



Section 3

How the Basic
System Works

Basic Air Brake System

Air is pumped by the compressor (1) to the wet reservoir (5), which is protected from over pressurization by a safety valve (4). The governor (2) controls the pressure in the reservoir to the bottom of the foot valve (31). The driver pushes the foot valve treadle down and air pressure flows to the front and rear brake chambers (32 & 11). The brake chamber push rods move the slack adjusters. The slack adjusters rotate the S-cams, forcing the brake shoes against the drums. This causes friction that stops the wheels. The driver releases the foot valve treadle and the air in the brake chambers is allowed to exhaust through the foot valve, releasing the brakes.

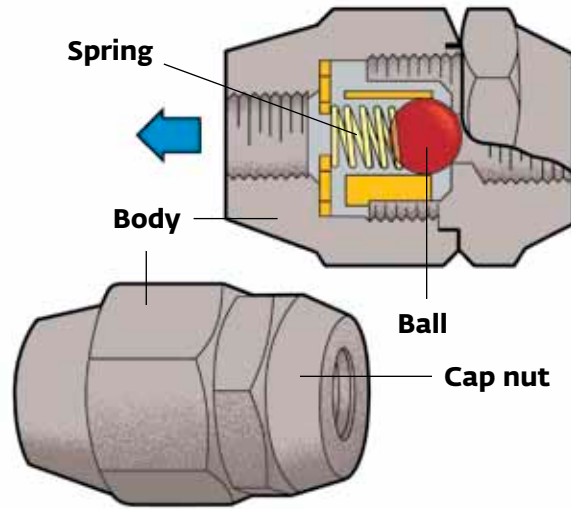
The following explains the additional components of a basic air brake system. Other valves which are necessary to ensure smooth and efficient operations are not included in this simple drawing. They will be discussed later in the manual.

Note: An air dryer (3) has been added to reduce the amount of moisture in the system.

One-Way Check Valve

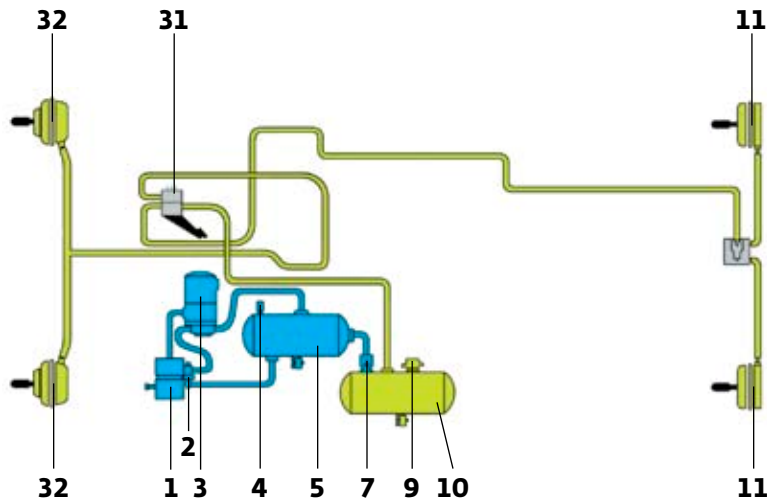
In the diagram below, two reservoirs are shown (5)(10). To prevent air from flowing backwards in the system toward the compressor, a one-way check valve (7) is installed between the reservoirs. This valve allows the air to flow in one direction only. The valve is spring loaded.

One-Way Check Valve



Pressure at the inlet side overcomes the spring pressure and lifts the check valve ball, or disc, off its seat. Air passes through the valve to the outlet. When pressure at the outlet becomes greater than at the inlet—together with the spring pressure—the check device seats, preventing air from flowing back through the valve.

Basic Air Brake System



Air Pressure Gauge

Vehicles with an air brake system are equipped with a reservoir air pressure gauge (29). This gauge is mounted in the cab, usually on the dashboard and indicates the air pressure in the primary and secondary or dry reservoirs. The supply or wet reservoir does not usually have an air pressure gauge. Common operating pressures are 80 to 135 psi, depending on the system. Monitoring the gauge will alert the driver to any unusual changes in air pressure.



Brake Application Gauge

An additional gauge can be installed on the dash to indicate the application air pressure when the brakes are applied. This gauge can be piped to indicate the pressure of either a foot or hand application. (Hand application will be explained later in the manual.)



