Check the air dryer operation by periodically looking for water in the reservoirs. More than a few drops may indicate that the air dryer or compressor needs servicing.

**Alcohol evaporators and alcohol injectors**

**Alcohol evaporators** and **alcohol injectors** are optional devices that introduce a small amount of alcohol vapour into the air system. The alcohol vapour combines with any moisture that may be present. In effect, the alcohol acts as an anti-freeze, lowering the freezing point of any moisture that’s collected in the air system.

Alcohol evaporators are connected to the inlet side of the compressor so that alcohol vapour is drawn in and compressed along with the intake air, which is then carried throughout the system.

Alcohol injectors are installed in the compressor discharge line between the compressor and the supply reservoir. The discharge air passes through a venturi (a tube with a narrow section, which causes air flowing through the tube to create a vacuum), picking up alcohol vapour and carrying it throughout the system.

The alcohol reservoir should be kept topped up with methyl hydrate during the winter months. It’s a good practice to begin before the first freeze of the season to ensure trouble-free operation.

These systems are designed to use pure methyl hydrate to provide the alcohol. Be sure to use only methyl hydrate specifically formulated for use in alcohol evaporators or alcohol injectors.

**Automatic drain valves**

Automatic drain valves (sometimes called “spitter valves”) are optional devices installed on some or all of the reservoirs on some air brake systems. They intermittently expel any contamination that’s collected.

Most are self-contained and open briefly each time reservoir pressure lowers two or three p.s.i. (13.8 or 20.7 kPa), but some are connected to the compressor governor and open briefly each time that the compressor cycles.

Some automatic drain valves are equipped with an electric heating element to prevent freezing in cold weather.
The manual drains should be opened periodically to check for the presence of water in reservoirs.

If you find contaminants or more than a few drops of water, the compressor or air dryer may need servicing, or the automatic drain valve may not be functioning correctly.

**Front wheel limiting systems**

Some vehicles may have an optional system to reduce the possibility of steering axle brake lockup and loss of steering control on slippery surfaces. There are two types of front wheel limiting systems:

- automatic front wheel limiting systems
- manual front wheel limiting systems.

**Automatic front wheel limiting systems**

This consists of a limiting valve, sometimes called a ratio valve, mounted near the steering axle. There’s no dashboard control.

At very low application pressures, no air pressure is delivered to the steering axle brakes. As application pressure exceeds the holdback point (five to 15 p.s.i. — 34.5 to 103 kPa), limited application pressure is delivered to the steering axle brakes. At brake application pressures below 40 p.s.i. (276 kPa), the steering axle brake pressure is approximately 50 per cent of drive axle pressure.

At application pressures above 40 p.s.i., the percentage gradually rises, until it reaches an application pressure that may be used during an emergency stop (60 to 70 p.s.i. — 414 to 483 kPa) and steering axle and drive axle brakes receive equal pressure. A built-in quick release function helps to speed up the release of the steering axle brakes.

**Manual front wheel limiting systems**

These are no longer installed on new vehicles. This type of system consists of a limiting quick-release valve mounted near the steering axle brakes, and a dash mounted control valve. The control valve may be a “flip” type switch, as shown, or a push-pull type.

With the control valve in the “dry” position, the steering axle brakes are applied with the same pressure as the drive axle brakes.

The “slippery” position limits the application pressure to the steering axle brakes to 50 per cent of drive axle brake application.

Commercial vehicle safety standards allow reduced braking on steering axle brakes only when weather and road surface conditions make such operation essential to safety. Tests have shown that front wheel skids aren’t as dangerous as the drive axles locking up.

The limiting quick release valve also acts as a normal quick-release valve, helping to speed up the release of the steering axle brakes.
**Spring parking brake emergency release system**

This system provides a special emergency release tank that can be used to release spring parking brakes if a disabled vehicle needs to be moved to a safe parking area and its main reservoir pressure is lost.

A second dashboard control valve is added so that air from the emergency release tank can be directed to the spring parking brakes to release them. This control valve is usually a “dead man” type that must be held in place while the vehicle is being moved. Once the vehicle has been moved, the spring parking brakes are re-applied by releasing hand pressure from the control.

Instructions for operating the emergency release system are usually found on the control valve or on a decal on the dashboard.

The popularity of this system was reduced with the introduction of the dual air system, but it’s still sometimes used on transit buses, school buses and fire trucks.

**Pressure-protection valves**

Pressure-protection valves are often installed between the service brake reservoirs and any non-essential air-operated accessories such as air seats, air horns, air windshield wipers, air suspensions, fifth wheel sliders and air shifts. Some air brake systems integrate the air dryer with the supply reservoir — these also use pressure-protection valves.

They’re designed to cut off the air supply to these systems if a failed accessory causes the service reservoir pressure to drop below a preset pressure, ensuring that sufficient pressure is maintained in the service system so that a safe stop can be made.

