



[Home](#), [Auto Repair Library](#), [Auto Parts](#), [Accessories](#), [Tools](#), [Manuals & Books](#), [Car BLOG](#), [Links](#), [Index](#)

AUTOMOTIVE TECHNICAL TERMS

Copyright AA1Car.com

AAA

Abbreviation for the American Automobile Association. AAA, in conjunction with various local motor clubs, often certifies various repair facilities. The approved facilities must meet certain minimum standards of service to be listed in the local AAA directory.

ABS

Acronym for "Anti-lock Brake System." Vehicles equipped with ABS use wheel speed sensors and a computer-controlled brake pressure regulator to prevent wheel lock-up during sudden stops. When the computer senses one wheel is slowing faster than the others (indicating it is about to lock-up and skid), the computer reduces brake pressure to that wheel by momentarily isolating brake pressure, releasing pressure then reapplying pressure in rapid sequence. This allows the wheel to regain traction so the vehicle does not skid. ABS also allows the driver to maintain steering control while braking hard on wet or slick surfaces. ABS improves braking safety on wet or slick surfaces. For more information about antilock brakes, see [Antilock Brakes](#).

ABS WARNING LIGHT

An indicator light on the instrument panel that warns the driver when there is a problem with the ABS system. When the ignition is first switched on, the ABS warning light should come on and remain on for several seconds for a bulb check. If the light fails to go out or comes on while driving, it signals a potential problem with the ABS system. The ABS system is usually disabled if the ABS warning light is on while driving (this should have no effect on normal braking -- unless the brake warning light is also on). The light is also used for diagnostic purposes when retrieving flash codes (trouble codes) from the ABS module.

ACCUMULATOR-DRYER

A container for receiving refrigerant liquid, vapor and oil from the evaporator. Its primary function is to separate the vapor from the liquid and oil, then release the vapor to the compressor. The accumulator also contains desiccant to absorb moisture.

ACKERMAN PRINCIPLE

The creation of toe-out when turning to minimize tire wear. To create the proper geometry, the steering arms are angled to turn the inside wheel at a sharper angle than the outside wheel. This allows the inside wheel to follow a smaller radius circle than the outside wheel.

ACTIVE SUSPENSIONS

A computerized hydraulic suspension system that uses hydraulic "actuators" instead of conventional springs and shock absorbers to support the vehicle's weight. A "chassis computer" monitors ride height, wheel deflection, body roll and acceleration to control ride and body attitude. Bumps are sensed as they are encountered, causing the computer to vent pressure from the wheel actuator as the wheel floats over the bump. Once the bump has passed, the computer opens a vent that allows hydraulic pressure to extend the actuator back to its original length. The only production active suspension was used on the Infiniti Q45.

AIR CONDITIONING (A/C)

A system that cools and dehumidifies air entering the passenger compartment. The system uses a refrigerant to cool the air and carry heat away from the passenger compartment. Major system components include a compressor, condenser, evaporator, accumulator or receiver/dryer, and orifice tube or expansion valve. Do not intermix different types of refrigerants in an A/C system. Use the type specified by the vehicle manufacturer (R12 for most 1994 & older vehicles, or R134a for most 1995 and newer vehicles). For more information, see [Troubleshooting Air Conditioning Problems](#). Also see [Retrofit](#).

AIR DELIVERY SYSTEM

Also called plenum, HVAC unit or evaporator housing. This component contains the air ducts, doors and blower fan that deliver air through or around the evaporator and heater cores. It then delivers air to various passenger compartment outlets and ducts.

AIR FILTER

A filter used to keep dirty air from entering the engine. The filter element is typically resin impregnated cellulose fibers (paper) with a mixture of synthetic fibers. The filter is located in a housing that is attached to the throttle body, or in a housing that sits atop the carburetor. See [Check Your Air Filter](#)

AIRFLOW SENSOR

A device that is used in many electronic fuel injection systems (See Electronic Fuel Injection) for measuring the volume of air entering the engine. Some use a spring loaded vane while others use a hot wire or heated filament to sense air flow.

AIR/FUEL RATIO

This is the relative proportion of air and fuel delivered by the carburetor or fuel injection to the engine. The "ideal" air/fuel ratio is 14.7 parts of air to every one part fuel. Less air or more fuel and the mixture is said to be rich. More air or less fuel and the mixture is said to be lean. Rich mixtures provide more power but also use more fuel and increase exhaust emissions. Lean mixtures use less fuel, but if too lean cause misfiring at idle. An engine requires a richer mixture when starting (See Choke) and while warming up. The air/fuel ratio at idle can be adjusted by turning the idle mixture screw on the carburetor (See Idle Mixture). To alter the mixture above idle, the main metering jets inside the carburetor must be changed.

With electronic fuel injection, no changes can be made because the mixture is determined by the duration (on time) of the injector(s). The longer the injectors are on, the richer the mixture (See Electronic Fuel Injection). additional information can also be found here: [Engine Air/Fuel Ratios](#).

AIR/FUEL SENSOR

A type of oxygen sensor that reads unburned oxygen concentrations in the exhaust to help the PCM determine the engine's air/fuel ratio. Feedback from the Air/Fuel Sensor allows the PCM to fine tune the air/fuel mixture for optimum performance, emissions and fuel economy. See also Oxygen Sensors. For additional information, see [Wide Band O2 Sensors](#).

AIR INJECTION

Supplies fresh air to the exhaust system, which helps oxidize HC and CO, and, gives the catalytic converter the extra air it needs to oxidize those pollutants. Some vehicles use an air pump while others use an aspirator system to route air into the exhaust.

AIR INLET DOOR

A movable door in the air distribution assembly that allows either passenger compartment or outside air to be delivered to the air conditioning air distribution system.

AIR PUMP

An emission control device on some engines that pumps air into the exhaust system so the catalytic converter can "reburn" pollutants in the exhaust.

AIR SHOCKS

A type of overload shock absorber that can be inflated with air to increase the suspension's load carrying ability.

AIR SPRINGS

Air-filled rubber or elastomer bags that are pressurized to provide support to the suspension. Air springs are used in place of conventional coil springs on some vehicles. Aftermarket air springs can be installed inside coil springs or between the axle and frame to provide additional lift support for handling overloads or towing.

AIR SUSPENSION

A type of suspension that uses air springs instead of conventional steel springs. Computer operated vents on the air springs, suspension sensors and an onboard air compressor allow the system to maintain ride height and vary the suspension's ride characteristics. See [Servicing Air Ride Suspensions](#).

AIR TEMPERATURE SENSOR

This sensor measures the temperature of air in the intake stream or intake manifold. An air temperature value is needed by the PCM to calculate the air/fuel ratio, as air density changes with temperature. The Intake Air Temperature (IAT) sensor is usually mounted in the intake manifold, or incorporated into the mass airflow sensor. See [Air Temperature Sensors](#).

ALCOHOL

Alcohol is used as a gasoline additive to boost the octane rating of the fuel (See Octane and Gasohol) and to oxygenate the fuel (makes it burn cleaner). Two types of alcohol may be used: ethanol or methanol. **Ethanol** is the most commonly used alcohol. It is made by distilling fermented corn, sugar beets or sugar cane. Ethanol is the same kind of grain alcohol that goes into booze. **Methanol** or "Wood Alcohol" is made primarily from coal, and is highly poisonous. Ethanol blend fuels typically have a 10 % ethanol content (E10), although the EPA has also approved the use of E15 (15% ethanol) for use in 2001 and newer vehicles. Methanol blends are limited to 5 percent because methanol can be corrosive in higher concentrations. For more information, see [E85 Ethanol Fuel](#) and [Alternative Fuels](#) and [E15](#).

ALIGNMENT

Although most people think of the front wheels when alignment is mentioned, it actually refers to all four wheels. All four wheels should be perpendicular to the road and parallel to one another for the best handling, traction and tire life. If the wheels are out of alignment, rapid or uneven tire wear, and/or a steering pull to one side can result. Four wheel alignment, as opposed to a basic two wheel alignment, is very important today especially on vehicles with independent rear suspensions and/or front-wheel drive. The three basic alignment angles are toe, camber and caster, but on some new cars caster and camber may not have factory adjustments. For these vehicles, aftermarket alignment kits may provide some adjustment. (See Camber, Caster and Toe). See [Wheel Alignment](#).

ALIGNMENT SHIMS

Metal or plastic spacers used in the alignment process to alter camber, caster and/or toe. On rear-wheel drive applications, shims may be added to or removed from stacks of shims on the front control arms to change camber and/or caster. On front-wheel drive applications, partial shims or full contact shims may be positioned behind the rear axle spindle to vary rear toe and/or camber. Camber shims are also available for 4x4 axle applications. Some shims are adjustable or can be indexed various ways to provide incremental alignment corrections.

ALL-WHEEL DRIVE (AWD)

A vehicle (usually a car) where all four wheels are driven. Most are fulltime systems for year-round driving, and use a viscous fluid coupling center differential instead of a transfer case to route drive torque to all four wheels. This allows the front and rear wheels to turn at slightly different speeds when turning on dry pavement.

ALTERNATOR

The component in a vehicle's charging system that makes electricity. The alternator's job is to keep the battery fully charged, and to provide additional current to meet the demands of the ignition system, lights and other accessories. Vehicles equipped with air conditioning and numerous electrical accessories require an alternator with a higher output capacity than a vehicle without such amenities. Alternator capacities are rated in amps, with typical outputs ranging from 50 to 80 amps. When the alternator or its control device, the "voltage regulator," goes bad, the alternator light on the dash will glow red. If a vehicle has a charge indicator, it will show a continual discharge or low voltage. Without the supply of electricity to keep it charged, the battery soon goes dead. Sometimes a slipping drive belt is all that is wrong but usually the alternator and/or regulator need to be replaced. See [Alternator Testing](#).

AMBIENT AIR

Air outside the vehicle passenger compartment.

AMBIENT AIR TEMPERATURE

The temperature of the air outside the vehicle. The value is measured with an air temperature sensor. See [Air Temperature Sensors](#).

AMBIENT COMPRESSOR SWITCH

Energizes the compressor clutch when ambient air temperature is above 32 degrees F. This switch also prevents compressor clutch engagement at temperatures below 32 degrees F.

ANTIFREEZE

Antifreeze protects the cooling system against both freezing and boiling over. When used at normal strength (50% antifreeze, 50% water), it can lower the freezing point of the coolant to -34 degrees F. and raise its boiling temperature to 276 degrees F. Never use straight antifreeze in a cooling system. Always mix it with at least 50% water. Most antifreeze is 95% ethylene glycol (EG). The only differences between brands of antifreeze are the type and/or quantity of anti-corrosion additives used. Ethylene glycol never wears out but the corrosion inhibitors do. That is why antifreeze should be changed every two years (except for long life antifreeze, which have special additive packages that allow them to go up to 5 years/150,000 miles between changes). For the environmentally concerned, propylene glycol (PG) antifreeze is also available at slightly higher cost. PG antifreeze is less toxic than ethylene glycol. See [Types of Antifreeze](#).

ASE

Abbreviation for the National Institute for Automotive Service Excellence. ASE certifies professional automotive technicians in various areas of repair expertise. A technician who has passed one or more tests is allowed to wear the ASE Blue Seal of Excellence on his uniform, and any repair facility that employs certified mechanics can display the ASE sign. See [ASE website](#).

ASPIRATOR VALVE

A one-way valve attached to the exhaust system of an engine that admits air during periods of vacuum between exhaust pressure pulses. Used to help oxidize HC and CO, and to supply additional air which the catalytic converter may require. Can be used instead of a belt-driven air injection pump in some applications. Called "Pulse-Air" in GM systems.

ASR

Automatic Slip Regulation. See Traction Control.

ATMOSPHERIC PRESSURE

Air pressure at any given altitude: 14.69 psi at sea level. This pressure decreases as altitude increases.

AUTOMATIC TRANSMISSION

A type of transmission that shifts itself. A fluid coupling or torque converter is used instead of a manually operated clutch to connect the transmission to the engine. Newer automatics use electronic controls to regulate shifting and torque converter lockup. See [Automatic Transmission Diagnosis](#).

AUTOMATIC TRANSMISSION FLUID (ATF)

A special kind of oil for use in automatic transmissions. There are several types: Dexron II, Dexron III, Type F, Mercon, Mercon V, Chrysler 7176 and several varieties of Chrysler ATF-Plus. All are "friction-modified" lubricants except Type F. Dexron II and Mercon have similar additive packages as do Dexron III and Mercon V. Even so, use only the type of ATF specified by the vehicle manufacturer. Using the wrong type of ATF can cause transmission problems. If you do not know what type of fluid the transmission takes, READ THE OWNER'S MANUAL! Some dipsticks are also marked as to the type of ATF required. "Universal" ATF fluids are available that supposedly meet the OEM requirements for many friction-modified applications, but make sure the label says it meets the specific vehicle requirements before using. The newer ATFs such as Dexron III and Mercon V are longer lived than earlier ATFs, but can still oxidize if the transmission runs too hot. Trailer towing is especially hard on ATF unless the transmission is equipped with an auxiliary oil cooler. Recommended change interval for older vehicles is every 24,000 to 30,000 miles. For newer vehicles, see the owners manual. See also [Automatic Transmission Fluid Types & Applications](#).

AXLE, FRONT

A crossbeam that supports the weight of the vehicle (typically a truck) and is connected to the spindles with king pins.

AXLE, REAR

May refer to the drive axles that connect both rear wheels to a center differential in a rear-wheel drive vehicle, or a crossbeam that connects both rear wheels and supports the rear of the vehicle in a front-wheel drive application.

AZEOTROPE

Refers to a blend of two or more refrigerants that will not separate (fractionate) and have different temperature and pressure characteristics than any of the separate ingredients.

BACKFIRE

This is the popping or banging sound sometimes heard in the exhaust when decelerating. It can indicate a problem such as over-rich carburetion, a bad exhaust valve or an ignition problem (retarded timing or a cracked distributor cap). If the backfiring occurs through the carburetor, it may mean over-advanced timing, a bad intake valve or a cracked distributor cap.

BACK PRESSURE

This is the pressure that backs up in the exhaust system as a result of the restriction caused by the muffler, catalytic converter and tailpipe. The faster you drive and/or the greater the load on the engine, the higher the back pressure in the exhaust system. Back pressure inhibits the exit of exhaust gases so the engine has to work harder to push the exhaust out. This cuts down on engine power and fuel

economy. Some of the causes of high back pressure include a clogged converter, a damaged or collapsed exhaust pipe or a restrictive muffler.

BACK PRESSURE EGR

Some emissions control systems use a back-pressure sensor or diaphragm to monitor backpressure so that exhaust gas recirculation (EGR) flow can be increased when the engine is under maximum load (and producing maximum back pressure). See [EGR](#).

BACKSPACING

The distance from the back edge of a wheel rim to the back of the center section.

BALL JOINT

A flexible coupling in a vehicle's suspension that connects the control arm to the steering knuckle. A ball joint is so named because of its ball-and-socket construction. Some are designed to never require grease while others should be lubed every six months. As the joint wears, it becomes loose. The result is suspension noise and wheel misalignment. See [Ball Joints](#).

BAROMETRIC PRESSURE

The pressure exerted by the weight of the earth's atmosphere, equal to one bar, 100 kilopascals, or 14.7 psi (often rounded off to 15 psi) at sea level. Barometric pressure changes with the weather and with altitude. Since it affects the density of the air entering the engine and ultimately the air/fuel ratio, some computerized emissions control systems use a barometric pressure sensor so that the spark advance and EGR flow can be regulated to control emissions more precisely.

BAROMETRIC PRESSURE SENSOR

A device that senses barometric pressure for the engine control system. May be combined with a Manifold Absolute Pressure (MAP) sensor.

BATTERY

The battery is a storehouse of electrical energy for starting the engine. All cars and light trucks today have a 12-volt battery. Most are also maintenance-free, meaning you do not have to add water to them periodically. Some even have built-in charge indicators to tell you if they need charging. A green dot in the window means the battery is at least 75% charged, no dot means it needs recharging, and a clear or yellow window means you need a new battery because the water level inside is low. Do NOT try to jump start or charge such a battery. You might be able to salvage the battery if you can pry the sealed caps open and add water, but usually the battery must be replaced. Batteries are rated according to their Cold Cranking Amp (CCA) capacity. As a rule of thumb, an engine needs a minimum of one CCA for every cubic inch of displacement, and preferably two. The higher the CCA rating of the battery, the better. A typical passenger car battery might be rated at 500 CCA or higher. See [Battery Testing](#), and [Battery Jump Starting](#).

BIODIESEL

Biodiesel is diesel fuel made from renewable non-petroleum resources. Most biodiesel is currently made from soybean oil, but it can also be made from sunflower seed oil, or less expensive animal fats such as

beef tallow or chicken fat, or even recycled restaurant grease. Biodiesel can be blended with conventional diesel fuel much like ethanol is blended with gasoline. Most diesels can safely handle biodiesel/regular diesel mixtures of up to 10 to 15% (B10 to B15) with no modifications, and up to 100% straight biodiesel (B100) with minor modifications. The most common blends include B2 (2% biodiesel), B5 5% biodiesel) and B20 (20% biodiesel). See [Biodiesel](#).

BLOWBY

A condition where combustion gases literally blow around the piston rings. When air and fuel are ignited inside the combustion chamber, the resulting explosion creates tremendous heat and pressure. The piston rings are supposed to seal against the cylinder walls to prevent the hot gases from escaping. But every engine suffers a small amount of blowby anyway. If the rings and cylinders are worn, blowby can be a real problem. The gases are mostly water vapor and unburned fuel, so when they enter the crankcase they contaminate the oil. Most of the gases are sucked out through the crankcase ventilation system (See PCV Valve) before they can do much damage. But in an engine with a lot of wear, excessive blowby can lead to rapid sludge buildup. For information on how to check blowby see [Engine Blowby](#).

BODY ROLL

The leaning or tipping of a vehicle's body to one side when turning sharply. This reduces traction and increases tire scuff due to undesirable alignment changes. Body roll is controlled primarily by a sway bar, but the stiffness of the springs and shocks also play a role.

BOOTS

Also called bellows, these are the protective rubber (synthetic or natural) or hard plastic (usually Hytrel) covers that surround CV joints. The boot's job is to keep grease in and dirt and water out. Split, torn or otherwise damaged boots should be replaced immediately. Old boots should never be reused when servicing a joint. Always install new boots.

BRAKE BLEEDING

This is the process of removing air bubbles from the brake system by pumping fluid through the lines. Air bubbles are bad because they compress when pressure is applied resulting in a low or spongy feeling pedal. The correct procedure for bleeding the brakes on most RWD vehicles is to start at the furthest wheel. Do the right rear then left rear brake, followed by the right front and left front brakes. On a FWD vehicle with a diagonally-split brake system, do the right rear then left front brake, followed by the left rear and right front brake. See [Bleeding Brakes](#).

BRAKE CALIPERS

The part of the disc brake that squeezes a pair of brake pads against the rotor. A caliper is nothing more than a casting with a piston inside. When hydraulic pressure pushes the piston out, it forces the brake pads against both sides of the rotor. Some calipers are "floating" in that they slide back and forth and self-center over the rotor. Others are said to be "fixed" because they do not move in and out. See [Loaded Brake Calipers](#).

BRAKE DRUMS

The cast iron housing and friction surface around a drum brake. The brake shoes expand outward and rub against the inside surface of the drums when the brakes are applied. Worn drums often take on a grooved appearance. The inner surface should be turned smooth on a brake lathe when the shoes are

replaced. If the drum has worn too thin, is cracked, warped or has taken on a bell-mouthed shape, it must be replaced. The spring around the outside of the drum on some vehicles is there to soak up vibrations and noise. See [Drum Brake Service](#).

BRAKE FLUID

The brake system uses a glycol-based hydraulic fluid. The fluid is "hygroscopic," which means it tends to absorb moisture over time (never leave a can of brake fluid open for this reason). Moisture lowers the boiling point of the fluid and causes internal corrosion in the brake system. That is why the fluid should be replaced when brake repairs are made or every two years for preventive maintenance. There are several different types, based on the boiling temperature and other characteristics of the fluid. DOT 3 or DOT 4 are used in most passenger cars and light trucks. Use only the type of fluid specified by the vehicle manufacturer. Using DOT 3 in an application that calls for DOT 4 might create a safety hazard. DOT 5 brake fluid is different from DOT 3 and DOT 4 in that it is silicone-based. DOT 5 is NOT recommended for any vehicle equipped with antilock brakes - but it can provide long-lasting protection against corrosion for vehicles that are stored for long periods of time or are driven in wet environments. See [Brake Fluid](#).

BRAKE JOB

A typical brake job includes replacing the brake linings (new disc brake pads and shoes), resurfacing the rotors and drums, adding fresh brake fluid and bleeding the system, and inspecting/replacing any other worn components (usually at extra cost). If rotors or drums are worn beyond safe limits, they can't be resurfaced and must be replaced. Leaky disc brake calipers, drum brake wheel cylinders or the master cylinder should be rebuilt or replaced. See [Brake Job](#).

