Product Knowledge Document

FUEL CIRCULATING SYSTEM

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INTRODUCTION

The function of the fuel system is to store and supply fuel to the cylinder chamber where it can be mixed with air, vaporized, and burned to produce energy. The fuel, which can be either gasoline or diesel is stored in a fuel tank. A fuel pump draws the fuel from the tank through fuel lines and delivers it through a fuel filter to either a carburettor or fuel injector, then delivered to the cylinder chamber for combustion.

This PPT is prepared to recognize the main components within a basic engine fueling system and its function within an internal combustion engine and-

- Recognize the main components within an engine's fueling system
- Be able to identify the correct air and fuel ratio for an internal combustion engine
- Be able to list the main components within an engine's fueling system
- To list the main differences between diesel and petrol fueling systems

INTRODUCTION

The fuel system is made up of the fuel tank, pump, filter, and injectors or carburettor, and is responsible for delivering fuel to the engine as needed. Each component performs flawlessly to achieve expected vehicle performance and reliability.

Fuel injection is the introduction of fuel in an internal combustion engine, most commonly automotive engines, by the means of an injector.

All diesel engines use fuel injection by design. Petrol engines uses gasoline direct injection, where the fuel is directly delivered into the combustion chamber, or indirect injection where the fuel is mixed with air before the intake stroke.

On petrol engines, fuel injection replaced carburettors from the 1980s onward. The primary difference between carburettors and fuel injection is that fuel injection atomizes the fuel through a small nozzle under high pressure, while a carburettor relies on suction created by intake air accelerated through a Venturi tube to draw the fuel into the airstream.

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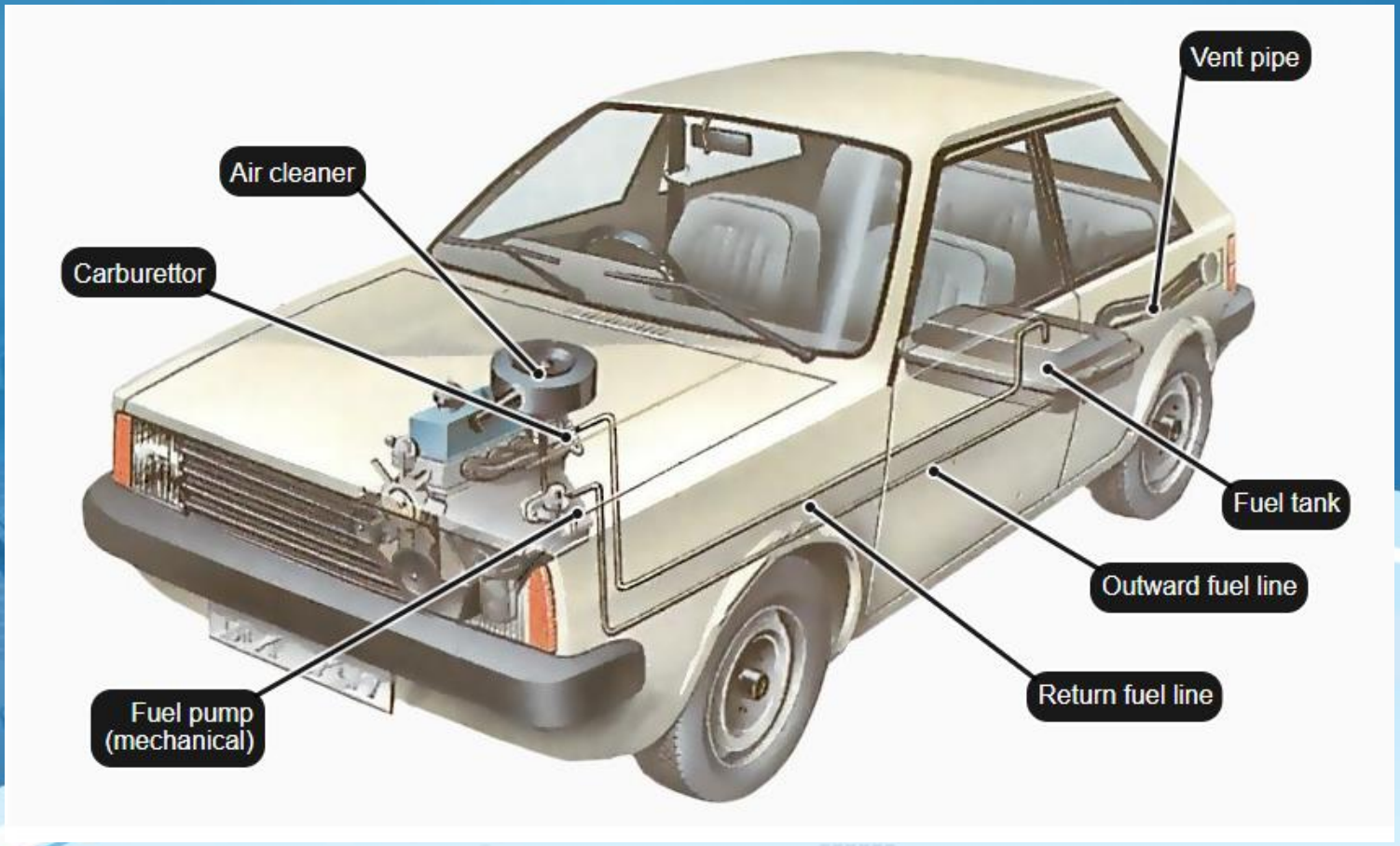
INDIAN STANDARDS FOR FUEL SYSTEM FOR IC ENGINES

