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# REMEDY FOR PULSING BRAKES

**BY PAUL WEISSLER**

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The driver in the left lane suddenly realizes he's about to miss his exit, so he cuts in front of you. You mash the brake pedal, and it vibrates like a running chain saw as the antilock braking system (ABS) keeps you out of a skid. Thankfully, you don't rear-end the jerk's car, as he also brakes to slow down. He's on the off ramp and gone, so you don't get the chance to pull alongside and express your feelings with universal sign language. But that's probably a good thing.

While it can be reassuring to feel that ABS-connected brake pedal pulsating beneath your firmly planted foot, it's reason to suspect a problem if you get the same pedal pulsation with a light to medium braking application.

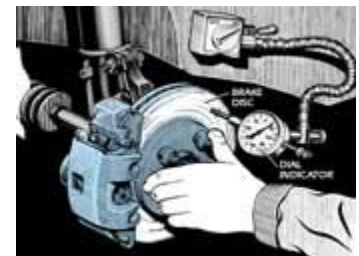
## ABS-esque

If the brake feels like the ABS is cycling, but you know that it's not, check the individual axle trigger wheels in front (and on some cars also in back) and the adjacent wheel speed sensors. If you see a damaged wiring connector, bent sensor mounting bracket or stone-damaged trigger wheel, that's a likely cause. But on almost all cars, the cause normally is something in the service brake itself, and the primary problems are ones you usually can check and correct yourself.

Before you check even the most likely problems on a late model, make absolutely sure there isn't a factory problem with a specific fix. Sure, this is low on the "likely" list, but it's a lot easier to look for a bulletin than to pull wheels, etc. If you have a POPULARMECHANICS CD-ROM disc that includes the service bulletins for your car, you can make absolutely sure.

Otherwise, go to the AllData Web site, a leading supplier of CD-ROM information systems for professional mechanics <http://www.alldata.com/>. If you work your way through its consumer information section and technical service bulletins (TSBs), you can check the titles of all bulletins for your specific make and model car.

## Lug Nut Torque



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Borrow or rent a dial indicator to measure brake disc runout. Even a scant thousandth of an inch of wobble will make your right foot dance on the pedal.

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The No. 1 cause of brake pedal pulsation is uneven lug nut torque. The usual reason is that some mechanic overtightened the wheel lug nuts with an impact wrench, distorting the brake disc.

How do you know if your torque wrench is accurate? Well, if it's by a name-brand tool company and hasn't been thrown around or had a cement block dropped on it, it should be okay. Check the torque at each wheel and compare the reading with manufacturer's specifications (do you have a POPULAR MECHANICS CD-ROM service manual?). If there's a difference of 20% between any two lug nuts, that's too much. Try loosening all the lug nuts, cleaning the stud threads with a wire brush, lightly coating them and the nut chamfer with clean engine oil, and then reinstalling the nuts fingertight.

Next, using a crisscross pattern, tighten all of them to about one-third the specified reading, then to two-thirds and finally to the specified torque.

### Basic Diagnosis

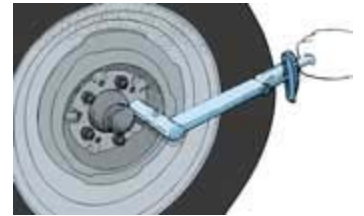
If simple retightening doesn't fix the problem, particularly if all wheels were off torque specs, you'll have to pull the wheels for a closer inspection. First, isolate the problem to the front or rear wheels. Try driving the car and then slowing or stopping with the parking brake lever lightly pulled up and your finger on the ratchet's release button. If the car has a pedal parking brake, try applying that lightly, but be sure to pick a safe, deserted parking lot with smooth pavement. If the car slows down smoothly to a stop, the brake problem is in the front wheels. If the car decelerates in surges, one or more of the rear brakes is out-of-true somehow.

### Full Inspection

Actually inspecting the wheel and brake is the next step. Make alignment marks for the wheel and a lug stud before removal so you're able to index the rim to the same stud. With the wheel off, inspect the mating surfaces of the wheel and disc "hat" surface. If they're packed with dirt or badly rusted, clean them thoroughly (use 100-grit sandpaper or emery cloth). Remove sanding residue with a cloth and brake solvent. Lube sparingly with antiseize. Look closely at both sides of the brake lining contact surfaces of the disc. Moderate scores (too small to snag your fingernail on) are not normally a concern, but rust or other materials are (typically brake lining transfer). Rust often occurs on cars that sit for extended periods in damp climates with not-so-clean air. Use a finer abrasive (200 grit) on the disc contact surfaces.

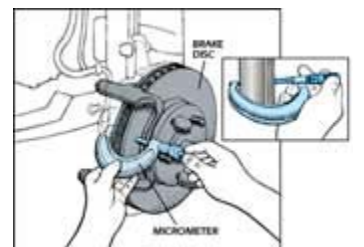
### 'Miking' A Disc

Check the disc for uneven thickness, using a micrometer at six to eight evenly spaced locations on the disc, and compare the readings with manufacturer's specs. As little as .0005 in. (that's five ten-thousandths!) is the maximum, and you can believe that you'll feel a lot of disc pulsation at .0008 in. Should you



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There's no proper alternative to torquing the lug nuts in a crisscross pattern, by stages and with a torque wrench. Oil the threads and chamfer with engine oil.



