

UNIFORM INSPECTION & COMMUNICATION STANDARDS 2010 - 2011

Routine Inspection Reference Guide

ROUTINE INSPECTION REFERENCE GUIDE

These materials are confidential and are not to be disclosed to, or utilized by, any individual or entity other than participants of the Motorist Assurance Program (MAP).

The Automotive Maintenance and Repair Association (AMRA) and MAP do not warrant these materials or guarantee their accuracy, and AMRA and MAP assume no liability for errors.

MAP STANDARDS OF SERVICE

MAP developed standards of service for shops to follow in working with customers. Written from the point of view of customers, and for the use of maintenance and repair shops, the standards expand on the ideas and promises established in MAP's Pledge to Customer

I. Our recommendations are based upon the following definitions.

System Failure - Parts/system indicated are out of manufacturers' specifications, have failed or are unable to perform their normal function as intended or designed by the manufacturers. Service/replacement is required.

Preventive/Scheduled Maintenance - Parts/system are scheduled for service/ replacement per industry standards or are near the end of their useful life and repair/ replacement is recommended in advance of parts/system failure. Service/replacement is suggested.

Improved System Performance - Parts/ system indicated are recommended for repair/ replacement to enhance/improve the vehicle's ability to perform as intended or designed by the manufacturer, or as requested by the customer. Service/replacement is suggested.

II. Training/Criteria Our personnel have acquired auto repair expertise through formal education or work experience. Where appropriate, personnel are moving toward certification (e.g. vehicle manufacturer, ASE, etc.) for the services performed. Continuing education will be supported by all MAP participants.

III. Appropriate Company Approved Inspection

We will perform an appropriate inspection based on MAP Uniform Inspection & Communication Standards.

IV. Written Estimates

Written estimates based on our inspection, in compliance with state and local regulations, will include parts (dollar amount), labor (dollar amount), and the total estimate.

V. Work Authorization

No work will be performed without the customer's prior approval.

VI. Limited Warranty

A minimum limited warranty will be offered of 90 days or 4,000 miles, whichever comes first, covering parts and labor.

VII. Returned Parts

All customers will be entitled to the return of old parts, or if they choose, they may examine the parts prior to leaving the store. Where failed parts are required to be returned to the manufacturer in order to

honor the warranty, the customer will be allowed to examine the parts.

VIII. Classification of Parts

Replaced parts will be identified as new, remanufactured, rebuilt or used. MAP participants will inform the customer and indicate on the estimate and invoice whether a part is new, remanufactured, rebuilt or used.

THE MAP PROCESS - OVERVIEW

Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program comes from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer / recommended maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt (1) a Pledge of Assurance to their Customers and (2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, Electrical Systems, and Drive Train and Transmissions. Further, revisions to all of these inspection communication standards are continually re-published. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www.motorist.org or contact us at:

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Falls Church, Virginia 22046

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THE MAP PROCESS - OVERVIEW OF SERVICE REQUIREMENTS AND SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-train, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer's best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience or the vehicle manufacturer's recommended service interval and must be documented. However, any suggestions must be documented and must be based on substantial and informed experience or the vehicle manufacturer's recommended service interval. NOTE: Vehicle manufacturer service intervals are often categorized as either Normal or Severe. Frequently, motorists are unaware that their driving patterns and habits meet the criteria for following Severe Service schedules. Severe Service is generally defined as, but not limited to one or more of the following conditions: Driving in stop-and-go traffic; frequent short trips; high-speed driving; extreme temperatures; towing or hauling.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

- **Example:** An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.
- **Example:** A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

- **Example:** An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.
- **Example:** The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement	Reasons to Suggest Repair or Replacement
A. Part no longer performs intended purpose B. Part does not meet a design specification (regardless of performance) C. Part is missing	1. Part is close to the end of its useful life B - Part does not meet a design specification (regardless of performance) (just above discard specifications, or weak; failure likely to occur soon, etc.) 2. To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.) 3. To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM) 4. Technician's recommendation based on substantial and informed experience 5. To comply with maintenance recommended by AMRA / MAP

Reasons to Require Repair or Replacement	Reasons to Suggest Repair or Replacement
NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.	NOTE: Suggested services are <i>always</i> optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

MAINTENANCE OVERVIEW

ANTIFREEZE/COOLANT

The main function of the Engine Cooling System is to carry heat away from the engine and maintain the desired operating temperature. This is accomplished by circulating antifreeze/coolant through the engine, where heat is generated, and carrying it to the radiator to be cooled.

Over the past decade internal combustion engines have become more fuel efficient; however, most of the energy in the gasoline (perhaps 70%) is converted into heat, and the cooling system keeps the engine from overheating by transferring this heat to the air. But the cooling system also has several other functions.

An automobile engine runs best at a fairly high temperature. When the engine is cold, components wear out faster, and the engine is less efficient and releases more pollutants into the atmosphere. The cooling system is designed to allow the engine to heat up as quickly as possible, and then to keep the engine at a constant temperature.

Modern automobiles operate in a wide variety of ambient temperatures, from well below freezing to well over 100 F. The fluid used to cool the engine must have a very low freezing point, a high boiling point, and it must have the ability to transfer a lot of heat.

An adequate amount of an antifreeze/coolant and water mixture is necessary to reduce the possibility of engine overheating and freezing, and to prevent rust and corrosion in the cooling system.

Water is one of the most effective fluids for holding heat, but water freezes at too high a temperature to be used in car engines. The fluid that most cars use is a mixture of water and ethylene glycol, also known as antifreeze. By adding ethylene glycol to water, the boiling and freezing points are improved significantly.

The temperature of the coolant can sometimes reach 250 to 275 F (121 to 135 C). Even with ethylene glycol added, these temperatures would boil the coolant. The cooling system is pressurized, which further raises the boiling point of the coolant. Most automobiles have around 14 to 15 pounds per square inch (psi), which raises the boiling point approximately 45 F so the coolant can endure the high temperatures produced in the engine.

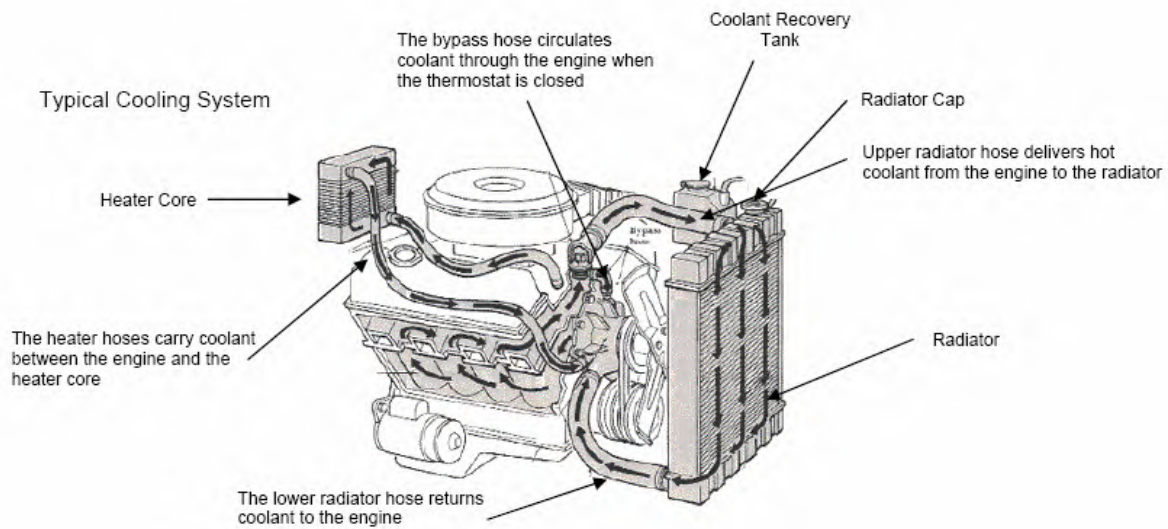


Fig. 1: Typical Cooling System

Hoses showing obvious signs of wear such as cracks, cuts, stiffness, bulges, excessive softness or abrasions should be replaced.

The National Automotive Radiator Service Association (NARSA) recommends a seven (7)-point preventative cooling system maintenance check at least once every two years. The program is designed to identify any areas that need attention, and consists of:

- a visual inspection of all cooling system components, including belts and hoses
- a radiator cap test to check for the recommended system pressure level
- a thermostat check for proper opening and closing
- a pressure test to identify any external leaks to the cooling system parts; including the radiator, water pump, engine coolant passages, radiator and heater hoses and heater core
- an internal leak test to check for combustion gas leakage into the cooling system
- an engine fan test for proper operation h a system power flush and refill with car manufacturer's recommended concentration of coolant

VISUAL INSPECTION

What you are looking for is the condition of the belts and hoses. The radiator hoses and heater hoses are easily inspected just by opening the hood and looking. You want to be sure that the hoses have no cracking or splitting and that there is no bulging or swelling at the ends. If there is any sign of problems, the hose should be replaced with the correct part number for the year, make and model of the vehicle. Never use a universal hose unless it is an emergency and a proper molded hose is not available.

Heater hoses are usually straight runs and are not molded, so a universal hose is fine to use and often is all that is available. Make sure that you use the proper inside diameter for the hose being replaced. For either the radiator hoses or the heater hoses, make sure that you route the replacement hose in the same way that the original hose was running. Position the hose away from any obstruction that can possibly damage it and always use new hose clamps. After you refill the cooling system with coolant, do a pressure test to make sure that there are no leaks.

RADIATOR CAP TEST

A radiator cap is designed to maintain pressure in the cooling system at a certain maximum pressure. If the cooling system exceeds that pressure, a valve in the cap opens to bleed the excessive pressure into the reserve tank. Once the engine has cooled off, a negative pressure begins to develop in the cooling system. When this happens, a second valve in the cap allows the coolant to be siphoned back into the radiator from the coolant reservoir. If the cap should fail, the engine can easily overheat. A pressure test of the radiator cap is a quick way to tell if the cap is doing its job. It should be able to hold its rated pressure for two minutes.

ENGINE FAN

The radiator cooling fan is an important part of the cooling system operation. While a fan is not really needed while a vehicle is traveling down the highway, it is extremely important when driving slowly or stopped with the engine running. In the past, the fan was attached to the engine and was driven by the fan belt. The speed of the fan was directly proportional to the speed of the engine; a viscous fan drive was developed in order to disengage the fan when it was not needed.

With computer controls, the engine-driven fans gave way to electric fans mounted directly on the radiator. A temperature sensor determined when the engine was beginning to run too hot and turned on the fan to draw air through the radiator to cool the engine. On many cars, there were two fans mounted side by side to make sure that the radiator had a uniform air flow for the width of the unit.

When the car is in motion, the speed of the air entering the grill is usually sufficient to keep the coolant at the proper temperature and the fans shut off. When the vehicle is stopped, there is no air flow and the fan is turned on when the engine reaches a designated temperature.

When the A/C is turned on the fan circuit would power the fans regardless of engine temperature. The air conditioning system always requires a good air flow through the condenser mounted in front of the radiator. If the air flow stopped, the air-conditioned air coming through the dash outlets would immediately start warming up.

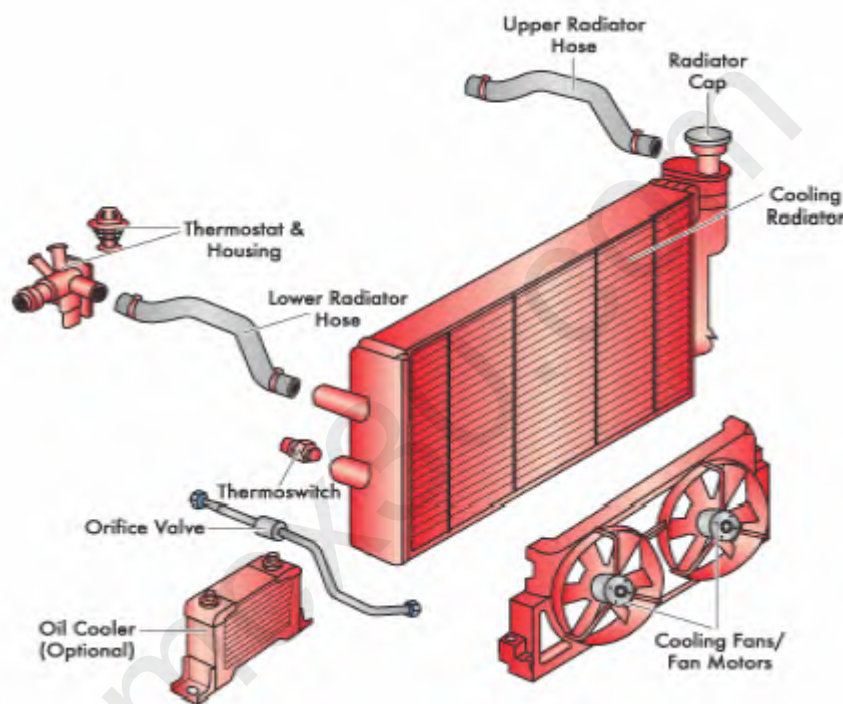


Fig. 2: Typical Cooling Fan

COOLING SYSTEM POWER FLUSH AND REFILL

Old coolant can be replaced by draining it out and replacing it with fresh coolant; however, power flushing will remove all the old coolant and pull out any sediment and scale along with it. Power flushing requires special equipment and generally requires the thermostat to be removed, the lower radiator hose disconnected, and the flush machine connected in line. Water and, sometimes, a cleaning agent are pumped through the cooling system in a reverse path from the normal coolant flow. When completed, the hose is reconnected and a new thermostat is installed. The cooling system is refilled with the appropriate amount of antifreeze to bring the coolant to the proper mixture of antifreeze and water. For most vehicles and most climates, the mixture is 50 / 50. In colder climates, more antifreeze is used, but must never exceed 75 percent antifreeze. Follow the vehicle manufacturers' procedures and recommendations.

BELTS (EXCEPT TIMING BELTS)

On most older vehicles, the water pump is driven by a V belt or serpentine belt on the front of the engine that is also responsible for driving the alternator, power steering pump and air conditioner compressor. These types of belts are easy to inspect and replace if they are worn. You are looking for dry cracking on the inside surface of the belt.

On later vehicles, the water pump is often driven by the timing belt. This belt usually has a specific life expectancy at which time it must be replaced to insure that it does not fail. Since the timing belt is inside the engine and will require partial engine disassembly to inspect, it is very important to replace it at the correct interval.

Low belt tension, contamination and belt vibration are common sources of belt noise. A screeching or squealing noise that occurs when pulling away from a stop normally indicates a lack of tension; check belt tension and automatic tensioners.

A grinding noise can result from damaged bearings, which must be replaced, aligned and lubricated to eliminate the noise and further damage. Vibration and noise can develop over time as drive components such as pulleys and spring tensioners wear, bearings and brackets loosen, or belts wear and stretch.

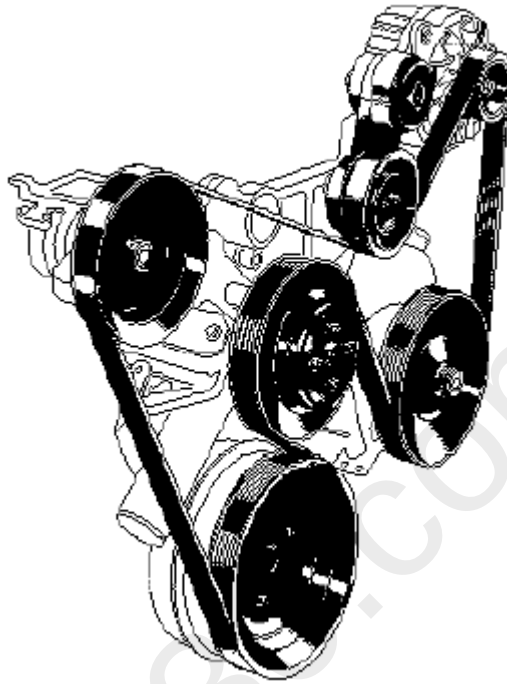
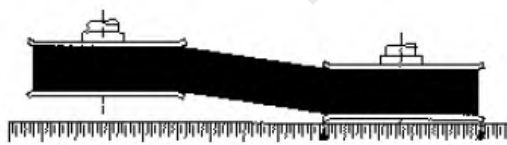


Fig. 3: Typical Accessory Drive Belt

The angle between belt span and pulley is the critical factor responsible for causing the "chirp" associated with misalignment noise. The presence of high humidity (or a damp belt) often increases the likelihood for misalignment noise to occur. Misalignment angle can result from many different combinations of pulley positions - parallel and angular are two typical examples.



Parallel misalignment.



Angular misalignment.

Fig. 4: Accessory Drive Belt Misalignment

Whenever a vehicle owner complains of belt noise, determine the type of noise and under what circumstances it occurs. The correction for a noise problem caused by belt misalignment is not likely to resolve a slip noise problem that may be caused by insufficient tension or other problem. The highest occurrence of belt noise due to misalignment comes from short belt spans entering large diameter pulleys. In the case of severe misalignment, repositioning of drive components may be required. Pulley alignment and tension must be correct for the drive to operate properly.

BELT TENSIONER

Belt tensioners are used to maintain constant tension on the belt, extending both belt and accessory drive bearing life.

NOTE:

A tensioner cannot be rebuilt since internal parts are not available. Never try to disassemble a tensioner unit. Injury may result.



Fig. 5: Typical Accessory Drive Belt Tensioner

AUTOMATIC TRANSMISSION FLUID

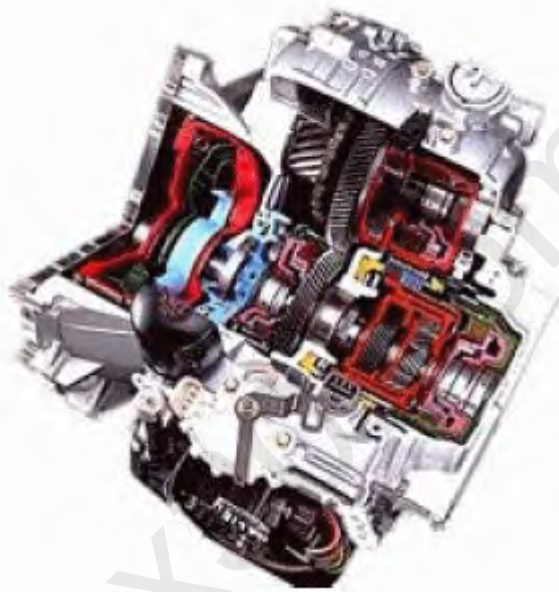


Fig. 6: Crosssection Of Automatic Transmission - Typical

Automatic transmission fluid (ATF) is the fluid used in vehicles with a self-shifting or automatic transmission. It is typically colored red or green to distinguish it from motor oil and other fluids in the vehicle. The fluid is a highly refined mineral oil optimized for the special requirements of an automatic transmission, such as valve operation, clutch and band operation, torque converter and gear lubrication. ATF is also used as a hydraulic medium in some power-assisted steering systems and as a lubricant in some 4WD transfer cases.

ATF usually contains an additive package with anti-foam additives, detergents and dispersants, anti-oxidation compounds, surfactants and petroleum dye. There are many specifications for ATF, such as the DEXRON and MERCON series, and the vehicle manufacturer will identify the ATF specification appropriate for each vehicle. The vehicle's owner's manual will typically list the ATF specification(s) that are recommended by the manufacturer. Some manufacturers will recommend different ATF products for different kinds of vehicle use, such as frequent trailer towing or vehicles that are used for longer periods between routine maintenance.

Overused ATF often has reduced lubrication properties and abrasive friction materials (from clutches and bands) suspended in it; failure to replace such fluid will accelerate transmission wear and could eventually ruin a transmission. Color is not an indication of the service life of an ATF as most ATF products will darken with use. The manufacturer's recommended service interval is a more reliable measure of ATF life.

AUTOMATIC TRANSMISSION FLUID EXCHANGE & FILTER REPLACEMENT

Automatic transmission fluid lubricates, cools and cleans internal components of the transmission. It also helps to maintain the hydraulic pressure necessary for the transmission to function. The additives in the transmission fluid can be depleted over time and should be replaced following the manufacturer's recommended service interval.

ENGINE OIL

The temperature range the oil is exposed to in most vehicles can be wide, ranging from cold ambient temperatures in the winter before the vehicle is started up to hot operating temperatures when the vehicle is fully warmed up in hot summer weather. A "specific" oil will have high viscosity when cold and a low viscosity at the engine's operating temperature. The difference in viscosities for any single-grade oil is too large between the extremes of temperature. To bring the difference in viscosities closer together, additives called viscosity index improvers are added to the oil. This creates "multi-grade" oil which has the viscosity of the first number when cold and the viscosity of the second number when hot. This allows one type of oil to be generally used all year.

In engines, there is inevitably some exposure of the oil to products of internal combustion, and microscopic particles from black soot accumulate in the oil during operation. Also the rubbing of metal engine parts inevitably produces some microscopic metallic particles from the wearing of the surfaces. Such particles could circulate in the oil and grind against the part surfaces causing wear. The oil filter removes many of the particles and sludge, but eventually the oil filter can become clogged, if used for extremely long periods. The motor oil and especially the additives also undergo thermal and mechanical degradation. For these reasons, the oil and the oil filter need to be periodically replaced.

Most vehicle manufacturers utilize a time/mileage-based schedule. Time-based intervals account for both the short trip driver who does fewer miles, but builds up more contaminants, as well as the long highway trips that are much easier on the oil. Many vehicle manufacturers list somewhat higher intervals for changing of oil and filter, with "severe" service requiring more frequent changes. This generally applies to vehicles that are mostly used in "Stop-and-Go" driving conditions; experience extended periods of idling; or used for short trips of under 10 miles, where the oil does not get to full operating temperature and other adverse conditions.

Some vehicle manufacturers have installed engine Oil Life Monitors using computer calculations to estimate the oil's condition based on the factors which degrade it. Conditions such as RPMs, temperatures, and trip length are factored in to the equation; and one system adds an optical sensor for determining the clarity of the oil in the engine.

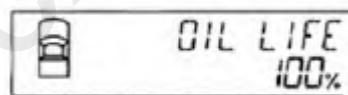


Fig. 7: Engine Oil Life Monitor Display Example

AIR FILTERS

The engine air filter prevents dirt from entering the engine's cylinders, where it would cause mechanical wear and oil contamination. Most fuel injected vehicles use a pleated paper filter element in the form of a flat panel. This filter is usually placed inside a plastic box connected to the throttle body with an intake tube. Older vehicles that use carburetors or throttle body fuel injection typically use a cylindrical air filter, usually a few inches high and between 6 and 16 inches in diameter, positioned above the carburetor or throttle body and may incorporate ducting to provide cool and/or warm inlet air, and secured with a metal or plastic lid.

