

# BRAKES

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## UNIT 5: DISC BRAKE DIAGNOSIS AND REPAIR

### LESSON 4: SERVICE DISC BRAKE ROTORS

- I. Terms and definitions
  - A. **Arbor** – The brake lathe shaft upon which the brake drum and rotor are mounted.
  - B. **Bezel** – A piece that surrounds an instrument's dial. The dial indicator's bezel is used to index the dial.
  - C. **Brake lathe** – A machine tool that is designed to refinish brake rotors and brake drums.
  - D. **Cross-feed lever** – A brake lathe lever that controls the movement of the cross-slide. The cross-feed lever determines the start and speed of the cut.
  - E. **Cross-slide** – A brake lathe component that moves perpendicularly to the arbor. The lathe cutting tools are connected to the cross-slide.
  - F. **Depth of cut** – The amount of materials removed from a brake rotor or brake drum in one cut.
  - G. **Dial indicator** – An instrument that measures the distance of change (movement).
  - H. **Encapsulator** – A device designed to capture and hold asbestos dust during brake work.
  - I. **Handwheel** – A hand-operated adjustment wheel.
  - J. **Inboard** – A term used to identify the area closest to the rotor's center.
  - K. **Indexing collar** – A scale printed on an adjustment knob collar that indicates the distance that the adjuster has been moved.
  - L. **Locking knobs** – Knobs that can lock a moveable part.
  - M. **Micrometer** – Precision tool that provides measurement that is accurate to fractions of one-thousandth of an inch.

- N. **Minimum thickness (discard thickness)** – The thickness at which the rotor cannot perform adequately.
- O. **Perpendicular** – A term that designates the relationship between two objects that are at a 90° angle to each other.
- P. **Rotor** – A metal disc that turns with the wheel.
- Q. **Silencer** – A rubber strap or band that eliminates or reduces vibrations in brake rotors during reworking.
- R. **Tool bit** – On a brake lathe, the machine part that does the cutting.
- S. **Tool bit control (depth of cut) knob** – A lathe knob that positions the tool bit.

### II. Determining rotor thickness, parallelism, and runout

- 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 and encapsulate and clean the brake parts.

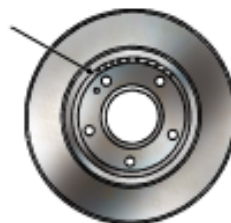
**CAUTION:** Asbestos is a cancer-causing substance. Never breathe asbestos dust or allow it to escape into the air. Special equipment is available to encapsulate the dust and prepare it for safe disposal. If this equipment is unavailable or in poor working order, do not perform brake work.

**CAUTION:** Carefully follow the manufacturer's instructions when using the encapsulator.

- C. Procedure for inspecting the rotor for deep grooves

1. Locate the specification for minimum rotor thickness. The minimum rotor thickness is usually printed on the rotor or on its hub.

Minimum Thickness Marking



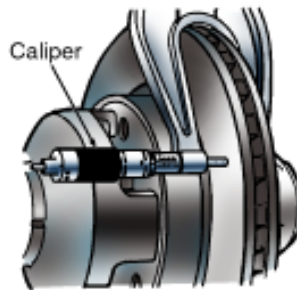
2. Check the rotor for grooves.
  - a. If there are no significant grooves, check the rotor for parallelism according to section D.
  - b. If significant grooves are found, measure the depth of the rotor grooving.
  - c. If grooving causes the rotor to fall below the minimum thickness at any point, discard the rotor.
  - d. If the rotor is still above the minimum thickness, machine the grooves out of the rotor. Do not machine the rotor below the minimum thickness, however.

**NOTE:** Some minor grooving in the rotor after reworking is acceptable.

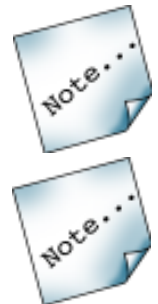
**NOTE:** Some rotors have grooves machined into them during manufacture. Disregard these grooves.

### D. Procedure for determining if the rotor is sufficiently parallel

1. Using a micrometer, measure the thickness of the rotor at 12 different locations. Record each measurement. If any one reading exceeds any of the others by .001 in, the rotor is not parallel.



2. If the rotor is parallel, proceed to section E and measure the rotor runout.
  - a. If the rotor is not parallel, calculate the rotor's thickness if it is machined to the smallest micrometer measurement.
  - b. Discard the rotor if machining drops it below its minimum thickness.



