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Fuel Injection in the CI Engine



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For the compression ignition engine, it is very important to promote a means of injecting fuel into the cylinder at the proper time in the cycle. This is so because the injection system starts and controls the combustion process.



Objectives of the Injection System

The injection system of the compression ignition engine should fulfill the following objectives consistently and precisely:

1. **Meter** the appropriate quantity of fuel, as demanded by the speed of, and the load on, the engine at the given time.
2. **Distribute** the metered fuel equally among cylinders in a multi-cylinder engine.
3. **Inject** the fuel at the correct time (with respect to crank angle) in the cycle.
4. **Inject** the fuel at the correct rate (per unit time or crank angle degree).
5. **Inject** the fuel with the correct spray pattern and sufficient atomization as demanded by the design of the combustion chamber, to provide proper penetration also.
6. **Begin and end injection sharply** without dribbling or



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Function of fuel injection equipment

The function of fuel injection equipment is to supply the engine with fuel in qualities exactly metered in proportion to the power required and timed with utmost accuracy, so that the engine will deliver that power within the limits prescribed for fuel consumption, exhaust smoke, noise and exhaust emissions.

The fuel must be injected through suitable nozzles at pressures high enough to cause the required degree of atomization in the combustion chamber and to ensure that it mixes with sufficient air for complete combustion in the cycle time available.

In multi cylinder engines the periods of injection, the timing and the delivered quantity must be accurately metered to ensure an even balance between the cylinders.



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Fuel Injection Systems

There are two main classifications for fuel-injection systems, namely

- 1. air injection which had become obsolete but now some interest has been shown by researchers (however very high pressure is required for air) and**
- 2. solid (or airless) injection systems.**



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The airless, mechanical, or solid injection systems consist of three types.

- 1. Individual pump system:** This consists of a separate metering and compression pump for each cylinder.
- 2. Distribution system:** This consists of a single pump for compressing the fuel (which may also meter), plus a delivery device for distributing the fuel to the cylinders (which may also meter).
- 3. Common rail system:** A single pump for compressing the fuel, plus a metering element for each cylinder.



Fuel Filters

A low pressure (2.5 bar) transfer pump or fuel feed pump is required to lift the fuel from the tank, to overcome the pressure drop in the filters, and to charge the metering or pressuring unit. Three filters are recommended, namely,

1. A primary stage (a metal- edge filter to remove coarse particles, larger than 25 microns).
2. A secondary stage (a replaceable cloth, paper or lint element to remove fine particles from about 4 to 25 microns) and
3. Final stage (a sealed, non-replaceable element) to remove fine particles that escaped the secondary stage.