A Pleated paper filter element is used for most automobile engine air cleaners, because they are efficient, easy to service, and cost-effective. The pleated-paper filter is sized appropriately for the airflow volumes encountered in a particular application and present only minor restriction to air flow until the filter has become clogged with dirt.

CABIN AIR FILTER

The cabin air filter is typically a pleated-paper filter that is placed in the outside-air intake for the vehicle's passenger compartment. Some of these filters are rectangular and similar in shape to the combustion air filter. Others are uniquely shaped to fit the available space of particular vehicles' outside-

air intakes. Clogged or dirty cabin air filters can significantly reduce airflow from the cabin vents, as well as introduce allergens into the cabin air stream.

BRAKE FLUID

The purpose of brake fluid is to:

1. Utilize hydraulic pressure to apply force on brake components that use a friction material to slow the vehicle
2. Protect the brake system from corrosion

Motor vehicle brake fluids are hygroscopic and absorb moisture when exposed to the atmosphere and in service. Water contamination from any source, including mechanical or accidental additions of free water, will appreciably lower the original boiling point of the brake fluid and increase its viscosity at low ambient temperatures. Water contamination may cause corrosion of brake cylinder bores and pistons, and may seriously affect the braking efficiency and safety of the brake actuating system. While moisture is definitely an issue with brake fluids, no consistent and accurate measurement identifying the percentage of moisture that is detrimental to brake fluid performance has been found in the literature. In addition, no specification exists for an in-use brake fluid boiling point that can be identified by a testing procedure and therefore no recommendation for replacement based on moisture content can be made with confidence.

It has been demonstrated that corrosion inhibitors in brake fluid deplete over time and can be severely depleted by 36 months. The depletion of corrosion inhibitors results in corrosion. Copper is not found in new brake fluid and is used as a brazing alloy in the brake lines, which represent a high surface area for brake fluid contact. Copper is the first metal to corrode in a brake system, and is a principle contaminate in brake fluid. Copper levels increase slowly and stably over time. The slow and steady increase in copper levels provides a means to predict the age of brake fluid under normal conditions. The age of the brake fluid can help determine when brake fluid should be serviced according to OEM recommendations when applicable. Copper can also directly affect ABS components as it can plate to the valve and valve seats.

Iron levels begin to sharply increase when the copper levels reach 150-250 ppm indicating corrosion of iron components. This also allows copper levels to be used to predict when iron levels will increase or the start of component corrosion and the depletion of corrosion inhibitors. Once iron corrosion begins copper acts as a catalyst to speed corrosion. At this point (iron corrosion) it is evident that the brake fluid no longer performs the intended purpose of protecting the system from corrosion.

A copper content of 200 ppm or greater indicates a depletion of corrosion inhibitors in the brake fluid and Brake Fluid Replacement is Required.

BATTERY

The automotive battery is an electrochemical device that produces voltage and delivers current. In an automotive battery the electrochemical action can be reversed, recharging the battery, providing many years of service. Batteries emit hydrogen gas while charging and the battery case cannot be completely sealed. Batteries (maintenance free) have small vents on the side forcing the gases to go through baffles to escape. This process allows the liquid to condense and flow back to the bottom of the battery.

The purpose of the battery is to supply current to the starter motor, provide current to the ignition system while cranking, to supply additional current when the demand is higher than the alternator can supply and to act as an electrical reservoir. Batteries are rated in cold cranking amps. This represents the current the battery can produce for 30 seconds at 0 degrees before the battery voltage drops below 7.2 volts.

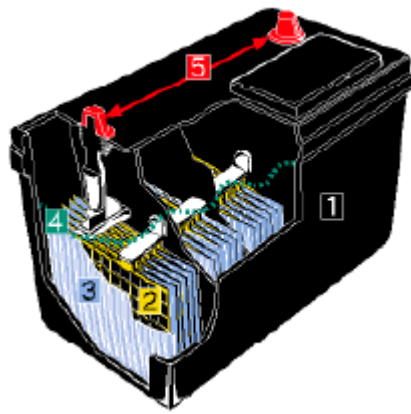


Fig. 8: Typical Battery Components

BATTERY CABLES

Battery cables are large diameter, multi-stranded wire which conveys the high current (250+ amps) necessary to operate the starter motor. Some battery cables will have a smaller wire, soldered to the terminal, which is used to either operate a smaller device or to provide an additional ground. When the smaller cable burns it indicates a high resistance in the heavy cable.

Even maintenance free batteries need periodic inspection and cleaning to insure they stay in good working order. Inspect the battery to see that it is clean and that it is held securely in its carrier. Some corrosion naturally collects around the battery. Electrolyte condensation contains corrosive sulfuric acid, which eats away the metal of battery terminals, cable ends and battery hold-down parts.

POWER STEERING

Power steering is a system for reducing the steering effort on cars by using an external power source to assist in turning the wheels. Most vehicles have power steering and the trend to front wheel drive, greater vehicle mass and wider tires means that modern vehicles would be extremely difficult to maneuver at low speeds (e.g. when parking) without assistance.

POWER STEERING FLUID

Power Steering Fluid is the hydraulic component in power steering systems and is charged with pressure transfer and component protection. It fails when it stops performing one of its tasks. When a fluid becomes oxidized, its resistance to flow is greater and it decreases its ability to protect components and transfer pressure. The more common failure mode of PSF is internal and external contamination, and excess particles in fluid promote component wear and can lead to component failures, including seals, shafts and gears.

Most power steering systems work by using a belt driven pump to provide hydraulic pressure to the system. This hydraulic pressure is generated by a rotary-vane pump which is driven by the vehicle's engine. As the speed of the engine increases, the pressure in the hydraulic fluid also increases, hence a relief valve is incorporated into the system to allow excess pressure to be bled away. Some of the hydraulic systems also include an electronic pressure valve which can reduce the hydraulic pressure of the power steering lines as the vehicle's speed increases (Variable assist power steering).

Electric Power Steering uses sensors to detect the motion and torque of the steering column and a computer module applies electric motor to provide power assist. This allows variable assist power steering to be applied depending on driving conditions. In the event of component failure, a mechanical linkage such as a rack and pinion serves as a back-up in a manner similar to that of hydraulic systems. Electric power steering is usually limited to smaller vehicles rather than trucks and SUVs. Electric systems have a significant advantage in fuel efficiency because there is no hydraulic pump constantly running, whether assistance is required or not.

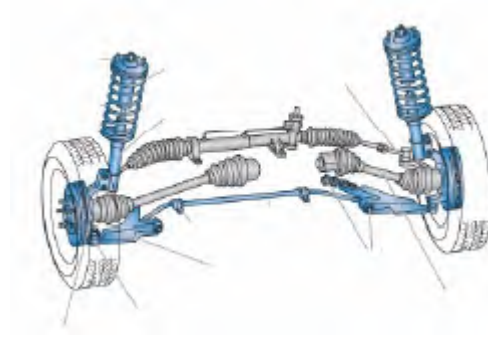


Fig. 9: Typical Front Suspension & Steering Components

WIPER BLADES

Worn wiper blades are dangerous. Ozone, airborne contaminants, oil, sunlight and dirt all act to weaken and reduce your wiper blades' ability to keep your view unobstructed. And exposure to sunlight and ozone cause the wiper blades to age, even if they're not used much. Weather also plays a critical role in your windshield wiper blades' deterioration. Freezing temperatures make the rubber in your wiper blades hard and brittle, which increases their tendency to crack or tear. Hot weather warps the rubber and prevents the blade from wiping your windshield cleanly.

Heavy use is hard on the wipers because dust, abrasives, road grime and bug juice wear away the cutting edge the blade needs to wipe cleanly. Even road dirt acts like an abrasive to wear away the flat surface necessary for a good squeegee effect. Rubber also deteriorates over time. As blades age, they lose their flexibility and are less able to wipe cleanly. They may develop a permanent set or curvature, which prevents full contact with your windshield.

A wiper blades ability to clean the glass depends on:

The slope and area of the windshield: Windshields are sloped for improved aerodynamics and a "cab-forward" windshield with a lot of surface area directs more wind against the wipers, and can force the blades away from the windshield at high speeds unless the wiper system is designed to resist lift.

The amount of spring tension on the wiper arm: This is important to keep the wiper blade in tight contact with the windshield and provide a squeegee effect.

The number of pressure points or claws holding the blade: The more claws a blade has, the broader the area over which the pressure of the wiper arm is spread. More claws also provide increased flexibility so the blade can more easily follow the curvature of a large, sloping windshield for full side-to-side contact.

ROUTINE INSPECTION CHECKSHEET



ROUTINE INSPECTION CHECKSHEET

Date: _____
Name: _____
Address: _____
City: _____ State: _____ Zip Code: _____
Year: _____ Make: _____ Model: _____
Mileage: _____ License: _____ VIN: _____ Eng Code: _____

Customer Interview:

Reason Code Explanation

Code Reason

Reasons

- A Part No Longer Performs Intended Purpose
- B Part Does Not Meet A Design Specification (Regardless Of Performance)
- C Part Is Missing

Suggested/Optional

- 1 Part Is Close To The End Of Its Useful Life
- 2 To Address A Customer Need, Convenience Or Request
- 3 To Comply With Maintenance Recommended By The Vehicle's Original Equipment Manufacturer
- 4 Technician's Recommendation Based On Substantial And Informed Experience
- 5 To Comply With Maintenance Recommended By AMRA/MAP



Your vehicle has been inspected following the Uniform Inspection and Communication Standards developed by the Motorist Assurance Program. MAP produces materials that give motorists the information and encouragement to take greater responsibility for their vehicles—through proper maintenance. We encourage participating service and repair shops to adopt the MAP Pledge of Assurance to their Customers and the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction. For more information visit: www.motorist.org

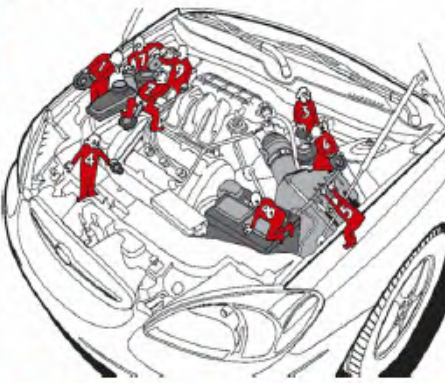
DISCLAIMER: This document may be used as a guide when performing vehicle inspection. This form is not to be used as an estimate form and may not comply with Local or State Laws. The Motorist Assurance Program is not responsible for the performance and accuracy of the motor vehicle inspection performed using this document.

Fig. 10: Routine Inspection Checksheet (1 Of 2)

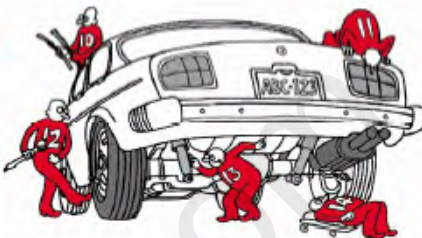
UNDERHOOD				
Component	OK	S	R	Condition
Coolant				
Coolant Hoses				
Belts (Except Timing Belt)				
Tensioner				
Transmission Fluid				
Engine Oil				
Engine Air Filter				
Cabin Air Filter				
Brake Fluid				
Clutch Fluid (M/T)				
Washer Fluid				
Battery				
Battery Hold Down				
Battery Box				
Battery Cables / Ends				
Power Steering Fluid				
Wiper Blades				

UNDER VEHICLE				
Component	OK	S	R	Condition
Shocks / Struts				
Exhaust				

Notes: _____



Lights/Lamps	OK	S	R	Location
Headlights				
Parking				
Turn Signal				
Brake				
License Plate				



CHECK TIRES									
Tire Size (Placard) _____		Actual _____		TPMS Warning On ___ Off ___ n/a ___					
	Tire Pressure				Wear Pattern / Damage				Wear Type 1.) Edge wear 2.) Cupped 3.) Cut 4.) Irregular wear 5.) Other
	Front Spec: _____	Before	After	OK	S	R	Wear Type		
	Left Front								
	Right Front								
	Rear Spec: _____								
	Left Rear								
	Right Rear								
	Spare Tire								
Tread Depth		Left Front	Right Front	Left Rear	Right Rear				

OK	Suggested 1, 2, 3, 4, 5	Required A, B, C
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Fig. 11: Routine Inspection Checksheet (2 Of 2)

ROUTINE INSPECTION - UICS

BRAKE SYSTEMS

NOTE: Some states may have specifications that differ from OEM. Check your local/state regulations. Where state or local laws are stricter, they take precedence over these guidelines.

BRAKE FLUID

NOTE: Most manufacturers prohibit the use of DOT 5 brake fluid in a system equipped with ABS. DOT 3, DOT 4, and DOT 5.1 brake fluids are clear or light amber in color. DOT 5 brake fluid is violet in color. Correct fluid type is normally stamped on the master cylinder cover.

NOTE: Fluid Flush - a process using a sufficient volume of fluid to help remove

contaminants and replacing the contaminated fluid with new fluid of the same type and specification. At times a chemical may be used to enhance removal.

NOTE: Fluid Exchange/Replace - draining (evacuating) old fluid and replacing it with new fluid of the correct type and specification.

Condition	Code	Procedure
At or beyond OEM service interval	3	Suggest fluid exchange/replacement
Brake fluid type incorrect	B	Require flushing and refilling
NOTE: For example, DOT fluid lower than specified for the vehicle or silicone brake fluid (DOT 5) in an ABS system		
Contaminated, for example, fluid other than brake fluid present	A	Require service
NOTE: If a fluid other than brake fluid is present in the brake system which DOES affect the rubber parts, the required service is to: 1) remove all components having rubber parts from the system, 2) flush lines, 3) repair or replace all components having rubber parts, and 4) fill with correct brake fluid.		
Contaminated, for example, fluid other than brake fluid present	B	Require service
NOTE: If a fluid other than brake fluid is present in the brake system which DOES NOT affect the rubber parts, the required service is to flush and fill with the correct brake fluid.		
Corrosion inhibitors depleted	B	Require fluid exchange/replacement
NOTE: A copper content of 200 ppm or greater indicates a depletion of corrosion inhibitors in the brake fluid.		
Fluid discolored	No Service Suggested or Required	
NOTE: Further testing necessary to determine condition of fluid.		
Hydraulic component overhaul or replacement	3	Suggest flushing and refilling
Rubber master cylinder cover gasket distorted and gummy	A	Require replacement of gasket
NOTE: This condition may indicate contaminated brake fluid. Further inspection required.		

BULBS AND LEDS

NOTE: Does not include soldered-in components.

Condition	Code	Procedure
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Condition	Code	Procedure
Application incorrect	B	Require replacement
NOTE: Application incorrect includes wrong bulb coating or color.		
Base burned, affecting performance	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Base burned, not affecting performance	2	Suggest repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Base corroded, affecting performance	A	Require repair or replacement
Base corroded, not affecting performance	2	Suggest repair or replacement
Base loose, affecting performance	B	Require repair or replacement
Base loose, not affecting performance	1	Suggest repair or replacement
Burned out	A	Require replacement
Intermittent	A	Require replacement
Missing	C	Require replacement
Seized in socket	A	Require repair or replacement
Terminal broken	A	Require repair or replacement
Terminal burned, affecting performance	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Terminal burned, not affecting performance	2	Suggest repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Terminal corroded, affecting performance	A	Require repair or replacement
Terminal corroded, not affecting performance	2	Suggest repair or replacement
Terminal loose, affecting performance	B	Require repair or replacement
Terminal loose, not affecting performance	1	Suggest repair or replacement

HOSES

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware

Condition	Code	Procedure
Attaching hardware not functioning	A	Require repair or replacement of hardware
Blistered	B	Require replacement
Expansion affecting performance	A	Require Replacement
Fitting threads damaged	A	Require repair or replacement
Fitting threads stripped (threads missing)	A	Require replacement
Incorrectly secured	B	Require repair
Inner fabric (webbing) cut	B	Require replacement
Leaking	A	Require replacement
Missing	C	Require replacement
Outer covering is cracked to the extent that inner fabric of hose is visible	B	Require replacement
Restricted	A	Require replacement
Routed incorrectly	B	Require repair

LENSES

Condition	Code	Procedure
Application incorrect	A	Require replacement
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Broken, affecting performance	A	Require replacement
Broken, not affecting performance	No Service Suggested or Required	
Cracked	B	Require replacement
Discolored	A	Require replacement
Leaking	B	Require repair or replacement
Melted, affecting performance	A	Require replacement
Melted, not affecting performance	2	Suggest replacement
Missing	C	Require replacement

LUG NUT

Condition	Code	Procedure
Lug nut flats rounded	A	Require replacement of nut
Lug nut installed backward	B	Require repair
Lug nut mating surface dished	A	Require replacement of nut
Lug nut mating type incorrect	B	Require replacement of nut
Lug nut seized	A	Require replacement of nut and/or stud
Stud incorrect	B	Require replacement of stud
Threads damaged	A	Require repair or replacement of component with damaged threads
Threads stripped (threads missing)	A	Require replacement of component with stripped threads

MASTER CYLINDER COVER GASKET

Condition	Code	Procedure
Rubber master cylinder cover gasket distorted and gummy	A	Require replacement of the gasket
NOTE: This condition may indicate contaminated brake fluid. See Brake Fluid.		

PARKING BRAKE CABLE

Condition	Code	Procedure
Cable improperly adjusted	B	Require cable adjustment
Cable or individual wires in the cable are broken	A	Require replacement of cable assembly
Cable sticking	A	Require cable lubrication
Cable stuck inside conduit and cannot be lubricated so that parking brake functions properly	A	Require replacement of cable assembly

VACUUM HOSES

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Blistered	B	Require replacement
Fitting threads damaged	A	Require repair or replacement
Fitting threads stripped (threads missing)	A	Require replacement
Incorrectly secured	B	Require repair
Inner fabric (webbing) cut	B	Require replacement
Leaking	A	Require replacement
Missing	C	Require replacement
Outer covering is cracked to the extent that inner fabric of hose is visible	B	Require replacement
Restricted	A	Require replacement
Routed incorrectly	B	Require repair

WHEEL ATTACHMENT HARDWARE

NOTE: For conditions noted below, also check condition of wheel stud holes. Proper lug nut torque is essential. Follow manufacturer's torque specifications and tightening sequence. **DO NOT** lubricate threads unless specified by the vehicle manufacturer.

Condition	Code	Procedure
Bent	A	Require replacement
Broken	A	Require replacement

Condition	Code	Procedure
NOTE: Some manufacturers require replacement of all studs on any wheel if two or more studs or nuts on the same wheel are broken or missing.		
Loose	A	Require repair or replacement of affected component
Lug nut flats rounded	A	Require replacement of nut
Lug nut installed backward	B	Require repair
Lug nut mating surface dished	A	Require replacement of nut
Lug nut mating type incorrect	B	Require replacement of nut
Lug nut seized	A	Require replacement of nut and/or stud
Stud incorrect	B	Require replacement of stud
Threads damaged	A	Require repair or replacement of component with damaged threads
Threads stripped (threads missing)	A	Require replacement of component with stripped threads

WHEEL BEARINGS, RACES AND SEALS

NOTE: When replacing or repacking wheel bearings, grease seal replacement is required. You are not required to replace these components in axle sets. Determine the need to replace based upon the individual component conditions.

Condition	Code	Procedure
Axle seal on drive axle leaking	A	Require replacement of seal and inspection of axle, bearing, housing, and vent tube
Bearing end-play exceeds specifications	B	Require adjustment of bearing, if possible. If proper adjustment cannot be obtained, require replacement of bearing and race assembly
Bearing rollers, balls or races are worn, pitted, or feel rough when rotated as an assembly or other damage affecting performance.	B	Require replacement of bearing and race assembly
Seal leaking	A	Require replacement of seal and inspection of bearings
NOTE: Require inspection of mating and sealing surface and repair or replace as necessary. Check vent. A plugged vent may force fluid past the seal.		
Seal missing	C	Require replacement

DRIVETRAIN AND TRANSMISSION

NOTE: When a procedure states that a required or suggested repair or replacement is recommended, the basis for the recommendation **MUST** be explained to the customer. If the customer asks whether there are alternatives to the recommendation, generally acceptable repair/replacement options must be explained, whether performed or not by the shop.

NOTE: Whenever transmission or drive-train service is performed that affects the suspension alignment, for example, removing the engine cradle, it is required that the alignment be checked and corrected if necessary.

NOTE: The conditions listed for the components included in this section assume that the problem has been isolated to the specific component through proper testing.