BRAKE LININGS

The friction material on disc brake pads or drum shoes. A variety of materials are used including asbestos, semi-metallic fibers, Fiberglass and Kevlar. Asbestos linings are used on most older vehicles and on the rear drum brakes. Semi-metallic linings are used on the front brakes of many front-wheel drive applications. Others may be factory equipped with ceramic-based linings. The latest generation of ceramic brake pads are low copper or copper free to conform to government regulations. Never substitute one type of brake lining material for another. The linings rub against the rotors or drums to create friction. This produces a tremendous amount of heat. If the heat builds up faster than it can be shed, the brakes can fade (See Brake Fade). The linings are a high wear item. Front brakes, especially those on FWD vehicles, receive the most wear. Average life for front brakes ranges from 30,000 to 60,000 miles. For rear brakes, 60,000 to 100,000 miles is the norm. Linings should be replaced when worn down to the lining rivet heads, or when lining thickness is less than 1/8th inch or minimum service specifications.

BRAKE PADS

These are the linings used in the front disc brakes. They are called pads because of their flat pad-like shape. Each brake uses a pair of pads (one inner, one outer). Replacement pads are sold in two-pair sets, and are fairly easy to change (See Brake Squeal). Calipers should be inspected for leaks (See Calipers), and the rotors resurfaced to restore a smooth surface (See Brake Rotors). See [Brake Pads](#).

BRAKE ROTORS

The flat disk-like plates that provide the friction surface in a disc brake. When hydraulic pressure is applied to the caliper, the brake pads are squeezed against both sides of the rotor producing friction and heat. Some rotors have cooling fins between both faces and are called "vented" rotors. The rotors should always be resurfaced when new pads are installed. If worn beyond safe limits, cracked or severely warped, the rotor must be replaced. See [Brake Rotors](#).

BRAKES

The brake system uses hydraulic pressure to stop the vehicle when you step on the brake pedal. Pushing the pedal down pumps fluid from the master cylinder to the brakes at each wheel. This squeezes the brake linings against the rotors and drums, creating friction which brings the vehicle to a halt. The only maintenance the system requires is to check the fluid level periodically, and to replace the fluid every couple of years, or when brake repairs are performed. See [Brake Job](#).

BRAKE SHOES

The brake linings used in drum brakes (the rear brakes on most cars). Each drum contains two shoes (a primary or leading shoe, and a secondary or trailing shoe). Replacement shoes are sold in sets of four, one pair for each brake. When shoes are replaced, the condition of the mounting hardware and return springs should be carefully inspected. Replace any worn, damaged or stretched components. Drums should also be turned on a lathe to restore a smooth surface. See [Drum Brake Service](#).

BRAKE SQUEAL

The annoying high pitched screech that is sometimes heard when braking. A common ailment on many disc brake-equipped cars, it is caused by vibration between the brake pad and rotor. It causes no harm, but metallic scraping sounds should be investigated because it usually means the brake linings are worn down to their metal backing plates. If not replaced, the metal-to-metal contact can ruin the rotors or drums. Brake squeal can be eliminated by installing shims on the backs of brake pads, by applying anti-squeal compound or a moly-based brake grease (never ordinary chassis grease) to the backs of the pads, and/or resurfacing the rotors. Applying a nondirectional swirl finish on the rotors can provide added noise suppression. See [Brake Noise](#).

BTU

Abbreviation for British Thermal Units. One BTU is the amount of heat it takes to heat one pound of water one degree Fahrenheit. The energy value of various fuels is often expressed in so many BTUs per gallon. Gasoline, for example, has around 120,000 BTUs per gallon.

BUMP STEER

The tendency of a vehicle to suddenly veer or swerve to one side when hitting a bump or dip in the road. The condition is caused by uneven toe changes that occur as a result of the steering linkage or rack not being parallel with the road surface. This causes the wheels to change toe unevenly as the suspension undergoes jounce and rebound.

BUMP STOPS

Rubber bumpers (often cone or wedge shaped) on the chassis that limit suspension travel. "Bottoming out" the suspension means hitting the bump stops.

BUSHINGS

A liner, grommet or sleeve made of rubber, plastic or metal that fits around a bolt or bar to support, position and in some instances cushion the part. Bushings are used around the pivot bolts that attach the control arms to the chassis. They are also used around sway bars, the links that connect the ends of the sway bar to the control arms, and on the ends of strut rods. Rubber or soft elastomer bushings provide

"compliance" in the suspension to help dampen road noise, vibrations and feedback. Hard plastic (usually polyurethane) bushings "firm" up the suspension for improved handling but also increase ride harshness.

CALCULATED LOAD VALUE

A scan tool PID that indicates engine load. It is the percentage of engine capacity being used based on current airflow divided by maximum airflow.

CAMBER

A wheel alignment angle that refers to the inward or outward tilt of the wheels as viewed from the front. Outward tilt is called "positive" camber while inward tilt is called "negative." Ideally, the wheels should have zero rolling camber (perpendicular to the road) when the vehicle is loaded. Camber changes as the vehicle is loaded and the suspension sags. To compensate, the static alignment specifications may call for a slight amount of positive or negative camber depending on how the suspension is built (See Alignment). On vehicles with independent rear suspensions, excessive negative camber often results with the vehicle is overloaded. Excessive camber can cause uneven tread wear on the tires (one side will be worn more than the other). Camber can be affected by worn suspension components such as control arm bushings and ball joints, or by bent parts such as a MacPherson strut. Camber is changed by adding or subtracting shims from the control arm pivot mounts, or on strut cars by moving the top or bottom of the strut in or out. See [Wheel Alignment](#).

CAMBER ROLL

The change in camber that occurs when the front wheels on a vehicle with an independent suspension are steered to either side. The amount of camber change that occurs is affected by the amount of caster. Some camber change is good because it causes the tires to lean into a turn for better handling and traction. But too much camber change can accelerate shoulder wear on the tires.

CAMBER WEAR

Tire wear that occurs on one side of the tread because the tire is leaning in or out. The underlying cause may be worn control arm bushings, a weak or sagging spring or a badly worn ball joint.

CAMBER BOLT

A bolt fitted with an eccentric that is turned to change a wheel's camber setting. Camber bolts are typically used on control arms and lower strut mounts.

CAMSHAFT

A shaft inside an engine that has lobes to operate the engine's valves. In "pushrod" engines, lifters ride on the cam lobes. The up and down motion is transferred through push rods and rocker arms to actuate the valves (See Lifters). In an "overhead" cam engine, the cam may push directly on the tops of the valves or work the valves through short rocker arms. Loss of lubrication (low oil) or dirty oil can cause scuffing and lobe wear on a cam. The result is loss of engine power because the affected valves do not open completely. The only cure is to replace the cam, a job that requires more advanced skills. The cam may also be changed to improve performance and/or fuel economy. Aftermarket camshafts offer a wide range of different lobe profiles from which to choose. A higher lift, longer duration cam generally provides more power and moves the engine's peak power point up the rpm scale. See [Camshafts](#).

CARBON DIOXIDE (CO₂)

A harmless, odorless gas composed of carbon and oxygen. It is the byproduct of complete combustion. But it is also a greenhouse gas that contributes to global warming and climate change.

CARBON MONOXIDE (CO)

A deadly gas that results from the incomplete burning of gasoline inside the engine, carbon monoxide is considered to be a serious air pollutant. You can't see it or smell it, but it can kill in very small concentrations. Because of this you should never run an engine inside a closed garage. Various means are used to reduce the amount of CO produced by an engine, and primary among these is the catalytic converter. The converter "reburns" CO in the exhaust and converts it into harmless carbon dioxide.

CARBURETOR

A component used to deliver air and fuel on older engines. It mixes air and fuel in varying proportions according to the position of the throttle opening and engine vacuum. Carburetors were replaced by fuel injection in the 1980s, but are still found on many older engines and performance engines. Carburetor adjustments include idle speed, idle fuel mixture and choke setting. Most carburetor problems are due to choke misadjustment or dirty air or fuel. Dirt can plug up the tiny metering orifices, resulting in a variety of drivability problems. Wear around the throttle shafts or warpage or vacuum leaks around the base plate can also cause problems. Overhaul kits are available, but many carburetors can be very difficult to rebuild correctly. A better alternative is a factory rebuilt carburetor that can be easily installed. See [Carburetor Diagnosis](#).

CARDAN JOINT

Also known as a Hooke Joint, Universal Joint or U-Joint, it is a simple flexible coupling using a double yoke and four-point center cross. Cardan joints are used as couplings in the driveshafts of rear-wheel drive cars. Because they can produce uneven shaft speeds when operated at joint angles of more than a few degrees, they are usually not used with front-wheel drive (because the front wheels also steer and create large operating angles).

CASTER

A wheel alignment angle that refers to the forward or rearward tilt of the steering axis on the front wheels (See Alignment). A forward tilt of the steering axis is called "negative" caster while a rearward tilt is called "positive." The caster angle has no affect on tread wear but it does affect steering return and stability. Most vehicle have a certain amount of positive caster. The higher the caster angle the more steady the car feels at high speed (Mercedes, for example, uses a very high caster setting). But the higher the caster angle, the greater the steering effort. The caster angle on many strut suspensions is fixed at the factory and is not adjustable. See [Wheel Alignment](#).

CASTER SHIMS

Small wedge shaped shims that fit between a leaf spring and solid axle to change caster. Used primarily on trucks with a solid front axle or four-wheel drive.

CATALYST MONITOR

The OBD II system monitors the operating efficiency of the catalytic converter to make sure it is reducing emissions and that the vehicle is in compliance with tailpipe emission standards. The OBD II system does this by using a "downstream" O2 sensor mounted behind or in the converter. It compares the readings of the downstream O2 sensor with the "upstream" O2 sensor(s) in the exhaust manifold(s) to estimate converter efficiency. If efficiency drops below a certain threshold, it sets a fault code (p0420) and turns on the Check Engine light. The catalyst monitor only runs under certain driving conditions. The catalyst monitor will NOT run if any O2 sensor codes are present.

CATALYTIC CONVERTER

The converter is an emissions control device in the exhaust system that reduces the amount of pollutants that come out the tailpipe. It does this by reburning certain pollutants and reforming others. Platinum, palladium and rhodium catalysts act as triggers for the chemical reactions. Catalytic converters were first used on 1975 model year cars to reduce hydrocarbon and carbon monoxide emissions. In 1981, a new type of "three-way" converter was installed to also reduce oxides of nitrogen. The converter does a superb job of reducing pollutants, but the catalyst can be contaminated with lead (from leaded gasoline) and phosphorus (from burning oil), or silicone (from internal coolant leaks). The converter is covered by an 8 year/100,000 mile emissions warranty. It is illegal to remove a catalytic converter. If replacement is necessary, it must be replaced with the same type of converter as the original. See [Catalytic Converters](#).

CENTER BOLT

The bolt that maintains the alignment of the leaves in a leaf spring, and the position of the axle on the springs.

CENTERLINE

The geometric center of the suspension defined by a line that runs the length of the vehicle and bisects the midpoints of the front and rear axles. Used as a reference line in alignment for measuring toe and thrust angle.

CENTER LINK

The center bar or link in a parallelogram steering system that connects the pitman arm and idler arm. Also called a "relay rod."

CENTER OF GRAVITY

An imaginary point around which the weight of a vehicle is centered. A lower center of gravity improves handling stability and cornering agility. The center of gravity can be lowered by installing shorter suspension springs and/or low profile tires.

CENTRIFUGAL ADVANCE

A mechanical means of advancing spark timing with flyweights and springs to compensate for changing engine speed (rpm). The weights are located inside the distributor on older vehicles with electronic (noncomputer) ignition systems. The size of the weights, the amount of spring tension, and engine rpm determine the rate and amount of advance. Advancing the spark timing as engine speed increases is necessary for good fuel economy and performance.

CHASSIS

The frame or undercarriage of a vehicle. On unibody vehicles, the lower structure to which the suspension is attached.

CFC CERTIFICATION

A process whereby technicians take an EPA approved course on R12 recovery and recycling, and pass a written examination. CFC certification is required to work on all A/C systems, but no additional certification is required for servicing R134a systems.

CHANGE OF STATE

The rearrangement of the molecular structure of matter as it changes from one physical state to another (solid, liquid or gas). Also called a "phase" change.

CHARCOAL CANISTER

A storage device in the evaporative emissions control system. It is a small cylindrical or rectangular container that contains activated charcoal particles. The charcoal traps gasoline vapors from the fuel tank (and carburetor on older vehicles). Later, the vapors are purged and drawn into the engine when the vehicle is being driven. See [EVAP System](#).

CHARGE

A specific amount of refrigerant or compressor oil by weight. This is specified by the vehicle manufacturer for individual A/C system applications.

CHARGING SYSTEM

The charging system includes the alternator, voltage regulator which is often a part of the alternator itself), the battery, and the indicator gauge or warning light on the dash (See Alternator, Battery and Voltage Regulator). The charging system's job is to generate enough current to keep the battery fully charged, and to satisfy the demands of the ignition and electrical systems. The voltage regulator senses the demands on the electrical system, and controls alternator output so sufficient current is produced. A loose V-belt, or a defective alternator or voltage regulator can cause the dash warning light to glow red (or the amp gauge to show a steady discharge). If the problem is not corrected, the battery will run down and eventually go dead. See [Charging System Checks](#).

CHECK ENGINE LIGHT

A warning light that comes on if the computerized engine control system detects an engine performance or emissions problem. Also called the "malfunction indicator lamp" (MIL). To determine the nature of the problem, the computer system must be accessed to read a fault code. See [Check Engine Light](#).

CHECK VALVE

A valve which permits the passage of a gas or fluid in one direction, but not in the other. For example, the check valve between the air pump and exhaust manifold in an air injection system allows air to flow to the

manifold, but stops exhaust gas from entering the air pump in the event that the pump belt breaks. A check valve in the master brake cylinder allows brake fluid to flow in one direction only.

CHOKE

A little flap-like valve in the top of a carburetor that opens and closes to control the amount of air entering the carburetor when the engine is cold. The choke's purpose is to artificially enrich the fuel mixture (by choking off the air supply) during starting and engine warm-up. If the choke is not adjusted correctly, it can make the engine hard to start and/or stall. See [Carburetor Diagnosis](#).

CHLOROFLUOROCARBONS (CFCs)

A family of manmade chemicals containing chlorine that include R12 automotive air conditioning refrigerant. CFCs have been blamed for a deterioration of the Earth's protective ozone layer. CFCs have been phased out of production by international agreement.

CIRCUIT BREAKER

A protective device that's often used in a wiring circuit to protect against overloads. A circuit breaker has a bimetallic arm and a pair of contact points. When the current exceeds its preset limits, the arm gets hot, bends and opens the contact points. This shuts off the current through the circuit and protects against damage or fire. Most circuit breakers automatically reset themselves after they cool down, but some have a button that must be manually reset to restore power. Circuit breakers are often used in the headlight and air conditioning circuits.

CLOSED LOOP

The basic principle of electronic engine management in which input from an oxygen sensor allows the engine control computer to determine and maintain a nearly perfect air-fuel ratio. To enter closed loop operation, the oxygen sensor must be producing a voltage signal and the engine must have reached a certain operating temperature. See also Open Loop.

CLUTCH

A device that couples the engine to the transmission. The clutch consists of a friction-lined disk (called the "clutch disk") and a spring-loaded "pressure plate" that presses the clutch disk tightly against the flywheel (See Flywheel). When you push in on the clutch pedal, the linkage releases the spring pressure allowing the clutch disk to slip. The clutch disk is subjected to a tremendous amount of friction and heat, which eventually wears it out. At this point it starts to slip. Oil or grease on the flywheel, weak or broken springs in the pressure plate, or overadjusted linkage can also make it slip. If it fails to release, the most likely cause is a broken clutch cable or a leaky hydraulic linkage. See [Common CLutch Problems](#).

COIL-ON-PLUG IGNITION (COP)

A type of distributorless ignition system where individual ignition coils are mounted directly over each spark plug. No spark plug wires are used. See [COP Ignition](#).

COIL SPRINGS

A type of spring made of wound heavy-gauge steel wire used to support the weight of the vehicle. The spring may be located between the control arm and chassis, the axle and chassis, or around a MacPherson strut. Coil springs may be conical or spiral wound, constant rate or variable rate, and wound with variable pitch spacing or variable thickness wire. Coil springs sag with age, and sometimes break. Replacement in pairs is recommended to maintain even ride height side-to-side.

COMPLIANCE

The "give" or flexing that occurs in the suspension and steering due to the compression of rubber bushings and joint play. A small amount of compliance is desirable because it absorbs shocks and dampens vibrations to reduce steering feedback and harshness. But too much compliance can make the steering feel vague and mushy (unresponsive), while also contributing to toe wear by allowing excessive changes in toe alignment.

COMPRESSION

The amount by which the air volume in a cylinder is reduced or compressed by the upward stroke of the piston. See Compression Ratio. Compression can be measured mechanically by installing a compression gauge in a spark plug hole, disabling the ignition and cranking the engine, or electronically by an engine analyzer during a cranking test. See [Compression Testing](#).

COMPRESSION RATIO

The relationship between the piston cylinder volume from bottom dead center to top dead center. Higher compression ratios improve combustion efficiency but also require higher-octane fuels. Pre-emission control engines often had compression ratios as high as 11.5:1 whereas most of today's engines are between 8.5:1 and 9.5:1. Diesel engines have very high compression ratios, from 18:1 to 22:1.

COMPRESSOR

The refrigeration system component that pumps refrigerant and increases the pressure and temperature of refrigerant vapor. The compressor is belt driven via a magnetic clutch, and may be a piston or scroll type design. A compressor failure can throw metallic debris into the A/C system that can damage a replacement compressor unless the condenser is cleaned by flushing or replaced. See [Compressor Failures](#).

COMPRESSOR CYCLING SWITCH

See Thermostatic Switch.

COMPRESSOR CUTOFF SWITCH

A low pressure cutoff switch in a CCOT refrigeration circuit that reacts to low head pressure and opens the compressor clutch circuit to disengage the compressor if the system loses its charge of refrigerant. Some systems also have a separate high pressure cutoff switch (or a combination high-low pressure switch) that opens the compressor clutch circuit if system pressure exceeds a preset limit.

COMPRESSOR OIL

The oil within the A/C system that lubricates the compressor. R12 systems use a special type of mineral oil. R134a systems use either a PAG or ester-based oil. A certain amount of compressor oil must be in the system at all times to prevent compressor damage. Loss of compressor oil (or failure to replace oil that was lost during the service or replacement of system components) will in compressor failure. Too much oil in the system can cause loss of cooling efficiency or compressor failure. See [PAG Oil Recommendations](#).

COMPUTERIZED ENGINE CONTROLS

A microprocessor based engine management systems that utilizes various sensor inputs to regulate spark timing, fuel mixture, emissions and other functions. Used on most vehicles since 1981 to comply with federal emission regulations. Diagnosis usually requires accessing trouble codes and/or putting the system into a special diagnostic mode. See [Engine Management Systems](#) and [PCMs](#).

CONDENSATION

The process whereby a vapor changes to a liquid. This requires a "cooling effect" to draw heat away from the vapor. When the temperature of the vapor reaches a certain point, droplets of liquid (condensate) begin to form. Condensation of the refrigerant vapor takes place in the condenser.

CONDENSER

The refrigeration system component that changes refrigerant vapor to a liquid by removing heat. The condenser is an air-to-air heat exchanger consisting of metal tubes and cooling fins. It is usually mounted just ahead of the radiator, and may have its own cooling fan.

CONDUCTION

The transmission of energy (heat) through a medium without perceptible motion of that medium (direct contact).

CONSTANT VELOCITY (CV) JOINT

A Constant Velocity Joint is one that provides consistent driveshaft speeds regardless of the operating angle of the joint. CV joints are used primarily in on the driveshafts of front-wheel drive vehicles, and they come in two basic varieties: the Rzeppa ball type joints (which you will find on the outer end of the driveshaft) and tripod joints (which are used on the inner end). See [CV Joints](#).

CONTROLLER AREA NETWORK (CAN)

CAN is essentially an engineering standard for how computers and modules talk to one another via the serial data bus in a vehicle's wiring system. It's a high speed standard designed for powertrain control modules, antilock brakes and stability control systems. It is used on a growing number of 2003 and newer vehicles. See [CAN systems](#).

CONTROL ARMS

Suspension components which connect the steering knuckles to the chassis or subframe, and allow the knuckles to move up and down.

