Why air brakes?

Air brake systems:

- use a much greater force to apply the brakes than hydraulic braking systems do, which is needed to cope with the heavy loads of commercial vehicles
- are more tolerant to small leaks, which in a hydraulic system could result in brake failure (an air brake system includes a compressor to generate more compressed air as needed).
- are capable of stopping heavy commercial vehicles safely.
Basic air brake components

This diagram shows the components that are used to make the simplest possible air brake system:

- A compressor to pump air, with a governor to control the compressor.
- Air lines to allow the pressurized air to flow between the air brake system components.
- A reservoir to store the compressed air.
- A brake pedal (usually called a foot valve) to apply the brakes by directing compressed air from the reservoir to the brakes.
- Foundation brakes, including brake chambers, slack adjusters, brake linings and drums or rotors, to transfer the force generated by the compressed air through a mechanical linkage to apply the brakes.

Air brake chamber components

Diagram of a typical clamp-type air brake chamber.
The diagram on the previous page shows the most common device used to apply truck air brakes — the air brake chamber. It converts the force of compressed air into a strong mechanical force through the pushrod and slack adjuster.

The air brake chamber consists of a flexible diaphragm clamped between two steel housings. The diaphragm construction is similar to a tire sidewall, consisting of a reinforced fabric core with a rubber coating. Other main parts are the pushrod and plate assembly, and a return spring.

**Long stroke and regular stroke brake chambers**

Many new air brake systems are equipped with long stroke brake chambers. As the name implies, a long stroke chamber design has a longer pushrod stroke than the pushrod of a standard brake chamber.

Long stroke brake chambers can be identified by their square-shaped inlet ports and/or trapezoid-shaped name tag on a clamp bolt.

**Air brake chamber — air pressure applied**

This diagram shows how air under pressure is admitted to one side of the diaphragm, causing it to inflate. As it inflates, the diaphragm pushes against the pushrod, plate assembly and the return spring, causing them to move. Note the position of the slack adjuster — it’s now at about a 90-degree angle to the pushrod.

The amount of pushrod force is governed by the air pressure (in pounds per square inch) and the effective surface area of the diaphragm (in square inches). The pushrod force is exerted against the brake mechanism, causing the brakes to apply.

The most common size air chamber used on truck drive axles and trailer axles is a regular Type 30 clamp type chamber with 30 square inches of effective diaphragm area.

Air chambers are very powerful. The common Type 30 regular chamber shown in the diagram above if applied with air pressure of 100 p.s.i. (690 kPa) develops a pushrod force of 3,000 pounds.
Air chambers are made in a number of sizes, ranging from Type 9 (with nine square inches of effective diaphragm area) to Type 36 (with 36 square inches of effective diaphragm area). The range of sizes allows the truck engineer to match air chamber force with axle capacity so that no axle is under- or over-braked.

Even though truck air brake system pressures are 100 p.s.i. (690 kPa) and above, much lower air application pressure, usually less than 20 p.s.i. (138 kPa), is used to make normal stops.

**Foundation brakes: s-cam type**

The brake assembly at each wheel is generally called the **foundation brake**. The assembly consists of the brake parts around the wheel that are operated by the air brake system, including the brake chamber. The most popular type of foundation brake is the s-cam drum brake.

This diagram shows the main components used in the s-cam drum foundation brake. The air brake chamber pushrod is connected to a lever arm called a **slack adjuster**. The slack adjuster is attached to a camshaft with an s-shaped head called an **s-cam**. Air pressure applied to the chamber causes the pushrod to move forward, causing the slack adjuster to rotate the s-cam. This causes the **brake linings** to press against the **brake drum**, causing friction, which causes the wheel to decelerate, stopping the vehicle.

The slack adjuster is also the way to adjust the brakes to compensate for brake lining and brake drum wear. Brake adjustment is important and is covered in **chapter 9, air brake adjustment**.

Brake shoe **return springs** keep the brake linings away from the drum when the air pressure is released from the air chamber.