



A Glossary of Air and Emissions Technologies' Terms

Absorption: The mechanism by which acoustic energy is converted into heat by friction in absorptive media. See Pack.

Acoustics: A science that deals with the production, control, transmission, reception and effects of sound.

Airborne: A noise that is transmitted by the atmosphere and can be heard outside the car.

Air Cleaner Housing: The housing that retains the air filter and forces the route of combustion air through the filter medium.

Air Filter: The medium that eliminates the major particulate from the air used in the engine combustion process. Purolator is an air filter supplier. Also called an "air cleaner".

Air Gap: Air gap pipes, including manifolds, comprise a tube within a tube and a gap of generally at least 4 mm in between. Used to reduce thermal inertia for faster catalyst warm up and/or to improve heat and noise insulation.

Air Induction: See Intake System.

Air Meter: A sensor that measures the amount (volume) of air that passes through the intake. Often mounted in the air intake duct.

Air2Air: A customized term referring to the design of the whole air management system, including the induction system, the cold-end exhaust and hot-end exhaust.

The concept is that, if the air management system is designed as a whole, the outcome

will be a more efficient (performance, complexity and cost) air management solution.

ArvinMeritor Gas Noise Simulation (AGNES): A method of predicting exhaust gas flow noise, developed internally by ArvinMeritor.

Attenuate: To lessen or decrease the amount of noise. Primarily used in reference to low-end periods.

Attenuation: A measure of the noise reduction achieved by a given exhaust design.

Automatic Dynamic Analysis of Mechanical Systems (ADAMS Modeling): See Multi-Body Dynamic Modeling.

Backpressure: The total resistance to flow in the exhaust system. Typically, the lower the backpressure, the better the engine performance.

Barrelly: An exhaust system noise that sounds as if the system was dumping into a tank or barrel.

Bean Can: A typical bean can consists of a perforated tube, with or without insulation, enclosed by a concentric outer shell. Used for muffler tuning.

Bellows: A thin metal cylinder with convolutions. It is very flexible and is used as part of flexible tube components.

Blowback: Noise, predominantly high-frequency, that is reflected back to the

automobile from pavement or from automobiles or buildings that are being passed.

Blub-Blub: Usually an intermittent low note occurring at deceleration while driving. Sometimes occurs under acceleration conditions.

Boundary Conditions: The loading and constraints on a component or system. The parameters that can quantify boundary conditions include forces, moments, displacements (or restraints thereof), rotations (or restraints thereof), accelerations, and temperatures, as well as the locations of any of these parameters.

Bracket Creep: Materials that stretch when subjected to a constant load for long periods of time are said to “creep.” The effect significantly increases with temperature.

Braid Liner: Flex tubes for petrol systems have a liner fitted inside to protect the bellows from the effect of very hot gas. Diesel systems operate at a much lower temperature and so do not require a liner.

Brick: See Substrate.

Bright Tip Garnish: Added to the tip of the tailpipe to create a more aesthetically pleasing visual element. Typically chrome-plated or polished stainless steel.

Canning: The process of enclosing a ceramic catalyst or filter into a metal housing.

Cap Ring: Similar to pipe noise, but occurring at muffler caps. See Pipe Noise.

Catalyst: A substance that speeds up the rate of a chemical reaction. An automotive catalyst comprises an inert substrate onto which an active wash coat is added. The wash coat is usually comprised of an alumina base with various additives such as ceria, and the precious metals (platinum, palladium and rhodium) in different ratios according to the application and current metal price. The typical catalyst speeds up the oxidation of

unconverted hydrocarbons and carbon monoxide to water and CO₂. The widely used three-way catalyst also reduces nitrogen oxides (NO_x) to nitrogen.

Catalyst Wall Thickness and Cell Density: Describes the properties of the substrate onto which the catalyst wash coat is deposited. High cell density increases surface area and thereby increases reaction rate. Low wall thickness also increases surface area and reduces pressure drop and heat capacity (thereby aiding “light off”). Usually expressed as 600/3, which is to say, 600 cells per square inch/3 thousandth of an inch wall thickness.