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get the disc machined? A lot of evidence says unless a shop does a good job of maintaining its brake lathe, the results often are poor. And if the disc is cut too thin, it will warp easily in service. A brand-new disc is the best choice, but even that should be checked for even thickness.

### Measuring Disc Runout

p>Measure lateral runout with a dial indicator on the lining contact surfaces, on both sides, with the lug nuts reinstalled and tightened to approximately 30 ft.-lb. The maximum amount of runout should be .003 in. If it's more, index-mark the caliper to the hub, and remove the caliper and then the disc. Inspect the mating surfaces of the disc and hub and if there's rust, remove it with gentle use of 200-grit paper. Also remove any debris and clean the surfaces with brake solvent.

Rotate the disc clockwise one stud, reinstall, tighten the lug nuts and recheck. Do this a couple of times to see if you can bring runout down to an acceptable level (the problem may have been produced by failure to make and follow alignment marks after some earlier service procedure).

If you can't bring runout down enough, check the hub for runout—.002 in. is the maximum. The thought of replacing the hub may not be appealing, but unless runout is far beyond reason and pulsation is intolerable, keep it in mind if nothing else surfaces as a possibility. A professional shop with an on-car lathe may (we repeat, may) be able to machine a disc so that it's referenced to the hub, to compensate for a small amount of excessive hub runout.

### Brakes Not Releasing

When there's an uneven thickness problem on the discs at relatively low mileage (under 50,000), accompanied by short lining life, it's possible the brakes aren't releasing fully, allowing the shoes to stay in contact with the discs. A defective caliper piston (sticking when you try to push it back), a bad piston seal (not retracting the piston) and a sticking caliper are all possibilities.

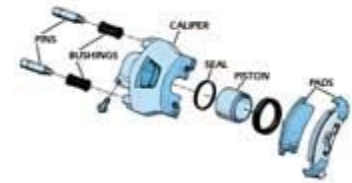
p>When the caliper doesn't slide smoothly back and forth, that's trouble, and short lining life from failure to retract the shoes completely is just one consequence. The brake shoes may also slap unevenly against the disc, another cause of pulsation.

Most calipers slide along guide bolts, through bushings with plastic or metal sleeves. When you remove the caliper, inspect everything. If the guide bolts are corroded, replace them with brand-new ones, lubed with silicone grease (don't try cleaning them). Ditto (including silicone lube) for the sleeves if they're corroded or cracked, and the bushings if they are deteriorated.

### Rear Drum Brakes

The rear drums are not as frequent a cause of pulsation as rear discs, but if they're warped, or if the linings are not making good contact, they certainly can be responsible. Unless a drum contact surface is badly grooved (grooves here

A micrometer is needed to check that each brake disc (new ones as well) is a consistent thickness. Check about 1 in. in from the outer edge, at six or eight equally spaced places.

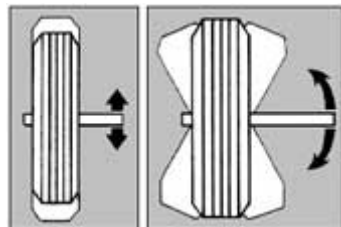


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Sloppy, corroded or deteriorated pins and their mating bushings on some calipers can cause wobble and pulsation.

are not as acceptable as on a disc), you'll need a drum gauge to check for taper or out-of-round. Or ask a machine shop to measure it for you, as the typical shop will do it for free or a nominal charge. Linings that are worn unevenly are a tip-off to a drum that should be measured. Also check for broken springs, or springs that show obvious signs of weakness by allowing shoes to move easily.

Invest in a good torque wrench, keep it in the trunk and use it to tighten the lug nuts instead of the lug wrench when you have a flat. You should enjoy smooth moderate stops for the life of the car.



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## How It Works: Tire Imbalance

Tire imbalance, per se, shouldn't cause a pulsating brake pedal. Brake pedal vibrations are almost always caused by an out-of-true condition somewhere in the braking system. But on rare occasions it can happen. Normally, each tire has to be balanced statically first-i.e., so no part of the tire is heavier and always sinks to the bottom. Then they all need to be balanced dynamically, so the rim doesn't wobble at higher speeds. Any imbalances from either of these conditions normally will manifest themselves as steering-wheel vibration, not brake pedal vibration. Even a tire with a high or low spot will normally be felt through the wheel.


But once in a great while you'll find a tire that has inconsistent stiffness. Some parts of the tire's sidewall will be more or less easy to deflect under load than others. This won't show up on the wheel balancer, but will make a brake pedal pulsate at a rate proportional to your road speed. The diagnosis is to swap for a different tire and see if the problem goes away.

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