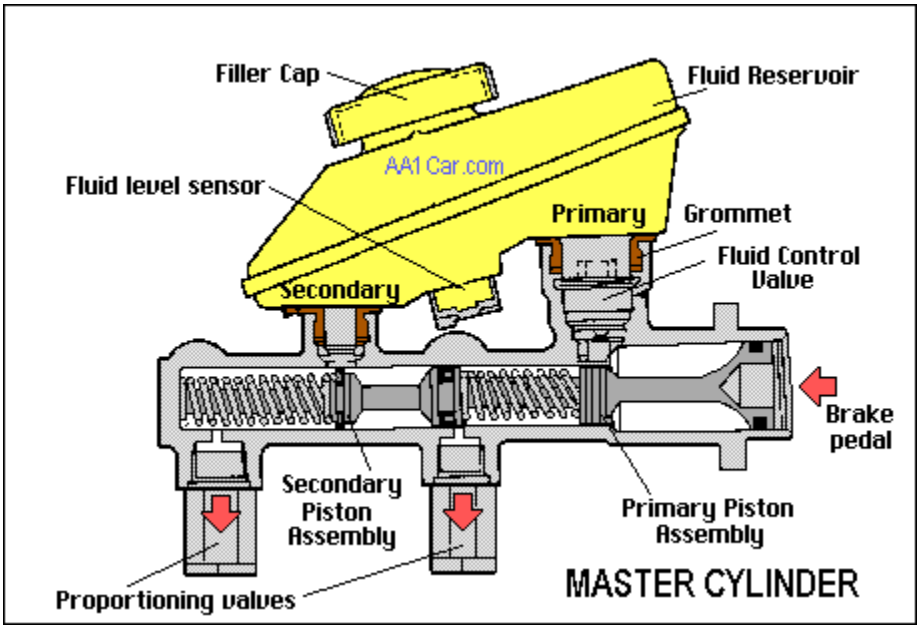

Brake Master Cylinder

by Larry Carley copyright 2019 AA1Car.com

The master cylinder is the heart of the brake's hydraulic system. It converts the force exerted on the brake pedal into hydraulic pressure to apply the brakes. Depressing the brake pedal moves a push rod in the master cylinder. Mounted on the push rod are a pair of pistons (primary and secondary) in tandem (one after the other) that exert force against the fluid in the master cylinder bore. The pressure created displaces fluid through the various brake circuits and lines to each of the wheels and applies the brakes.

The master cylinder is able to do its job because brake fluid is incompressible. The fluid inside acts like a liquid linkage between the master cylinder's pistons and the calipers and wheel cylinders. Any movement of the pistons in the master cylinder is transferred to each of the brakes. For it to work properly, though, there must be no air in the fluid because air is compressible. That means no bubbles or air pockets in the brake lines, master cylinder, the calipers or the wheel cylinders. And if the vehicle has antilock brakes, no air in the hydraulic modulator assembly or ABS solenoids.

When the brake pedal is released, the spring-loaded piston assembly in the master cylinder returns to its rest position. The fluid that was displaced by the pistons is pushed

back to the master cylinder as the disc brake pads and drum brake shoes retract, and the fluid returns to the fluid reservoir through the compensating ports.

On many late model vehicles, a special "quick take-up" master cylinder is used to reduce brake drag for improved fuel economy. The caliper piston seals retract the pistons when the brakes are released so the pads don't drag against the rotors. Because the caliper pistons have to travel further when applied, the master cylinder has a stepped bore that delivers a larger volume of fluid when the brake pedal is initially depressed. These type of master cylinders have a special "quick take-up" valve inside to control the movement of this extra fluid.

MASTER BRAKE CYLINDER WEAR

Like any other component that receives a lot of use, the master cylinder eventually wears out. Stop-and-go city driving is obviously a lot harder on a master cylinder than highway driving, so a master cylinder that goes 150,000 or more miles in one application may only last 70,000 miles in another.

Brake Master Cylinder Reservoir.

MASTER BRAKE CYLINDER PROBLEMS

Master cylinder problems include external leaks, internal leaks and valve problems. Brake fluid leaking from the rear of the master cylinder bore is usually bad news because it means the seals are leaking. But sometimes a leak at the vacuum booster input seal and/or pushrod misalignment can cause a fluid leak, so a closer inspection is needed to determine the cause.

When the master cylinder's pistons and/or bore become worn, the pistons won't hold pressure and the brake pedal will gradually sink when the brakes are applied. Be careful not to confuse this condition with air in the lines that can cause a soft or spongy pedal. A low pedal is usually due to worn linings. If the master cylinder is worn, however, then replacement is recommended.

MASTER BRAKE CYLINDER: REPAIR OR REPLACE?

Most brake technicians today won't waste their time overhauling a leaky master cylinder with a kit because in many instances the bore is too badly worn. And if the master cylinder is aluminum, it can't be honed because doing so removes the anodized coating (or what's left of it) that protects the metal against corrosion. So to avoid the risks associated with rebuilding a master cylinder, most repair shops will simply replace your old master brake cylinder with a remanufactured or new unit. Remanufactured aluminum master cylinders are usually sleeved, and are just as good as a new one, but cost less.