Low Pressure Warning Device

All vehicles equipped with an air brake system must have a device to warn the driver if the air pressure in the system drops to a dangerous level. This device could be a red warning light, a buzzer or a wig-wag. Due to overuse or leaks, the low pressure indicator switch (9) will turn on a red warning light on the dash or cause a buzzer to sound at or before 60 psi. Some vehicles are equipped with both a light and a buzzer to warn the driver of a low air pressure condition.

Wig-wags are not found in modern vehicles having been replaced with a red warning light and buzzer. They may still be in use on older vehicles. There are two types of wig-wag low pressure warning devices that may be used. Both types will drop into the driver's view should the system pressure drop to 60 psi. The automatic warning device will rise out of the driver's view when the pressure in the system rises above 60 psi. The manual reset type must be placed in the "out of view" position manually and will not stay in place until the pressure in the system goes above 60 psi.

Whichever warning system is used, buzzer-lights or wig-wag, the driver must stop the vehicle in a safe place immediately and find the cause of the air loss. The air pressure remaining in the system (approximately 60 psi) is enough for a brake application if the driver acts promptly.

Keep in mind if the vehicle has spring parking brakes, at 60 psi the spring parking brakes are partially applied and you cannot release them until air pressure increases. If you do not move your vehicle to a safe place you may find yourself stranded in the traveled portion of the highway.

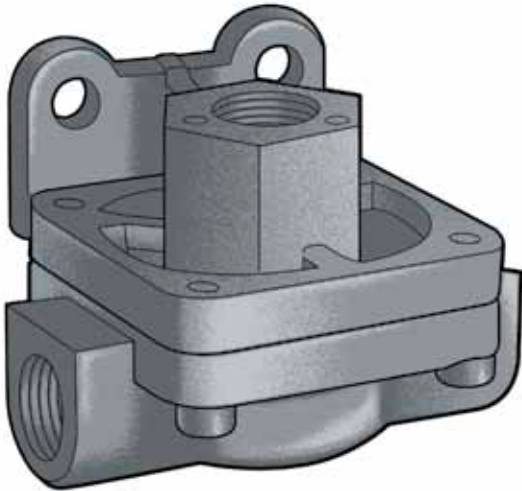
Stop Light Switch

Any driver following your vehicle must be warned when reducing speed or stopping the vehicle. The stop light switch (25) is an air-operated electric switch that turns on the brake lights at the rear of the vehicle when a brake application is being made.

Quick Release Valve

The application of the brakes in the basic system was described earlier. In a basic system, when the driver releases the foot valve, it would be necessary for the air under pressure in the brake chambers to return to the foot valve to release the brakes. This releasing action would be slowed in long wheel base vehicles because of the longer lines between the foot valve and the rear brake chambers. A quick release valve (33) is installed to allow the brakes to release quickly and fully by discharging the application air near the brake chambers. To allow the brakes to release quickly and fully by discharging the application air near the brake chambers.

Quick Release Valve

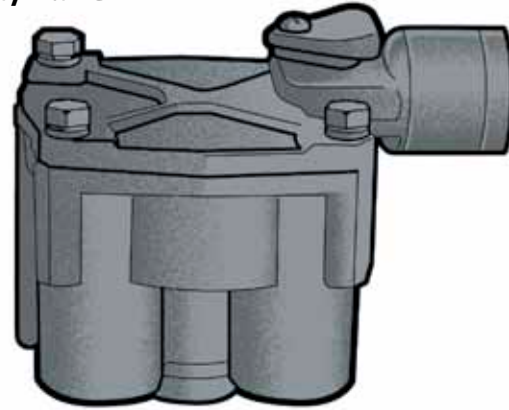


Relay Valve

The foot valve is usually located closer to the front wheels than to the rear wheels. The longer the distance from the foot valve to the rear chambers, the more time it will take before the rear brakes apply. This is known as brake lag. To correct this condition on a long wheel base vehicle, a relay valve (13) is installed near the rear brake chambers. A larger diameter pipe is connected between the main reservoir and the relay valve. The air line from the foot valve to the relay valve now becomes a “control line”. (The air in the control line “dead ends” at the relay valve.) When the foot valve is depressed, the air pressure in the control line acts on the top section of the relay valve, relaying reservoir air directly to the rear brake chambers through the larger diameter pipe. The pressure of the reservoir air delivered in this way will be the same as the control pressure delivered by the foot valve.