CONVECTION

The transfer of heat by the circulation of a liquid or vapor

COOLANT

The liquid inside the radiator and cooling system is called the "coolant" because it cools the engine. It circulates through the engine and soaks up heat. The coolant then flows to the radiator (See Radiator) where it sheds its heat. When the heater is turned on, coolant also flows through the heater core (which acts like a miniature radiator) to heat air entering the passenger compartment. A low coolant level can result in overheating, no heat from the heater, and/or serious engine damage. The coolant level inside the radiator should be checked periodically to replace any that has been lost. The recommended coolant for most vehicles is a mixture of 50% water and 50% antifreeze. Straight water should never be used because it is extremely corrosive, and offers no freezing or boilover protection. See [Types of Antifreeze](#).

COOLANT TEMPERATURE SENSOR

A variable resistance thermistor which changes resistance as the engine's coolant temperature changes. The sensor's output is monitored by the engine computer to regulate various ignition, fuel and emission control functions, and to turn the radiator cooling fan on and off as needed. In the PTC (Positive Temperature Coefficient) type of sensor, ohms go up with temperature. In the more common NTC (Negative Temperature Coefficient) type, resistance goes down as heat goes up. See [Coolant Sensors](#).

COOLING SYSTEM

The cooling system consists of the radiator, water pump, thermostat, heater core, heater and radiator hoses, and the water jackets inside the cylinder head and engine block (See Coolant, Radiator and Water pump). An engine produces a tremendous amount of waste heat when it runs, so some means of cooling is needed to prevent the engine from self-destructing. Some engines (such as lawn mower and small motorcycles) are air-cooled. But liquid-cooling is used for most automotive applications because it is more efficient, it allows better temperature control (for better performance and lower emissions), and it can provide heat in the winter. See [Servicing Cooling System](#).

CRADLE

A structural member used in many front-wheel drive cars that supports the engine and transaxle. The cradle is bolted to the subframe, and is also connected to the lower control arms. The position of the cradle is important because it affects camber and caster.

CRANKCASE EMISSIONS

See blowby, also [Measuring Blowby](#)

CRANKSHAFT

The main shaft inside the engine that turns the up-and-down motion of the pistons into rotational torque. There are two types of crankshafts: cast iron and forged steel. The cast variety are used in most passenger car engines while the stronger forged ones are used primarily in high performance applications. When an engine is overhauled, the rod and main bearing journals are reground to restore a smooth surface. Crankshaft failures are fortunately not very common, but when they happen it usually caused by excessive internal engine vibration or defects in the crankshaft itself.

CRANKSHAFT POSITION (CKP) SENSOR

A type of sensor used to monitor the position of the crankshaft. The sensor's input is used to trigger the ignition system. There are two basic types: magnetic and hall effect. The sensor reads notches in a ring mounted on the crankshaft, harmonic balancer or flywheel. See [Crankshaft Position Sensors](#).

CROSS CAMBER

The difference side-to-side between camber settings. More than half a degree difference may cause a steering pull toward the side with the most (positive) camber. See [Wheel Alignment](#) and [Alignment Diagnosis](#).

CROSS CASTER

The difference side-to-side between caster settings. More than half a degree difference may cause a steering pull toward the side the least (negative) caster. Caster on the left front wheel is sometimes decreased to compensate for high road crown. See [Wheel Alignment](#) and [Alignment Diagnosis](#).

CROSS COUNTS

Refers to the switching activity of the oxygen sensor as it switches back and forth from rich to lean and back again. Low cross count activity in an upstream oxygen sensor on a warm engine indicates a bad oxygen sensor.

CROSSMEMBER

A structural component that bolts between the frame rails or attaches to the subframe of a unibody. The lower control arms may be attached to the crossmember. The position of the crossmember is important because it affects camber, caster and setback.

CYCLING CLUTCH ORIFICE TUBE (CCOT)

A refrigerant system in which a fixed displacement compressor is engaged and disengaged to maintain the refrigeration cycle. By cycling the compressor clutch on and off, the cooling output of the system is regulated.

DATA COMMUNICATIONS BUS

The communications network in a vehicle that allows multiple control modules to communicate with each other. Various protocols determine the speed or baud rate at which information flows over the bus network.

DATA LINK CONNECTOR (DLC)

The diagnostic communications connector on a vehicle. Allows a scan tool to communicate with the Powertrain Control Module (PCM) and other onboard modules. On 1996 and newer OBD II vehicles, the connector is usually located under the dash near the steering column.

DESICCANT

A drying agent used in the refrigeration system to remove moisture. The moisture-absorbing zeolyte crystals are located in the accumulator-dryer or receiver-dryer depending on the type of system. R134a systems generally require XH-7 or XH-9 desiccant.

DETONATION

This is the pinging or knocking sound that is sometimes heard while accelerating. The noise is the result of erratic combustion inside an engine. Instead of burning normally, the fuel explodes in multiple flame front, and the colliding fireballs inside the cylinders shake and rattle the pistons. Mild detonation is annoying but it will not hurt anything. Severe or prolonged detonation, on the other hand, can ruin an engine. If switching to a higher octane fuel does not cure the problem, timing adjustments or other repairs may be necessary. Detonation is often a symptom of a faulty EGR system or a defective knock sensor. See [Spark Knock](#).

DICHLORODIFLUOROMETHANE

Chemical name of R12 refrigerant. See [Alternative Refrigerants](#).

DIAGNOSTIC TROUBLE CODE (DTC)

Computerized engine control systems have a certain amount of built-in self-diagnostic capability to detect problems that affect engine performance and emissions. The same is true for the antilock brake system and other onboard systems that are computer controlled. When a fault is detected, the computer will store a diagnostic trouble code in its memory and illuminate the "Check Engine" light. On some vehicles, the computer can be put into a special diagnostic mode by grounding certain terminals on a diagnostic connector. This will cause the Check Engine or other lights to flash out the fault code. On many vehicles, though, a scan tool must be plugged into the computer system to access and read the codes. For more information about Trouble Codes, [Click Here](#).

DIESEL ENGINE

A type of engine that uses compression to ignite its fuel rather than a spark. A diesel engine has a much higher compression ratio than a gasoline engine (22:1 versus 8:1 for example), and because of this it is able to squeeze more usable power out of each drop of fuel. A typical diesel gets 30 to 50 percent better fuel mileage than a comparable gasoline engine of equal displacement. A diesel engine has no carburetor or throttle. Fuel is injected directly into the engine's cylinders through high pressure injectors. Injector timing is very important because it affects idle quality, rattling and exhaust smoke. Engine speed is governed by the injection pump which controls the amount of fuel delivered. Newer diesels use electronic injectors and computer controls to reduce emissions. Most passenger car diesel engines have a glow plug starting system that preheats the combustion chamber. The fuel system can be contaminated by water so many also have fuel/water separator filters. See [Diesel Diagnosis](#).

DIFFERENTIAL

This is the gear box between the drive axles that transfers torque from the driveshaft to the axles and allows the drive axles to rotate at different speeds. This is necessary because the inner wheel follows a smaller arc than the outer one when the vehicle turns. The differential always provides power to the wheel that needs it least, because the gears always allow torque to follow the path of least resistance. Locking differentials that use spring-loaded clutch packs or fluid-encased disks are available as an option on some vehicles to prevent wheel spin. This is a "must" option for any high performance or off-road vehicle.

DIODE

An electrical component used to control the flow of electricity in one direction. Used in alternators to convert alternating current into direct current. Diodes are part of the alternator's rectifier assembly.

DISC BRAKES

A type of brake design that uses a flat disk-shaped rotor as the friction surface. A caliper squeezes a pair of brake pads against the rotor to stop the vehicle. Disc brakes are used on the front wheels of most passenger cars, and sometimes on the rear. See [Disc Brake Service](#).

DISCHARGE AIR

The conditioned (cooled & dehumidified) air entering the passenger compartment from the A/C system.

DISCHARGE LINE

Connects the compressor outlet to the condenser inlet. Also called the "high side" line. High pressure refrigerant vapor flows through this line.

DISCHARGE PRESSURE

The pressure of the high temperature refrigerant vapor as it leaves the compressor.

DISCHARGE SIDE

The part of the A/C system from the outlet port of the compressor to the evaporator inlet.

DISPLACEMENT ON DEMAND

A method of improving fuel economy under light load when full engine power isn't needed. The engine computer deactivates up to half of the engine's cylinders to reduce the engine's effective displacement. When more power is needed, the cylinders are reactivated to increase engine displacement. Used on late model Chrysler 300 Hemi engines.

DISTRIBUTOR

The "brain" of the ignition system that "distributes" ignition voltage to each of the spark plugs. The distributor contains an electronic trigger or pickup device (older cars use contact points) that trigger the ignition coil. High voltage enters the distributor cap from the coil, travels down through the rotor to the appropriate spark plug terminal and exits out the wire. On pre-computer cars, the distributor also controls spark timing via centrifugal and vacuum advance units, but this function is performed by the computer in late model cars. The only maintenance the distributor requires is periodic replacement of the rotor and cap (older cars need annual point replacements). Most newer engines (1990s & up) do not have distributors, but use a "distributorless" type of ignition system.

DISTRIBUTORLESS IGNITION SYSTEM (DIS)

An ignition system that does not use a distributor to route high voltage to the spark plugs. The high voltage plug wire runs directly from the ignition coil to the spark plug. Some DIS systems have one coil for every two spark plugs (a shared system), while others have a separate coil for each spark plug (See Coil-On-Plug Ignition). Eliminating the distributor makes the system more reliable and eliminates maintenance. See [Distributorless Ignition Systems](#).

DRIVESHAFT

The propeller shaft that transmits engine torque to the differential, or from the differential to the drive wheels. In front-wheel drive vehicles, the two driveshafts are often referred to as "halfshafts."

DOG TRACKING

Also called crabbing, this refers to a condition where the rear wheels do not follow straight behind the front ones because of rear axle or rear toe misalignment. The rear wheels track off to one side, which produces off-center steering and contributes to front toe wear. See [Alignment Diagnosis](#).

DOT 3 BRAKE FLUID

Brake fluid that meets the Department of Transportation specifications for glycol based fluids with a wet boiling point (lowest allowable after it has been in use) of 284 degrees F. and a dry boiling point of 401 degrees F. DOT 3 fluid is the type commonly specified by most vehicle manufacturers. Because it is glycol based, it absorbs moisture over time (hygroscopic). This lowers its effective boiling point and promotes internal corrosion in the brake system. For this reason, the brake fluid should be replaced periodically (every two years is recommended by many experts) and every time the brakes are relined or serviced. See [Brake Fluid](#).

DOT 4 BRAKE FLUID

A "heavy-duty" glycol based brake fluid with a slightly higher wet boiling point of 311 degrees F. and a dry boiling point of 446 degrees. This type of fluid is sometimes specified for performance vehicles or those subject to high brake temperatures. See [Brake Fluid](#).

DOT 5 BRAKE FLUID

A silicone based fluid that does not absorb moisture and has a boiling point of at least 500 degrees F. DOT 5 fluid does not have to be changed periodically and can minimize brake system corrosion, but is very expensive compared to DOT 3 or DOT 4 fluid (it costs three to five times as much). It will not mix with DOT 3 or DOT 4 brake fluid. DOT 5 is NOT recommended for any vehicle with ABS brakes because it tends to aerate when cycled rapidly through small orifices. See [Brake Fluid](#).

DUTY SOLENOID

On a feedback carburetor, a solenoid that cycles many times per second to control a metering rod, hence the air/fuel mixture. The "on time" (duty cycle) of the solenoid determines the air/fuel ratio.

DYNAMIC BALANCE

Wheel balance that results from the equal distribution of weight on both faces or sides of a wheel. Achieving dynamic balance requires spinning the wheel to identify the heavy spots on each side. A wheel that lacks dynamic balance will shimmy back-and-forth.

DYNAMOMETER

A machine that is used to measure the horsepower output of an engine. A chassis dyno has large rollers upon which the drive wheels are placed. The vehicle is run up to a certain speed and put under load so the amount of power that is being delivered to the wheels can be measured (See Horsepower and Torque). A dyno can also be used to simulate actual driving conditions when troubleshooting various drivability problems. Dynos are also used to simulate driving conditions during certain types of emissions tests.

EGR VALVE

The EGR valve is the main emissions control component in the exhaust gas recirculation system (See Exhaust Gas Recirculation). The valve is located on the intake manifold, and opens a small passageway between the exhaust and intake manifold to allow a metered amount of exhaust to flow back into the engine. This reduces combustion temperatures and helps control the formation of oxides of nitrogen (See NOX). The EGR valve is opened by the application of vacuum to its control diaphragm. Some also require a certain amount of exhaust back pressure before they will open. On newer vehicles, the valve is electronic and uses one or more solenoids or a small stepper motor. The valve should remain closed while the engine is cold and at idle. It should only open once the engine has warmed up and is running at part-throttle. If the valve sticks shut (or is disconnected), NOX emissions will soar and detonation will often result (See Detonation and Spark Knock). If it sticks in the open position or fails to close all the way, it acts like a vacuum leak resulting in a rough idle, hesitation and possible stalling. See [EGR](#).

ELECTRICAL SYSTEM

The battery, wires and electrically-operated accessories in a vehicle. All modern passenger cars, light trucks and most large motorcycles have 12-volt electrical systems. Farm tractors, most small motorcycles, antique cars and pre-1967 Volkswagens have 6-volt electrical systems. Most heavy-duty trucks use 24-volt systems. The electrical system uses the battery and charging system as its power source, with wires and switches routing the voltage to where it is needed. The metal body serves as the ground or return path for the voltage back to the battery. The electrical system is protected against damage by various devices (See Circuit Breaker, Fuse and Relay). Most electrical problems fall into one of three basic categories: poor ground connections (loose or corroded), opens (breaks in circuit wires, connectors or switches), or shorts (grounded circuit wires or switches). A test light, ohmmeter and/or voltmeter can be used to find the fault. See [Troubleshooting Electrical Problems](#).

ELECTRONIC FUEL INJECTION (EFI)

Abbreviation for Electronic Fuel Injection. This type of system uses computer-controlled fuel injectors to spray fuel into the engine rather than mechanically controlled injectors or a carburetor. EFI comes in several varieties: "throttle body injection" (See TBI), "multi-port injection" (See MFI or PFI) or Sequential Fuel Injection (SFI). Electronic fuel injection is considered to be superior to carburetion because it allows more precise fuel metering for easier starting, lower emissions, better fuel economy and performance.

EMISSION CONTROL SYSTEM

The vehicle components that are responsible for reducing air pollution. This includes crankcase emissions, [evaporative emissions](#) and tailpipe exhaust emissions. Crankcase emissions consist of unburned fuel and combustion byproducts. These gases are recirculated back into the engine for reburning by the Positive Crankcase Ventilation (PCV) system (See PCV system). Evaporative emissions are the fuel vapors that seep out of the fuel tank and carburetor. They are prevented from escaping into the atmosphere by sealing the fuel system and storing the vapors in a vapor canister (See Charcoal Canister) for later reburning. Tailpipe exhaust emissions consist of carbon monoxide (CO), unburned hydrocarbons (HC) and oxides of nitrogen (NOX)(See Carbon Monoxide, Hydrocarbons and NOX). These formation of these pollutants is minimized by various engine design features, careful control over fuel calibration (see Air/Fuel Ratio) and ignition timing, and the EGR system (See [Exhaust Gas Recirculation](#)). The pollutants that make it into the exhaust are "reburned" before they exit the tailpipe by the catalytic converter (See Air Pump and [Catalytic Converter](#)). The emission control system is an integral part of the engine, and should not be tampered with or disconnected. This is especially true on vehicles with computerized engine controls and/or those that must be subjected to mandatory emissions testing. See [Emissions Testing](#).

ENABLE CRITERIA

The specific operating conditions that must be met before OBD II will run self-diagnostic checks and/or set a diagnostic trouble code. The criteria will vary depending on the year, make and model year of the vehicle, and the system or sensor being monitored.

ENGINE CONTROL MODULE (ECM)

The computer or electronic control module that regulates engine functions such as spark timing, fuel delivery and other emissions functions. Also called a Powertrain Control Module (PCM) if it incorporates transmission control functions. See [Engine Management Systems](#) and [PCMs](#).

ENGINE DISPLACEMENT

The size of an engine or its volumetric displacement is a function of cylinder bore diameter, piston stroke and the number of cylinders. Displacement = Surface area of the bore Diameter x stroke x number of cylinders. Engine displacement is usually expressed in Cubic Inches Displaced (CID) or Liters (L). As a rule, the larger the engine, the more power it is capable of making. For more information on this subject, see [Engine Displacement](#).

ENVIRONMENTAL PROTECTION AGENCY (EPA)

Abbreviation for the Environmental Protection Agency, the government agency responsible for enforcing anti-pollution rules. The EPA requires all vehicle manufacturers to certify their new car as being in compliance with the applicable clean air standards for the year of manufacture. The manufacturer, in turn, must provide an "emissions" warranty on every vehicle they sell that guarantees free replacement of any emissions control device that might fail during that time. This coverage usually extends to such items as the computer control system, catalytic converter, fuel and ignition system (except the spark plugs and normal wear items). See [EPA website](#).

EVACUATE

To create a vacuum within a refrigeration system for the purpose of drawing out air and moisture. The system may be evacuated as part of a refrigerant recovery process, to check for leaks or to purge the system of unwanted air and moisture prior to recharging it with refrigerant.

EVAPORATIVE EMISSIONS

Gasoline fuel vapors that are released into the atmosphere from a vehicle's fuel system.

EVAP SYSTEM

The emission control system that prevents the escape of fuel vapors from a vehicle's fuel system. Fuel vapors are routed by hoses to a charcoal canister for storage. Later, when the engine is running a purge control valve opens allowing intake vacuum to siphon the fuel vapors into the engine. See [EVAP System](#)

EVAPORATION

The change from a liquid to a vapor. This process absorbs heat and has a cooling effect. Refrigerant evaporates inside the evaporator to cool the air flowing through it.

EVAPORATOR

The component in the refrigeration system that absorbs heat from air entering the passenger compartment to produce a cooling effect. It is an air-to-air heat exchanger.

EXHAUST ANALYZER

A piece of test equipment used to analyze the composition of vehicle exhaust gases. A 5-gas analyzer measures carbon dioxide (CO₂), carbon monoxide (CO), oxygen (O₂), hydrocarbons (HC) and oxides of nitrogen (NO_x). The gas readings can be used to determine emissions compliance, and to diagnose various engine performance problems. See [Emissions Testing](#).

EXHAUST GAS RECIRCULATION (EGR)

This is an emissions control technique for reducing oxides of nitrogen emissions in the tailpipe. A small amount of exhaust gas is recirculated back into the intake manifold to dilute the incoming air/fuel mixture. Contrary to what you would think, it has a cooling effect on combustion temperatures which helps reduce the formation of oxides of nitrogen (See NO_x). The EGR valve is the main control device in this system. See [EGR](#)

EXHAUST SYSTEM

The exhaust system consists of the exhaust manifold, exhaust pipe, catalytic converter, muffler and tailpipe. The system performs three important jobs: it carries exhaust gases away from the engine, it quiets the engine (See Muffler), and it helps control pollution (See Catalytic Converter). The exhaust systems one weakness is its vulnerability to corrosion. Original equipment exhaust systems usually have stainless steel headpipes (the pipe between the exhaust manifold and catalytic converter) and converter shells, and aluminized pipe to resist corrosion. But after three or four years, the muffler and tailpipe often need to be replaced. Many newer vehicles are equipped with stainless steel exhaust systems which typically last 7 to 10 years. See [Troubleshooting Exhaust Problems](#) and [How to Check Exhaust Backpressure](#)

EXPANSION VALVE

Same as TXV valve, a control device that meters the amount of refrigerant to the evaporator to regulate cooling.

FAST IDLE

The higher speed at which an engine idles during warm-up. When first started, a cold engine needs more throttle opening to idle properly. On carbureted engines without computer idle speed control, a set of cam lobes on the choke linkage provides a fast idle speed (850 to 1200 rpm) during engine warm-up.

FAULT CODE

See Diagnostic Trouble Code and Trouble Codes. [Click Here for more information about Fault Codes.](#)

FEEDBACK

A principle of fuel system design wherein a signal from an oxygen sensor in the exhaust system is used to give a computer the input it needs to properly regulate the carburetor or fuel injection system in order to maintain a balanced air/fuel ratio. Also, a signal to a computer that reports on the position of a component, such as an EGR valve. Typically, the feedback device is a variable resistor.

FEEDBACK CARBURETOR

An electronic carburetor that controls the air/fuel mixture according to commands from the engine control computer, typically through the operation of a duty solenoid.

FIRING ORDER

The order in which the spark plugs fire. The firing order will vary depending on the engine application. The firing order must be correct otherwise the engine may not start or run properly. See [Chevy Firing Orders](#), and [Ford Firing Orders](#)

FLAMMABLE REFRIGERANTS

A refrigerant that may ignite or burn. This includes butane, propane, isobutane and certain other hydrocarbons. Flammable refrigerants are considered dangerous because of their risks to service personnel as well as the occupants of a vehicle should there be a refrigerant leak into the passenger compartment or during a collision. Flammable refrigerants are not approved for use in mobile A/C systems by the EPA.

