

TECHNICAL - Master Cylinder?

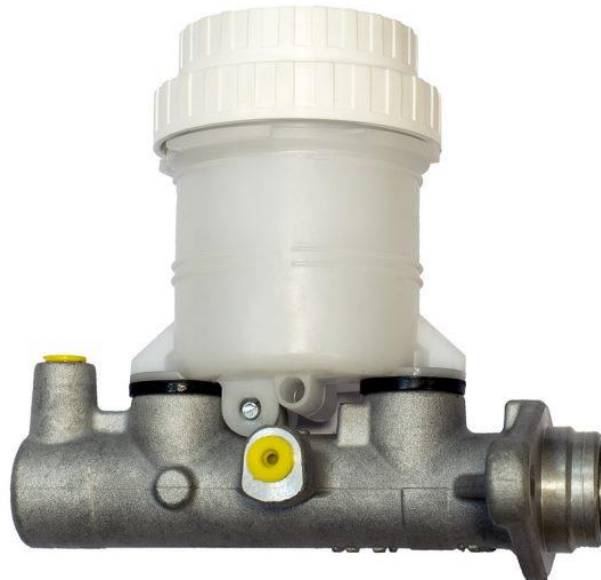
The brake master cylinder is a component in your car's braking system that drives the pressure generated by the brake pedal to the braking mechanism at your vehicles' wheels. It's essentially the heart of your car's brake system.

When you press down on the brake pedal, that force pushes a piston through the brake cylinder, converting the force into hydraulic pressure.

This pressure pumps hydraulic fluid through the [brake lines](#), transmitting pressure to a secondary cylinder at each wheel's braking mechanism.

The secondary cylinders drive the caliper piston to engage the brake calipers in disc brakes (the wheel cylinder in drum brakes). This action then goes on to stop the wheel.

The clutch system in manual cars also employs master cylinders, but they're not the same kind as *brake* master cylinders.



For **manual brakes**, the master cylinder is attached directly to the firewall and linked to the brake pedal.

In **power-assisted brakes**, the master cylinder is attached to a brake booster, which supplies more power to the braking system. The assembly is attached to the firewall in the engine compartment, with the brake pedal linked to the booster.

Now that you know *how* the master cylinder functions in the brake system, let's see what happens **inside** the master cylinder:

Most master cylinders have a "tandem" design (sometimes called a dual master cylinder).

In the tandem master cylinder, two master cylinders are combined inside a single housing, sharing a common cylinder bore. This allows the cylinder assembly to control two separate hydraulic circuits.

Each of these circuits controls the brakes for a pair of wheels.

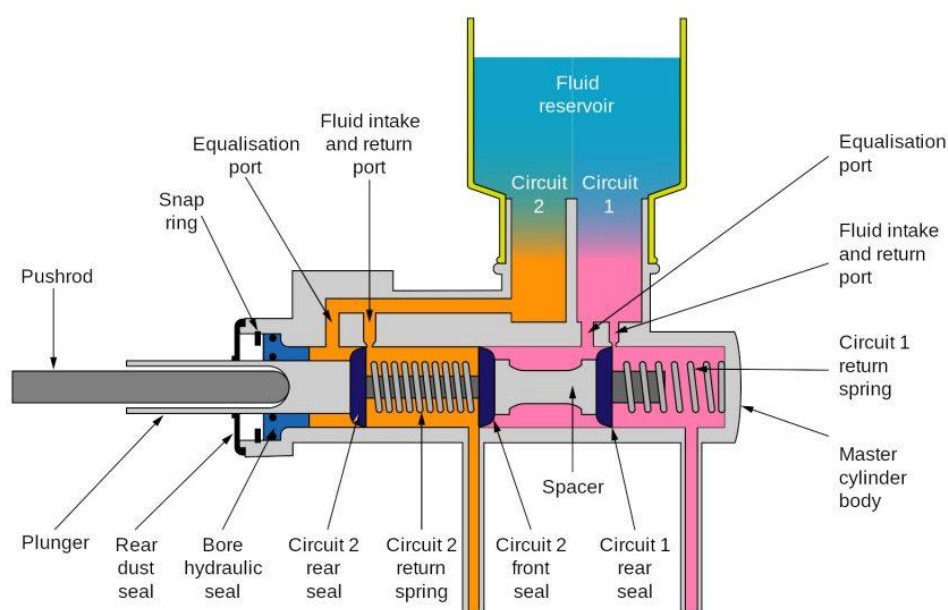
The circuit configuration can be:

- Front/rear (two front and two rear)
- Diagonal (left-front/right-rear and right-front/left-rear)

This way, if one brake circuit fails, the other circuit (that controls the other pair) can stop the vehicle.

