Performance Analysis of Turbo Charger in Two Wheeler Engine

S. Vanangamudi, C. Thamotharan, P. Naveenchandran, S. Prabhakar and R. Anbazhagan

Abstract--- *The progress of automobiles for transportation has been intimately associated with the progress of civilization. The automobile of today is the result of the accumulation of many years of pioneering research and development. An attempt has been made in this project, the exhaust gas is used to rotate the turbine , which in turn to rotates the impeller connected it . Our fore most aim in selecting this project is to use efficiency turbo charging. It is also good with regard to economical considerations and engine efficiency.*

Keywords--- Wheeler Engine, Performance Analysis, Engine Efficiency.

I. INTRODUCTION

In 1909,a Swiss inventor named Alfred buchi, building on what the super charger guys were learning ,demonstrated that he could harness some of the energy remaining in the exhaust stream of a diesel engine and use it to drive a compressor. He correctly reasoned that a significant quantity of the combustion energy was literally wasted out the tailpipe at the end of every exhaust stroke. If he could harness some of this “WASTE HEAT “ energy with , say a turbine , he could power a compressor and have the benefits of a super charger , without corresponding huge crankshaft horse power drain. With this simple revelation, the turbo charger was born.

Turbo-charging, simply, is a method of increasing the output of the engine without increasing its size. The basic principle was simple and was already being used in big diesel engines. European car makers installed small turbines turned by the exhaust gases of the same engine. This turbine compressed the air that went on to the combustion chamber, thus ensuring a bigger explosion and an incremental boost in power. The fuel-injection system, on its part, made sure that only a definite quantity of fuel went into the combustion chamber.

Turbo-charged was does is that it simply increases the volumetric efficiency of the engine. To give you an example: a 1,500 cc engine that produced, say, 60 bhp when it was normally aspirated, benefited at times with a 10- to 20-per cent power boost depending on the kind of turbo-charged used. Normally, the manufacturer would have had to resort to a bigger displacement in the engine, or design and develop an all-new engine to get more power from the same unit.

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BMW was the first to use turbo-charging in a production passenger car when they launched the 2002 in 1973. The car was brilliantly packaged too and paved the way for a simply magnificent 'Turbo Era' in the automotive world. Swedish giant Saab took its cue from this, and its ensuing 900 series was one of the most characteristic turbo cars of its time.

Turbo charging technology is today considered as a promising way for internal combustion engine energy saving and CO2 reduction. Turbocharger design is a major challenge for turbocharged engine performance improvement. The turbocharger designer must draw upon the information of engine operation conditions, and an appropriate link.

Between the engine requirements and design features must be carefully developed to generate the most suitable design recommendation. The objective of this research is to develop a turbocharger design approach for better turbocharger matching to an internal combustion engine. The development of the approach is based on the concept of turbocharger design and interaction links between engine cycle requirements and design parameter values. A turbocharger through flow model is then used to generate the design alternatives. This integrated method has been applied with success to a gasoline engine turbocharger assembly.

Early manufacturers of turbochargers referred to them as "turbo superchargers". A supercharger is an air compressor used for forced induction of an engine. Logically then, adding a turbine to turn the supercharger would yield a "turbo supercharger". However, the term was soon shortened to "turbocharger". This is now a source of confusion, as the term "turbo supercharged" is sometimes used to refer to an engine that uses both a crankshaft-driven supercharger and an exhaust-driven turbocharger, often referred to as twin charging.

Aviation engine manufacturers such as Teledyne Continental Motors still use the term turbo supercharged to refer to turbo chargers that are used to boost manifold pressure above 1 ATM. Turbochargers that maintain 1 ATM of manifold pressure to a specific altitude are considered turbo-normalized. Though these represent true turbochargers, they should not be confused with some aircraft engines that employ actual engine-driven superchargers.

A turbocharger is a small centrifugal pump driven by the energy of the exhaust gases of an engine. A turbocharger consists of a turbine and a compressor on a shared shaft. The turbine converts kinetic energy from the engine exhaust's velocity and potential energy from the exhaust's higher-than-atmospheric pressure into rotational

kinetic energy, which is in turn used to drive the compressor. The compressor draws in ambient air and pumps it into the intake manifold at increased pressure, resulting in a greater mass of air entering the cylinders on each intake stroke.

The objective of a turbocharger is the same as that of a supercharger; to improve an engine's volumetric efficiency by solving one of its cardinal limitations. A naturally aspirated automobile engine relies mostly on the downward stroke of a piston to create an Area of low pressure in order to draw air into the cylinder through one or more intake valves. The pressure in the atmosphere is no more than 1 atm (approximately 14.7 psi, or 1 bar), so there ultimately will be a limit to the pressure difference across the intake valves and thus the amount of airflow entering the combustion chamber. Since the turbocharger increases the pressure at the point where air is entering the cylinder, a greater mass of air (oxygen) will be forced in as the inlet manifold pressure increases. The presence of additional air mass in the cylinder makes it possible to create a bigger explosion if more fuel is injected, increasing the power and torque output of the engine.

