

SPONGY PEDAL DIAGNOSIS

With this type of problem the most common symptoms your customers will complain of are : They've lost pedal height (sometimes called pedal reserve); or the brakes may feel spongy; the pedal may even touch the floor under heavy braking; or the brakes may not provide sufficient "stopping power". Once the symptom has been verified, the next task is to establish the cause.



Air in the system

A spongy pedal is usually a sign of air in the system. Air may have got in through the master cylinder because the fluid level is low. If this is the case, refill the system with the correct grade of brake fluid, then bleed any remaining air out.



Often the cause is simply that the fluid is leaking from somewhere in the system. It's usually pretty easy to find the leak if there is one – and once found it should be fixed straight away. Once the leak

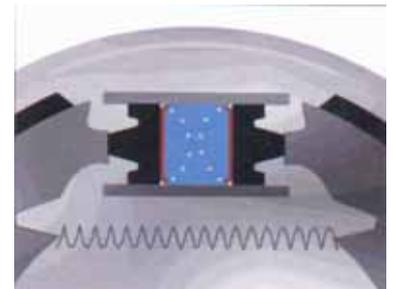
has been fixed, refill the system with the correct grade of brake fluid, then bleed the system.



If there is no obvious sign of leakage, then a more detailed inspection will need to be carried out to find the cause of the air in the system.

For example, both heat and age will cause wheel cylinder cups to deteriorate, resulting in a lack of lip tension. When the brake pedal

is released, a low pressure or partial vacuum is created in the hydraulic system. This will suck air in over the sealing edges of the wheel cylinder cups if they have lost tension. If this has happened, replace the cups with new ones.



Drum Brakes

Brake drums that are cracked or that have been machined past their maximum limit, will cause the brake pedal to feel spongy.



The spongy feel is caused by the drum expanding as the shoes press against it, either because of the crack

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or the thinness of the drum. Always check the drum diameter against the manufacturers specs whenever you inspect or repair a brake system.

Brake shoes are ground so that there's a small clearance between the shoe ends and the drum when they first contact. As the force on the shoes increases, they flex slightly so that the whole lining contacts the drum.



The special grinding of the shoes is called radius grinding, and it stops the shoes from contacting at the ends first, which would cause squealing and grabbing.

If brake drums are machined oversize the shoe and lining radius needs to be altered to suit the new drum diameter. Otherwise, the shoes may be forced to flex more to contact the drum, and this too will give a spongy feeling at the pedal.



Disc Brakes

On the whole, disc brakes have fewer problems than drum brakes, but there are still things that will cause a spongy pedal.

The disc pads can have excessive taper in either a longitudinal or radial direction.



The pad on the piston side can wear concave. This is caused by the backing

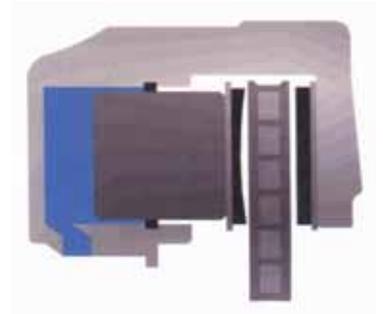


plate flexing under repeated heavy braking. If the dimple on the back of the rear disc pad is incorrectly positioned so that it does not line up with the slot in the piston, then the pad will flex when the brakes are applied, giving a spongy feeling to the brakes.

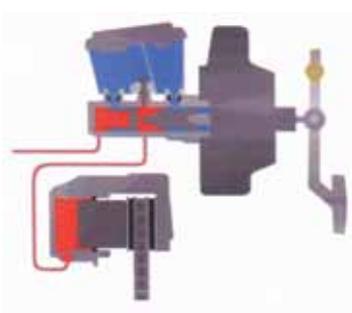


Fluid Contamination

Over time, brake fluid will absorb moisture and this can also cause spongy pedal problems.

