

Use of CRDi/MPFi Technology in Automobiles

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Abstract— The use of CRDi and MPFi is becoming more and more significant in the automotive industry. Gone are the days when vehicles used to be only mechanical machines. CRDi (Common Rail Direct Injection) and MPFi (Multipoint fuel Injection) are intelligent ways of controlling the diesel and petrol engines respectively with the help of modern computer systems. CRDi and MPFi help to improve the power, performance and reduce harmful emissions from a car engine. Non CRDi/MPFi engines are sluggish, noisy and poor in performance as compared to CRDi/MPFi engines.

Keywords— Automobile, Carburetor, CRDi, ECU, Engine, Microprocessor, MPFi, Vehicle

1 INTRODUCTION

1.1 CRDi

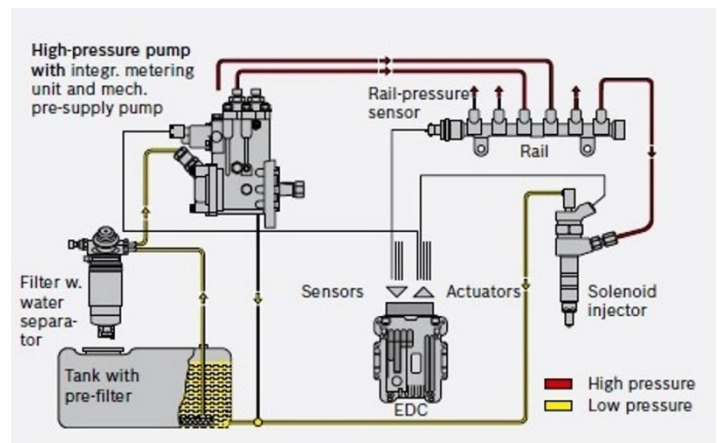
CRDi or Common Rail Direct Injection is used in diesel engines for better performance and efficiency. The concept of Common Rail Injection first began in Japan in the mid 1990's under the Denso Corp. After extensive research by the FIAT group, the final design was acquired by the German group Bosch for mass production.

In CRDi, the fuel system components are more intelligent which are controlled electrically. The traditional injectors are replaced with advanced electrically operated solenoid injectors. Injectors are opened with an ECU (Engine control unit) signal depending upon the variables such as engine speed, load, engine temperature etc.

Combustion in CRDi commences directly in the main combustion chamber located at the top of the piston crown. A fuel distribution pipe is used to maintain optimum residual fuel and acts as a fuel reservoir for all the injectors. The fuel is constantly supplied at the required pressure for injection. High pressure fuel is stored usually in this tube which then supplies it to the solenoid valve injectors as opposed to fuel injection pump supplying diesel through independent fuel lines to injectors.

Pressure generation takes place in the high-pressure pump. The pump compresses the fuel at the pressures at about 1,000 bar or about 15,000 psi. It then supplies the fuel via a high-pressure pipe to the inlet of the rail. From there, the fuel is distributed to the individual injectors, which inject it into the cylinder's combustion chamber. Most diesel engines use Common Rail with Unit-Injector system combined with a Turbocharger to achieve increased power output and meet stringent emission norms. This helps to improve engine power, throttle response, fuel efficiency and control emissions. Manufacturers use custom acronyms to make their diesel CRDi product.

SL	Acronym	Company
1	CDi	Mercedes Benz
2	CRDi	Hyundai
3	D	BMW & Volvo
4	JTD	Fiat
5	CR-4	Tata
6	DCi	Renault
7	VCDi	Chevrolet
8	TDi	Volkswagen
9	TDCi	Ford
10	i-DTEC/VTEC	Honda
11	D-4D	Toyota



Courtesy: Bosch

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1.2 MPFI

MPFI or Multipoint Fuel Injection can be considered as the analog of CRDi in petrol engines. It is different from CRDi in the sense of the amount of pressure used and the fact that it's used for petrol (gasoline engines.)

Before MPFI system was invented, Carburetors (purely mechanical engines) were used. A carburetor consisted of a single chamber in which petrol and air were mixed in a fixed ratio and then sent to cylinders for combustion to produce power. This system is purely a mechanical machine with little or no intelligence. It was not very efficient in burning petrol; it would often burn more petrol than needed at times and would cause a lot of pollution.

MPFI emerged as an excellent way to replace the carburetor. In MPFI system, each cylinder has one injector (which makes it multi-point). Each of these injectors are controlled by a small micro-processor, which keeps telling each injector about how much petrol and at what time it needs to inject near the cylinder so that only the required amount of petrol goes into the cylinder at the right moment.

The micro-processor has a number of sensors to keep track of the temperature of the Engine, the Speed of the Engine, the load on the Engine, the current state of the engine, the amount of oxygen coming out of exhaust pipes or the amount of air pressure near the cylinders. Based on these observations the MPFI system decides how much fuel should be injected i.e. the amount of petrol that should go in to make the vehicle fuel efficient.

This technology consists of the following parts:

1. Injectors
2. Fuel Rail
3. Fuel pump
4. Fuel Pressure Sensor
5. ECU
6. Sensors
7. Fuel pressure regulator



2 ADVANTAGES

- **Increased Fuel Economy:**
CRDi and MPFI engines efficiently manage fuel consumption according to the need of the vehicle. There is high output even at low rpm.
- **Reduced Noise:**
The engine does not produce any sound unlike the carburetors as there are reduced vibrations which lead to the engine running smoothly.
- **Less pollution:**
Efficient combustion of the fuel leads to reduced smoke, particulates and exhaust which ensures less pollution in comparison to purely mechanical engines (carburetors).

3 DISADVANTAGES

- **Increased Cost:**
The cost of CRDi and MPFI technology is more as compared to carburetors due to the high pressure pumps used and the engine Control Unit (ECU)
- **Cannot be used in carburetors:**
This technology cannot be applied to purely mechanical engines i.e. carburetors.
- **Spare parts and maintenance:**
Spare parts and maintenance is more expensive than purely mechanical engines (carburetors) due to the technology used in CRDi and MPFI.

4 CONCLUSION

Although CRDi and MPFI technology are more expensive than purely mechanical engines, they are better in terms of fuel efficiency, offer a better driving experience to the user and are also environment friendly in comparison to carburetors as they cause less pollution.

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