Releasing the foot valve exhausts the control air to the relay valve, allowing it to cut off the flow of reservoir air to the rear chambers. This in turn exhausts the air in the brake chambers by the quick release feature of the relay valve.

Relay Valve

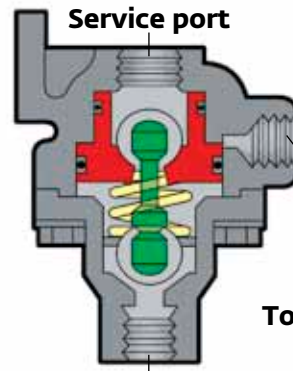


Manual Front Brake Limiting Valve

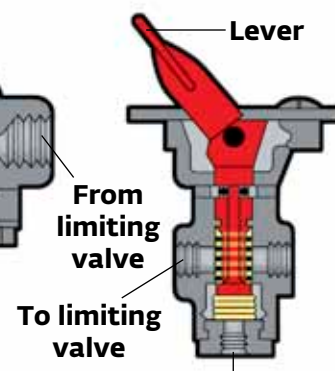
For better steering control when braking on a slippery road surface, it can be an advantage to reduce the braking effort to the front wheels. This can be accomplished by installing a control valve (35) in the cab, and a front brake limiting valve (36) on the front axle.

The control valve is set in the “normal” position for dry road surfaces and the front braking application air pressure is normal. On a slippery road surface, the control valve (35) is set to the “slippery road” position. In this position, the control valve will cause the limiting valve (36) to operate. Applying air pressure to the front brakes is then reduced to 50 percent of the application air pressure being delivered to the rear brake chambers.