Catalytic Converter: The complete unit, including catalyst wash coat, catalyst substrate, holding medium and outer can. See Catalyst.

Cell Density: Refers to the number of cells per inch in the honeycomb cross section of the catalytic substrate.

Ceramic Catalyst: Uses a ceramic extrusion for the substrate of the catalytic converter. Ceramic substrates are used in most high-volume applications and come in a variety of wall thickness and cell densities. The extrusion can have several cross-sectional profiles, including, round, oval, racetrack and irregular.

Channel Shape: See Profile.

Chickery: A light exhaust noise that sounds like paper rattling.

Chirpy: See Chickery.

Clean: See Smooth.

Close-Coupled Catalyst: A catalytic converter mounted in close proximity to the engine. In some cases there may be a second converter to complete the exhaust emissions conversion.

Coast: See Rundown.

Coke Bottle Hoot: See Hoot.

Cold End: The back half of the exhaust system, comprised of the muffler, resonator, piping and garnish. Sometimes includes a flex tube.

Component Durability Testing: Tests performed on pieces of a system, ranging from entire hot-end or cold-end assemblies to such portions as converters, hangers and joints of pipes to other system elements. The tests can be single-axis or multi-axis, hot or cold, using constant-amplitude loads, block loads or proving ground-based time histories, with load inputs at a single location or multiple locations. The chosen test configuration depends on test objectives and the loading characterization known for the specific subsystem or component.

Computational Fluid Dynamics (CFD): The computer simulation of the movement of fluids that predicts the behavior of exhaust gases in the different components of the exhaust system. The simulation shows speed and location of the flow and predicts pressure losses. CFD is frequently used to provide the optimal shape and path of the exhaust system and to identify the ideal position of lambda sensors.

Computer Assisted Engineering (CAE): The use of computers to simulate real-world conditions to predict operating results. CAE allows the developer to build fewer prototypes, thus streamlining the time to production.

Condensate: A liquid inside muffler boxes. When burned, fuel and air produce water, among other things. This can condense inside a cold exhaust system and become trapped. Other products of combustion can be dissolved in the water. The water is converted to a weak acid, which attacks the metal of the exhaust system. It can be removed from the system by various means.

Conduction: The method by which heat is transferred through solid objects.

Convection: The principal method by which heat is transferred from hot exhaust gas to the exhaust system components.

Conversion Ability: A unit measure of the substrate's capacity of converting pollutants. Used for comparative purposes only. The higher the number, the greater the conversion ability.

Converter: See Catalytic Converter.

Correlation of Full-System Simulation: Full system durability "drive files" (i.e. the test inputs that command the simulator) should be correlated to actual proving ground conditions in a number of comparison steps of simulator results to their proving ground counterparts. These comparison steps include the chassis acceleration and driveline torque inputs compared in the frequency domain and time domain, strains at key locations in the system compared in the frequency domain and time domain, and ultimately calculated fatigue damage at key locations in the system. A time-frequency plot is a tool that allows simultaneous checking of correlation in the frequency domain and time domain.

Corrosion: Reaction of metal with atmospheric elements, such as oxygen or water, which causes oxidation.

Crack: A sharp snapping noise that usually occurs in exhaust systems with mufflers located in a rearward position. The noise normally occurs on quick deceleration in neutral, though in some systems, it occurs under hard acceleration in gear. Sounds like a small piece of sheet metal vibrating.

Crossover: A connecting link between the two banks of a V-type engine exhaust system, either through the engine or between the exhaust components.

Damage-Based Editing: A method of applying fatigue calculations on strain measurements to determine which portions of loading content contribute such minimal projected fatigue damage that they can be

removed from the test, thereby shortening the test.

Decoupler: A much shorter form of flexible tube. An important difference is that flexible tubes are much softer than decouplers. Decouplers can carry load, whereas flexible tubes need hangers very close to both ends.

Design for Manufacturing (DFM): A product development philosophy that takes into account the manufacturing process expertise and limitations. The goal is to design a product that meets the user's requirements, but is also efficient to manufacture with quality and repeatability. The philosophy is also referred to as "simultaneous engineering" and "concurrent engineering."