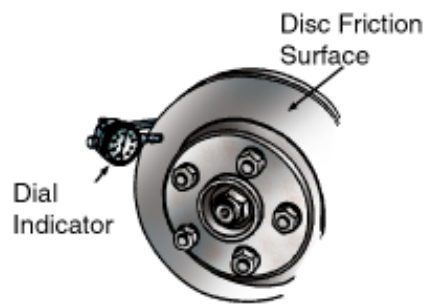
- c. If machining does not drop the rotor below its minimum thickness, machine the rotor until there is no more than .001 in variation between any two points.

**NOTE:** Some minor grooving in the rotor after reworking is acceptable.

E. Procedure for checking rotor runout

**NOTE:** If the rotor is not integral with the hub assembly, retighten the wheel nuts onto the hub to hold the rotor in place. In some cases, it may be necessary to install a spacer before installing the wheel nuts. Follow the manufacturer's recommended procedure.

1. Connect a dial indicator to the knuckle, adapter, or some other solid area that allows the indicator to touch the disc.



2. Adjust the dial indicator so that it contacts the rotor somewhere near the center of the friction surface.
3. Rotate the rotor while watching the dial indicator.
4. Stop and zero the dial indicator at the point of its lowest reading.
5. Continue turning the rotor.
  - a. Stop the dial indicator at its highest reading.
  - b. Subtract the lowest reading from the highest reading; the difference is the rotor runout.
  - c. If there is no difference between the lowest and highest reading, then the runout is zero.

- d. If the difference is greater than .005 in, machine the rotor.

**NOTE:** A worn or poorly adjusted bearing can cause excessive rotor runout. Inspect the bearing for excessive wear and check the bearing adjustment before machining the rotors.

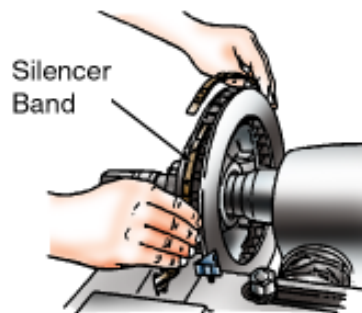
6. To remove runout, reduce the rotor thickness by one half of the runout measurement. For example, if the runout is .006 in, then reduce the rotor thickness by .003 in.
7. Calculate the rotor's thickness if it is machined. If the thickness is less than the minimum thickness specifications, discard the rotor. If the thickness still exceeds the minimum thickness specifications, machine the rotor until the runout is under .001 in.

### III. Machining rotors off the vehicle

- A. Mount the rotor on the brake lathe arbor.

**NOTE:** Be sure to center the rotor between the arbor's two cones. If the rotor wobbles when turned, make sure the rotor is correctly connected to the arbor. Also make sure that no dirt or chips are between the rotor and the arbor.

- B. Install the rotor silencer. In most cases, the silencer is a rubber band that stretches around the rotor's edge. However, the silencer may be a pad that contacts the rotor's face.



- C. Install the cutting tools. Make sure to center the rotor between the cutting tools. Also make sure that the cutting tools are perpendicular to the arbor.

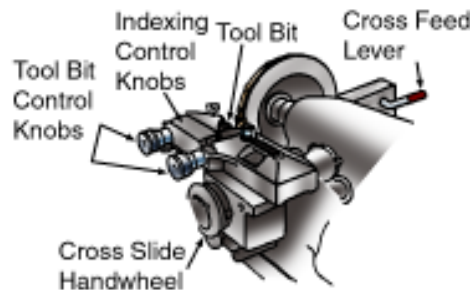




- D. Using hand pressure, rotate the rotor at least one complete turn. Make sure that the rotor turns freely and both tool bits are clear of the rotor's face.

**CAUTION:** Make sure that all controls are in neutral or at zero before turning on the lathe.

- E. Turn on the lathe.
- F. Turn one of the tool bit control knobs clockwise until the tool bit makes contact with the rotor's face.
1. Turn the indexing collar on the knob to zero.
  2. Repeat this procedure on the other tool bit control knob.
  3. After setting the collars, do not change their position. Keep the collars in the same position during the entire machining process. The collars indicate how much material is being removed.



- G. Using either of the tool bits, make a scratch cut on the rotor.
1. If the scratch cut is all of the way around, rework the rotor without further adjustments.
  2. A scratch cut going only part of the way around the rotor may indicate that the rotor is not square on the arbor.
    - a. Loosen the rotor and rotate the arbor 180°.
    - b. Move the tool slightly and scratch the rotor again. If the two scratches run side by side, then the wobble is in the rotor and thus can be reworked.

- c. If the scratches are located across the rotor from each other, then the wobble is in the machine or in the space between the rotor and the arbor. Correct any problems with the machine or recheck the rotor mounting.
- H. Machine the rotor after making sure it is correctly installed on the arbor.
1. Turn the cross-slide handwheel clockwise until the tool bits are on the most inward edge of the rotor's face.
  2. Turn the depth of cut knobs (tool bit control knobs) until they indicate the depth of the first cut. Then lock them in this position with the locking knobs.  
  