FLASH CODES

The name given to fault codes or trouble codes that are read by counting flashes of the Check Engine light or ABS warning light. Though not available on some systems, flash codes provide essential diagnostic information for troubleshooting problems. To read any codes that may be stored in the control module's memory, the computer system must first be put into a special diagnostic mode by grounding a terminal on the vehicle's diagnostic connector. The codes are then flashed out via the light. By carefully counting the flashes and pauses, a numeric code is deciphered that tells you which diagnostic chart to refer to in the service manual. A series of step-by-step checks must then be made to isolate the faulty component.

FLUSHING

The process of using a chemical to remove sludge, dirt, rust or metallic debris from inside A/C system components, the purpose of which is to clean the system, restore proper refrigerant flow and prevent clogging. Or, refers to reverse flushing the cooling system to remove accumulated scale deposits and old coolant.

FLYWHEEL

A large heavy wheel on the end of the crankshaft that helps the engine maintain momentum when the clutch is engaged. The flywheel also helps dampen engine vibrations. The flywheel should be resurfaced when the clutch is replaced to restore a smooth surface. Oil or grease on the surface of the flywheel can make the clutch slip and chatter. On some vehicles, the ignition timing marks are on the flywheel and are observed by peering through a hole in the bellhousing. The teeth along the edge of the flywheel are for the starter to engage when the engine is cranked. Nicked, broken or missing teeth can cause starting problems, so a damaged flywheel should be replaced. On vehicles equipped with an automatic transmission, the flywheel is lightweight stamped steel and resembles a spoked wheel. This is because the torque converter is quite heavy and provides the momentum. See [Flywheel Resurfacing](#).

FOUR-WHEEL ALIGNMENT

An alignment job that includes all four wheels, not just the front two. All vehicles can benefit from a four-wheel alignment, not just those with front-wheel drive or independent rear suspensions. The rear wheels have just as much influence over directional stability as those at the front, and that is why many vehicles need to have all four wheels aligned. Many problems such as a steering pull to one side, uneven tire wear on the rear tires or poor tracking can be caused by misaligned rear wheels. See [Wheel Alignment](#) and [Fixing Common Alignment Problems](#).

FOUR-WHEEL DRIVE (4WD)

A method of driving a vehicle by applying engine torque to all four wheels. Various schemes are used for 4WD including part-time, full-time and variable four-wheel drive. The primary advantage of four-wheel drive is increased traction, which is especially useful for off-road excursions or severe weather driving, but is of little practical value for normal driving. Because of the added friction in the drivetrain, a four-wheel drive vehicle typically gets significantly lower fuel mileage than a front- or rear-wheel drive vehicle. To help cut the drag, most 4WD drivetrains have a transfer case that allows the driver to select either two- or four-wheel drive depending on driving conditions. In trucks, you will often find locking hubs on the front wheels that can be locked in the "on" or free-wheeling position as needed. Some performance cars have full-time variable four-wheel drive and use a computer-controlled transfer case to route power between the wheels.

FOUR-WHEEL STEERING

A system that uses all four wheels to steer the car. Turning the rear wheels in the opposite direction to the front at slow speeds can allow faster maneuvering and a much tighter turning radius. Turning the rear wheels in the same direction as those at the front at high speed allows sudden lane changes with much greater stability. Turning the rear wheels in the same direction as the front when parking makes parallel parking much easier.

FRAME ANGLE

The angle of a truck's frame with respect to the ground. The angle affects front caster. For every degree of change in the frame angle, caster also changes one degree. Raising the rear of a truck increases the frame angle (positive) while lowering the rear decreases it (negative).

FREEZE FRAME DATA

Operating data such as sensor values, engine rpm, coolant temperature, vehicle speed, etc. that are captured or stored by a scan tool or by the OBD II system when a fault occurs. Can be used for diagnostic purposes, especially with intermittent faults.

FREEZE PLUG

An expansion plug located in the side of an engine block that is supposed to protect the block against freeze damage. Water expands when it turns to ice, and if the coolant does not have enough antifreeze protection it can freeze and crack the engine block. The freeze plugs (there are several) are supposed to pop out under such conditions to relieve the pressure on the block. Freeze plugs can often be a source of troublesome leaks as a result of internal cooling system corrosion. Ease of replacement depends on accessibility.

FREON

A registered trademark of the DuPont Corporation for their family of CFC refrigerants, which includes R-12.

FRONT-WHEEL DRIVE (FWD)

A means of driving a vehicle by applying engine power to the front wheels instead of the rear wheels. There are advantages and disadvantages to front-wheel drive. On the plus side, the advantages go mostly to the vehicle manufacturers because it makes it easier for them to package a vehicle engine/drivetrain/body combination more efficiently. In other words, the same basic engine/drivetrain package can be installed under a variety of "different" model cars. The same basic engine/transaxle package Chrysler developed for their Omni and Horizon (which they basically copied from Volkswagen) can be found under all their current front-wheel drives ranging from the mini-vans to the sports sedans. Thus a manufacturer can save a bundle in tooling and development when he wants to bring a new front-wheel drive model to the showroom floor. As far as FWD being superior to RWD, it is mostly hype. Some people will argue that front-wheel drive handles better than rear-wheel drive while others will argue exactly the opposite. Porsche and Mercedes seem to be unimpressed by FWD, and most race cars are rear-wheel drive. On the negative side, some front-wheel drive cars have a tendency to "torque steer" (See Torque Steer), and transaxle problems can be very costly to repair because it often involves pulling the engine. See [Front-Wheel Drive Guide](#).

FUEL FILTER

A device installed in the fuel line to trap contaminants before they reach the engine. A plugged fuel filter can cause the engine to stall. The fuel filter should be replaced periodically for preventive maintenance. See [Fuel Filters](#).

FUEL INJECTION

A method of fuel delivery whereby fuel is sprayed into the intake manifold or intake ports through a nozzle. Originally developed by the Robert Bosch Corp. Fuel injection replaced carburetors back in the 1980s because it allows faster and easier starting, better emissions and fuel economy. Different types include Throttle Body Injection (TBI), Multiport Injection (MPI) and Gasoline Direct Injection (GDI). Throttle Body Injection has one or two injectors mounted in a throttle body on the intake manifold. Multiport Injection has a separate fuel injector for each of the engine's cylinders mounted in the intake manifold ports. Gasoline Direct Injection also has a separate injector for each cylinder, but the injectors are mounted in the head and spray fuel directly into the cylinders. See [Fuel Injection Basics](#).

FUEL PUMP

A pump that moves fuel from the fuel tank to the engine. On older vehicles with carburetors, a low pressure engine-mounted mechanical fuel pump is used. On newer vehicles with electronic fuel injection, a high pressure electric fuel pump is used. If the fuel pump fails, the engine will stop and not restart. See [Electric Fuel Pumps](#), [Fuel Pump Diagnosis](#) and [Mechanical Fuel Pumps](#)

FUEL TRIM (FT)

Refers to fuel mixture adjustments made by the ECM or PCM in response to engine operating conditions. Fuel trim numbers above the zero (neutral) point indicate a lean fuel mixture while negative numbers indicate a rich mixture. Short term fuel trim varies with changes in throttle position and engine load, while long term fuel trim is a learned value that compensates for an engine's tendency to run rich or lean. Fuel trim numbers that deviate more than 10 to 15 points from the norm typically indicate a problem. For more information about using fuel trim to diagnose a lean fuel condition, read this article on [Fuel Trim by Wells Manufacturing](#) (PDF file, requires Adobe Acrobat to read).

FUSE

A fuse is a protective link in a wiring circuit that is designed to burn out in case of an overload. The fuse has a tiny wire inside it that is designed to melt if the current exceeds a certain value. When the wire melts, it breaks the circuit and protects against damage or fire. Most fuses are located in the fuse box under the dash, although "in-line" fuses may be hidden elsewhere. "Fuse links" which are short sections of special wiring are also used to protect wiring circuits. The locations of both in-line fuses and fuse links can be looked up in a wiring diagram for the vehicle. When replacing a blown fuse, try to determine why the fuse blew. Always replace a fuse with one of the same rated capacity. Never substitute one of a higher capacity because the circuit may not be able to handle it. See [Fuses & Relays](#).

GAS SHOCKS

A type of shock absorber that is pressurized with nitrogen gas to reduce internal foaming and cavitation. Considered to be a premium grade shock, gas shocks are often used as original equipment on sports sedans and even mini-vans. A gas shock usually provides noticeably better ride control and flatter cornering. They are well worth considering if you are in need of replacement shocks. See [Diagnosing Ride Control Complaints](#).

GASKET

A means of sealing the mating surfaces between various components. Gaskets are used between the various parts of the engine to keep oil, coolant, air and fuel in their respective places. Rubber, cork or combination cork/rubber gaskets are often used to seal the oil pan, valve covers, waterpump and timing

chain cover. Metal gaskets are used between the cylinder head and engine block, and metal or asbestos gaskets are used to seal intake and exhaust manifolds. Over time, cork gaskets tend to become brittle and break. This allows oil to leak out of the engine (See Oil Consumption). Tightening the cover bolts will sometimes stop a leak but usually the gasket must be replaced. Some late model engines use various chemical sealers (such as RTV silicone) in place of conventional gaskets. Leaks can be repaired by either applying fresh sealer or substituting a conventional gasket. See [Preventing Repeat Head Gasket Failures](#).

GAS LINE FREEZE

When condensation builds up inside a fuel tank during the winter, water sometimes gets into the fuel line where it freezes in the low spots. The ice effectively blocks the flow of fuel and makes the car impossible to start. The only cure is to get the vehicle inside a warm garage where it can thaw out. There are several ways to prevent gas line freeze. One is to keep the fuel tank full so there is little room for condensation to form. Another is to dump an alcohol-based additive in the fuel tank at every fill to absorb moisture.

GASOLINE

A mixture of various liquid hydrocarbons derived from crude oil. It is a non-renewable resource upon which we are overdependent and for which we will pay dearly if and when supplies run short. Depending on how it is refined and what is added to it, the fuel's quality can vary greatly (See Octane and Gasohol). Tetraethyl lead used to be used as a fuel additive to boost low-grade gasoline to a higher octane rating, but MBTE or ethanol is used now. Gasoline is highly flammable and should always be treated with respect. Never smoke when working on the fuel system (or when filling the fuel tank) and never use it as a cleaning solvent. See [Bad Gasoline Can Cause Performance Problems](#), [Bad Gas Update 2006](#), [Fuel Octane Ratings & Recommendations](#) and [Alternative Fuels](#).

GASOLINE DIRECT INJECTION (GDI)

A type of fuel injection system that sprays fuel directly into each of the engine's cylinders under extremely high pressure (up to 2200 PSI or higher). Gasoline Direct Injection allows better fuel control, fuel economy and performance than multiport injection. See [Gasoline Direct Injection](#).

GAUGE SET

Same as "manifold gauge set." One, two or three pressure gauges attached to a manifold (a pipe with several inlet & outlet connections) used to measure A/C system pressures.

GLOBAL WARMING

A gradual increase in the average temperature of the Earth blamed on human activity. The primary causes are the emission of carbon dioxide (CO₂) by burning fossil fuels (coal-fired factories and vehicle emissions), deforestation and methane emissions (cow farts) from livestock and decaying crops. An international agreement called the Kyoto Protocol is supposed to limit CO₂ emissions. The effects of global warming are uncertain, but may include climate change, melting of polar ice (rising sea level) and species extinctions (including possibly our own!). See [Global Warming](#).

GREEN HOUSE GAS

A gas that contributes to a gradual warming of the Earth's climate (Global Warming) as a result of increased heat retention. Certain gases (primarily carbon dioxide from the burning of fossil fuel, but also CFCs) increase the retention of heat from the sun in the atmosphere. See [SUVs versus Trees](#).

HALL EFFECT

A phenomenon in which voltage is generated by the action of a magnetic field acting on a thin conducting material, commonly used to control the primary circuit of an electronic ignition system. Named for the American scientist, Edwin Hall (1855-1938). The principle is used in Hall effect crankshaft position sensors and ignition pickups to produce a very clean on-off signal.

HALF SHAFT

The name given to either of the two driveshafts that run from the transaxle to the wheels in a front-wheel drive vehicle. Halfshafts may be of solid or tubular construction, and of equal or unequal length side-to-side. See [Front-Wheel Drive Guide](#).

HALOGEN HEADLIGHTS

A type of headlight that produces more light than an ordinary headlight. A halogen bulb burns brighter because it has a thinner filament. To keep the filament from melting, however, the gas mixture inside the bulb is altered slightly by adding a small amount of halogen gas (bromine, chlorine, fluorine, iodine or astatine) and sometimes krypton. See [Headlights](#).

HEAD PRESSURE

Same as "discharge pressure" in an A/C system, the amount of pressure in the compressor discharge line.

HEATED AIR INTAKE SYSTEM

A system that maintains intake air at a more or less constant temperature by blending outside or underhood air with heated air picked up from a shroud over the exhaust manifold. A typical version uses a vacuum motor to power a door in the air cleaner snorkel, and a thermostatic bleed valve to control the signal to the vacuum motor. Also called Thermostatic Air Cleaner (TAC). A malfunction that prevents the door from closing can cause hesitation and stumbling when the engine is cold. An air temperature control flap stuck shut will overheat the air/fuel mixture, possibly causing detonation and elevated CO levels (due to a rich air/fuel ratio, as warm air is less dense than cold air). See [Emission Guide](#).

HEATER CORE

A water-to-air heat exchanger that provides heat to the passenger compartment airstream. Hot coolant from the engine circulates through the tubes in the heater core.

HEAT RISER

A channel in an intake manifold through which exhaust gas flows in order to heat the manifold, thus aiding in fuel vaporization. Commonly used in V6 and V8 engines.

HEAT RISER VALVE

A control valve between the exhaust manifold and exhaust pipe on one side of a V8 or V6 engine that restricts the flow of exhaust causing it to flow back through the heat riser channel under the intake

manifold. This aids fuel evaporation and speeds engine warm up. A heat riser valve stuck open will slow engine warm-up and may cause hesitation and stalling when the engine is cold. A valve stuck in the closed position will greatly restrict the exhaust system and cause a noticeable lack of power and drop in fuel economy.

HELPER SPRINGS

Auxiliary springs that increase a suspension's load carrying capacity. These are typically bolt-on springs with a progressive action that do not come into play until the vehicle is loaded or the suspension deflects past a certain point. May be leaf or coil springs.

HIGH PRESSURE LINES

The refrigeration lines between the compressor outlet and orifice tube or expansion valve. The two longest high pressure lines are the "discharge" and "liquid" lines.

HIGH SIDE

Same as "discharge side" in an A/C system, the part of the refrigeration circuit between the compressor outlet and orifice tube or expansion valve.

HIGH SIDE PRESSURE

Same as "discharge pressure" or amount of pressure in refrigerant liquid line.

HORSEPOWER

A unit of measure for quantifying power output. Invented by James Watt, the term was originally used to describe how much effort a horse exerted when lugging coal out of a coal mine. One horsepower was the amount of effort one horse put forth in raising 33,000 lbs. one foot in one minute. Engine horsepower ratings are determined on special equipment (See Dynamometer), and are usually expressed as so much "brake" horsepower (the amount of horsepower the engine actually delivers after internal friction and parasitic losses are taken into account). For more information on this subject, see [Horsepower & Torque](#).

HOT IDLE COMPENSATOR

A temperature-sensitive carburetor valve that opens when the inlet air temperature exceeds a certain level. This allows additional air to enter the intake manifold to prevent overly rich air/fuel ratios.

HUB CENTRIC

A wheel that is centered or located on the hub by a machined center hole, as opposed to "lug centered" wheels that are located by the position of the lug nuts alone.

HUMIDITY

The amount or percentage of moisture in the air. This affects the perceived cooling performance of the A/C system, and also causes condensation to form on the inside of the windows on cold or rainy days.

HVAC

Acronym for "Heating, Ventilation and Air Conditioning."

HYGROSCOPIC

Refers to attracting or absorbing moisture. Refrigerants and lubricating oils and brake fluid will all pick up moisture in service. Moisture is undesirable because it can freeze and form ice that may block an A/C orifice tube, promote the formation of corrosion inside an A/C system and the brake system, and lower the boiling temperature of brake fluid (increasing the risk of pedal fade if the brakes get too hot). See [Brake Fluid: A Hot Topic](#).

HUB NUT

The large hex nut on the outer end of a front-wheel drive halfshaft that holds the shaft within the wheel hub. Most vehicle manufacturers recommend replacing this nut if it is removed for CV joint service.

HYDROCARBON (HC)

A hydrocarbon (HC) is any kind of substance that contains hydrogen and carbon. Gasoline is a hydrocarbon. So is oil. When gasoline burns inside an engine, there is always a tiny amount that is left over. If an engine is misfiring because of a fouled spark plug or a leaky valve, or if it has worn rings or valve guides and uses oil, quite a bit of unburned HC can pass through into the exhaust. Unburned HC is a major source of air pollution and is the primary source of smog in most urban areas. Various means are used to reduce the amount of HC an engine produces, the primary one of which is the catalytic converter. The converter reduces HC emissions by "reburning" and converting it into harmless water vapor. See [Emission Guide](#).

IDIOT LIGHT

A derogatory term for an instrument panel warning light. They are called idiot lights because they are for idiots who do not know how to read or understand gauges. Actually they are not all bad. An idiot light won't give you any indication that a problem is developing until it happens. On the other hand, a light commands more immediate attention than a gauge. The "ultimate" instrumentation should include both: gauges to give an accurate indication of coolant temperature, oil pressure and charging current, and lights to catch the driver's attention when readings approach the "danger zone." See [Warning Lights](#) and [Troubleshoot Electronic Instrument Cluster](#)

IDLE AIR CONTROL VALVE (IAC)

An electrically-operated valve which allows air to bypass the throttle plate in a fuel injected engine to regulate engine idle speed. See also [Idle Surge \(cause & cure\)](#)

IDLE LIMITER CAP

A plastic device pressed over a carburetor's idle mixture screw which limits the amount of adjustment available during service. Also designed to discourage tampering that could increase emissions.

IDLE ADJUSTMENT

Adjusting the engine idle speed. Idle is not adjustable on many late model engines with computerized idle speed controls. [How To Diagnose & Repair Carburetor Problems](#).

IDLE MIXTURE

The air/fuel ratio that is delivered through the carburetor when the engine is idling. It can be adjusted by turning the idle mixture adjustment screw(s) on the carburetor. The screw opens up a little passage that lets more or less fuel into the engine. On most late model vehicles, the idle mixture screws have caps that allow only limited adjustment, or they are sealed to prevent tampering. The relative richness or leanness of the idle mixture has a big effect on tailpipe emissions at idle. See [How To Diagnose & Repair Carburetor Problems](#).

IDLE SPEED

This refers to how fast the engine runs when idling. It can usually be adjusted by turning a screw on the carburetor throttle linkage, or by turning an air bypass screw on a fuel injection throttle body. On most newer cars, however, it is computer-controlled and non-adjustable. The idle speed is programmed into the computer, and the computer regulates idle speed by opening and closing the idle air control valve. See also [Idle Surge \(cause & cure\)](#)

IDLE STOP SOLENOID

An electromagnetic device mounted on carburetor linkage that maintains the proper throttle opening for specified idle speed while the ignition is on, but allows the throttle to close farther when the ignition is switched off. This shuts off the engine's air supply to prevent engine run-on.

IDLER ARM

A pivot point in a parallelogram steering system that follows the motions of the pitman arm. A worn idler arm bushing typically causes steering wander (looseness) and toe wear.

IGNITION COIL

The component in the ignition system that turns low voltage into high voltage to fire the spark plugs. When 12-volts passes through the coil's primary windings, it creates a strong magnetic field. Then when the current is shut off (by the ignition module or the opening of the contact points in older ignition systems), the magnetic field causes a surge of high voltage (as much as 40,000 volts) in the coil's secondary windings. The high voltage passes to the distributor, then on to the spark plugs where it jumps the plug gap and fires the plugs. Coil problems include shorts or opens in the internal wiring, and cracks around the high voltage terminal. See [Distributor Ignition Systems](#), [Distributorless Ignition Systems](#), [Coil-Over-Plug Ignition Systems](#) and [Multi-Coil Ignition Systems](#). and [Ignition Coil Diagnosis & Testing](#)

IGNITION MODULE

The electronic control for the ignition system. The module receives a signal from a magnetic pickup or Hall effect sensor in the distributor. The module uses this signal to open and close the ground circuit to the ignition coil to fire the spark plugs. The ignition module itself may be located inside the distributor (GM and some imports), on the distributor housing (some Ford applications) or in the engine compartment. Some modules also control timing advance and retard. If a module goes bad, it usually goes completely dead. The engine won't run because there is no trigger voltage to the ignition coil.

