

Vehicle Requirements

22

Contents

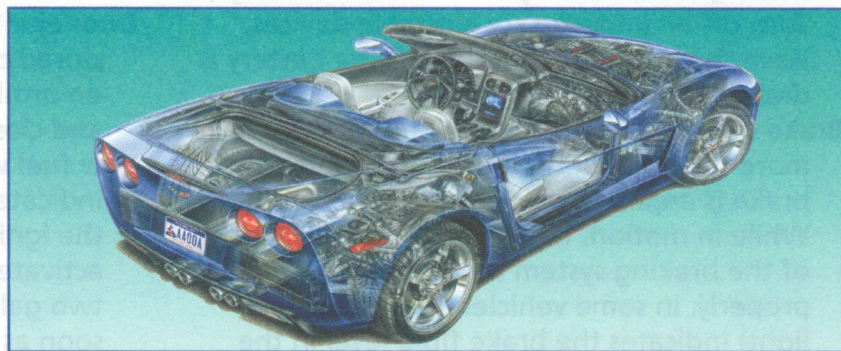
- 22-A
Alert Lights and Symbols
- 22-B
Vehicle Malfunctions
- 22-C
Fire
- 22-D
Vehicle Systems
- 22-E
Trip Planning
- Module Ten Review

As an owner, you are responsible for keeping your vehicle in proper operating condition and ensuring that it is equipped to handle the different seasons and driving conditions.

An engine that is properly maintained will operate at maximum efficiency. It is less likely to break down and cause inconveniences. In this chapter, we will review some of the systems of the automobile, as well as the maintenance that each may require.

Far from intending that you become a mechanic, the intention is to remove the mystery that surrounds the automobile. The owner's manual should also be consulted for specific information for the vehicle and maintenance.

A well maintained vehicle is safer, more economical, and produces less pollution!



AFTER COMPLETING THIS CHAPTER, THE STUDENT MUST BE ABLE TO LOCATE THE COMPONENTS, DESCRIBE THE GENERAL FUNCTION OF, AND TAKE RESPONSIBILITY FOR:

- the visual check of gauges/lights and their assessment.
- vehicle failures, as well as driver and road sharing errors.
- potential warning signs that indicate problems.
- planning a trip (routes, needs, and costs) and using road maps.

22-A

Alert Lights and Symbols

It is essential to know what the warning lights and gauges on the instrument panel mean and where they are located. Whenever you drive an unfamiliar vehicle, take the time to perform the driver's compartment drill to familiarize yourself with all of the gauges and controls.

As a general rule, you should become familiar with your vehicle by reading the owner's manual and then performing the drill. This will prevent you from being caught off-guard should an alert light or warning symbol indicate a problem.



Temperature gauge / light: Mounted in the instrument panel. It informs you of the operating temperature of the engine. If it comes on while driving, pull off the road safely, and get professional help. Never open the radiator cap when hot.

Oil pressure warning light or gauge: Warns you when the oil is not circulating at the proper pressure (pump failure, lack of oil). It does not inform about the oil level in the engine. If the warning light/gauge activates, proceed to the nearest service station.

Alternator warning light/gauge: The electrical system of your vehicle is in trouble if this light comes on, or the gauge shows "discharge," while the engine is operating. The alternator is not generating enough electricity to charge the battery. The vehicle is using the electricity stored in the battery. Turn off all unnecessary electrical devices. Have the alternator checked. If the battery is drained, the car may stop.

Brake system warning light: Some vehicles have more than one light. It indicates the parking brake is applied before moving the vehicle. While in motion, it alerts you that all or part of the braking system is not working properly. In some vehicles, it (or a second light) indicates the brake fluid level in the reservoir is low. If the brake system is not working properly, brake gradually to a stop, have the vehicle towed, and then repaired.

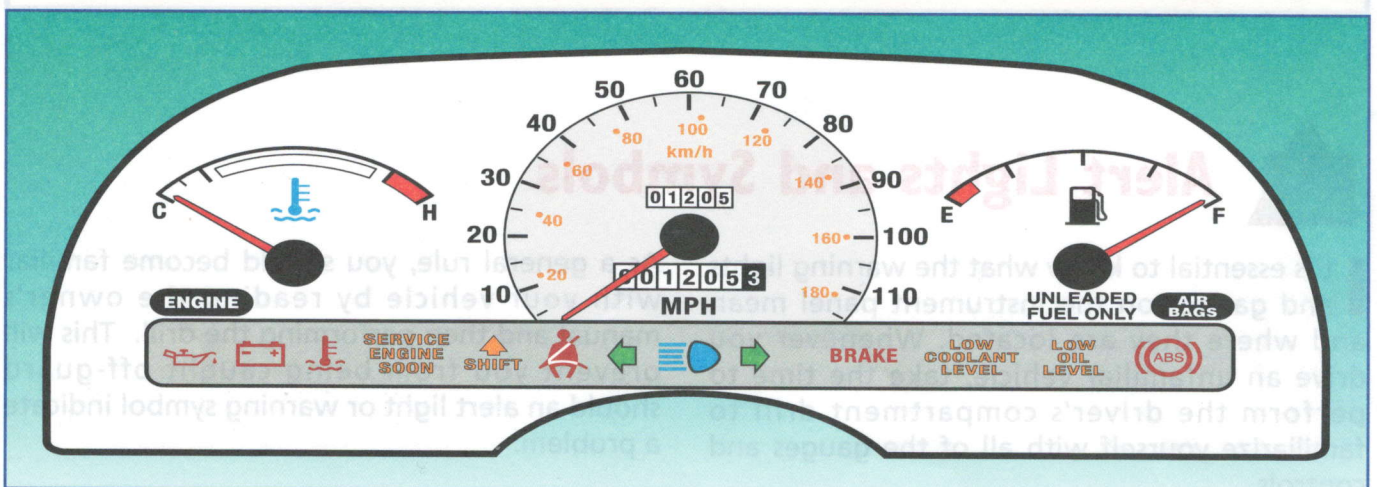
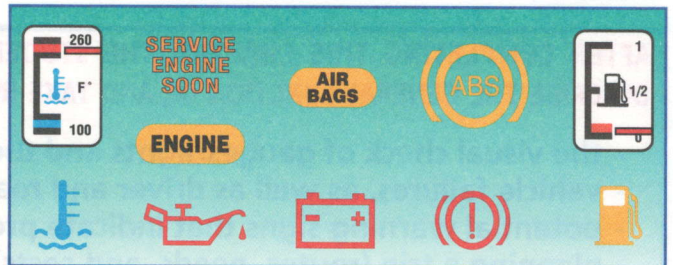
Anti-lock Braking System (ABS) light: Alerts you that the system is fine on start-up. If the light comes on while driving, it indicates a problem with the ABS. Have the problem corrected at a service center.

Air bag warning light: Alerts you that the air bags are in proper working condition on start-up (it should go off after a few seconds). If it remains on, or comes on while driving, the air bags are not in proper working condition. Have them repaired at a service center.

Service engine soon light: An on-board computer, the electronic command module or ECM, monitors the operation of the fuel, ignition, and emission control systems. This alert light should come on when you turn the ignition switch to ON. If it does not illuminate, have the system fixed right away. If the light stays on, or comes on while driving, the computer is indicating that there is a problem. Take your vehicle to a service center in the near future to have a service technician analyze and repair the problem.

Door ajar light: This comes on if a door(s) is not closed completely. The warning light will stay on until this is corrected. Do not try to open and close the door that is ajar while driving.

Low fuel warning light: The fuel gauge indicates how much fuel is in the tank when the ignition is on. When the low fuel light activates, it means there are approximately two gallons remaining. Stop and refuel as soon as possible.