Water can get into the system through the rubber brake lines. It will lower the boiling point of the fluid so that, under heavy braking, the heat forms

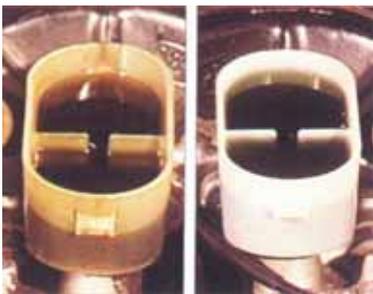
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bubbles of gas in the fluid itself. This gas is compressible (whereas brake fluid is not) -- hence the spongy feel in the brakes.



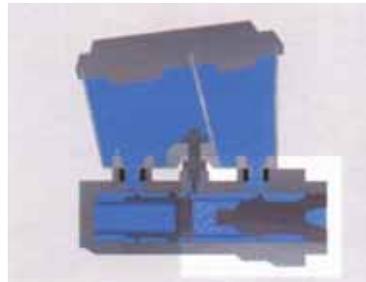
If you don't have access to a device that checks the boiling point of brake fluid, then check the fluid in the master cylinder for clarity and colour if it's either dirty or discoloured, then you should replace it.



Diagnosis Methods

Most modern vehicles are equipped with dual circuit braking systems. It's quite possible for air to be in one circuit but not the other. There are two different methods you can use to test the circuits.

For the first, have someone take off the master cylinder reservoir cap and put rags around the reservoir to soak up any spillage. Then pump the brake pedal around twelve times and then hold it down.



Release the brake pedal suddenly. Have someone check the reservoir and note the amount of disturbance caused as the fluid returns from the brake circuits. A small disturbance is normal. A large eruption indicates air in the system, or one of the other problems already mentioned.



There are two different reasons for this depending upon the cause. In the case of air in the system, the air will have been compressed when the pedal was pushed down. When the pedal was released, the air will have expanded forcing the fluid up the brake lines more quickly than normal.

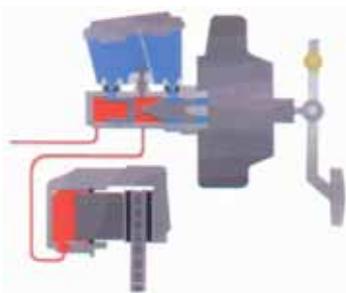


Alternatively, if the brake drums are oversize or the brake pads are incorrectly aligned, the abnormal deflection in the system will displace more fluid

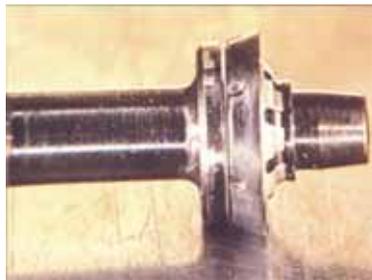
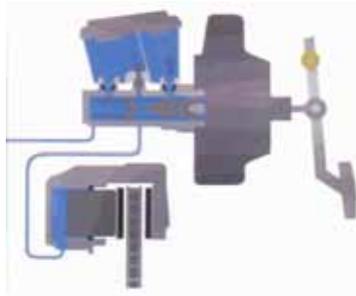
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and increase the disturbance in the master cylinder.

There is another test to see which brake circuit the air is in. Isolate each wheel or pair of wheels with brake hose clamps. Have someone release the clamps one at a time while you press the brake pedal – the pedal will drop a little when the clamp is released, but will drop further than normal when you release the clamp on the faulty circuit.



On the other hand, if the pedal travel is still excessive with all the clamps still on, the problem is likely to be in the master cylinder. Check the cups to see if fluid has made them soft or swollen; or if their sealing edges are eroded by dirt which has then got into the system.



Also, check the fluid to see if it's cloudy, discoloured, or contaminated with other liquid(s). Check the rubber diaphragm cap gasket for distortion. All these things indicate contamination in the system.