IGNITION SYSTEM

The various components that control the igniting of fuel in the engine's cylinders. The ignition system has two parts: the primary side (the distributor and electronic control module), and the secondary side (the ignition coil, distributor cap, rotor, spark plug wires and spark plugs). In distributorless ignition systems, there is no distributor. Each cylinder has its own ignition coil, or coils are shared between paired cylinders that are opposite one another in the firing order. See [Distributor Ignition Systems](#), [Distributorless Ignition Systems](#), [Coil-Over-Plug Ignition Systems](#) and [Multi-Coil Ignition Systems](#).

I/M 240

Stands for "Inspection/Maintenance", an "enhanced" emissions testing program with a tailpipe test that lasts 240 seconds. The test is done on a dynamometer to simulate actual driving conditions. The vehicle is put through a "driving trace" as it accelerates, decelerates and cruises at various speeds. The emissions are collected at the tailpipe and analyzed by a computer to compute the total amount of pollutants in grams per mile (gpm) that are being emitted. The test measures carbon monoxide (CO), unburned hydrocarbons (HC) and oxides of nitrogen (NOX). The I/M 240 test also includes a check of the vehicle's evaporative emissions control system to make sure that the fuel system is not leaking fuel vapors into the atmosphere, and a flow test of the canister purge control valve. See [Diagnosing OBD II Emission Problems](#) and [Emissions Testing](#).

IMMOBILIZER MODULE

An anti-theft module that disables the ignition if an attempt is made to start the engine without a computer-coded key or fob. The module may be part of a keyless entry system.

INCLUDED ANGLE

The sum of the camber and SAI angles in a front suspension. This angle is measured indirectly and is used primarily to diagnose bent suspension parts such as spindles and struts. See [Wheel Alignment](#).

INLINE FILTER

A filter which may be installed in a fuel line, power steering pump discharge line, or A/C compressor discharge line to trap debris that might cause damage. See [Fuel Filters](#).

INJECTOR

The component in a diesel or gasoline fuel injection system that squirts fuel into the engine. In gasoline engine applications, the injector is usually electrically triggered. Varnish and dirt can build up in the nozzle opening restricting the flow of fuel. Injectors can be cleaned by using various fuel additives. In most diesel engines, the injectors are mechanical and deliver fuel under very high pressure directly into the cylinders. Clogging and leaking are two common problems with diesel injectors. Dirty injectors can be cleaned with fuel additives but leaky injectors must be replaced. See [Troubleshooting Fuel Injectors](#).

INNER OR INBOARD CV JOINT

The CV joint closest to the transaxle in a front-wheel drive car. See [Front-Wheel Drive Guide \(free download\)](#).

INTERCOOLER

A heat exchanger that is added to a turbocharged engine to cool the air after it leaves the turbo. This increases air density and means more air can be pumped into the engine. The result is roughly a 10 to 15 percent improvement in horsepower. See [Turbocharger Diagnosis & Repair](#).

JOUNCE

When you drive over a bump and the suspension is momentarily compressed, that is called jounce. When it springs back, that is called "rebound." See [Diagnosing ride control complaints](#).

JUMP STARTING

A technique of starting one vehicle using another vehicle's battery. A pair of jumper cables are required to connect the terminals of both batteries together (positive to positive, negative to negative). The safest technique is first connect the positive terminals on both batteries to one another, and then to connect the negative terminal on the good battery to a ground (such as the engine block or frame) on the vehicle with dead battery. The final jumper connection usually sparks so keeping the spark away from the discharged battery avoids any danger of blowing up the battery. Once the jumper cables have been connected, the engine should be run at fast idle to help charge the dead battery for a couple of minutes. Then the first attempt to start the car should be made. If it does not start within 15 seconds, stop and wait a minute before trying again. This gives the starter a chance to cool off. Continuous cranking can ruin the starter and drain the good battery. See [Battery Safety & Jump Starting](#).

KINGPIN

A pin that serves as the pivot or hinge for the steering knuckle, used primarily on trucks with I-beam axles and older vehicles that do not have ball joints.

KINGPIN INCLINATION (KPI)

The angle formed by a line that runs through the king pin in the steering knuckle on a truck with an I-Beam axle. It is the same as the steering axis inclination (SAI).

LATENT HEAT

The amount of heat required for a change in physical state (phase change). The latent heat of vaporization is the amount of heat required to change a liquid into a vapor.

LATERAL RUNOUT

Also called axial runout, it is the amount of sideways motion or wobble in a wheel or tire as it rotates. It is usually measured by holding a dial indicator against the face of the rim or tire sidewall. A wheel with too much lateral runout will wobble back and forth as it rotates creating a shimmy that feels like dynamic imbalance problem. See [Curing wheel & tire vibrations](#) and [Wheel Balancing](#).

LCD

A "Liquid Crystal Display" is a type of electronic display that forms opaque or dull-colored letters or numbers on various backgrounds. LCD displays are popular for digital dashboards, but they are not as readable in direct sunlight as LED displays.

LEAF SPRINGS

A type of spring made out of a flat strip or individual leaves. Most are steel, but some are made of lightweight composite materials.

LEAN MISFIRE

A condition caused by an air/fuel mixture that is too lean to sustain combustion. Lean misfire causes one or more cylinders to pass unburned fuel into the exhaust system causing a big increase in hydrocarbon (HC) emissions. Symptoms include a rough idle and hesitation or stumble on acceleration. Lean misfire is often caused by vacuum leaks or an EGR valve that is stuck open. See [Engine Hesitation](#) and [Random Misfire](#).

LED

A "Light Emitting Diode" is an electronic light bulb of sorts that produces colored light. You will find LEDs used in the center high mounted stop light on many vehicles, and used as indicator lights in some instrumentation. LED headlights and trim lights are also common on late model vehicles. LEDs are also used in some vehicle speed sensors and in some electronic ignitions.

LIFTERS

Also called "followers" or "tappets," they are the components that ride on the cam lobes and help "lift" the valves open. There are two basic types: solid and hydraulic. Hydraulic lifters are hollow and fill up with oil to take up slack in the upper valve train. Low oil pressure, loss of pressure from the lifters or plugged oil holes in the lifters can result in a "clattering" sound that is referred to as "noisy lifters." Hydraulic lifters do not require periodic adjustment but solid lifters do to maintain the correct amount of valve lash.

LIQUID LINE

In Clutch Cycling Orifice Tube (CCOT) systems, the line connecting the evaporator to the orifice tube. In systems using TXVs (expansion valves), the line connecting the receiver-dryer to the TXV valve inlet.

LINEAR EGR VALVE

A type of electronic EGR system that uses a small motor to move the EGR valve's pintle in small steps, which provides precise control of gas flow. See [Exhaust Gas Recirculation \(EGR\)](#).

LIQUID/FUEL SEPARATOR

An evaporative emissions system component mounted above the fuel tank that prevents liquid gasoline from entering the vent lines.

LOCK NUT

A type of nut that is used to prevent another nut or threaded component from loosening and backing off.

LOW PRESSURE LINE

Same as "suction line" in an A/C system, the line from the evaporator outlet to the compressor inlet. Refrigerant vapor passes through this line as it circulates back to the compressor.

LOW SIDE

Same as "suction side" of an A/C system, the side between the evaporator inlet and compressor inlet where refrigerant exists as a vapor.

MACPHERSON STRUT

A special kind of oversized shock absorber that is used as part of the vehicle's suspension. When used on the front suspension, it replaces the upper control arm and ball joint. Some struts have coil springs around them while others do not. Some struts have replaceable internal components that can be repaired by dropping in a new cartridge. See [Diagnosing ride control complaints](#).

MALFUNCTION INDICATOR LAMP (MIL)

The "Check Engine" on the instrument panel light that comes on when the onboard diagnostic system detects a fault. The MIL light will come on to alert the driver if a fault may cause vehicle emissions to exceed federal emission limits. A vehicle with an illuminated MIL lamp will NOT pass an OBD II plug-in emissions test. The only way to turn off the lamp on an OBD II vehicle is to clear the fault codes with a scan tool. If the fault that set the code is not corrected, the MIL lamp will probably come on again after a period of time. See [Check Engine Light Diagnostics](#), [More on Fault Code Diagnostics](#) and [Trouble-Codes](#).

MANIFOLD AIR TEMPERATURE (MAT)

The temperature of in the intake stream or manifold. Used by the computer to calculate air density and to regulate the air/fuel mixture. The MAT sensor may be a separate component or incorporated into an airflow sensor. See [Air Temperature Sensors](#).

MANIFOLD VACUUM

The amount of vacuum created in the intake manifold by the pumping action of the engine's pistons. Vacuum is highest at idle and lowest at wide open throttle. Vacuum is measured in inches or millimeters of mercury. See [Finding & Fixing Engine Vacuum Leaks](#).

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

Refers to a manifold absolute pressure sensor, a variable resistor used to monitor the difference in pressure between the intake manifold at outside atmosphere. This information is used by the engine computer to monitor engine load (vacuum drops when the engine is under load or at wide open throttle). When the engine is under load, the computer may alter spark timing and the fuel mixture to improve performance and emissions. See [MAP sensors](#) and [Sensor Guide](#).

MASS AIRFLOW SENSOR (MAF)

A device used in many fuel injected engines to measure the amount of air entering the engine so the computer can control the air/fuel mixture. Located ahead of the throttle body, the MAP sensor uses a heated wire or filament to measure airflow. See [Mass Airflow Sensors](#) or [Sensor Guide](#).

MASTER CYLINDER

When you step on the brake pedal, it pushes a piston inside the master cylinder which produces hydraulic pressure inside the brake system. The brake fluid reservoir is located on top of the master cylinder, and you will find both mounted on the firewall in the engine compartment on the driver's side of the vehicle. When the piston seals in the master cylinder eventually wear out, the cylinder may start to leak fluid and/or lose pressure. A brake pedal that gradually sinks to the floor is a sure sign of a bad master cylinder. The unit can be rebuilt or replaced (Note: aluminum master cylinders should never be honed because doing so removes the protective anodizing from the inside of the cylinder). See [Master Cylinder](#).

MATCH MOUNTING

Mounting a tire on a rim so the low spot of the rim lines up with the high spot on the tire. This reduces overall runout for a smoother running tire and wheel assembly. See [Curing wheel & tire vibrations](#) and [Wheel Balancing](#).

MODIFIED STRUT

A type of strut suspension where the coil spring is mounted between the lower control arm and chassis instead of around the strut. Typical applications include late model Mustangs and Camaros.

MONITOR

A self-diagnostic check that runs when certain enable criteria are met. OBD II vehicles have a variety of monitors to check various sensors and systems. The monitors must be "ready" (have run) before the vehicle will be accepted to take an OBD II plug-in emissions test. See [OBD II Diagnostics](#).

MOTORIST ASSURANCE PROGRAM (MAP)

Acronym for "Motorist Assurance Program," an organization that has developed voluntary uniform inspection guidelines and a code of ethics for the auto repair industry. See [Motorist Assurance Program \(MAP\) website](#).

MFI

Abbreviation for Multi-port Fuel Injection, a type of fuel injection system that has one injector for each engine cylinder. Each injector sprays its fuel directly into the intake port in the cylinder head. Multi-port fuel injection is considered to be the "hot" setup because it provides better cylinder-to-cylinder fuel distribution for more power.

MOTOR OIL

The lifeblood of the engine, it not only lubricates the engine but also cools the crankshaft bearings and pistons. As an engine runs, combustion blowby into the crankcase contaminates the oil with moisture, soot and unburned fuel. Moisture is the worst culprit because it forms acids and sludge. Additives in the

motor oil (nearly a third of a can of oil is additives) fight the contaminants and give the oil special lubricating properties. The oil itself never wears out but the additives do. That is why the oil must be changed periodically. Changing the oil also gets rid of accumulated acids, sludge and moisture. The oil filter traps dirt (but not moisture) so it too should be replaced at every oil change. Use the recommended viscosity and type of oil listed in the owner's manual (See Viscosity). The difference between competing brands of motor oil is mostly advertising hype. Any oil of the proper viscosity that conforms to the highest America Petroleum Institute rating should be safe to use. Straight weight or non-detergent oils in late model engines is not recommended. See [What Every Motorist Should Know About Motor Oil](#), [Motor Oils & Lubricants](#), [How Often Should You Change Your Oil?](#) and [API Motor Oil Classifications](#).

MPG

Abbreviation for Miles Per Gallon. A vehicle's fuel economy is determined by a number of factors including the size of the engine, the type of carburetion used, the weight of the vehicle, the type of transmission used (manual or automatic), the final drive ratio, the size and type of tires used, tire inflation pressures, aerodynamic streamlining of the body, the driving habits of the driver, the kind of road surface and terrain upon which the vehicle is driven, the speed at which its driven, and environmental factors such as temperature, wind and humidity. Taking all these into consideration, it is no wonder the EPA says "the mileage you get may vary from the official EPA estimates." See [Fuel Saving Tips from the Car Care Council](#) and [Advice On Gas-Saving Gadgets](#).

MUFFLER

The device in the exhaust system that quiets the exhaust. A muffler is nothing more than a steel can full of baffles. Some (the so-called "glass-pack" mufflers) use Fiberglass batting to soak up noise. Mufflers rust out because exhaust is roughly 50 percent water vapor. The further the muffler is located from the engine, the more prone it is to rapid rust-through because the water vapor has more time to cool and condense. The best mufflers use metal that is galvanized on both sides. "Aluminized" mufflers or those that use galvanized metal on the outside only are not as rust-resistant. The worst (cheapest) mufflers are those with no protection at all.

NEUTRAL STEERING

A vehicle that neither understeers or oversteers. It responds predictably and evenly to steering inputs when cornering.

NHTSA

Abbreviation for the National Highway Traffic and Safety Administration. This is the government agency that is responsible for making and policing safety rules for all vehicles. NHTSA is the agency that can order a vehicle manufacturer to issue a safety recall. See [National Highway Traffic & Safety Admin. \(NHTSA\) website](#).

NOX

Abbreviation for Oxides of Nitrogen. The "N" stands for Nitrogen, the "O" for Oxygen, and the "X" is scientific notation for all the various combinations of the two. NOX is formed inside an engine when combustion temperatures exceed 2500 degrees Fahrenheit. NOX is considered to be a serious air pollutant because it is so irritating. NOX emissions are minimized by the EGR valve, and by the catalytic converter in 1981 and newer model cars. See [Exhaust Gas Recirculation \(EGR\)](#) and [Emission Guide](#).

OBD II

Onboard Diagnostics II, A second generation emissions diagnostic system required on all 1996 and newer vehicles (though some 1994 and 1995 model year vehicles were equipped with early versions of the system). The OBD II system monitors vehicle emissions, and illuminates the Check Engine or Malfunction Indicator Lamp (MIL) if it detects a problem that causes emissions to exceed the federal limits by 50% or more. The OBD II system also stores diagnostic trouble codes to help technicians diagnose the cause of the emissions problem. OBD II cars and light trucks also have a standard diagnostic connector. See [All About OBD II](#) and [OBD II Diagnostics](#).

See also [OBDClearingHouse.com](#) for tons of OBD information.

OCTANE

This is a measure of a fuel's resistance to detonation (See Detonation). The higher the number, the better the fuel. Typical unleaded regular octane ratings range from 86 to 88. Premium grade unleaded fuels start around 89 and go as high as 93 or 94. By comparison, leaded premium fuels of a decade ago often started at 95 and went to over 100. The octane rating of gasoline can be boosted by additional refining and/or adding "octane boosting" chemicals such as benzene, alcohol or tetraethyl lead. Lead is a great octane booster but it ruins catalytic converters and oxygen sensors. Because of this, leaded fuel was phased out. See [Fuel Octane Ratings & Recommendations](#).

OFF-CENTER STEERING

A condition where the steering wheel is not centered or is crooked when traveling straight ahead. The condition contributes to toe wear because anytime the wheels are steered off dead center, they toe out slightly which increases side slippage and scrubbing. The underlying cause of off-center steering is often rear axle or toe misalignment, but it can also be caused by failing to center the steering prior to adjusting toe. If accompanied by a lead or pull to one side, the underlying cause may be cross camber, cross caster, uneven tire pressure or mismatched tire sizes side to side. See [Correcting Steering Pulls](#).

OFFSET

The position of the backside of the wheel center section with respect to the centerline of the rim. If the center is closer to the back of the wheel, it has "negative" offset. If the center is closer to the outside face or front of the wheel, it has "positive" offset. Most wheels on FWD cars have positive offset.

OIL CONSUMPTION

All engines use a small amount of oil over time. It gets past the piston rings and valve guide seals and is burned in the combustion chamber. A small amount escapes through the PCV system and a few drops usually managed to seep through a gasket or seal. The question is at what point should one consider oil consumption to be a problem? Any engine that consumes less than a quart of oil every 3000 miles is in excellent mechanical condition. If it uses less than a quart in 1500 miles, it is still in pretty good condition. But once oil consumption exceeds a quart every 1000 miles, it signals the engine is approaching retirement. Blue smoke in the exhaust or oil consumption on the order of a quart or more every 500 miles indicates serious oil burning problems (usually due to worn or broken piston rings, a cracked piston, or worn valve guides and/or seals). Sometimes a leaky seal or gasket can make an otherwise good engine use oil. The most frequent leak points are valve cover gaskets, crankshaft end seals and oil pan gaskets. Tightening the valve cover or pan bolts can sometimes stop a leak but usually the only cure is to replace the gasket See [Causes of High Oil Consumption](#).

OIL COOLER

A heat exchanger for cooling oil. Most automatic transmissions are equipped with an oil cooler located inside the radiator. Since the radiator usually runs close to 200 degrees, the amount of "cooling" this kind of setup provides is questionable. An aftermarket oil cooler that can be installed outside the radiator can provide much better cooling, and is recommended for towing or high performance applications. Except for air-cooled engines (older Volkswagens for example) and race cars, most engines do not use an oil cooler for the engine. The engine's cooling system is usually adequate to keep oil temperatures within safe limits.

OIL PRESSURE

The amount of pressure created in an engine's oil system by the oil pump. A certain amount of oil pressure is needed to circulate oil throughout the engine and to maintain adequate lubrication. Low oil pressure or loss of pressure is dangerous because it can lead to expensive engine damage. A low oil level in the oil pan, oil leaks, dirty oil, diluted oil (with gasoline), too low a viscosity oil, a plugged oil pickup screen or oil filter, a worn oil pump or worn main bearings can all contribute to low oil pressure. Complete loss of oil pressure usually results from a broken oil pump drive shaft (if the pump is driven off the camshaft). Unless the engine is shut off immediately, it will be ruined. Oil pressure is monitored by a sending unit mounted on the engine block. Oil pushes against a spring-loaded diaphragm, which in turn is connected to a resistor or set of contacts that trigger a warning light if pressure drops below about 4 or 5 psi. See [Troubleshooting Low Oil Pressure](#) and [Oil Pump Diagnosis](#).

ONBOARD DIAGNOSTICS (OBD)

Software in the engine control module or powertrain control module that runs self-diagnostic checks on the control module, sensors and other related systems. When a fault is found, the software sets a diagnostic trouble code and turns on the MIL lamp. See [OBD II Help](#).

ONBOARD VAPOR RECOVERY SYSTEM (ORVR)

Part of some vehicle's evaporative emissions (EVAP) control system, a vapor recovery system traps and stores fuel vapors when the vehicle is refueled.

OPEN LOOP

A mode of operation in a computerized engine management system that occurs after a cold start. During open loop, the computer provides a fixed air/fuel ratio that is richer than normal to improve cold drivability until the engine warms up. See also Closed Loop. See [Understanding Engine Management Systems](#).

ORIFICE TUBE

A metering device located just ahead of the evaporator on the high pressure side of an A/C system that restricts the flow of refrigerant into the evaporator. A small hole (the orifice) allows only a certain amount of refrigerant to pass through the device. The creates a pressure drop that allows the refrigerant to evaporate inside the evaporator.

OUTER OR OUTBOARD CV JOINT

The CV joint closest the wheel in a front- or rear-wheel drive vehicle. See [Front-Wheel Drive Guide \(free download\)](#).

OVERHEAD CAM (OHC)

This refers to a type of engine design that positions the camshaft in the cylinder head over the valves. It is a popular design on many four-cylinder, V6 and even some V8 engines. On engines that use a rubber belt to drive the overhead cam, the belt usually needs to be replaced somewhere around 60,000 to 90,000 miles (see the owners manual for specific recommendations).