Diesel Particulate Filter (DPF): A filter in the exhaust system that removes particulate matter from the exhaust. Used on diesel passenger cars and trucks.

Diffusion Length: The distance from the center of a substrate to the active catalytic sites on the substrate walls.

Double Skinned: The skin of a component, usually a muffler, made from two layers of metal. Friction between the two layers reduces vibration and thereby reduces noise.

Down Pipe: The pipe used to route the exhaust flow from the manifold or turbo to the underbody of the vehicle.

Drain Holes: To reduce/eliminate accumulation of condensate in an exhaust system muffler or resonator.

Drive-Away: A method of exhaust evaluation in which one person stands behind the stationary automobile and listens, as another person drives the car away from him.

Drumming: A low-end period that varies in intensity at a constant engine or road speed. Usually descriptive of body noise.

Dual-Mode: A design of muffler whereby muffler-tuning volumes are adjusted internally during operation to optimize attenuation and backpressure.

Duplicate PG Damage: See Correlation of Full-System Simulation.

Emission Simulation Program (ESP): A software program developed in-house by ArvinMeritor that predicts emission levels.

Emissions: The gases generated by the combustion process of the engine. Generally used in reference to legislated pollutants. Typical emissions include Nitrogen Oxide (NOx), Carbon Monoxide (CO) and Hydrocarbons (HC).

End Chambers: Typically, the internal portion of the muffler, between the baffle and cap.

Engine Vibration: An engine contains large numbers of moving components that cause vibration when in operation. Different types of engines produce different vibration levels.

Exhaust: See Emissions.

Exhaust Noise Levels: The total noise generated by the exhaust system.

Exhaust System: The system provides a means to discharge and treat the exhaust gas from the engine. The system encompasses the engine manifold to the tailpipe and is generally comprised of muffler(s), resonator(s), converter(s), tubing, sensors and sometimes a flex joint and/or garnish. The overall goal of the system is to reduce NVH (noise, vibration, and harshness), treat emissions, manage heat and route exhaust gas. In addition, sensors located at key points are used to optimize engine performance and emissions.

Exhaust System FSD Validation: See Full-System Durability Testing.

Exhaust System Response Correlation: See Correlation of Full-System Simulation.

External Noise Reduction: A predicted quantifier of the attenuation of an exhaust system, defined as the noise reduction from source (engine input) and measured tailpipe noise.

Fabricated Manifold: A generic term applied to either tubular manifolds or pressed manifold.

Failure Mode: The way an exhaust system fails to perform function or meet requirements, such as breakage, too noisy, leaks, etc.

Fatigue-Based Editing: See Damage-Based Editing.

Finite Element Analysis (FEA): A computer simulation technique using 3D modeled parts that show color mapping of stresses, based on expected conditions in application.

Flexible Tube: A component comprised of a bellows with a braid on the outside and a protective liner on the inside. It is used on exhaust systems to reduce vibration transmitted to the exhaust system from the engine and to reduce the effect of engine rock on the exhaust system.

Flow Noise: A component of tailpipe noise. Noise generated by gas flowing through the exhaust system. Turbulence related.

Free Kick: Quick acceleration and deceleration at standstill with transmission in neutral.

Full-System, Full-Service Supplier (FSFSS): The philosophy of the supplier providing a solution based on a set of performance standards supplied by the customer. The supplier would develop, test and validate the design. This would include designing with computer-aided simulations, prototyping and validating the design with accelerated testing simulating actual conditions.

Full-System Durability Drive File: Actual road conditions used to program the full-system durability test fixture.

Full-System Durability Testing (FSD): Tests performed on an entire system, usually in a multi-axial, inertially reacted simulation of vehicle motion, usually for rough-road conditions. These tests are typically run at operating temperatures representative of a proving ground or the field. ArvinMeritor has created a tested apparatus that allows an accelerated test of the full exhaust system and air induction system to be testing for durability. The system is programmed using actual road conditions and simulates 100,000 miles in four weeks.

Full-System Rig: See Full-System Durability Testing.