AUTOMATIC TRANSMISSION FLUID

Condition	Code	Procedure
Additive depletion	A	Require replacement of fluid
Application incorrect	B	Require replacement
NOTE: Determine and correct cause.		
Burned	Further inspection required	
NOTE: Fluid that is burned indicates a serious problem. Determine and correct the cause.		
Contaminated, for example, fluid other than the specified fluid present	A	Require service
NOTE: If an incorrect fluid is present in the hydraulic system which DOES affect the rubber parts, the required service is to: 1) remove all components having rubber parts from the system, 2) flush lines, 3) repair or replace all components having rubber parts, and 4) fill with correct fluid.		
Contaminated, for example, fluid other than the specified fluid present	B	Require service
NOTE: If a fluid other than the specified fluid is present in the hydraulic system which DOES NOT affect the rubber parts, the required service is to flush and fill following OEM specified procedure with the correct hydraulic fluid.		
Fluid at or beyond service interval	3	Suggest replacement
Fluid discolored	No Service Suggested or Required	
NOTE: Further testing necessary to determine condition of fluid.		
Fluid incorrect	B	Require service
NOTE: If a fluid other than the correctly specified fluid is present in the hydraulic system, the required service is to flush and fill with the correct fluid.		
Level incorrect	B	Require correction of fluid level
Oxidized	A	Require replacement of fluid
Varnish deposits present on system components affecting performance	Further inspection required	

CLUTCH MASTER CYLINDERS

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Condition	Code	Procedure
Cover gasket distorted	A	Require replacement of cover gasket
Cover gasket gummy	A	Require replacement of cover gasket
NOTE: This condition may indicate contaminated fluid. Further inspection required.		
Cylinder leaking fluid from rear of bore	A	Require repair or replacement
Cylinder leaking fluid internally	A	Require replacement
Dust boot missing	C	Require replacement of dust boot
Dust boot punctured	A	Require replacement of dust boot
Dust boot torn	A	Require replacement of dust boot
Fluid level incorrect	B	Require fluid level adjustment
Housing damaged, affecting performance	A	Require repair or replacement
Master cylinder has residue in reservoir	2	Further inspection required
NOTE: Do not replace master cylinder unless it exhibits conditions listed for replacement.		
Pushrod out of adjustment	B	Require Repair or Replacement
Threads damaged	A	Require repair or replacement
Threads stripped (threads missing)	A	Require replacement

COOLER LINES

Condition	Code	Procedure
Abrasion damage, affecting structural integrity	A	Require repair or replacement
Abrasion damage, not affecting structural integrity	No Service Suggested or Required	
Application incorrect	B	Require replacement
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Clamp corroded, not reusable	1	Suggest replacement
NOTE: If clamp removed, require replacement.		
Connected incorrectly	A	Require repair
Corroded, affecting structural integrity	A	Require replacement
Corroded, not affecting structural integrity	No Service Suggested or Required	
Cracked	B	Require repair or replacement

Condition	Code	Procedure
Fitting type incorrect (such as compression fitting)	B	Require replacement
Flange leaking	A	Require repair or replacement
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement
Leaking	A	Require repair or replacement
Melted	1	Suggest repair or replacement
Missing	C	Require replacement
Outer covering damaged to the extent that the inner fabric is visible	A	Require replacement
Protective sleeves damaged	2	Suggest replacement of sleeves
Protective sleeves missing	C	Require replacement of sleeves
Restricted, affecting performance	A	Require repair or replacement
Routed incorrectly	B	Require repair
Swollen	1	Suggest replacement
Threads damaged	A	Require repair or replacement
Threads stripped (threads missing)	A	Require replacement
Type incorrect	2	Suggest repair or replacement

COOLERS

Condition	Code	Procedure
Air flow obstruction	A	Require repair
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Connection leaking	A	Require repair or replacement
Contaminated	A	Require repair or replacement
Corroded	1	Suggest repair or replacement
Fins damaged, affecting performance	A	Require repair or replacement
Fins damaged, not affecting performance	No Service Suggested or Required	
Internal restrictions	B	Require repair or replacement
Leaking	A	Require repair or replacement
Threads damaged	A	Require repair or replacement
Threads stripped (threads missing)	A	Require repair or replacement
Tubes damaged, affecting performance	A	Require repair or replacement
Tubes damaged, not affecting performance	No Service Suggested or Required	

DIFFERENTIAL FLUID

Condition	Code	Procedure
Additive depletion	A	Require replacement of fluid
Application incorrect	B	Require replacement

Condition	Code	Procedure
NOTE: Determine and correct cause.		
Burned	Further inspection required	
NOTE: Fluid that is burned indicates a serious problem. Determine and correct the cause.		
Contaminated, for example, fluid other than the specified fluid present	B	Require service
NOTE: If a fluid other than the specified fluid is present in the hydraulic system which DOES NOT affect the rubber parts, the required service is to flush and fill following OEM specified procedure with the correct hydraulic fluid.		
Contaminated, for example, fluid other than the specified fluid present	A	Require service
NOTE: If an incorrect fluid is present in the hydraulic system which DOES affect the rubber parts, the required service is to: 1) remove all components having rubber parts from the system, 2) flush lines, 3) repair or replace all components having rubber parts, and 4) fill with correct fluid.		
Fluid at or beyond service interval	3	Suggest replacement
Fluid discolored	No Service Suggested or Required	
NOTE: Further testing necessary to determine condition of fluid.		
fluid incorrect	B	Require service
NOTE: If a fluid other than the correctly specified fluid is present in the hydraulic system, the required service is to flush and fill with the correct hydraulic fluid.		
Level incorrect	B	Require correction of fluid level
Oxidized	A	Require replacement of fluid
Rubber master/ clutch cylinder cover gasket distorted or gummy	A	Require service
NOTE: If an incorrect fluid is present in the hydraulic system which DOES affect the rubber parts, the required service is to: 1) remove all components having rubber parts from the system, 2) flush lines, 3) repair or replace all components having rubber parts, and 4) fill with correct fluid.		
Varnish deposits present on system components affecting performance	Further inspection required	

DRAIN PLUGS AND GASKETS

Condition	Code	Procedure
Leaking	A	Require repair or replacement

Condition	Code	Procedure
NOTE: Require inspection of mating and sealing surface and repair or replace as necessary.		
Missing	C	Require replacement
Threads Damaged	A	Require repair or replacement

FILTERS AND SCREENS

Condition	Code	Procedure
At service interval	3	Suggest replacement
Bent, affecting performance	A	Require repair or replacement
Exceeding service interval	3	Suggest replacement
Missing	C	Require replacement
Near service interval	3	Suggest replacement
Restricted	A	Require repair or replacement
NOTE: Further inspection may be required to determine the source of restriction or contamination.		
Torn	A	Require replacement
Worn, affecting performance (metal or nylon screen type)	A	Require repair or replacement

FLUIDS AND LUBRICANTS

Condition	Code	Procedure
Additive depletion	A	Require replacement of fluid
Application incorrect	B	Require replacement
NOTE: Determine and correct cause.		
Burned	Further inspection required	
NOTE: Fluid that is burned indicates a serious problem. Determine and correct the cause.		
Contaminated, for example, fluid other than the specified fluid present	A	Require service
NOTE: If an incorrect fluid is present in the hydraulic system which DOES affect the rubber parts, the required service is to: 1) remove all components having rubber parts from the system, 2) flush lines, 3) repair or replace all components having rubber parts, and 4) fill with correct brake fluid.		
Contaminated, for example, fluid other than the specified fluid present	B	Require service
NOTE: If a fluid other than the specified fluid is present in the hydraulic system which DOES NOT affect the rubber parts, the required service is to flush and fill following OEM specified procedure with the correct hydraulic fluid.		

Condition	Code	Procedure
Fluid at or beyond service interval	3	Suggest replacement
Fluid discolored	No Service Suggested or Required	
NOTE: Further testing necessary to determine condition of fluid.		
Fluid incorrect	B	Require service
NOTE: If a fluid other than the correctly specified fluid is present in the hydraulic system, the required service is to flush and fill with the correct hydraulic fluid.		
Level incorrect	B	Require correction of fluid level
Oxidized	A	Require replacement of fluid
Rubber master/ clutch cylinder cover gasket distorted or gummy	A	Require service
NOTE: If an incorrect fluid is present in the hydraulic system which DOES affect the rubber parts, the required service is to: 1) remove all components having rubber parts from the system, 2) flush lines, 3) repair or replace all components having rubber parts, and 4) fill with correct fluid.		
Varnish deposits present on system components affecting performance	Further inspection required	

HOSES, LINES, AND TUBES

Condition	Code	Procedure
Application incorrect	B	Require replacement
At or beyond service interval	3	Suggest replacement
Connected incorrectly	A	Require repair
Corroded, not reusable	1	Suggest replacement
Cracked line or tube	A	Require replacement
Hard hose	1	Suggest replacement
Inner fabric (webbing) damaged	A	Require replacement
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement
Leaking	A	Require repair or replacement
Melted	1	Suggest repair or replacement
Missing	C	Require replacement
Outer covering damaged	1	Suggest replacement
Outer covering damaged to the extent that the inner fabric is visible	A	Require replacement
Protective sleeves damaged	2	Suggest replacement of sleeves
Protective sleeves missing	2	Suggest replacement of sleeves
Restricted, affecting performance	A	Require repair or replacement
Restricted, not affecting performance	2	Suggest repair or replacement
Routed incorrectly	2	Suggest replacement
Safety clip missing	C	Require replacement
Spongy	1	Suggest repair or replacement

Condition	Code	Procedure
Stripped	A	Require replacement
Surface cracked (weather-checked)	1	Suggest repair or replacement
Swollen	B	Require replacement
Threads damaged	A	Require repair or replacement
Threads stripped (threads missing)	A	Require replacement
Type incorrect	1	Suggest repair or replacement

HYDRAULIC FLUID

Condition	Code	Procedure
Additive depletion	A	Require replacement of fluid
Application incorrect	B	Require replacement
NOTE: Determine and correct cause.		
Burned	Further inspection required	
NOTE: Fluid that is burned indicates a serious problem. Determine and correct the cause.		
Contaminated, for example, fluid other than the specified fluid present	A	Require service
NOTE: If an incorrect fluid is present in the hydraulic system which DOES affect the rubber parts, the required service is to: 1) remove all components having rubber parts from the system, 2) flush lines, 3) repair or replace all components having rubber parts, and 4) fill with correct brake fluid.		
Contaminated, for example, fluid other than the specified fluid present	B	Require service
NOTE: If a fluid other than the specified fluid is present in the hydraulic system which DOES NOT affect the rubber parts, the required service is to flush and fill following OEM specified procedure with the correct hydraulic fluid.		
Fluid at or beyond service interval	3	Suggest replacement
Fluid discolored	No Service Suggested or Required	
Fluid incorrect	B	Require service
NOTE: If a fluid other than the correctly specified fluid is present in the hydraulic system, the required service is to flush and fill with the correct hydraulic fluid.		
Level incorrect	B	Require correction of fluid level
Oxidized	A	Require replacement of fluid
Rubber master/ clutch cylinder cover gasket distorted or gummy	A	Require service

Condition	Code	Procedure
NOTE: If an incorrect fluid is present in the hydraulic system which DOES affect the rubber parts, the required service is to: 1) remove all components having rubber parts from the system, 2) flush lines, 3) repair or replace all components having rubber parts, and 4) fill with correct fluid.		
Varnish deposits present on system components affecting performance	Further inspection required	

LUBRICANTS

Condition	Code	Procedure
Additive Depletion	A	Require replacement of fluid
Application incorrect	B	Require replacement
NOTE: Determine and correct cause.		
At service interval	3	Suggest replacement
Beyond service interval	3	Suggest replacement
Burned	Further inspection required	
NOTE: Fluid that is burned indicates a serious problem. Determine and correct the cause.		
Contaminated, for example, fluid other than the specified fluid present	B	Require service
NOTE: If a fluid other than the correctly specified fluid is present in the hydraulic system which DOES NOT affect the rubber parts, the required service is to flush and fill following OEM specified procedure with the correctly specified hydraulic fluid.		
Fluid incorrect	B	Require service
NOTE: If a fluid other than the correctly specified fluid is present in the hydraulic system, the required service is to flush and fill with the correct hydraulic fluid.		
Level incorrect	B	Require correction of fluid level
Near service interval	3	Suggest replacement
Oxidized	A	Require replacement of fluid
Rubber master cylinder cover gasket distorted and gummy	A	Require service
NOTE: If a fluid other than brake fluid is present in the system which DOES affect the rubber parts, the required service is to: 1) remove all components having rubber parts from the system, 2) flush lines, 3) repair or replace all components having rubber parts, and 4) fill with correct brake fluid.		

MANUAL TRANSMISSION FLUID

Condition	Code	Procedure
Additive depletion	A	Require replacement of fluid
Application incorrect	B	Require replacement

Condition	Code	Procedure
NOTE: Determine and correct cause.		
Burned	Further inspection required	
NOTE: Fluid that is burned indicates a serious problem. Determine and correct the cause.		
Contaminated, for example, fluid other than the specified fluid present	A	Require service
NOTE: If an incorrect fluid is present in the hydraulic system which DOES affect the rubber parts, the required service is to: 1) remove all components having rubber parts from the system, 2) flush lines, 3) repair or replace all components having rubber parts, and 4) fill with correct brake fluid.		
Contaminated, for example, fluid other than the specified fluid present	B	Require service
NOTE: If a fluid other than the specified fluid is present in the hydraulic system which DOES NOT affect the rubber parts, the required service is to flush and fill following OEM specified procedure with the correct hydraulic fluid.		
Fluid at or beyond service interval	3	Suggest replacement
Fluid discolored	No Service Suggested or Required	
NOTE: Further testing necessary to determine condition of fluid.		
Fluid discolored	No Service Suggested or Required	
NOTE: Further testing necessary to determine condition of fluid.		
Fluid incorrect	B	Require service
NOTE: If a fluid other than the correctly specified fluid is present in the hydraulic system, the required service is to flush and fill with the correct hydraulic fluid.		
Level incorrect	B	Require correction of fluid level
Oxidized	A	Require replacement of fluid
Rubber master/ clutch cylinder cover gasket distorted or gummy	A	Require service
NOTE: If an incorrect fluid is present in the hydraulic system which DOES affect the rubber parts, the required service is to: 1) remove all components having rubber parts from the system, 2) flush lines, 3) repair or replace all components having rubber parts, and 4) fill with correct fluid.		
Varnish deposits present on system components affecting performance	Further inspection required	

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Broken	A	Require replacement
Leaking (hydraulic mount)	A	Require replacement
Mounting hole worn, affecting performance	A	Require replacement
Mounting hole worn, not affecting performance	No Service Suggested or Required	
Rubber deteriorated, affecting performance	A	Require replacement
Rubber deteriorated, not affecting performance	No Service Suggested or Required	
Threads damaged	A	Require repair or replacement
Threads stripped (threads missing)	A	Require replacement

TRANSFER CASE FLUID

Condition	Code	Procedure
Additive depletion	A	Require replacement of fluid
Application incorrect	B	Require replacement
NOTE: Determine and correct cause.		
Burned	Further inspection required	
NOTE: Fluid that is burned indicates a serious problem. Determine and correct the cause.		
Contaminated, for example, fluid other than the specified fluid present	A	Require service
NOTE: If an incorrect fluid is present in the hydraulic system which DOES affect the rubber parts, the required service is to: 1) remove all components having rubber parts from the system, 2) flush lines, 3) repair or replace all components having rubber parts, and 4) fill with correct brake fluid.		
Contaminated, for example, fluid other than the specified fluid present	B	Require service
NOTE: If a fluid other than the specified fluid is present in the hydraulic system which DOES NOT affect the rubber parts, the required service is to flush and fill following OEM specified procedure with the correct hydraulic fluid.		
Fluid at or beyond service interval	3	Suggest replacement
Fluid discolored	No Service Suggested or Required	

Condition	Code	Procedure
NOTE: Further testing necessary to determine condition of fluid.		
Fluid incorrect	B	Require service
NOTE: If a fluid other than the correctly specified fluid is present in the hydraulic system, the required service is to flush and fill with the correct hydraulic fluid.		
Level incorrect	B	Require correction of fluid level
Oxidized	A	Require replacement of fluid
Rubber master/ clutch cylinder cover gasket distorted or gummy	A	Require service
NOTE: If an incorrect fluid is present in the hydraulic system which DOES affect the rubber parts, the required service is to: 1) remove all components having rubber parts from the system, 2) flush lines, 3) repair or replace all components having rubber parts, and 4) fill with correct fluid.		
Varnish deposits present on system components affecting performance	Further inspection required	

VACUUM HOSES

Condition	Code	Procedure
Application incorrect	B	Require replacement
At or beyond service interval	3	Suggest replacement
Connected incorrectly	A	Require repair
Corroded, not reusable	1	Suggest replacement
Cracked line or tube	A	Require replacement
Hard hose	1	Suggest replacement
Inner fabric (webbing) damaged	A	Require replacement
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement
Leaking	A	Require repair or replacement
Melted, affecting performance	B	Require repair or replacement
Missing	C	Require replacement
Outer covering damaged	1	Suggest replacement
Outer covering damaged to the extent that the inner fabric is visible	A	Require replacement
Protective sleeves damaged	2	Suggest replacement of sleeves
Protective sleeves missing	C	Suggest replacement of sleeves
Restricted, affecting performance	A	Require repair or replacement
Restricted, not affecting performance	2	Suggest repair or replacement
Routed incorrectly	B	Suggest replacement
Safety clip missing	C	Require replacement
Spongy	1	Suggest repair or replacement
Stripped	A	Require replacement
Surface cracked (weather-checked)	1	Suggest repair or replacement

Condition	Code	Procedure
Swollen	B	Require replacement
Threads damaged	A	Require repair or replacement
Threads stripped (threads missing)	A	Require replacement
Type incorrect	2	Suggest repair or replacement

ELECTRICAL SYSTEMS

BATTERIES

NOTE: Proper operation of any electrical system or component can be affected by battery condition. The battery(ies) must meet or exceed minimum specification for vehicle as equipped and test to that specific battery's CCA.

Definition of Terms

Battery Performance Testing - Testing that determines whether or not a battery meets both vehicle OEM and battery manufacturer's specifications.

Cold Cranking Amp (CCA) Rating - The number of amperes a new, fully charged battery at 0°F (-17.8°C) can deliver for 30 seconds and maintain at least a voltage of 1.2 volts per cell (7.2 volts for a 12-volt battery).

Cranking Amps (CA) - The number of amperes a new, fully charged battery, typically at 32°F (0°C) can deliver for 30 seconds and maintain at least a voltage of 1.2 volts per cell (7.2 volts for a 12volt battery).

OEM Cranking Amps - The minimum CCA required by the original vehicle manufacturer for a specific vehicle.

Condition	Code	Procedure
Battery frozen	Further inspection required	
NOTE: Do not attempt to charge a frozen battery. Allow battery to warm thoroughly and then performance-test. If battery fails performance test, require replacement.		
Battery tests near the ""end of its useful life"" utilizing a tester or on-board monitor able to accurately determine this condition	1	Suggest Replacement
Case leaking	A	Require replacement
Casing swollen	A	Further inspection required
NOTE: No service suggested or required unless the battery fails performance test, in which case, require replacement.		
Circuit open internally	A	Require replacement
Electrolyte contamination	A	Further inspection required
NOTE: No service suggested or required unless the battery fails performance test, in which case, require replacement.		
Electrolyte discoloration	A	Further inspection required

Condition	Code	Procedure
NOTE: No service suggested or required unless the battery fails performance test, in which case, require replacement.		
Fails to accept and hold charge	A	Require replacement
NOTE: This phrase refers to a battery that fails to either accept and/or retain a charge using appropriate times listed in the Battery Charging Guide of the BCI Service Manual, battery charger operating manual, or battery manufacturer's specifications.		
Fluid level low	B	Further inspection required
NOTE: Determine cause of low fluid level. Refill to proper level(s) with water (distilled water preferred). Recharge battery and performance-test. If battery does not meet specifications, require replacement. If battery is sealed type (non-removable filler caps), require replacement.		
Out of performance specification for battery	B	Require replacement
NOTE: The battery may meet vehicle's OEM specifications for that vehicle but test below the minimum specifications defined by the battery manufacturer.		
Out of specification for application	B	Require replacement
NOTE: The battery may meet battery manufacturer's specifications but test below the minimum specification defined by the vehicle's OEM for that vehicle.		
Post (top or side) burned, affecting performance	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Post (top or side) burned, not affecting performance	2	Suggest repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Post (top or side) corroded, affecting performance	A	Require repair
Post (top or side) corroded, not affecting performance	2	Suggest repair
Post (top or side) loose	A	Require replacement
Post (top or side) melted, affecting performance	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Post (top or side) melted, not affecting performance	2	Suggest repair or replacement

Condition	Code	Procedure
NOTE: Determine cause and correct prior to repair or replacement of part.		
Specific gravity low	B	Further inspection required
NOTE: Recharge and test to manufacturer's specifications. If battery fails performance test, require replacement.		
State of charge low	A	Further inspection required
NOTE: Recharge and test to manufacturer's specifications. If battery fails performance test, require replacement.		
Top dirty	2	Suggest cleaning battery
Top wet	A	Require cleaning battery Further inspection required
NOTE: Check fluid level and adjust to manufacturer's specification. Suggest checking charging system for proper operation.		
Vent cap loose	A	Require repair or replacement of vent cap
Vent cap missing	C	Require replacement of vent cap

BATTERY CABLES

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Connector broken	A	Require repair or replacement
Connector melted	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Connector missing	C	Require replacement
Insulation damaged, conductors exposed	A	Require repair or replacement
NOTE: Exposed conductor at replacement (aftermarket) terminal end does not require repair or replacement.		
Insulation damaged, conductors not exposed	1	Suggest replacement
Open	A	Require repair or replacement
Protective shield (conduit) melted	2	Suggest repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		

Condition	Code	Procedure
Protective shield (conduit) missing	C	Suggest repair or replacement
Resistance (voltage drop) out of specification	A	Require repair or replacement
Routed incorrectly	B	Require repair
Secured incorrectly	B	Require repair
Shorted	A	Require repair or replacement
Terminal broken	A	Require repair or replacement
Terminal burned, affecting performance	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Terminal burned, not affecting performance	2	Suggest repair or replacement
Terminal corroded, affecting performance	A	Require repair or replacement
Terminal corroded, not affecting performance	2	Suggest repair or replacement
Terminal loose, affecting performance	B	Require repair or replacement
Terminal loose, not affecting performance	1	Suggest repair or replacement
Voltage drop out of specification	A	Require repair or replacement

BATTERY TRAYS AND HOLD DOWN HARDWARE

Condition	Code	Procedure
Battery improperly secured	2	Suggest repair
Bent, affecting performance	A	Require repair or replacement
Bent, not affecting performance	No Service Suggested or Required	
Broken, affecting performance	A	Require repair or replacement
Broken, not affecting performance	No Service Suggested or Required	
Corroded, affecting performance	A	Require repair or replacement
Corroded, not affecting performance	2	Suggest repair or replacement
Cracked, affecting performance	A	Require repair or replacement
Cracked, not affecting performance	1	Suggest repair or replacement
Missing	C	Require replacement
Threads damaged	A	Require repair or replacement
Water drain clogged	A	Require repair

BULBS, SEALED BEAMS AND LEDS

NOTE: Does not include soldered-in components.

