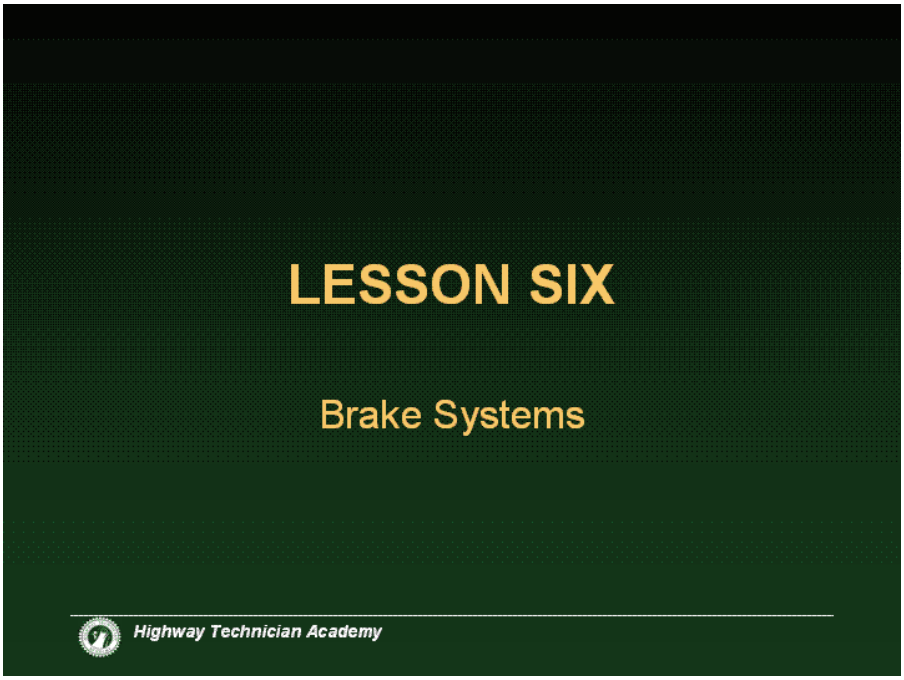
Lesson Six: Brake Systems



A. Brake Types

1. Hydraulic brakes

a. Hydraulic brakes use fluid to activate the brake system

i. The fluid pumped from the master cylinder forces slave cylinders to activate the brakes

b. Hydraulic systems react more quickly than air systems because fluid is already present in the lines

c. There is no emergency system for hydraulic brakes

i. If there is fluid loss, the brakes fail

2. Air brakes

a. Air brakes are the most common type of brake system on ODOT trucks

b. Air systems are slower than hydraulic systems because they have to pump air from the storage tanks to the brakes

c. Air brakes combine three different systems

i. Service

ii. Parking

iii. Emergency

d. The parking and emergency systems use springs to activate the brakes

Figure 6-1 Truck and trailer parking and emergency brake controls

e. During normal operation, the parking and emergency brakes are held back by air pressure

f. If enough air pressure is lost from the storage tanks, the emergency brakes will lock in place and keep the vehicle from moving until sufficient air pressure is built back up

B. Inspection

1. Inspection of the brake system is critical to daily operation

a. Determine whether the brake system is air or hydraulic

b. The inspection procedure as outlined in the pre-trip lesson is as follows:

i. Air brakes

a) Test the air leakage rate – with a fully charged air system (typically 125 psi), turn off the engine

b) Turn the electrical power on

c) Release the service brake and time the pressure drop for one minute

1) The air pressure may not drop more than 2 psi for single vehicles (3 psi for combination vehicles)

d) Apply the foot valve and keep it applied for one minute

1) The air pressure may not drop more than 3 psi for single vehicles (4 psi for combination vehicles)

e) Test the low pressure warning signal – with the engine still off and the electrical system still on, use the foot valve, pump the brakes, and watch the pressure gauge

1) At 60 psi, a visual warning must appear. It may also be accompanied by an audio signal, though the audio is not required.

f) Test to be sure that the spring brakes activate automatically – continue pumping the foot valve to reduce air pressure

