A typical low-air warning device is a warning light on the dashboard. There may also be a buzzer.

Some older vehicles are equipped with a low-air warning device near the top of the windshield that drops into the driver’s view when air pressure drops below approximately 60 p.s.i. This type of warning device is known as a wig-wag.

Some wig-wags automatically retract when air pressure rises above the warning level of 60 p.s.i.; others need to be manually pushed up to the “out of view” position after the air pressure has risen above the warning level.

When a low-air warning device activates, stop the vehicle and find the cause of the air loss. The air pressure remaining in the system (approximately 60 p.s.i.) will be enough to stop the vehicle if you act promptly.

Quick release valve

In the previous diagram, when the driver released the brakes, all the air contained in the air lines and in the air chambers was vented through the foot valve exhaust port. Because of the distance that the exhaust air has to travel, there can be a considerable lag time for the brakes to release.

This is where the quick release valve comes in.

A quick release valve allows the brakes to release quickly and fully, by allowing the pressurized air to exhaust near the brake chambers. In this diagram a quick release valve is placed close to the front brake chambers between the foot valve and the air chambers.

When the brakes are applied, air from the foot valve flows through the quick release valve to the chambers in the normal way.
When the driver releases the foot valve, only the air in the line between the foot valve and the quick release valve is vented at the foot valve exhaust port. The larger volume of air contained in the air chambers is vented at the exhaust port of the quick release valve.

Note the difference in the air bursts at the foot valve and at the quick release valve — there’s a much bigger burst of exhausting air at the quick release valve.

Quick release valves may be found in a number of places in an air brake system, including front brakes, rear brakes, spring parking brakes and any other place that the rapid exhausting of air is required.

### Relay valve

A relay valve has been installed between the reservoir and the rear brake chambers.

Relay valves are used to reduce the lag time when the brakes are applied, and when they’re released. They’re remote-controlled air valves that respond to a control signal from the foot valve. They’re usually mounted on a frame rail close to the air chambers that they’re to operate.

Relay valves are supplied with air directly from the primary or secondary reservoirs through a large diameter air line (shown as the supply line in the diagram) so that there’s a high volume of air available for rapid delivery to the air chambers.

The pressure of the reservoir air delivered in this way will be the same as the control pressure delivered by the foot valve. If you make a 20 p.s.i. (138 kPa) brake application, approximately 20 p.s.i. of air pressure would be directed to the rear brake chambers through the relay valve.

When the driver releases the foot valve, only the air in the control line is vented at the foot valve exhaust port. The volume of air contained in the air chambers is vented through an exhaust port built into the relay valve.

Relay valves are designed to handle the volume requirements of two or four air chambers. They’re primarily found on rear axle brakes, but relay valves are sometimes found on steering axle brakes or wherever there’s a need to apply and release air rapidly.
For simplicity, quick release valves and relay valves are not shown in the following diagrams because they don’t change the basic concept of an air brake system, but serve only to speed up the release of the brakes, if needed.

**Dual system with primary system failure**

This diagram shows the worst-case failure where a line rupture has caused a total loss of pressure in the primary reservoir.

Air pressure in the secondary reservoir has been protected by the one-way check valve. The low-air warning system must activate when pressure in any reservoir falls below 60 p.s.i. (414 kPa) to alert the driver to the problem. In many systems, the warning will come on at pressure above 60 p.s.i.

When you apply the brakes, you’ll be able to make a controlled stop, but only the steering axle brakes will apply. Stopping distances will be longer because the braking force will be reduced.

If the failure had been in the secondary system, braking on the rear axle would’ve been maintained, but the steering axle brakes would not operate.

The compressor will continue to pump air, but all of its output will take the path of least resistance and be vented at the line rupture.

If the low-air warning system activates at any time, **stop immediately** and don’t proceed until a repair has been made.

**Parking brakes**

While air pressure does an excellent job in helping stop a vehicle by applying the foundation brakes, it’s totally unreliable (and illegal) for parking. If you park a vehicle using only the air brakes, any leaks in the system, or any failure in a hose, diaphragm, or air valve would result in loss of air pressure and a possible rollaway collision.

Regulations for parking brakes require that the parking force must be maintained by mechanical means and be unaffected by loss of air pressure.
The most common type of parking brake in an air brake system is the spring parking brake. The second type is known as a safety actuator and is usually found only on some highway coaches and intercity buses.

## Spring parking brakes

Most spring parking brakes consist of an additional chamber attached to the rear of a service brake chamber. The added chamber contains a powerful coil spring arranged so that the spring force can be applied to the brakes through the normal service chamber pushrod.

This diagram shows the main components of a typical combination spring and service brake chamber.

