

# Workshop

## STOP THAT CAR

Part 1 of a 3 part series  
on brake system  
restoration and upgrading

### What you need:

- Cylinder clamps • Tubing wrench
- Adjusting spoon • Brake pliers
- Brake fluid • Hydraulic brake cleaner



1. These are the necessary hand tools for doing a brake system rebuild. At left is a clamp for holding wheel cylinders together when shoes are removed. Next is a brake tubing wrench, necessary for loosening brake hydraulic tubes. S-shaped tool is a brake spoon for a shoe adjustment. Item on right is a set of brake pliers for dealing with springs.

Going through the brake system is an important part of any restoration, and one of the easier tasks you'll face. The job doesn't require expensive tools and can be done in a couple of days if you take your time. Hydraulic brake systems have changed little since the mid-1930s when they first became common, except for the addition of front disk brakes and dual bore master cylinders for increased performance and safety. Here is how a typical old car brake system works:

Each wheel has a cast iron drum against which two semi-circular, lined shoes press to bring the car to a stop. (In the case of front disk brakes, drums are replaced by iron (or occasionally steel) disks, and the shoes are replaced by a set of calipers holding lined pads that grip the disk to stop the car.

With drum brakes, the front shoes are called primary shoes, and the rear facing ones are called secondary shoes. When you step on your brakes, the master cylinder (usually mounted on the firewall or frame) actuates the wheel cylinders and engages the primary shoes first, then the secondaries, which actually do most of the braking.

Because of a vehicle's forward momentum and flexible suspension it will nose-dive during stopping, and that is especially true of unloaded, front-engined cars. This action transfers much of the car's weight forward. As a result, the brakes on the front wheels do most of the job of stopping. That's why front brakes generally wear out first, and why front disks and drums need to be replaced more often than rears.

The brake shoes are attached to the brake backing plate by the anchor pin at the top and spring-loaded brake nails at the sides. The shoes are pulled in, away from the drums, by long springs when they're not in use. When the brakes are applied, the brake shoes are pushed out against the drums by hydraulic brake cylinders, usually at the tops of the backing plates, though some vehicles have cylinders top and bottom. Adjustment of shoe travel is accomplished by turning the star wheel adjusters at the bottoms of the backing plates between the shoes. See the illustration nearby.

### SAFETY NOTE

Many old vehicles still have shoes or calipers faced with asbestos linings, so always wear at least a particle mask when working on your car's brake system. Also, never use compressed air to blow the dirt out of brakes. The dust is carcinogenic and impossible to get out of your lungs once it lodges in them.

### Taking them apart

Put your chassis on sturdy jack stands. Pop off the front wheel covers and the little dust caps over the axle nuts. Pull out the cotter keys securing the axle nuts and remove the nuts. Now pull on the front wheels to remove them; drums, bearings and all. This method makes it easier to remove the front drums. Unbolt the drums from the front wheels.

Disconnect the flex hoses going to the front wheel cylinders and drain any fluid into a waiting container. Disconnect the springs holding the brake shoes in place using the tool on the end of the handle of your brake pliers. Now push in and disengage the spring-loaded, nail type keepers in the middles of the shoes. Set the shoes out of the way, and unbolt the wheel cylinders. If in the process of a restoration you intend to detail these parts, remove the backing plates from the axles as well.

Disconnect the emergency brake by rolling under the car and pulling out the pin holding the equalizer line of the parking brake that goes to the cables for the back wheels. This assembly is located about mid-frame. The emergency brake cable system is the biggest difference between the front and back brakes on most old cars.

Remove the back wheels. Back brake drums usually need to be pulled off using a drum puller. There are two types in common use. The first grips the outside of the drum and pops it loose after a couple of sharp blows on the puller's center. The second type pulls the drum off by its studs, and should never be struck in the center, because doing so could damage the differential. Make sure you ascertain which type of puller is required for

your car before you try to remove the drums.