Vehicle Malfunctions

Despite the best of intentions and precautions, you are likely to face at least one critical situation at one time or another during your driving career. Apply loss control strategies to minimize the potential results. Avoid panic!

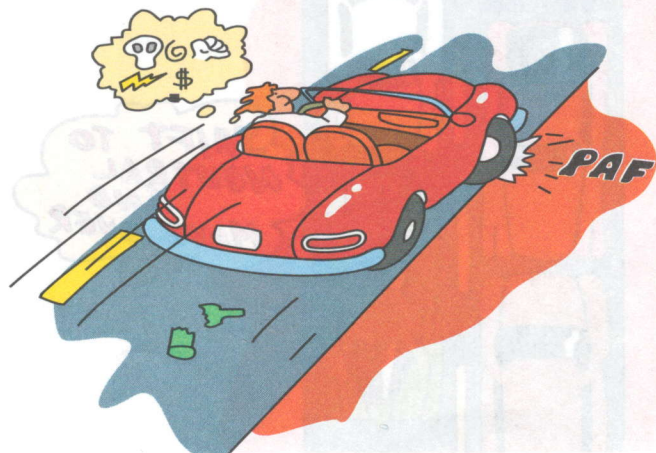
What is panic? When the brain receives input from the senses either too quickly to assimilate or concerning a totally unknown situation; it is incapable of reaching a decision. A weighty, telling pause ensues... !

A decision will then be rendered which has no factual basis. It is most likely to be an incorrect response. This chapter is intended to mentally prepare you for the possible emergency situations which might arise. Then the brain will have the necessary information. You will not need to panic. The correct response will be readily available and the situation can be resolved safely.

TIRE FAILURE

All tires wear out gradually through hard braking and/or acceleration. They also require periodic balancing and alignment. Look for wear bars (tread wear indicators) appearing across the tread as a sign tires need replacing.

A blowout is a rapid loss of tire inflation (explosion or reaction to driving over an object



on the roadway). A flat tire while driving produces a similar effect.

The result: the vehicle pulls to the side where the front tire has deflated. If a rear tire deflates, the rear of the vehicle will wobble and shake and pull some in the direction of the blowout.

WHAT TO DO

- Maintain speed - DO NOT BRAKE!
- Grip the steering firmly and steer to keep the vehicle in a straight line.
- Activate the hazard lights, if possible.
- When under control, ease off the accelerator.
- Check traffic and select a safe path.
- Change lanes to move off the roadway as far as possible to change the tire.

If it is not possible to move off the roadway to a protected location (a freeway with no shoulder), drive on the tire at a slow speed until you can exit.

PREVENTION

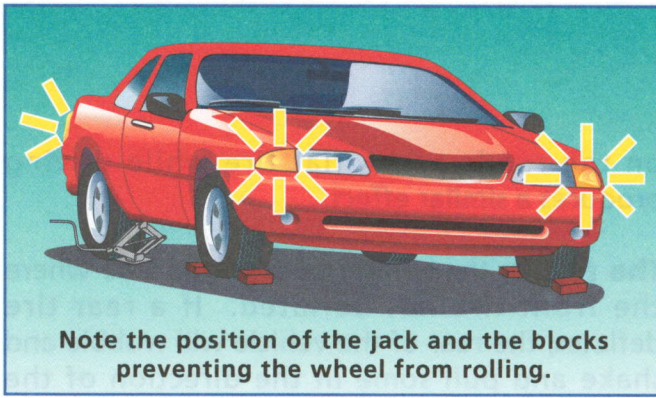
Check tire inflation regularly. Check the tire tread and sidewall each time you approach the vehicle (have a more thorough examination performed when the vehicle is being serviced - oil change). Replace tires when worn, bulging, or cracked. Avoid driving over objects on the roadway.

CHANGING A TIRE:

Too many injuries and deaths occur while changing tires every year. To proceed safely, activate the hazard lights, position the vehicle on a hard flat surface as far off the roadway as possible, and apply the parking brake. Set out reflective warning devices 100 feet in both directions.

Take the jack, jack handle, lug wrench and spare tire out of the trunk. Block both the front and the rear of the wheel diagonally opposite the flat using stones or blocks. Position the jack





(trunk lid diagram or owner's manual) and jack up the vehicle slightly. Remove the wheel cover, use the lug wrench to loosen the bolts a couple of turns, then raise the vehicle until the flat clears the ground.

Remove the lug nuts and the tire. Install the spare and the bolts by hand. Tighten the bolts slightly. Lower the vehicle and remove the jack. Re-tighten the bolts (every second bolt until they have each been tightened twice). Store the jack, jack handle, lug wrench, wheel cover, flat tire, and warning devices in the trunk.

DRIVING WITH A COMPACT SPARE:

To save space, most vehicles have an under-sized, limited mileage spare tire. Do not exceed 50 mph, avoid sudden change in speed or direction, and be aware of the lower ground clearance while driving with this type of spare. Stop at the nearest service station to repair and re-install the regular tire.



ACCELERATOR PEDAL STICKS

Release the accelerator and you continue accelerating; the accelerator is stuck. A broken spring or engine mount, a stuck linkage or a floor mat could be the cause.

WHAT TO DO

If you must stop quickly:

- Apply and maintain pressure on the brakes

(until you are stopped).

- Shift to Neutral (depress the clutch).
- Turn off the ignition switch.
- Activate the hazard lights.

If an immediate stop is not required without looking, try to free the pedal with your right foot. If no success:

- Activate the hazard lights, if possible.
- Shift to (N) Neutral (depress the clutch).
- Check traffic, choose a safe path of travel, and steer off the roadway.
- Apply the brakes in a continuous manner until the vehicle is stopped.
- Turn off the ignition switch (on today's vehicles, the Electronic Control Module [ECM] will prevent over-revving).

Correct the problem before proceeding.

PREVENTION

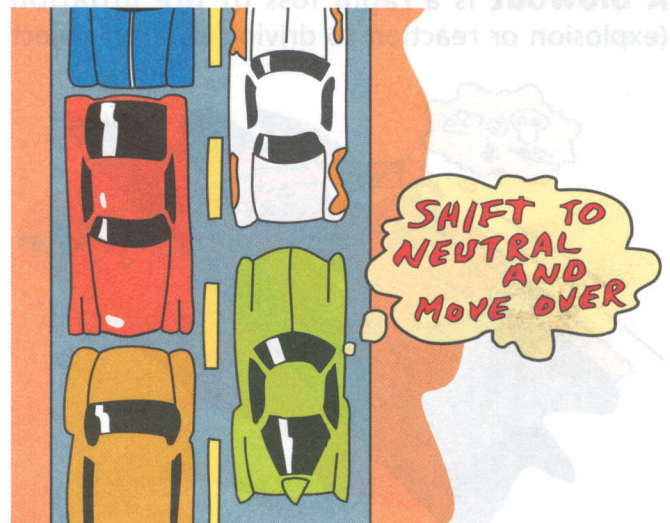
Check the floor mat, foot pedals, accelerator, and have the accelerator cable lubricated regularly.

THE ENGINE STALLS

If the engine of your vehicle stops suddenly while driving, mechanical failure, an empty fuel tank, water, or cold weather are the normal causes of this situation.

WHAT TO DO

- Shift to (N) Neutral (depress the clutch).
- Activate the hazard lights, if possible.
- Activate the starter using the ignition switch



several times (Push-Start).

- If the engine restarts, shift to the appropriate gear, accelerate and turn off the hazard lights.
- If the engine does not restart, check traffic, choose a safe path of travel, and steer off the roadway or near the curb.
- Apply the brakes with continuous pressure until you stop.
- Park in a safe location.

