Rotor Service:

More Than Just Machining

By Tony Lux

Machining rotors. You've done it more times than you can count. Besides, you take pride in your work and want it to be complete. So whenever you replace brake pads, you install fresh hardware and resurface the rotors. It's kept your customers happy for years. So nothing's changed, right?

Wrong! Several engineering modifications over time have affected rotor servicing. And because the parts look much the same as they used to, doing things the old way is tempting. Unfortunately, some rotor-servicing techniques have changed, and rotor-related problems are now a major cause of comebacks. Improper rotor machining and installation techniques can result in rapid pad wear, pulls, pedal pulsation, noise, reduced brake effectiveness / hard pedal and unhappy customers. Need any more reasons to keep reading?

Machine or Not?

Many of us automatically throw any rotor we're going to install – new or used – on the lathe. The reasoning is straightforward: fresh working surfaces. Often, though, we're better off not machining a rotor. For one thing, we'll leave more metal in place, and the thicker the rotor, the longer its potential service life and the better it handles heat.

And that's not the only advantage of not machining new rotors. The better-quality rotors work well right out of the box. Installing them as is (after cleaning) saves you time.

Measure rotor thickness at several points with a micrometer, and replace the rotor if any reading is at or below the "discard" specification. If all readings are above "discard" but thickness varies more than 0.005 inch, resurfacing is needed to prevent pulsation.

More important, though, fresh working surfaces on used rotors may be good, but they're not always best. A major benefit of reusing *certain* used rotors – without resurfacing them – is their well-conditioned working surfaces. As you know, many modern disc-brake pads need an initial break-in. During break-in, some pad material transfers to the surfaces of the rotor, improving its ability to be gripped by the pads. Machining the rotor removes that conditioned surface. This means conditioning is needed again before the brake achieves maximum effectiveness. Meanwhile, the customer may have to step on the pedal harder than before to get the stopping power that's expected.

So, you should prize the unmachined working surfaces of certain used rotors, because they're already broken in. Of course, the trick is knowing which rotors to re-use as is, which to resurface and which to replace – otherwise, you may not be satisfied with the results of your work. The selection process should begin during your inspection of the vehicle.

First Things First

Be on the lookout for noises, pulls or pedal pulsation when test-driving any car or truck. If the pads need replacement but your test drive revealed no symptoms of brake problems, the rotors may be candidates for re-use as is. Of course, before you can re-use any rotor, it must be free from heat cracks or hard spots and must meet minimum factory specifications. Measure thickness with a micrometer at several points around the "clock face" of the rotor. If all readings are above "discard" but thickness varies more than 0.005 inch, resurfacing is needed to prevent pulsation.

Runout Readings and Indexing

Resurfacing also may cure excessive lateral runout (check specifications for the vehicle), but first be sure the runout is genuine. With hubless rotors, runout may be caused by foreign material between the hub and rotor. Metal chips, rust flakes etc. may lodge there if the rotor flinches as you remove the wheel. If runout is excessive and you suspect a false reading, mark the hub and rotor for reassembly, then remove the rotor, clean the mating surfaces and re-install the rotor with at least two lug nuts holding it against the hub (if necessary, place washers between the lug nuts and the rotor to be sure the rotor is held snugly against the hub). Recheck for accuracy.

If the reading is still excessive, don't condemn the rotor before re-indexing it:

Remove it, rotate it to the next position where it fits, put the nuts back and check again. You may find a position at which runout drops to within specs.

Deciding Factors for Resurfacing

If a rotor doesn't have heat cracks or hard spots, meets specifications for runout and minimum thickness, is not scored more than 0.060 inch and isn't rust pitted, it may be a candidate for re-use without resurfacing. However, there is one situation in which machining a rotor that passes all the tests is desirable: when its partner on a front axle needs resurfacing or replacement. This is because pads grip an "as-is" rotor better than one with smooth, freshly machined surfaces. As a result, if only one rotor has a new surface, the brakes may pull toward the "as-is" rotor until both sides are broken in.

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'Think Smooth'

The formulas used in making brake pads have changed over the years. Modern friction formulations work best with smoother rotor surfaces than many of us are used to. Without a smooth surface, noisy brakes, rapid pad wear and comebacks are likely.

Using a sharp cutting tool on your lathe is vital. Use the procedure your lathe manufacturer recommends for providing the smoothest possible cut your lathe can deliver. Then make it even smoother.

The final finish you need is non-directional. It may be provided by either your lathe's "swirl" attachment or a rotary sander. Use 120-grit aluminum-oxide paper for about a minute on each side. You want a surface finish of 10 to 50 RA (roughness average). Machine-shop supply houses sell low-priced plastic "surface comparators" to help you determine when your surface finish is in this range.

Microscopic metal particles can remain on the rotor surface after machining and sanding. If left there, they'll embed in the pads, possibly causing noise and/or rapid rotor wear. Wash freshly resurfaced rotors with hot water and detergent, which lifts the particles off and floats them away. Rinse and then dry them with either compressed air or paper towels. (Avoid cloth towels. Even if washed, they may contain residue if they've ever been in contact with oil.)

Final Installation

You have new pads and fresh hardware with either new, quality rotors, expertly resurfaced rotors or a matched pair of finely conditioned, unresurfaced rotors. So what's left? A final runout check (for hubless rotors) and lug-nut torque. Both help prevent pedal-pulsation comebacks.

If you've had to remove a hubless rotor, check for runout with a dial indicator before re-installing the caliper. As you did before disassembly, use at least two lug nuts to hold the rotor in place while checking; re-index if necessary.

One thing hasn't changed in years: The most-careful rotor care in the world can be torpedoed by an impact wrench. Runout and rotor-thickness variations often result from excessive or uneven lug-nut torque loads and the heating and cooling of rotors that naturally result from using the brakes. Prevent these problems by running lug nuts down hand tight, then torquing to factory specifications. After all your hard work, nothing is more frustrating than a comeback that resulted from "torquing" the lug nuts with an air gun. UD

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