Once the cause of the spongy pedal has been fixed, the system will need to be bled to get rid of any air. If the master cylinder has been removed, it will be more convenient to bleed it on the bench before refitting it.

Clamp the master cylinder with a soft jaw vice that won't damage it. Fit bleeder pipes to the fluid outlets, and fill the reservoir with the correct grade of fluid until the ends of the bleeder pipes are covered. (Short lengths of brake pipe, flared at one end, make good bleeder pipes.)

Gently push the pistons to the end of the bore, then slowly release them. Keep this up until no air bubbles rise to the surface of the fluid in the reservoir.



Bleeding – Off Car

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fluid flows from both connections.



(Use a piece of wooden dowel to push the piston. That way, if you slip, the wood won't score the bore of the cylinder.)

Hint : If the cylinder is a fast-fill or quick take-up type like Falcon or Magna, wait fifteen seconds between piston pumps. Otherwise, you won't remove all the air from the cylinder.

This reduces lost pedal travel but it means before the retaining nuts are tightened, there will be a small gap between the master cylinder and the booster. Once the cylinder is refitted, the bleeder pipes can be taken off and the brake lines re-connected.



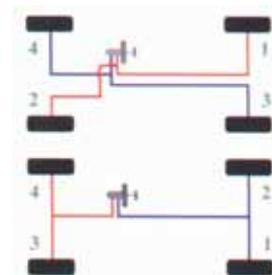
Once the cylinder is bled, take it out of the vice and refit it to the vehicle. Most Australian produced vehicles use the booster output rod as the stop for the master cylinder pistons.



Tighten them to the correct torque setting.

The master cylinder can now be used to pump fresh fluid through the system. Bleed at each wheel in turn until new fluid comes out.

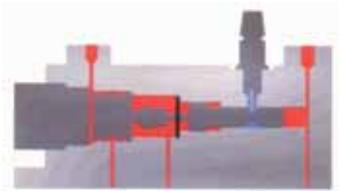
The brake lines will have a little air left in them so they shouldn't be fully tightened. Get rid of this air by having someone push slowly on the brake pedal until a steady stream of



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Not only will this rid the system of air, but it will also flush out any contaminated fluid.

It's normal for the brake failure warning light to come on with ignition after some forms of manual bleeding.

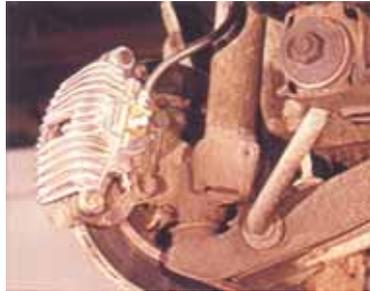


It will go off again once both systems have been bled and a medium pressure applied to the brake pedal. This pressure centralises the pressure differential warning switch spool in the cylinder bore and switches the light off.

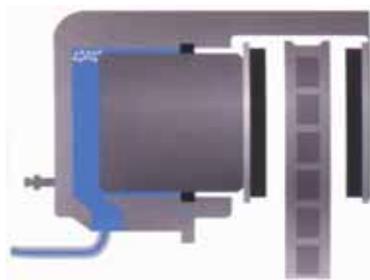
Bleeding Methods

There is one thing worth remembering about all forms of bleeding :

Air always rises to the high point of the system. So, for instance, if someone has swapped the left and right calipers on a car you are working on, the bleeder screws will be at the bottom.



The air will have risen to the top of the caliper, so you will never be able to remove all the air. Similarly, a rise in the hydraulic line, such as over a rear axle housing, will be a natural collection point for air. Not all methods of bleeding will cope with these situations, so here are several methods.



Manual Bleeding :

This is best done by two people. Immerse one end of a tube (preferably a

transparent tube) in a container filled with clean brake fluid. Attach the other end to the bleeder screw.

Open the bleeder screw about half a turn and have someone push the brake pedal down slowly to about half way.