Gap Bulk Density (GBD): The density of the support mat after catalytic converter canning. An indicator of the pressure exerted by the mat.

Gas Rush: See Flow Noise.

Genetic Algorithm: A prediction method used by ArvinMeritor to automatically optimize exhaust design for noise and backpressure.

H-Pipe: A junction where two pipes are joined by a cross pipe. Used on dual exhaust systems to further reduce backpressure.

Hanger: The supporting rod to which the exhaust isolator is attached.

Hanger Force: A measure of vibration input, due to exhaust vibration, to the vehicle body. This is a primary design target for some customers.

Harmonic: Whole number multiples of the fundamental frequency.

Harshness: Related to sharpness, with lower frequencies intermingled with the high frequencies. Has an unpleasant rattling sound.

Heavy: Descriptive of low-end periods that sound deep and resonant – usually below 100 cps.

Helmholtz Resonator: See Resonator.

Helmholtz Theory: A volume that is attached by a conduit of a given length and cross-sectional area will attenuate a given frequency of noise.

High Frequency: A rapid, sharp cracking noise that sounds like small pieces of sheet metal popping and cracking. Also includes “hiss” and “swish” sounds.

Highs: See High Frequency.

Hiss: A high-frequency noise due to high velocity of gas. Sounds like an air or gas leak.

Hoot: A low note, just below the intermediate range, that sounds like a stream of air blown over a Coke bottle.

Hot End: The front part of the exhaust system comprised of the manifold, down pipes and the catalytic converter. May include a flex joint.

Hydrocarbons: Pollutants that result from incomplete combustion of fuel and engine oil.

Individual Noise: An intermediate frequency noise (250-1500 cps) that follows the engine RPM. Sounds like an identifiable explosion going down the exhaust system every time an exhaust valve opens.

Induction: See Intake System.

Induction Noise Levels: The total noise generated by the intake system.

Induction System: See Intake System.

Intake System: The portion of the air system that comprises the air inlet through the throttle body. The air is cleaned of particulate matter and used for engine combustion. Commonly includes the air cleaner body, air filter and ductwork.

Interior Noise Levels: The noise detected by the vehicle occupants. Typically, measurements are taken around the hearing areas of the driver and the front and rear passengers.

Intermediate Pipe: The pipes used to route the exhaust flow between resonators, mufflers and converters.

Intermediates: Noise frequencies above the low-end range or 250-300 cps to 1500 cps. These are usually not affected by volume (Helmholtz resonators) or spit chambers, but are quieted in reversing sections and other devices.

Intumescent Mat: A mat that expands with increased temperature.

Irregular Profile: The shape of a substrate that uses an irregular cross section comprised of radii and straight sides.

Isostatic Strength: A substrate’s ability to withstand compressive forces.

Light Off: The time from a cold engine start to the point of 50-percent pollutant conversion.

Light-Off Converter: A converter close to the manifold that heats up quickly to convert the emissions, especially hydrocarbons at start up.

Listen to Interior Re-synthesized Acoustics (LIRA): A method of re-synthesis of vehicle interior noise for theoretical changes to exhaust tailpipe noise. Developed by ArvinMeritor.

Local Fatigue: There are many instances where structural simulations can be performed at the component level. When fatigue damage accumulates at a rather limited number of places in a system, the analysis is targeted at key areas in order to identify structural characteristics. This analysis is quite computationally intensive and therefore should be limited to the locations where necessary.

Local Load: See Local Fatigue.

Lows: Noise where a period or periods occur in the low-frequency range.

Manifold: The portion of the engine that combines the exhaust gases into one or two final paths from the pistons on the engine.

After the exhaust gases are combined, they are typically routed through catalytic converters and then a combination of resonator(s) and muffler(s). The typical types of manifolds are cast iron, cast stainless, stamped, fabricated bent tubes, and more recently, hydro-formed tubes.

Maniverter: An assembly in which the manifold and converter are one piece.

Mass Flow Sensor (MFS): See Air Meter.

Mat: The material between the brick and housing in a tourniquet-type converter. The material holds the brick or bricks in place and creates a seal, forcing the exhaust to travel through the cells of the substrate.

