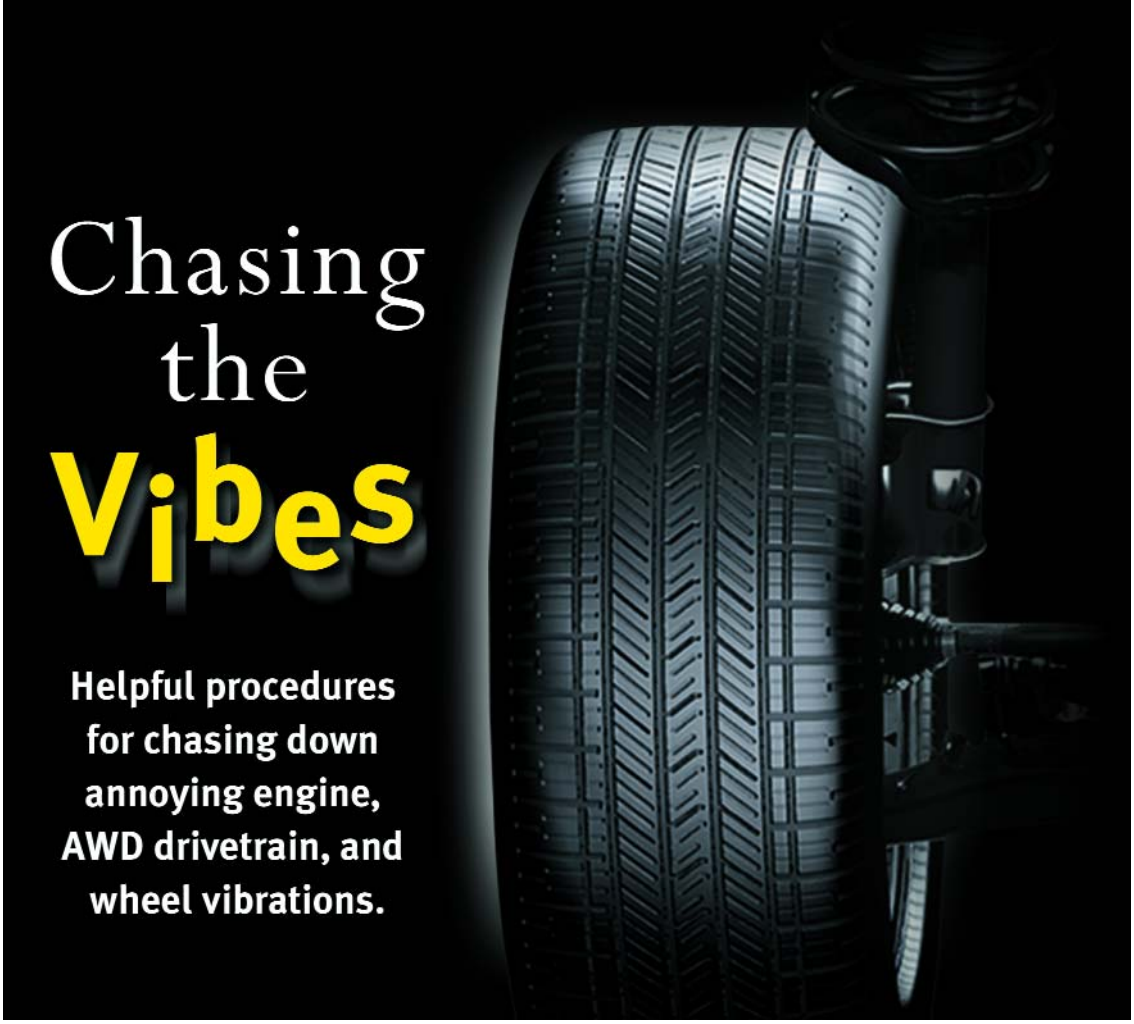
Chasing the Vibes



Helpful procedures for chasing down annoying engine, AWD drivetrain, and wheel vibrations.

Vibrations were an accepted part of motoring in the early days of automobiles. Hard rubber tires mounted on rickety wooden wheels clattered down cobblestone streets and rutted, rock-strewn roads. The bone-jarring bumps and thumps transferred to the passengers' rumps through crude suspension and primitive springs. The rumbling engines also provided a less-than-enjoyable massage to the posteriors of those who chose to endure a trip aboard an early 1900s motorcar.