There is standard available to be followed by the Indian manufacturers to meet requirements of fuel system for internal combustion engines

The below mentioned is the Standard –

1. **IS0 14681:1999-** Automotive Vehicles - Fuel Tanks For Two Or Three Wheelers
2. **IS0 1460: 2005 –** Automotive diesel fuel- Specification (5th revision)
3. **IS 2796: 2000-** BIS petrol specifications. Table 2.5
4. **IS 1593-1982-** Specification for fuel oils (2nd revision)

FUEL SYSTEM- CONSTRUCTION



Components of Fuel supply system

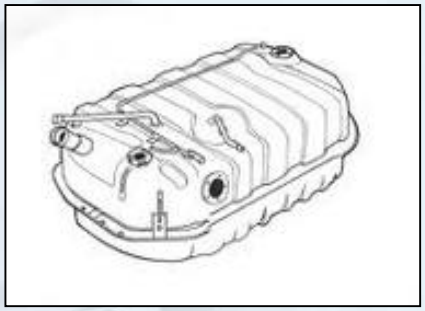
FUEL SUPPLY SYSTEM IN SPARK IGNITION ENGINE

The fuel supply system of spark ignition engine consists of:-

(i) Fuel tank
(ii) Fuel filter
(iii) Fuel pump
(iv) Carburettor
(v) Fuel pipes
(vi) Inlet manifold

MAIN FUELING COMNPONENTS

Fuel tank-



Fuel Pipes/ Lines

Fuel Filter

Carburettor or injectors

Fuel gauge

The difference between Petrol and Diesel

Petrol

- Petrol is lighter
- More volatile
- Contains hydrocarbons with around 8 carbon atoms per molecule
- A petrol engine is a spark-ignition engine
- Utilises a spark to ignite the volatile petrol/air mixture

Diesel

- Diesel oil is heavier
- Less volatile
- Greater lubrication qualities, contains hydrocarbons with around 10 carbon atoms per molecule
- A diesel engine is a compression-ignition engine
- Utilises high compression to create the high temperatures in which diesel oil will burn

- Petrol and Diesel are fuels that are particularly suitable for use in internal combustion engines
- Fuel is mixed with air and introduced into the engines cylinder in order to be burnt within the engines Otto cycle

Fuel Tank

Tank location and design (shape, volume) always depend on the available space. Most automobiles have a single tank located in the rear of the vehicle. Today's fuel tanks have internal baffles to prevent the fuel from sloshing back and forth. All tanks have a fuel filler pipe, a fuel outlet line to the engine and a vent system.

If the tank is below the level of the carburettor, a lift pump is provided in between the tank and the carburettor for forcing fuel from the tank to the carburettor of the engine. The fuel comes from the fuel tank to the sediment bowl and then to the lift pump. From there the fuel goes to the carburettor through suitable pipe. From the carburettor, the fuel goes to the engine cylinder, through the inlet manifold of the engine.