Mechanical: See Vibration.

Metal Fatigue: Cracks in metal caused by repeated application of loads that are individually too small to cause failure. The susceptibility of steels to metal fatigue varies considerably with chemical composition.

Metallic Catalyst: A metal corrugate for the substrate of the catalytic converter. Metal substrates are better suited for low-volume applications since they have lower capital tooling costs and higher material cost than ceramic substrates. They can only be produced in round and racetrack cross-sectional profiles. Typically, metal catalysts result in lower backpressure.

Metallic Flutter: See Crack.

Mid-Bed Sensors: A sensor placed between the bricks in a two-brick system.

Modal: Relative to the modes of a structure. Every structure exhibits modes that are defined by their shape and their natural frequency. If the structure is excited at a natural frequency, then it responds by vibrating in its corresponding mode shape at an amplified level.

Modulation: The variation in amplitude of a noise signal with time. The presence of modulated noise has a significant effect on sound quality of exhaust tailpipe noise.

Moo: Noise in which a low-end period is drawn out.

Muffler: A device used in the exhaust system to alter or eliminate objectionable frequencies. The muffler disrupts the exhaust flow with a combination of baffles, tubes and passages. The sound is changed with a combination of slots, perforations and fillers, such as glass wool.

Multi-Body Dynamic Modeling: Involves solving the equations of motion for a vehicle, system or component(s) that are assumed to be rigid bodies, flexible bodies or a combination. Determines such behavior as the transformation of inputs at certain locations on the bodies (e.g. a vehicle hitting bumps) into the reactions at other location(s) (e.g. forces at exhaust hangers or moments at an exhaust system joint).

Natural Frequency Dynamometer: In vehicles, the energy from the fuel is used to overcome air resistance and friction. In a test cell, there is no air resistance or friction, so a dynamometer is used to absorb the energy instead. There are several different types. The most common types are eddy current and water brake. The energy absorbed is turned to heat.

Noise: Any sound that is undesired or interferes with one's hearing. In an exhaust system, noise can come from the tailpipe, the surface of the exhaust system (muffler shell, for example), or from the structure of the system transmitted through the hangers.

Noise, Vibration and Harshness (NVH): Terminology describing the sound characteristics of an exhaust system or vehicle.

Noise Transfer Function: A measure of the vehicle behavior, which quantifies the relationship between the noise or vibration of a

source (i.e. exhaust system) and the perceived noise in the vehicle cabin.

Non-Intumescent Mat: A mat that does not expand during increased temperatures.

NOx Trap: A device for the absorption and catalytic conversion of nitrogen oxides. Resembles a catalytic converter.

Off-Idle Boom: Same as off-idle period or off-idle low.

Off-Idle Lows: A period that is predominate at a point just above idle RPM. These periods have a booming characteristic and are usually below 60 cps.

Open Sound: See Barrelly.

Orders: The number of events (usually noise or vibration pulsations) per revolution of the engine. This results in a frequency that changes with engine RPM.

Oval Profile: The shape of a substrate that uses a cross section comprised of four radii with no straight sides.

Overall noise: The total noise energy of a sound. That is, the sum of energy within all measured frequency bands.

Over-Run: A low note that resonates as the engine is decelerated with the car at a standstill.

Over-Run Fluff: See Pop Back.

Overtone: The second or higher harmonic of a fundamental tone.

Oxidation: A specific form of corrosion in which the metal reacts with oxygen present in the atmosphere to form a thin layer of metal oxide on the outer surface of the metal. This film is brittle and cracks easily under vibration or thermal loads, exposing fresh metal underneath.

Pack: A volume of absorptive material, usually fibrous, which is inserted into mufflers to absorb high-frequency noise.

Particulate Matter: Material emitted from the exhaust that is in the solid phase, after cooling to ambient temperature and diluting with air. Typically comprised of high carbon-content material ("soot"), a soluble oil fraction and sulphate.

Peak Mat Pressure: The maximum force sustained on the perimeter of the mat from the tourniquet process/canning.