One hundred years later, modern motorists have come to enjoy the blessings of quiet, comfortable driving. Now, when vibration occurs, it is a sign of trouble. Over the last few decades, advanced engineering has created smoother-operating mechanical components. The elimination of noise, vibration and harshness — known as NVH to engineers — has been a priority for customer satisfaction, vehicle safety and durability.

Still, annoying vibrations may occur in the engine, drivetrain and wheel systems. These pesky "vibes" are an indication of a mechanical malfunction. If not repaired, your customer will certainly not be happy with the vibration and noise, plus the vehicle may end up with a more severe problem.

A Few Things to Remember:

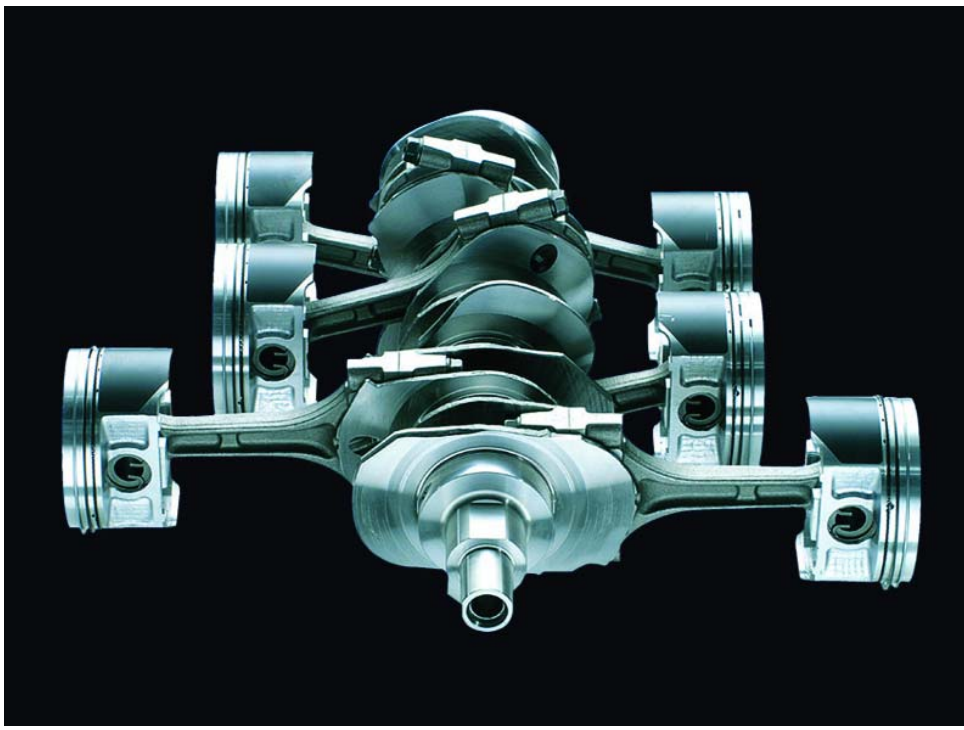
- Any part or component of the vehicle that spins or moves can create vibration. Lack of lubrication, wear or damage are usually the most common culprits here.
- Any part that is loose from its normally fixed mounting can cause vibration. A part that is supposed to be solidly in place can cause noise if it becomes loose.
- Vibration usually creates noise. The friction of two surfaces harshly rubbing against each other when they are not supposed to will normally result in a sound emanating from the agitated source. A loose part or component can create a harmonic vibration and resulting sound.
- Vibration can be happening in one area of the vehicle, yet seem to be coming from another area. Listen from both the inside and outside of the vehicle. If not sure, ask one of the other technicians in your shop to listen also.

Based on these factors, you can approach a vibration complaint with logical steps. Covering all the possibilities that could cause vibrations in all Subaru vehicles would be difficult. However, there are a few guidelines you can follow to help pinpoint the source of the vibration.

Diagnosing Vibrations

Electronic vibration finders and analyzers are available, either in handheld versions (such as the popular Chassis Ear), or as accessories for other diagnostic tools, but can be quite costly. Most repair facilities have at least one automotive stethoscope around. This is an inexpensive device and can be very helpful.

As a preliminary, be sure to check for any diagnostic trouble codes (DTCs) stored in the vehicle's system. If the source of the vibration is not quickly discovered, testdrive the vehicle. Do not be



The compact, horizontally-opposed configuration of Subaru engines is designed to eliminate stress, wear and vibration.

totally convinced that what the customer has perceived to be the exact type of vibration, or where it is emanating from, is actually correct. In fact, it probably isn't. Your experience and training may reveal the real problem.

