Mileage Enhancement and Emission Control in Bikes using Turbochargers

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Abstract - *A turbocharger, colloquially turbo, is a turbine-driven forced induction device that increases an internal combustion engine's efficiency and power output by forcing extra air into the combustion chamber. Turbochargers are commonly used on truck, car, train, aircraft, and construction equipment engines. Turbochargers are widely used in car and commercial vehicles because they allow smaller-capacity engines to have improved fuel economy, reduced emissions, higher power and considerably higher torque. In this work a turbocharger of a 4 wheeler has been innovatively fixed to the exhaust of a bike and its effect on mileage and emission control are studied.*

Key Words: Turbo chrger, Combustion Chamber, Fuel Economy, Exhaust, Mileage

1. INTRODUCTION

1.1 Turbocharger

In naturally aspirated piston engines, intake gases are drawn or "pushed" into the engine by atmospheric pressure filling the volumetric void caused by the downward stroke of the piston (which creates a low-pressure area), similar to drawing liquid using a syringe. The amount of air actually inspired, compared with the theoretical amount if the engine could maintain atmospheric pressure, is called volumetric efficiency. The objective of a turbocharger is to improve an engine's volumetric efficiency by increasing density of the intake gas (usually air) allowing more power per engine cycle.

The turbocharger's compressor draws in ambient air and compresses it before it enters into the intake manifold at increased pressure. This results in a greater mass of air entering the cylinders on each intake stroke. The power needed to spin the centrifugal compressor is derived from the kinetic energy of the engine's exhaust gases. A turbocharger may also be used to increase fuel efficiency without increasing power. This is achieved by recovering waste energy in the exhaust and feeding it back into the engine intake. By using this otherwise wasted energy to increase the mass of air, it becomes easier to ensure that all fuel is burned before being vented at the start of the exhaust stage. The increased temperature from the higher pressure gives a higher Carnot efficiency.

The turbocharger has three main components:

1. The turbine, which is almost always a radial inflow turbine (but is almost always a single-stage axial inflow turbine in large Diesel engines)

2. The compressor, which is almost always a centrifugal compressor

3. The centre housing/hub rotating assembly

Many turbocharger installations use additional technologies, such as waste gates, intercooling and blow-off valves.

1.2 Model Selected for Study

The Yamaha Crux is a 106 cc, single-cylinder four-stroke motorcycle made by India Yamaha Motor. The Crux is designed for Indian markets. It was launched in 2001 replacing RX 100, as 2-Stroke engines were not able to meet government's emission norms. A different version of Crux known as Crux R and Crux S were introduced with the same specifications but rectangular headlights. But after it could not make a considerable sale, the production was halted. User and owner claimed mileage and top speed is 55kmpl and 95kmph respectively.

2. TESTS CONDUCTED ON THE MODEL

2.1 Emission Test

The turbo charger was initially placed at the exit valve of the engine in between the silencer and the engine exhaust valve. It was welded to outlet and further connected to inlet using a connection setup. It utilizes exhaust gases for charging the intake. Waste gases from the turbocharger were expelled through silencer at the last.

Fig-1: Engine without modification