Disassemble the back brakes the same way you did the front ones. Use a brake tubing wrench to loosen the back brake tubing nipples. Don't try to do this with a standard, open-end wrench because chances are you will merely round off the nuts. You can tap on the nipples with a small hammer, and shoot a little penetrating oil on them to loosen them, but if the tubing wrench rounds them off, a vise grips may be your last alternative. When you remove the back wheel cylinders, don't mix them up with the front ones. Chances are they are different diameters with the front wheel cylinders being slightly larger.

2. Machine shops can sleeve your cylinders with brass or stainless steel, making them impervious to corrosion.




The master cylinder is the final component to be removed. On many cars made from the mid-sixties on, it is in the firewall and is easily extricated from the vehicle by disconnecting its tubing and unbolting it. Older cars have the master cylinder attached to the frame and actuated directly by the brake pedal. If you have one of these, you will need to roll under the chassis, disconnect the pedal linkage, then remove the cylinder from the car.

### Hydraulics

You will want to put new piston and rubber kits in the master and wheel cylinders for sure, and if their bores are badly pitted or rusted, you will want to replace the cylinders, or have them sleeved with brass or stainless steel, which will make them pretty much impervious to further damage. If your cylinders are only a little rough though, you can use a brake cylinder


3. Here is what the brake assembly looks like back together and clean. Now we just need to install the drums, then bleed and adjust the cylinders.



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- 4. Be sure to top up the master cylinder before bleeding the brakes. Keep an eye on the level of fluid while working too.**

hone to clean up the bores, but don't try to remove deep pitting with a hone because doing so will multiply the amount of pedal effort required to apply the brakes.


To use a brake cylinder hone, chuck it up in a variable speed hand drill, coat the cylinder bore and stones liberally with cutting oil, then slip in the stones. Spin the stones slowly in the cylinder, moving them up and down in the bores, but don't let them slip out at the ends. Keep working until all indications of corrosion or pitting are gone. Thoroughly clean the cylinder with alcohol-based brake cleaner before installing an overhaul kit.

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- 5. To get the front wheels off, take the outer wheel bearing out, then pull the wheel off, drum and all. Try not to scrape spindle.**

Another trick for master and wheel cylinders with pits too deep to be honed is to have a machine shop bore them out and install brass or stainless steel sleeves. This can be a bit pricey, but if you can't

find good replacements for your bad cylinders, it may be your only alternative. A big plus for having this done is that you will never need to do it again because the sleeves won't rust.

When you have removed the pits, or when you get your cylinders back after being sleeved, install new kits. Make sure your work area and your hands are surgical room clean. One little bit of grit in a wheel cylinder can ruin it. Place the components of the kit in a small container of brake fluid, then withdraw them as you need them. Use wheel-cylinder clamps to hold the cylinders together until you can install them.

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- 6. Front wheel brake assembly is finished by installing springs at top. Be sure to use the springs that are the correct tension and length.**

## Mechanicals

Brake drums that are lightly scored but do not cause a fingernail to hang up in the grooves can be cleaned up by sanding them with fine emery cloth. Drums that are deeply scored will need to be turned down, and in that case, the brake shoes that go with them should be arced to match.

Inspect your brake lining carefully. If it is black, glazed and shiny, or contaminated with

grease, it will need to be replaced. If it is less than 18 mils thick midway up the shoe it should be replaced too, because it has very little useful life left at that point. But if your old linings are thick and healthy, leave them alone except to knock the glaze off of them with a little sandpaper.

## Putting it all together

Cleanliness is the key to a good brake overhaul. As we said before, hydraulic cylinders can be ruined quite easily by grit. In addition, oil or grease on brake lining will ruin it. Try not to touch lining with your hands, and keep drum surfaces clean too. Use alcohol brake cleaner to rid either of these of any slight contamination, and to clean out any hydraulic cylinder couplings, tees or tubes.