Engine Shakes

First, take comfort in knowing that Subaru horizontally-opposed "boxer" engines were designed from the ground up to avoid potential vibration. This balanced, even-firing design assures smooth crankshaft revolution that helps avoid vibration problems and results in outstanding engine durability and an extremely low level of NVH.

Traditionally, one of the main sources of engine vibration has been the crankshaft — the central spine of engine operation. Crankshafts rely on oil-bathed bearings to eliminate friction. Older inline and V-configurations used longer crankshafts to accommodate the piston placement and therefore needed more bearings to support the crankshaft. Longer length and the number of bearings required for this length increase the possibility of bearing wear and failure. It used to be commonplace to replace the bearings — and perhaps the crankshaft itself — during an engine overhaul.

The crankshaft in a Subaru engine is short because a 4- or 6-cylinder horizontally-opposed engine has two banks of two or three cylinders rather than a long single row of four or six cylinders, as with in-line or V-block engines. Because the horizontally-opposed engine is arranged symmetrically, the weight is more balanced and the crankshaft does not require extra weight for counterbalance. These two features make the crankshaft both short and light, a significant advantage for any engine part that revolves at such high speeds. The crankshaft is forged from extra-hard chrome molybdenum steel, and the engine is designed with five main bearings to support the crankshaft. This combination produces a strong, durable engine.

If a Subaru vehicle arrives at your shop experiencing engine vibrations, ask the customer if any engine work has been done, recent or not. Any replaced internal engine parts that were not specifically designed for that particular engine may over time create an imbalance or vibration problem and it may not show up immediately. That is why using the correct O.E. part is so important in engine repair. This is even more important if engine performance work, such as the installation of performance pistons, has been done to the vehicle.

Engine Noise Inspection Chart

Type of Sound	Condition	Possible Cause
Regular Clicking Sound	Sound increases as engine speed increases	• Valve mechanism is malfunctioning • Incorrect valve clearance • Worn valve rocker • Worn camshaft • Broken valve spring
Heavy, Dull Clank	Oil pressure is low	• Worn camshaft main bearing • Worn connecting rod bearing (big end)
	Oil pressure is normal	• Damaged engine mounting
High-Pitched Clank (Spark Knock)	Sound is noticeable when accelerating with an overload	• Ignition timing advanced • Accumulation of carbon inside combustion chamber • Wrong spark plug • Improper gasoline
Clank at 1,000 to 2,000 RPM	Sound is reduced when fuel injector connector of noisy cylinder is disconnected*	• Worn camshaft main bearing • Worn bearing at crankshaft end of connecting rod
Knocking at Idle Speed, Warm Engine	Sound is reduced when fuel injector connector of noisy cylinder is disconnected*	• Worn cylinder liner and piston ring • Broken or stuck piston ring • Worn piston pin and hole at piston end of connecting rod
	Sound is not reduced if each fuel injector connector is disconnected in turn*	• Worn cam sprocket • Worn camshaft journal bore in cylinder head assembly
Squeak		• Alternator bearing/bushing
Rubbing Noise		• Worn alternator brush and rotor contact
Gear Scream When Starting		• Worn starter switch • Worn gear and starter pinion
Sound Like Polishing Glass with a Dry Cloth		• Loose drive belt • Worn water pump shaft
Hissing		• Loss of compression • Air leakage in air intake system, hoses, connections or manifolds
Timing Belt Noise		• Loose timing belt • Belt contacting with case/adjacent part
Valve Noise		• Incorrect valve clearance

*When disconnecting the fuel injector connector, the malfunction indicator light (MIL) illuminates and a DTC is stored in ECM memory. Carry out the clear memory mode and inspection mode after reconnecting the fuel injector connector.

Damaged or worn engine mounts can be a mystifying source of vibration. The vibration may seem to be emanating from under the vehicle and be mistakenly diagnosed as suspension, chassis, brake or wheel problems. On high-mileage vehicles, or if the vehicle has been in an accident, be sure to inspect the engine mounts for damage or wear.

The chart on page 16 can be helpful in locating the source of engine noise and vibration.

AWD Drivetrain

Drivetrain vibration can be especially difficult to diagnose. Many times, the problem only appears at cruising speeds of 40 mph or greater. Vibration while cruising may be caused by many things, including propeller shaft problems, front or rear drive shaft maladies, hub unit wear or damage, an unbalanced tire, improper tire inflation pressure, improper wheel alignment, or even aftermarket wheels.