Carburettor

The basic principle of all carburettor design that when air flows over the end of a narrow tube or jet containing liquid, some liquid is drawn into the air stream. The quantity of liquid drawn into the air stream increases as the speed of air flow over the jet increases and also the quantity is greater if the jet is made larger.

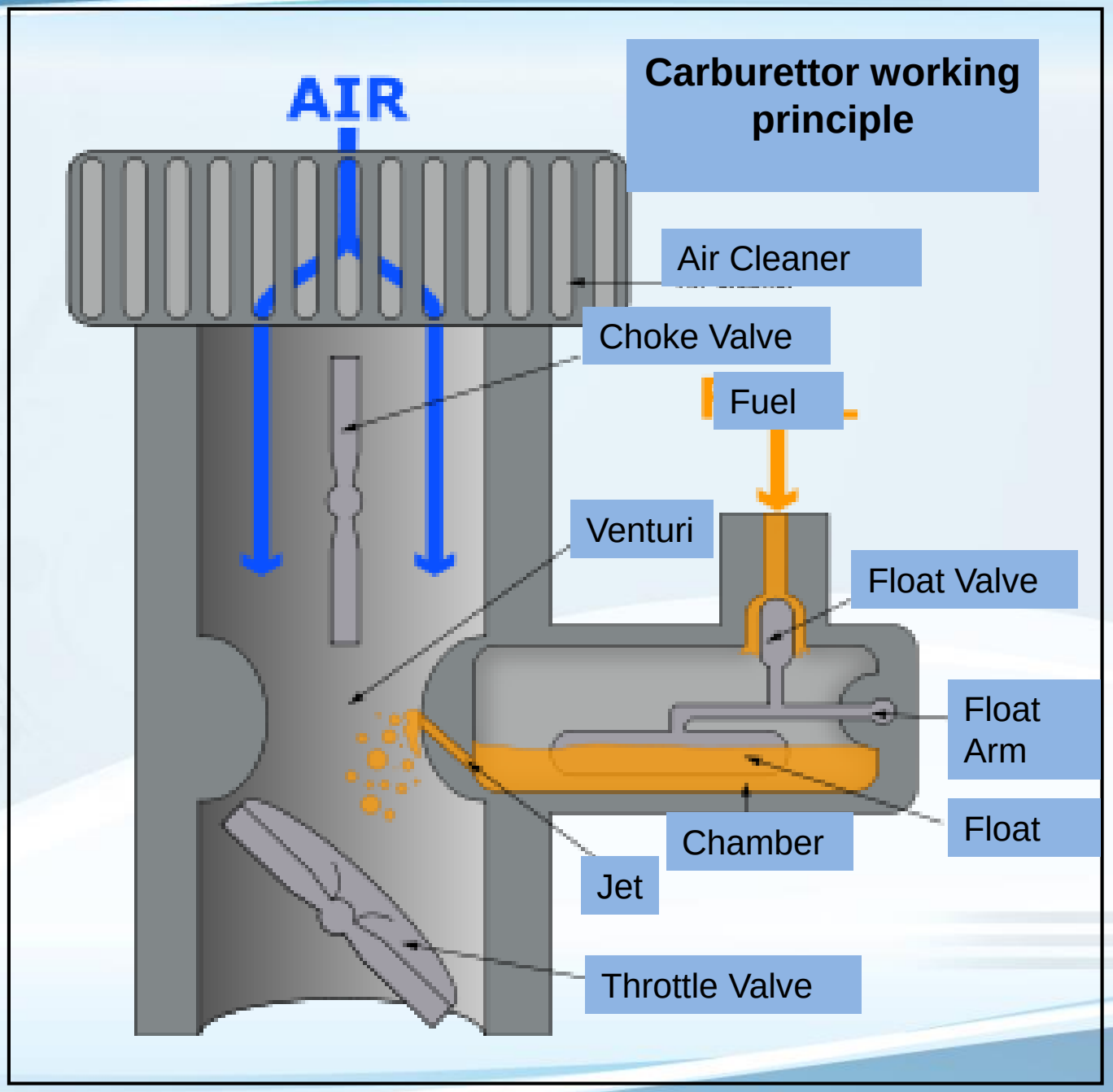
The process of preparing an air-fuel mixture away from the cylinders of an engine is called carburetion and the device in which this process take place is called carburettor

Function of Carburettor-

The main functions of the carburettor are:

(i) To mix the air and fuel thoroughly
(ii) To atomise the fuel
(iii) To regulate the air-fuel ratio at different speeds and loads and
(iv) To supply correct amount of mixture at different speeds and loads.

