

**UNIT 5 MAINTENANCE OF FUEL SYSTEM, COOLING  
SYSTEMS, LUBRICATION SYSTEM  
AND VEHICLE BODY**

## servicing and maintenance of fuel system of different types of vehicles

The fuel system within your automobile is usually either mechanical or electronic. Most of today's vehicles are equipped with an electronic fuel system. The fuel system usually comprises the **fuel tank, pump, filter, and injectors or carburetor.**

- The **fuel pump** is needed to pressurize fuel from the gas tank and deliver it to the engine.
- In an electronic fuel system, fuel injectors eject fuel into the motor's combustion chambers. The car's computerized system manages this process along with the position of the throttle, the air-fuel ratio, and the exhaust byproducts.
- The **fuel pump** is electronically controlled to obtain the fuel from the tank and deliver it throughout the system. You can find it inside or next to the fuel tank.
- The **fuel filter** filters out dust and debris from the fuel, so it does not get into the engine. These contaminants can sometimes get picked up when the gasoline moves from different areas.

The best way to care for your fuel system and its components is by making the following efforts:

- Replace your fuel filter on time and according to your manufacturer's recommended intervals.
- Keep the fuel system clean by having the throttle body and fuel injection system cleaned professionally (~20,000 to 30,000 miles). This type of job is not recommended to do at home.
- Don't let your fuel levels get too low, or else it can harm the fuel pump. A good rule of thumb to follow is not letting your tank fall below a quarter of the tank.

Following these maintenance tips can help your engine attain a proper air-fuel ratio mixture and reduce strain on your fuel system parts. Furthermore, your car will run more efficiently with better mileage and fewer emissions. Lastly, these tips can also prevent you from dealing with inconveniences like a breakdown.

If your vehicle needs a fuel system service or repair, we welcome you to bring your car to West Coast Tire & Service.

### 5. Start With The Right Gas

Of course, treating your fuel system right means only putting the right fuel in the tank. Luckily, gas stations make it easy, since you'll only find high-quality unleaded (and sometimes diesel) at most reputable filling stations. But make sure not to put diesel gas in a car that requires regular gasoline or vice-versa. Generally, diesel pump nozzles are too wide to put into the filler neck of gas-burning cars, but a gas nozzle will fit right into a diesel vehicle. No matter which fuel your engine prefers, the fuel system can become severely damaged by running the wrong one. So, if you drive a diesel vehicle, be extra careful not to accidentally fill up with regular 87 octane.



### 4. ...But Don't Bother With Premium Fuel Unless It's Necessary

If the right gas is good, then more premium fuel must be even better for my car, right? One might think so, but there's no need to spend the extra few dollars on a tank of premium fuel compared to regular unleaded unless it's required by the

engine. In some high-performance, high-compression engines, higher octane fuels are more stable, resisting combustion until the very last second for the best efficiency and horsepower. However, in the engine of a typical passenger car, compression ratios aren't high enough to require anything more than regular unleaded. Adding premium fuel to an ordinary street car engine won't have any measurable impact on performance or efficiency.

### 3. Fuel System Additives

Don't be misled by products that claim you can simply pour them into the gas tank or add them to the fuel itself to boost performance or efficiency. If the claim seems too good to be true, then it probably is. There's really nothing you can merely add to the fuel tank to get your car to perform better.



### 2. Fuel System Cleaners

Having said that, there is one thing that might be worth adding to your fuel system: a proven fuel system cleaner. On newer, modern vehicles, even this is probably unnecessary. However, on high-mileage vehicles, or vehicles that are driven infrequently, carbon deposits can build up inside the engine, on intake valves and fuel injectors, causing the engine to run poorly. The right fuel system cleaner can be part of a solution that helps keep your high-mileage engine running strong. Speak with one of our technicians for recommendations on what works best in your particular Toyota.

