# Braking system

The typical brake system consists of disk brakes in front and either **disk** or **drum brakes** in the rear connected by a system of tubes and hoses that link the brake at each wheel to the master cylinder. Other systems that are connected with the brake system include the parking brakes**,** power brake booster and the **anti-lock** system.

When you step on the brake pedal, you are actually pushing against a plunger in the master cylinder which forces hydraulic oil (brake fluid) through a series of tubes and hoses to the braking unit at each wheel. Since hydraulic fluid (or any fluid for that matter) cannot be compressed, pushing fluid through a pipe is just like pushing a steel bar through a pipe. Unlike a steel bar, however, fluid can be directed through many twists and turns on its way to its destination, arriving with the exact same motion and pressure that it started with. It is very important that the fluid is pure liquid and that there is no air bubbles in it. Air can get compressed which causes sponginess to the pedal and severely reduces braking efficiency. If air is suspected, then the system must be bled to remove the air. There are "bleeder screws" at each wheel cylinder and caliper for this purpose.

On a **disk brake**, the fluid from the master cylinder is forced into a caliper where it presses against a piston. The piston, in-turn, squeezes two brake pads against the disk (**rotor**) which is attached to the wheel, forcing it to slow down or stop.

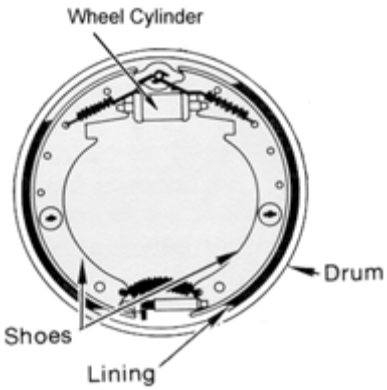
With **drum brakes**, fluid is forced into the wheel cylinder which pushes the brake shoes out so that the friction linings are pressed against the drum which is attached to the wheel, causing the wheel to stop.

In either case, the friction surfaces of the pads on a disk brake system, or the shoes on a drum brake convert the forward motion of the vehicle into heat. Heat is what causes the friction surfaces (linings) of the pads and shoes to eventually wear out and require replacement.

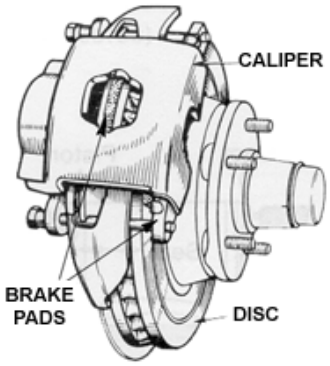
**Master Cylinder.** The master cylinder is located in the engine compartment on the firewall, directly in front of the driver's seat. A typical master cylinder is actually two completely separate master cylinders in one housing, each handling two wheels. This way if one side fails, you will still be able to stop the car. The brake warning light on the dash will light if either side fails, alerting you to the problem. Master cylinders have become very reliable and

rarely malfunction; however, the most common problem that they experience is an internal leak. This will cause the brake pedal to slowly sink to the floor when your foot applies steady pressure. Letting go of the pedal and immediately stepping on it again brings the pedal back to normal height.

**Disk Brakes.** The disk brake is the best brake we have found so far. Disk brakes wear longer, are less affected by water, are self adjusting, self cleaning, less prone to grabbing or pulling and stop better than any other system around. The main components of a disk brake are the **Brake Pads**, **Rotor**, Caliper and **Caliper Support**.



DRUM BRAKE



DISK BRAKE

**Drum Brakes.**While all vehicles produced for many years have disk brakes on the front, drum brakes are cheaper to produce for the rear wheels. The main reason is the parking brake system. On drum brakes, adding a parking brake is the simple addition of a lever, while on disk brakes, we need a complete mechanism, in some cases, a complete mechanical drum brake assembly inside the disk brake rotor! Parking brakes must be a separate system that does not use hydraulics. It must be totally mechanical, but more on parking brakes later.

Drum brakes consist of a **backing plate**, **brake shoes**, **brake drum**, **wheel cylinder, return springs** and an **automatic or self-adjusting system**. When you apply the brakes, brake fluid is forced, under pressure, into the wheel cylinder which, in turn, pushes the brake shoes into contact with the machined surface on the inside of the drum. When the pressure is released, return springs pull the shoes back to their rest position. As the brake linings wear, the shoes must travel a greater distance to reach the drum.

**Brake Fluid.** Brake fluid is special oil that has specific properties. It is designed to withstand cold temperatures without thickening as well as very high temperatures without boiling. (If

the brake fluid should boil, it will cause you to have a spongy pedal and the car will be hard to stop.) Brake fluid must meet standards that are set by the Department of Transportation (DOT). The brake fluid reservoir is on top of the master cylinder. Most cars today have a transparent reservoir so that you can see the level without opening the cover. The brake fluid level will drop slightly as the brake pads wear. This is a normal condition and no cause for concern. Brake fluid must maintain a very high boiling point. Exposure to air will cause the fluid to absorb moisture which will lower that boiling point.

**Power Brake Booster.** The power brake booster is mounted on the firewall directly behind the master cylinder and, along with the master cylinder, is directly connected with the brake pedal. Its purpose is to amplify the available foot pressure applied to the brake pedal so that the amount of foot pressure required to stop even the largest vehicle is minimal. Power for the booster comes from engine vacuum. The automobile engine produces vacuum as a by-product of normal operation and is freely available for use in powering accessories such as the power brake booster. Vacuum enters the booster through a check valve on the booster. The check valve is connected to the engine with a rubber hose and acts as a one-way valve that allows vacuum to enter the booster but does not let it escape. The booster is an empty shell that is divided into two chambers by a rubber diaphragm. There is a valve in the diaphragm that remains open while your foot is off the brake pedal so that vacuum is allowed to fill both chambers. When you step on the brake pedal, the valve in the diaphragm closes, separating the two chambers and another valve opens to allow air in the chamber on the brake pedal side. This is what provides the power assist.

**Anti-Lock Brakes (ABS).**The most efficient braking pressure takes place just before each wheel locks up. When you slam on the brakes in a panic stop and the wheels lock up, causing a screeching sound and leaving strips of rubber on the pavement, you do not stop the vehicle nearly as short as it is capable of stopping. Also, while the wheels are locked up, you lose all steering control so that, if you have an opportunity to steer around the obstacle, you will not be able to do so.

Anti-lock brake systems solve this lockup problem by rapidly pumping the brakes whenever the system detects a wheel that is locked up. In most cases, only the wheel that is locked will be pumped, while full braking pressure stays available to the other wheels. This effect allows you to stop in the shortest amount of time while maintaining full steering control even if one or more wheels are on ice. The system uses a computer to monitor the speed of each wheel.

When it detects that one or more wheels have stopped or are turning much slower than the remaining wheels, the computer sends a signal to momentarily remove and reapply or pulse the pressure to the affected wheels to allow them to continue turning. The system consists of an electronic control unit, a hydraulic actuator,  and wheel speed sensors at each wheel.

https://www.quora.com/How-do-car-brakes-work