The master cylinder may also experience problems if rust or dirt plugs up the compensating or metering ports. This can sometimes create residual pressure in the system causing one or more brakes to drag. If a caliper or wheel cylinder that is in good working condition appears to be dragging, then check out this possibility. Sometimes residual pressure can also be created by a misadjusted brake pedal stop light switch.

There is no need to replace the master cylinder if all that is wrong is a bad proportioning or metering valve. The proportioning valve splits the hydraulic pressure so that the front and rear wheels receive just the right amount of pressure when the brakes are applied to compensate for the difference in braking effort and weight distribution front-to-rear. A defective proportioning valve can upset brake balance allowing too much pressure to reach one set of wheels.

When a brake imbalance problem such as rear wheel skidding leads you to suspect something is wrong with the proportioning valve, the valve should be tested or replaced. Testing requires two hydraulic pressure gauges that read up to 2000 PSI. Install one gauge immediately behind the valve and the other ahead of the valve. When pedal pressure is applied, the first gauge will show the output pressure from the master cylinder and the second will read the reduced pressure. If the valve does not reduce pressure according to the specs for your vehicle, replace the valve.

Some newer cars do not have a mechanical brake proportioning valve. Instead, they use the ABS system to reduce pressure to the rear brakes if the rear wheels are losing their grip. The advantage with this approach is that the rear brakes can handle a greater share of the brake load, and help stop the vehicle in a shorter distance. The downside is

that the rear brake linings will wear much faster, and sometimes even faster than the front brake linings.

New master cylinders may not come with a new brake fluid reservoir. If no reservoir is included, you will have to swap the old reservoir to the new master cylinder. Clean it before reusing it!

HOW TO REPLACE A MASTER BRAKE CYLINDER

When replacing a master cylinder, it's a good idea to bench bleed the new unit before you install it in your vehicle. This is especially important on master cylinders that are mounted at an angle as these can trap air in the front chamber.
To bench bleed the master cylinder, you have to rig up a return path so the fluid that comes out the discharge ports can be routed back to the fluid reservoir. You can use an inexpensive bench bleeding kit that includes plastic fittings and a hose, or you can jury rig a pair of return pipes using some flexible tubing and fittings that fit the discharge ports. If you are doing a lot of brake work, there are also special tools such as the Phoenix Brake Bleeder that can "reverse" bench bleed a master cylinder by injecting fluid into the master cylinder through the discharge ports.
If you forget to bench bleed it prior to installation, you can raise the rear of your vehicle up with a jack. This will tilt the master cylinder forward, allowing the air to move rearward and hopefully vent out.

To replace your master cylinder:

1. Set the parking brake, place the transmission in gear and/or block the wheels so your vehicle won't roll while you are working on it.

2. Place a catch pan or rags under the master cylinder, then loosen and remove the front and rear brake lines that attach to the housing. Remove any other hydraulic connections that may connect the master cylinder to the ABS system. Use a flare nut

wrench so you do not damage the fittings. Cover the ends of the open brake lines with electrical tape to keep out dirt and air.

3. Unbolt the master cylinder from the vacuum booster (typically two bolts), and pull it forward to remove it from the vehicle.

If there is an electrical connector that attaches to the fluid reservoir, disconnect it. The connector is for a fluid level sensor inside the reservoir.

4. Once the unit has been removed, you may have to swap the plastic fluid reservoir from the old unit to the new (if the new unit does not come with a reservoir). The reservoir simply pulls off the housing. Remove the filler cap, dump out the old brake fluid, then separate the reservoir from the master cylinder. Be careful not to crack the plastic reservoir. If the inside of the reservoir is dirty, rinse it out with clean brake fluid. DO NOT use any type of petroleum-based product or cleaner in the reservoir as this can contaminate and damage the seals in your brake system.

5. Install the reservoir on the new master cylinder, fill the unit with clean, fresh brake fluid (NEVER reuse the old fluid), and bench bleed it by using a long 3/8 ratchet wrench extension or similar tool to push the piston assembly in. This will pump fluid through the pistons and metering ports, and out the brake line ports. Repeat until the master cylinder piston chamber is full of fluid and no air bubble can be seen in the fluid coming out of the discharge port.

6. Position the new master cylinder up against the brake booster and push it inward, being careful to align the pushrod with the piston assembly. Install and tighten the master cylinder mounting bolts. If the reservoir has a fluid level sensor, reconnect the electrical connector.

7. Attach the front and rear brake lines to the master cylinder. Tighten carefully with a flare wrench. Don't overtighten has this may damage the fittings or strip the treads. Make sure the connections are leak-free. DO NOT use Teflon tape or any type of sealer on the thread fittings as this may allow small shreds of tape or sealer to find their way into the brake lines.

8. Bleed the brakes to remove any trapped air from the system. Follow the bleeding procedure and sequence for your vehicle.

9. Pump your brake pedal several times BEFORE you start the engine or attempt to move or drive your vehicle to make sure you have a firm pedal, normal pedal travel and that the brakes will stop your vehicle.

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