Spring parking brakes are mounted on the rear axles only — not on steering axles. The service brake chamber contains the normal pushrod, diaphragm and return spring. The spring parking brake section is mounted behind the service brake chamber.
The spring parking brake chamber contains a second diaphragm, a large coil spring, and an intermediate pushrod that transmits the force of the coil spring to the service brake pushrod when the spring parking brake is applied. The coil spring in most spring parking brake chambers can exert a force of between 1,500 and 2,000 pounds.

When you make a regular foot brake application, air pressure is applied against the diaphragm in a service brake chamber, causing the diaphragm to inflate, pushing the pushrod out against the slack adjuster to apply the foundation brakes.

Spring parking brakes work in the opposite way. These brakes are applied and remain applied by mechanical spring pressure, not by air pressure. If air pressure falls beneath the amount needed to keep the spring compressed, the spring pushes against the pushrod in the service brake chamber, pushing the pushrod out against the slack adjuster to apply the foundation brakes (because the parking brake chambers are piggy-backed onto the service brake chambers and operate the foundation brakes through the same linkage).

Spring parking brake assemblies should only be serviced by qualified personnel. The spring in a spring parking brake chamber is under extreme pressure and could cause serious injury.

### Applying and releasing spring parking brakes

There are several ways to apply and release spring brakes.

- Normally they’re applied and released by using the parking brake control valve on the dashboard.
- If the air pressure in the system falls below approximately 60 p.s.i., the spring brakes may begin to drag, and at 20 to 45 p.s.i. (138 to 310 kPa) may automatically fully apply.

### Spring parking brake — released

Air pressure in the spring parking brake chamber keeps the spring parking brake off. There’s no air pressure in the service brake chamber.

This diagram shows a spring parking brake chamber in the released position. The service brake is also in the released position.

Air at reservoir pressure has been supplied to the spring parking brake section. The parking brake diaphragm has inflated, compressing the main spring. The spring parking brakes are now released.
A **parking brake control valve** (usually a yellow button) is mounted on the dashboard. In most cases, pushing this valve in allows air pressure to flow to the spring parking brake chambers, causing these spring parking brakes to release. Pulling this valve out exhausts the air pressure against the spring parking brake chamber, causing these brakes to apply. Instructions are usually imprinted on the button.

While the push-pull parking brake control is the most common, some systems use a switch, usually set so that flipping it in one direction applies the spring parking brakes and flipping it in the other direction releases them.

A parking brake control valve.

**Spring parking brake — service brake applied**

The driver has applied the foot valve, delivering air to the service brake port, inflating the service brake diaphragm.
The driver has placed the parking brake control valve in the “park” position. This has caused the air from the spring parking brake section to be exhausted.

The force of the coil spring has been transmitted to the intermediate pushrod, which in turn has pushed against the service brake diaphragm, pushrod, and slack adjuster, applying the brakes.

**Driver alert — compounding of brakes**

Always be sure that the spring parking brakes are released before making heavy service brake applications, like during a pre-trip inspection.

When spring parking brakes are applied, there’s up to 2,000 lbs of force applied to all of the brake components. If a heavy service brake application is made, the force of the air application is added to the spring force. This could add a further 3,000 lbs for a total of 5,000 lbs. This adding together of the two forces, known as **compounding**, can damage slack adjusters, s-cams, brake chamber mounting bolts, brake shoe rollers, shoes and brake drums.

Note that lighter brake applications of less than 30 to 40 p.s.i. (207 to 276 kPa), to prevent a vehicle from rolling while the spring parking brakes are being released or applied, aren’t harmful.

**Spring parking brake — manual release**

Most spring parking brake chambers have a means of manually releasing (or “caging”) an applied spring parking brake. This feature should only be used by mechanics when making a repair.

If all air’s lost and the vehicle has to be towed, spring parking brakes can be released by caging them. Always block the wheels when caging spring parking brakes. Once a spring brake chamber is caged, there’ll be no parking brake force at that wheel.
Some chambers have a built-in release bolt while others have a release bolt, nut and washer carried in a bracket mounted on the chamber housing.

This diagram shows how one type of release bolt is inserted into the rear of the spring parking brake housing. The release bolt is then given a quarter turn to lock it in place. Then the release nut is turned until the spring is compressed.

Instructions for manual release are usually imprinted on the housing of most spring parking brake chambers.

Before trying to manually release spring parking brakes, block the wheels to prevent the vehicle from rolling. To move a vehicle after manually releasing the spring parking brakes call a tow truck.

**Spring parking brakes in dual air brake systems**

This installation takes advantage of the primary and secondary reservoirs to supply the parking brake dash control with air from the tank that has the highest pressure.

**Driving tip**

Caging spring parking brakes should be done only in an emergency.

Once a spring brake chamber is caged, there’ll be no parking brake force at that wheel.

**Fast fact**

The effectiveness of spring parking brakes depends on how well the brakes have been kept in adjustment.