UNIT 4: DRUM BRAKE DIAGNOSIS AND REPAIR

LESSON 1: DRUM BRAKE OPERATING PRINCIPLES

I. Terms and definitions

A. **Adjustment mechanism —** A group of parts that adjusts the position of the drum brake shoe.

B. **Anchor —** Steel component that prevents the brake shoe from rotating with the wheel during brake application. (The brake shoe contacts the anchor when the driver applies the brakes.)

C. **Brake backing plate —** A stationary metal plate fastened to the spindle or axle. Several brake components may be connected to the brake backing plate.

D. **Dissipate —** To scatter or dispel. To be effective, brakes must dissipate the heat that the brakes create.

E. **Friction material —** A material designed to create friction. Friction material is mounted on brake pads or shoes in the form of brake lining.

F. **Friction surface —** Any surface designed to create friction when contacting another surface. Brake shoes, pads, drums, and discs all have friction surfaces.

G. **Primary brake shoe —** Drum brake shoe located toward the front of the vehicle. Identified only on dual servo brake assemblies, the primary shoe pulls away from the anchor.

H. **Secondary brake shoe —** Drum brake shoe located toward the rear of the vehicle. Identified only on dual servo brake assemblies, the secondary shoe is forced against the anchor.

I. **Servo action (self-energizing) —** Brake shoes acting with a rotating brake drum to increase the force of brake application.

II. Drum brake components

A. The brake drum

1. The drum provides a friction surface, usually iron, to which the brake shoes are applied. When the shoes and drum come together, they convert the kinetic energy of the moving vehicle into heat, which then dissipates.

2. The brake drum rotates with the wheel. In some brake systems, the drum contains the wheel hub and the wheel bearings.

a. If the drum contains the hub, the drum provides the mounting hardware for the wheel and tire assembly.

b. If the drum and hub are separate, the hub provides the mounting hardware for both the drum and the wheel/tire assembly.

3. The brake drum must be perfectly round and concentric with the spindle or axle. Brake pedal pulsation occurs if the drum is out of round or nonconcentric with the spindle or axle.

4. Deep grooving in the drum friction surface prevents new shoes from conforming to the drum. Because the grooves in the drum surface key into the component that cuts them, grooved drums can be difficult to remove.

B. Brake shoes

1. When the driver depresses the brake pedal, hydraulic pressure from the wheel cylinder forces the shoes against the rotating brake drum, thus producing friction that transforms kinetic energy into heat.

2. Brake shoes are arc-shaped to conform to the brake drum surface.

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3. Brake lining, a layer of special friction materials, is either bonded (glued) or riveted to the brake shoes.

C. Wheel cylinders

1. When the driver applies the brake pedal, hydraulic pressure from the master cylinder moves to the wheel cylinder. In the wheel cylinder, hydraulic pressure causes the cylinder cups to push the pistons outward. The action of the cylinders forces the brake shoes against the drum.

2. When the driver releases the brake pedal, this relieves the hydraulic pressure. The brake shoe return springs then pull the shoes back against their anchor(s) and retract the wheel cylinder pistons.

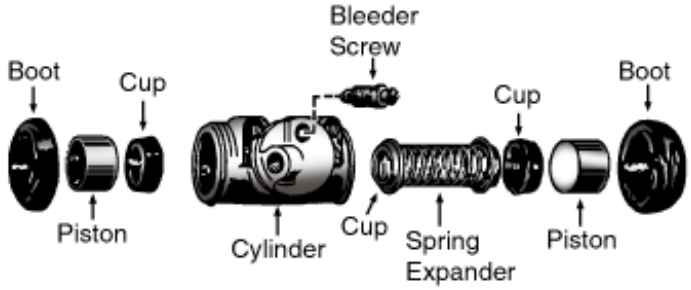
3. Wheel cylinders connect to the master cylinder through a series of steel tubes and special rubber high-pressure hoses.

4. The wheel cylinders are always fastened firmly to the brake backing plate.

   NOTE: The backing plate is a steel disc that firmly connects to the spindle or axle housing. The backing plate is discussed later in this lesson.

5. Each wheel cylinder has a bleeder valve that allows the removal of air from the cylinder.

6. Wheel cylinders may contain either one or two pistons, depending on the type of brake system in which they are used.



D. Anchors

1. A brake anchor is a round piece of steel that either connects to the backing plate or threads into the spindle through a hole in the backing plate.

