

# Designing a ic engine

Design



As is mandatory in most vehicles, a Catalytic Converter is also included. 2. 4.

1. Intake System \* This involves the use of an Intake Manifold. The main purpose of an Intake Manifold is to uniformly distribute the air-fuel mixture to each intake port in the cylinder head. It is extremely important that the mixture be uniformly distributed to ensure that an optimum efficiency and performance can be obtained from the engine. It also acts as a carrier for other components like throttle body, fuel injectors, etc. \* The downward movement of the pistons induces a certain amount of vacuum in the intake manifold.

In reality, this vacuum is pretty substantial and can be used to power auxiliary systems like power assisted brakes, ignition advance, cruise control, windshield wipers, power windows, ventilation system valves, emission control devices, etc. Also, it is always desired that the air-fuel mixture be highly atomized for better combustion. Turbulence plays an important role in atomizing the mixture. This turbulence can be achieved to a certain degree if the surface of the intake and intake mixture better is by high pressure in the flow of the mixture, by reducing the cross sectional area.

But it should be done in such a way that the volumetric efficiency is not affected. The Intake manifold has usually been made from Cast Iron. But nowadays, it is being replaced by Aluminum Alloys. \* As said before, the intake manifold acts as a carrier for the Throttle Body. It is the component of the engine which mixes the air and the fuel in the pre-set mixture ratio. The intake system also comprises of the Air Induction components like the Air Cleaner and Housing, Solid and Flexible Duct Tubing and connectors which

are used for drawing in the air from ambient atmosphere. . 4. 2. Exhaust System \* Just like the presence of an Intake Manifold in the Intake System, there is an Exhaust Manifold in the exhaust system. It is an assembly designed to collect the exhaust gas from two or more cylinders into one pipe. They are usually made out of Caste Iron, to save production costs. Since the firing in each cylinder occurs at different times, the exhaust gases leaves each cylinder at different times, and the subsequent pressure waves from the gas exiting from each cylinder may not clear out in time from the manifold; which results in a back pressure.

This leads to inefficient gas exhaust and thus, the performance of the engine can be inhibited. To combat this, in this engine, a Header can be used. This a better designed, albeit costly manifold which is much more efficient at scavenging the gases from the exhaust. Headers are generally circular steel tubing with bends and folds calculated o make the paths from each cylinder's exhaust port to the common outlet all equal length, and Joined at narrow angles to encourage pressure waves to flow through the outlet, and not back towards other cylinders. The use of a catalytic converter has been necessitated for every vehicle as per the EURO 5 emission requirements. A catalytic converter forms part of the exhaust system. Its purpose is to reduce the toxicity of the gases coming out through the exhaust. \* Along with this, exhaust brackets can be used are basically rubber mounted supports that help in damping the vibrations to the exhaust caused by the main body. In complying with reducing sound pollution, a Muffler is also fitted. This helps reduce the noise levels of the exhaust system.

It then continues into the Tailpipe which takes away the exhaust gases from the vehicle in such a fashion that it cannot reenter the engine.

Turbochargers/Supercharging - Turbochargers and superchargers are fans that force compressed air into an engine's cylinders. This fan is powered by exhaust from the engine, while a supercharger fan is powered by the engine itself. Both concepts allow more compressed air and fuel to be injected into the cylinders, which help in energizing more power.

This allows manufacturers to use smaller engines without sacrificing performance. In the engine under consideration, a supercharger would be more convenient to install than a turbocharger. \* Variable Valve Timing and Lift - The engine efficiency can be affected by controlling the timing and the lift of the Inlet and Outlet Valves. Optimum timing and lift settings are different for high and low engine speeds.

Firstly, based on the specified type of vehicle, 2 engines in present day commercial use were considered and their engine data and performance data were compared and evaluated. After this, with the help of some previously given data and parameters, the design of a concept engine was carried out successfully. A study of components that could support the concept base engine was also conducted. Along with this, a brief understanding of advanced technology that can be incorporated into the same engine was also made. From this study, it can be recommended that with a reduction in piston weight, the power of the engine can be increased.