Manual Front Brake Limiting Valve



Dash Mounted Control Valve

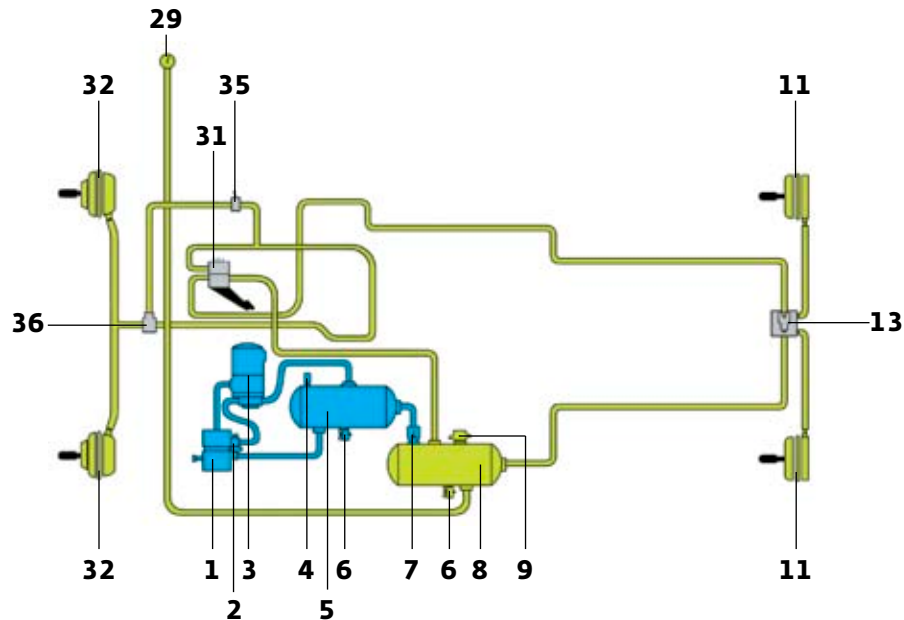


Exhaust port

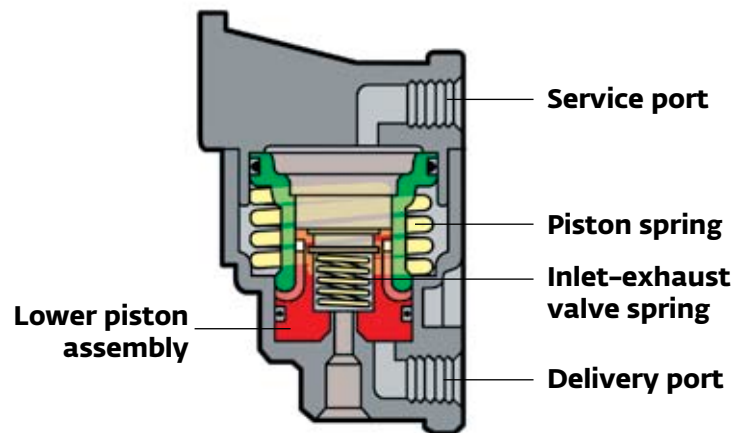
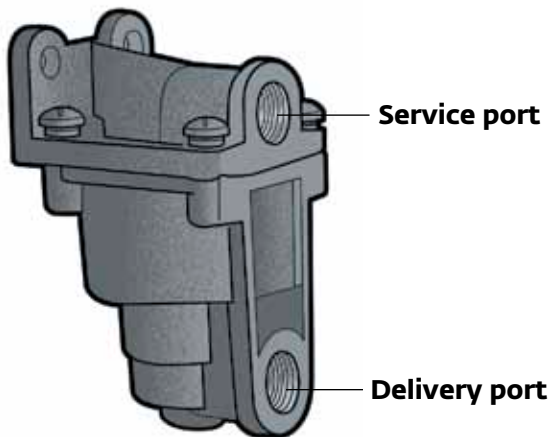
Service port

Delivery ports not shown

Basic Air Brake System with Manual Front Brake Limiting Valve



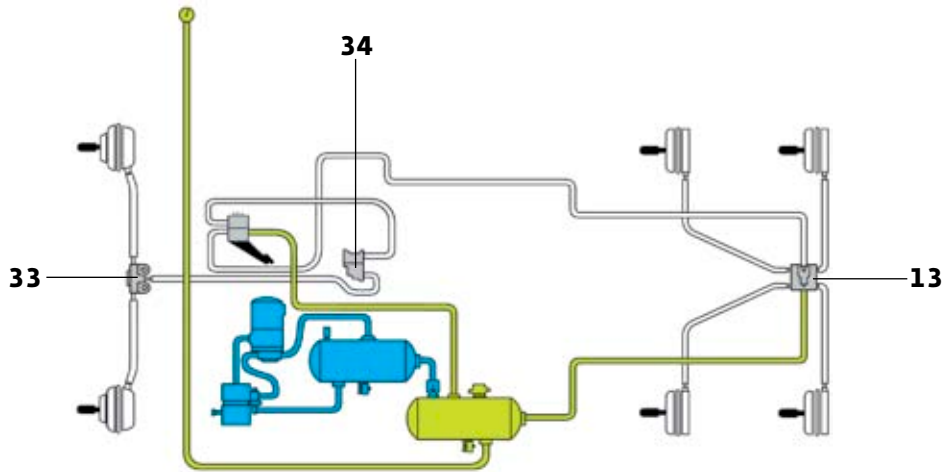
Automatic Front Brake Limiting Valve



Some systems are equipped with an automatic limiting valve (34). This valve will hold off brake application to the front wheels from 0 to 10 psi, depending on how it has been preset. Between the preset pressure and 40 psi of brake application, the reduction is

approximately 50 per cent. Brake applications between 40 psi and 60 psi are reduced by less than 50 per cent. Brake applications more than 60 psi are not reduced and full application is directed to the front wheels.

Tandem Rear Axles



The air brake system discussed previously is for a vehicle with a single rear axle. The diagram illustrates an air brake system for a vehicle equipped with an automatic front brake limiting valve (34), a quick release valve (33) and a tandem set of rear axles. Both axles of the tandem set are equipped with brakes.

A relay valve (13) has two uses: to provide a quicker application of air pressure to the tandem rear axle brakes when a brake application is made, and to release the brakes quicker when a brake application is released.

Section Summary Questions

1. How can the driver tell how much air pressure is in the main reservoirs?
2. What must the driver do when a low pressure warning system activates?
3. What is the purpose of a quick release valve?
4. What is the purpose of a relay valve?
5. What is the purpose of using a larger diameter pipe between the reservoir and the relay valve?
6. If the front brake limiting valve is in the “slippery road” position, and the foot valve is depressed to make a brake application of 30 psi, how much pressure will be applied in the front brake chambers?
7. How is the reservoir protected from over pressurization?
8. What stops pressurized air from flowing from the dry reservoir back into the compressor?
9. At what pressure should the low pressure warning device activate?
10. How is “brake lag” to the rear wheels minimized?
11. When should a driver use the front brake limiting valve?