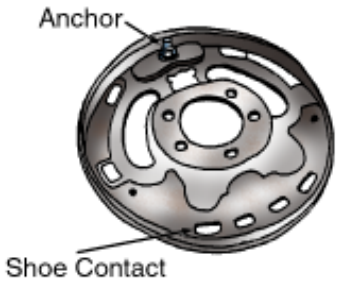
2. Anchors bear all the force that the brake shoe(s) apply to the drum and therefore must be very solid.

3. Most servo systems use one anchor per wheel. Some non-servo systems use two anchors per wheel, one for each shoe.

E. Backing plate

1. The backing plate is a steel disc that firmly connects to the spindle or the axle housing. The backing plate cannot rotate.

2. The backing plate provides a foundation for the drum brake system. The anchor(s) and wheel cylinders, including the brake shoe return springs and some of the adjuster linkages, are fastened to the backing plate. The plate has built-in pads on which the brake shoes can move.



F. Shoe hold-down devices are springs and pins that hold the brake shoes against the backing plate. This allows them to slide outward to the drum when the driver applies the brakes.

G. The brake shoe return springs either return shoes to their rest position or pull the brake shoes away from the drum. In some systems, the return springs help control the automatic adjusters.

H. Brake adjusters

1. Brake adjusters are used to achieve proper brake clearance between the brake lining and drum while the shoes are in the rest position. Maintaining proper clearance is important. Too much resting clearance results in excessive brake pedal travel. Too little resting clearance may cause the brake shoes to overheat.

2. Brake adjusters are categorized into two basic types: automatic and manual.

a. Automatic brake adjusters automatically adjust clearances during normal brake system use.

b. For manual adjusters, the technician must periodically adjust clearances.

III. Operating principles of servo drum brakes

A. How servo drum brakes function

1. The brake pedal connects to the master cylinder, which is located under the hood. When the driver presses the brake pedal, the master cylinder applies hydraulic pressure through a series of lines and hoses to pistons located in the wheel cylinders.

2. With the application of hydraulic pressure, the wheel cylinder pistons force two brake shoes outward against the rotating drum. The drum rotates with the wheel.

3. When the brake shoes contact the rotating drum, the primary shoe forces away from the anchor while the secondary shoe forces into the anchor, causing the secondary shoe to stop. The adjuster is located between the two brake shoes and moves along with them.

4. The force of the rotating drum then presses the primary shoe and adjuster against the secondary shoe (which the anchor stops) with great force. Therefore, the primary shoe applies a great deal of extra pressure to the secondary shoe, which in turn applies the extra pressure to the drum.

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NOTE: The extra pressure that the rotating drum creates by pressing the primary shoe into the secondary shoe results from a servo (self-energizing) action for which the brake system is named.

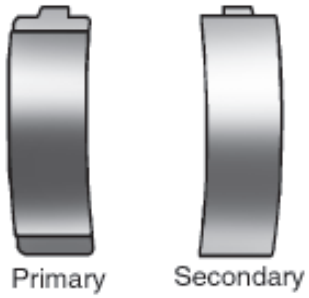
5. When the driver releases the brake pedal, this relieves the hydraulic pressure. The brake shoe return springs retract the pistons and return the brake shoes to their rest position.

B. Important characteristics of servo drum brakes

1. In servo drum brake systems, both brake shoes are applied to the drum regardless of the vehicle's direction.

NOTE: In some non-servo systems, brake shoe application depends on the direction the vehicle is moving.

2. The primary and secondary shoes on servo brakes are different and often cannot be interchanged. The primary shoe, located at the front of the wheel, sometimes has less brake lining than the secondary shoe, which is located at the back of the wheel.



3. In most servo systems, the anchor is located near the top of the backing plate.

   a. When not in use, the brake return springs hold the shoes against the anchor.

   b. When the driver depresses the brake pedal, the primary shoe pulls away from the anchor as it contacts the rotating drum. As described above, the secondary shoe abruptly stops as it attempts to rotate with the drum.

4. In servo brake systems, each wheel cylinder uses two pistons; the cylinder is usually mounted near the top of the backing plate. The wheel cylinder uses pistons to push both of the brake shoes off the anchor and into contact with the drum.

5. Most servo systems use automatic adjuster linkages.

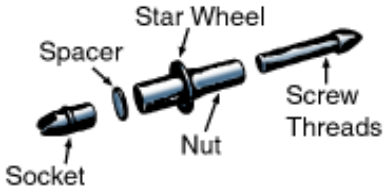
   a. When the driver applies the brakes, movement of the secondary brake shoe activates these adjuster linkages while the vehicle is in reverse.

   b. As the clearance between the shoe and drum increases, the distance that the shoe moves also increases.