Clean, free up and lightly oil the star wheel adjuster mechanisms before installing them. Put a dab of white grease where each brake shoe moves on the backing plate. Replace any springs with new ones of the same tension. (As a rule of thumb, springs that are different colours have different tensions. Make sure you obtain the correct ones for your car.)

## Bleeding the cylinders

Fill the system with brake fluid up to the specified level in the master cylinder, then attach two feet of clear plastic tubing to the bleeder valve on the passenger-side, rear wheel cylinder. (You always want to bleed the cylinder furthest from the master cylinder first). Place the other end of the hose in a small glass jar with a couple of inches of brake fluid in it.

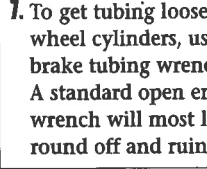
Have a friend pump the brakes slowly several times, then have him hold down the pedal while you crack open the bleeder valve just enough to let the fluid come through. Tighten the valve and have your friend pump the brakes again. Crack open the valve again to release fluid. Keep the process going until you see no more air bubbles. Now top up the master cylinder, then do the same to the driver's side rear brake. Keep working in this manner until you have done all four wheels. Watch for system leaks while you work.

## Adjusting brakes

Check a shop manual for your car to determine exactly how its brakes are to be adjusted. The following instructions will work on all but a few, but there are some minor differences here and there.

## Master cylinder

Set the cylinder actuating rod so there is about 1 1/4" of free movement in it before it starts to actuate the piston in the master cylinder. On most cars, there is a threaded portion on the end of the rod that has an adjusting and a locking nut to allow you to do this. Loosen the lock nut, then adjust in or out to find the correct tolerance. Be sure to tighten the lock nut when you've finished setting the movement.

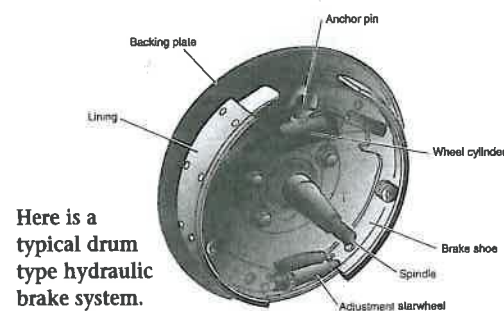
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- 7. To get tubing loose from wheel cylinders, use a brake tubing wrench. A standard open end wrench will most likely round off and ruin the nut.**

## Shoe adjustment

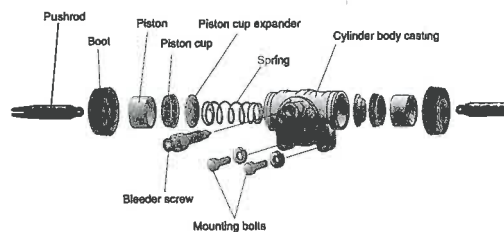
Stick a brake adjusting spoon through the slot in the backing plate and rotate the star wheel adjusters down to expand the brake shoes out against the drums, or up to contract them. Adjust each of the wheels until you can't easily turn it, and then back off until the wheel will turn with some drag on it. Install rubber plugs in the backing plates to keep moisture out. Take your car out for a test drive, and readjust if it pulls to one side or the pedal is too low.

## Adjusting emergency brakes

Pull the brake cable toward the equaliser link. Remove any slack so both clevis pins will just enter at the equaliser link when the equaliser link is parallel to the drive shaft. Always install clevis pins with the heads up. Back off two turns on the clevis pins, then tighten the clevis lock nuts and install new cotter keys.



Here is a typical drum type hydraulic brake system.



These are the parts of a wheel cylinder. Always keep everything spotlessly clean when working on hydraulic cylinders.

To bleed brakes use about two feet of plastic tubing attached to the bleeder nipple of the cylinder, with the other end immersed in a jar with about two inches of clean fluid in it. Have a friend press the brakes while you crack open the nipple to let out air bubbles.