Power steering becomes more difficult to turn when the engine stalls. Grip the steering firmly and you can control your vehicle. (Low power steering fluid level, a broken V-belt, or a defective pump may also cause power steering failure.)

Power brakes work normally for one more application when the engine stalls. Apply the brakes in one continuous application, modulating the pressure, without releasing. If you release the brakes completely, the brakes will require a much greater pressure to reduce speed.

PREVENTION

Follow the recommended service intervals in your owner’s manual. Check the fuel gauge every time you start your engine. Check the fluid levels every time you refuel. Allow the engine extra time to warm up in extreme cold conditions before driving in heavy traffic. Avoid puddles and splashing, when possible.

FLOODED ENGINE

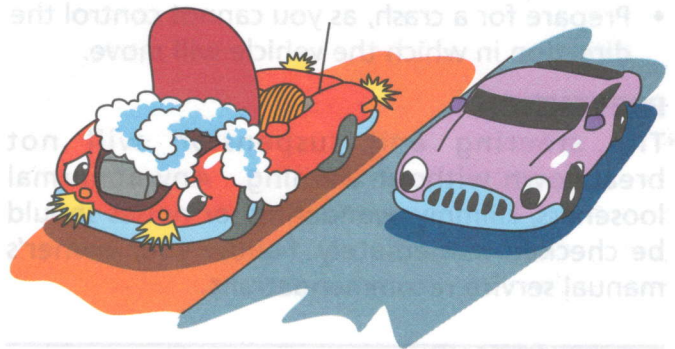
The starter sounds normal and hopeful, but the engine doesn’t start. The odor of gasoline permeates the passenger compartment. An excess of gasoline in the engine prevents proper combustion.

To start the engine, depress the gas pedal fully and maintain this position even if the first attempt fails. Turn the ignition switch to the START position (Push-Start) for 5 to 10 seconds; release the switch if it does not start. Try again without moving the accelerator pedal. As soon as the engine does start, ease up on the accelerator quickly.

This procedure will work on all gasoline engines, even those equipped with fuel injection systems.

ENGINE OVERHEATS

The gauge or indicator light shows the engine temperature is rising above the normal level. This may occur in slow-moving traffic during hot weather or due to a mechanical defect in the cooling system. Lengthen your stopped distance from the preceding vehicle, activate the heater in the hot position with the fan on high, shift to neutral while stopped and rev the engine slightly. **The temperature should return to the normal range. If not...**



WHAT TO DO

- Check traffic, select a safe path of travel and steer onto the shoulder (near curb).
 - Park in a safe place; turn off the engine.
 - Activate the hazard lights.
 - Open the hood to allow heat to escape (cover your hand with a glove or cloth).
 - Visually check hoses, belt(s), etc. while the engine cools.
 - If the coolant level (overflow tank) is low or empty, get a container of water.
 - Unlock the radiator cap (1/4 turn) and step back from the front of the vehicle.
 - After the pressure has been released, push and turn the radiator cap to remove completely.
 - Add some water slowly.
 - Restart the engine and fill the radiator, as needed.
 - Close the cap and proceed to the nearest service center to have the cooling system inspected.
- If unsure of what to do, seek professional help.



PREVENTION

Have the cooling system serviced yearly.

TOTAL STEERING FAILURE

Though a very rare occurrence, if you lose steering control completely, a breakdown in the front suspension or steering is the reason.

WHAT TO DO

- Communicate by using the horn and activating the hazard lights.
- Shift to **(N)** Neutral (depress the clutch).
- Hold the parking brake release mechanism and pump the parking brake firmly to reduce speed quickly.
- Shift to a lower gear.
- Prepare for a crash, as you cannot control the direction in which the vehicle will move.

PREVENTION

- The steering and suspension will not breakdown without warning. Any abnormal looseness, shimmy, wandering, or noises should be checked immediately. Follow your owner's manual service recommendations.

BRAKE FAILURE

Complete service brake failure is rare today, as vehicles have a dual braking system. Should one fail, the other will stop your vehicle, and a warning light will advise you of the problem. Partial or temporary brake failure can occur due to lack of brake fluid, overheating, wet brakes, V-belt failure (on some models only), etc.

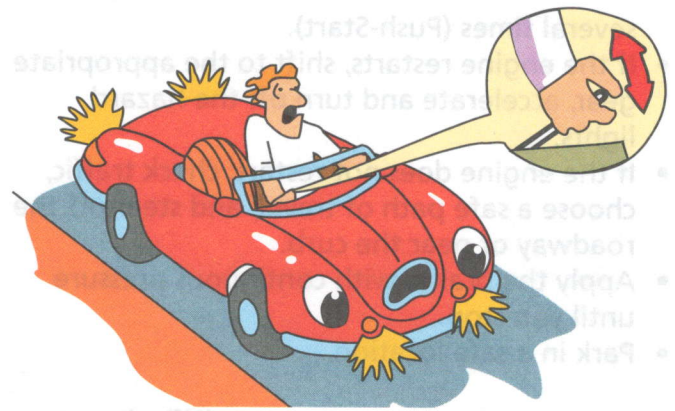


Fire

Vehicle fires rarely occur, but when they do, you must act quickly to minimize danger to people and property. While driving, if you see or smell smoke, there is likely a fire in your vehicle.

WHAT TO DO

- Activate the hazard lights, if possible.
- Select a safe path of travel and move your



WHAT TO DO

- Downshift to use the engine compression (using engine braking).
- Pump the brake pedal several times (to restore braking power).
- Activate the hazard lights (to warn of your situation).
- Pump the parking brake while releasing the lock mechanism (use the rear brakes to stop).
- Select a safe path of travel while slowing (steer around obstacles).

If none of these permit you to stop, look for an uphill slope, guard rail, or curb to further reduce your speed. As a last resort, select objects that will give on impact to bring you to a complete stop.

PREVENTION

Check the brake fluid level monthly. Have the brakes checked at recommended intervals. Check the parking brake by using it every time you park. Practice emergency stops using the parking brake in a quiet area (a driving range is ideal).

vehicle out of the traffic flow.

- Park away from crowds, vehicles, and buildings (especially service stations).
- Turn off the ignition switch (Push-Start).
- All occupants should move at least 100 feet away from the vehicle.

A CIGARETTE OR MATCH

Don't over-react, the materials used in the





passenger compartment are non-flammable. When stopped, locate the cigarette or match, and put it out. Make sure that any smoldering embers are out, as well.

AN ASHTRAY FIRE

Close the ashtray while driving; this will cut off the oxygen supply somewhat. When parked,

remove the ashtray and extinguish the fire outside the vehicle.

UNDER THE HOOD

Once the vehicle is safely stopped, have someone call the fire department. Decide how serious the fire is (high heat and flames). Wait for the fire department.

If you have a fire extinguisher (ABC type), and the fire appears to be minor, cover your hands with a cloth or gloves. Release the hood latch. Approach the front with your head below the hood line, pull the hood release and raise the hood slightly. Aim at the base of the fire through the opening and smother the flames. Open the hood and spray the area completely.

A fire extinguisher should be mounted in the passenger compartment within reach of the driver. It should never be stored in the trunk (too close to the fuel tank).

UNDER THE DASH

A fire under the dash is an electrical fire. Wait for the fire department.

