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Assessment of pollution control using an air injection system to act as a cataract for the oxidation process

Sachin B Bhatt[1] | Jitendra Kedaria[2]

[1] Assistant Professor, Mechanical Engineering Department, L .D. College of Engineering, Ahmedabad.
[2] P.G. Student, Mechanical Engineering Department, L .D. College of Engineering, Ahmedabad.

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ABSTRACT

The high pressure exhaust gas from an internal combustion engine is used to power a small compressor using the theory of a turbo charger, while the low pressure air is used for the catalyst's oxidation process. A common shaft connects the compressor and turbine. The turbine runs and supplies oxygen for the oxidation process even at low rpm. The engine is not required to expend additional energy for this system.

Keyword: *air injection system, Turbocharger, catalytic converter*

INTRODUCTION

Engine exhaust is produced by combustion and chemical reactions, and although it can still be economically and usefully reused, it is disposed of into the environment. IC engines produce large amounts of hot, high-pressure flue gasses. Fuel consumption will naturally drop if the high-pressure waste exhaust is used to run a compressor in order to generate energy or regulate pollution. This will save a significant amount of energy for the engine-powered air injection operation. There is no way to entirely recover the energy lost to waste gas pressure. The exhaust pipes may release a significant amount of pressure.

To make it easier to use recovered heat, various heat exchangers, heat pipes, and combustion equipment can be used, depending on the exhaust stream's temperature and the intended usage. Boost pressure is restricted in all turbocharger applications to maintain the engine system as a whole—including the turbo—within the working range of its mechanical and thermal design.

The turbine is used to harvest the exhaust gas's kinetic energy. The gas flow through the turbine is directed by the turbine housings, whose shape might affect the turbocharger's overall performance. The manufacturer may frequently offer a variety of housing options for the turbine and occasionally the compressor cover in addition to the same basic turbocharger unit. This makes it possible to customize the ratio of efficiency, response time, and performance for any application.

The volume of air or exhaust that can pass through the system and its overall efficiency are also determined by the diameters of the turbine and impeller wheels. Larger turbine and compressor wheels generally translate into higher flow capacities. Wheel dimensions, forms, and the quantity and curve of their blades can all differ.

Air injection system

The mechanism used to control exhaust emissions has changed over the course of technological development and is dependent on the injection technique and the exhaust system's air entry point.

Air was injected very close to the engine in the first systems, either in the exhaust manifold or in the exhaust ports on the cylinder head. These devices supplied oxygen so that fuel that had not yet burned completely and partially could be burned in the exhaust before being expelled from the tailpipe. Vehicles from the 1960s and early 1970s had a lot of unburned and partially burned fuel in their exhaust, so secondary air injection greatly decreased tailpipe emissions. But the additional heat from recombustion, especially when a misfiring or improperly adjusted carburetor produced an overly rich exhaust, often damaged exhaust valves and even appeared to cause the exhaust manifold to incandesce.

The amount of partially burned and unburned fuel in the exhaust stream decreased as emission control techniques became more advanced and efficient. This was especially true after the introduction of the catalytic converter, which changed the role of secondary air injection. The secondary air injection system was modified to facilitate the effective operation of the catalytic converter rather than serving as the main source of emission control. The term "upstream injection point" refers to the original air injection location. At this point, air is injected into the engine to clean up the extra-rich exhaust and raise its temperature, which helps the catalytic converter reach operating temperature more quickly when the engine is cold. Once the engine is warm, air is injected to the downstream location — the catalytic converter itself — to assist with catalysis of unburned hydrocarbons and carbon monoxide.

METHODS OF IMPLEMENTATION

Pumped air injection

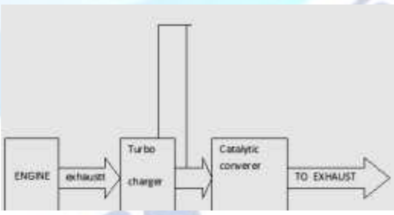
Pumped air injection systems use an electric motor or belt to turn a vane pump, which is powered by the engine. A revolving screen centrifugally filters the pump's air intake, removing any dirt particles big enough to harm the system. Pressure is applied to deliver air to the injection point (s). Exhaust cannot force its way back through the air injection system through a check valve, as this could harm the pump and other parts.

When the driver abruptly releases the throttle, the raw fuel content of the exhaust from carbureted engines tends to spike. A diverter valve is used to stop the explosive combustion of this raw fuel, which could have shocking and harmful effects. This valve directs the air pump's outlet to the atmosphere when it detects a sudden increase in intake manifold vacuum brought on by the throttle closure. In order to reduce annoying pump noise, this diverted air is often directed toward the engine air cleaner or a different silencer.

Aspirated air injection

Utilizing the exhaust system's negative pressure pulses while the engine is idling is another way to introduce air. The air injection plumbing contains a sensitive reed valve assembly known as the aspirator valve, which draws air straight from the clean side of the air filter. Air is drawn through the aspirator valve and into the exhaust stream at the catalytic converter by brief but recurring negative pressure pulses in the exhaust system during engine idle. Beginning in the 1970s, American Motors, Chrysler, and other manufacturers used this system, which was marketed as Pulse Air. The aspirator provided advantages in cost, weight, packaging, and simplicity compared to the pump, but the aspirator functions only at idle and so admits significantly less air within a significantly narrower range of engine speeds compared to a pump. This system is still used on modern motorcycle engines, e.g. the Yamaha AIS (Air Injection System).

Experiment set up for the process



The system's stratified compressor operates based on the pressure of the exhaust gas. Utilizing this therefore saves the engine power required to run the compressor. The turbine, which is connected to the compressor section, is powered by the high pressure exhaust gas. The turbine assembly is made up of a series of movable blades that work together to nearly maintain the necessary pressure to run the turbine. The accelerator pedal connects and moves the movable blades. The blades are positioned so that the turbine rotates even at low rpm and that the pressure is nearly constant even at high rpm.

CONCLUSION

It has been concluded that by this process the harmful by products reduced more effectively. By running the compressor with the exhaust pressure the engine power is saved and more over the oxygen required for oxidation process is always supplied by compressor

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