Shutoff pressures vary between 60 and 90 p.s.i. (414 and 620 kPa), depending on the manufacturer’s specifications.

**Application pressure gauges**

Some trucks and tractors are equipped with one or more optional gauges that indicate the actual pressure being delivered to the service brakes.

There may be a single gauge or separate gauges for tractor and trailer brake application.

Tractors may have a single gauge that indicates application pressure if either the foot valve or trailer hand control valve is applied.

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**fast fact**

Spring parking brake emergency release systems are sometimes called “California spring parking brake systems.”
Anti-lock braking systems

Anti-lock braking systems (ABS) are typically made up of three main sections: speed sensing, decision-making, and brake releasing or modulation.

In this diagram, vehicle speed is sensed by magnetic pickups mounted in close proximity to toothed wheels that are attached to some or all of the wheel hubs. As the wheels rotate, a pulsating electrical current is generated.

This pulsating current is monitored by a simple computer called an electronic control unit (ECU). The ECU is powered by the vehicle electrical system. During normal brake application, if the ECU detects a sudden change in the pulsating current, the ABS system will activate.

If the brakes are applied too hard for road conditions, and a wheel lockup occurs, the rate of the pulsating current will rapidly decrease. The ECU, sensing the sudden drop in wheel speed, will signal electrically controlled solenoid air valves to release air pressure from the brake chambers at the affected wheels. The solenoid valves are frequently called modulators.

As the brakes begin to release, the wheels will regain traction, the pulsating current will be restored, and the ECU will allow the brakes to re-apply. If the lockup re-occurs, the apply-and-release cycle will repeat as often as necessary. Most systems are capable of cycling the brakes up to five times per second.

To achieve the shortest possible stopping distance on extremely slippery surfaces, you simply have to apply and maintain firm continuous pressure on the brake pedal. You need to apply the brake pedal in order to allow the ABS system work to stop the vehicle from skidding. The ABS system will rapidly apply and release the brakes as often as necessary. There may be some noise and vibration. ABS prevents the axle brakes from locking up allowing the driver to retain complete steering control.
The ABS lights for the tractor and trailer brakes should be on when you first start the tractor.

**driving tip**

When coupling to a trailer, always check to see if it’s equipped with ABS. Stopping in an emergency with a combination unit — where the tractor and all trailers are ABS-equipped — is quite different than stopping a combination where all the units do not have ABS.

Trucks and tractors are equipped with a dash mounted failure warning lamp that monitors the ABS system. When the ignition switch is first turned on, the ABS system performs a self-checking sequence. Depending on the system, the dash lamp may light, flash briefly, then stay lit until vehicle speed reaches 7–11 km/h, or light briefly then turn off.

If the lamp doesn’t go out, or comes on during vehicle operation, it’s signalling that there’s been a failure in the ABS system. Normal braking is still operational, only the anti-lock feature is disabled. The vehicle may be driven to a service depot for repairs.

**Trailer ABS air brake systems**

Trailer ABS systems use similar components as those on trucks and tractors. The ECU may be powered from the stop lamp circuit, or may have a dedicated power source through the electrical connector.

Trailers with ABS air brakes will also have an indicator visible in the tractor’s mirror to indicate if the system’s not functioning properly. This warning light may be mounted on the front left side of the trailer or on the rear left side of the trailer.

On some air brake systems, there may be a trailer ABS warning indicator on the dashboard of the tractor.
Review questions

1. Why are air brakes, rather than hydraulic brakes, used on heavy commercial vehicles?
2. What are the five components of a simple air brake system?
3. What prevents total loss of air pressure in the service brake system in the event of an air line rupture between the compressor and the supply reservoir?
4. How can you tell how much air pressure is in the main reservoirs?
5. What must you do if the low pressure warning indicator activates?
6. What’s one advantage of a dual air brake system?
7. In a dual air brake system, if an air line in the secondary braking system ruptures, how would you know? What would happen if you then made a brake application?
8. How does a spring parking brake work?
9. What are the two ways that the spring in a spring parking brake chamber can be held in the released position?
10. Why should you avoid compounding the brakes?
11. Why are spring parking brakes a reliable type of parking brake?
12. What’s the purpose of the tractor protection system on a tractor?
13. If a driver makes a 20-pound (138 kPa) brake application with the hand valve, what’s the application pressure at the tractor brakes?
14. What would happen if the control line to the trailer becomes disconnected while you’re driving the tractor-trailer combination?
15. How does a wedge brake work?
16. How does an air-over-hydraulic braking system work?
17. Where would an air dryer be installed in an air brake system?
18. If you make a full brake application during an emergency stop with an automatic front wheel limiting system, how much air pressure is directed to the front brakes?
driving commercial vehicles