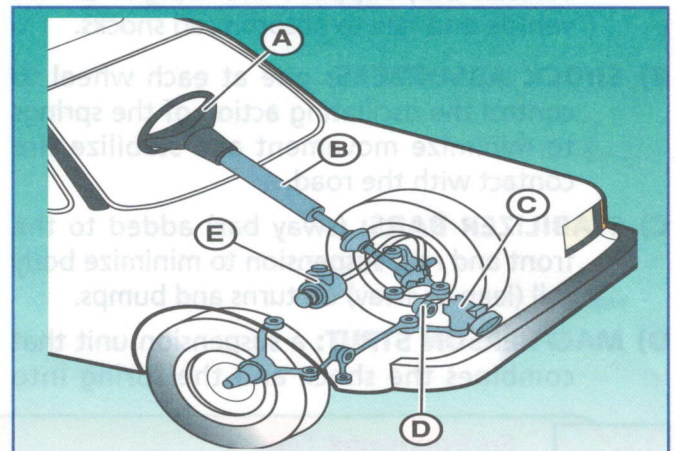


Vehicle Systems

The steering system changes the position of the front wheels in order to permit the driver to control the direction of the vehicle.

BASIC COMPONENTS

- A) STEERING WHEEL:** driver control that turns the front wheels - may be adjustable. (tilt and/or telescoping steering)
- B) STEERING COLUMN:** connects the steering wheel to the gearbox. Collapsible on impact to protect the driver.
- C) STEERING GEARBOX:** converts the rotary motion of the wheel into linear motion of the steering linkage: various types.



- D) STEERING LINKAGE:** a series of arms, rods and tie-rods that transmit the linear motion to



the front wheels to change their position.

E) POWER STEERING: hydraulic pump impelled by a belt connected to the engine that facilitates steering.

Common signs of steering problems are:

- Play or excessive movement in the steering

wheel.

- Steering difficulty, even though the tires are properly inflated.
- Shimmying or wobbling, shaking or pulling to one side under normal driving conditions.
- Squealing sounds when you turn at normal speeds.



Environmental Tips

Power steering fluid is toxic, contaminates soil and water, can cause eye and skin irritation and combustion produces carbon monoxide. Unused fluid can be shared with others or brought to a hazardous waste site.

MAINTENANCE TIPS

Check the power steering fluid level and the condition and adjustment of the belt regularly.

Avoid turning the steering if the vehicle is not in motion (dry steering); premature wear of steering components and tires will result.

Never force the steering at the limit of travel; back off slightly and the wheels will still be fully

turned. Forcing causes early failure of power steering / steering components.

Avoid deep potholes, curbs and any other sudden or hard impacts that may damage the steering components.

Have the steering aligned at least once a year and after any serious impacts.

The suspension system supports the weight of the vehicle, holds the wheels in alignment, absorbs the shocks caused by road irregularities, and provides flexibility while ensuring vehicle stability and driveability by maintaining traction.

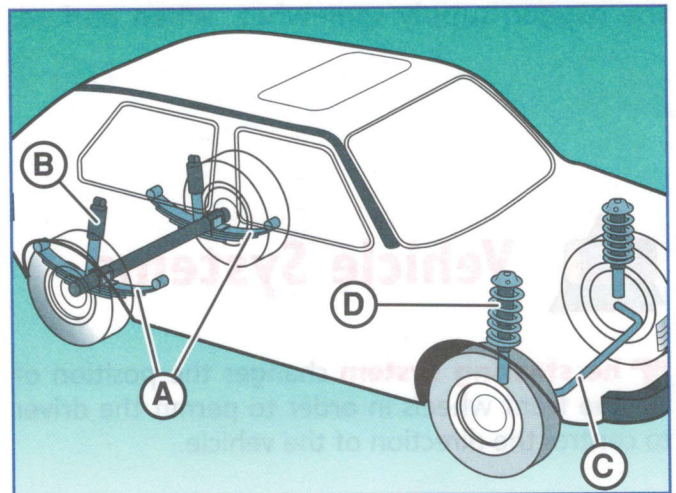
BASIC COMPONENTS

A) SPRINGS: whether leaf, coil, air (air bags), or torsion bar, support the weight of the vehicle and flex to absorb road shocks.

B) SHOCK ABSORBERS: one at each wheel to control the oscillating action of the springs to minimize movement and stabilize tire contact with the road.

C) STABILIZER BARS: (sway bar) added to the front and rear suspension to minimize body roll (lean or sway) on turns and bumps.

D) MACPHERSON STRUT: a suspension unit that combines the shock and the spring into



one component (front / rear on compacts).

HYDRAULIC ACTUATORS: (not shown) replace shocks and can be computer or manually controlled to adjust ride and height of vehicle. They keep the tires forced against the pavement, thereby improving traction.



Environmental Tips

Whenever components have to be replaced on your vehicle, whether you do the work yourself or have it done by a professional, make sure the old parts are disposed of properly.



MAINTENANCE TIPS

Have the shocks checked for leakage whenever your vehicle is in for service.

If your vehicle tends to bounce while driving, check your shocks by pushing down on the corners of your vehicle. The vehicle should stabilize after

rebounding once. If it continues to oscillate, change the shocks.

Whenever your vehicle does not appear to be level (unloaded), have the springs checked for sag, wear and/or breakage.

TIRES

Tires are an integral part of the suspension and steering systems of your vehicle. Improved tire design has reduced the incidence of tire troubles on modern vehicles; yet, tires are still one of the most neglected parts of the vehicle.

Tires have two functions. First, they are air-filled cushions that absorb most of the shocks caused by road hazards. The tires flex, or give, as they meet these irregularities. Thus they reduce the effect of the shocks on the vehicle and the passengers. Second, the tires grip the road to provide traction. This enables the driver to accelerate, brake, and steer the vehicle.

TIRE CONSTRUCTION

The tire casing is composed of plies (layers of cord impregnated with rubber) shaped on a form. The rubber treads and sidewalls are then applied to give the desired form, wear characteristics, and flexibility. There are two basic tire types: the bias ply (also belted bias) and the radial ply design.

THE BIAS PLY has the plies criss-crossed. This makes the casing strong in all directions; however, the plies tend to move against each other. This generates heat and tire "squirm". The tires wear more rapidly and provide less traction.

THE RADIAL PLY has the plies parallel and perpendicular to the tread. Belts (usually steel) are then attached in the same position as the tread which is then applied with the sidewall. This results in more flexibility. The tread stays in contact with the road producing greater traction. Radial tires also wear more slowly.

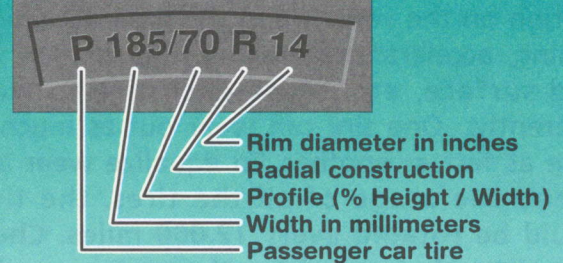
NEVER MIX BIAS AND RADIAL TIRES ON YOUR VEHICLE. EVEN MIXING RADIAL TIRES OF

DIFFERENT MAKES AND TREAD DESIGNS IS NOT RECOMMENDED.

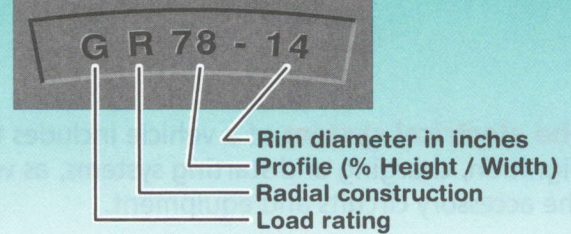
TIRE SPECIFICATIONS

By law, details about each tire must be molded into both sidewalls - tire size, maximum inflation pressure, load rating, construction, number of plies and manufacturer. The two formats are shown below.