### 1. Fuel System Deep-Cleaning Service

Instead of relying on a chemical additive to keep your fuel system clean, you can get a deep-clean performed by the pros here at Capitol. We can physically remove the fuel injectors from the engine, get them clean using special tools and chemicals to remove all carbon deposits. Then, we reinstall the injectors, add a new fuel filter and you should enjoy better fuel economy and everyday performance. While this service is typically only required by high-mileage vehicles, if you experience sluggish throttle response, have one of our technicians inspect your vehicle. If we suspect the fuel system is to blame, we've got the tools and the know-how to repair it right here at Capitol.

#### **calibration and tuning of engine for optimum fuel supply**

Calibrating fuel injectors are intended to simulate closely the function of fuel injectors in the fuel injection system of a diesel (compression-ignition) engine.

Injection pumps for emission-controlled engines require a new generation of calibrating injectors in order to comply with the higher injection pressures. The field of application is similar to those of the calibrating injectors specified in [ISO 7440-1](#) and of the calibrating nozzle specified in [ISO 4010](#). Compared with calibrating injectors according to [ISO 7440-1](#), the new designs show the following differences:

- — change-over from high spring nozzle holder to low spring nozzle holder,
- reduction of masses,

- — reduction of dead volumes, e.g. edge filter.

Therefore, the following parts are modified:

- — nozzle holder body,
- — nozzle retaining nut,
- — edge filter,
- — spring,
- — needle valve assembly and pintle nozzle,
- — distance sleeve.

The following parts are not modified:

- — the orifice plates with the orifice diameter range from 0,4 mm to 0,8 mm,
- — the optional spray damper,
- — the distance sleeve of the calibrating fuel injector with the single hole orifice plate.

## 1 Scope

This International Standard specifies two types of calibrating injectors intended for testing and setting diesel fuel injection pumps on test benches.

It applies to

- a) calibrating injectors for different orifice plates, max. delivery range 400 mm<sup>3</sup>/stroke;
- b) calibrating injectors with pintle type nozzle, max. delivery range 200 mm<sup>3</sup>/stroke.

The field of application is similar to the calibrating injectors specified in [ISO 7440-1](#) and to the calibrating nozzle specified in [ISO 4010](#).

Compared to the calibrating injector specified in [ISO 7440-1](#), the calibrating injectors specified in this International Standard represent an advanced stage of design which is more appropriate to modern high pressure/high performance fuel injection systems.

Specification of the type of calibrating fuel injectors to be used, the appropriate single hole orifice plate size or pintle nozzle (as applicable), high pressure pipes, exact limits, etc. is left to the manufacturer of the injection equipment and/or the manufacturer of the engine.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

- [ISO 4010:—<sup>1</sup>](#), *Diesel engines — Calibrating nozzle, delay pintle type.*
- [ISO 4113:1988](#), *Road vehicles — Calibration fluid for diesel injection equipment.*
- [ISO 7440-1:1991](#), *Road vehicles— Fuel injection equipment testing — Part 1: Calibrating nozzle and holder assemblies.*
- [ISO 7440-2:1991](#), *Road vehicles — Fuel injection equipment testing — Part 2: Orifice plate flow-measurement.*

Cooling system-

The main purpose of cooling system is to keep the engine at its most efficient operating temperature at all speed and under all operating condition.

**TYPES OF COOLING:-**

1. Air cooling – Here there are metal fins on the heads and cylinder to dissipate heat from the engine. Even fans are used on some air – cooled engine to improve air circulation around the cylinder and heads.

