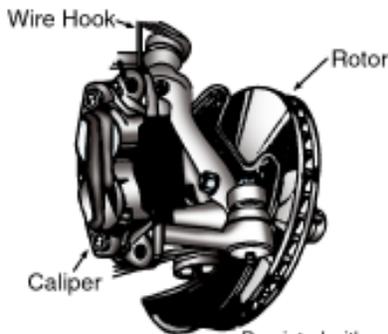


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- E. Remove the caliper from the adapter.
 1. Be sure to disconnect the correct caliper fasteners.

NOTE: A common mistake is to remove the adapter from the knuckle.

 2. Inspect all attachment hardware and note any broken or worn parts. Be sure to mark parts for replacement.
 3. Hang the caliper by using a piece of wire or welding rod. Never allow a caliper to hang by the brake line.



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- F. Disconnect the hydraulic system from the caliper.
 1. If the brake hose is connected with a banjo bolt, disconnect the hose at the caliper.

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2. If a disconnecting device is located at the end of the brake hose opposite the caliper, leave the hose on the caliper.
3. If the cover has been off the master cylinder thus far during the procedure, put it back on.

NOTE: On some rear-wheel disc brakes, the steel brake lines connect to the caliper. These calipers use a flexible hose above the rear axle to accommodate suspension movement. If the vehicle has independent rear suspension, then a flexible hose is provided to each rear-wheel caliper.

NOTE: If the lines are left open for a long time, tape them to avoid contamination from dirt and moisture.

III. Inspecting and repairing calipers

- A. Clean all brake components.

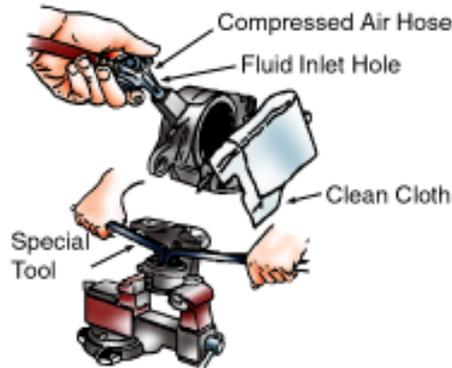
NOTE: Use only a brake cleaning solvent to clean the brake components. Never use an engine solvent or gasoline.

- B. Disassemble the caliper and remove its pistons.

1. When servicing a floating caliper, use compressed air to blow out the piston.
2. When servicing a fixed caliper, insert a rag pad between the pistons for protection and apply compressed air to the hydraulic port.
 - a. In most cases, only the piston that is the most free moves.
 - b. After one of the pistons leaves its bore, no more air can be trapped.



- c. Remove the other pistons one at a time with special pullers.



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CAUTION: The piston can blow out of the caliper with enough force to cause personal injury. Make sure the rag pad is between the piston and the other side of the caliper. Cover the caliper with another pad to prevent parts from flying. Do not place fingers between the pistons and the caliper.

CAUTION: Do not use heat or machine tools to remove the pistons; doing so may ruin the caliper.

NOTE: It may take considerable time to remove stuck caliper pistons. If the pistons are stuck so securely that normal removal procedures cannot free them, then the bores are probably corroded and the entire caliper needs to be replaced.

- C. Inspect the caliper components.
1. After cleaning all the internal parts with an approved brake solvent, inspect the pistons for pitting, rusting, cracks, chipping, and scoring. If any of these problems are found, replace the pistons.



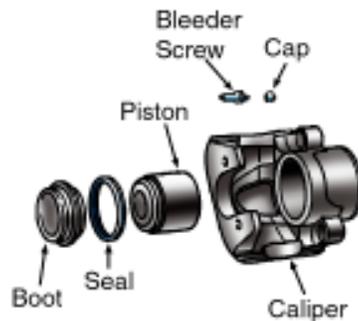
NOTE: Whether damaged or not, always replace plastic pistons after removal.