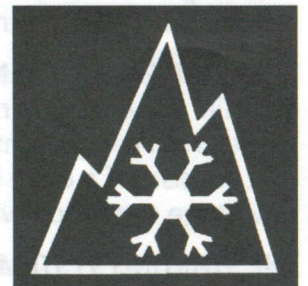
METRIC SPECIFICATIONS



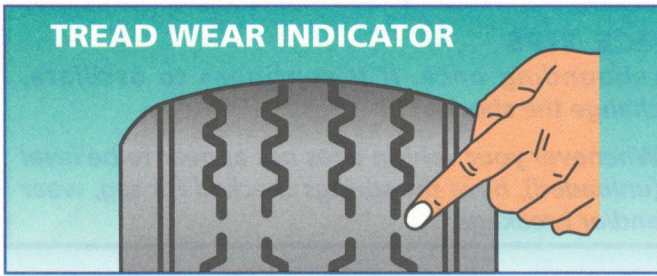
ALPHANUMERIC SPECIFICATIONS



Tires marked "M + S" (mud and snow, aka all-season tires) provide safe all-weather performance, but they lose traction due to cold temperatures. Tires marked with the pictograph (at right) of a three peaked mountain with a snowflake meet specific winter performance requirements, and are designed specifically for use in severe snow conditions. (made of soft compounds / tread designs for better traction - see Chapter 20-C).



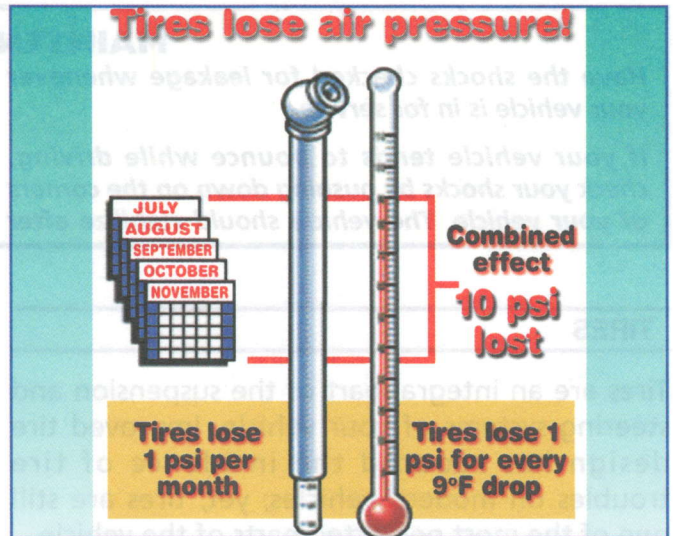
TREAD WEAR INDICATOR



WEAR BARS

Most tires have wear bars or tread wear indicators, which are filled-in sections of the tread grooves. When the tread has worn down enough to reveal the wear bars as a line of rubber across the tread, the tire should be replaced (see above).

Tires lose air pressure!



TIRE ROTATION

The amount of wear a tire gets depends on its location on the vehicle and the type of vehicle. Turning, accelerating, braking, the slant of the road surface, etc. cause each tire to wear differently. One tire can wear out as much as twice as fast as another. To equalize wear and extend the usage of all the tires, the tires should be rotated every 12,000 miles. Check your owner's manual for the recommended interval for your vehicle.

TIRE INFLATION

Tire inflation is also very important. Properly inflated tires produce the largest "footprint" with the pavement, therefore giving the best traction. *If you drive on under-inflated tires, they may overheat and even cause a blowout!*

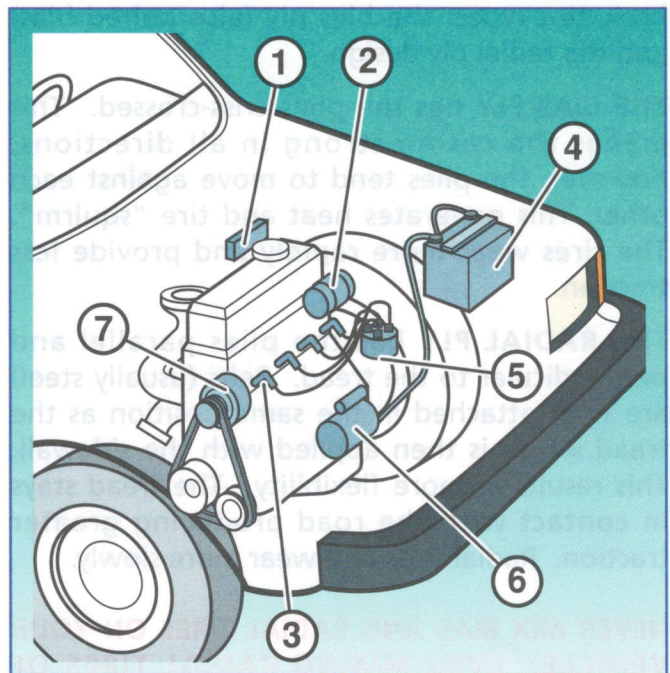
As shown above, tires lose pressure under normal conditions. They can also lose pressure due to hitting curbs, crossing potholes, etc. Checking inflation with a good tire gauge is essential.

The electrical system of a vehicle includes the ignition, charging and starting systems, as well as the accessory circuits and equipment.

THE IGNITION SYSTEM converts the 12 volt battery current to high voltage surges directed to the spark plug at the proper time to initiate combustion. It consists of the ignition switch, distributor assembly, ignition coil, spark plugs, wiring and the battery. The Electronic Control Module (**ECM**) controls the timing of the spark.

THE CHARGING SYSTEM produces electrical power while the engine is running to operate all the electrical components and recharge the battery. It consists of a drive belt, the alternator, the voltage regulator, wiring and the battery.

THE STARTING SYSTEM permits the driver to turn the ignition switch to activate an electric motor to crank and usually start the engine. It consists



of the ignition switch, the starter motor, a solenoid switch, wiring and the battery.

THE ACCESSORY CIRCUITS power the lights, safety systems, and accessories. It includes the fuse box, wires and electrically-powered components.

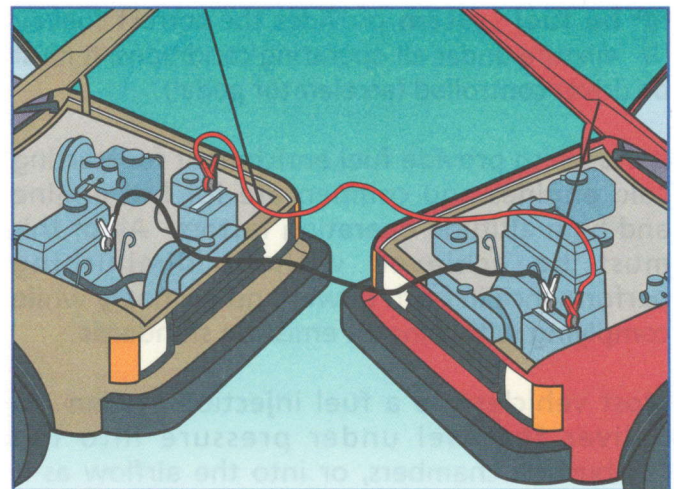
BASIC COMPONENTS

- 1) **THE FUSE BOX:** protects the electrical equipment from excess current / surges.
- 2) **THE IGNITION COIL:** transforms the 12 volt current to a surge of current of thousands of volts.
- 3) **THE SPARK PLUGS:** produce a spark to ignite the air-fuel mixture.
- 4) **THE BATTERY:** stores energy in chemical form to supply electricity to start the engine.
- 5) **DISTRIBUTOR:** produces and distributes the surges to the spark plugs.
- 6) **THE STARTER:** is an electric motor that cranks the engine (turns the flywheel) during starting.
- 7) **THE ALTERNATOR:** driven by the belt, charges the battery and feeds electrical components.