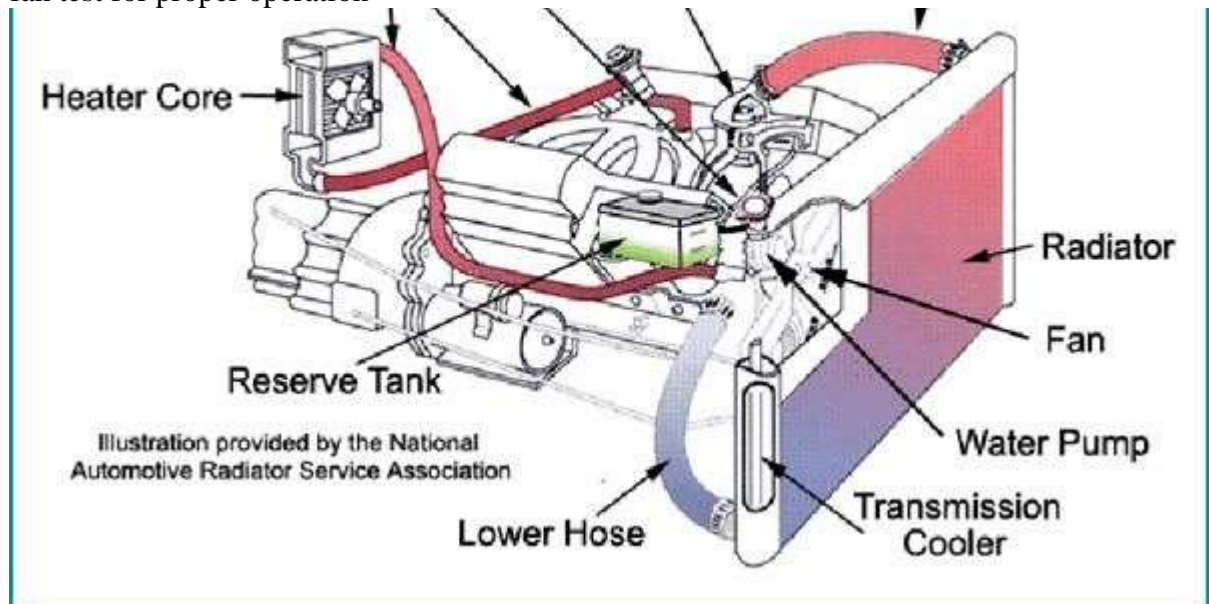
2. Liquid cooling – Here the liquid is circulated around the cylinder to observe from the cylinder walls. The liquid used is water, but even antifreeze solutions are used as coolant to prevent freezing in cooled weather.

## COOLING SYSTEM

- Check the radiator for any damage and blocks
- Check the hoses that connect radiator and engine
- Check for any leakage
- Check the fan belt
- Use clean water in the radiator

## COOLING SYSTEM AUTO MAINTENANCE

- a visual inspection of all cooling system components, including belts and hoses
- a radiator cap pressure 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 cooling fan test for proper operation



- **Antifreeze/Coolant**
- The main function of the 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.
- 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 heat.  
An adequate amount of an antifreeze/coolant and water mixture is necessary to reduce the possibility of engine overheating and freezing, and contain additives 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 automobile engines alone.

- The fluid used in most vehicles is a mixture of water and ethylene glycol, also known as "antifreeze" or "coolant". By adding antifreeze 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 antifreeze added, these temperatures would boil the coolant. To prevent this, the cooling system is pressurized, which further raises the boiling point of the coolant. Most systems 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.
- **Coolant Hoses**
- The radiator hoses and heater hoses are easily inspected 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 are any signs of problems, the hose should be replaced with the correct part number for the year, make, model and engine of the vehicle. Never use a universal hose unless it is an emergency and a proper molded hose is not available. 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 the cooling system is refilled with the proper coolant mixture, a pressure test should be performed to ensure that there are no leaks.
- **Belts**
- On older vehicles, the water pump is driven by either 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. Check for dry cracking on the inside surface of the belt.
- On newer 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 the timing belt at the scheduled interval.

## LUBRICATING SYSTEM SERVICING (AUTOMOBILE)

### COMMON PROBLEMS

#### **Higher Oil Consumption.**

The main factors affecting oil consumption are engine speed and engine wear. engine temperature increases at high speed due to which the oil viscosity decreases. the low viscosity oil can pass at higher rate through piston rings into the combustion chamber where it is burned. high speed can cause ring shimmy or ring float. under this condition the oil control rings cannot function effectively. crankcase ventilation at higher speeds causes more air to pass through the crankcase due to which more oil is lost in the form of mist. at high speeds more oil is fed through the crankcase to the connecting rod journals. oil consumption increases with engine parts wear. worn bearings throw more oil on the cylinder walls. oil control rings do not perform perfectly on the worn cylinder wall and hence more oil is admitted into the combustion chamber where it burns and fouls spark plugs, valves, rings, and pistons. worn intake-valve

and exhaust-valve guides increase oil consumption. therefore worn parts are to be repaired or replaced accordingly to bring down the oil consumption to the recommended level.

