Tire Vibrations

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Balancing is required when tires are mounted on wheels. This includes installing a new set of tires on your vehicle as well as tires that have been dismounted for repair such as patching a flat.

Balancing provides a smoother ride by evening out rotational forces that can produce tire bounce as the tire spins at high sped. Balancing extends tire life and also helps improve traction, steering control and safety. But no matter how carefully the tires are balanced, they will eventually lose their balance as the tread wears over time. Tread wear can change the distribution of weight around the circumference of the tire, altering the balance of the tire and wheel assembly. Eventually the tire may have to be rebalanced because only 1/4 ounce of imbalance can produce a noticeable vibration.

Symptoms of Tire Imbalance

An out-of-balance tire and wheel will typically create a vibration or shake that becomes progressively worse as the vehicle speed increases. The speed at which the vibration first becomes apparent will vary depending on the size and weight of the tires and wheels, the size and weight of the vehicle, the sensitivity of the steering and suspension and the amount of imbalance, but usually starts at 40 to 50 mph and increases in intensity as the speed goes up.

NOTE: Low profile tires (those with an aspect ratio of 50, 40 or even 30) have shorter, stiffer sidewalls and tend to be much more sensitive to balance issues than tires with taller sidewals and higher aspect ratios (60 or above).

Tire/wheel balance problems will typically produce vibrations that are proportional to speed. In other words, the vibration will get progressively worse as the speed increases. You might not feel it at all at speeds below 40 or 50 mph, but at higher speeds you will feel the vibration in the steering and chassis.

Causes of tire imbalance and vibration include improperly balancing the tires when they were installed or mounted, loss of a wheel weight, uneven tread wear on a tire, or a tire or wheel manufacturing defect (out-of-round with excessive radial runout).

Clamp-on tire weights that are not properly mounted may come loose and create an imbalance that causes a vibration.
Wheel balance weights that stick on the inside face of the wheel can also come loose if the adhesive loses its grip.

Tire/Wheel Balance Diagnosis

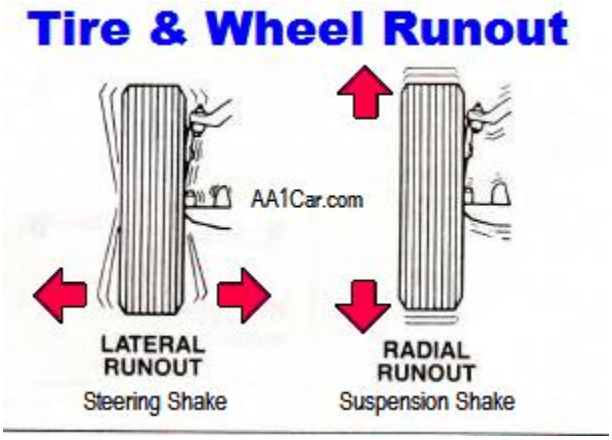
If you have a tire/wheel vibration problem, take your vehicle to a tire dealer or repair facility that has a tire balancing machine. Have them check the balance of all four wheels and tires, and have any wheels that are out-of-balance rebalanced as needed.

It is also important to remember that speed-sensitive vibrations can also be caused by radial (vertical) or lateral (sideways) runout in a tire, wheel or hub. Loose, worn or damaged wheel bearings as well as certain kinds of tread wear can also cause vibrations. So too can an out-of-balance or out-of-phase rear-wheel-drive driveshaft (FWD shafts usually do not rotate fast enough to cause vibration problems.)

When troubleshooting the cause of a speed-sensitive vibration, start by inspecting the tires and wheels. Look for evidence of missing weights, mud or dirt packed in the back of the rim or debris embedded in the tread that could create an imbalance.

On front-wheel-drive cars and minivans with independent rear suspensions, as well as many all-wheel drive cars and SUVs, excessive flex or wear in the rear control arm bushings can allow changes in rear toe alignment that produces an uneven sawtooth wear pattern on the rear tires. The uneven tread surface, which you can usually feel by rubbing your hand one way across the tread, then rubbing the other way, will produce a humming noise as well as a vibration at speed. Rotating the tires in an X-pattern so they rotate in the opposite direction may help reduce the noise/vibration after a few thousand miles. However, you will likely need to replace the worn tires as well as the rear control arm bushings. The rear suspension must also be realigned to restore proper rear toe alignment.

Pay close attention to the amount of wear on the tread. If the tires are more than 50 percent worn, chances are they have not been rebalanced since they were new. Be sure to measure tread depth at several points around the circumference of the tire. This will tell you if the tread is wearing evenly and if the depth is equal. A difference of more than about 1/16 inch would indicate an out-of-round condition.



