ENGINE EXHAUST GAS PRESSURE CONTROL SYSTEM

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ABSTRACT

For turbocharged diesel engines, exhaust pressure is decisive part of the engine affecting the torque production in diesel engine. Turbo do not need any extra power for its own functioning. The exhaust gases which are coming out from the engine are not with constant pressure. Due to which the turbo cannot compress the air in proper ratio. This paper shows the outcome of total practical experiment to control the exhaust gases. These control and constant gasses automatically controls the turbine to run at the constant speed, so that the engine can get proper compressed ratio of air and diesel.

Keywords: Electronic BP, exhaust division, mechatronics, electromagnetic.

I. INTRODUCTION

The turbine section consists of two major components. The turbine housing is bolted to the exhaust manifold of the engine. The exhaust gasses are used to rotate the turbine wheel, which has been positioned in the turbine housing. Turbine temperatures rise up to 1100 degrees C in truck and tractor pulling applications turbine wheel + shaft assy. The turbine wheel is friction welded to a forged steel shaft, which in turn rotates the compressor wheel, which is fitted at the opposite shaft end and secured by a locknut. The heat energy, pressure and flow from the exhaust gasses are driving the turbine wheel, when these are guided through the turbine housing. The hot exhaust gasses are passing an opening of a defined size in the turbine housing (nozzle area).

After having passed the nozzle area, the hot exhaust gasses expand and kinetic energy from pressure drop, flow and heat drop/expansion drive the turbine wheel to high speeds. Once the speed of the engine increases and more exhaust gasses pass the nozzle area of the turbine housing, the turbine wheel assembly and compressor fixed to it, will increase in speed. The result is increased air pressure and air flow charge (mass flow) to the engine cylinders. Turbochargers are also employed in certain two-stroke cycle diesel engines, which would normally require a Roots blower for aspiration.

The compressors in Superchargers are driven by the power taken directly from the engine. The turbo chargers are used where fuel economy is a concern. The turbochargers are known for their dramatic rise in pressures and tremendously high working temperatures making them inherently more difficult to control at the time when they deliver the additional power. In turbochargers, exhaust gases control the drive and hence the system takes a bit of time before it reaches the operating speed after opening the throttle which is also referred to as Turbo Lag. The turbocharger takes the lead with its compactness and requires significantly less space. Improvements in power, fuel economy and Noise, Vibration, and Harshness in both small- and large-capacity turbo diesels over the last decade have spurred their widespread adoption. Turbo diesels are generally considered more flexible for automotive uses than naturally aspirated diesels, which have strong low-speed torque outputs but lack power at higher speeds. A turbocharger compresses the air in order to produce rated power at high altitude. Since the size of the turbocharger is chosen to produce a given amount of pressure at high altitude, the turbocharger is over-sized for low altitude. The speed of the turbocharger is controlled by a waste gate. Early systems used a fixed waste gate, resulting in a turbocharger that functioned much like a supercharger. Later systems utilized an adjustable waste gate, controlled either manually by the pilot or by an automatic hydraulic or electric system.

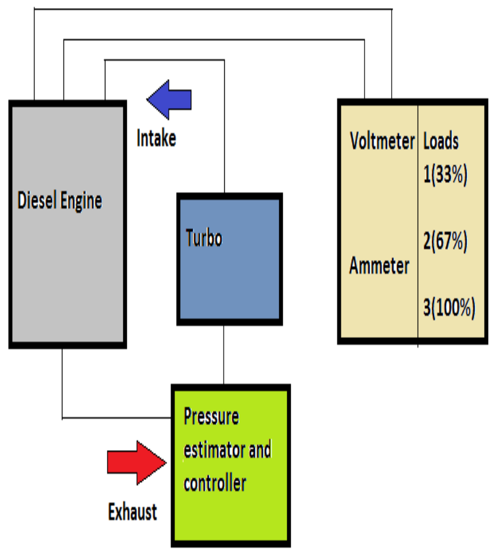
Today, turbochargers are most commonly used on gasoline engines in high-performance automobiles and diesel engines in transportation and other industrial equipment. Small cars in particular benefit from this technology, as there is often little room to fit a large engine. Volvo, Saab, Audi, Volkswagen, and Subaru have produced turbocharged cars for many years