**NOTE:** If the first cut is made at high speed, the depth should not exceed .010 in. If the rework is less than .010 in, then set the depth at the rework dimension and run the first cut at low speed.
  3. Engage the cross-feed lever. The lever has two positions: high and low. High speed is for a rough cut and low speed is for a finish cut.  
  
**NOTE:** The depth of cut should never be less than .004 in. Cuts less than .004 in do not allow heat to transfer from the tool bit to the rotor. Excessive heat buildup in the tool bit may cause damage.
  4. Continue taking cuts until the rotor is smooth and true. Check the rotor's thickness, parallelism, and runout after making the final cut but before removing the rotor from the arbor.
- I. Using a sanding block or other abrasive, put a nonsymmetrical finish on the rotor's friction surface.
1. Turn on the brake lathe.
  2. Lightly drag the abrasive across the machined surface of the rotor.
  3. Turn off the brake lathe.
- J. Remove the rotor from the arbor.



## IV. Machining rotors on the vehicle

### A. Preparation for machining rotors

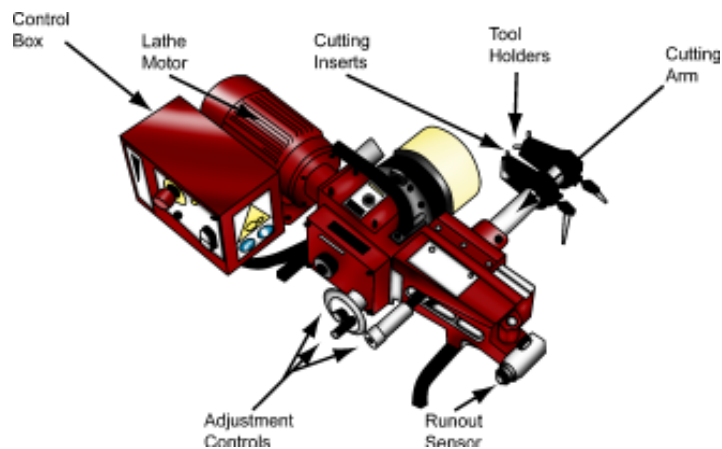
1. Use proper lifting equipment to raise the vehicle.

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

2. Remove the wheel from the rotor to be serviced and encapsulate and clean the brake parts. Be sure to follow the latest federal procedures when encapsulating and cleaning brake assemblies and follow the manufacturer's instructions when using the encapsulator.

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

3. Remove the disc brake caliper. Use service information to locate the correct procedure for the make and model of vehicle being serviced.
4. Visually inspect and measure the rotor to determine if it can be resurfaced or must be replaced.





### B. Connecting the brake lathe

1. Select the proper hub flange adapter to fit the vehicle's rotor/hub assembly.
2. Mount the hub flange adapter to the rotor/hub assembly. Verify that all mounting areas are clean.
3. Attach the brake lathe to the mounting flange adapter.

**CAUTION:** Be sure the lathe is properly aligned and mounted to avoid damaging the flange.

4. Attach a dial indicator and compensate for hub and adapter runout.

**NOTE:** Some brake lathes have the ability to self-compensate.



### C. Machining the rotor

1. Install the rotor silencer.
2. Check the condition of the cutting inserts.
3. Position the cutting inserts at the inner diameter of the rotor's inboard and outboard friction surfaces.
4. Adjust the cutting inserts for the desired depth of cut.

**NOTE:** The depth of cut should never be less than .004 in. Cuts less than .004 in do not allow heat to transfer from the tool bit to the rotor. Excessive heat buildup in the tool bit may cause damage.





5. Turn on the brake lathe.
6. Engage the feed mechanism.

**CAUTION:** To avoid damaging the rotor, do not disturb the lathe once the feed mechanism has been engaged.

7. Machine the rotor's surface.
8. Remove the brake lathe from the adapter. Be careful not to hit the rotor with the cutting inserts while removing the lathe.
9. Check the rotor's thickness, parallelism, and runout before removing the adapter. Be sure that the rotor is above the manufacturer's minimum thickness specification.
10. Remove the hub flange adapter.
11. Reinstall the brake caliper and pads. Use service information to locate the correct procedure for the make and model of vehicle being serviced.
12. Depress the brake pedal and check brake operation.
13. Reinstall the wheel-and-tire assembly and torque the wheel nuts to the proper specification.
14. Repeat the procedure on other rotors as required.