Period: An audible note, loud enough to be distinguishable from background noise, usually in the lower frequency ranges up to 250 cps. Periods can be caused by the exhaust system, air induction system or other automotive components.

Pipe Noise: A pinging noise due to gas impinging on the walls of pipe or from the transmittal of high-frequency noise through walls of pipe before entry into muffler.

Pop Back: An intermittent low note that occurs during quick deceleration with transmission in neutral. Sounds like a period excited by rush of gas back into the exhaust system.

Power Spectral Density (PSD): A plot of an input or response variable squared, divided by frequency (vs. frequency). Examples of variables of interest include acceleration and strain/stress. PSD is one of several ways to output the results of spectral analysis. Other ways include ASD (amplitude spectral density), ESD (energy spectral density), and FFT (fast Fourier transform). The objective of spectral analysis is to determine the frequencies at which the input or response is most significant.

Precious Metals: Used to coat the substrate during the wash-coat process. Precious metals are the key components that catalyze the chemical reaction to convert pollutants from the engine (nitrogen oxide, carbon monoxide and hydrocarbons). The typical metals that are used are palladium, platinum and rhodium.

They are deposited within an alumina-based wash coat.

Predictive Analysis: Testing through the use of computer simulation to predict the outcome in actual application. Predictive analysis is not an exact science, but is continually improved to narrow the gap between predictive behavior and real-world results.

Predictive Model Improvement: The refinement of a simulation model to predict real-world conditions. Predictive modeling strives to simulate real-world conditions through computer simulations, with constant comparisons to refine and improve the accuracy of the simulation.

Pressed Manifold: A manifold made from pressed steel.

Profile: Refers to the cross-sectional shape of the substrate.

Pulsating Flow: The opening and closing of the valves in rapid succession creates a rhythm due to the changes in the pressure of the exhaust flow. The closer the valves are to the engine, the more likely there will be a pulsating flow in the exhaust. The further away from the engine, the more the exhaust stream evens out into a smooth, continuous flow.

Putt-Putt: A noise that sound like a muffled, small one-cylinder engine. Usually heard at low engine speeds or idle. It may sound like a loose baffle rattling or individual “rapping” on acceleration or deceleration.

QED: A method developed by ArvinMeritor to optimize exhaust designs using genetic algorithms.

Quarter-Wave Tuner: Consists of a small tube that is attached to an exhaust system. It has the pipe length of the quarter wave and is terminated at the other end. The attenuation varies with the pipe diameter and length. Placing a drain hole at the terminated end may broaden the tuning.

Quinkie Tube: Much like the quarter wave tuner, except it is attached at the problem frequency quarter wave and terminates downstream at a length that will phase out the problem frequency – one-half wave longer or any odd multiple of the one-half wave.

Racetrack Profile: The shape of a substrate using a cross section comprised of two straight sides connected by two 180-degree radii.

Radiated noise: Applied to exhaust systems, this is a measure of noise emanating from a surface of a component, such as a muffler or catalyst, due to the vibration of its surface. Also called “shell noise”.

Radiation: The principal method whereby heat is transferred from very hot exhaust components to surrounding objects or other components.

Rap: A modulation of several frequency bands at approximately the same dB level at the same frequency. This can emanate in lower frequency as what is called “individual beat” or “motor boat” characteristic at the higher frequency.

Rasp: A metallic noise consisting of intermittent high-frequency noise. Often associated with single-muffler exhaust systems and caused by nonlinear acoustic behavior resulting in pressure-wave steepening.

Raspy: A high-frequency noise similar to spit, but more frequent.

Real-Time Pressure Mapping Equipment: A patented system developed by ArvinMeritor and used in the production of converters, using the tourniquet process. There is a very narrow operating window between adequate holding pressure at high temperature and the required pressure during assembly. The system utilizes two hydraulically controlled actuators to ensure full 360-degree application of pressure onto the converter assembly.

Rebound: See Blowback.

Resonance: Noise or vibration behavior at a more or less constant frequency, due to acoustic standing waves or mechanical vibration modes.

Resonant Frequency: A frequency, usually low, that excites the exhaust system, causing a period to stand out over surrounding noise.