Radial or Lateral Runout can cause tire vibrations

Tire/Wheel Runout Can Cause Vibrations

Most tires should probably have less than .050 inch of radial runout, and some even less depending on how sensitive the vehicle's steering and suspension (and driver) are to vibration. Low profile tires are more sensitive to runout and balance issues than tires with aspect ratios over 50. Larger diameter wheels (18 inches and larger) also tend to be more sensitive to runout issues.

Runout problems can often be corrected by "match-mounting" the tire on the wheel (rotating the tire so the tire high spot is over the rim low spot). Also, rotate and wiggle each wheel by hand to check for excessive play or noise from the wheel bearings.

Tires can sometimes go out of balance almost immediately if the tire slips (turns) on its rim. This can happen if someone uses a lubricant such as silicone on the tire bead or rim when mounting tires on aluminum alloy wheels. Hard braking or acceleration can cause the tire to rotate on the rim, destroying the original balance.

Tire Force Variation Issues Can Cause Vibrations Too

The relative stiffness or resistance to flexing of a tire sidewall can sometime vary if there is a defect in the tire manufacturing process. This "force variation" can cause the tire to wobble even if it has been perfectly balanced, causing a high speed vibration. Low profile tires are typically much more sensitive to force variations that may cause vibrations.

Diagnosing a force variation issue can be tricky because the tire will show perfect balance on a tire balancing machine. You also can't detect force variation by checking tire roundness with a dial indicator. There has to be a load on the tire as it rotates to detect force variation. Some tire balancing machines have a special roller that can apply a load to the tire as it rotates to detect force variations. If the machine detects a force variation, it will identify the stiffest area of the tire sidewall. In some cases, it may be possible to rotate the tire on the wheel so the stiffest area of the sidewall is over the lowest point on the rim. But in most cases, the only way to eliminate a force variation vibration is to replace the tire with a new one.

A tire with a significant force variation is a tire with a manufacturing defect. Therefore, you may be entitled to a free replacement tire (or a prorated discount depending on tire mileage) under the tire manufacturer's defect warranty.

This Hunter Road Force Elite tire balancing machine uses a roller to detect force

variations in the tire sidewall.

Wheel Balancing Equipment

To accurately balance tires and wheels, an electronic spin balancer that can achieve both static (at rest) and dynamic (in motion) balance should be used. Old fashioned bubble balancers can do a decent job of achieving static balance, but dynamic balance can only be achieved with a spin balancer. This is especially important with today's larger, wider, heavier tire and rim packages and absolutely essential for run-flat tires that have thicker, stiffer sidewalls.

Most balancers today have self-calibrating electronics with accuracy to hundredths of an ounce (or tenths of a gram). Graphical displays also make information easier to read and understand, and reduce the chance of making a mistake. Automatic data entry for wheel width and diameter on some balancers also saves time.

Most balancers today operate at lower speeds. This helps extend motor life and reduces cycle times as well as risk to the operator. Older balancers typically had to spin a wheel fairly fast (about 500 rpm, or the equivalent of 55 to 60 mph) to generate a usable signal. But the more sensitive electronics in newer balancers are able to pick up vibrations at much lower speeds (only 100 rpm, or 10 to 15 mph).

So, the next time you encounter a speed-related vibration, you may have an out-of-balance tire/wheel assembly, too much runout in the tire or wheel, or a force variation issue with the tire itself. Accurate diagnosis is the key to eliminating your tire vibration problem.

WARNING: DO NOT USE OIL, GREASE, ANTI-SEIZE OR LUBRICANTS OF ANY KIND WHEN TIGHTENING LUG NUTS!

Proper torque on lug nuts is very important for three reasons. One is to keep the lug nuts from loosening up and the wheel coming loose, another is to prevent distortion of the brake rotor behind the wheel, and a third is to prevent broken studs. A torque wrench should be used for final tightening of the lug nuts, and the nuts should always be torqued to the recommended specifications.

CAUTION: Torque specifications for lug nuts are always for **CLEAN**and **DRY** studs and lug nuts. That means no oil, no grease, no anti-seize and no lubricants of any kind. Any of these products will reduce the friction between the threads. This may seem like a good thing to prevent rust and frozen lug nuts, but the reduction in friction means a much higher percentage of the applied torque (up to 25% or more) will go toward loading the lug nuts. The end result may be brake rotor distortion or broken studs!

Wheel studs should be cleaned with a wire brush to remove rust and dirt **BEFORE** the wheels are mounted. If the lug nuts are heavily rusted or have damaged threads and won't turn easily on the studs, replace the lug nuts. The same goes for any wheel studs with damaged or badly corroded threads. And remember to mount the wheels DRY with nothing on the threads.

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