Carburettor



Fuel Pump

Two types of fuel pumps are used in automobiles; mechanical and electric. As engines moved away from carburettors and towards fuel injection, mechanical fuel pumps were replaced with electric fuel pumps, because fuel injection systems operate more efficiently at higher fuel pressures than mechanical pumps can generate. Electric fuel pumps are generally located within the fuel tank, in order to use the fuel in the tank to cool the pump and to ensure a steady supply of fuel.

FUEL LIFT PUMP (FEED PUMP OR TRANSFER PUMP)-

It is a pump, which transfers fuel from the fuel line to the fuel injection pump. It is mounted on the body of fuel injection pump. It delivers adequate amount of fuel to the injection pump. The pump consists of: (I) body (2) piston (3) inlet valve and (4) pressure valve.

FUEL INJECTING PUMP

It is a pump, which delivers metered quantity of fuel to each cylinder at appropriate time under high pressure. Tractor engines may use two types of fuel injection pump:

1. Multi-element pump and
2. Distributor (Rotary) type pump.

Fuel Pump

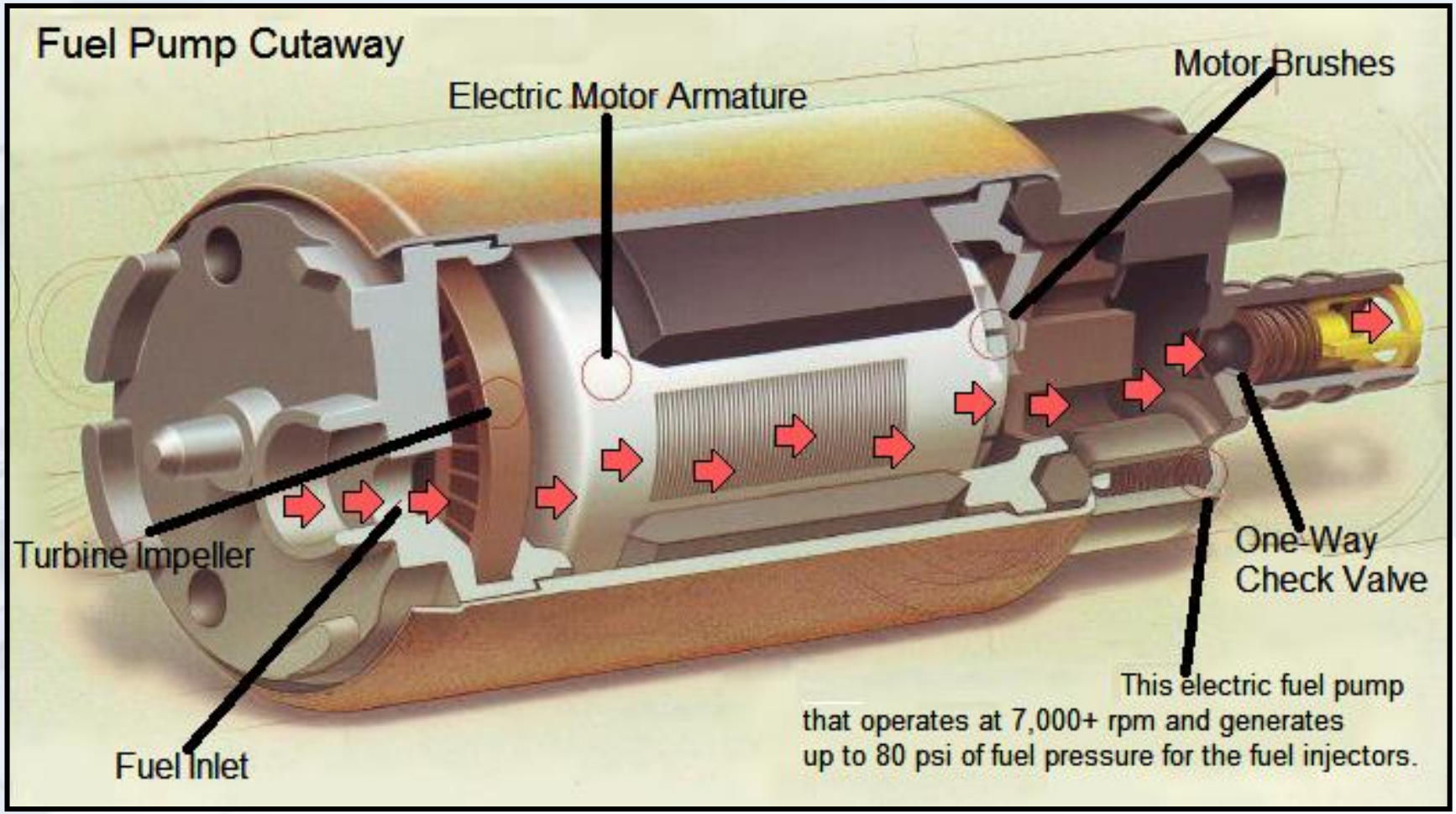


Figure- Electric Fuel Pump

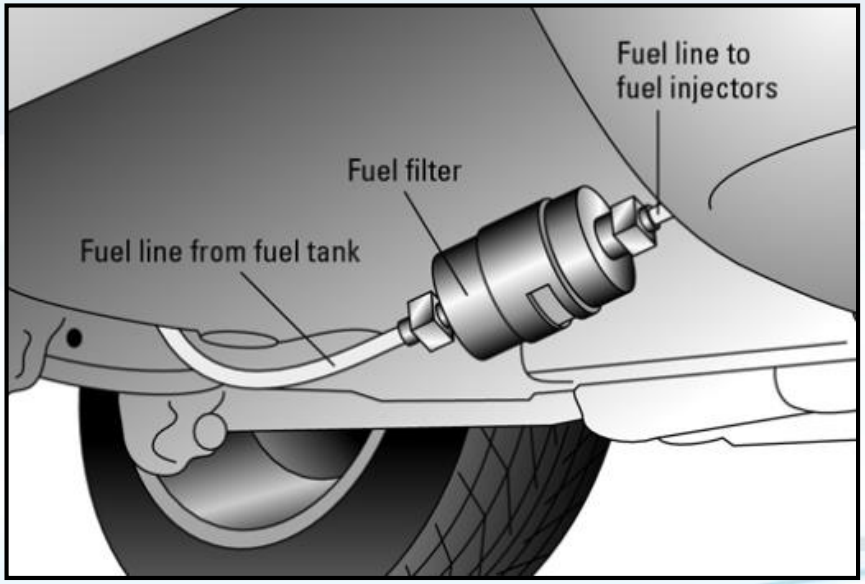
Fuel filter

It is a device to remove dirt from fuel oil. Solid particles and dust in diesel fuel are very harmful for giving a fine degree of filtration. Fuel injection equipment in diesel engines is extremely sensitive to dirt and solid particles present in fuel. A filter is used to remove the dirt and solid particles from the fuel to ensure trouble free fuel supply. It consists of a hollow cylindrical element contained in a shell, an annular space being left between the shell and the element. The filtering element consists of metal gauge in conjunction with various media such as packed fibres, woven cloth, felt, paper etc. These filters are replaced at certain intervals, specified by the manufacturer.

Usually there are two filters in diesel engine:

(1) Primary filter and (2) Secondary filter.

The primary filter removes water and coarse particle of dirt from the fuel. The secondary filter removes fine sediments from the fuel.