Resonator: Typically a Helmholtz resonator built into a muffler. The design typically has a larger tube encompassing a smaller tube, creating a closed volume around the smaller tube. The wall of the smaller tube has perforations that allow frequencies into the cross-sectional area, which is usually filled with glass wool or stainless steel wrap. Also used to describe a small muffler.

Reversing Section: The section of the muffler in which the gas enters, reverses through a tube or holes and then exits through another tube or set of holes.

Rig Test: A test performed on a rig, usually using a hydraulic ram to apply an oscillating load to a component. Rig tests can be run hot or cold. Hot gas can be supplied by gas-fired burner or by a slave engine.

Rigid Body: A mode of the structure where the element moves rigidly. There is no relative movement between the points of this element. Movement only occurs between the element and the rest of the structure. For example, the exhaust system on a car moves rigidly as a whole.

Road Excitation: See Correlation of Full-System Simulation.

Road Load: Loads applied to the exhaust system originating from the road surface.

Rosette: A special type of strain gauge from which the data can be taken to calculate principal stresses/strains. The data can also be used to determine the extent to which the stress/strain state at a given location on the system is uni-axial or multi-axial.

Roughness: See Harshness.

Round Profile: The shape of a substrate that uses a round cross section.

Rubber Isolators: Used as a way of eliminating vibration between the muffler hanger brackets and under-body hanger brackets.

Rundown: A low note that resonates as the automobile decelerates.

Selective Catalytic Reduction (SCR): A process for removing Nox, by reducing with a reductant such as ammonia over a catalyst. Being developed for commercial vehicle exhaust treatment in Europe.

Separation Rings: Used in two-brick systems to separate the bricks. Usually, allows a sensor (mid-bed sensors) to be placed between the two bricks' separation rings.

Sharpness: A noise that is noticeable when listening to the tailpipe, with the characteristic of gas rushing over sharp edges. Frequency range would be above 250 cps.

Shell Noise: Similar to pipe noise, but occurring in the muffler through the shell.

Shift Point: The point at which automatic transmissions shift and cause a rapid change in engine RPM and a resulting surge of noise through the exhaust system.

Silky: See Smooth.

Single-Skinned: Skin made of one layer.

Siphons: See Drain Holes.

Smooth: The description of an exhaust system whose overall noise level is low and has no outstanding or distinguishable periods or characteristics.

Snarly: Related to harshness, but more pronounced at only certain frequencies or

when the accelerator is operated up and down in a certain range.

Snorty: Related to snarly, but more pronounced at certain frequencies than others and usually at lower frequencies than snarly.

Sound Quality: Describes the quality of noise rather than just level. Sound quality is an advancing science by which perceptions of noise can be quantified and converted into objective targets.

Spit: An intermittent, high-frequency noise.

Spit Chamber: A part of a muffler. Usually a tubular resonator closed down at the end around a perforated or slotted tube. This attenuates high- and some intermediate-frequency noises.

Stainless Steel: Steel with chromium and nickel to improve resistance to corrosion. There are many different types of stainless steel available.

Standard Wall Catalyst: Catalyst substrate with less than .008" of wall thickness (.0055 to .008"). Usually with low cell density (350 to 400 cells per square inch).

Substrate: Refers to the catalytic structure comprised of either ceramic honeycomb or metallic honeycomb. The substrate is coated with a solution of precious metals to provide a chemical reaction.

Substrate Density: Refers to the number of cells per inch in the honeycomb cross section of the catalytic substrate.

Substrate Strength: The strength or ability of a brick/substrate to withstand failure when subjected to the pressure of canning or a tourniquet process.

Substrate Volume: The overall size of the substrate, measured in liters or in cubic inches.

Suck Back: See Pop Back.

Swish: See Hiss.

System Boundary Conditions: The conditions at the boundaries of the system. For the full exhaust system, they are the isolators and the engine or the decoupler.

Tailpipe: The pipe exiting the rear of the muffler and typically visible from the rear of the vehicle.