Condition	Code	Procedure
Adjustment out of specification	B	Require repair or replacement
Application incorrect	B	Require replacement

Condition	Code	Procedure
NOTE: Application incorrect includes wrong bulb coating or color.		
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Base burned, affecting performance	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Base burned, not affecting performance	2	Suggest repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Base corroded, affecting performance	A	Require repair or replacement
Base corroded, not affecting performance	2	Suggest repair or replacement
Base leaking	A	Require repair or replacement
Base loose, affecting performance	B	Require repair or replacement
Base loose, not affecting performance	1	Suggest repair or replacement
Base melted	A	Require replacement
NOTE: Determine cause and correct prior to replacement of part.		
Bracket bent, affecting performance	A	Require repair or replacement
Bracket bent, not affecting performance	No Service Suggested or Required	
Bracket broken, affecting performance	A	Require replacement
Bracket broken, not affecting performance	No Service Suggested or Required	
Bracket corroded, affecting performance	A	Require repair or replacement
Bracket corroded, not affecting performance	2	Suggest repair or replacement
Bracket cracked, affecting performance	A	Require repair or replacement
Bracket cracked, not affecting performance	1	Suggest repair or replacement
Bracket loose, affecting performance	A	Require repair or replacement
Bracket loose, not affecting performance	1	Suggest repair or replacement
Bracket missing	C	Require replacement
Burned out	A	Require replacement

Condition	Code	Procedure
Connector (Weatherpack type) leaking	A	Require repair or replacement
Connector broken	A	Require repair or replacement
Connector melted	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Connector missing	C	Require replacement
Corroded, affecting performance	A	Require repair or replacement
Corroded, not affecting performance	2	Suggest repair or replacement
Cracked	B	Require replacement
Intermittent	A	Require replacement
Lamp base melted	A	Require replacement
NOTE: Determine cause and correct prior to replacement of part.		
Leaking	B	Require repair or replacement
Missing	C	Require replacement
Seized in socket	A	Require repair or replacement
Terminal broken	A	Require repair or replacement
Terminal burned, affecting performance	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Terminal burned, not affecting performance	2	Suggest repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Terminal corroded, affecting performance	A	Require repair or replacement
Terminal corroded, not affecting performance	2	Suggest repair or replacement
Terminal loose, affecting performance	B	Require repair or replacement
Terminal loose, not affecting performance	1	Suggest repair or replacement
Threads damaged	A	Require repair or replacement
Threads stripped (threads missing)	A	Require replacement

FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS

Condition	Code	Procedure
Application incorrect	B	Require replacement
Blown	A	Require replacement
NOTE: Determine cause and correct prior to replacement of part.		
Corroded, affecting performance	A	Require repair or replacement

Condition	Code	Procedure
Corroded, not affecting performance	2	Suggest repair or replacement
Cracked, affecting performance	A	Require repair or replacement
Cracked, not affecting performance	1	Suggest repair or replacement
Inoperative	A	Require replacement
NOTE: Determine cause and correct prior to replacement of part.		
Insulation damaged, conductors exposed	A	Require repair or replacement
Insulation damaged, conductors not exposed	1	Suggest replacement
Missing	C	Require replacement
Routed incorrectly	B	Require repair
Secured incorrectly	B	Require repair
Terminal broken	A	Require repair or replacement
Terminal burned, affecting performance	A	Require repair or replacement
NOTE: Inoperative includes intermittent operation.		
Terminal burned, not affecting performance	2	Suggest repair or replacement
Terminal corroded, affecting performance	A	Require repair or replacement
Terminal corroded, not affecting performance	2	Suggest repair or replacement
Terminal loose, affecting performance	B	Require repair or replacement

GROUND CABLES AND STRAPS

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Corroded, affecting performance	A	Require repair or replacement
Corroded, not affecting performance	2	Suggest repair or replacement
Insulation damaged, exposing conductors	2	Suggest replacement
Loose	A	Require repair
Missing	C	Require replacement
Open	A	Require repair or replacement
Resistance high	A	Require repair or replacement
Terminal resistance (voltage drop) is out of specification	B	Require repair or replacement
Voltage drop out of specification	B	Require repair or replacement

GROUND STRAPS

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Corroded, affecting performance	A	Require repair or replacement
Corroded, not affecting performance	2	Suggest repair or replacement
Insulation damaged, exposing conductors	2	Suggest replacement
Loose	A	Require repair
Missing	C	Require replacement
Open	A	Require repair or replacement
Resistance high	A	Require repair or replacement
Terminal resistance (voltage drop) is out of specification	B	Require repair or replacement
Voltage drop out of specification	B	Require repair or replacement

LENSES

Condition	Code	Procedure
Adjustment out of specification	B	Require repair
Application incorrect	A	Require replacement
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Broken, affecting performance	A	Require replacement
Broken, not affecting performance	No Service Suggested or Required	
Cracked	B	Require replacement
Discolored	A	Require replacement
Leaking	B	Require repair or replacement
Melted, affecting performance	A	Require replacement
Melted, not affecting performance	2	Suggest replacement
Missing	C	Require replacement

SEALED BEAMS

NOTE: Does not include soldered-in components.

Condition	Code	Procedure
Adjustment out of specification	B	Require repair or replacement
Application incorrect	B	Require replacement
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware

Condition	Code	Procedure
Attaching hardware not functioning	A	Require repair or replacement of hardware
Base burned, affecting performance	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Base burned, not affecting performance	2	Suggest repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Base corroded, affecting performance	A	Require repair or replacement
Base corroded, not affecting performance	2	Suggest repair or replacement
Base leaking	A	Require repair or replacement
Base loose, affecting performance	B	Require repair or replacement
Base loose, not affecting performance	1	Suggest repair or replacement
Base melted	A	Require replacement
NOTE: Determine cause and correct prior to replacement of part.		
Bracket bent, affecting performance	A	Require repair or replacement
Bracket bent, not affecting performance	No Service Suggested or Required	
Bracket broken, affecting performance	A	Require replacement
Bracket broken, not affecting performance	No Service Suggested or Required	
Bracket corroded, affecting performance	A	Require repair or replacement
Bracket corroded, not affecting performance	2	Suggest repair or replacement
Bracket cracked, affecting performance	A	Require repair or replacement
Bracket cracked, not affecting performance	1	Suggest repair or replacement
Bracket loose, affecting performance	A	Require repair or replacement
Bracket loose, not affecting performance	1	Suggest repair or replacement
Bracket missing	C	Require replacement
Burned out	A	Require replacement
Connector (Weatherpack type) leaking	A	Require repair or replacement
Connector broken	A	Require repair or replacement
Connector melted	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		

Condition	Code	Procedure
Connector missing	C	Require replacement
Corroded, affecting performance	A	Require repair or replacement
Corroded, not affecting performance	2	Suggest repair or replacement
Cracked	B	Require replacement
Intermittent	A	Require replacement
Lamp base melted	A	Require replacement
NOTE: Determine cause and correct prior to replacement of part.		
Leaking	B	Require repair or replacement
Missing	C	Require replacement
Seized in socket	A	Require repair or replacement
Terminal broken	A	Require repair or replacement
Terminal burned, affecting performance	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Terminal burned, not affecting performance	2	Suggest repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Terminal corroded, affecting performance	A	Require repair or replacement
Terminal corroded, not affecting performance	2	Suggest repair or replacement
Terminal loose, affecting performance	B	Require repair or replacement
Terminal loose, not affecting performance	1	Suggest repair or replacement
Threads damaged	A	Require repair or replacement
Threads stripped (threads missing)	A	Require replacement

WASHER PUMPS

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Connector broken	A	Require repair or replacement
Connector melted	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Connector missing	C	Require replacement
Inoperative	A	Require repair or replacement

Condition	Code	Procedure
NOTE: Inoperative includes intermittent operation.		
Leaking externally	A	Require repair or replacement
Leaking internally	A	Require repair or replacement
Noisy	2	Suggest repair or replacement
Resistance out of specification	B	Require repair or replacement
Terminal broken	A	Require repair or replacement
Terminal burned, affecting performance	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Terminal burned, not affecting performance	2	Suggest repair or replacement
Terminal corroded, affecting performance	A	Require repair or replacement
Terminal corroded, not affecting performance	2	Suggest repair or replacement
Terminal loose, affecting performance	B	Require repair or replacement
Terminal loose, not affecting performance	1	Suggest repair or replacement
Threads damaged	A	Require repair or replacement
Threads stripped (threads missing)	A	Require replacement
Wire lead conductors exposed	B	Require repair or replacement
Wire lead corroded	A	Require repair or replacement
Wire lead open	A	Require repair or replacement
Wire lead shorted	A	Require repair or replacement

WIPER ARMS AND BLADES

NOTE: Windshield coatings or waxes can cause blades to not function as intended. Clean surface before making final judgment about blade replacement.

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Attaching socket stripped	A	Require replacement
Bent	A	Require repair or replacement
Loose	2	Suggest repair or replacement
Missing	C	Require replacement
Noisy	2	Suggest repair or replacement
Size incorrect	2	Suggest replacement
Tension insufficient	B	Require repair or replacement
Torn	A	Require replacement
Worn, affecting performance	A	Require replacement

Condition	Code	Procedure
Worn, not affecting performance	1	Suggest replacement

WIPER HOSES AND NOZZLES

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Blocked	A	Require repair or replacement
Leaking	A	Require repair or replacement
Missing	C	Require replacement
Oil-soaked (spongy)	1	Suggest replacement
Spray pattern incorrect	2	Suggest repair or replacement
Surface cracks (dry-rotted)	1	Suggest replacement

WIPER PUMP RESERVOIRS

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Cap missing	C	Require replacement
Leaking	A	Require repair or replacement
Missing	C	Require replacement

ENGINE PERFORMANCE AND MAINTENANCE

NOTE: **CHEMICAL ENGINE DECARBONIZATION** is a process utilizing chemicals to remove soft and semi-hardened gum, varnish, resin and carbon deposits from the air/fuel delivery systems and combustion chambers of gasoline internal combustion engines, providing benefits that include improved fuel economy, performance and driveability and reduced emissions. This process is performed to remove deposits preferably prior to deposit accumulation and hardening which may require costly mechanical deposit removal or component replacement.

NOTE: **SUGGEST** Chemical Engine Decarbonization service every 15,000 miles or 12 months.

NOTE: **CONTAMINATED OIL SYSTEM SERVICE** is an event based process (beyond that of a normal oil and filter change) performed to remove coolant, water or fuel contamination. Contamination increases oil's oxidation rate and has been shown to result in increased engine wear and reduced oil flow. **CAUTION:** Some OEM's (including GM and Honda) have issued Technical Service Bulletins advising that Chemical Crankcase Flushing may damage some engine components and that such damage will not be covered by the manufacturer's new car warranty.

ACCESSORY BELTS

Condition	Code	Procedure
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Condition	Code	Procedure
Alignment incorrect	B	Further inspection required
NOTE: Determine cause of incorrect alignment and require repair.		
Cracked	1	Suggest replacement
Frayed	1	Suggest replacement
Missing	C	Require replacement
Noisy	2	Further inspection required
NOTE: Determine cause of noise and suggest repair.		
Plies separated	A	Require replacement
Tension out of specification	B	Require adjustment or replacement
Worn beyond adjustment range	B	Require replacement
Worn so it contacts bottom of pulley	A	Require replacement

AIR FILTER ELEMENTS

Condition	Code	Procedure
At or beyond service interval	3	Suggest replacement to comply with vehicle's OEM recommended service intervals
Leaking	A	Require replacement
Melted	A	Required replacement
Missing	C	Require replacement
Paper filter element oil-soaked	A	Require replacement
NOTE: Further inspection required to determine cause.		
Restricted, affecting performance	A	Require replacement
Water-contaminated	A	Require replacement
NOTE: Further inspection required to determine cause.		

AIR FILTER GASKETS

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Leaking	A	Require repair or replacement
Missing	C	Require replacement

AIR FILTER HOUSINGS AND GASKETS

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Leaking	A	Require repair or replacement
Missing	C	Require replacement

AIR PUMP BELTS

Condition	Code	Procedure
Alignment incorrect	B	Further inspection required
NOTE: Determine cause of incorrect alignment and require repair.		
At or beyond service interval	3	Suggest replacement to comply with vehicle OEM recommended service intervals
Cracked	1	Suggest replacement
Frayed	1	Suggest replacement
Missing	C	Require replacement
Noisy	2	Further inspection required
NOTE: Determine cause of noise and suggest repair.		
Plies separated	A	Require replacement
Tension out of specification	B	Require adjustment or replacement
Worn beyond adjustment range	B	Require replacement
Worn so it contacts bottom of pulley	A	Require replacement

BATTERIES

NOTE: Proper operation of any electrical system or component can be affected by battery condition. The battery(ies) must meet or exceed minimum specification for vehicle as equipped and test to that specific battery's CCA.

Definition of Terms

Battery Performance Testing - Testing that determines whether or not a battery meets both vehicle OEM and battery manufacturer's specifications.

Cold Cranking Amp (CCA) Rating - The number of amperes a new, fully charged battery at 0°F (-17.8°C) can deliver for 30 seconds and maintain at least a voltage of 1.2 volts per cell (7.2 volts for a 12-volt battery).

Cranking Amps (CA) - The number of amperes a new, fully charged battery, typically at 32°F (0°C) can deliver for 30 seconds and maintain at least a voltage of 1.2 volts per cell (7.2 volts for a 12-volt battery).

OEM Cranking Amps - The minimum CCA required by the original vehicle manufacturer for a specific vehicle.

Condition	Code	Procedure
Battery frozen	Further inspection required	
NOTE: Do not attempt to charge a frozen battery. Allow battery to warm thoroughly and then performance-test. If battery fails performance test, require replacement.		
Battery tests near the ""end of its useful life"" utilizing a tester or on-board monitor able to accurately determine this condition	1	Suggest Replacement
Case leaking	A	Require replacement
Casing swollen	A	Further inspection required
NOTE: No service suggested or required unless the battery fails performance test, in which case, require replacement.		
Circuit open internally	A	Require replacement
Electrolyte contamination	A	Further inspection required
NOTE: No service suggested or required unless the battery fails performance test, in which case, require replacement.		
Electrolyte discoloration	A	Further inspection required
NOTE: No service suggested or required unless the battery fails performance test, in which case, require replacement.		
Fails to accept and hold charge	A	Require replacement
NOTE: This phrase refers to a battery that fails to either accept and/or retain a charge using appropriate times listed in the Battery Charging Guide of the BCI Service Manual, battery charger operating manual, or battery manufacturer's specifications.		
Fluid level low	B	Further inspection required
NOTE: Determine cause of low fluid level. Refill to proper level(s) with water (distilled water preferred). Recharge battery and performance-test. If battery does not meet specifications, require replacement. If battery is sealed type (non-removable filler caps), require replacement.		
Out of performance specification for battery	B	Require replacement
NOTE: The battery may meet vehicle's OEM specifications for that vehicle but test below the minimum specifications defined by the battery manufacturer.		
Out of specification for application	B	Require replacement
NOTE: The battery may meet battery manufacturer's specifications but test below the minimum specification defined by the vehicle's OEM for that vehicle.		

Condition	Code	Procedure
Post (top or side) burned, affecting performance	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Post (top or side) burned, not affecting performance	2	Suggest repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Post (top or side) corroded, affecting performance	A	Require repair
Post (top or side) corroded, not affecting performance	2	Suggest repair
Post (top or side) loose	A	Require replacement
Post (top or side) melted, affecting performance	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Post (top or side) melted, not affecting performance	2	Suggest repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Specific gravity low	B	Further inspection required
NOTE: Recharge and test to manufacturer's specifications. If battery fails performance test, require replacement.		
State of charge low	A	Further inspection required
NOTE: Recharge and test to manufacturer's specifications. If battery fails performance test, require replacement.		
Top dirty	2	Suggest cleaning battery
Top wet	A	Require cleaning battery Further inspection required
NOTE: Check fluid level and adjust to manufacturer's specification. Suggest checking charging system for proper operation.		
Vent cap loose	A	Require repair or replacement of vent cap
Vent cap missing	C	Require replacement of vent cap

BATTERY CONNECTORS

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware

Condition	Code	Procedure
Attaching hardware not functioning	A	Require repair or replacement of hardware
Connector broken	A	Require repair or replacement
Connector melted	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Connector missing	C	Require replacement
Insulation damaged, conductors exposed	A	Require repair or replacement
Insulation damaged, conductors not exposed	1	Suggest replacement
NOTE: Exposed conductor at replacement (aftermarket) terminal end does not require repair or replacement.		
Open	A	Require repair or replacement
Protective shield (conduit) melted	2	Suggest repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Protective shield (conduit) missing	C	Suggest repair or replacement
Resistance (voltage drop) out of specification	A	Require repair or replacement
Routed incorrectly	B	Require repair
Secured incorrectly	B	Require repair
Shorted	A	Require repair or replacement
Terminal broken	A	Require repair or replacement
Terminal burned, affecting performance	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Terminal burned, not affecting performance	2	Suggest repair or replacement
Terminal corroded, affecting performance	A	Require repair or replacement
Terminal corroded, not affecting performance	2	Suggest repair or replacement
Terminal loose, affecting performance	B	Require repair or replacement
Terminal loose, not affecting performance	1	Suggest repair or replacement
Voltage drop out of specification	A	Require repair or replacement

BELT IDLER ASSEMBLIES (ACCESSORY AND CAM BELTS)

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement
Attaching hardware broken	A	Require repair or replacement of hardware

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Bearings worn	1	Suggest replacement
Cracked	2	Suggest replacement
Missing	C	Require replacement
Noisy	2	Suggest replacement
Seized	A	Require repair or replacement

BELT TENSIONERS (ACCESSORY AND CAM BELT)

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Bearings worn	1	Suggest replacement
Belt tension incorrect	B	Require adjustment or repair
Cracked	B	Suggest replacement
Missing	C	Require replacement
Noisy	2	Suggest replacement
Pulley damaged, affecting belt life	A	Require replacement
Seized	A	Require repair or replacement

CHEMICAL ENGINE DECARBONIZATION

NOTE: Chemical engine decarbonization is a process utilizing chemicals to remove soft and semi-hardened gum, varnish, resin and carbon deposits from the air/fuel delivery systems and combustion chambers of gasoline internal combustion engines, providing benefits that include improved fuel economy, performance and driveability and reduced emissions. This process is performed to remove deposits preferably prior to deposit accumulation and hardening which may require costly mechanical deposit removal or component replacement.

NOTE: SUGGEST Chemical Engine Decarbonization service every 15,000 miles or 12 months.

COMBUSTION CHAMBER CLEANING

NOTE: See [CHEMICAL ENGINE DECARBONIZATION](#).

COOLANT RECOVERY TANKS

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Leaking	A	Require repair or replacement

Condition	Code	Procedure
Missing (if original equipment)	C	Require replacement

COOLANT

Condition	Code	Procedure
Acidity (pH) incorrect	1	Suggest correction or replacement
At or beyond service interval	3	Suggest replacement
NOTE: The system should be drained and/ or flushed and refilled with correct coolant according to OEM recommended service interval and procedures.		
Contaminated	B	Require replacement or recycling Further inspection required
NOTE: Determine source of contamination and require correction prior to coolant replacement.		
Fluid discolored	No Service Suggested or Required	
NOTE: Further testing necessary to determine condition of fluid.		
Level incorrect	B	Require correction of fluid level
NOTE: Determine source of incorrect level and suggest repair.		
Mixture incorrect	B	Require correction or replacement
Type incorrect	B	Require replacement

DISTRIBUTOR CAPS

Condition	Code	Procedure
Application incorrect	B	Require replacement
Arcing	A	Require replacement
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Burned	A	Require replacement
Carbon button missing	A	Require replacement
Carbon button worn, affecting performance	A	Require replacement
Carbon button worn, not affecting performance	1	Suggest replacement
Carbon-tracked	A	Require replacement
Cracked	B	Require replacement
Loose	B	Suggest repair or replacement
Terminal broken	A	Require repair or replacement
Terminal burned, affecting performance	A	Require repair or replacement

Condition	Code	Procedure
NOTE: Determine cause and correct prior to repair or replacement of part.		
Terminal burned, not affecting performance	2	Suggest repair or replacement
Terminal corroded, affecting performance	A	Require repair or replacement
Terminal corroded, not affecting performance	2	Suggest repair or replacement
Terminal eroded, affecting performance	A	Require repair or replacement
Terminal eroded, not affecting performance	No Service Suggested or Required	
Terminal loose, affecting performance	B	Require repair or replacement
Terminal loose, not affecting performance	1	Suggest repair or replacement

DISTRIBUTOR ROTORS

Condition	Code	Procedure
Application incorrect	B	Require replacement
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Carbon-tracked	A	Require replacement
Contact burned	A	Require replacement
Corroded	1	Suggest replacement
Eroded	1	Suggest replacement
Loose	B	Require repair or replacement
Out of specification	B	Require replacement

ENGINE COOLING SYSTEMS

NOTE: Overheating, poor engine performance, and insufficient cabin heat can be affected by, but are not limited to, all of the components in the engine cooling system.

ENGINE DECARBONIZATION

NOTE: See [CHEMICAL ENGINE DECARBONIZATION](#).

ENGINE OIL DRAIN PLUGS AND GASKETS

Condition	Code	Procedure
Leaking	A	Require repair or replacement
Missing	C	Require replacement
Threads damaged	A	Require repair or replacement
NOTE: Some OEMs require replacement of drain plug gasket when removing drain plug. Inspect threads in oil pan for damage.		