OVERHEATING

When the temperature of the coolant exceeds the normal operating temperature range of the engine, it is said to be overheating. A number of things can cause this to happen. Idling for long periods of time in traffic during hot weather can cause overheating because the water pump does not turn fast enough to circulate sufficient coolant through the system (put the transmission in neutral and rev up the engine to help cool it off). A defective thermostat can stick shut and prevent the coolant from circulating to the radiator (replace the thermostat). A leak that allows the coolant level to drop can result in overheating (fix the leak, then refill the cooling system). A defective or inoperative cooling fan can cause the engine to overheat, as can a slipping or broken fan belt (find the fault and fix it). If an engine overheats, turning on the heater can sometimes help increase cooling capacity enough to cool it down. In most cases, though, the engine should be shut off and allowed to cool. Running it hot can damage the engine. NEVER open the radiator cap on a hot engine. Steam and coolant can spray out under considerable force and burn you! Add coolant to the coolant reservoir, or wait until the engine has cooled to open and cap to add coolant directly to the radiator. See [Overheating](#).

OVERINFLATION

A condition where a tire contains more air pressure than the recommended amount for the tire size and load. Overinflation reduced rolling resistance but also increases ride harshness and the risk of tire damage. A tire's inflation pressure should never exceed the maximum rating on the tire sidewall. See [Tire inflation tips](#).

OVERLOAD SHOCKS

A type of shock absorber that is equipped with a helper spring to keep the suspension from sagging when a vehicle is heavily loaded.

OVERSTEER

A handling trait wherein a vehicle tends to overrespond to changes that are made in the direction of the steering wheel. The rear end on a vehicle that oversteers will tend to spin around when the vehicle is turned sharply (see Understeer).

OXIDATION

Any reaction in which a chemical joins with oxygen, as rusting or combustion.

OXIDATION CATALYST

A two-way catalytic converter or the chamber in a three-way converter that oxidized unburned hydrocarbons (HC) and carbon monoxide (CO) to reduce pollution. See [Catalytic Converters](#).

OXIDES OF NITROGEN

See NOX.

OXYGEN

A gaseous element given the chemical symbol O, and occurring as O₂, which makes up approximately 20% of the earth's atmosphere. Necessary for combustion, and measured by an exhaust analyzer to identify lean fuel mixtures.

OXYGEN SENSOR

A component in the engine's computer control system that monitors the amount of oxygen in the exhaust. The computer uses this information to change the relative richness or leanness of the air/fuel mixture. Located in the exhaust manifold, the O₂ sensor resembles a small spark plug on the outside. But inside it has a special zirconium element that produces a varying voltage once it gets hot. The lower the oxygen content, the higher the sensor's output voltage. The oxygen sensor is vulnerable to contamination and may be damaged by lead, silicone or phosphorus. A contaminated O₂ sensor or one that has become sluggish with age can cause an increase in fuel consumption and emissions. On some older vehicles, replacement may be recommended at 50,000 miles for preventive maintenance. See [Oxygen Sensors](#).

OZONE

A molecular form of oxygen that contains three atoms of oxygen instead of the normal two. It is formed naturally by sunlight and electrical discharge. It has a pungent odor and a strong oxidizing effect. Ozone is broken down by natural chemical reactions, including reacting with chlorine which is present in R12 refrigerant.

OZONE DEPLETION

Destruction of ozone in the ozone layer attributed to the presence of chlorine from manmade CFCs and other forces. The layer is thinning because ozone is being destroyed at a faster rate than it is being regenerated by natural forces. See [Alternative Refrigerants](#).

OZONE LAYER

A region in the stratosphere 12 to 35 miles up where the air is very cold and thin, and ozone is found in high concentrations. The ozone layer is continually replenished by solar radiation and screens out about 95 to 99% of the sun's UVC ultraviolet radiation.

PAG OIL

A type of polyalkylene glycol lubricant used as a compressor oil mainly in original equipment R134a A/C systems. Various viscosities of PAG oils are specified by the vehicle manufacturers for specific A/C applications. [Click Here for a list of PAG oil recommendations](#).

PARALLELOGRAM STEERING

A type of steering linkage that uses a pitman arm, idler arm and center link to steer the front wheels. Used primarily on trucks and older rear-wheel cars, the system is so named because the center link always moves parallel to the axle.

PARKING BRAKE

A mechanical brake for locking the rear wheels when parking. When you pull on the parking brake handle or step on the parking brake pedal, it pulls a pair of cables that extend to the rear brakes. The cables work a lever mechanism that binds the rear shoes against the drums, or on rear disc brake-equipped vehicles locks the pads (or a pair of mini-shoes) against the rotor. The most common problem associated with the parking brake is corrosion in the cable sleeves, which can prevent the rear brakes from releasing once the brake has been applied. The best way to prevent this from happening is to use the parking brake frequently. See [Parking Brake Service](#).

PARTICULATES

Solid particles, mostly carbon, found in vehicle exhaust. These types of emissions are associated primarily with diesel engines, and can be caused by a misadjusted or mistimed injection pump. See [Emission Guide](#).

PARTICULATE TRAP

An emission control device in the exhaust system of a diesel engine that captures particulates before they can enter the atmosphere.

PCV VALVE

The Positive Crankcase Ventilation valve is an emissions control device that routes unburned crankcase blowby gases back into the intake manifold where they can be reburned. The PCV system is one of the oldest emission control devices, and also one of the most beneficial. Besides totally eliminating crankcase emissions as a source of air pollution, the constant recirculation of air through the crankcase helps remove moisture which otherwise would cause sludge to form. Thus the PCV valve extends the life of the oil and engine. The PCV valve requires little maintenance. The valve and filter should be replaced somewhere around 30,000 to 50,000 miles (see the vehicle owners manual for service intervals). See [Positive Crankcase Ventilation \(PCV\)](#)

PFI

Abbreviation for Port Fuel Injection, another name for a multi-port fuel injection system. The system uses one injector for each engine cylinder. Fuel is sprayed directly into the intake port for better cylinder-to-cylinder fuel distribution and more power. See [Understanding Today's Fuel Systems](#).

PITMAN ARM

The arm connected to the steering box sector shaft that moves side to side to steer the wheels.

POLYOL ESTER (POE) OIL

A type of compressor oil that is compatible with both R134a and R12 refrigerants, as well as residual mineral oil that may still be in the A/C system. POE oil is often used when retrofitting an older R12 A/C system to R134a.

POSITIVE CRANKCASE VENTILATION

A means of controlling crankcase blowby emissions and removing moisture condensation from the crankcase to prolong oil life. See [Positive Crankcase Ventilation \(PCV\)](#)

PORTED VACUUM

Engine vacuum that is available above the throttle plates of a throttle body or carburetor. Used to advance ignition timing on older carbureted engines when the throttle is opened above its idle position.

PORTED VACUUM SWITCH

A valve which passes or blocks the passage of vacuum to a vacuum-operated component, such as a distributor advance mechanism or EGR valve. The operation of the valve may be controlled by engine temperature or an electric solenoid.

POWER BRAKES

Most vehicles use a vacuum booster to increase the pedal force applied to the master cylinder. Some use a hydraulic power unit that does the same thing with hydraulic pressure rather than vacuum. Power brakes require no special maintenance, but if the booster goes bad pedal effort will be noticeably higher. A loose or leaky vacuum hose to the booster unit is often all that is wrong. But if the booster itself is bad, it must be replaced. See [Troubleshooting Power Brakes](#).

POWER STEERING

A means of hydraulically assisted steering. A belt-driven power steering pump creates system pressure. The pressurized fluid is then routed into a cylinder that helps push the wheels one way or the other when the steering wheel is turned. The two most common power steering complaints are noise and leaks. A slipping drive-belt on the power steering pump can produce a loud squeal, especially when turning sharply. A bad valve or bearings in the pump itself can make a growling noise. Leaks most often occur at hose couplings or on the power cylinder seals. In power rack & pinion steering units, internal leaks can be a major problem (which require replacing the entire unit with a new or rebuilt assembly). The only required maintenance for this system is to check the level of the power steering fluid periodically. If low, check for possible leaks, then add fresh fluid to the pump reservoir. Running the system low can ruin the pump. See [Variable-Assist Power Steering Systems](#).

PREIGNITION

A damaging engine condition wherein the air/fuel mixture ignites spontaneously due to hot spots in the combustion chamber. Causes include engine overheating, spark plugs that are the wrong heat range (too hot), sharp edges on the combustion chamber, low octane gasoline, a lean fuel mixture, or carbon buildup in the combustion chamber. Preignition can burn holes in pistons and contribute to detonation.

PRELOAD

A thrust load applied to a bearing such as a wheel bearing to minimize axial or sideways play. The amount of preload is critical with an adjustable wheel bearing because too little can contribute to steering wander while too much may cause premature bearing failure. Sealed wheel bearings are not adjustable. See [Wheel Bearing & Seal Service](#).

PREVENTIVE MAINTENANCE

A method of preventing problems by maintaining wear items according to a regular schedule. Lubricating, adjusting and replacing all wear items before they can cause problems contributes to trouble-free driving and longer vehicle life. Regular fluid checks, and fluid and filter changes are the most important items on any preventive maintenance checklist. See [Preventive Maintenance Guidelines Chart](#).

PSI

Abbreviation for Pounds per Square Inch. Usually used when referring to tire inflation pressures, cooling system pressure or turbocharger boost pressure.

PULSE WIDTH MODULATION (PWM)

A method for controlling various functions by switching the current on and off. Varying the time (duty cycle) of the signal increases or decreases the operating speed or opening of the device being controlled (such as the fuel injectors, cooling fan, A/C compressor, etc.)

R-12

The automotive term for dichlorodifluoromethane, also known as "Freon," a type of manmade CFC refrigerant used in all 1992 and earlier automotive A/C systems. R12 is being phased out because of its harmful effects on the ozone layer when it leaks or is vented into the atmosphere. See [Alternative Refrigerants](#).

R-1234YF

A new environmentally friendly refrigerant that has a much lower Global Warming Potential (GWP) than R-134 (4 versus 1400). The new refrigerant has cooling characteristics similar to R-134 but requires a special compressor lubricant. It is being phased in to replace R-134 on 2013 and newer vehicles. See [R-1234yf](#).

R-134A

The automotive term for tetrafluoroethane, also known as "SUVA," a manmade refrigerant that contains no chlorine and is considered to be "ozone safe." Used in most 1995 and newer automotive A/C systems. See [Troubleshooting A/C Cooling Problems](#).

RABS

Rear Antilock Brake System. Ford's name for rear wheel ABS. See [RWAL Rear Wheel Antilock Brakes](#).

RACK & PINION STEERING

A type of lightweight steering gear that uses a worm-like gear (the pinion) to drive a horizontal bar (the rack). The primary advantage of rack & pinion steering is that it is lightweight and uses fewer parts than a reciprocating ball steering gear. See [Servicing Variable Assist Power Steering](#).

RADIAL RUNOUT

Variation (out-of-round) in the radius or circumference of a wheel or tire. It is measured by placing a dial indicator on the inside edge of the rim or tire tread. Too much radial runout can cause up-and-down vibrations similar to those caused by a static imbalance. See [Diagnosing Tire Problems](#).

RADIAL TIRE

A type of tire that is constructed with the reinforcing belts sideways under the tread rather than lengthwise. This makes the tire more flexible which reduces rolling resistance to improve fuel economy (See Tire Ratings). A radial tire can be identified by looking for the letter "R" in the size designation on the tire's sidewall.

RADIATOR

The part of the cooling system that gets rid of the engine heat. Coolant from the engine flows past the thermostat and into the radiator where it is cooled by air passing through the fins. Internal corrosion and hairline cracks caused by vibration are the two primary causes of radiator leaks. "Stop leak" can be dumped into the radiator to temporarily plug small leaks but larger ones usually require professional repair or replacement. "Recoring" a radiator means replacing the heat exchanger section between the end tanks.

REAR AXLE STEER

A steering pull or lead to one side caused by misalignment of the rear wheels or axle. Misalignment creates a thrust angle that causes the vehicle to lead to one side resulting in an off-center steering wheel and accelerated toe wear in the front tires.

REAR WHEEL ABS

A type of ABS system that only involves the rear wheels. Commonly used on pickup trucks and vans, rear-wheel ABS provides skid control with varying vehicle loads. This type of ABS system uses only a single speed sensor in the transmission or differential for both rear wheels. See [RWAL Rear Wheel Antilock Brakes](#).

REAR-WHEEL DRIVE (RWD)

A method of driving a vehicle whereby engine power is applied to the rear wheels. Power from the engine flows through the transmission, down the driveshaft, through the differential to the rear axles and wheels.

REAR TOE

The toe setting of the rear wheels. Rear toe is not adjustable on rear-wheel drive cars with solid axle housings but is adjustable on many front-wheel drive cars and minivans. If rear toe is unequal, it can produce a diagonal wear pattern (heel and toe wear) on the rear tires. See [Wheel Alignment](#).

REBOUND

This term has nothing to do with basketball. What it refers to is the suspension springing back after it is been momentarily compressed (See Jounce).

REBUILT PARTS

Rebuilt parts are those that have been salvaged and reconditioned to good-as-new condition. Rebuilt parts include alternators, starters, water pumps, clutches, brake calipers, brake shoes, master brake cylinders and fuel pumps. Savings compared to equivalent new parts range from 20 to 50 percent.

RECIRCULATING BALL STEERING

A type of steering gear normally used with a parallelogram steering linkage. So named because of the ball bearings that are recirculated in the gear box between the worm and sector gears to reduce friction.

RECEIVER-DRYER

A container for storing liquid refrigerant from the condenser. This component also contains a bag of desiccant that absorbs small amounts of moisture from the refrigerant.

RECOVERY & RECYCLING

A mandatory requirement for all facilities that perform A/C service work. Venting refrigerant into the atmosphere is no longer permitted. All refrigerant (R12 or R134a) must be recovered from a vehicle's A/C system prior to opening the system for repairs. The refrigerant must then be recycled to meet certain purity standards.

RECTIFIER

A part of an alternator that uses diodes to convert alternating current into direct current. It usually consists of three pairs of diodes.

REFERENCE VOLTAGE

In computerized engine management systems, a five volt signal sent out from the computer to a variable resistance sensor such as a TPS. The computer then reads the voltage value of the return signal. Called "V-ref."

REDUCTION CATALYST

The section of a three-way catalytic converter that breaks NO_x down into harmless nitrogen and oxygen through a reduction reaction. See [Catalytic Converters](#).

REFRIGERANT

The working agent in an A/C system that absorbs, carries and releases heat. The two primary automotive refrigerants are R12 and R134a, but many other substances have similar properties (primarily a low boiling temperature) that allow them to be used as "alternative" refrigerants. But most of these substances are not "approved" for use in mobile A/C systems because of safety (flammability) or incompatibility concerns. See [Alternative Refrigerants](#) and [Troubleshooting A/C Cooling Problems](#).

REFRIGERATION

The removal of heat by mechanical means.

REFRIGERATION CYCLE

The complete course of refrigerant back to its starting point. During the refrigeration cycle, refrigerant circulates through the system changing temperature, pressure and physical state (liquid & vapor). This allows heat to be absorbed from air entering the passenger compartment and carried to the condenser where it is released. The compressor provides the pumping action necessary to move the refrigerant and create the desired changes. See [Troubleshooting A/C Cooling Problems](#).

RELATIVE HUMIDITY

The actual moisture content of the air in relation to the total amount of moisture the air can hold at a given time. If air contains three-quarters of the maximum moisture content it could possibly hold at a given temperature, the relative humidity is said to be 75 percent. Warm air is capable of holding more moisture than cold air. Humidity affects the cooling performance of the A/C system and the engine's octane requirements.

RELAY

An electrical device that uses an electromagnetic switch and contact points to turn on and off various high amperage electrical accessories. Most vehicles have a horn relay, a headlight relay, a relay for the rear window defogger, and relays for various other things such as the blower motor. When an accessory goes dead, it is often the relay that needs to be replaced. See [Electrical Relays & Fuses](#).

RETROFIT

To replace an older component, system or refrigerant with a newer one. With respect to A/C systems, retrofit refers to replacing R12 with R134a. Changing refrigerants requires changing compressor lubricants and service fitting, and may also require other system modifications. See [Retrofit Guide](#).

RIDE HEIGHT

The distance between a specified point on the chassis, suspension or body and the ground. Measuring ride height is an indirect method of determining spring height, which is important because it affects camber, caster and toe. Low ride height indicates weak or sagging springs. Ride height should be within specifications before the wheels are aligned. See [Ride Height](#).

ROAD CROWN

The slope of a road surface to the outside for proper drainage. Excessive road crown can cause a vehicle to lead to the right. Reducing caster on the left front wheel is sometimes used to compensate for road crown.

RPM

Abbreviation for Revolutions Per Minute. Engine speed is often expressed as so many rpm.

REAR-WHEEL DRIVE (RWD)

A method of driving a vehicle whereby engine power is applied to the rear wheels. Power from the engine flows through the transmission, down the driveshaft, through the differential to the rear axles and wheels.

RUNOUT

The amount of variation or wobble in a wheel, tire, shaft or pulley. See [Diagnosing Tire Problems](#).

RWAL

Rear Wheel Anti-Lock brakes. A term used by General Motors and Chrysler for rear-wheel antilock braking. See [RWAL Rear Wheel Antilock Brakes](#).

RUSTPROOFING

The process of applying rust-inhibiting chemicals, waxes or sealers to the underside and inside of the vehicle body as well as any other rust-prone areas. Not to be confused with undercoating which treats only the underside of the vehicle. Commercial rustproofing treatments usually include a guarantee for a certain number of years. Be aware that some guarantees require annual "checkups" to touch up any areas where the rustproofing may have been damaged.

SCAN TOOL

A diagnostic tool that is plugged into a vehicle's diagnostic connector to read fault codes, sensor data and other system information. The software in the tool must be compatible with the vehicle application, and may only be able to access or display limited information. OEM scan tools can access all vehicle data and test functions but typically cover only one make of vehicle. Aftermarket scan tools can be used on a wider variety of makes and models, but may not have all the capabilities of the OEM scan tool. A scan tool is necessary for vehicle diagnostics and to clear fault codes on most 1996 and newer vehicles with OBD II. See [Scan Tool Help](#).

SCHRADER VALVE

A type of valve fitting that opens when depressed. Schrader valves are used in tire valve stems, on air conditioning hoses and on the fuel rails of many fuel injection systems.

SCRUB RADIUS

The distance between the extended centerline of the steering axis and the centerline of the tire where the tread contacts the road. If the steering centerline is inboard of the tire centerline, the scrub radius is positive. If the steering centerline is outboard of the tire centerline, the scrub radius is negative. Rear-wheel drive cars and trucks generally have a positive scrub radius while FWD cars usually have zero or a negative scrub radius because they have a higher SAI angle. Using wheels with different offset than stock can alter the scrub radius. See [Wheel Alignment](#).

SEMI-METALLIC BRAKES

A type of brake lining that uses steel wool instead of asbestos as a reinforcing fiber. Semi-metallic brakes give better high temperature performance and wear characteristics than conventional asbestos linings. They are commonly used on the front disc brakes of front-wheel drive passenger cars. Asbestos pads should never be substituted for semi-metallic pads when relining the brakes. Rapid brake wear will result. See [Choosing Friction Linings](#).

SENSOR RING

The toothed ring that generates a signal in a wheel speed sensor. It may be mounted on the back of the wheel hub, inside the rotor or brake drum, or mounted on the transmission output shaft or differential pinion shaft. The number of teeth or notches in the ring determines the signal frequency in the sensor as the wheel rotates. For this reason, any replacement rings must have the same number of teeth. See [Antilock Brakes](#).

SEQUENTIAL MULTIPOINT FUEL INJECTION (SFI)

A type of fuel injection system that uses a separate fuel injector for each cylinder, and pulses the injectors individually. See [Understanding Today's Fuel Systems](#).

SERPENTINE BELT

A type of flat rubber drive belt that is used to turn multiple accessories on the front of an engine. It is called a serpentine belt because of the way it snakes around the various pulleys. Many vehicles now have a single serpentine drive belt because it eliminates the need for several separate V-belts. A spring-loaded pulley maintains tension on the serpentine belt. This does away with the need to retension the belt when it is replaced. Serpentine belts generally last 25% to 50% longer than conventional V-belts. See [Belt & Hose Service](#).

SETBACK

The amount by which one front wheel is further back from the front of the vehicle than the other. It is also the angle formed by a line perpendicular to the axle centerline with respect to the vehicle centerline. If the left wheel is further back than the right, setback is negative. If the right wheel is further back than the left, setback is positive. Setback should usually be zero to less than half a degree, but some vehicles have asymmetrical suspensions by design. Setback is measured with both wheels straight ahead, and is used as a diagnostic angle along with caster to identify chassis misalignment or collision damage. The presence of setback can also cause differences in toe-out on turn angle readings side-to-side.

SELECT LOW PRINCIPLE

An operating strategy on ABS systems that have one wheel speed sensor for each rear wheel. The control module selects the wheel that is turning the slowest to initiate antilock braking. See [Antilock Brakes](#).

SHACKLE

A link that connects a leaf spring to the chassis or frame. The shackle allows the length of the spring to change as the suspension moves up and down.

SHIMMY

A back and forth vibration that is felt in the steering wheel, sometimes violent. It can be caused by a bent wheel, excessive radial runout in a wheel, a dynamic wheel imbalance or loose steering parts.