### **Erratic Oil Pressure Indication.**

if sometime light glows, or the gauge shows low pressure reading, then either there is less oil in the crankcase or the oil pickup is inconsistent. if light stays on all the time, or the pressure gauge constantly reads low, then the causes may be

- (t) a weak relief-valve spring,
- (ii) a defective sender unit or oil pressure indicator,
- (hi) a worn oil pump,
- (iv) obstructed or cracked or broken oil lines,
- (u) insufficient or excessively thin oil, and/or
- (vi) worn bearings, which pass more oil than the pump can deliver.

### **Excessive Oil Pressure Indication May Be Due To**

- (i) a clogged oil line,
- (ii) excessively viscous oil, (hi) stuck relief valve, and/or
- (iv) excessively strong valve spring.

## **SYSTEM MAINTENANCE**

### **Checking Oil Level.**

While checking the oil level, the vehicle should be on a level surface and the engine should be stopped. if the engine has just been shut off, then some time should be allowed for the oil to drain back into the oil pan. The appearance of oil should be noticed to check whether it is dirty, thin or thick. the oil is rubbed between the thumb and finger to check for dirt. if oil is dirty or thin it should be drained and clean oil should be filled. if oil level is less, oil should be added to the required level.

### **Changing Oil.**

The oil additives become depleted as the vehicle is driven. The antioxidant additive is used up which may cause thick tar-like deposits in the engine. The corrosion and rust inhibitors become depleted, and corrosion begins to take place on the bearing surfaces. The oil is slowly contaminated with carbon. In some cases moisture gradually forms sludge in the oil.

Oil change intervals are based on the time or mileage, whichever occurs first. it is very important to change the oil at the manufacturers' recommended intervals to maintain engine internal cleanliness and long engine life. Older vehicles usually have shorter recommended oil change intervals. When the oil is changed it is very important to follow the manufacturers' recommended oil classification and viscosity rating. The engine should be at normal operating temperature before oil is drained from the crankcase. This helps for complete drainage of oil with contaminants. to change the engine oil, the vehicle is put on a lift. An oil drain pan is placed in position and the drain plug is removed from the oil pan. After oil is drained, the plug is installed and the vehicle is lowered. then oil is filled in the crankcase.

### **Servicing the Oil Filter.**

As per the recommendation of the manufacturer the oil filter should be serviced or replaced regularly for long life of the engine. Normally oil filter is serviced with the first oil change and then after every other oil change. Some filters have replaceable elements, and with full-flow oil filters, which are commonly used, the filter element and container are replaced as a unit. a new filter should always start out with new oil.

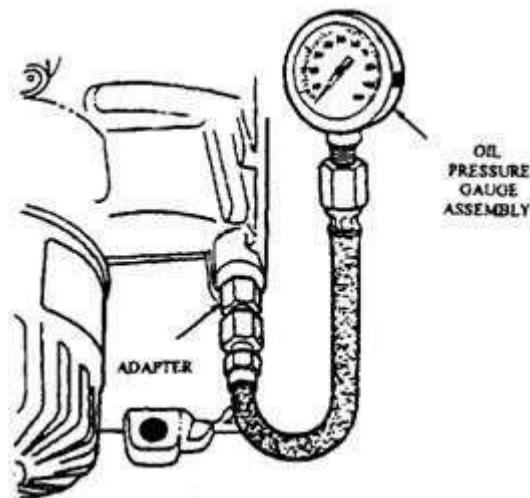
With the old filter off, the recess and sealing face of the filter bracket should be wiped with a clean shop towel. Then, the sealing gasket of the new filter should be coated with oil. The seal on the new oil filter should be lubricated with a small amount of clean engine oil before the filter is installed. When the new oil filter is installed, it should be tightened by rotating it about one half-turn after the seal makes contact with the mounting plate.