ENGINE OIL FILTERS AND CANISTERS

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Condition	Code	Procedure
At or beyond service interval	3	Suggest replacement to comply with vehicle's OEM recommended service intervals
Bulged	A	Require replacement. Further inspection required
NOTE: Inspect pressure relief valve.		
Canister attaching hardware broken	A	Require repair or replacement of hardware
Canister attaching hardware loose	A	Require repair
Canister attaching hardware missing	C	Require replacement
Canister attaching hardware not functioning	A	Require repair or replacement of hardware
Center tube collapsed	A	Require replacement. Further inspection required
NOTE: Inspect bypass.		
Dented	2	Suggest replacement. Further inspection required
NOTE: Determine cause, such as broken motor mount.		
Leaking	B	Require repair or replacement

ENGINE OIL

Condition	Code	Procedure
Additive Depletion	A	Require replacement of fluid
At or beyond service interval	3	Suggest replacement to comply with vehicle's OEM recommended service intervals
Contaminated	A	Require replacement of oil and filter; Further Inspection Required
NOTE: Determine source of contamination, such as engine coolant, fuel, metal particles, or water when changing oil.		
Fluid discolored	No Service Suggested or Required	
NOTE: Further testing necessary to determine condition of fluid.		
Fluid incorrect	B	Require service
Level Incorrect	B	Adjust to correct level. Further Inspection Required.
NOTE: Determine cause of incorrect level such as leaking gaskets or contamination by engine coolant, fuel or water.		
Oxidized	A	Require replacement of fluid

FUEL FILTERS

Condition	Code	Procedure
At or beyond service interval	3	Suggest replacement to comply with OEM recommended service interval
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Leaking	B	Require repair or replacement
Missing	C	Require replacement
Restricted, affecting performance	A	Require replacement
Restricted, not affecting performance	1	Suggest replacement
Water-contaminated	2	Suggest replacement

FUEL INJECTOR CLEANING

NOTE: See **CHEMICAL ENGINE DECARBONIZATION.**

FUEL INJECTORS

Condition	Code	Procedure
15,000 miles or 12 months beyond most recent Chemical Engine Decarbonization	5	Suggest chemical engine decarbonization
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware threads damaged	A	Require repair or replacement of hardware
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware
Connector (Weatherpack type) leaking	A	Require repair or replacement
Connector broken	A	Require repair or replacement
Connector melted	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Connector missing	C	Require replacement
Contaminated	A	Require repair or replacement
NOTE: Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.		
Inoperative	A	Require repair or replacement
NOTE: Inoperative includes intermittent operation. Some components may be serviceable; check for accepted cleaning procedure.		
Leaking	A	Require repair or replacement
Missing	C	Require replacement

Condition	Code	Procedure
Resistance out of specification	B	Require repair or replacement
Restricted, affecting performance	A	Require repair or replacement
Restricted, not affecting performance	2	Suggest repair or replacement
Terminal broken	A	Require repair or replacement
Terminal burned, affecting performance	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Terminal burned, not affecting performance	2	Suggest repair or replacement
Terminal corroded, affecting performance	A	Require repair or replacement
Terminal corroded, not affecting performance	2	Suggest repair or replacement
Terminal loose, affecting performance	B	Require repair or replacement
Terminal loose, not affecting performance	1	Suggest repair or replacement
Threads damaged	A	Require repair or replacement
Threads stripped (threads missing)	A	Require replacement
Wire lead conductors exposed	B	Require repair or replacement
Wire lead corroded	A	Require repair or replacement
Wire lead open	A	Require repair or replacement
Wire lead shorted	A	Require repair or replacement

FUEL SYSTEM CLEANING SERVICE

NOTE: See **CHEMICAL ENGINE DECARBONIZATION**.

HOSE CLAMPS

Condition	Code	Procedure
Application incorrect	B	Require replacement
Connected incorrectly	A	Require repair
Corroded, not reusable	1	Suggest replacement
Cracked	A	Require replacement
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement
Missing	C	Require replacement
Safety clip missing (not leaking)	C	Require replacement of safety clip
Stripped	A	Require replacement

HOSE CONNECTORS

Condition	Code	Procedure
Application incorrect	B	Require replacement
Connected incorrectly	A	Require repair
Corroded, not reusable	1	Suggest replacement
Cracked	A	Require replacement

Condition	Code	Procedure
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement
Leaking	A	Require repair or replacement
Missing	C	Require replacement
Safety clip missing (not leaking)	C	Require replacement of safety clip
Stripped	A	Require replacement

HOSE COUPLERS

Condition	Code	Procedure
Application incorrect	B	Require replacement
Connected incorrectly	A	Require repair
Corroded, not reusable	1	Suggest replacement
Cracked	B	Require replacement
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement
Leaking	A	Require repair or replacement
Missing	C	Require replacement
Safety clip missing (not leaking)	C	Require replacement of safety clip
Stripped	A	Require replacement

HOSES AND TUBES (FUEL LINES, RADIATOR, VACUUM, BY-PASS, HEATER, RECOVERY TANK AND OIL COOLERS)

Condition	Code	Procedure
Application incorrect	B	Require replacement
At or beyond service interval	3	Suggest replacement
Connected incorrectly	A	Require repair
Corroded, not reusable	1	Suggest replacement
Cracked	B	Require replacement
Dry-rotted	1	Suggest repair or replacement
Hard	1	Suggest repair or replacement
Inner fabric (webbing) damaged	A	Require replacement
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement
Leaking	A	Require repair or replacement
Melted	1	Suggest repair or replacement
Missing	C	Require replacement
Outer covering damaged	1	Suggest replacement
Outer covering damaged to the extent that the inner fabric is visible	A	Require replacement
Protective sleeves damaged	2	Suggest replacement of sleeves
Protective sleeves missing	C	Require replacement of sleeves
Restricted, affecting performance	A	Require repair or replacement
Restricted, not affecting performance	2	Suggest repair or replacement
Routed incorrectly (where failure is likely to occur)	B	Require repair or replacement
Safety clip missing	C	Require replacement
Spongy	1	Suggest repair or replacement
Stripped	A	Require replacement

Condition	Code	Procedure
Swollen	B	Require replacement
Threads damaged	A	Require repair or replacement
Threads stripped (threads missing)	A	Require replacement
Type incorrect	2	Suggest repair or replacement

IGNITION WIRES (SECONDARY)

Condition	Code	Procedure
Application incorrect	B	Require replacement
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Carbon-tracked	A	Require replacement
Corroded	1	Suggest repair or replacement
Insulation leaking (shorted)	A	Require repair or replacement
Metal heat shield bent	2	Suggest repair or replacement
Missing	C	Require replacement
Oil-soaked (spongy)	1	Suggest replacement
Resistance incorrect	B	Require replacement
Routed incorrectly	B	Suggest repair

NOTE:

If improper routing affects the performance of other systems, require repair. Proper routing, hardware, heatshields, etc., are intended to prevent premature failure of secondary ignition components.

Terminal broken	A	Require repair or replacement
Terminal burned, affecting performance	A	Require repair or replacement

NOTE:

Determine cause and correct prior to repair or replacement of part.

Terminal burned, not affecting performance	2	Suggest repair or replacement
Terminal corroded, affecting performance	A	Require repair or replacement
Terminal corroded, not affecting performance	2	Suggest repair or replacement
Terminal loose, affecting performance	B	Require repair or replacement
Terminal loose, not affecting performance	1	Suggest repair or replacement

INTAKE CLEANING

NOTE: See [CHEMICAL ENGINE DECARBONIZATION](#).

O2 SENSORS

Condition	Code	Procedure

Condition	Code	Procedure
At or beyond service interval	3	Suggest replacement to comply with vehicle's OEM recommended service intervals
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware threads damaged	A	Require repair or replacement of hardware
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware
Connector (Weatherpack type) leaking	A	Require repair or replacement
Connector broken	A	Require repair or replacement
Connector melted	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Connector missing	C	Require replacement
Contaminated	A	Require repair or replacement
NOTE: Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.		
Inoperative	A	Require repair or replacement. Further inspection required
NOTE: Inoperative includes intermittent operation. Some components may be serviceable; check for accepted cleaning procedure.		
Leaking	A	Require repair or replacement
Missing	C	Require replacement
Resistance out of specification	B	Require repair or replacement
Restricted, affecting performance	A	Require repair or replacement
Terminal broken	A	Require repair or replacement
Terminal burned, affecting performance	A	Require repair or replacement
NOTE: Determine cause and correct prior to repair or replacement of part.		
Terminal burned, not affecting performance	2	Suggest repair or replacement
Terminal corroded, affecting performance	A	Require repair or replacement
Terminal corroded, not affecting performance	2	Suggest repair or replacement
Terminal loose, affecting performance	B	Require repair or replacement
Terminal loose, not affecting performance	1	Suggest repair or replacement
Threads damaged	A	Require repair or replacement
Threads stripped (threads missing)	A	Require replacement
Wire lead conductors exposed	B	Require repair or replacement
Wire lead corroded	A	Require repair or replacement

Condition	Code	Procedure
Wire lead open	A	Require repair or replacement
Wire lead shorted	A	Require repair or replacement

PCV BREATHER ELEMENTS

Condition	Code	Procedure
At or beyond service interval	3	Suggest replacement to comply with vehicle's OEM recommended service intervals
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Leaking	A	Require replacement
Melted	A	Required replacement
Missing	C	Require replacement
Restricted, affecting performance	A	Require replacement
Restricted, not affecting performance	1	Suggest replacement
Water-contaminated	A	Require replacement

PCV VALVES

Condition	Code	Procedure
Application incorrect	B	Require replacement
At or beyond service interval	3	Suggest replacement to comply with vehicle's OEM recommended service intervals
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Grommet broken	A	Require repair or replacement of grommet
Grommet missing	C	Require replacement of grommet
Grommet not functioning	A	Require repair or replacement of grommet
Inoperative	A	Require replacement
NOTE: Inoperative includes intermittent operation.		
Leaking	A	Require replacement
Missing	C	Require replacement
Restricted	A	Require replacement

RADIATOR CAPS AND PRESSURIZED EXPANSION TANK CAPS

Condition	Code	Procedure
Application incorrect	B	Require replacement

Condition	Code	Procedure
Coolant recovery check valve inoperative	A	Require replacement
NOTE: Inoperative includes intermittent operation.		
Fails to maintain proper pressure	B	Require replacement
Gasket missing	C	Require replacement of gasket
Missing	C	Require replacement
Seal missing	C	Require replacement of seal

SPARK PLUGS

NOTE: You are not required to replace spark plugs in sets. However, you may suggest replacement of the other plugs for preventive maintenance.

Condition	Code	Procedure
Application incorrect	B	Require replacement
At or beyond service interval	3	Suggest replacement
Electrode eroded	1	Suggest replacement
Fouled	A	Require repair or replacement
NOTE: Determine cause of fouling and suggest repair.		
Gap incorrect	B	Require repair or replacement
Improperly Indexed	Remove and Reinstall following manufacturers installation requirements	
Insulation broken	A	Require replacement
Insulator cracked	A	Require replacement
Leaking compression	A	Require repair or replacement
Threads damaged	A	Require repair or replacement
Threads stripped (threads missing)	A	Require replacement

THERMOSTATS AND HOUSINGS

Condition	Code	Procedure
Application incorrect	B	Require replacement
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware corroded	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Housing corroded	1	Suggest replacement of housing
Inoperative	A	Require replacement
NOTE: Inoperative includes intermittent operation.		
Installation incorrect	B	Require repair or replacement
Leaking	A	Require repair or replacement

Condition	Code	Procedure
Thermostat missing	C	Require replacement of thermostat
Threads damaged	A	Require repair or replacement
Threads stripped (threads missing)	A	Require repair or replacement

THROTTLE BODY CLEANING

NOTE: See **CHEMICAL ENGINE DECARBONIZATION**.

TIMING BELTS

Condition	Code	Procedure
Adjustment incorrect	B	Suggest adjustment
NOTE: Inspect belt tensioners, pulleys, and cover.		
Alignment incorrect	B	Further inspection required
NOTE: Determine cause of incorrect alignment and require repair.		
At or beyond service interval	3	Suggest replacement to comply with vehicle OEM recommended service intervals
Broken	A	Require replacement
Cam timing out of specification	B	Require repair
Cracked	1	Suggest replacement
Fluid-soaked	1	Suggest replacement. Further inspection required
Frayed	1	Suggest replacement
Missing	C	Require replacement
NOTE: Internal engine damage may result from timing belt damage/failure.		
Noisy	2	Further inspection required
NOTE: Determine cause of noise and suggest repair.		
Plies separated	A	Require replacement
Teeth missing	A	Require replacement
Tension out of specification	B	Require adjustment or replacement

VACUUM HOSES, TUBES AND CONNECTIONS (NON-METALLIC)

Condition	Code	Procedure
Leaking	A	Require repair or replacement
Melted	A	Require replacement
Missing	C	Require replacement
Oil-soaked (spongy)	1	Suggest replacement
Restricted	A	Require repair or replacement
Surface cracks (dry-rotted)	1	Suggest replacement

EXHAUST SYSTEMS

WARNING: Federal EPA rules prohibit altering an exhaust system in any way that defeats the emission reduction components of a vehicle. Be sure to review and adhere to EPA policy on removing and replacing catalytic converters. Where state or local laws are stricter, they take precedence over these guidelines.

NOTE: Some exhaust systems are of a welded design. It is not required that the entire system be replaced. Determine the need to replace individual components based on conditions of component.

EXHAUST AND TAIL PIPES

Condition	Code	Procedure
Broken bracket	A	Require repair or replacement
Pipe Bent Out Of Position	B	Require repair or replacement
Pipe Broken	A	Require repair or replacement
Pipe Cracked	B	Require repair or replacement
Pipe Leaking	A	Require replacement
Pipe Missing	C	Require replacement
Pipe Plugged	A	Require replacement
Pipe Weak Due To Corrosion, But No Leaks Present	1	Suggest replacement
Weld Broken	A	Require repair or replacement

HEATING, VENTILATION AND AIR CONDITIONING SYSTEMS

NOTE: AIR CONDITIONING SYSTEM FLUSHING utilizes chemicals or refrigerant to remove oil, debris and contaminants from the evaporator, condenser, hoses or metal lines.

NOTE: An INLINE FILTER, both high and low side, protects a/c components from residual debris in the system. An inline filter or suction screen is suggested when a condenser, evaporator, compressor, expansion valve, accumulator/drier, hoses or metal lines is replaced, or if debris is found in the system during an a/c repair. An inline filter is suggested to help prevent future component damage and increase system longevity.

BELTS

Condition	Code	Procedure
Alignment incorrect	B	Further inspection required
NOTE: Determine cause of incorrect alignment and require repair.		
Cracked	1	Suggest replacement
Frayed	1	Suggest replacement
Missing	C	Require replacement
Noisy	2	Further inspection required
NOTE: Determine cause of noise and suggest repair.		
Plies separated	A	Require replacement
Serpentine belt routed incorrectly	B	Require repair
Tension out of specification	B	Require adjustment or replacement
Worn beyond adjustment range	B	Require replacement

Condition	Code	Procedure
Worn so it contacts bottom of pulley	A	Require replacement

CABIN AIR FILTERS

Condition	Code	Procedure
Air flow obstruction	A	Require cleaning or replacement
At or beyond service interval	3	Suggest replacement
Microbial growth causing odor	A	Require replacement of filter
Missing	C	Require replacement

COOLANT

Condition	Code	Procedure
Acidity (pH) incorrect	1	Suggest correction or replacement
At or beyond service interval	3	Suggest replacement
Contaminated	B	Require replacement or recycling. Further inspection required
NOTE: Determine source of contamination and require correction prior to coolant replacement.		
Fluid discolored	No Service Suggested or Required	
NOTE: Further testing necessary to determine condition of fluid.		
Level incorrect	B	Require filling to proper level
NOTE: Determine source of incorrect level and suggest repair.		
Mixture incorrect	B	Require correction or replacement
Type incorrect	B	Require replacement

EVAPORATOR DRAIN TUBES

Condition	Code	Procedure
Disconnected	A	Require repair
Leaking	A	Require replacement
Missing	C	Require replacement
Restricted	A	Require repair or replacement
Routed incorrectly	B	Require repair

EVAPORATOR FILTERS

Condition	Code	Procedure
Air flow obstruction	A	Require cleaning or replacement
At or beyond service interval	3	Suggest replacement
Microbial growth causing odor	A	Require replacement of filter
Missing	C	Require replacement

IN-LINE FILTERS

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Condition	Code	Procedure
Connection leaking	A	Require repair or replacement
Leaking	B	Require repair or replacement
Restricted	A	Require replacement
Threads damaged	A	Require repair or replacement
Threads stripped (threads missing)	A	Require replacement

VACUUM HOSES AND TUBES

Condition	Code	Procedure
Disconnected	A	Require repair
Leaking	A	Require repair or replacement
Leaking	A	Require repair or replacement
Melted	A	Require repair or replacement
Missing	C	Require replacement
Oil-soaked (spongy)	1	Suggest replacement
Restricted	A	Require repair or replacement
Routing incorrect	B	Require repair
Surface cracks (dry-rotted)	1	Suggest replacement

STEERING AND SUSPENSION, WHEEL ALIGNMENT, WHEELS AND TIRES

NOTE: Steering and Suspension are complex systems made up of a variety of interdependent components and controls. For proper vehicle handling, ride, and tire wear, a thorough inspection is required whenever suspension work is being performed.

NOTE: Listed repair conditions assume that the problem has been isolated to the specific component by proper testing procedures. When replacing steering and/or suspension components which may affect an alignment angle, you are required to check and adjust alignment as needed. Refer to the OEM specifications for both ride height and alignment angle tolerances.

NOTE: Improper alignment geometry, and/or improper tire/wheel fitment may affect other systems such as Adaptive Cruise Control, Electronic Stability Control, Electronic Traction Control and Variable Ratio Steering. These systems may require attention after an alignment or suspension service is performed. Care must be taken to identify these vehicles/systems before any repair procedures are performed. Failure to follow OEM guidelines when servicing interrelated systems could result in an unsafe condition.

CAUTION: Do not use ride height altering or load compensating components, such as variable rate springs or coil over shocks on vehicles with height sensing or load sensing proportioning- valve equipped braking systems, unless these components are supplied as original equipment.

HYDRAULIC HOSES

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware

Condition	Code	Procedure
Attaching hardware threads damaged	A	Require repair or replacement of hardware
Attaching hardware threads stripped (threads missing)	A	Require replacement of hardware
Blistered	B	Require replacement
Fitting threads damaged	A	Require repair or replacement
Fitting threads stripped (threads missing)	A	Require replacement
Inner fabric (webbing) cut	B	Require replacement
Leaking	A	Require replacement
Missing	C	Require replacement
Outer covering is cracked to the extent that inner fabric of hose is visible	B	Require replacement
Restricted	A	Require replacement
Routed incorrectly (where failure is likely to occur)	B	Require repair or replacement
Secured incorrectly	B	Require repair

POWER STEERING BELTS

Condition	Code	Procedure
Alignment incorrect	B	Further inspection required
NOTE: Determine cause of incorrect alignment and require repair.		
Cracked	1	Suggest replacement
Frayed	1	Suggest replacement
Missing	C	Require replacement
Noisy	2	Further inspection required
NOTE: Determine cause of noise and suggest repair.		
Plies separated	A	Require replacement
Serpentine belt routed incorrectly	B	Require repair
Tension out of specification	B	Require adjustment or replacement
Worn beyond adjustment range	B	Require replacement
Worn so it contacts bottom of pulley	A	Require replacement

POWER STEERING FLUID

Condition	Code	Procedure
50,000 miles or greater on OE fluid (in absence of published manufacturer interval)	5	Suggest Replacement
NOTE: One time only fluid exchange		
Additive Depletion	A	Require replacement of fluid
Fluid at or beyond service interval	3	Suggest fluid replacement

Condition	Code	Procedure
Fluid contaminated (i.e. fluid other than power steering fluid present)	B	Require flushing and refilling of the system
NOTE: Determine and correct source of contamination. OEM specifications must be followed for fluid type.		
Fluid discolored	No Service Suggested or Required	
NOTE: Further testing necessary to determine condition of fluid.		
Fluid level incorrect	B	Require adjustment of fluid level
Fluid type incorrect	B	Require flushing and refilling with correct fluid
Oxidized	A	Require replacement of fluid

POWER STEERING HOSES

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Attaching hardware threads damaged	A	Require repair or replacement of hardware
Attaching hardware threads stripped (threads missing)	A	Require replacement of hardware
Blistered	B	Require replacement
Fitting threads damaged	A	Require repair or replacement
Fitting threads stripped (threads missing)	A	Require replacement
Inner fabric (webbing) cut	B	Require replacement
Leaking	A	Require replacement
Missing	C	Require replacement
Outer covering is cracked to the extent that inner fabric of hose is visible	B	Require replacement
Restricted	A	Require replacement
Routed incorrectly (where failure is likely to occur)	B	Require repair or replacement
Secured incorrectly	B	Require repair

SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES

NOTE: You are not required to replace shocks or struts in axle sets. However, when replacing a shock or strut due to the conditions that follow, you may suggest replacement of the other shock or strut on the same axle for one or more of the following: improved performance or preventive maintenance; part is close to the end of its useful life; to extend tire life; to balance ride and handling; or to improve stopping distance. When replacing steering and/or suspension components which may affect an alignment angle, you are required to check and adjust alignment as needed. Refer to the OEM specifications. Under no circumstances should

a technician bend struts or strut housings. A vehicle's load-carrying and handling abilities are limited by its suspension, tires, brakes, and driveline. Installing coil over shocks or any other load assist device does not increase the vehicle's load capacity. See the vehicle owner's manual for more details. If vehicle is equipped with OEM coil over shocks, apply the conditions for coil springs from the Springs: Coil, Leaf, and Torsion Bar section of the Steering and Suspension guidelines. If the vehicle is equipped with add-on coil over shocks, you may suggest replacement with standard shocks for a spring-related condition.

Condition	Code	Procedure
50,000 miles or greater on OEM Shocks or Struts	1	Suggest Replacement
NOTE: Applies only to OEM hydraulic fluid and/or gas charged shocks and struts, NOT electronically controlled units.		
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware corroded, affecting structural integrity	A	Require replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Attaching hardware threads damaged	A	Require repair or replacement of hardware
Attaching hardware threads stripped (threads missing)	A	Require replacement of hardware
Binding	A	Require replacement
Body dented	A	Further inspection required
NOTE: Require replacement of units where dents restrict shock or strut piston rod movement. If dents don't restrict movement, no service is suggested or required. Especially critical on mono-tube shocks.		
Body punctured	A	Require replacement
Brake hose bracket bent	B	Require repair or replacement
Brake hose bracket missing	C	Require replacement
Brake hose bracket threads damaged	A	Require repair or replacement
Brake hose bracket threads stripped (threads missing)	C	Require replacement
Compression bumper missing	C	Require replacement of compression bumper
Compression bumper split	1	Suggest replacement of compression bumper
Damping (none)	A	Require replacement
Dust boot (bellows) missing	C	Require replacement of boot
NOTE: If boot is not available as a separate component, suggest replacement of shock or strut (reason code 2). This condition can lead to damage of the piston rod, which causes piston rod seal wear.		
Dust boot (bellows) split	A	Require replacement of boot

Condition	Code	Procedure
NOTE: If boot is not available as a separate component, suggest replacement of shock or strut (reason code 2). This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.		
Dust boot (bellows) torn	A	Require replacement of boot
NOTE: If boot is not available as a separate component, suggest replacement of shock or strut (reason code 2). This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.		
Dust shield broken	2	Suggest replacement
NOTE: This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.		
Dust shield missing	2	Suggest replacement
NOTE: This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.		
Gland nut (strut housing cap) is not removable using appropriate tool	A	Require replacement of nut and/or housing
NOTE: Only required if replacing cartridge.		
Gland nut (strut housing cap) threads damaged	A	Require repair or replacement of nut
Housing dented	A	Further inspection required
NOTE: Require replacement of units where dents restrict shock or strut piston rod movement. If dents don't restrict movement, no service is suggested or required. Especially critical on mono-tube shocks.		
Housing punctured	A	Require replacement
Jounce bumper missing	C	Require replacement of jounce bumper
Jounce bumper split	1	Suggest replacement of jounce bumper
Leaking oil, enough for fluid to be running down the body	A	Require replacement
NOTE: If the strut cartridge has been replaced previously, the oil on the strut housing may be filler oil. The technician must identify the source of the oil.		
Noisy	2	Further inspection required
NOTE: If noise is isolated to shock or strut, suggest replacement.		
Piston rod bent	A	Require replacement
Piston rod broken	A	Require replacement
Piston rod has surface defect	2	Suggest replacement

Condition	Code	Procedure
Piston rod threads damaged	A	Require repair or replacement
Piston rod threads stripped (threads missing)	A	Require replacement
Seized	A	Require replacement
Shock missing	C	Require replacement
Strut housing bent	A	Require replacement
Strut housing cap (gland nut) is not removable using appropriate tool	A	Require replacement of nut and/or housing
NOTE: Only required if replacing cartridge.		
Strut housing cap (gland nut) threads damaged	A	Require repair or replacement of nut
Strut housing cap (gland nut) threads stripped (threads missing)	A	Require replacement of nut
Strut housing severely corroded, affecting structural integrity	A	Require replacement
Strut housing threads damaged	A	Require repair or replacement
Strut housing threads stripped (threads missing)	A	Require replacement
Tire cupping	A	Further inspection required
NOTE: Although shocks or struts may have contributed to tire cupping, an inspection is needed of the entire suspension system. If the shock or strut is found to be contributing to the tire cupping, require replacement.		