1) The "parking brake" knob should pop out when the pressure falls to the manufacturer's specification (usually between 20 and 40 psi)

g) Restart the engine and let the air pressure rebuild

ii. Hydraulic brakes

a) With the engine off and the key off

1) Depress and hold the foot pedal

2) An electric assist motor will be audible when the pedal is held down

b) With the engine running

1) Pump the foot pedal three times and hold the pedal down

2) Wait for five seconds

3) The pedal should not move during the five seconds

c) Check the brake fluid in the master cylinder

1) Be sure to wipe off the cap before removing it

2) The fluid should be clean and at operating level

3) The master cylinder may have two reservoirs

C. Chambers

1. Brake chambers are divided into two sections

a. Service section

b. Emergency section

2. Pancakes

a. The pancake is a diaphragm that sits on top of the springs and holds air in the brake chamber. The air holds the springs in place.

b. If the pancake is not working properly, air escapes from the service portion of the brake chamber

3. Springs

a. Springs are used to push the piston in and out to activate the brakes

b. When there is no air pressure, the springs engage the brakes

c. The spring and piston are in the emergency portion of the brake chamber

D. Damage

1. Avoid brake system damage

a. Never set the parking brake while the vehicle is still rolling. This can cause damage to the springs.

b. Never apply the parking brake while the brakes are hot. This can cause the brake pads to seize to the drums.

c. Never apply the service brakes while the parking brakes are set. The combined force can cause damage to the springs and pancakes.

d. If the pancake or spring is defective, do not disassemble the unit until all necessary precautions have been taken to prevent it from exploding – all work on the brake system ***must*** be performed by the mechanic

i. If accidentally released, the spring is powerful enough to go through a block wall in a building

E. Heat

1. A brake system's worst enemy

a. Heat is caused by friction and is a natural by-product of brake use

b. Tests show that brake drum surface temperatures can exceed 1,000 degrees Fahrenheit after ten minutes of light application. Heat becomes greater as applications increase due to:

i. Speed

ii. Load

iii. Steepness of grade

iv. Time

c. At 400 degrees F

i. Some linings begin to fade and lose their effectiveness

d. At 750 degrees F

i. Bonding resins in the brake lining begin to break down

e. At 800 degrees F

i. Asbestos becomes powder

f. At 960 degrees F

i. Heat spots and "bluing" develop in the drum

g. At 1,350 degrees F

i. The drum begins to grow and loses contact with the brake shoes

h. Remittent brake application is not the answer

i. This can cause depletion of the air system. Brake systems cool more slowly than drivers realize; it takes time for them to cool adequately.