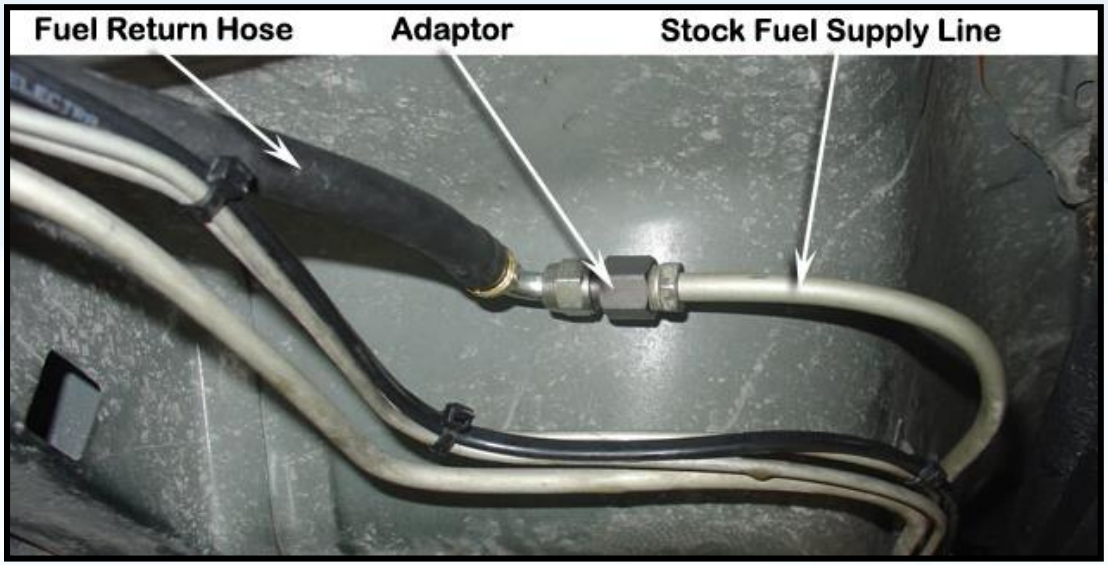
Fuel Pipe

A fuel line is a hose used to bring fuel from one point in a vehicle to another or from a storage tank to a vehicle. It is commonly made of reinforced rubber to prevent splitting and kinking.

The most usual type of connector for metal fuel pipes on modern cars is a short length of rubber hose fitting over the pipe ends and secured by two hose clips. Aluminium fuel filler tube are manufactured from an extruded tube which is then bent and formed in order to increase their ability to flex and bend without leakage in case of car crash.

Flexible aluminium tube advantages include:

1. Permeation tight
2. Flexible assembly
3. One material throughout the entire tube
4. Elimination of connections
5. Increased crash integrity
6. Vibration absorbent
7. Cooling properties
8. Recycling friendly



Material

Due to its excellent corrosion resistance against gasoline, diesel and also biofuels at room temperature, aluminium is a suitable construction material for the different components of the fuel system.