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2. Remove all seals and boots from the caliper bores. Check the bores for pitting and scoring. Clean the bores with a fine crocus cloth or caliper hone if doing so does not increase bore diameter by more than .002 in. If there is any bore damage deeper than .001 in, replace the caliper.

NOTE: Discard all seals, boots, and any other rubber caliper parts.

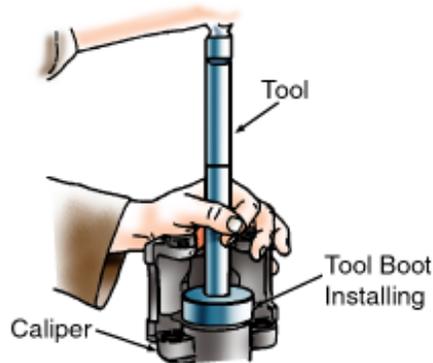
3. Remove and clean the bleeder valve; replace it if necessary.



4. Reassemble the caliper.
 - a. During reassembly, lubricate all parts liberally with clean brake fluid or another appropriate lubricant. All parts should freely move into their proper positions; inspect any part that does not fit easily into its position. Do not force the pistons into their bores.
 - b. Using only new soft parts, manually insert all seals and pistons into the caliper bores. Do not use excessive pressure. Press pistons to the bottom of their respective bores.



- c. Install a new dust seal according to the manufacturer's directions.



- d. If the transfer passage is drilled into the body of a fixed caliper, clean the passage and make sure it is free of obstructions. If the transfer passage is a separate tube, clean the tube and ensure that it is free of obstructions before installation.

NOTE: Floating calipers do not have transfer passages.

- e. On fixed caliper brakes, reassemble the caliper halves by using new gaskets or seals where indicated.
- f. Inspect all hoses and replace any that show evidence of leaking or deterioration.
- g. Reinstall all bleeder valves.

IV. Installing and adjusting disc brake calipers

- A. Inspect the caliper attachment hardware. If servicing a floating caliper, inspect the surface upon which the caliper floats. Repair any worn areas and thoroughly clean the adapter and knuckle.
- B. Clean and lightly lubricate all attachment hardware.
- C. Inspect the rotors for proper parallelism, runout, and minimum thickness. Make sure the rotors are not grooved in excess of allowable limits. Repair or replace rotors as necessary.

NOTE: Service or replace the rotors before installing the calipers. For rotor inspection and service, see Lesson 4 of this unit.



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D. Using the manufacturer's directions, install the brake pads securely in the caliper. Fit the pads, if necessary.

E. Using the manufacturer's directions, install the caliper.

NOTE: When servicing the fixed caliper brake systems, make sure that the caliper is adjusted to the rotor. Adjustments are usually made with shims. Be sure to follow the manufacturer's procedures.

NOTE: Floating calipers used on front wheels require no adjustment.

F. Install the brake hoses.

CAUTION: Until the pistons return to their operating positions, the brakes are inoperative. The driver has to apply the brakes several times before the pistons resume their operating positions. Make sure brakes are operative before driving the vehicle.

G. Bleed all air from the lines and the calipers; check the level of brake fluid in the master cylinder.

H. If installing a rear-wheel caliper, connect the parking brake cable and adjust the parking brake according to the manufacturer's directions.

NOTE: There are two basic designs of parking break mechanism used on rear disc brake vehicles. One type uses an expanding shoe and drum (a small mechanical drum brake system inside the disc rotor). The second type uses a screw-actuated unit that is an integral part of the caliper. Procedures for service and adjustment of these systems differ between one make and model and another. Use the manufacturer's recommended procedure.

I. Reinstall the wheel/tire assembly and torque the wheel nuts to specifications.

CAUTION: Always check and refill the master cylinder after testing or servicing the hydraulic system components.

CAUTION: Always make sure the hydraulic system is free from air after testing or servicing the hydraulic components.