II. EXPERIMENTAL SETUP AND PLAN

The test bed consists of a diesel engine, an eddy current dynamometer; fuel tank with thermostat-controlled heater is inbuilt in control panel with fuel measuring unit, and a data acquisition system. Pressure is supplied to the liquids and gases to prevent them from increasing and pressure estimators help with this process. Pressure estimators work as a warning when the applied pressure is more, or less, than implied. Two filters are installed: one at exit of tank and other one at fuel pump. Fuel is fed to the injector pump under gravity. Lubricating oil temperature is measured by using a thermocouple. The cooling water temperature is maintained constant (65 to 700°C) throughout the work by controlling the flow rate of fuel. Smoke opacity was measured using smoke opacity meter. The engine tests were conducted for entire load range (0 to 100%) at constant speed of 1500rpm.

EXPERIMENTAL SETUP

BLOCK DIAGRAM



Step1: Setup the system: first step is to put the diesel in the capillary tube and to start the engine.

Step 2: Measurements: take the start watch and start taking the measurements up to 10 cc and note the time, taken for the consumption of diesel.

Step 3: Measuring voltage and current:

Readings of voltage and current are taken along with the step 2.

Step 4: Calculations of different loads: the upper steps are repeated for three loads that are, 33%, 67% and 100% load.

Step 5: calculate BP: Now calculate BP for the entire three loads.

Step 6: measurement for electronic system: now repeat all the above steps for this step.

Step 7: compare the results.

Engine Specifications

Manufacturer	Kirloskar Oil Engine Ltd., India
Model	SR II
Engine	Single cylinder, DI

Bore/stroke	87.5mm/110mm
Compression ratio	17.5:1
Speed	1500 r/min, constant
Rated Power	5.2 Kw
Working cycle	Four cycles
Injection Pressure	240 bar
Type of estimator	Piezo electric

III RESULTS AND DISCUSSION

The experimental work covered in this paper is focused to control the compressed air flow in the cylinder of an internal combustion engine. The process is an implementation of linear control system.

During our investigations on automatic turbo pressure control system, we obtained the results for the engine first without implementing the electronic system and its performance is shown is Table-1, and then the whole system is connected with electronic system whose performance details are shown in Table-2. During this experiment we calculated the breaking power (KW). This showed a better result difference between the two different setups.

Table 1: Readings without estimator

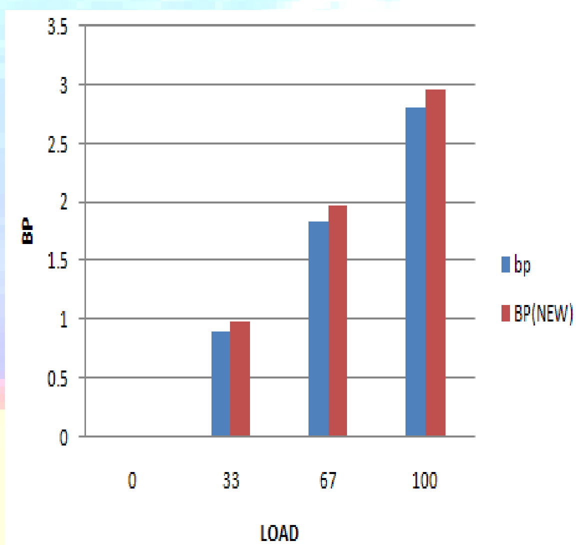
S. No.	Load	(V)	(A)	Time (Sec.)	Fuel consumed (CC)	B.P (Kw)
1	0%	250	0	52	10-20	0
2	33%	238	3.3	50	25-35	.89
3	67%	230	7	43	25-35	1.83

4	100 %	22 5	11	38	10-20	2.81

Table 2: Readings with estimator

S. No.	Load	(V)	(A)	Time (Sec.)	Fuel consumed (CC)	B.P (Kw)
1	0%	250	0	59	10-20	0
2	33%	238	3.6	57	25-35	.97
3	67%	230	7.5	50	25-35	1.96
4	100%	225	11.6	42	10-20	2.96

RESULT GRAPH



IV CONCLUSION

Based on the results of the study, conclusions drawn were that the BP is increase by applying the electronic system. It will increase more if more emphasis is done on the research and development of electronic circuit. More accurate pressure estimators can make the engine more efficient and with more BP.

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