SHOCK ABSORBER

A part of the suspension that is designed to dampen up-and-down wheel motions that result from bumps and chassis movement. Each wheel has its own shock absorber (See MacPherson Strut), which is nothing more than a fluid-filled cylinder with a piston and valving inside. The shock absorber's job is to provide a controlled amount of resistance every time the wheels bounce up and down or the chassis leans as it goes around a corner. The constant motion and the heat created by all the internal friction can wear out an original equipment shock after 50,000 miles. There are many different types of replacement shocks from which to choose, and selecting the one that is right depends on the application. Oil on the outside of a shock is a sign that the seal is leaking and the shock may need to be replaced. A "bounce test" can also be used to tell if the shocks are worn (the vehicle should bounce no more than once or twice after rocking the bumper up and down vigorously). See [Shock Absorber & Strut Diagnosis](#).

SHOCK FADE

A condition where loss of dampening action occurs because of fluid foaming inside a shock absorber. The rapid oscillations of the piston moving through the fluid churns it into foam, which reduces the amount of resistance encountered by the piston. This causes the dampening action to fade, resulting in loss of control, excessive suspension travel and reduced handling. Pressurizing the fluid chamber inside the shock with a gas charge can minimize foaming and prevent fade.

SHORT-LONG ARM (SLA) SUSPENSION

A common type of suspension that uses upper and lower control arms of unequal length. The upper arm is usually shorter than the lower arm to control camber changes during jounce and rebound.

SIGHT GLASS

A window, usually located in the top of the receiver-dryer for observing the refrigerant during diagnosis. Most newer A/C systems do not have this device.

SLIP PLATES

Movable plates on an alignment rack that go under a vehicle's wheels that allow the suspension to settle prior to an alignment.

SMART SUSPENSIONS

Any suspension that uses computer-controlled shock absorbers and/or air springs to vary ride characteristics and/or ride height. The advantage of such a suspension is that it can change the way the suspension reacts to changing road conditions. On a rough road, it can provide a smoother ride. On smooth roads, it can firm up to provide better handling. A computer-controlled solenoid atop each shock absorber or MacPherson strut changes the internal valving of the shock to provide a stiffer or softer suspension as needed. On suspensions that use air springs, ride height sensors allow the computer to maintain the same ride height in spite of changing loads. Air can be added or bled from the air springs by computer-controlled solenoid valves. On some vehicles, the computer lowers the vehicle for better aerodynamics at high speed. On some four-wheel drive vehicles, the suspension can be raised for increased off-road ground clearance. See [Servicing Air Ride Suspensions](#).

SMOG PUMP

A slang term for an air injection system pump. Used to pump extra air into the exhaust system to help the converter reburn pollutants. See [Emission Guide](#).

SNAP RULE

The EPA's "Significant New Alternatives Policy." This was implemented in July, 1994 for the purpose of approving alternative refrigerants for automotive use. Under this rule, a manufacturer must submit refrigerant data to the EPA for review. If the alternative refrigerant is not approved, it cannot be used as a substitute for R12 or R134a. The EPA does not approve any flammable refrigerants any that contain butane, propane or other flammable hydrocarbons), or any that contain CFCs. See [Alternative Refrigerants](#).

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

A professional association that among other things establishes industry "standards" for tools and repairs, including A/C service procedures, recovery, recycling and leak detection equipment, refrigerant purity, etc. See [SAE website](#).

SOLENOID

A type of electrical device that uses an electromagnet to move something. The starter on the engine uses a solenoid for engaging the flywheel. Power door locks use solenoids to pull and release the locks. A fuel injector has a built-in solenoid that opens and closes the nozzle. An idle stop solenoid may be used on the carburetor to close the throttle to prevent dieseling when the engine is shut off, or to increase idle speed when the air conditioner is running.

SPARE TIRE

There are several different types of spare tires: a folding spare (which must be inflated with an air canister prior to mounting), a compact spare (which is much smaller and narrower than the other wheels on the vehicle), and a lightweight spare (which is the same diameter as the other tires on the vehicle but thinner). All of these tires are labeled "temporary" spares because of their weight-saving construction. As such, they are intended for emergency use only, and not for sustained or high speed driving. Most carry a warning not to exceed 50 mph nor to travel further than 50 miles. The only kind of spare tire that can be used without such restrictions is a conventional full-sized spare that is the same as the other tires on the vehicle.

SPARK KNOCK

This is the pinging or rattling noise sometimes heard during acceleration that indicates detonation is occurring inside the engine. Spark knock can be caused by a variety of things including using low octane fuel, over-advanced ignition timing, too much compression (often due to a buildup of carbon in the combustion chamber), by an inoperative EGR valve, and/or by too much heat. If switching to a higher octane fuel does not cure the problem, the cause should be investigated because prolonged or heavy knocking can damage the engine. See [Spark Knock](#).

SPARK PLUG

A component in the ignition system that ignites the fuel inside the combustion chamber. The spark plug is nothing more than a pair of electrodes with a gap in between. When high voltage from the ignition system

reaches the gap, an electrical arc jumps across it and ignites the fuel. The distance across this gap is critical because if it is too wide, there may not be enough voltage to push the spark across. The center electrode gradually wears away as the spark plug accumulates miles, and deposits build up around the insulated tip that can short circuit the firing voltage. That is why spark plugs require periodic replacement. With unleaded fuel, average plug life should be around 30,000 miles. With platinum plus, the interval is 100,000 miles. See [Why Spark Plugs Still Need To Be Changed](#) and [Spark Plugs](#).

SPEED-DENSITY FUEL INJECTION SYSTEM

A type of fuel injection system that does NOT use an airflow sensor, but estimates air flow based on engine speed, throttle opening, air temperature and intake manifold vacuum. See [Understanding Today's Fuel Systems](#).

SPINDLE

The component on which the hub and wheel bearings are mounted.

SPOILER

An aerodynamic add-on that goes across the trunk or back of a vehicle to deflect the direction of airflow and reduce drag. A front spoiler is technically an "air dam" because it prevents air from getting under the car and increasing drag.

SPRING COMPRESSOR

A tool for compressing and holding a coil spring so it can be removed or replaced, or to allow the disassembly of a MacPherson strut.

SPRING

A suspension component that supports the weight of the vehicle. Basic types include coil springs, leaf springs, air springs and torsion bars. Spring height affects ride height, which in turn affect wheel alignment. Weak or sagging springs should be replaced in pairs to restore and maintain proper ride height and wheel alignment.

STABILITY CONTROL

A type of advanced antilock brake/traction control system that uses the brakes to assist steering maneuvers and to help improve vehicle handling and stability as driving conditions change. The system includes various sensors that monitor the driver's steering inputs and the position of the body with respect to the road. A "yaw sensor" can tell if the vehicle is starting to understeer or oversteer in a turn. The stability control system is active fulltime and will apply individual brakes to create a counter-steer effect that brings the vehicle back under control. See [Electronic Stability Control](#).

STATIC BALANCE

Wheel balance that depends on an equal distribution of weight around the circumference of the wheel and tire assembly. Static balance can be achieved without spinning the wheel by using a bubble balancer. A wheel that lacks static balance will shake or tramp up-and-down.

STEERING ARM

The arms on the steering knuckles (or struts) to which the tie rods are attached to steer the wheels.

STEERING AXIS INCLINATION (SAI)

The angle formed by a line that runs through the upper and lower steering pivots with respect to vertical. On a SLA suspension, the line runs through the upper and lower ball joints. On a MacPherson strut suspension, the line runs through the lower ball joint and upper strut mount or bearing plate. Viewed from the front, SAI is also the inward tilt of the steering axis. Like caster, it provides directional stability. But it also reduces steering effort by reducing the scrub radius. SAI is a built-in nonadjustable angle and is used with camber and the included angle to diagnose bent spindles, struts and mislocated crossmembers. See [Wheel Alignment](#).

STEERING EFFORT

The amount of driver input or muscle it takes to turn or steer the wheels. Excessive effort can be caused by loss of power assist, binding in the steering gear, worn upper strut bearing plates or binding in ball joints or tie rod ends. Excessive caster can also increase steering effort as can underinflated tires.

STEERING DAMPER (STABILIZER)

A hydraulic device similar to a shock absorber attached to the steering linkage to absorb road shock and steering kickback.

STEERING GEOMETRY

A general term used to describe the angular relationships between the wheels, steering linkage and suspension. See [Wheel Alignment](#).

STEERING KNUCKLE

A forging that usually includes the spindle and steering arm, and allows the front wheel to pivot. The knuckle is mounted between the upper and lower ball joints on a SLA suspension, and between the strut and lower ball joint on a MacPherson strut suspension.

STEERING RETURN

The ability of the steering wheel to self-center after turning. Causes of poor return include excessive caster or binding in the steering column, steering gear, ball joints, upper strut bearing plates or tie rod ends. See [Correcting Steering Pulls](#).

STOP-AND-GO DRIVING

This type of driving is especially hard on a vehicle because the engine spends most of its time at idle where it works less efficiently. Because the water pump is turning slowly at idle, the cooling system can overheat on a hot day. Continual stopping and starting also accelerates wear on the brakes, clutch and automatic transmission. When combined with short trips, the engine never gets a chance to reach full operating temperature so the oil becomes contaminated much more rapidly. Therefore, this kind of driving usually means more frequent oil changes and more frequent brake, clutch and transmission repairs. See [How Often Should You Change Your Oil?](#).

STRUT TOWERS

The panels or structural members in a unibody to which the upper strut mounts are bolted. The position of the towers is important because it affects camber and caster readings.

SUBCOOLING

The process of removing heat from refrigerant after condensation.

SUBFRAME

The lower frame rails and structural members that comprise the lower elements of a unibody. Steering and suspension components may be attached directly to the subframe, or to a "cradle" or "crossmember" that bolts to the subframe.

SUCTION LINE

Connects the evaporator outlet and compressor inlet. Low pressure refrigerant vapor is drawn from the evaporator to the compressor through this line.

SUCTION SIDE

The portion of an A/C system under low pressure, the area between the evaporator and compressor inlet.

SUCTION PRESSURE

Compressor intake pressure as indicated by a manifold gauge set.

SUPERCHARGER

Also called a "blower," a supercharger is a device that forces more air and fuel into the engine to increase horsepower. Unlike a turbocharger (See Turbocharger), a supercharger is belt or gear driven and provides instant boost pressure to the engine at all speeds. See [Basics of Supercharging](#).

SUPERHEAT

The difference between A/C evaporator inlet and outlet temperatures. It is created in the evaporator as liquid refrigerant changes into vapor.

SUPERHEATED VAPOR

Refrigerant vapor at a temperature that is higher than its boiling point at a given pressure.

SUSPENSION

The part of a vehicle that carries the weight. This includes the springs, control arms, ball joints, struts and/or shock absorbers.

SUVA

DuPont's trade name for tetrafluoroethane or R134a refrigerant.

SWAY BAR

A component that is often used in a suspension system to control body roll. A sway bar may be used on the front and/or rear suspension to help keep the body flat as the vehicle rounds a corner. This greatly improves a vehicle's cornering agility. Replacing the sway bar with one of a larger diameter can increase it even more.

TDC

Abbreviation for Top Dead Center. This is the point at which the piston reaches its uppermost position in the cylinder. Ignition timing is usually expressed as so many degrees before top dead center (BTDC) or after top dead center (ATDC). A timing mark on the crankshaft pulley or flywheel corresponds to the top dead center position of the number one engine cylinder.

TEMPERATURE

Heat intensity measured in degrees. Engine operating temperature is a critical factor in engine performance and emissions. Brake temperature can affect the operation of the brakes.

TEST PIPE

A short piece of exhaust pipe that is designed to replace a catalytic converter in an exhaust system, supposedly while you test the results of the switch (See Catalytic Converter). Test pipes are illegal and you can be fined if you are caught with one on your vehicle.

TETRAFLUOROETHANE

Chemical name of R134a refrigerant

THREE-WAY CONVERTER (twc)

A catalytic converter that oxidizes hydrocarbons and carbon monoxide, and also reduces oxides of nitrogen emissions. Usually, it has separate chambers, the one upstream handling reduction, and the one downstream handling oxidation. The noble metals used as the catalytic agents are platinum, palladium, and, for reduction, rhodium. See [Catalytic Converters](#).

THERMISTOR

A device that changes electrical resistance as temperature changes. A coolant sensor and air temperature sensor are thermistors.

THERMOSTATIC EXPANSION VALVE (TXV)

A component in the refrigeration system that controls the rate of refrigerant flow into the evaporator. This is done by means of a temperature sensing bulb that causes the valve to open or close in response to temperature changes in the evaporator.

THERMOSTAT

A temperature control device in the engine's cooling system that speeds engine warm-up and helps the engine run at a consistent operating temperature. Thermostats come in various temperature ratings most engines today use ones that open between 190 and 195 degrees. The thermostat is usually located in a small housing that connects the upper radiator hose to the engine. Sometimes a thermostat will stick shut, causing the engine to overheat because it blocks the flow of coolant back to the radiator. If a thermostat sticks open, the engine will warm-up slowly and may never reach its normal operating temperature. This can result in little or no heat from the heater. Running an engine without a thermostat is not recommended because excessive cooling can lead to increased blowby and ring wear.

THERMOSTATIC SWITCH

A component (sometimes adjustable) used in a cycling clutch A/C system to engage and disengage the compressor clutch. It prevents water (condensate) from freezing on the evaporator core. It also controls the temperature of air flowing out of the evaporator fins.

THROTTLE BODY INJECTION (TBI)

A type of electronic fuel injection system that uses a single injector or pair of injectors mounted in a centrally-located throttle body. The throttle unit resembles a carburetor except that there is no fuel bowl, float or metering jets. Fuel is sprayed directly into the throttle bore(s) by the injector(s).

THROTTLE POSITION SENSOR (TPS)

A little gadget on the carburetor throttle linkage or fuel injection throttle body that keeps the engine control computer informed about the throttle opening (See Computerized Engine Controls). The TPS is a variable resistor that changes resistance as the throttle opens wider. The computer needs this information to change the air/fuel mixture. Adjustment is very critical and is best left to a qualified professional. TPS sensors are also used on throttle-by-wire applications for throttle position feedback to the PCM. See [Throttle Position Sensors](#), [Throttle-By-Wire](#) and [Sensor Guide](#).

THRUST ANGLE

The angle between the thrust line and centerline. If the thrust line is to the right of the centerline, the angle is said to be positive. If the thrust line is to the left of center, the angle is negative. It is caused by rear wheel or axle misalignment and causes the steering to pull or lead to one side or the other. It is the primary cause of an off-center or crooked steering wheel. Correcting rear axle or toe alignment is necessary to eliminate the thrust angle. If that is not possible, using the thrust angle as a reference line for aligning front toe can restore center steering. See [Correcting Steering Pulls](#).

THRUST ANGLE ALIGNMENT

Aligning front toe to the rear thrust angle instead of the vehicle's centerline to compensate for rear axle steer. See [Correcting Steering Pulls](#).

THRUST LINE

A line that bisects total rear toe. It defines the direction the rear wheels are pointed. The thrust line should correspond to the centerline for the vehicle to steer straight. See [Correcting Steering Pulls](#).

TIE ROD

A part of the steering linkage that connects the steering arms on the knuckles to the steering rack or center link.

TIE ROD END

A flexible coupling in the steering linkage that connects the tie rods to the steering knuckles. Some require periodic greasing (twice a year or every 6,000 miles) while others are sealed. A loose or worn tie rod will cause a feathered wear pattern on tires, and is probably the leading cause of rapid tire wear. Worn tie rod ends can be detected by raising the suspension and rocking the front wheel back and forth. If there is any free play, it probably means the tie rod ends are bad. Toe alignment must be reset once the new tie rods ends have been installed.

TIE ROD SLEEVES

A part of the tie rod assembly that is threaded internally and is turned to shorten or lengthen the tie rod to adjust toe alignment.

TIMING LIGHT

A strobe light for checking ignition timing. The light is connected to the number one spark plug wire so every time the plug fires the light flashes. The light is then aimed at the timing marks on the crankshaft pulley or flywheel to read timing.

TIRE RATINGS

On the sidewall of every tire is information about tire size, maximum load rating, maximum inflation pressure, tire construction (See Radial Tire) and performance standards. Treadwear is a comparative rating of how long the tire will last compared to other tires. The higher the number, the longer the predicted life of the tread. A tire with a 200 rating should go twice as many miles as one with a 100 rating. The numbers do not correspond to a fixed mileage figure because there are so many variables that affect the life of the tread (maintaining the correct inflation pressure is one of the most important). The traction rating is a measure of the tires ability to stop on wet pavement. An "A" is the best rating, "B" is average, and "C" is the lowest acceptable rating. The temperature rating is an indication of how cool the tire runs as highway speeds. Again, an "A" is the best while "C" is the lowest acceptable rating. Performance tires also carry a speed rating: "H" rated tires are good for speeds up to 130 mph, and "V" rated tires are certified for speeds above 130 mph.

TIRE ROTATION

Changing the relative positions of the tires on a vehicle periodically to even out tread wear. Rotation is recommended every 5,000 miles for optimum tire life. When tires are not rotated, they can develop wear patterns particular to their wheel location that shortens tread life and may cause vibrations or a rough ride. See [Tire Rotation: When & How To Rotate Your Tires](#)

TOE

A wheel alignment angle that refers to the parallelism of the tires as viewed from above (See Alignment). Toe-in means the leading edges of the tires are closer together than the rear edges. Toe-out means the leading edges of the tires are farther apart than the rear edges. A vehicle should have zero running toe (perfect parallel alignment) when driving. But because the rubber bushings and joints in the suspension

"give" a little (called "compliance"), most rear-wheel drive vehicles call for a slight amount of toe-in when the wheels are initially aligned. Front-wheel drive vehicles are just the opposite, Most call for a slight amount of toe-out because the drive wheels tend to bow in as they pull the vehicle down the road. Toe alignment is very important because it greatly affects tread wear. If toe alignment is off, it will produce a feathered wear pattern across the tire tread. Toe is adjusted by turning the tie rods or tie rod ends to shorten or lengthen the steering linkage. On front-wheel drive vehicles, the rear toe setting can often be changed by adding shims behind the wheel hub, or by changing the pivot position of the control arms. See [Wheel Alignment](#).

TOE-IN

Toe-in means the leading edges of the tires are closer together than the rear edges. A small amount of toe-in is usually specified for rear-wheel drive vehicles to compensate for suspension compliance that allows the wheels to toe-out slightly as the vehicle is pushed down the road. Too much toe-in accelerates tire wear and causes the outside edges of the tread to wear more quickly. See [Wheel Alignment](#) and [Fixing Wheel Alignment Problems](#).

TOE-OUT

Toe-out means the leading edges of the tires are farther apart than the rear edges. A small amount of toe-out is often specified for front-wheel drive cars to compensate for suspension compliance that allows the wheels to toe-in slightly when the front wheels pull the vehicle down the road. Too much toe-out accelerates tire wear and causes the inside edges of the tread to wear more quickly. See [Wheel Alignment](#) and [Fixing Wheel Alignment Problems](#).

TOE-OUT ON TURNS

The change in toe that occurs when the wheels are steered to either side. The change in toe allows the inside wheel to follow a smaller circle than the outer wheel to reduce tire scuffing and wear. The toe angle is nonadjustable and is determined by the geometry of the steering arms and linkage. A toe-out on turn angle is usually specified for the outer wheel when the inner wheel is turned 20 degrees. If the angle is not within specifications, it usually means a steering arm is bent. See [Wheel Alignment](#).

TOE WEAR

Wear across the face of the tire tread caused by slippage or scrubbing as the tire rolls along. Toe wear can produce a feathered wear pattern (bias ply tires primarily) as well as shoulder wear on radial tires. It results from too much toe-in or toe-out, which in turn may be caused by toe misalignment, worn tie rod ends, a worn idler arm or a worn or bent center link. See [Wheel Alignment](#) and [Fixing Wheel Alignment Problems](#).

TORQUE

Turning or twisting force. Torque is usually expressed as so many foot/pounds (a one pound force exerted on a lever one foot in length). A torque wrench measures how much twisting force is being applied to a nut or bolt. The torque output of an engine is expressed as the maximum force exerted by the engine at a given engine speed. Large cubic inch displacement engines and engines with long throw crankshafts produce high torque outputs. For more information on this subject, see [Horsepower & Torque](#).