### **Servicing Oil Pump and Relief Valve.**

Oil pumps require very little service in normal operation. If pump is badly worn, the pump is to be removed and disassembled. The pressure relief valve should be removed and checked to make sure that it is moving freely. Springs of different tension may be required to be installed to change the regulating pressure in the relief valve.

if the rotor or the pump housing is worn to the point where the end play exceeds specifications, one or the other must be replaced. The clearance between the inner and outer rotors, and that between the outer rotor and the pump housing should be measured and if the clearance exceeds the specification replacement of specific part or the total pump is necessary.

similar is the case with the gear-type pump. The oil pump pickup should be checked for a plugged screen and air leaks.



### **Servicing Oil Pressure Indicators.**

If the oil indicator light does not come on when the ignition switch is turned on, the wire at the pressure switch should be removed and grounded. If the bulb does not come on, the bulb, fuse, or connecting wires have an open circuit. When the oil indicator bulb is illuminated with the pressure switch wire grounded, but does not come on with the wire connected to the switch, the pressure switch is defective. When the oil



indicator light is on with the engine running, the engine should be stopped and the oil level in the crankcase should be checked. If the crankcase oil level is correct, the oil pressure should be tested by removing the pressure switch and installing a pressure gauge in place of the switch, as shown in fig. If the oil pressure equals or exceeds the manufacturer's specifications, a defective oil pressure switch must be the cause of the illuminated oil light. A low oil pressure reading indicates a defect within the engine and the oil pump should be checked first.

### **Window rising mechanism**

Windows are provided in the upper part of the doors. They are used to admit natural light when closed and allow inflow of air when open. To provide additional passenger space without increasing the overall vehicle width, the window glasses are curved at passenger shoulder level. They are made of one-piece safety glass of about 5 – 6 mm thickness. Like windshield glass they are also made of toughened (tempered) or laminated glass. The window can be raised or lowered by means of a window lever through mechanism. A rack and pinion mechanism is employed for this purpose.

### **Door locking mechanism:**

To open from outside

As soon as the push button is pressed, the catch is raised upwards and the slotted disc rotates and free from the U- fitting. When the catch is raised up, locking bar is also raised up with the catch. When the U-fitting is free from slotted disc, the door is opened.

To open from inside

To unlock the door from inside, the locking bar is raised initially and then inside opening lever is pulled up. If this inside opening lever is pulled up the catch is raised and the slotted disc rotated and free from the U- fitting.

Door in closed position

When the door is closed the slotted disc rotates and fastens into the V- fitting. During this operation the catch with locking bar is also selected into the slot. Once the slotted side fastens the V- fitting, the door is locked

## Vehiclebody maintenance:

The most common thing is to pay attention to the mechanics and tires of our vehicles. Unfortunately, **drivers rarely think about checking their bodywork**, and that might be dangerous when traveling.

First of all, an impeccable body is aesthetically beautiful to see, and that also helps maintain its market value. Secondly, any damage to the sheet metal, no matter how small, can lead to severe damages in the medium-long term.

During the hottest months, the exterior of our car is exposed to sun, saltpeter, insects, bird droppings and other harmful contaminates. It's highly recommended to **take care of the car body**, and doing that it's not hard at all. Just take a few basic tips.



## 1. Avoid parking your car in the sun

Although vehicle paints are becoming more and more resistant, they still can deteriorate and lose their original brightness and intensity. One of the factors that accelerates this deterioration is the prolonged exposure to the sun's rays. Whenever possible, **park your car indoors or in shaded areas**. In case you don't have any place where you can protect it, cover it with a car hood.



## 2. Extreme care with sand

In summer, it is almost inevitable that beach sand ends up reaching the body of the car. Removing it is not hard, but you have to be very careful because the **risk of scratching the paint** is high.