Don't forget to check the propeller shaft connector for excessive play. It can be a source of underbody vibration.

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The chart to the right can help you diagnose drivetrain vibration problems.

Brakes

Vibration and the accompanying noise in the braking system can be a source of customer complaint. The customer may feel that the noise indicates an unsafe braking condition. To maintain your relationship with the customer, always consider the problem as serious and take the time to explain the repair you performed. While brake squeal and pedal pulsation are not as prominent as they were some years ago, they still occur, and fixing them right the first time can make you a hero to your customers. The chart to the right below may be helpful in locating and correcting brake vibration and noise.

Brake vibration and noises are potential customer complaints. Correcting the problem quickly will keep your customers happy.

Drivetrain Vibration Inspection Chart

Symptom	Possible Cause	Corrective Action
Propeller Shaft Noise or Vibration	Center bearing.	• Inspect for wear or damage. • Repair or replace as needed.
	Propeller shaft runout.	• Inspect propeller shaft for wear or damage.
	Loose or free play of connection.	• Inspect joint and connector. • Inspect splines and bearing.
Abnormal Wheel Vibration	Wheel is out of balance.	• Inspect and rebalance as needed.
	Front wheel alignment.	• Inspect and re-align as needed.
	Rear wheel alignment.	• Inspect and re-align as needed.
	Front strut.	• Inspect and test. Repair or replace as needed.
	Rear shock absorber.	• Inspect and replace as needed.
	Front drive shaft.	• Inspect and repair as needed.
	Rear drive shaft.	• Inspect and repair as needed.
	Front hub unit bearing.	• Inspect and replace as needed.
	Rear hub unit bearing.	• Inspect and replace as needed.
Underbody Noise	Wheel is out of balance.	• Inspect and rebalance as needed.
	Front wheel alignment.	• Inspect and re-align as needed.
	Rear wheel alignment.	• Inspect and re-align as needed.
	Front strut.	• Inspect and test. Repair or replace as needed.
	Rear shock absorber.	• Inspect and replace as needed.

Brake Noise Inspection Chart

Symptom	Possible Cause	Corrective Action
Creaking Sound	Hardened or deteriorated lining.	• Replace the shoe assembly or pad.
	Worn lining.	• Replace the shoe assembly or pad.
	Loose back plate or support bolts.	• Retighten.
	Loose wheel bearing.	• Retighten to correct torque.
	Dirty drum or rotor.	• Clean drum or rotor, or clean and reinstall brake assembly.
Hissing Sound	Worn lining	• Replace shoe assembly or pad
	Improperly installed shoe or pad.	• Correct or replace the shoe assembly or pad.
	Loose or bent drum or rotor.	• Retighten or replace.
Clicking Sound	**Disc Brake**	
	Excessively worn pad or support	• Replace pad or support.
	Drum Brake	
	Excessively worn shoe ridge.	• Replace back plate.
	Lack of lubrication on shoe ridge surface and anchor.	• Add more grease.

Wheels and Tires

A wheel/tire assembly that is out of balance will usually cause a wobble or shake that starts at low to medium speed and gets progressively worse as the speed increases, depending on how serious the imbalance is. The cause can be the tire, the wheel, a lost weight, or any combination. It can also be caused by loose lug nuts or improperly inflated tires. If you find a wheel and tire out of balance, check the other tires and re-balance them as needed. Follow all mounting and tightening procedures for the vehicle. While you are checking the wheels, be sure to inspect the hub, bearings and suspension. Finally, check the alignment of the vehicle and correct any mis-alignment.

Be sure to consult the correct Subaru Service Manual. It's available from your Subaru N.E.W. Horizons Dealer, or on the Subaru Technical Information System website at *http://techinfo.subaru.com*.

Wheel and Tire Inspection Chart

Symptom	Possible Cause	Corrective Action
Front Wheel Shimmy	Worn or improperly inflated tire.	• For worn tire, replace the tire. • For improperly inflated tire, adjust the tire air pressure properly.
	Wheel is out of balance.	• Rebalance as needed.
Abnormal Worn Tire	Improperly inflated tire.	• Replace tire.
Sways/Pitches	Worn or improperly inflated tire.	• For worn tire, replace the tire. • For improperly inflated tire, adjust the tire air pressure properly.
Wander/Pulls	Worn or improperly inflated tire.	• For worn tire, replace the tire. • For improperly inflated tire, adjust the tire air pressure properly.