STRUT RODS

Condition	Code	Procedure
Adjusting nut seized	A	Require repair or replacement of hardware
NOTE: Only required if an alignment is being performed and adjustment of the strut in question is required.		
Attaching (mating) hole oversized	A	Require repair or replacement of bracket or frame
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Attaching hardware threads damaged	A	Require repair or replacement of hardware
Attaching hardware threads stripped (threads missing)	A	Require replacement of hardware
Attaching point on bracket or frame corroded, affecting structural integrity	A	Require repair of bracket or frame
Bent, affecting performance	A	Require replacement

Condition	Code	Procedure
Mating (attaching) hole oversized	A	Require repair or replacement of bracket or frame
Threads damaged	A	Require repair or replacement
Threads stripped (threads missing)	A	Require replacement

TIRE PRESSURE MONITORING SYSTEM

NOTE: A Tire Pressure Monitoring System (TPMS) is designed to detect and alert the driver should the air pressure level in one or more of the vehicle's tires, up to all four tires, fall below the manufacturer's recommended inflation pressure or another pre-set level.

NOTE: NHTSA does not consider installation of an aftermarket or replacement tire or rim that is not compatible with the TPMS to be a "make inoperative" situation under 49 U.S.C. 30122, provided that the entity does not disable the TPMS malfunction indicator.

TIRE PRESSURE SENSORS

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Inoperative	A	Require repair or replacement
NOTE: Inoperative includes intermittent failure.		
Loose	B	Require repair or replacement
Missing (Non-OE Wheel and/or Tire Applications)	2	Suggest replacement if appropriate sensor is available
Missing (OE Wheel and Tire Applications)	C	Replacement Required
Not Responding	Further inspection required	
NOTE: If sensor does not Wake Up, follow manufacturers recommended diagnostic procedure to determine cause		

TIRES

NOTE: These guidelines do not apply to split rims. Some vehicle manufacturers restrict replacement of tires to specific brands, types, or sizes. High pressure temporary compact spare tires should not be used with any other rims or wheels, nor should standard tires, snow tires, wheel covers, or trim rings be used with high pressure compact spare rims or wheels. Attempting to mount a tire of one diameter on a wheel of a different diameter or flange type may result in serious injury or death. Only specially trained persons should de-mount or mount tires. Explosions of tire and wheel assembly can result from improper mounting, possibly causing serious injury or death. Consult the vehicle owner's manual or vehicle placard for correct size, speed rating, designation, and cold inflation pressure of the original tires. Do not exceed the maximum load or inflation capacity of the tire specified by the Tire and Rim Association. When replacing tires, it is suggested that the replacement tires match or

exceed the OEM speed rating designation. If tires of different speed rating designations are mixed on the same vehicle, the tires may vary in handling characteristics. Do not mix different speed rating designations on the same axle. Do not mix radials with non-radial tires on the same axle, as this may affect vehicle handling and stability. If radial tires and bias or bias-belted ply tires are mixed on the same vehicle, the radials must be on the rear. High-pressure temporary compact spare tires are exempt from this rule. Do not mix size or type (Run Flat, all season, performance, mud and snow) of tires on the same axle. If any flammable emergency tire inflation product has been used on a tire, consult inflation product, manufacturer's product information label for tire deflation procedures to avoid possible serious injury or death. In some vehicles, changing the tire diameter from factory-equipped size can affect drive ability, as well as the performance of ABS and other vehicle systems. Consult the vehicle manufacturer's specifications.

Condition	Code	Procedure
Air pressure incorrect	B	Require repair
Bead broken	A	Require replacement
Bead leaking, caused by tire	A	Require repair or replacement
Bead wire/cord exposed	A	Require replacement
Cord or belt material exposed	A	Require replacement
Cord ply separations	A	Require replacement
Directional/asymmetrical tires mounted incorrectly	B	Require remounting and/or repositioning
Irregular tread wear, affecting performance	2	Suggest replacement

NOTE:

Determine and correct cause of irregular tire wear.

Load ratings less than OEM specifications	B	Require replacement
Mixed tread types (all season, performance, mud and snow) on same axle	A	Require replacement
Number of punctures exceeds manufacturer's limit	B	Require replacement
Out of balance	B	Require rebalance of tire/wheel assembly
Ply separation	A	Require replacement
Pull or lead, caused by tire	A	Require repair or replacement
Radial and bias or bias-belted ply tires on same axle	B	Require repair or replacement
Radials are on the front and not on the rear	B	Require repair or replacement

NOTE:

If radials and bias or bias-belted ply tires are on the same vehicle, the radials must be on the rear axle, except for high-pressure temporary spares.

Run flat damage	A	Require replacement
Shoulder cut	A	Require replacement
Shoulder puncture	A	Require replacement
Shoulder with plug	A	Require replacement
Sidewall bulge	A	Require replacement
Sidewall cut	A	Require replacement
Sidewall indentation	No service required or suggested	

Condition	Code	Procedure
Sidewall puncture	A	Require replacement
Sidewall with plug	A	Require replacement
Speed rating designations different on same axle	2	Suggest rotation or replacement
Tire and wheel assembly has excessive run-out	B	Require repair or replacement of appropriate part
NOTE: Excessive is defined as enough to contribute to performance problems. Match mounting may correct run-out. If not, require replacement of appropriate part. Refer to manufacturer's specifications.		
Tires with excessive diameter difference on an all-wheel drive vehicle or four-wheel drive vehicle	B	Require replacement
NOTE: Excessive diameter difference is defined as exceeding manufacturer's specifications or, if no manufacturer's specifications exist, with more than 1/4" diameter difference.		
Tires with excessive diameter difference on the same side of a dual-wheel application	B	Require replacement
NOTE: Excessive diameter difference is defined as exceeding manufacturer's specifications or, if no manufacturer's specifications exist, with more than 1/4" diameter difference.		
Tread area puncture larger in diameter than manufacturer's specifications	B	Require replacement
Tread missing pieces (chunking), exposing cord	A	Require replacement
Tread missing pieces (chunking), not exposing cord	1	Suggest replacement
Tread separations	A	Require replacement
Tube in tubeless tire	3	Suggest removal of tube
NOTE: Most manufacturers do not recommend tubes in tubeless tires. Inspect tire and wheel . Assembly to determine the reason for a tube in tubeless tire. Recommendation for repair or replacement should be based upon condition of tires and! Or wheel listed in these guidelines.		
Weather-checking	No service required or suggested	
Worn to tread wear indicators	B	Require replacement

VALVE STEMS

NOTE: Most tire manufacturers suggest replacement of non-TPMS valve stems any time a new tire is installed. For TPMS valve stems, the manufacturer may require replacement of the valve stem, o-ring seals, washers, gaskets, valve cores, compression washers and/or locking nut.

Condition	Code	Procedure
Bent	2	Suggest replacement
Broken	A	Require replacement

Condition	Code	Procedure
Cap seized	A	Require repair or replacement
Cut, but not leaking	1	Suggest replacement
Deteriorated (cracking, dry rot)	1	Suggest replacement
Leaking	A	Require repair or replacement
Missing	C	Require replacement
O-Ring leaking	A	Require replacement of O-Ring
Threads damaged	A	Require repair or replacement
Threads stripped	A	Require replacement
Valve cap missing	C	Require replacement of cap

WHEEL ATTACHMENT HARDWARE

NOTE: For conditions noted below, also check condition of wheel stud holes. Proper lug nut torque is essential. Follow recommended torque specifications and tightening sequence. DO NOT lubricate threads unless specified by the vehicle manufacturer.

Condition	Code	Procedure
Bent	A	Require replacement
Broken	A	Require replacement
NOTE: Some manufacturers require replacement of all studs on that wheel if two or more studs or nuts on the same wheel are broken or missing.		
Locking lug nut locking groove damaged	A	Require replacement
Loose	A	Require repair or replacement of affected component
Lug nut installed backward	B	Require repair or replacement
Lug nut mating surface distorted	A	Require replacement of nut
Lug nut mating type incorrect	B	Require replacement of nut
Lug nut missing	C	Require replacement
Lug nut rounded	A	Require replacement of nut
NOTE: Only required if removing wheel.		
Lug nut seized	A	Require replacement of nut
NOTE: Only required if removing wheel.		
Stud incorrect	B	Require replacement of stud
Stud missing	C	Require replacement
Threads damaged	A	Require repair or replacement of component with damaged threads
Threads stripped	A	Require replacement of component with stripped threads

WHEEL BEARINGS, RACES AND SEALS

NOTE: When replacing or repacking wheel bearings, grease seal replacement is required. You are not required to replace these components in axle sets.

Determine the need to replace based upon the individual component conditions that follow.

Condition	Code	Procedure
Axle seal on drive axle leaking	A	Require replacement of seal and inspection of axle, bearing, housing, and vent tube
Bearing end-play exceeds specifications	B	Require adjustment of bearing, if possible If proper adjustment cannot be obtained, require replacement of bearing and race assembly
Bearing rollers, balls or races are worn, pitted, or feel rough when rotated as an assembly or other damage affecting performance.	B	Require replacement of bearing and race assembly
Seal leaking	A	Require replacement of seal and inspection of bearings
NOTE: Require inspection of mating and sealing surface and repair or replace as necessary. Check vent. A plugged vent may force fluid past the seal.		
Seal missing	C	Require replacement

WHEEL & TIRE SUPPLEMENT

Steering and suspension are complex systems made up of a variety of interdependent components. For proper vehicle handling, ride, and tire wear, a thorough inspection is required whenever suspension work is being performed. Conditions listed assume that the problem has been isolated to the specific component by proper testing procedures.

NOTE: When replacing steering and/or suspension components that may affect an alignment angle, you are required to check and adjust alignment as needed. Refer to the OEM specifications.

CAUTION: Do not use ride height altering or load compensating components, such as variable rate springs and coil over shocks, on vehicles with height or load sensing proportioning valve-equipped braking systems, unless these components are original equipment.

NOTE: Depending on the air suspension design, there are some aftermarket products available to eliminate the air ride suspension on certain vehicles. If the system has been eliminated with one of these products, then no service is suggested or required.

WARNING: These guidelines do not apply to split rims.

TIRES

When replacing tires, it is suggested that the replacement tires match or exceed the OEM speed rating designation. If tires of different speed rating designations are mixed on the same vehicle, the tires may vary in handling characteristics. Do not mix different speed rating designations on the same axle.

Consult the vehicle owner's manual or vehicle placard for correct tire size, service description, load index, speed rating and cold inflation pressure of the original tires. Do not exceed the maximum load or inflation capacity of the tire specified by the Tire and Rim Association (www.us-tra.org)

When replacing fewer than ALL tires on a vehicle, follow the vehicle manufacturer's recommendations as to the placement of the new tires. If it is not possible to follow the vehicle manufacturer's tire replacement recommendations, remember to replace tires on the same axle with the same size, construction, speed rating, and, if possible, similar tread pattern.

Do not mix radials with non-radial tires on the same axle, as this may affect vehicle handling and stability. If radial tires and non-radial tires are mixed on the same vehicle, the radials must be on the rear. If radial and non-radial tires are used on a vehicle equipped with dual rear tires, radial tires may be used on either axle. High-pressure temporary compact spare tires are exempt from this rule.

Do not mix size or type (all season, performance, mud and snow) of tires on the same axle. When replacing only two tires on front or rear drive vehicles, follow the vehicle manufacturer's recommendations concerning placement. If it is not possible to follow OE recommendations, it is preferable to place the two new tires on the rear for greater stability, greater adhesion affecting steering - on other than dry pavement -- and overall safety, regardless of whether the vehicle is front or rear wheel drive.

It is particularly important to match all tire sizes and constructions on 4-wheel (4x4) and all-wheel (AWD) drive vehicles unless otherwise specified by vehicle manufacturer. Ideally, all four tires should be replaced at the same time. Some vehicle manufacturers restrict replacement of tires to specific brands, types, or sizes.

MOUNTING TIRES

Only specially trained persons should de-mount or mount tires. Explosions of tire and wheel assembly can result from improper mounting, possibly causing serious injury or death. High pressure temporary compact spare tires should not be used with any other rims or wheels, nor should standard tires, snow tires, wheel covers, or trim rings be used with high pressure compact spare rims or wheels.

Mount tires only on same or approved rim widths.

Attempting to mount a tire of one diameter on a wheel of a different diameter, bead taper or flange type may result in serious injury or death.

If any flammable emergency tire inflation product has been used in a tire, consult inflation product manufacturer's product information label for tire deflation procedures to avoid possible serious injury or death.

VEHICLE TIRE PLACARD

Since 1968, cars and light trucks sold in the United States have been required to have a tire information sticker, called a vehicle tire placard. The vehicle tire placard indicates the size of the original equipment tires (including the spare), cold inflation pressure for the tires on both axles as well as the spare, and load index or range. Depending on the vehicle, the vehicle tire placard will either be located on the edge of any door, the doorpost, glove box, fuel door or inside trunk lid. If the tire placard is missing, consult the owner's manual, vehicle manufacturer, or tire manufacturer regarding applicable tire information.

Always refer to the vehicle manufacturer's recommendations before replacing tires. Tires should always be replaced with the same size designation, or approved options, as recommended. Never choose a smaller size with less load carrying capacity than the size on the tire placard. (Some vehicle manufacturers require different-sized tires for either the front or rear axles.)

NOTE: It is not always possible to select a replacement tire with exactly the same size as shown on the placard. Consult with a vehicle or tire manufacturer for replacement recommendations.

Vehicle Placard



Fig. 12: Vehicle Tire Placard - Typical

TIRE ROTATION

The front tires on most vehicles tend to wear out faster than the rear tires. This is due to the effects of steering the vehicle and the weight transfer that occurs during braking. To ensure that all four tires wear evenly, it is important to rotate them on a regular basis. Tire rotation helps maintain balanced handling because it allows all four tires to wear at the same rate. Keep in mind, as tire wear reduces tread depth, it increases the tires' response to driver inputs. Consequently, by equalizing tire wear at all four corners, dry road performance is actually enhanced. Another advantage of regular rotation is that it allows the tires to be replaced in complete sets rather than in pairs. This maintains handling continuity. It also enables drivers to take advantage of the latest in tire technology, instead of trying to match a pair of older tires.

Most manufacturers list rotation intervals in the scheduled maintenance section of the vehicle service manual and/or the owner's manual. Tire rotation patterns can also be found in these books. If this information is unavailable for a particular vehicle, rotate the tires every 5-7,000 miles following the appropriate rotation sequence shown in the illustrations. After completing a tire rotation, be sure to reset inflation pressures to the manufacturer's recommended specifications indicated on the vehicle tire placard.

To ensure that the proper amount of clamping force is applied to each fastener, follow these guidelines:

- Make sure the area around the lug holes, as well as the wheel and hub mating surfaces are clean and dry. A wire brush can be used to remove corrosion and other debris. Wipe the areas clean using a shop rag.
- Inspect the bolt holes for damage. Do not use a wheel if the bolt holes are deformed.
- Inspect the wheel studs and lug nuts or lug bolts and bolt holes (depending on the vehicle) for damage. Replace or repair any damaged or worn components.
- Always follow a star pattern when tightening lugs.

WHEEL LUG NUT TORQUE & CLAMPING FORCE

Although proper wheel lug nut torque is important, it does not guarantee that the required clamping force will be achieved. For example, excessive corrosion on the wheel and hub mating surfaces will result in improper clamping force, even when the lugs are tightened with a calibrated torque wrench. Low clamping force can also occur if the threads are dirty. This is because dirt causes interference between the mating threads. As a result, the torque wrench will register the correct reading but the clamping force will be inadequate. To improve the chances of achieving the precise clamping force between the wheel and hub, proper torque must be applied to clean components in good condition. Specifications for wheel lug nut torque can be found in the 'Tire and Wheel' section of most vehicle

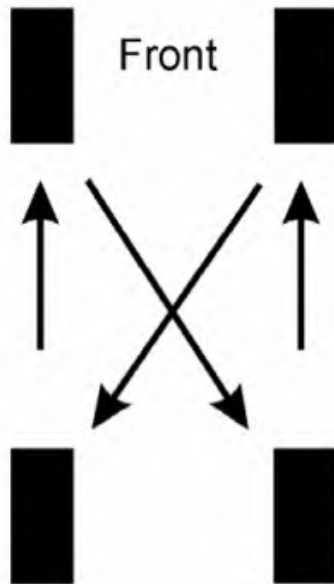
service manuals. When specifications are indicated as a range, adjust the torque wrench to the middle of the range to compensate for normal variations in tool calibration.

POPULAR TIRE ROTATION PATTERNS

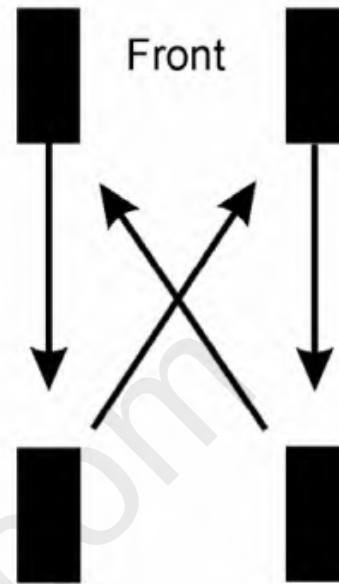
POPULAR TIRE ROTATION PATTERNS

(Only Where Tires Are Same Type & Size)

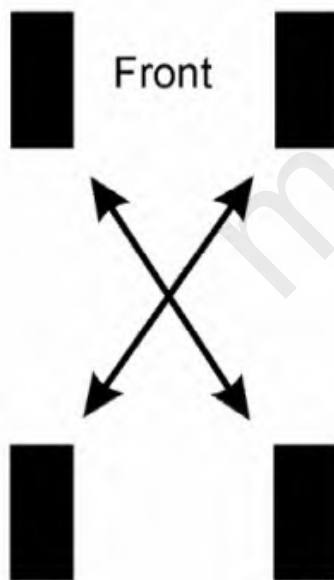
Rear- and Four-Wheel-Drive Vehicles



Front-Wheel-Drive Vehicles



All Vehicles



All Vehicles

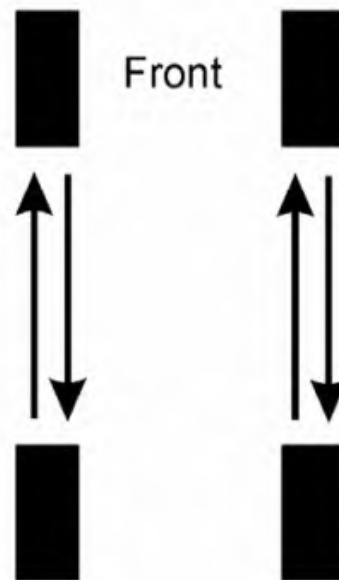
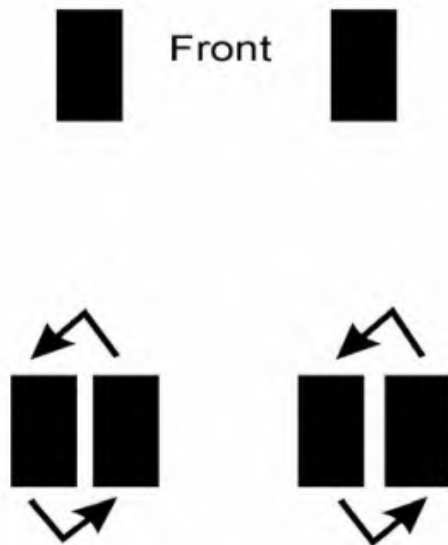


Fig. 13: Popular Tire Rotation Patterns - Without Dual Rear Wheels

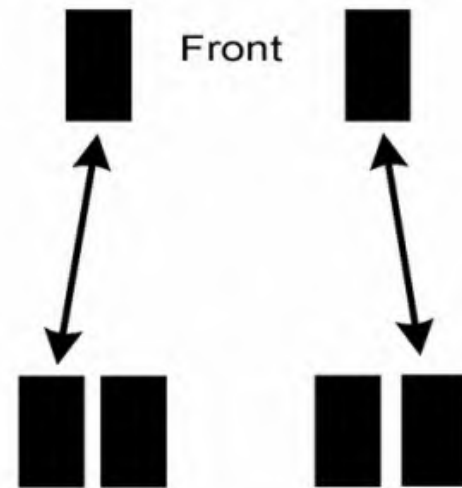
Never rotate directional tires from side-to-side since this will reverse their direction of rotation. Directional tires can only be rotated from front to rear or vice versa. Directional tires are typically used on high-performance cars and can be identified by the arrows imprinted on the sidewall.