There's also a proportioning valve in most vehicles, connecting the master cylinder to the rest of the brake system. It controls the pressure distribution between the front and rear brake for balanced, reliable braking performance.

The master cylinder reservoir is located on top of the master cylinder. It must be adequately filled with brake fluid to prevent air from entering the brake system.



Here's what happens in the master cylinder when you press down on the brake pedal:

- A pushrod drives the primary piston to compress the brake fluid in its circuit
- As the primary piston moves, hydraulic pressure builds inside the cylinder and brake lines
- This pressure drives the secondary piston to compress the brake fluid in its circuit
- Brake fluid moves through the brake lines, engaging the braking mechanism

When you release the brake pedal, the springs return each piston to its initial point.

This relieves the pressure in the system and disengages the brakes.

How The Master Cylinder Influences Braking Performance

The master cylinder bore diameter is an essential factor influencing braking performance.

A change in the cylinder diameter will affect how the brake pedal feels to you and the brake pressure that's applied.

If the cylinder bore diameter is **too large**, it will create a:

- Hard brake pedal — where you'll need to exert more effort to press the pedal
- Short stroke — the brake pedal doesn't travel far enough to generate enough braking pressure

Because of this, you could end up with a jumpy car, as you'll have to tap the brakes hard (due to the high resistance), and the brakes will engage too fast.

If the cylinder bore size is **too small**, it will have a:

- Soft brake pedal — where less effort is needed to press the brake pedal
- Long stroke — the brake pedal needs to be pressed down all the way to create braking pressure

You'll feel less resistance on the pedal, but you'll be pressing down farther to get the brakes to work. This is not a great scenario in a traffic jam or if you need to make a quick stop.

Note: Drum brakes require less pressure, so the master cylinder for drum brakes is usually smaller. They typically have a one-way residual pressure valve. The residual valve helps maintain a bit of pressure in each brake line, so the drum brakes can engage faster.

We know what you're thinking:

Learning about how master cylinders work is great, but how can you tell when it fails?

How To Spot A Bad Or Failing Master Cylinder

A **bad** brake master cylinder can result in several issues. Here are some common red flags that indicate a faulty master cylinder:

1. Unusual Brake Pedal Behavior

Your brake pedal should reflect any major problems in the sealing or force distribution of your master cylinder.

For example, you might notice a spongy brake pedal — where it'll lack resistance and may sink slowly to the floor when pressed. The brake pedal may also not spring back smoothly into place after you remove your foot. This is usually due to an issue with your brake fluid pressure – which is likely caused by a bad brake master cylinder.

As a general rule, take your car to the mechanic whenever your brake pedal suddenly starts acting differently.

2. Brake Fluid Leaks

Brake fluid leaking under your car is a clear sign that something is wrong. If this happens, make it a point to have your mechanic check your brake fluid reservoir. A leak will cause the brake fluid level to drop.

Luckily, the master cylinder has several seals inside it to keep the brake fluid and brake pressure contained. However, if any piston seal wears out, it'll create internal leaks.

A severe dip in your brake fluid level will compromise the performance of your brake system and your road safety.

3. Contaminated Brake Fluid

Brake fluid is supposed to have a clear, golden yellow to brown color.

If you notice your brake fluid turning a dark brown or black, something's wrong.

If your brakes aren't performing up to par, there's a chance that a rubber seal in the master cylinder has worn out and broken down. This introduces a contaminant into the brake fluid and darkens its color.

4. The Engine Light Or Brake Warning Light Comes On

Newer vehicles may have brake fluid level and pressure sensors installed in the master cylinder. These will detect unusual drops in hydraulic pressure and alert you.

That's why, if your engine light or brake warning light turns on, don't ignore it. It could be a sign of master cylinder failure, especially when accompanied by any of the previous symptoms.

5. Weaving When Braking

The brake master cylinder usually has two separate hydraulic circuits to transfer the brake fluid to two different pairs of wheels. Any failure in one circuit can cause the car to [drift](#) to one side when braking.

6. Uneven Wear In Brake Pads

If one of the circuits in the master cylinder has a problem, it can translate to [uneven brake pad](#) wear. One set of [brake pads will wear down](#) more than the other — which can again result in your car weaving whenever you brake.