TORQUE CONVERTER

A fluid coupling that connects the engine to an automatic transmission. The torque converter contains a three sets of bladed wheels that face one another. One wheel (the impeller) is attached to the converter housing and turns at the same speed as the engine. The other wheel (the turbine) is attached to the transmission input shaft. As the impeller spins, it slings automatic transmission fluid at the turbine, and makes it turn. The third wheel (the stator) is positioned between the turbine and impeller to redirect fluid flow. When starting out, the stator remains stationary and multiplies torque from two to two-and-a-half times (much like a reduction gear) by recirculating fluid back through the impeller. But when the speed of the turbine wheel starts to catch up with the impeller, the stator starts to spin and the converter "locks up," becoming a direct drive fluid coupling. Many late model vehicles are equipped with a "lockup" torque converter that contains an electrically-operated computer-controlled clutch mechanism. The mechanical clutch eliminates the slight amount of slippage that occurs in an ordinary torque converter fluid coupling to improve fuel economy. The lockup solenoid is engaged when the vehicle reaches a predetermined speed and/or engine load. See [Diagnosing Automatic Transmission Problems](#).

TORQUE STEER

The annoying tendency of some front-wheel drive vehicles to pull to one side when engine torque is applied. In other words, you step on the gas and the car wants to steer right or left. By redesigning the powertrain to use equal length halfshafts between the transaxle and wheels, the tendency towards torque steer can be greatly reduced. The other cure is to keep off the gas. See [Torque Steer](#) and [Front-Wheel Drive Guide](#).

TORQUE WRENCH

A special wrench with a built-in indicator that shows you how much force you are applying to a bolt. A torque wrench should always be used when doing any type of major engine work, when tightening fasteners on the brake system or suspension, when tightening wheel lug nuts or when you do not want to risk breaking a bolt. See [Tightening Cylinder Head Bolts](#).

TORSION BARS

A steel bar that is twisted to support the weight of the vehicle. Torsion bars are used in place of coil or leaf springs on some vehicles, and allow ride height to be adjusted to compensate for sag that occurs over time.

TOTAL TOE

The combined toe reading of a pair of wheels on a given axle. Total toe is the difference between the leading and trailing edges of both tires with respect to one another. It may be specified in inches, millimeters or degrees.

TOWING

Most vehicles can tow a moderate amount of weight (1000 lbs. or less) without too much trouble. But for heavier loads, the suspension and cooling system may require beefing up (See the owners manual for towing recommendations and load limits). Overload or air-assist shocks can keep the rear end from sagging, and a stabilizer bar on the trailer hitch can reduce swaying. Automatic transmissions should be equipped with an oil cooler to protect the transmission against overheating. A larger radiator or a larger fan may be required to keep the engine from overheating.

TRACKING

How the rear wheels follow the front wheels. For proper alignment, they should follow the same path. If the rear wheels do not track straight and follow slightly to one side due to rear axle or toe misalignment, the result can be off-center steering and accelerated tire wear.

TRACTION CONTROL

An enhancement of an existing ABS system that prevents wheel spin while accelerating on wet or slick surfaces. It uses the same wheel speed sensors to monitor wheel speed during acceleration, but requires some additional control solenoids and a pump to apply braking pressure to control wheel spin. The traction control system brakes the drive wheel that is starting to spin to shift torque to the opposite drive wheel that still has traction. Most traction control systems only operate at speeds up to about 30 mph. Additional control strategies that some traction control systems use to limit wheel spin include reducing the throttle opening, upshifting the transmission, retarding spark timing and deactivating fuel injectors. See also [Traction Control](#)

TRAILING ARMS

Components in the rear suspension that connect the rear axle or spindles to the chassis.

TRANSAXLE

The transmission in a front-wheel drive vehicle. It combines both transmission and differential into one assembly.

TRANSISTOR

An electronic component using a semiconductor to amplify or switch current. Used in voltage regulators, computers and other electronic accessories.

TRANSMISSION

The gear box that multiplies engine torque via gear reduction and/or torque conversion. A typical manual transmission has four or five speeds, with the final or highest gear being either a direct 1:1 drive ratio or an "overdrive" ratio (less than 1:1). An automatic transmission first multiplies engine torque as it passes through the fluid coupling known as the "torque converter" (appropriate name, huh?) and then through three or four separate gear ratios. A manual transmission usually gives slightly better fuel economy than an automatic because there is a certain amount of slippage that occurs in the automatic torque converter. A manual transmission is normally trouble-free, except for the clutch, which can be very troublesome if adjusted incorrectly or abused. With automatics, the leading problem is fluid breakdown from overheating. Fluid and filter changes every 24,000 miles can avoid premature transmission failure but few people heed such advice. Consequently, automatics often call it quits long before they realize their potential design life. See [Diagnosing Automatic Transmission Problems](#) and [Common Clutch Problems](#).

TRANSMISSION CONTROL MODULE (TCM)

The electronic control module or computer that regulates the operation of the transmission. This function may be integrated into the Powertrain Control Module, eliminating the need for a separate TCM control module.

TROUBLE CODES

A code number generated by a vehicle's onboard computer that corresponds to a specific fault. Most computerized engine control systems have a certain amount of self-diagnostic capability. When the engine is running and the computer detects a problem in one of its sensor or output circuits, or even within itself, it triggers a trouble code. In some systems, the code number is retained in memory. In others, the code is not stored but is regenerated when a mechanic runs the system through a special self-diagnostic test. The only indication of trouble is when the "Check Engine" light on the instrument panel lights up. What does it mean? It depends on the problem. Sometimes it is nothing serious, but it could signal a failure that might lead to further problems. To understand trouble codes, you have to have a reference manual that tells what the numbers mean and explains the step-by-step diagnostic procedure for isolating the fault. Codes are read out of the computer by grounding the computers diagnostic connector or by using a scan tool to access the computer system. See [Trouble Codes](#).

TUNE-UP

An obsolete term used to describe the periodic maintenance that is performed when "tuning" an engine to its original specs. With electronic ignition systems that require no periodic adjustments, sealed carburetors and non-adjustable fuel injection, there is not much left to adjust. Today's tune-up, therefore, consists primarily of replacing the spark plugs. It may also include replacing the air and fuel filters and inspecting the emissions control system but as far as "tuning" is concerned, there is little left to tune. See [Tune-ups Today](#).

TURBOCHARGING

A means of increasing horsepower (up to 50 percent or more) by using an exhaust-driven air pump (the turbocharger) to force more air and fuel into the engine. Hot exhaust gases coming out of the engine spin an impeller on one end of the turbocharger. On the other end is a second impeller that pumps air into the engine. A "wastegate" (a small trap door that opens to bleed off exhaust pressure) limits the amount of pressure boost the turbo can produce (See Intercooler and Wastegate). A little boost is a good thing, but too much boost can destroy the engine. Generally speaking, the higher the boost pressure, the greater the horsepower produced. It is a way of making a little engine breathe like an engine of much higher displacement. Turbochargers spin at extremely high speeds, sometimes over 100,000 rpm. A steady supply of clean oil is essential to lubricate the turbo shaft bearings. Because of this, a turbocharged engine should never be revved up and shut off abruptly. The high temperatures in the turbo are hard on oil, so more frequent oil changes are usually recommended. Special "turbo oils" are also available that offer better high temperature resistance. If the turbo bearings go bad, the impellers will not turn freely and boost pressure will drop. A turbo can be inspected by removing the plumbing from either side and seeing if the impeller spins freely when turned by hand. Any looseness, roughness or sign of rubbing means it is shot and needs to be replaced. See [Turbocharger Diagnosis & Repair](#).

TURNING PLATES

Plates on an alignment rack that go under the front wheels and allow the wheels to be steered 20 degrees to either side to measure toe-out on turns.

TURNING RADIUS

The diameter of the smallest circle in which a vehicle can complete a U-turn. Turning radius depends on the wheelbase of the vehicle (longer vehicles usually need more space to turn around), and maximum steering angularity.

TWIN I-BEAM

A type of independent front suspension used on Ford pickup trucks that used two parallel I-beam axles (one for each wheel). The design combines the superior strength of an I-beam suspension with the flexibility and ride comfort of an independent suspension.

U-BOLT

A bolt in the shape of a "U" that attaches an axle housing to a leaf spring.

U-JOINT

Another name for a Cardan joint (See Cardan Joint or Universal Joint).

UNDERCOATING

The application of a sound-deadening and/or rust-inhibiting chemical, wax or sealer to the underside of a vehicle. Do not confuse it with rustproofing (See Rustproofing) which includes coating the inside body panels and other rust-prone areas of the vehicle, too.

UNDERINFLATION

A condition where a tire contains less air pressure than the recommended amount. This increases rolling resistance (which may contribute to a steering pull or lead), tire wear and the risk of tire failure due to overheating from excessive flexing of the sidewalls. See [Tire Inflation Tips](#).

UNDERSTEER

A steering condition where the vehicle does not respond quickly to steering changes. If a vehicle understeers, it wants to continue going straight when the steering wheel is turned (See Oversteer). Under normal driving conditions, understeer is not a problem. But when the vehicle is driven at high speed into a curve, the front of the car will tend to plow to the outside. Some vehicles are more prone to understeer than others. Front-wheel drive vehicles fall into this category as do over-powered rear-engine Porsches.

UNIVERSAL JOINT

Another name for a Cardan joint (See Cardan Joint).

V-BELT

More commonly known as a "fan belt," a V-belt is the rubber belt that drives such things as the alternator, air conditioning compressor, power steering pump and water pump. It is called a V-belt because of its "V" shaped cross-section. The sides of the belt are what grip the pulleys. Some belts have notches in them to increase grip, to help cool the belt and to relieve stress as the belt bends around small diameter pulleys. Some vehicles use a single flat belt (Serpentine Belt) to drive multiple accessories. Cogged rubber timing belts are used on many overhead cam engines to drive the camshaft (See Overhead Cam). After three or four years of flexing and countless cycles around the engine pulleys, most V-belts need to be replaced. But due to the way in which many belts are constructed today, you cannot determine a belt's true condition by a visual examination. Time and mileage must also be taken into consideration. That is why most experts now recommend replacing the belts as a preventive measure every three to four years regardless of how they look.

VACUUM

The absence or reduction of air pressure. Vacuum is created in the intake manifold by the pumping action of the pistons. Air is pulled out of the manifold into the cylinders faster than it can be replenished by air bypassing the throttle plate. The throttle creates a restriction that allows vacuum to buildup inside the manifold. This is necessary to help pull fuel through a carburetor, and to vaporize fuel sprayed into the engine by fuel injectors. Vacuum is also used to operate various components such as the EGR valve, to pull crankcase vapors through the PCV system, to boost the power brakes and to open and close air control doors in many A/C systems. See Manifold Vacuum. See [Vacuum Leaks](#).

VACUUM ADVANCE

This has nothing to do with pushing a vacuum cleaner forward. Actually it is the name of a device on the distributor that changes ignition timing in response to engine load. When an engine is cruising under light load, there is very strong vacuum in the intake manifold. This pulls on the vacuum advance diaphragm and advances timing for better fuel economy. When the engine is under heavy load, the throttle is opened wide and vacuum falls. This releases the diaphragm and eliminates the extra timing advance. Where the extra advance not canceled, the engine would likely experience spark knock. See [Spark Knock](#) and [Distributors](#).

VACUUM DELAY VALVE

An orifice-controlled valve which delays a vacuum signal to a diaphragm, such as in the distributor vacuum advance unit. Used to improve drivability and emissions when the throttle suddenly changes position.

VACUUM MOTOR

Same as "vacuum actuator" and "vacuum power unit." It is a device that opens valves (heater controls) or doors (air control doors in the HVAC plenum) using vacuum as a power source.

VALVE JOB

This is when the engine valves are reconditioned. It requires removing the cylinder head, disassembling the head and checking it for cracks or warpage (a common problem on aluminum cylinder heads), regrounding the valve faces and seats, replacing or restoring the valve guides, installing new valve guide seals, inspecting the springs, and other valve hardware, then reassembling the heads and putting them back on the engine. See [Valve Seat Repairs](#).

VANE AIRFLOW (VAF) SENSOR

A type of airflow sensor that uses a mechanical flap to measure engine airflow. As the flap moves, the sensor produces a variable voltage signal that changes in proportion to airflow. See [Vane Airflow Sensors](#).

VAPOR LINES

Lines carrying refrigerant vapor. See "suction line" and "discharge line." May also refer to hoses in the evaporative emission control system that route fuel vapors to the charcoal canister.

VAPOR LOCK

When gasoline overheats and boils inside the carburetor bowl or fuel pump of a hot engine, it ceases to flow. This can cause stalling or hard starting. This is called vapor lock, and it usually happens during hot weather. If a hot engine will not start, all you can do is let it sit and cool off. You should check the cooling system to see if anything is causing the engine to run unusually hot (a bad thermostat or cooling fan, for example). Switching brands of gasoline may also help.

VARIABLE ASSIST STEERING

A type of power steering system where electronics are used to vary the amount of power assist provided as vehicle speed changes. Most such systems provide maximum assist at low speed to make parking maneuvers easier, and reduce assist at higher speeds to increase road feel and stability. System inputs include the vehicle speed sensor and sometimes a steering angle sensor. See [Servicing Variable Assist Power Steering](#).

VARIABLE RATE SPRINGS

A type of spring that changes stiffness as it deflects. A variable rate spring uses coils of varying thickness or spacing to provide a soft ride when the vehicle is lightly loaded, but a firmer ride when the load increases. Only a few vehicles have variable rate springs as original equipment. On most vehicles, the rear coil springs can be easily replaced with variable rate springs to reduce bottoming and to increase the vehicle's load carrying capacity. Variable rate springs are also available for the front suspension.

VARIABLE VALVE TIMING (VVT)

A method that advances or retards camshaft timing to improve engine performance. A hydraulic mechanism on the cam drive uses oil pressure to rotate the cam's position slightly as engine speed changes. This increases valve duration to produce more horsepower at higher rpms.

VENTURI

The narrow part of the carburetor throat. When air passes this point, the restriction causes an increase in velocity and a drop in pressure that siphons fuel from the fuel bowl into the airstream.

VISCOSITY

This is a term used to describe the thickness of motor oil. The higher the number, the thicker the oil. Common straight grade viscosity ratings are 10, 20, 30 and 40, with 10 being the thinnest and 40 the thickest. A low viscosity oil provides better lubrication at low temperatures and reduces internal drag on the engine. But they lack the staying power for high temperature or high speed protection. The heavier grade oils such as 30 and 40, on the other hand, are much better for high speed and high temperature lubrication, but they may be so thick at low temperatures as to inhibit easy cranking. The best motor oils take advantage of each. These are the "multi-viscosity" oils such as a 5W-20, 5W-30, 10W-30 and 10W-40. By using a blend of different viscosity oils, they have the flow characteristics of a low viscosity oil when cold but offer the protection of a heavy oil when hot. See [Motor Oil Viscosity](#).

VIN

Abbreviation for Vehicle Identification Number. This is a vehicle's serial number. It is stamped on a small metal plate affixed to the dash at the base of the windshield. The number may also be stamped on

various body parts, the engine and transmission. It is sometimes necessary to refer to the VIN number when ordering replacement parts.

VOLTAGE REGULATOR

A part of the charging system that controls how much electricity the alternator puts out (See Alternator). The voltage regulator on today's cars is an electronic black box, which means you cannot adjust it or repair it if anything goes wrong with it. On most newer vehicles the voltage regulator is located inside the alternator and cannot be replaced separately. On some cars, the powertrain control module (PCM) regulates the alternator. A defective regulator can cause the alternator to produce too much voltage (which can damage the battery, lights and electronic components) or it can prevent it from making enough voltage to keep the battery fully charged. The toughest challenge when diagnosing a charging problem is to figure out whether it is the voltage regulator or alternator that is at fault. Using a procedure called "full fielding the alternator" that causes the alternator to put out maximum current will reveal which component is at fault. See [Charging System Checks](#).

WARRANTY

The basic guarantee that comes with a new vehicle. All vehicle manufacturers today offer a bumper-to-bumper (covers everything!) warranty of 3 years or 36,000 miles (which ever comes first). Separate warranties may be provided on emission controls, body rust, powertrain or other components. On 1995 and newer vehicles, the emissions warranty is 8 years and 80,000 miles on the catalytic converter and engine computer, and 2 years/24,000 miles on all other emission control components. New car and truck dealers also sell "extended" warranty packages that extend the time and mileage of coverage. Extended warranties are expensive but can easily pay for themselves if the vehicle requires major repairs. For more info, see [New Car Warranty Coverage: What Is Covered, What Is Not](#)

WASTEGATE

A trap door-like device on the exhaust side of a turbocharger that limits the amount of boost a turbo can produce (See Turbocharging). The wastegate consists of a spring-loaded diaphragm. A control pressure hose connects the diaphragm to the plumbing between the turbo and intake manifold. When boost pressure starts to exceed the rating of the wastegate, pressure moves the actuator diaphragm and opens a bypass flap in the turbo housing. This allows some of the exhaust to bypass the turbine wheel, slowing the turbo and reducing boost output. A wastegate can be checked by applying pressure to the hose with a hand-held pump. If it does not move at the specified pressure (which you can look up in a manual), the diaphragm is probably ruptured and the wastegate needs to be replaced. See [Turbocharger Diagnosis & Repair](#).

WATER JACKET

No, this is not a new type of life preserver. It refers to the hollow space inside the engine block and cylinder head where coolant flows.

WATER PUMP

A small impeller-like pump that circulates coolant through the engine's cooling system. The water pump is mounted on the engine and is driven by the fan belt, alternator belt or overhead cam timing belt. The pump shaft has a large bearing and seal, which after 40,000 miles or so usually starts to leak. The pump can be replaced with a new or rebuilt unit, but the degree of difficulty varies, depending on pump accessibility. See [Water Pump Diagnosis & Replacement](#).

WHEEL BALANCE

The even distribution of weight around a wheel so that it rotates without vibrating or shaking. See static and dynamic balance. It is achieved by positioning weights on the rim that offset heavy spots on the wheel and tire assembly. See [Wheel Balancing](#).

WHEELBASE

The distance between the centers of the front and rear wheels. Measuring and comparing the wheelbase on both sides of a vehicle can identify rear axle misalignment or front wheel setback.

WHEEL BEARINGS

Inside the wheel hubs are either roller or ball bearings that carry the vehicle's weight. On RWD vehicles with solid axles, the rear wheel bearings are mounted on the axles. The front wheel bearings on older rear-wheel drive cars and trucks usually require "repacking" (regreasing) every two years or 24,000 miles. The wheel bearings on most newer vehicles are sealed and do not require any maintenance. A bad wheel bearing will typically make grinding, whining or squealing noises, and you can often feel the looseness or roughness if you raise the suspension and rotate the wheel by hand. Worn wheel bearings should be replaced, because failure may cause the wheel to come off the vehicle. See [Wheel Bearing Service](#).

WHEEL CYLINDER

This is the hydraulic component that pushes the brake shoes out in a drum brake.

The wheel cylinder consists of a small casting with two outward facing pistons. When hydraulic fluid from the master cylinder is forced into the cylinder, it pushes the two pistons out and applies the brakes. Leaks sometimes develop around the cup-like piston seals. The cheapest way to fix a leaky wheel cylinder is to install a "kit" that contains new piston seals.

WHEEL SPIN

This is when one drive wheel spins uselessly while the other does not turn. It can happen when one wheel is on a slippery surface (ice, snow, mud, slush) and the other on dry pavement. The reason it happens is because the differential always routes power to the wheel that needs it the least (See Differential). The only way to eliminate it is to buy a vehicle with a locking differential or traction control.

WHEEL WEIGHTS

A weight used to balance a wheel and tire assembly. Most are metal (lead, zinc or steel) and clip to the wheel rim. Wheel weights come in various sizes and styles, and must be properly attached to the rim so they do not move or fall off. Different style clips are available for various types of rims. Self-adhesive stick-on weights are also available that mount to the inside face of alloy wheels. See [Wheel Bearing Service](#).

WHEEL TRAMP

The up-and-down bouncing motion of a wheel or spindle due to static imbalance or an out-of-round tire or wheel. See [Curing Wheel & Tire Vibrations](#).

WINTERIZING

The process of preparing a vehicle for the ravages of winter. The annual fall ritual includes checking, replacing and/or replenishing the antifreeze in the cooling system (See [Antifreeze](#)), mounting the snow tires, waxing the body to protect it against road salt, and sometimes a tune-up to aid starting. See [Winterizing Tips](#).

WOT

Wide Open Throttle. Some carburetors and throttle bodies have a switch that signals the engine computer when the throttle is wide open.

WRIST PIN

A polished steel pin that attaches a connecting rod to a piston. Some wrist pins are press fit into the small end of the connecting rod while others are a "free floating" loose fit.

YAW

The rotation of the vehicle body around its centerpoint as viewed from above. When a vehicle enters a turn or makes a sudden lane change, it experiences a change in yaw. A yaw sensor in the ABS stability control system senses this change to determine if the vehicle is experiencing understeer or oversteer. If the yaw rate indicates a problem, corrective actions are taken to help keep the vehicle under control. See [Antilock Brakes](#).

ZEV

Zero emission vehicle, one that produces no pollutants. Unless somebody comes up with a car that burns water, this means an electric-powered car with a battery, fuel cell or flywheel using an energy storage device. See [Alternative Fuels](#).