ECM/ECU (Electronic Control Module or Unit) (not shown) uses programs stored in memory and data supplied by a variety of electronic sensors to control the production and timing of the spark plugs, as well as the engine.

JUMP STARTING A VEHICLE

In extremely cold weather, it is not uncommon for a battery to go "dead" (lose the electrical charge). To start the vehicle, you will have to



"JUMP START" or **boost it** using another vehicle.

MAKE SURE:

- The two vehicles are not touching;
- The batteries have the same voltage;
- The dead battery is not frozen; and
- The fluid level is not low.

WHAT TO DO:

- Turn off accessories, engine and apply parking brakes
- Remove battery caps, if so equipped (Cover with a heavy cloth)
- Connect both ends of the red cable to the positive terminals (+ or marked **P**) of both batteries
- Connect the black cable to the negative terminal (- or marked **N**) of the battery being used to boost
- Attach the other end to the engine block or frame of the vehicle with the "dead" battery (avoid moving parts)
- Start the booster vehicle and fast idle
- Start the vehicle and run for several minutes
- Reverse the order to disconnect.

MAINTENANCE TIPS

Spare fuses should be stored in your vehicle. If a fuse needs replacement twice, consult a mechanic.

Check the battery regularly. Make sure the terminals, clamps, or connectors are clean and properly tightened. They are sealed and maintenance free.

Check the condition and tension of the belt that drives the alternator.

Check your owner's manual for the tune up and electrical service intervals.

Diesel engines do not have an ignition system as fuel is ignited by the heat of compression. They have GLOW plugs which pre-heat the combustion chamber (or the air) for "cold" starting. When the ignition switch is turned to the "ON" position, an alert light is illuminated to signify the warm-up. When the light is out, you may start the engine.



The fuel system provides the correct fuel/air mixture under all operating conditions. It must be driver controlled (accelerator pedal).

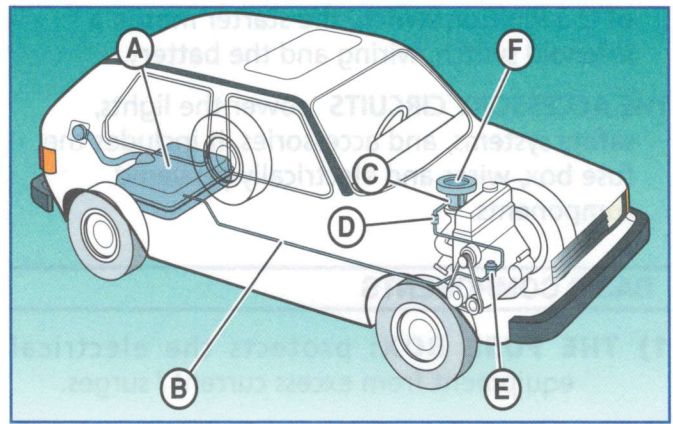
It must also provide fuel enrichment for starting cold engines and compensate for hot engine and high altitude operating factors. All of this must be achieved without diminishing performance in both power and economy while complying with exhaust emission standards.

Most vehicles use a fuel injection system to deliver the fuel under pressure into the combustion chambers, or into the airflow as it enters each cylinder.

ELECTRONIC COMMAND MODULE (ECM)

Modern electronic technology utilizes a variety of sensors that feed information to the ECM. This central computer controls all aspects of your engine's performance, maximizing power, fuel economy, and diminishing air pollution.

The ECM can, in some cases, be programmed to limit vehicle speed for a "specified vehicle key" - an option for parents to prevent their child from speeding. The electronic command module also receives data from the Traction Control System (TCS). When necessary to reduce wheel spin under hard acceleration, the ECM will reduce engine speed and torque by cutting off the fuel supply to each cylinder or by altering the spark timing.



THE BASIC COMPONENTS

- A) FUEL TANK:** a reservoir for fuel. A gauge to inform the driver of the fuel available.
- B) FUEL LINE:** steel tubes connect the tank to the carburetor or injection system.
- C) FUEL INJECTION:** supplies fuel to engine. Gas pedal controls air/fuel flow.
- D) FUEL FILTER:** removes dirt and contaminants from the fuel.
- E) FUEL PUMP:** electrical or mechanical device that forces fuel from the tank to the carburetor.
- F) AIR FILTER:** removes dirt and dust particles from air entering engine.
- TURBO:** (not shown) an exhaust-driven turbine to increase the air entering the cylinders.



Environmental Tips

Gasoline contaminates soil and ground water and poses a risk of explosion and fire. Store it carefully (never for an extended period of time), and try to use it up entirely. If not, bring it to a hazardous waste disposal site. Conserve fuel, a non-renewable resource, by proper driving habits and eliminating unnecessary trips (ride sharing). Maintenance will also reduce fuel consumption and pollution.

MAINTENANCE TIPS

Check the fuel gauge every time you start your vehicle. Keep the fuel level above the one-quarter mark to avoid:

- Condensation in cold weather
- Fouling or clogging with contaminants
- Running out of gas.

IN WINTER, keep the fuel level above the one-half mark. Never fill-up just prior to parking (this can

lead to a frozen gas line). IN SUMMER, avoid filling the tank completely in order to leave space for gasoline expansion.

When you refuel, turn off the engine. Make sure no one smokes / uses a cell phone nearby and do not overfill as drips can damage the vehicle paint.

Check the owner's manual for recommended service intervals.

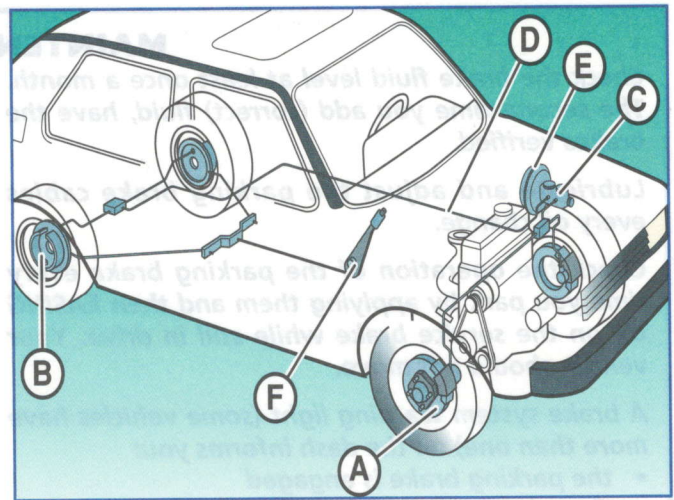


The brake system permits the driver to slow or stop the rotation of the tires. The friction of the tires against the road surface will then slow and/or stop the vehicle. Modern vehicles are equipped with 2 braking systems: a dual hydraulic brake system (service brakes) and a mechanical brake system (parking or emergency brake).