Tailpipe Noise: Noise radiated from the tailpipe orifice, consisting of a combination of order noise (derived from engine pressure pulsations) and flow noise (from turbulence caused by gas flow through the system). This is a significant design target that drives the overall design of the exhaust system and determines the muffler volumes required.

Take Away: See Drive-Away.

Teary: See Raspy.

Thin-Wall Catalyst: A catalyst substrate with less than .005" of wall thickness (.0045"). Usually with medium cell density (400 to 600 cells per square inch).

Time-Frequency Plot: A 3D plot that allows simultaneous visualization of the time domain and frequency domain contents of a signal. The two horizontal axes are time and frequency, and the vertical axis is the magnitude of the observed signal. The plot might be two-dimensional, in which case the two axes are time and frequency. A scale of colors represents the magnitude. See also Correlation of Full-System Simulation.

Timet: Company that is the world's largest titanium producer and distributor. See also Titanium.

Titanium: A metal used largely in the aerospace industry for its high strength-to-weight ratio and corrosion resistance. ArvinMeritor is the first manufacturer to use titanium in a mass-produced exhaust system, which was introduced on the Corvette Z06.

Torca Joint: An inexpensive way of attaching two parts of an exhaust together. It consists of a clamp wrapped around the joint and tightened by a bolt.

Tourniquet Process: A technique for housing a substrate/brick by wrapping sheet metal around the outside of the brick. The brick is first wrapped with a mat, and then the sheet metal is wrapped around the outside and closed by rolling the leading edge with the trailing edge. Benefits of this process are low-cost tooling and even, repeatable pressure to retain and seal brick(s). The process is ideal for thin and ultra-thin catalyst substrates with low isostatic strength and for low volume applications. Suitable for two brick systems.

Tourniquet Wrap: See Tourniquet Process.

Transfer Path Analysis: An experimental method available from ArvinMeritor that quantifies the contribution of noise and vibration sources to vehicle interior noise. This method relies on measurement of noise-transfer functions.

Transmission Loss: A measured or predicted quantifier of exhaust attenuation under certain ideal conditions. Often used to characterize muffler designs and to correlate prediction methods.

Two-Brick Systems: A converter comprised of two substrates of the same profile, mounted in line.

Ultra-Thin Wall Catalyst: A catalyst with less than 0.004" of wall thickness (.0025" to .0035"). Usually with high cell density (600 to 900 cells per square inch).

Under-Body Converter: A converter located under the car and away from the manifold, typically after the down pipe.

Under-Body Hanger Brackets: Brackets off the underside of the vehicle used to suspend the muffler system.

Under-Body Heat Shield: A heat shield attached to underside of the car to prevent high temperatures from being radiated onto the underbody.

Usage Profile: The way in which vehicles are driven in the "real" world. Different vehicles will have different usage profiles, as they will be used for different purposes. This can be significant, as it affects the loads and environment to which the exhaust is subjected.

Vehicle Mapping: Acquisition of data on a vehicle in the field or on a proving ground, using many types of sensors (accelerometers, strain gages, thermocouples, engine parameter measurements, etc.), in order to characterize our systems' operating environment and response to that environment.

Vibration: A vibration in the vehicle or exhaust system, which can be sensed physically and is airborne. It may resonate the exhaust system period.

Vibration Heat-Affected Zone: The area immediately surrounding a weld that has been damaged by the extreme heat of the welding process. The damage usually affects the resistance to corrosion and fatigue.

Visco-Elastic: Support mat stiffness is dependent upon the rate of compression. The faster the compression, the greater the stiffness. The support mat continues to relax (reduce in pressure) after manufacture of the converter assembly is complete.

Wash Coat: Catalytic material applied to the substrate, either prior to the precious metals or at the same time as the precious metals. The wash coat has some catalytic activity and increases the dispersion (surface area) of the precious metal components to achieve high catalytic activity and stability.

Whistle: A very high-frequency continuous note that occurs at quick deceleration and or acceleration with transmission in neutral.

Usually caused by using too wide slots in slotted tubing or by breaks in gas passage tubing.

Wire-Mesh: Steel wire knitted together to make seals and spacers to guarantee an air gap.

Y-Pipe: A junction where two pipes come together and join into one.