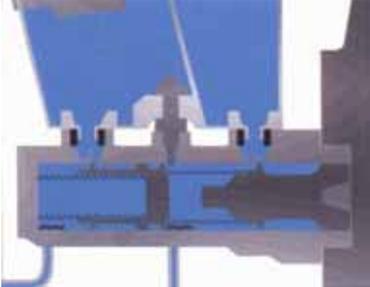
Tighten the bleeder screw and release the brake pedal to the rest position. Repeat this until only clean fluid with no air comes out the bleeder screw.

It's important to work the brake pedal slowly so the master cylinder can recuperate and so the fluid doesn't become aerated. Also, always tighten the bleeder screw before releasing the pedal. If you don't the master cylinder will draw the old fluid back again.

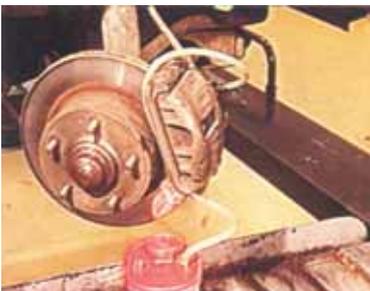
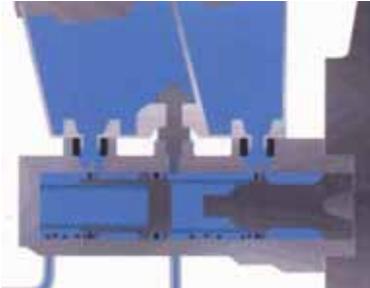
Also, be careful not to damage the master cylinder. Over time, dirt collects at the ends of the bores where the

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piston cups don't normally travel.



If the pistons are pushed to the ends of their bores, this dirt will be picked up by the cups and dragged back up the bore. This will damage both the cups sealing lips and the cylinder bores.



A tip. Always loop the bleeder hose up above the bleeder screw before it's immersed in the container of fluid. This makes it easier to see the air leaving the system and it always

leaves a head of fluid at the bleeder screw, too.

Surge Bleeding :

Use surge bleeding when the layout of the brake lines has large rises in it or the lines are looped around backing plates from one wheel cylinder to another. In other words, whenever the system has built in "air pockets".

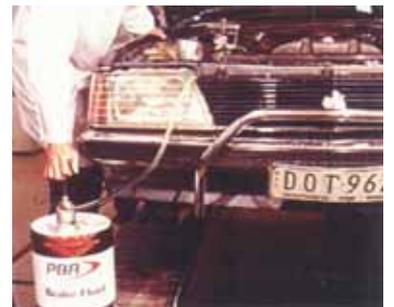
Surge bleeding involves the same process as manual bleeding, except that the brake pedal is pressed down hard and then released slowly. This blasts the fluid through the system, carrying any trapped air with it.



Remember that the problem of dirt in the piston bores still applies here. It pays to place a chock under the pedal to limit the distance it travels.

Pressure Bleeding :

Pressure bleeding involves the use of a specially designed adaptor attached to the master cylinder reservoir.



The brake system is then pressurised by a pump that is connected to a drum of new brake fluid. Each bleeder screw is opened and closed in turn until the system is free of air. The adaptor can then be taken off the master cylinder and

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the reservoir topped up to the right level.



Gravity Bleeding :

This method only needs one person. Fill the master cylinder reservoir to the correct level with the specified grade of brake fluid. Replace the cap loosely to help stop moisture absorption. Connect a flexible hose to the bleeder nipple in the same way as for manual bleeding.

As with manual bleeding, it's a good idea to loop the bleeder hose above the bleeder screw before placing the end in a suitable container.

Open the bleeder screw and simply let the fluid flow through the system (which it will do because the master cylinder's higher than the bleeder screw).

Bleeding sequences are usually recommended by the manufacturers, but if not, start with the bleeder screw furthest away from the master cylinder as a rule of thumb.

A couple of notes : Gravity bleeding is slow and the reservoir must be constantly topped up. This method is not recommended for systems with loops in the pipes.