a) In one minute brakes cool from 800 to 700 degrees F

b) In six minutes brakes cool from 800 to 400 degrees F

c) In twenty minutes brakes cool from 800 to 200 degrees F

F. Air Dryer

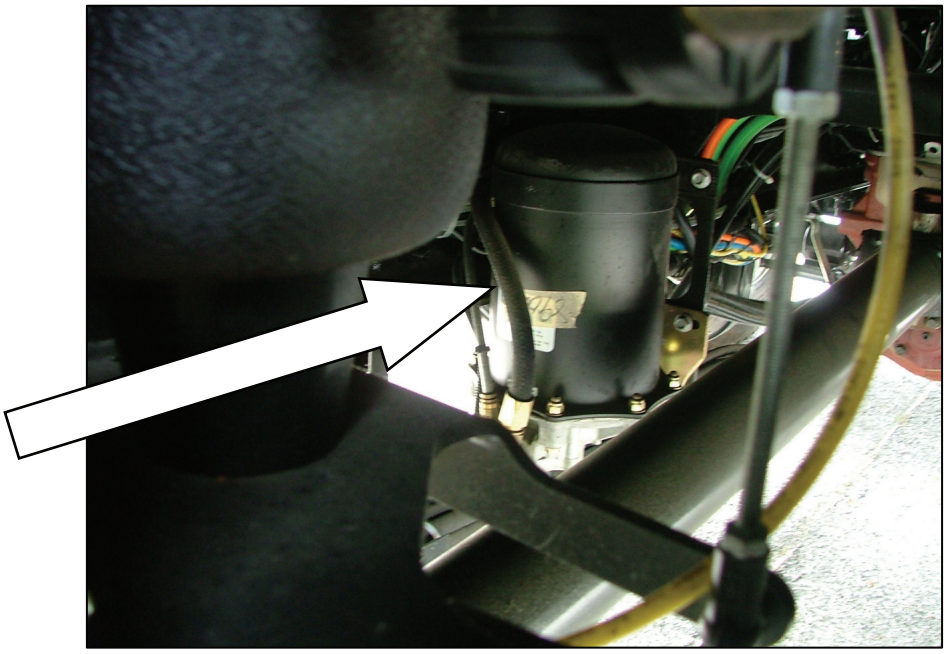


Figure 6-3 Brake system automatic air dryer

1. Functions of the air dryer for the brake system

a. Air dryers remove moisture and oil from the air in the storage tanks

i. Water and oil

a) Products of manufactured air

b) As the compressor pumps air to the storage tanks, small amounts of condensation and oil travel with it

b. Once the air in the storage tanks reaches a pre-set limit, the air blows out through the bottom of the tank

c. If the truck is not equipped with an air dryer, the storage tanks must be drained daily

G. Gauges

1. Air supply pressure gauge

a. Located on the dashboard of the truck

b. There may be more than one, but generally there is just one gauge for each supply tank

c. The gauge shows readings of how much pressure is available in the tanks

d. The gauge shows pressure decreases each time any of the brake controls is used

e. Near the gauges on the dash board is the visual warning device that provides an alert if the pressure in the tanks falls below 60 psi

H. S Cam Brakes

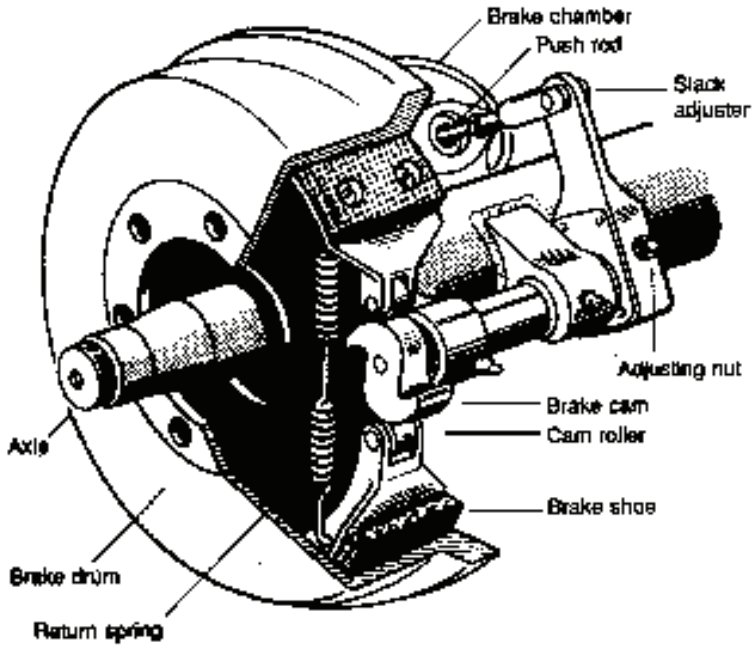


Figure 6-4 Diagram of "S-Cam" brake system

1. Most common style of brake at ODOT

a. Just as the name says, there is an S shaped cam

b. When the brakes are applied and the slack adjuster extends, the S-cam forces the brake pads out to contact with the brake drum causing the truck to slow

c. When the brakes are released, the pressure from the return spring and the action of the S-cam returns the pads to their normal position

I. Maintenance

1. Brake systems are fairly easy to maintain

a. Daily proper pre-trip inspections will help keep brakes maintained

i. Proper adjustment

a) Both the slack adjusters and the pads

ii. Lubrication

a) Any of the parts that require greasing

1) A mechanic must perform adjustments and other maintenance

iii. Cleanliness

a) Keeping brakes free of excess grease, dirt, and debris will keep all of the parts functioning properly

Exercise: Lesson Six Review

1. Modern air brake systems combine three different systems: _____, _____, and _____.

2. The driver must be able to see a warning when the air pressure in the service tank falls below _____.