BASIC COMPONENTS

- A) DISC BRAKES:** superior brakes (cool faster) that utilize a pinching action on a metal disc to slow or stop rotation of the tire - on the front wheels (as the front does 70% of braking) - optional on all four wheels.
- B) DRUM BRAKES:** brake shoes (hemispherical type) push outward on a rotating drum. (Because they are enclosed, they retain heat and may overheat more easily.)
- C) DUAL MASTER CYLINDER:** brake pedal applies pressure on two pistons that pressurize the brake fluid. The fluid transmits this pressure to each wheel where it activates the disc or drum brake mechanisms. Two reservoirs supply extra fluid when needed. The dual systems each operate independently, in case one should fail, the other will still function.
- D) BRAKE LINES:** stainless steel tubes full of brake fluid that conduct the hydraulic pressure.
- E) POWER BRAKE:** an engine-activated booster unit that reduces the effort required to apply the hydraulic brakes. Will operate normally one more time if the engine should stop operating.
- F) PARKING BRAKE:** a lever or foot pedal that mechanically (cables and levers) activates the rear brakes only (most vehicles). Can be used for parking and if the hydraulic brakes fail.

INDICATOR LIGHT: (not shown) comes on if one of the dual hydraulic brake systems should



fail or in some vehicles, if the brake fluid is low.

ANTI-LOCK BRAKE SYSTEMS (ABS)

All vehicles manufactured since 2012 are equipped with ABS (part of the ESC/ESP/TCS required by law). The ABS System assists you; allowing you to perform an emergency stop while retaining steering control. You apply the brakes fully. The onboard computer controls the brake pressure at each wheel; cycling from locked to slightly rolling in a pumping-like action many times a second.

The result is continuous braking action, under control while maintaining steering control. The vehicle will not rotate on its axis! You do not have to modulate the pressure on the brake pedal. **HAMMER THE BRAKE.** Brake as hard as you can, target your path of travel, steer where you want to go; you will reduce speed rapidly and still change direction.

REMEMBER, BRAKE AND STEER!

You should practice emergency stops to learn the technique required to take full advantage of the system. Most drivers defeat the system by easing off the pedal when the pedal begins to pulsate, or by attempting to pump the brake pedal out of habit.



Environmental Tips

Brake fluid is toxic, can contaminate soil and water and can contain heavy metals. Store in a safe place and recycle or dispose of at hazardous waste sites. Most other brake components can be recycled; if not, dispose of properly.



MAINTENANCE TIPS

Check the brake fluid level at least once a month. The second time you add (correct) fluid, have the brakes verified.

Lubricate and adjust the parking brake cables every oil change.

Check the operation of the parking brake every time you park by applying them and then EASING UP on the service brake while still in drive. Your vehicle should not move.

A brake system warning light (some vehicles have more than one) on the dash informs you:

- the parking brake is engaged
- there is a brake system malfunction
- the brake fluid level is low

Most drum brakes are self-adjusting - while reversing and braking or, in some recent models, as the parking brake is applied.

If the brake pedal feels low or "spongy" (is soft but firms up when pumped), the vehicle pulls to one side during braking, or makes any unusual noises (grinding or squealing) have the brake system checked by a service technician.

Have the brake system cleaned, verified and adjusted every spring even if it does not demonstrate any unusual symptoms.

With ABS brakes, check the owner's manual for service (brake fluid must be replaced at specified intervals).



Trip Planning

Whenever you plan to drive a vehicle, you must consider where you are going and the safest possible route to use. A route that will present the least number of potential hazards will reduce the risk of a mis-adventure or having to cope with an unforeseen emergency situation.

Always work out the route in advance (use a map); planning the most direct route with the fewest maneuvers will usually diminish the risk. Take into account rush hour traffic, available freeways, one-way streets, or problems associated with driving in an urban area. Listen to radio stations that broadcast road and weather reports.

Calculate the length of the trip in miles, and calculate the average speed you can expect to travel on the type of roads that you have selected; how long it should take you to reach your destination if there are no unforeseen occurrences. Leave yourself sufficient time (with an extra margin) to reach your destination.

condition. Checks should be performed every time you drive. On short trips, 50 miles or less, these will normally ensure a trouble-free excursion. However, before a longer journey, take the vehicle to your service station to be checked and serviced more completely.

This should include the following:

- Brakes (condition / adjustment)
- Tires (condition / inflation / the spare)
- Fluid levels (battery, cooling system, power steering, brake fluid, engine, transmission and differential)
- Belts and hoses
- Front-end- steering and alignment
- Shock absorbers
- Exhaust system
- Lights and electrical system

Make sure that the fuel tank and windshield washer reservoir are full and that you have plenty of windshield washer fluid in reserve. Check your emergency supplies and tool kit. (Chapter 20 - Adverse Conditions) Make sure that you have an extra set of keys on you at all times.

VEHICLE MAINTENANCE

Your vehicle should always be in proper



LOADING YOUR VEHICLE

Check the owner's manual for maximum load and recommended tire pressure; adjust the pressure to the specifications. Pack luggage carefully to distribute the weight as evenly as possible. Make sure the load is secure so that it will not move under hard braking or sudden maneuvers. (This is especially important in vans and hatchbacks as luggage is stored in the passenger compartment). Don't block your view to the rear or to the blind spots. Heavy articles should be at the bottom; emergency equipment and the spare tire should be accessible.

Only light luggage should be stored in a car-top carrier and secured using straps. Check the tightness of these after one-half hour and again every time you stop. Be aware that the center of gravity/wind resistance of the vehicle changes with a roof-top carrier, and adjust your driving.

TOWING A TRAILER

Towing requires major adjustments by the driver. Quick swerving maneuvers are not possible; stopping distances are increased. Acceleration is slower. Passing maneuvers take longer and need more space. Adjust following distance to a minimum of 4 seconds and search further ahead. Control speed on downhills and assist the transmission on grades by shifting to the appropriate gear. Practice reversing with an empty trailer until you are confident of your ability to park.

To tow a trailer consistently, the vehicle requires a tow package (suspension, shocks, radiator, differential, etc.). Check the engine oil and transmission fluid frequently. Use an appropriate trailer hitch and attach the safety chains. Install special side-view mirrors and a hook-up for the trailer lights. You may need



extra emergency equipment for breakdowns. Check the trailer manual for additional information and the vehicle manual for the maximum towing load.

When packing, load heavy items at the bottom over the axle. Distribute the weight evenly from side to side and secure the load firmly. Check the trailer and vehicle are level when finished. After one-half hour of driving, stop and check the hitch connections, straps, etc. Repeat this inspection each time you stop.

PERSONAL PREPARATION

Get plenty of rest prior to the journey. Plan your route and rest stops. Avoid rush hour and congested roadways. Be certain to bring extra money or credit cards to cover unforeseen expenses.

Never start out at the time when you would go to sleep. Your alertness is at its lowest at this time. If, while driving, you find yourself becoming fatigued, stop and rest or change drivers. On long trips, travel with at least one companion who has a valid license, and split the driving. Every two hours, stop for a break. Make sure you have all necessary documents in a safe and easily accessible place. If you take medication, take along sufficient medicine to last the trip. Make sure your vehicle insurance and medical coverage is proper for the area you will be visiting.

SAFETY TIPS



Be aware of your down time between one and five p.m. and plan to take a break during that period of the day. Since two out of three traffic fatalities occur at night, avoid driving after dark when visibility is limited, and particularly after 11 p.m., when you are more apt to fall asleep.



PLANNING THE TRIP

For short trips, work out the route in advance, especially when traveling to a new location. Take into account rush hour traffic. Use a map to locate the route, highways, streets, etc. that you must use. Contact road information services to check the route; have alternate routes planned, just in case something unexpected develops. While driving, listen to a local radio station that transmits road and weather reports. Allow sufficient time for the journey.

For longer trips, consult the Internet, your local auto club, or tourist agency. They can supply maps (strip maps) as well as assist you to plan a scenic route or the shortest possible trip. Recommended service stations and hotels can also be supplied.

Familiarize yourself with these road maps and the legend (key that explains the symbols) that appears as an insert. Study the distance scale and calculate the distances to be traveled daily.