Vehicles With Dual Rear Wheels

Rear Tire Irregular Wear



Front Tire Irregular Wear



Six-Tire Rotation

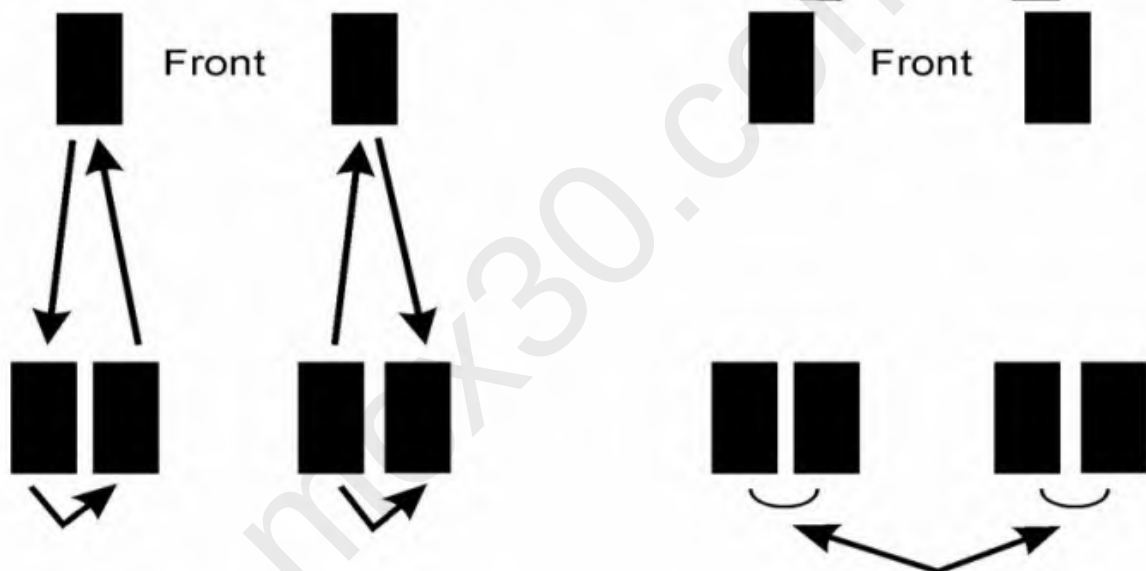


Fig. 14: Popular Tire Rotation Patterns - With Dual Rear Wheels

Some tires cannot be rotated in the manners described. Such tires include uni-directional tires and tires with asymmetric tread designs. Also, some vehicles may have different-sized tires mounted on the front and rear axles, and these different-sized tires also have rotation restrictions. Check your owner's manual or with a tire manufacturer or a tire dealer for proper recommendations for these specific cases.

WHEELS AND RIMS

The wheels on today's vehicles are made of steel, aluminum, or aluminum alloy (a combination of two or more metals). Steel wheels are the least expensive to produce, which is why they come as original equipment on many passenger cars and light trucks. The center section includes the bolt circle, or mounting holes, and is used to attach the wheel to the vehicle. The flange is the outermost lip of the rim, and is the area typically used for attaching wheel (balancing) weights. The rim is formed by rolling a strip of metal and then welding the two ends together. The interior section of the rim has a smaller diameter section called a drop center. This area provides the means for removing and installing a tire, since the bead is not designed to stretch. During removal or installation, most of the tire bead is pushed into the drop center so that the exposed portion can be pulled over the rim. The edges of the rim are flared to form the bead seats, which hold the tire and provide the airtight seal. Many rims include safety humps. These are small elevations on the inside of the bead seats. Safety humps help prevent the tire

from falling into the drop center during a blowout. This allows the driver to maintain better directional control of a vehicle running on one or more deflated tires.

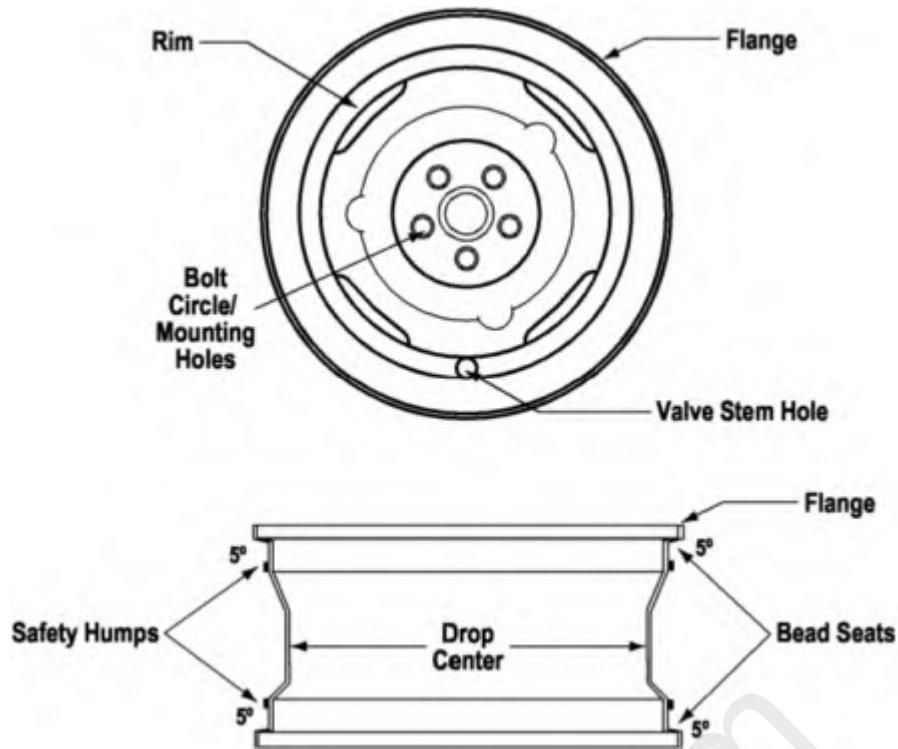


Fig. 15: Steel Wheel

WARNING: Mounting a regular tire on a high-pressure compact spare wheel is not permitted. Attempting to mount a tire of one diameter on a wheel of a different diameter or flange type may result in serious injury or death. Mount tires only on approved rim widths. If the wheel identification stamp is not legible, or cannot be found, do not use the wheel until the size and type have been properly identified. Load, cold inflation pressure, and tire construction forces imposed on the rim/wheel must not exceed the rim/wheel manufacturer's recommendations, even if the tire is approved for a higher load or inflation. Wheels of different diameter, offset, or width cannot be mixed on the same axle. Bead seat tapers cannot be interchanged.

TIRE PRESSURE MONITORING SYSTEMS

To avoid damaging sensors when mounting and demounting tires, it is beneficial to know where the sensors are located. Sensor assemblies are commonly attached to the valve stem, with the valve stem acting as an antenna to assist with transmitting RF signals. They may also be strapped to the drop center of the wheel. If this is the case, the sensor assembly should be located in-line with the valve stem.



Fig. 16: Valve Stem Mounted Sensor

To avoid damaging sensors when demounting tires, do not break the bead within 45° of either side of sensor assembly locations. Be careful not to damage sensors when mounting tires as well. Sensors are not repairable and require replacement if damaged or when their battery is completely drained. It is recommended that the sensor be carefully "dropped into the tire" prior to demounting to avoid damage.

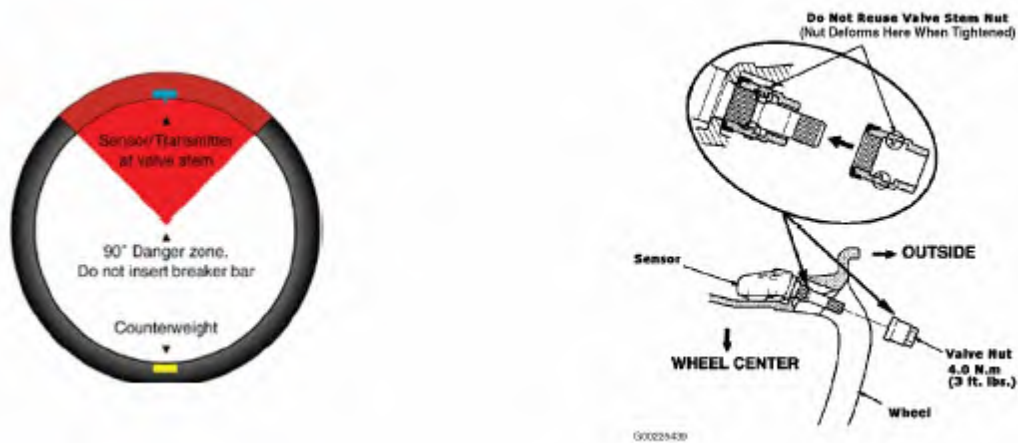


Fig. 17: Mounting Sensor

When reinstalling the sensor, it is suggested that the locknut, gasket and valve stem be replaced and torqued to the proper specification. It is also necessary to use the proper valve cap as it is also an integral part of the system.

It may be necessary to reprogram the TPMS when the tires are rotated, when a new sensor is installed, or after the vehicle loses power. This usually requires a scan tool and may involve the use of a special magnet. Refer to the vehicle service manual to properly reprogram the TPMS.

WHEELS & TIRES CHECKSHEET



WHEELS & TIRES CHECKSHEET

Date: _____
 Name: _____
 Address: _____
 City: _____ State: _____ Zip Code: _____
 Year: _____ Make: _____ Model: _____
 Mileage: _____ License: _____ VIN: _____ Eng Code: _____

Customer Interview:

Reason Code Explanation

- | <u>Code</u> | <u>Reason</u> |
|---------------------------|---|
| <u>Required</u> | |
| A | Part No Longer Performs Intended Purpose |
| B | Part Does Not Meet A Design Specification (Regardless Of Performance) |
| C | Part Is Missing |
| <u>Suggested/Optional</u> | |
| 1 | Part Is Close To The End Of Its Useful Life |
| 2 | To Address A Customer Need, Convenience Or Request |
| 3 | To Comply With Maintenance Recommended By The Vehicle's Original Equipment Manufacturer |
| 4 | Technician's Recommendation Based On Substantial And Informed Experience |
| 5 | To Comply With Maintenance Recommended By AMRA/MAP |



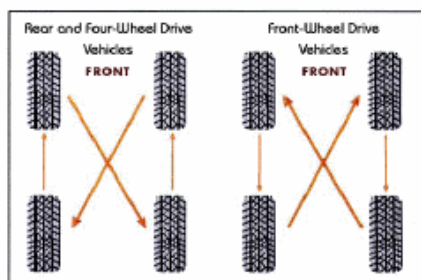
Your vehicle has been inspected following the Uniform Inspection and Communication Standards developed by the Motorist Assurance Program. MAP produces materials that give motorists the information and encouragement to take greater responsibility for their vehicles—through proper maintenance. We encourage participating service and repair shops to adopt the MAP Pledge of Assurance to their Customers and the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction. For more information visit: www.motorist.org

DISCLAIMER: This document may be used as a guide when performing vehicle inspection. This form is not to be used as an estimate form and may not comply with Local or State Laws. The Motorist Assurance Program is not responsible for the performance and accuracy of the motor vehicle inspection performed using this document.

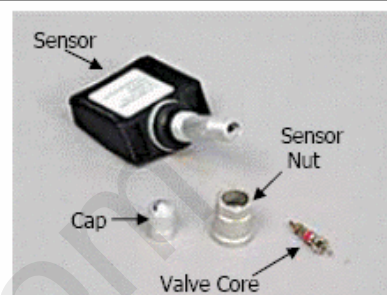
Fig. 18: Wheels & Tires Checksheet (1 Of 2)

WHEELS & TIRES CHECKSHEET

LEFT FRONT				
Component	OK	S	R	Condition
Lugs/Studs				
Tire Size				Spec _____
Speed Rating _____				Actual _____
Run Flat				Y _____ N _____
Tread Depth				_____/32nds
Tire Pressure				Before _____
Placard _____				After _____
TPMS Sensor Nut Valve core / Cap Sensor				
Valve Stem				
Wheel (Condition)				Spec _____
Wheel Size				Actual _____
☐ Edge wear ☐ Cupped ☐ Cut ☐ Irregular wear				



RIGHT FRONT				
Component	OK	S	R	Condition
Lugs/Studs				
Tire Size				Spec _____
Speed Rating _____				Actual _____
Run Flat				Y _____ N _____
Tread Depth				_____/32nds
Tire Pressure				Before _____
Placard _____				After _____
TPMS Sensor Nut Valve core / Cap Sensor				
Valve Stem				
Wheel (Condition)				Spec _____
Wheel Size				Actual _____
☐ Edge wear ☐ Cupped ☐ Cut ☐ Irregular wear				



LEFT REAR				
Component	OK	S	R	Condition
Lugs/Studs				
Tire Size				Spec _____
Speed Rating _____				Actual _____
Run Flat				Y _____ N _____
Tread Depth				_____/32nds
Tire Pressure				Before _____
Placard _____				After _____
TPMS Sensor Nut Valve core / Cap Sensor				
Valve Stem				
Wheel (Condition)				Spec _____
Wheel Size				Actual _____
☐ Edge wear ☐ Cupped ☐ Cut ☐ Irregular wear				

RIGHT REAR				
Component	OK	S	R	Condition
Lugs/Studs				
Tire Size				Spec _____
Speed Rating _____				Actual _____
Run Flat				Y _____ N _____
Tread Depth				_____/32nds
Tire Pressure				Before _____
Placard _____				After _____
TPMS Sensor Nut Valve core / Cap Sensor				
Valve Stem				
Wheel (Condition)				Spec _____
Wheel Size				Actual _____
☐ Edge wear ☐ Cupped ☐ Cut ☐ Irregular wear				

OK

Suggested
1, 2, 3, 4, 5

Required
A, B, C

Automotive Maintenance & Repair Assn © 2009

Fig. 19: Wheels & Tires Checksheet (2 Of 2)

WHEEL & TIRE - UICS

TIRE PRESSURE MONITORING SYSTEM

NOTE: A Tire Pressure Monitoring System (TPMS) is designed to detect and alert the driver should the air pressure level in one or more of the vehicle's tires, up to all four tires, fall below the manufacturer's recommended inflation pressure or another pre-set level.

NOTE: NHTSA does not consider installation of an aftermarket or replacement tire or rim that is not compatible with the TPMS to be a "make inoperative" situation under 49 U.S.C. 30122, provided that the entity does not disable the TPMS malfunction indicator.

TIRE PRESSURE SENSORS

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware
Attaching hardware missing	C	Require replacement of hardware
Attaching hardware not functioning	A	Require repair or replacement of hardware
Inoperative	A	Require repair or replacement
NOTE: Inoperative includes intermittent failure.		
Loose	B	Require repair or replacement
Missing (Non-OE Wheel and/or Tire Applications)	2	Suggest replacement if appropriate sensor is available
Missing (OE Wheel and Tire Applications)	C	Replacement Required
Not Responding	Ã,Ã	Further inspection required
NOTE: If sensor does not Wake Up, follow manufacturers recommended diagnostic procedure to determine cause		

TIRES

NOTE:

These guidelines do not apply to split rims. Some vehicle manufacturers restrict replacement of tires to specific brands, types, or sizes. High pressure temporary compact spare tires should not be used with any other rims or wheels, nor should standard tires, snow tires, wheel covers, or trim rings be used with high pressure compact spare rims or wheels. Attempting to mount a tire of one diameter on a wheel of a different diameter or flange type may result in serious injury or death. Only specially trained persons should de-mount or mount tires. Explosions of tire and wheel assembly can result from improper mounting, possibly causing serious injury or death. Consult the vehicle owner's manual or vehicle placard for correct size, speed rating, designation, and cold inflation pressure of the original tires. Do not exceed the maximum load or inflation capacity of the tire specified by the Tire and Rim Association. When replacing tires, it is suggested that the replacement tires match or exceed the OEM speed rating designation. If tires of different speed rating designations are mixed on the same vehicle, the tires may vary in handling characteristics. Do not mix different speed rating designations on the same axle. Do not mix radials with non-radial tires on the same axle, as this may affect vehicle handling and stability. If radial tires and bias or bias-belted ply tires are mixed on the same vehicle, the radials must be on the rear. High-pressure temporary compact spare tires are exempt from this rule. Do not mix size or type (Run Flat, all season, performance, mud and snow) of tires on the same axle. If any flammable emergency tire inflation product has been used on a tire, consult inflation product, manufacturer's product information label for tire deflation procedures to avoid possible serious injury or death. In some vehicles, changing the tire diameter from factory-equipped size can affect drive ability, as well as the performance of ABS and other vehicle systems. Consult the vehicle manufacturer's specifications.

Condition	Code	Procedure
Air pressure incorrect	B	Require repair
Bead broken	A	Require replacement
Bead leaking, caused by tire	A	Require repair or replacement
Bead wire/cord exposed	A	Require replacement
Cord or belt material exposed	A	Require replacement

Condition	Code	Procedure
Cord ply separations	A	Require replacement
Directional/asymmetrical tires mounted incorrectly	B	Require remounting and/or repositioning
Irregular tread wear, affecting performance	2	Suggest replacement
NOTE: Determine and correct cause of irregular tire wear.		
Load ratings less than OEM specifications	B	Require replacement
Mixed tread types (all season, performance, mud and snow) on same axle	A	Require replacement
Number of punctures exceeds manufacturer's limit	B	Require replacement
Out of balance	B	Require rebalance of tire/wheel assembly
Ply separation	A	Require replacement
Pull or lead, caused by tire	A	Require repair or replacement
Radial and bias or bias-belted ply tires on same axle	B	Require repair or replacement
Radials are on the front and not on the rear	B	Require repair or replacement
NOTE: If radials and bias or bias-belted ply tires are on the same vehicle, the radials must be on the rear axle, except for high-pressure temporary spares.		
Run flat damage	A	Require replacement
Shoulder cut	A	Require replacement
Shoulder puncture	A	Require replacement
Shoulder with plug	A	Require replacement
Sidewall bulge	A	Require replacement
Sidewall cut	A	Require replacement
Sidewall indentation	Ã,Â	No service required or suggested
Sidewall puncture	A	Require replacement
Sidewall with plug	A	Require replacement
Speed rating designations different on same axle	2	Suggest rotation or replacement
Tire and wheel assembly has excessive run-out	B	Require repair or replacement of appropriate part
NOTE: Excessive is defined as enough to contribute to performance problems. Match mounting may correct run-out. If not, require replacement of appropriate part. Refer to manufacturer's specifications.		
Tires with excessive diameter difference on an all-wheel drive vehicle or four-wheel drive vehicle	B	Require replacement
NOTE: Excessive diameter difference is defined as exceeding manufacturer's specifications or, if no manufacturer's specifications exist, with more than 1/4" diameter difference.		
Tires with excessive diameter difference on the same side of a dual-wheel application	B	Require replacement
NOTE: Excessive diameter difference is defined as exceeding manufacturer's specifications or, if no manufacturer's specifications exist, with more than 1/4" diameter difference.		

Condition	Code	Procedure
Tread area puncture larger in diameter than manufacturer's specifications	B	Require replacement
Tread missing pieces (chunking), exposing cord	A	Require replacement
Tread missing pieces (chunking), not exposing cord	1	Suggest replacement
Tread separations	A	Require replacement
Tube in tubeless tire	3	Suggest removal of tube
NOTE: Most manufacturers do not recommend tubes in tubeless tires. Inspect tire and wheel . Assembly to determine the reason for a tube in tubeless tire. Recommendation for repair or replacement should be based upon condition of tires and! Or wheel listed in these guidelines.		
Weather-checking	Ã,Â	No service required or suggested
Worn to tread wear indicators	B	Require replacement

WHEEL ALIGNMENT

NOTE: Wheel alignment is defined as the measurement, analysis, and adjustment of steering and suspension angles to conform to manufacturer specifications. These angles usually include, but are not limited to: caster, camber, toe, and thrust angle. Where these angles are not adjustable and not in specification, component replacement or correction kits may be required. Errors in set-back and steering axis inclination (SAI) are often attributable to failed or damaged components and must be corrected prior to performing an alignment. Failure to replace or correct suggested parts or service may prevent a proper alignment. Before performing an alignment check, inspect and verify the following: Tire pressure and size . Vehicle loading . Ride height . Steering and suspension parts only if the inspection reveals that all the above are within published specifications, a wheel alignment check and a proper wheel alignment, if needed, may be performed. Under no circumstances should a technician bend or heat any steering or suspension component, unless specified by the vehicle manufacturer. All measurements and specifications must be noted on the inspection report.

Condition	Code	Procedure
Beyond manufacturer's service interval	3	Suggest alignment check
Dog tracking, shown to be caused by faulty alignment	2	Suggest repair
Drift, shown to be caused by faulty alignment	A	Require alignment
Lead, shown to be caused by faulty alignment	A	Require alignment
Outside manufacturer's specifications	B	Require repair
Part has been changed, affecting alignment	A	Require alignment check
Pull, shown to be caused by faulty alignment	A	Require alignment
Steering wheel off-center	2	Suggest alignment
Tire wear, shown to be caused by faulty alignment	A	Require alignment
Wander, shown to be caused by faulty alignment	A	Require alignment

WHEEL ATTACHMENT HARDWARE

NOTE: For conditions noted below, also check condition of wheel stud holes. Proper lug nut torque is essential. Follow recommended torque specifications and tightening sequence. DO NOT lubricate threads unless specified by the vehicle manufacturer.

Condition	Code	Procedure
Bent	A	Require replacement

Condition	Code	Procedure
Broken	A	Require replacement
NOTE: Some manufacturers require replacement of all studs on that wheel if two or more studs or nuts on the same wheel are broken or missing.		
Locking lug nut locking groove damaged	A	Require replacement
Loose	A	Require repair or replacement of affected component
Lug nut installed backward	B	Require repair or replacement
Lug nut mating surface distorted	A	Require replacement of nut
Lug nut mating type incorrect	B	Require replacement of nut
Lug nut missing	C	Require replacement
Lug nut rounded	A	Require replacement of nut
NOTE: Only required if removing wheel.		
Lug nut seized	A	Require replacement of nut
NOTE: Only required if removing wheel.		
Stud incorrect	B	Require replacement of stud
Stud missing	C	Require replacement
Threads damaged	A	Require repair or replacement of component with damaged threads
Threads stripped	A	Require replacement of component with stripped threads

WHEELS (RIMS)

NOTE: Mounting a regular tire on a high-pressure compact spare wheel is not permitted. Attempting to mount a tire of one diameter on a wheel of a different diameter or flange type may result in serious injury or death. If the wheel identification stamp is not legible, or cannot be found, do not use the wheel until the size and type have been properly identified. Wheels of different diameter, offset, or width cannot be mixed on the same axle. Bead seat tapers cannot be interchanged.