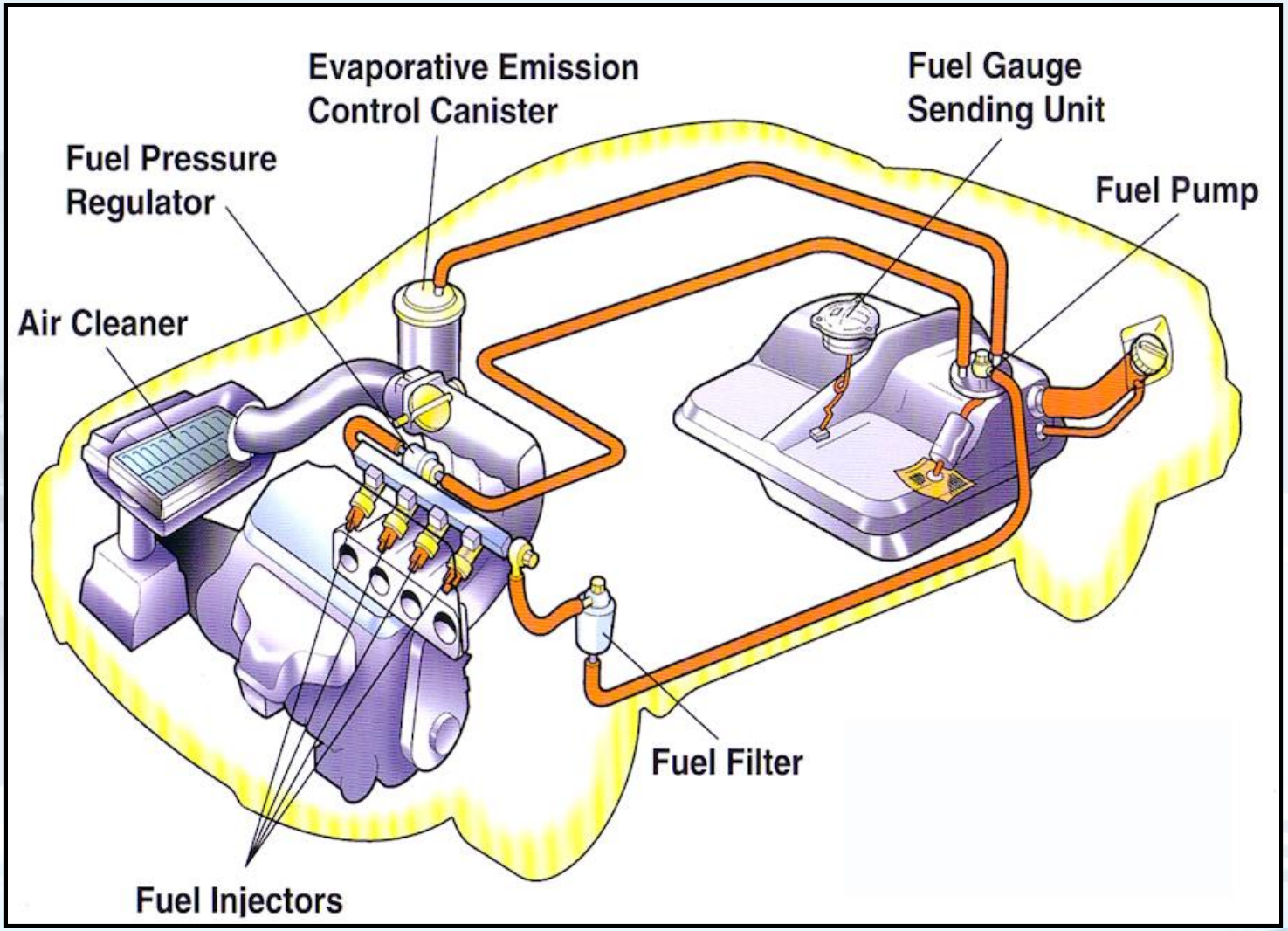
The application of aluminium in the fuel system offers significant weight savings compared to steel (50 – 70 %).

Two technologies are used to make fuel tanks for automobiles:

1. High Density Polyethylene (HDPE) plastic fuel tanks made by blow moulding
2. Metallic fuel tanks welded from stamped sheets (Steel and in particular the significantly lighter aluminium fuel tanks are only used for specialty cars)