Plan rest and overnight stops in advance. Reserve accommodations; make sure you ask about rates and the availability of parking. If you are going to be late, call ahead, and cancel if necessary. Don't speed up to make up for lost time or stay on the road longer, as this may put you and your passengers in danger. Include time for unexpected stops or delays. Calculate your budget and allow for unforeseen expenses. When travelling alone, never check a road map while driving; pull off the roadway into a rest area or onto the shoulder when this can be done safely.

While on the road, try to start out early each day. Eat lightly to avoid drowsiness, and allow time to stretch your legs at each stop. Keep your radio tuned to local stations that transmit

regular road and weather bulletins (these are often posted on roadside signs). Often, they will warn of unforeseen circumstances that you may be able to avoid by a slight detour.

An unplanned scenic stop to avoid being caught in rush hour traffic may get you to your final destination at about the same time without the aggravation. Keep alert. Adapt the SIPDE system to the driving environment and you will enjoy your journey without any mishaps.

ROAD MAP SKILLS

Using road maps is a basic skill that you should master. Acquire state and local road maps, and complete these exercises.

A) On the local map, locate where you live.
Determine the map co-ordinates for your home. (Map co-ordinates are located on two sides of the map. One side uses numbers and the other uses letters.)

Place your finger on where you live and then move across the map horizontally to locate the letter co-ordinate. Repeat moving vertically to find the number. Put these two together (example D4) and these are the map co-ordinates for your home.

Repeat this exercise for your school, the city hall and the local court house.

B) Find the map scale. (This informs you of distance in miles as related to this particular map) Measure the distance, using a ruler, as the "crow flies" from your home to the city hall. That is a straight line measurement. Compare this distance to the scale and convert it to miles.

How far is it? Repeat for your school and the local court house.

C) Plan the route that you would use to get from your home to school, the city hall and

SAFETY TIPS



Pre-trip planning, preparing your vehicle and yourself, and then exercising control of the hours driven by each driver with planned rest stops will ensure the safest possible trip with the least number of inconveniences. Travel safe! Travel smart!



the court house. Be careful to include the possibility of one-way streets, recent construction, as well as the safest route possible. Notice that the driving distance is much longer than your previous measurement.

Calculate the amount of time required. Allow for the posted speed limit and some extra time for unforeseen delays.

D) On the state map, find your community in the map index. It is listed alphabetically. Beside the name, you will find the map coordinates for your community. Locate your community on the map. Choose another community where a friend or relative lives outside your local area. Look it up on the index, and locate it on the map.

Are the names written in the same size type? The larger the type, the greater the population. Are the symbols used the same? Check the map insert for the legend as to the meaning of the different symbols.

E) Measure the distance between them (as the "crow flies") using the map scale. Check the map mileage chart. If both are listed, the driving distance will be listed. How do they compare?

F) Plan a route to travel from your home to the other community. Follow this route on the map. As you move from one place to another, the distance in miles will be printed over the roadway. Mark them down.

When you reach your destination, add them up. This is your traveling distance. How long should this trip take? Allow for unexpected delays, construction, traffic jams, etc.

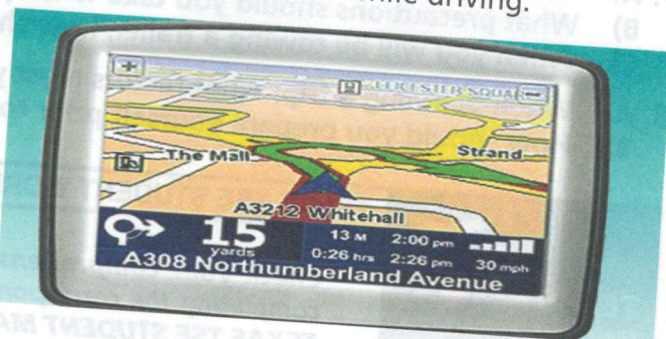
G) As you move along your route, notice that all roadways do not have the same symbols. Check the legend to find the meaning of the different symbols. List the roads that you will use to travel to the other community. What

speed limits will be posted on these roadways? What type of traffic can you expect? Plan rest stops.

H) As a project, choose an out-of-state city or town. Plan a trip to this locale. Visit a local auto club to obtain a strip map to that location. Create a budget to travel and visit including overnight stops, gas, food, etc. Plan the route. Include some sight-seeing and the necessary rest stops. Compare notes.

I) Using the internet; many websites offer helpful trip planning aids; <http://maps.google.com/> and <http://www.mapquest.com/> are two examples. By entering your starting location and your final destination a route is chosen and listed in a step by step manner describing distances and travel time.

J) GPS (Global Positioning System) is a satellite based navigation system for automobile applications; the GPS receiver can determine its location, speed, direction, and time. The vehicle's location is displayed on an electronic map screen. GPS will navigate a route to a specific address through turn-by-turn directions. GPS receivers are now available factory installed with the screen incorporated in the dash or "after market". While your vehicle is parked enter the destination into the device (or do so the night before); a route is planned and the directions are visually and verbally presented while you drive. Be careful, while in use, not to let it become a distraction while driving.



SAFETY TIPS



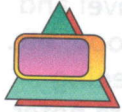
Map skills are essential to planning a trip. Remember, you must never consult a map while driving - this will distract you. Ask a passenger to act as navigator. If this is not possible, stop in a safe place before consulting the map.





DRIVING PLAN

The student formulates a Driving Plan incorporating the knowledge and skills of Module Ten (Vehicle Requirements) to endorse, to promote and to sustain lifelong legal and responsible reduced-risk driving practices in the HTS.



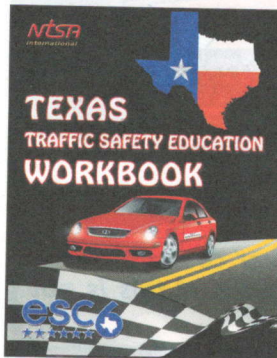
Module Ten Review

VOCABULARY - WRITE A SHORT DEFINITION FOR THE FOLLOWING :

- Alert lights
- Brake failure
- Ignition system
- Blowout
- ABC fire extinguisher
- Starting system
- Compact spare
- Power steering
- ECM
- Engine stall
- Shock absorber
- Master cylinder
- Flooded engine
- Tire tread
- Disc brakes
- Engine overheats
- Tire rotation
- ABS

TEST A- ANSWER THE FOLLOWING QUESTIONS.

1. A) Describe how to react when each alert light (Page 22.2) illuminates.
2. A) How would you respond to a blowout while driving?
B) Describe the procedures for changing a tire.
C) What precautions should you take when driving with a compact spare?
3. A) What should you do when the engine stalls while driving?
B) How will an engine stall affect the steering and brake systems?
4. A) How would you start a flooded engine?
5. A) What should you do if the temperature gauge indicates the engine is heating up?
B) If you must stop due to overheating, how would you proceed?
6. A) What should you do if the temperature gauge indicates the engine is heating up?
7. A) How can you make sure that your vehicle is serviced properly?
B) What precautions should you take when packing for a trip?
C) When you will be towing a trailer, how should you prepare yourself?
8. A) When planning a trip, what factors must you take into consideration?
B) How should you prepare yourself prior to the trip?



TEXAS TSE STUDENT WORKBOOK

Check your comprehension and mastery of the contents of this Module by completing the corresponding exercises that are found in the complement to the TEXAS TSE STUDENT MANUAL:

TEXAS TSE STUDENT WORKBOOK

Complete the assigned questions in the workbook. If necessary, review the chapters when uncertain of an answer and refer to your instructor for further guidance.