## 3. Frequent washing

Salt peter is a very corrosive element; a serious threat to vehicle paint if we drive frequently along the coast. Washing the car weekly (best manually, and drying it with a cloth and in the shade) will erase its remains and avoid future problems.



## 4. Don't let insects and bird droppings on the car paint for a long time

Lots of mosquitoes and small insects will be embedded in on your car body, and not a few birds will soil it with their droppings. Adding to that tree resin, particles of industrial dust and tar fragments, and the chances that **the corrosion will end up affecting the paint** and the metal will be very high risk. So, don't let these elements remain on your car for long.



## 5. Nano-ceramic

Nowadays, thanks to **nano-ceramic technology**, we can find in the market new products that **protect the body** against scratches, bird droppings, solar rays and some chemical elements. They repel water easily and help maintain the paint's shine.



## 6. Repair quickly any eventual damage

Scratches, bumps and dents that break vehicle paint leave the body exposed to rust and corrosion. A slight flaw in the sheet metal that is not treated in time **can become a serious problem in the medium term**. Also, the repair cost won't be as cheap as it should have been. It is essential to act quickly against any damage, no matter how small it might be.

### Major and Minor Body works:

Vehicles are a significant investment, and it is important to take care of them properly. With regular maintenance and timely repairs, your car can last for years and serve you well. However, even with the best care, there may be times when your car needs major or minor repairs. In this article, we will discuss major and minor body repairs for cars, including what they are, how they are performed, and their importance in keeping your car in top condition.

### Major Body Repairs:

Major body repairs are typically needed when your car has been involved in a significant accident or collision. These repairs can involve replacing or repairing major components of the car's body, such as the frame, doors, roof, or trunk. In some cases, major body repairs may also include engine repairs or replacement.

When it comes to major body repairs, it is important to take your car to a professional auto body shop that specializes in this type of work. These shops have the tools, equipment, and expertise to repair your car correctly and safely.

The first step in major body repairs is to assess the damage to your car. This is done by a trained technician who will look for any visible damage to the body, as well as any damage to the frame or other structural components. Once the damage has been assessed, the technician will create a plan for repairing the car.

Depending on the extent of the damage, major body repairs may involve:

#### Frame Repair or Replacement:

If the frame of your car has been damaged, it may need to be repaired or replaced. This is a complex process that requires specialized equipment and training. The technician will use a frame straightening machine to carefully bend the frame back into its original shape. If the damage is too severe, the frame may need to be replaced entirely.

#### Door and Panel Repair or Replacement:

If your car's doors or panels have been damaged, they may need to be repaired or replaced. This typically involves removing the damaged components and replacing them with new ones. The technician will carefully align the new parts to ensure that they fit correctly and function properly.

#### Roof Repair or Replacement:

If the roof of your car has been damaged, it may need to be repaired or replaced. This can be a complicated process, as the roof is a structural component of the car. The technician will carefully remove the damaged roof and replace it with a new one, ensuring that it is aligned and sealed properly.

#### Trunk Repair or Replacement:

If the trunk of your car has been damaged, it may need to be repaired or replaced. This typically involves removing the damaged components and replacing them with new ones. The technician will ensure that the trunk opens and closes correctly and that it is aligned properly.

### Engine Repair or Replacement:

In some cases, major body repairs may also involve engine repairs or replacement. This typically happens when the engine has been damaged in an accident or collision. The technician will carefully assess the damage to the engine and determine the best course of action, which may include repairing or replacing the engine entirely.

### Minor Body Repairs:

Minor body repairs are typically needed when your car has suffered minor damage, such as a scratch, dent, or ding. These repairs are generally less complicated than major body repairs and can often be completed quickly and inexpensively.

Some common examples of minor body repairs include:

#### Paint Repair:

If your car has a scratch or other minor damage to the paint, it may be possible to repair it without repainting the entire car. The technician will carefully sand down the damaged area and then use a special paint to match the color of your car.

#### Dent Repair:

If your car has a dent, it may be possible to remove it using a process called paintless dent repair. This involves using specialized tools to carefully push the dent