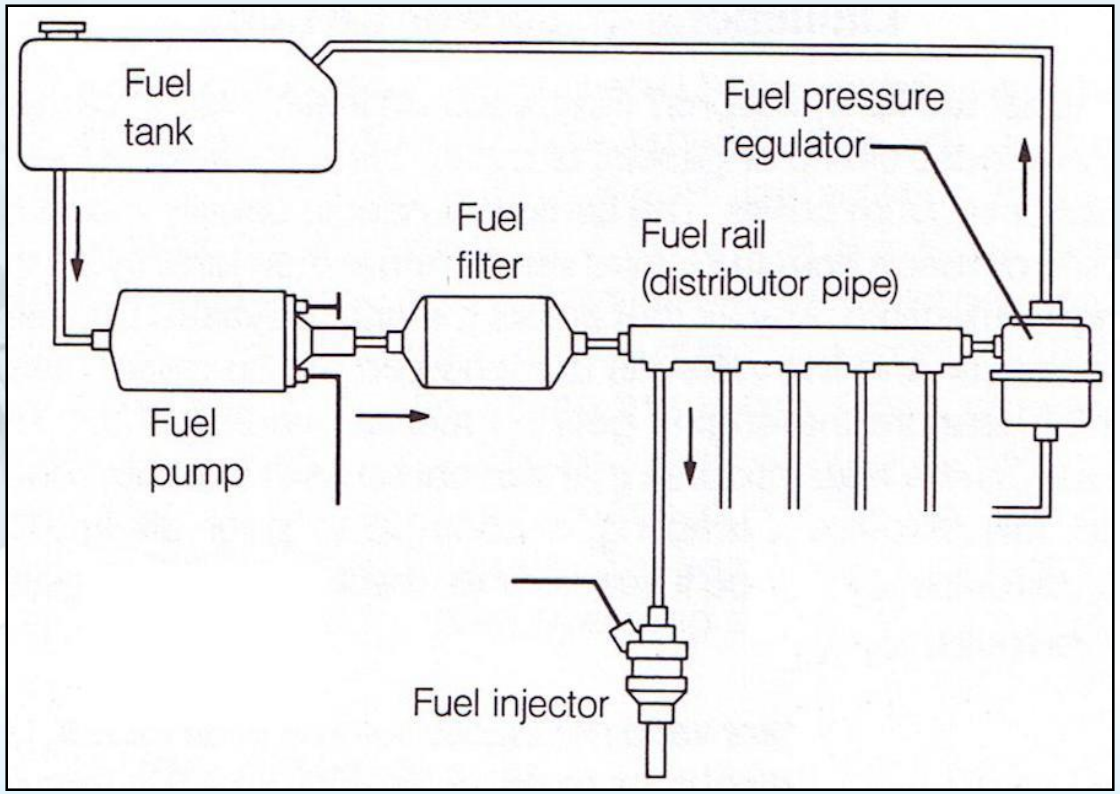
FUEL SYSTEM - WORKING

Working principle–Fueling system



Working principle– Fuel Circulating system

The function of the fuel system is to store and supply fuel to the cylinder chamber where it can be mixed with air, vaporized, and burned to produce energy. The fuel, which can be either gasoline or diesel is stored in a fuel tank. A fuel pump draws the fuel from the fuel tank through fuel lines and delivers it through a fuel filter to either a carburettor or fuel injector and finally to the cylinder chamber for combustion.



Working of Fuel Circulating system

The Functions of Fuel Injection System is –

1. To enhance the engine performance and Fuel economy
2. Initiating and controlling the combustion process
3. Preparation of the combustible charge (Just like carburettor)

The main difference between Carburettor and Fuel injection system-

Carburettor –

In carburettor fuel is atomized by processes relying on the air speed greater than fuel speed at the fuel nozzle and the amount of fuel drawn into the engine depends upon the air velocity in the Venturi.

Fuel Injection System –

In furl injection system the fuel speed at the point of delivery is greater than the air speed to atomize the fuel and the amount of fuel delivered into the air stream going to the engine is controlled by a pump which forces the fuel under pressure.

Tire Classification of Fuel Circulation system

Fuel Circulating system- Ignition systems

There are four different systems of igniting fuel:

(a) Ignition by electric spark i.e. spark ignition

(b) Ignition by heat of compression i.e. compression ignition

(c) Ignition by hot tube or hot bulb and

(d) Ignition by open flame.

Only the first two are important methods for modern engines.

Fuel Circulating system- Ignition systems

Spark Ignition-

Usually a petrol engine, where the combustion process of the air-fuel mixture is ignited by a spark from a spark plug. A spark-ignition engine is an internal combustion engine, generally a petrol engine, where the combustion process of the air-fuel mixture is ignited by a spark from a spark plug.

Compression ignition-

Generally the Diesel Engines, where the combustion process is caused by the elevated temperature of the air in the cylinder due to the mechanical compression. A compression-ignition engines, typically diesel engines, where the heat generated from compression together with the injection of fuel is enough to initiate the combustion process, without needing any external spark.

Fuel Circulating system- Ignition systems

Description	SI Engine	CI Engine
Basic Cycle	Otto cycle	Diesel Cycle
Fuel	Gasoline/ Petrol	Diesel
Introduction of Fuel	Fuel and air mixture is supplied to the engine with the help of carburettor or gasoline injection	Fuel directly injected into combustion camber, with the help of a fuel pump and injector
Load Control	throttle valve controls the supply of fuel air mixture	Quantity of fuel is regulated, not air
Ignition	Uses spark plug for ignition	Self ignition due to high compression
Compression ratio	6 to 10	16 to 20
Speed	used for high speed	used for comparatively low speed
Thermal efficiency	lower compared to CI engines	Higher compared to SI engines
Weight	Lighter due to low peak pressure	Higher due to high peak pressure

THANK YOU

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Are there any Questions?