

Department of mechanical engineering



**ASSIGN
BUSTER**

The various cylinders receive the reasoning mixture in varying quantities and richness. This problem is called the maladministration and can be solved by the port injection system by having the same amount of gasoline injected at each intake manifold. By adopting gasoline Injection each cylinder can get the same richness of the air-gasoline mixture and the mall-dilutions can be avoided to a great extent. Typical pattern of mixture distribution in a multi-cylinder engine

3 Reasons for Gasoline Injection multi-cylinder engine

- 0 To improve the breathing capacity and hence the volumetric efficiency
- 0 To reduce or eliminate detonation
- 0 To prevent fuel loss during scavenging in case of two-stroke engines

Types of Injection Systems

- 0 Gasoline direct injection (GUI)
- 0 Port-alienation (a) Timed and (b) Continuous
- 0 Manifold Injection

4 Groupings

- 0 The above fuel injection systems can be roped under two heads, biz. , single-point and multi-point injection.

In the single point injection system, one or two injectors are mounted inside the throttle body assembly. Fuel sprays are directed at one point or at the center of the intake manifold. This type is also known as throttle body injection. Multiplied injection has one injector for each engine cylinder, where fuel is injected in more than one location. This is somewhat more common and is often called port injection system.

5 Continuous Injection Systems

- 0 This system usually has a rotary pump. The pump maintains a fuel line gauge pressure of about 0. 5 to 1. 5 bar.

The system injects fuel through a nozzle located in the manifold immediately downstream of the throttle plate. In a supercharged engine, fuel is injected at the entrance of the supercharger. The determined by Electronic Control Unit (ECHO) depending upon the load and speed.

6 Timed Injection Systems

0 This system has a fuel supply pump which sends fuel at a low pressure of about 2 bar when the engine is running at maximum speed. A fuel metering or injection pump and a nozzle are the other parts of the system. The nozzle injects the fuel in the manifold or the cylinder head port at about 6. Bar or into the combustion chamber at pressures that range from 16 to 35 bar. Timed injection system injects fuel usually during the early part of the suction stroke. 7 Gasoline injection in four-stroke engines 8 Fuel injection in two-stroke engines 9 Electronic Fuel Injection System Modern gasoline injection systems use engine sensors, a computer, and solenoid operated fuel injectors to meter and inject the right amount of fuel into the engine cylinders. These systems called electronic fuel injection (EFFIE) use electrical and electronic devices to monitor and control engine-operation.

An electronic control unit (ECHO) or the imputer receives electrical signals in the form of current or voltage from various sensors. It then uses the stored data to operate the injectors, ignition system and other engine related devices. Typical sensors for an electronic fuel injection system includes the following: 10 Typical Sensors 1 . Exhaust gas or oxygen sensor - senses the amount of oxygen in the engine exhaust and calculates air -fuel ratio. Sensor output voltage changes in proportion to air -fuel ratio. 2.

Engine temperature sensor - senses the temperature of the engine coolant, and from this data the computer adjusts the mixture strength to rich side for cold starting. 3. Air flow sensor - monitors mass or volume of air flowing into the intake manifold for adjusting the quantity of fuel. 11 Typical Sensors - cont'd. 4. Air inlet temperature sensor - checks the temperature of the ambient air entering the engine for fine-tuning the mixture strength. 5.

Throttle position sensor - senses the movement of the throttle plate so that the mixture flow can be adjusted for engine speed and acceleration. 6.

Manifold pressure sensor - monitors vacuum in the engine intake manifold so that the mixture strength can be adjusted with changes in engine load. 12 7.

Camshaft position sensor taxation of engine - senses camshaft/crankshaft for speed and timing of injection. 8. Knock sensor - microphone type sensor that detects ping resignation noise so that the ignition timing can be retarded. 13

0 The injector pulse width is an indication of the period for which each injector is energized and kept open. The computer decides and controls the injector pulse width based on the signals received from the various sensors. Under full load, the computer will sense a wide-open throttle, high intake manifold pressure, and high inlet airflow. The SEC will then increase the injector pulse width to enrich the mixture, which will enable the engine to produce higher power. 14 0 Under low load and idling conditions, the SEC will shorten the pulse width by which the injectors are kept in the closed position over a longer period of time. Because of this, air-fuel mixture will become leaner and will result in better fuel economy. Start injector too.

This is an extra injector that sprays fuel into the center of the engine intake manifold, when the engine is cold. It serves the same purpose as the carburetor choke. The cold start injector ensures easy engine startup in very cold weather. 15 MPH system 0 The main purpose of the Multi-Point Fuel Injection (MPH) System is to supply a proper ratio of gasoline and air to the cylinders. These system function under two basic arrangements viz. , (I) Port injection (it) Throttle body injection 16 Port Injection this system, the injector is placed on the side of the intake manifold near the intake port.

The injector sprays gasoline into the air, inside the intake manifold. The gasoline mixes with the air in a reasonably uniform manner. This mixture of gasoline and air then passes through the intake valve and enters into the cylinder. Every cylinder is provided with an injector in its intake manifold. If there are six cylinders, there will be six injectors. Figure shows simplified view of a port or multi point fuel injection (MPFI) system. Throttle Body Injection Figure illustrates the simplified sketch of throttle body injection system (single point injection).

This throttle body is similar to the carburetor throttle body, with the throttle valve controlling the amount of air entering the intake manifold. Remark already mentioned, fuel injection systems can be either timed or continuous. In the timed injection system, gasoline is sprayed from the injectors in pulses. In continuous injection system, gasoline is sprayed continuously from the injectors. The port injection system and the throttle-body injection system may be either pulsed systems or continuous systems.

In both systems, the amount of gasoline injected depends upon the engine speed and power demands. Classified into two types viz. , D-MPI and L-MPI. D-MPI system The D-MPI system is the manifold fuel injection system. In this type, the vacuum in the intake manifold is first sensed. Further, it senses the volume of air by its density. Figure shows the block diagram regarding the injection of the D-MPI system. Intake manifold vacuum sensor Mixture of air and gasoline Engine Gasoline Injection into intake manifold Injector Injection volume control ECM RPM sensor D-MPI System - cont'd. As air enters into the intake manifold, the manifold pressure sensor detects the intake manifold vacuum and sends the information to the

ECHO. The speed sensor also sends information about the RPM of the engine to the ECHO. 0 The SEC in turn sends commands to the supply for injection. When the injector sprays fuel in the intake manifold the gasoline mixes with the air and the mixture enters the cylinder. L-MAPI system 0 The L-MAPI system is a port fuel- injection system. Here, the fuel metering is regulated by the engine speed and the amount of air that actually enters the engine.

This is called air-mass metering or air-flow metering. This block diagram of L-MAPI system is shown. Air flow sensor fuel and air RPM near port 24 L-MAPI System - cont'd. Air flow sensor measures the amount of air and sends information to the ECHO. Similarly, the speed sensor sends information about the speed of the engine to the ECHO.