Most residual check valves are located under the tubing seats in the master cylinder outlet ports.

The momentary drop in pressure created when the brakes are released can draw air into the hydraulic system.
The use of cup expanders is the main reason why residual check valves are not used in most braking systems today.

A red brake warning lamp.

A leak in the hydraulic system causes unequal pressures between the two different brake circuits. This difference in pressure causes the spring inside the pressure-differential switch to move, which completes the electrical ground circuit for the red brake warning lamp.
Figure 95-6  The pressure-differential switch piston is used to provide the electrical ground for the red brake warning light circuit.

Figure 95-7  A movable contact brake fluid level switch. When the brake fluid level and float drop, the rod-mounted contact completes the electrical circuit which turns on the red brake warning lamp.

Figure 95-8  A magnetic brake fluid level switch.
Figure 95-9  Many proportioning valves are mounted directly to the master cylinder in the outlet to the rear brakes.

Figure 95-10  Typical proportioning valve pressure relationship. Note that, at low pressures, the pressure is the same to the rear brakes as is applied to the front brakes. After the split point, only a percentage (called the slope) of the master cylinder pressure is applied to the rear brakes.

Figure 95-11  A Chrysler proportioning valve. Note that slope and split point are stamped on the housing.
These two proportioning valves are found under the vehicle on this Dodge minivan.

The proportioning valve piston can travel within the range shown without reducing pressure to the rear brakes.

At the split point, the proportioning valve piston closes the fluid passage through the valve.
TECH TIP: Always Inspect Both Front and Rear Brakes

If a vehicle tends to lock up the rear brakes during a stop, many technicians may try to repair the problem by replacing the proportioning valve or servicing the rear brakes. Proportioning valves are simple spring-loaded devices that are usually trouble free. If the rear brakes seem to be locking up, check the fluid level in the master cylinder and look for signs of insufficient brake fluid. Leaking fluid can cause the rear brakes to grab. Do not stop there — always inspect the rear brakes looking for contaminated linings or other problems that can cause the rear brakes to grab. Do not stop there — always inspect the rear brakes looking for contaminated linings or other problems that can cause the rear brakes to grab. Do not stop there — always inspect the rear brakes looking for contaminated linings or other problems that can cause the rear brakes to grab. Do not stop there — always inspect the rear brakes looking for contaminated linings or other problems that can cause the rear brakes to grab. Do not stop there — always inspect the rear brakes looking for contaminated linings or other problems that can cause the rear brakes to grab. Do not stop there — always inspect the rear brakes looking for contaminated linings or other problems that can cause the rear brakes to grab. Do not stop there — always inspect the rear brakes looking for contaminated linings or other problems that can cause the rear brakes to grab. Do not stop there — always inspect the rear brakes looking for contaminated linings or other problems that can cause the rear brakes to grab.

If the rear brakes are rusted or corroded, they cannot operate efficiently and greater force must be exerted by the driver to stop the engine. If the rear-proportioning valve is functioning properly, the higher brake pedal pressure by the driver could easily cause the rear brakes to lock up. An locked wheel has less traction with the road than a rolling wheel. A result, if one rear wheel becomes locked, the rear end of the vehicle will “come around” or “fishtails,” causing the vehicle to skid. Critical inspection of the entire braking system is required to be assured of a safe vehicle.

Figure 95-16
A stepped cam is used to alter the split point of the height-sensing proportioning valve.
Figure 95-17 A proportioning valve pressure test can be performed using two pressure gauges—one to register the pressure from the master cylinder and the other gauge to read the pressure being applied to the rear brakes. This test has to be repeated in order to read the pressure to each rear wheel.

Figure 95-18 A metering valve when the brakes are not applied. Notice the brake fluid can flow through the metering valve to compensate for brake fluid expansion and contraction that occurs with changes in temperature.

Figure 95-19 A metering valve under light brake pedal application.
Figure 95-20 A metering valve during a normal brake application.

**TECH TIP: Push-In or Pull-Out Metering Valve?**
Whenever bleeding the air out of the hydraulic brake system, the metering valve should be bypassed. The metering valve stops the passage of brake fluid to the front wheels until pressure exceeds about 125 PSI (860 kPa). It is important not to push the brake pedal down with a great force so as to keep from dispersing any trapped air into small and hard-to-bleed bubbles. To bypass the metering valve, the service technician has to push or pull a small button located on the metering valve. An easy way to remember whether to push in or to pull out is to inspect the button itself. If the button is rubber coated, then you push in. If the button is steel, then pull out.

Special tools allow the metering valve to be held in the bypass position. Failure to remove the tool after bleeding the brakes can result in premature application of the front brakes if the rear drum brakes have insufficient pressure to operate.

Figure 95-21 Typical two-function combination valves.
TECH TIP: No Valves Can Cause a Pull

When diagnosing a pull to one side during braking, some technicians tend to blame the metering valve, proportional valve, the pressure-differential switch, or the master cylinder itself.

Just remember that if a vehicle pulls during braking that the problem has to be due to an individual wheel brake or brake line. The master cylinder and all the valves control front or rear brakes together or diagonal brakes and cannot cause a pull if not functioning correctly.

Figure 95-22 Combination valve containing metering, pressure-differential (warning switch), and proportioning valves all in one unit. This type is often called a “pistol grip” design because the proportioning valve section resembles the grip section of a handgun.

Figure 95-23 Typical brake light switches.