Condition	Code	Procedure
Bead leaking, caused by wheel	A	Require repair or replacement
NOTE: Do not attempt to correct a bent rim.		
Bent hub mounting surface	A	Require replacement
Bent rim, causing vibration	2	Suggest replacement
NOTE: Do not attempt to correct a bent rim.		
Broken	A	Require replacement
Cast wheel porous, causing a leak	A	Require repair or replacement
Clip-on balance weight is incorrect type for rim flange	2	Suggest replacement of weight
Corrosion affecting structural integrity	A	Require replacement
Corrosion build-up on wheel mounting surface	A	Require repair
Cracked	B	Require replacement

Condition	Code	Procedure
Directional/asymmetrical wheels mounted incorrectly	B	Require remounting and/or repositioning
Load capacity less than OEM specifications	B	Require replacement
Mating surface distorted	A	Require replacement
Offset mismatched on same axle	B	Require replacement
Rivets leaking	A	Require replacement
Run-out beyond OEM specs	B	Require replacement
NOTE: Some wire-spoke wheels may be repaired.		
Stud holes elongated	A	Require replacement
NOTE: Inspect wheel attaching hardware for damage.		
Welded or brazed repair	2	Suggest replacement
Welds leaking	A	Require replacement
Wheel centering (pilot) hole incorrect	B	Require replacement

REASON CODE EXPLANATION

Code	Reason
Required	
A	Part No Longer Performs Intended Purpose
B	Part Does Not Meet A Design Specification (Regardless Of Performance)
C	Part Is Missing
Suggested/Optional	
1	Part Is Close To The End Of Its Useful Life
2	To Address A Customer Need, Convenience Or Request
3	To Comply With Maintenance Recommended By The Vehicle's Original Equipment Manufacturer
4	Technician's Recommendation Based On Substantial And Informed Experience
5	To Comply With Maintenance Recommended By AMRA/MAP

AUTOMOTIVE TERMINOLOGY & DEFINITIONS

ABRASIVE CLEANING

removing contaminants using a cleaning agent containing abrasive material. Cleaning that requires physical abrasion (e.g., glass bead blasting, wire brushing).

ADDITIVE

in automotive terminology, a substance added to a liquid, such as engine oil, transmission fluid, gear oil or coolant to enhance its properties.

AEROSOL

a cloud consisting of particles dispersed in a gas or gases

AFTERMARKET

broad term that applies to any change after the original purchase, such as adding equipment. When applied to AFVs, it refers to conversion devices or kits for conventional fuel vehicles.

ALIGNMENT

an adjustment to bring parts or components into a line or proper coordination.

ALTERNATOR

a belt driven device that provides electrical current for the vehicle's charging system.

ANTIFREEZE

a material such as ethylene glycol which is added to water to lower its freezing point; used in an automobile's cooling system.

AQUAPLANING

the loss of traction that results when a tire loses sufficient grip on a wet roadway, the tire actually loses contact with the road surface and rides on a thin film of water.

AUTOMATIC TRANSMISSION FLUID (ATF)

the oil that is used in an automatic transmission.

BATTERY ACID

the sulfuric acid solution used as the electrolyte in a battery.

BATTERY CELL

the part of a battery made from two dissimilar metals and an acid solution. A cell stores chemical energy to be used later as electrical energy.

BATTERY SAVER

the battery saver system is an effective way to prevent complete battery discharge when the engine is shut down. Based on the preset time-limit, the system automatically disconnects the battery load when the battery is not being charged. Depressing the reset push button will enable the battery to be reconnected for additional periods of time. Critical systems can be set up to have battery power maintained.

BATTERY

batteries are the principal energy storage devices for hybrid electric vehicles (HEVs). Desirable attributes of high-power batteries for HEV applications are high-peak and pulse- specific power, high specific energy at pulse power, a high charge acceptance to maximize regenerative braking utilization, and long calendar and cycle life. Developing methods/designs to balance the packs electrically and thermally, developing accurate techniques to determine a battery's state of charge, and developing abuse-tolerant batteries, and recyclability are additional technical challenges.

BEARING RACE

the machined surface of a bearing assembly against which the needles, balls or rollers ride. The outer race is also called a cup.

BEARING

part that supports and reduces friction between a stationary and moving part or two moving parts.

BLEEDER VALVE

a valve located on disc brake calipers, wheel cylinders and some master cylinders that allows air and fluid to be removed from the brake system.

BOILING POINT

the temperature at which a liquid turns to vapor.

BRAKE DRAG

a condition that occurs when brake pads or shoes are in continuous contact with the disc brake rotors or brake drums.

BRAKE FLUSHING

a procedure to clean the brake hydraulic system with fresh, clean fluid that should be performed whenever new parts are installed, if there is any doubt as to the grade of fluid in the system, if a glycol fluid has been mixed with a silicone-based fluid, or if the fluid has been contaminated with petroleum or mineral based fluids.

BRAKE HOSE

flexible hoses that connect the brake lines on the chassis with the calipers or wheel cylinders, or the junction block on a solid axle.

BRAKE LINE

metal tubing that carries the brake fluid from the master cylinder to other brake system components.

CHARGE

the electrical current that passes through the battery to restore it to full power; to fill, or bring up to the specific level, an A/C system with refrigerant; the required amount of refrigerant for an A/C system.

CHARGING SYSTEM

the system that supplies electrical power for vehicle operation and recharges the battery.

CHEMICAL CLEANING

relies primarily on chemical action to remove dirt, grease, scale, paint or rust.

COLD CRANKING AMPS

the amount of cranking amperes that a battery can deliver in 30 seconds at 0°F (-18°C).

COLD START

difficulty of starting an internal combustion engine in cold weather because of gasoline, which evaporates more slowly when it is cold; oil, which gets thicker in cold weather; and the chemical reactions inside the battery, which progress more slowly in cold weather.

CONDENSER

a device, similar to a radiator, in which the refrigerant loses heat and changes state from a high-pressure gas to a high pressure liquid as it dissipates heat to the surrounding air.

COOLANT

the mixture of water and antifreeze used in an engine's cooling system to maintain the engine's temperature throughout its operating range.

COOLING FAN

a mechanically or electrically driven propeller that draws air through the radiator.

COOLING SYSTEM

the system used to remove excess heat from an engine and transfer it to the atmosphere. Includes the radiator, cooling fan, hoses, water pump, thermostat and engine coolant passages.

CORE PLUGS

plugs that fill holes in a block or head left from the casting process. Also called freeze, welsh or expansion plugs.

CORE

in automotive terminology, the main part of a heat exchanger, such as a radiator, evaporator or heater. Usually made of tubes, surrounded by cooling fins, used to transfer heat from the coolant to the air.

CORROSION INHIBITORS

additives used to inhibit corrosion (e.g., rust) in the fuel system.

CROSSFLOW RADIATOR

a radiator in which coolant enters on one side, travels through tubes, and collects on the opposite side (see downflow radiator).

DIFFERENTIAL

gear assembly that transmits power from the driveshaft to the wheels; allows the outside wheel to turn faster than the inside when cornering.

DIGITAL VOLT/OHMMETER (DVOM)

an instrument that measures volts, ohms and amps and displays the results numerically.

DIRECTIONAL TIRE

tire with a tread pattern that is designed to give maximum traction by removing water from under the tread in such a way as to minimize the risk of aquaplaning. Directional tires must be installed to turn in a specific direction.

DOWNFLOW RADIATOR

a radiator in which coolant enters the top of the radiator and is drawn downward by gravity (see crossflow radiator).

DRIVETRAIN

all of the components that generate power and transfer it to the vehicle's wheels.

DUAL MASTER CYLINDER

a master cylinder that has one cylinder bore, but two pistons and two fluid reservoirs. Each piston applies hydraulic pressure to two wheels only. In the event one of the hydraulic circuits fails, the other provides enough braking power to stop the vehicle.

DUO-SERVO DRUM BRAKES

a drum brake design that provides increased stopping power due to the servo or self-energizing action of the brake shoes.

EGR VALVE

see 'exhaust gas recirculation (EGR) valve',

ELECTROLYTE

a material whose atoms become ionized (electrically charged) in solution. In automobiles, the battery electrolyte is a mixture of sulfuric acid and water.

ELECTRONIC AIR SUSPENSION

electronic air suspension provides the comfort of riding on air with adjustable spring rates and capability to change ride height and load-carrying ability. Under normal driving conditions, an electronic air suspension vehicle rides at the same height as a traditionally sprung vehicle. With a heavy load, ride height is increased automatically. On current vehicles, the suspension lowers the ride height by 20 mm at highway speeds for improved aerodynamics, with about 2 percent better fuel economy. Lower ride height also can improve on-center feel of steering due to the change in suspension geometry and increased caster angle.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

a sensor which works by a negative coefficient thermistor that loses resistance as its temperature goes up (just like the intake air temperature sensor). When the computer applies its 5-volt reference signal to the sensor, this voltage is reduced through a ground circuit by an amount corresponding to the temperature of the engine coolant.

EVAPORATOR

a heat exchanger, in which low-pressure refrigerant flows and changes state, absorbing heat from the surrounding air.

EXHAUST GAS RECIRCULATION (EGR)

component in the EGR system, used to meter a controlled amount of exhaust gas into the intake air stream.

EXHAUST GAS RECIRCULATION (EGR) VALVE

an emissions control technique that reuses engine exhaust gases as part of the intake air supply to help reduce harmful emissions (especially Nox).

FAHRENHEIT

a scale of temperature measurement with the boiling point of water at 212°, °F. In the metric system, water's boiling point is 100°, °Celsius.

FAN CLUTCH

a device attached to a mechanically driven cooling fan that allows the fan to freewheel when the engine is cold or the vehicle is driven at speed.

FAN SHROUD

an enclosure that routes air through the radiator cooling fins.

FAN

a mechanically or electrically driven propeller that draws or pushes air through the radiator, condenser, heater core or evaporator core.

FILTER

a screen or filter element that can be made to filter specified sizes of particles from air or liquid.

FLOODING

a condition in which unvaporized fuel in the intake manifold and/or combustion area, prevents the engine from starting.

FOOT POUND

a unit of measurement for torque. One foot pound is the torque obtained by a force of one pound applied to a wrench handle that is 12-in. long; a unit of energy required to raise a weight of one pound, a distance of one foot.

FOUR STROKE CYCLE ENGINE

an engine, either gasoline or diesel that uses four strokes: intake, compression, power and exhaust. A firing impulse occurs every two turns of the crankshaft. When this engine is a gasoline engine it is also called an Otto cycle engine after its inventor. A diesel engine is called a Diesel cycle engine for the same reason.

FREEZE PLUG

another name for core plug.

FRONT WHEEL DRIVE

the entire drivetrain is located at the front of and drives the front wheels of the vehicle.

FUSE

a metal circuit protection device that melts when there is a circuit overload or short.

FUSIBLE LINK

a smaller gauge wire that is included in an electrical circuit to provide circuit protection. The smaller gauge wire will melt when the circuit is overloaded.

GASKET

a material such as artificial rubber, cork, or steel used to seal between parts that would otherwise leak fuel, coolant, lubricants or combustion gases.

GENERATOR

a device that converts mechanical energy into electrical energy; SAE J1930 nomenclature for an alternator; a generating device that uses diode rectifiers to convert ac to dc.

HALF SHAFT

transfers power from the transaxle to the front wheels on a front-wheel drive vehicle. Also used on some vehicles with rear-wheel drive and independent rear suspension to transfer power from the differential to the rear wheels. Consists of a stub shaft that is splined into the differential side gear, another stub shaft that is splined into the wheel hub, an interconnecting shaft, and two CV-joints, which connect the interconnecting shaft to the stub shafts.

HEATER CORE

a radiator-like device used to heat the inside of a vehicle. Hot coolant is pumped through it by the water pump, and heat from the coolant moves from the heater core to the passenger compartment as the blower fan forces air through it.

HUB

mounting point for the wheel on an axle or spindle; the part of the synchronizer assembly that is splined to the transmission shaft; the center part of a wheel, gear, etc., that rides on a shaft.

HYDRAULIC PRESSURE

pressure exerted through a liquid.

HYDROMETER

an instrument used to measure the specific gravity of a solution.

IMPEDANCE

the total resistance of an electrical device measured in ohms.

INCH POUND

one twelfth of a foot pound.

INDEPENDENT SUSPENSION

a suspension in which each wheel can travel up and down without directly affecting the position of the opposite wheel.

INNER BEARING RACE

inner part of a ball or roller bearing that provides a surface for the balls or rollers to rotate.

INTEGRATED CIRCUIT

an electrical circuit containing many interconnected amplifying devices and circuit elements formed on a single body or chip of semiconductor material; diodes, transistors and other electronic components mounted on semiconductor material and able to perform numerous functions.

INTERCOOLER

a component on some turbocharged engines used to cool the compressed intake air.

INTERNAL COMBUSTION ENGINE (ICE)

engine that converts the energy contained in the fuel inside the engine into motion. Combustion engines use the pressure created by the expansion of the gases to do mechanical work.

JAM NUT

a locknut.

KEEP-ALIVE MEMORY

a series of vehicle battery-powered memory locations in the microcomputer that store information on input failure, identified in normal operations for use in diagnostic routines; adapts some calibration parameters to compensate for changes in the vehicle system.

LEAF SPRING

a suspension spring consisting of a single flat plate made of steel or composite material or several steel plates bundled together.

LIGHT-DUTY VEHICLE

passenger cars and trucks with a gross vehicle weight rating of 8,500 or less.

LIMITED SLIP DIFFERENTIAL

a type of differential that uses clutches to supply a major portion of the drive torque to the wheel that has better traction when one wheel is slipping,

LITER (L)

a metric measurement used to calculate the volume displacement of an engine. One liter is equal to 1,000 cubic centimeters or 61 cubic inches.

LUBRICATION

the process of introducing a friction reducing substance between moving parts to reduce wear.

MACPHERSON STRUT

the principal device in the suspension of the same name, in which the spring, shock absorber and sometimes the steering knuckle are combined in a single unit.

MALFUNCTION INDICATOR LIGHT (MIL)

also known as the CHECK ENGINE or SERVICE ENGINE SOON light on many vehicles. The MIL comes on when the ignition is first turned on (to check the bulb) and then goes out once the engine is started, unless a trouble code is stored in the computer. If the MIL is on when the vehicle is running, there has been a malfunction on one of the sensor or actuator circuits monitored by the computer, and a diagnosis will have to be made by retrieving the code.

MASTER CYLINDER

the primary fluid pressurizing device in some hydraulic systems. In automotive use, it is found in the brake and hydraulic clutch systems and is pedal-activated, either directly or through a vacuum assist unit.

MILLIMETER

the base of metric size measurement. One millimeter equals 0.039370-in. One inch is equal to 25.4 mm.

MULTIVISCOSITY OIL

chemically-modified oil that has been tested for viscosity at cold and hot temperatures.

OFF-ROAD

any non-stationary device, powered by an internal combustion engine or motor, used primarily off the highways to propel, move, or draw persons or property, and used in any of the following applications: marine vessels, construction/farm equipment, locomotives, utility and lawn and garden equipment, off-road motorcycles, and off-highway vehicles.

OHM

a unit of electrical resistance of a circuit in which an electromotive force of one volt maintains a current of one ampere, named after German physicist Georg Ohm.

OHMMETER

an instrument that measures electrical resistance in ohms.

OHM'S LAW

a basic law of electricity expressing the relationship between current, resistance and voltage in any electrical circuit. Ohm's law states that the voltage in a circuit is equal to the current multiplied by the resistance.

OIL COOLER

device used to remove heat from the engine or transmission oil. There are oil-to-air coolers and oil coolers that are incorporated into the vehicle's cooling system.

OIL PAN

the part that encloses the crankcase at the lower end of the block.

OIL PRESSURE

the pressure that results from resistance to flow from the oil pump. As the pump turns faster, it produces more flow. A relief valve limits the amount of pressure it can produce.

ON-CAR BALANCING

the practice of spinning a wheel on the car to balance the wheel and all other rotational components together.

ORIGINAL EQUIPMENT MANUFACTURER (OEM)

the original manufacturer of a vehicle or engine.

OSCILLOSCOPE

an instrument that displays electrical activity in the form of line patterns on a screen.

OUTER BEARING RACE

outer part of a ball or roller bearing that provides a surface for the balls or rollers to rotate. Can be integral with the bearing or a separate part.

OXIDATION

the process of combining with oxygen, resulting in rusting or burning. Rust is slow oxidation; fire is rapid oxidation.

PAG

polyalkylene glycol oil (lubricant) used with A/C systems containing R-134a refrigerant.

PARALLEL CIRCUIT

a circuit with more than one path for the current to follow.

PARKING BRAKE

a system that applies the brakes mechanically through a series of linkages and cables. Depending on the vehicle, the parking brake system will either be actuated using a foot pedal or a hand-operated lever.

PASCAL'S LAW

the law of physics stating that liquids are noncompressible, and that a force applied to the top of a liquid in a closed container is exerted equally in all directions.

PCV SYSTEM

see 'positive crankcase ventilation system'.

PCV VALVE

a part of the positive crankcase ventilation system. Meters crankcase vapors into the intake manifold.

PLAY

the relative movement between or among parts.

POLARITY

the condition of being positive or negative relative to a reference point or object; the particular state (positive or negative) with reference to the two magnetic poles.

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

a system that controls crankcase emissions by using a valve to meter crankcase vapors into the intake manifold.

POWER BRAKES

a system that uses vacuum or hydraulic pressure to assist the driver with brake application.

PSI

measurement of pressure in pounds per square inch.

RADIAL RUNOUT

the out-of-roundness of a wheel or tire.

RADIATOR CAP

a device that seals the radiator and maintains a set pressure in the cooling system.

RADIATOR

the part of the cooling system that acts as a heat exchanger, transferring heat to atmosphere. It consists of a core and holding tanks connected to the cooling system by hoses.

REAR WHEEL DRIVE

system where the driveline drives the rear wheels of the vehicle. Most often the engine is located in the front of the vehicle and a transmission and drive shaft connect to a drive axle, however there are also systems where the entire drive line is located toward the rear of the vehicle.

REAR WHEEL STEERING

a system used on some vehicles to change the toe of the rear wheels to either steepen a sharp turn or enhance cornering on a shallower, faster one.

RESISTOR

an electrical device installed in a circuit to lower voltage and current flow.

RIDE HEIGHT

the dimension between a fixed point on the vehicle and the pavement. The fixed point varies according to vehicle and manufacturer. Also called vehicle height.

RUNOUT

wobble or deflection beyond a rotating part's normal plane of movement.

SCAN TOOL

microprocessor designed to communicate with a vehicle's on-board computer system to perform diagnostic and troubleshooting functions.

SEMICONDUCTOR

a material that is neither a good conductor of electricity nor a good insulator.

SENDING UNIT

a mechanical, electrical, hydraulic or electromechanical device which transmits information to a gauge or other receiving unit.

SERIES CIRCUIT

a circuit that has only one path for current to follow.

SERIES-PARALLEL CIRCUIT

a circuit that combines series and parallel circuits.

SERVO

a device, such as an electric motor or hydraulic piston, that is controlled by an amplified signal from a low power command device.

SHOCK ABSORBER

a device used to dampen the oscillation of the suspension caused by irregularities in the road surface.

SHORT CIRCUIT

a condition that occurs in an electrical circuit when the current bypasses the intended load and takes a path with little or no resistance, such as another circuit or ground.

SPECIFIC GRAVITY

the ratio of the weight or mass of the given volume of a substance to that of an equal volume of another substance, e.g. - water for liquids and solids; air or hydrogen for gases, are used as standards.

SPONGINESS

the feel of a soft or mushy brake pedal usually caused by trapped air in the hydraulic system.

SPRUNG WEIGHT

the weight of all the vehicle components that are supported by the springs; see 'unsprung weight'.

STABILIZER BAR

a torsion-bar spring connecting the suspension on either side of the vehicle. When a vehicle rolls to the side in a turn, the suspension at the outside wheel compresses and the suspension at the inside wheel extends. The stabilizer bar that connects them twists to apply a counteracting force to hold the vehicle closer to level. Also called an anti-roll bar or sway bar.

STARTER

the electric motor that is used to start an engine.

STUD

a fastener that has screw threads at both ends.

TECHNICAL SERVICE BULLETIN (TSB)

information published by vehicle manufacturers that describe updated service procedures and service procedures that should be used to handle vehicle defects.

TENSIONER

a device used with a timing chain or belt to maintain its tension.

THERMOSTAT

a device installed in the cooling system that allows the engine to come to operating temperature quickly and then maintain a minimum operating temperature.

TIMING BELT

a toothed reinforced belt used to drive the camshaft from a sprocket on the crankshaft.

TOLERANCE

the difference between the allowable maximum and minimum dimensions of a mechanical part; the basis for determining the accuracy of a fitting.

TORQUE SEQUENCE

a specified order in which a component's mounting bolts should be tightened

TORQUE WRENCH

a breaker bar or ratchet wrench with an indicator that measure the twisting effort applied to a fastener during tightening.

TORQUE

twisting effort on a shaft or bolt.

TWIN I-BEAM SUSPENSION

a type of independent front suspension and used on light trucks and vans. It consists of two I-beams supported by coil springs, and the steering knuckles/spindles, which are connected by king pins or ball joints. The inner end of the axle connects to the vehicle frame through a rubber bushing. A radius arm also connects to the frame through rubber bushings to control wheelbase and caster.

UNIVERSAL JOINT (U-JOINT)

a joint that allows the driveshaft to transmit torque at different angles as the suspension moves up and down.

UNSPRUNG WEIGHT

the components of a vehicle that rest directly on the road surface without being supported by the suspension springs.

VACUUM

a pressure lower than atmospheric.

VOLT

unit of electromotive force. One volt of electromotive force applied steadily to a conductor of one-ohm resistance produces a current of one ampere.

VOLTAGE DROP

voltage lost by the passage of electrical current through resistance.

VOLTMETER

an instrument used to measure voltage in a circuit.

WATER PUMP

a device used to circulate coolant through the engine.

WHEEL ALIGNMENT

the adjustment of suspension and steering components to optimize steering control and minimize tire wear.

WHEEL BALANCE

the condition in which a wheel/tire assembly has equal weight around its center, preventing vibration at high speeds. Wheel balance can be static, such as on a bubble balancer, or dynamic, such as with a spin balancer.

WHEEL WEIGHTS

small weights, usually made of lead, attached either mechanically or by adhesive to a wheel/tire assembly to correct its balance.

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