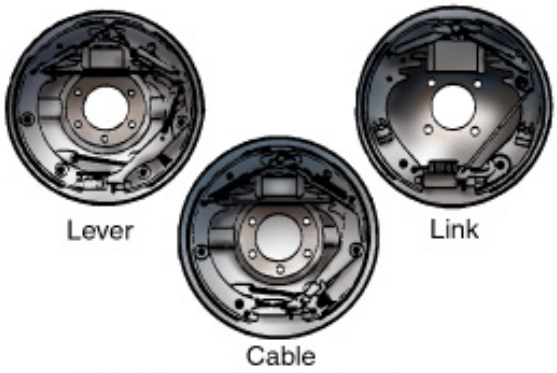
   c. When a predetermined amount of shoe movement occurs, the linkage moves the adjuster's star wheel, thus adjusting the clearance.

NOTE: In servo brakes, the adjuster is a threaded link that bridges the end of the brake shoe located opposite the anchor.

NOTE: Servo brake adjusters can be used only on the side of the vehicle where they were originally installed. They are not interchangeable from one side to the other.



6. The three types of automatic adjuster linkages are lever, cable, and link.



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IV. Operating principles of non-servo drum brakes

A. On non-servo systems, an anchor is located at the end of each shoe. Depending on the system design, these anchors can be located at either the opposite ends or the same ends of each shoe. The brakes function differently according to anchor location.

1. Non-servo systems with anchors located near the bottom of the backing plate

a. In most non-servo systems, the anchors are located together near the bottom of the backing plate. The wheel cylinder bridges the space between the tops of the shoes.

b. When the driver presses the vehicle's brake pedal as the vehicle moves forward, the master cylinder applies hydraulic pressure through a series of lines and hoses to pistons located in the wheel cylinder.

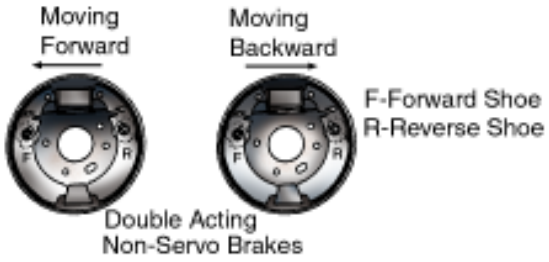
• The cylinders then spread the top of the shoes apart until they both contact the drum.

• Upon contact, the drum's rotation produces hydraulic pressure and energy that force the shoe located at the front of the wheel against its anchor.

• The shoe that is located at the rear of the wheel forces away from its anchor and maintains light pressure against the brake drum.

• In this type of system, the front shoe (the one forced against the anchor) is applied to the drum with the greatest force and therefore provides the greatest stopping power.

• The rear shoe provides only a small amount of stopping power.



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NOTE: Non-servo brake systems are used on most front-wheel-drive vehicles.

NOTE: The above explanation describes non-servo brake action on a vehicle that is moving forward. When the vehicle moves backward, the rear brake shoe forces against the anchor and provides greater stopping power.

c. When the driver releases the brake pedal, this relieves the hydraulic pressure. The brake shoe return springs retract the pistons and return the brake shoes to their rest position.

2. Non-servo systems with one anchor placed opposite the other on the backing plate

a. In the second type of non-servo system, one anchor is placed opposite the other on the backing plate.

• Each shoe is held against its own anchor. In this system there are two single-piston wheel cylinders for each wheel—one cylinder for each shoe.

• Metal tubing hydraulically connects the cylinders. The cylinders therefore act simultaneously, causing both shoes to stop drum rotation regardless of the direction of vehicle travel.

Non-Directional,
Two Cylinder
Non-Servo Brakes

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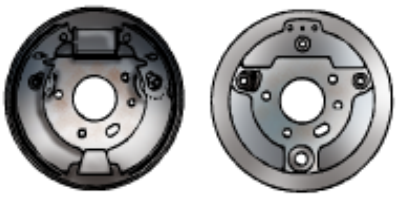
b. When the driver releases the brake pedal, this relieves the hydraulic pressure. The brake shoe return springs retract the pistons and return the brake shoes to their rest position.

B. Important characteristics of non-servo drum brakes

1. Non-servo systems use either single- or double-piston wheel cylinders. Single-piston cylinders are mounted near the end of each brake shoe opposite the anchor. Double-piston cylinders are mounted between the shoes.

2. Some non-servo systems use automatic adjuster linkages. The movement of each shoe or use of the parking brake causes automatic adjusters to adjust the rest position of each shoe. There are three styles of automatic adjusters: lever latch, contact plug, and link crank.

3. In some non-servo systems, the adjusters are located at each shoe and adjust individually. The adjusters must be adjusted manually from time to time.



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