Brake Rotor Installation Tips

To assure pulsation free performance over the life of your brakes

Almost every case of brake pulsation issues are due to uneven brake pad friction transfer to the surface of the rotor. This causes a Disc Thickness Variation which changes the distance between the pads at least twice per rotor revolution during a brake application. This results in pressure surges feeding back to the master cylinder, and ultimately, an annoying pedal vibration or pulsation.

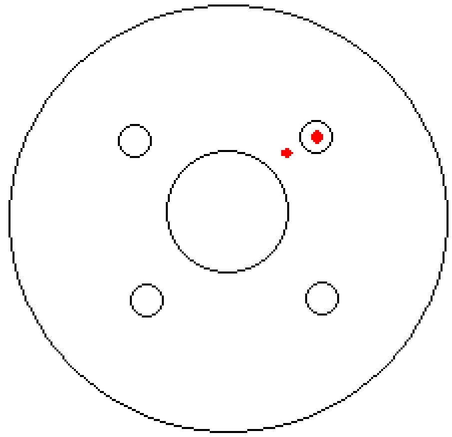
There are several very commonly overlooked steps that can eliminate almost all pulsation issues.

Installed Rotor Lateral Runout. It is important that when new rotors are installed or machined rotors reinstalled on a vehicle, a dial indicator is used to verify that the lateral runout is within factory specification for the particular model of vehicle. OEM maximum lateral runout specifications generally range anywhere from 0.0012” to 0.0025” measured ¼” in from the outer diameter of the brake rotor. Obviously, ZERO is the ideal number, so regardless of the OEM maximum allowance for runout, the closer to ZERO, the better.

It is very rare to see a new rotor with more than .001” of runout out of the box. Most excessive runout conditions on floating or behind-the-hub rotor applications are due to either damaged or worn hubs, lack of cleanliness of the hub and rotor mating surfaces, or uneven/improper wheel fastener torque.

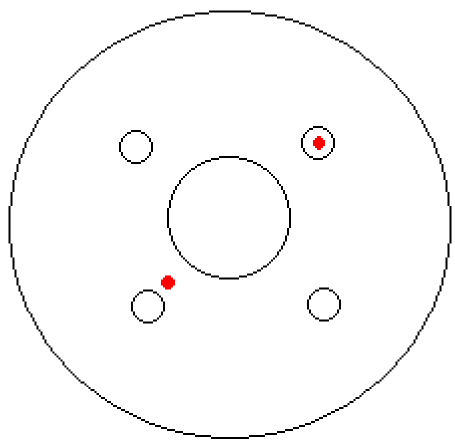
When excessive runout is measured in a newly installed rotor, follow these steps to determine the cause and correct the condition.

- Confirm that the hub and rotor mating surfaces are clean and free of any rust, dust, or other debris, install the rotor onto the hub, and mark the initial position with a paint mark on a lug stud and next to the corresponding lug hole.



- Measure rotor runout, recording the ZERO location and the high spot location, as well the amount of runout on the surface of the rotor with a marker.

- Next, remove the rotor and install in a different position on the hub:



Measure runout and record results once again. If the results from both measurements match in both location and amount of runout measured, then excessive runout exists in the rotor itself, and the rotor requires either replacement or machining.

- If the results from both tests are marked in different locations on the rotor, then runout exists in the hub. If this is the case, cleanliness of mating surfaces should be confirmed once again, and then hub runout measured to confirm previous results. Any measurable hub runout requires hub replacement or a more short term solution of machining the disc on the hub using an on-car lathe. An on-car lathe with yield a finished product that compensates for any hub runout and if done correctly, will result in a rotor with ZERO installed runout when mounted to the hub in the same position in which it was machined. Any hub runout will show up as a considerably higher number when measured at the edge of the rotor….the larger the rotor, the greater the increase in measured runout.

- Minor runout conditions can sometimes be corrected by installing the rotor in different locations on the hub…if a minor runout condition exists in both the hub and the rotor, they can usually be “clocked” to counteract each other so that runout measured while the rotor is installed meets the factory specification.

- Uneven wheel torque can distort and actually warp the rotor, creating runout. Make sure to use a torque wrench when installing lugs.

- In more corrosive environments, even the most perfect brake job can go bad as rust develops between the hub and rotor over the course of the service life of the parts. Any rust development may “jack” the rotor away from the hub, creating runout. To resist situations like this, a high temperature grease or even paint can be applied to the mating surfaces before installation to act a sealer to delay corrosion.

Uneven Brake Pad Friction Transfer:

To function properly, modern brake pad formulas require a short bed-in to condition the brake rotor so that the system operates as designed. Conditioning the brake rotor or “bed-in” consists of heat cycling the pads and rotor in a controlled manner to form a thin and uniform layer of brake pad friction material on the rotor surface. This is the “transfer layer”. When the brake pads are pressed against this layer of the same friction material on the rotor, bonds in the materials are broken and reformed converting the kinetic energy in the vehicle to heat energy to slow or stop the wheel.

When a brake pad is operated outside of the temperature range for which it was designed, friction material transfer can become uncontrollable and occur in an uneven manner on the brake rotor. Additionally, since the transfer layer is constantly breaking down and renewing itself, runout in the rotor can cause the transfer to become uneven in thickness, causing a pedal pulsation. When a rotor has runout, there will be a relative “high spot” on each side of the rotor. These high spots will contact the pads at higher pressures than the rest of the rotor, and after the brakes are released, may contact the pads several times before the pads are able to retract while the pads are not contacting the “low spots”.

These high spots will eventually develop a transfer layer that differs in thickness from the transfer layer on other parts of the rotor, making the high spots not only high, but also thicker than other parts of the rotor. This will cause a change in distance between the pads while the brakes are applied, resulting in a pedal pulsation.

Additionally, if the brake pads are operating at the top of their designed temperature range or outside of their designed temperature range, and the driver comes to a complete stop and remains there with pedal pressure applied, excessive friction transfer can take place where the rotor came to rest between the pads, making it slightly thicker than the rest of the rotor and causing a pedal pulsation.