To avoid detonation and physical damage to the host engine, the intake manifold pressure must not get too high, thus the pressure at the intake manifold of the engine must be controlled by some means. A Waste gate, which vents excess exhaust gas so that it will bypass the exhaust turbine is the most common boost control device. An actuator, connected to the compressor outlet via a signal hose, and usually controlled via a solenoid by the car's Engine Control Unit, forces the waste gate to open as the boost pressure rises. The reduction in turbine speed results in the compressor slowing, and in less air pressure at the intake manifold.

Modern Group N Rally cars are forced by the rules to use a 34mm restrictor at the compressor inlet, which effectively limits the maximum boost (pressure above atmospheric) that the cars can achieve at high rpm. Interestingly, at low rpm they can reach boost pressures of above 22psi (1.5bar).

A natural use of the turbocharger is with aircraft engines. As an aircraft climbs to higher altitudes the pressure of the surrounding air quickly falls off. At 5,486 m (18,000 ft) the air is at half the pressure of sea level, and the airframe only experiences half the aerodynamic drag. However, since the charge in the cylinders is being pushed in by this air pressure, it means that the engine will normally produce only half-power at full throttle at this altitude. Pilots would like to take advantage of the low drag at high altitudes in order to go faster, but a naturally aspirated engine will not produce enough power at the same altitude to do so.

II. TURBO CHARGER

Turbo-charging:

Turbo-charging, simply, is a method of increasing the output of the engine without increasing its size. The basic principle was simple and was already being used in big diesel engines. European car makers installed small turbines turned by the exhaust gases of the same engine. This turbine compressed the air that went on to the combustion chamber, thus ensuring a bigger explosion and an incremental boost in power. The fuel-injection system, on its part, made sure that only a definite quantity of fuel went into the combustion chamber.

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Intercoolers the latest turbo's

They are used by most of today's turbo-diesel engines to make the compressed air denser. It works like this - on starting, exhaust gases spin the turbine and thus activate a compressor that pressurizes the air. This pressurized air from the turbo-charged is then sent through a duct to an air-cooled intercooler, which lowers the temperature of the intake charge and thus increases its density. The air-cooled intercoolers receive air through separate intakes and that explains the small scoops and louvers usually found on the hoods of turbo-charged cars.

Modern turbo-diesel engines also make use of a temperature-sensitive, motor-driven fan which boosts airflow at low engine speeds or when the intake air temperature is high.

Though there are diesel engines that 'earn' a turbo-charger mid-way through their life, the usual practice is to design and develop an engine with a turbo-charger in mind. Then, as and when a turbo-charged model is added to the stable, the engine can adapt to it without any additional strengthening and cooling of engine parts. A well-engineered, turbo-charged diesel engine offers better fuel efficiency (at times by 15 per cent), better overall performance (better torque and high-end power), reduced noise (compared to normally aspirated diesel engines) and minimum engine maintenance (owing to better combustion of diesel fuel).

Turbo looses steam Multiple valves and double-overhead camshaft designs developed reasonable performance without the complication of turbo-charging, and these methods were politically correct too since they consumed less fuel. Consequently today there are only a few petrol-powered road cars that still use turbo-chargers for enhanced performance.

Computers soon started playing an even bigger role in cars. Engine management systems linked to fuel-injection systems meant getting more out of the engine was even easier. For example, one can buy chips that can boost power by 100 bhp for some Japanese cars, such as the Nissan Skyline. Moreover, on-road speeds were being restricted all over the world. Though most of the sports cars today are capable of doing more, they are restricted electronically not to exceed 250 kmph even in autobahn-blessed Germany.

Turbo-charging lost its edge towards the end of the '80s and today this technology is used only in select performance cars. Porsche, for example, is all set to build a turbo-charged version of its all-new 911 (water-cooled) with added performance. Turbo engines were banned in Formula One too with the idea of restricting the performance of the cars (and thereby making them safer too). There are many who consider this a backward step in the world of Formula One, which is considered to represent the 'tomorrow' of automotive technology. But if one analyses the performance of normally aspirated cars in

F1 today, (3,500 cc non-turbo), they perform as well, if not better, than the turbo cars of the early '80s. So, there are no full stops in technology. While road cars and even sports and racing cars are going in for more efficient engines, better metallurgy and wilder-than-ever electronics to get their engines to perform at an optimum level without sacrificing the performance edge, turbo-chargers still continue to serve the same purpose they were invented for... albeit more so with diesel engines.

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III. COMPONENTS AND DESCRIPTION

Bearing Housing

A grey cast iron bearing housing provides locations for a fully-floating bearing system for the shaft, turbine and compressor which can rotate at speeds up to 170,000 rev/min. Shell moulding is used to provide positional accuracy of critical features of the housing such as the shaft bearing and seal locations. CNC machinery mills, turns, drills and taps housing faces and connections. The bore is finish honed to meet stringent roundness, straightness and surface finish specifications.

Turbine Wheel:

The turbine wheel is made from a high nickel super alloy investment casting. This method produces accurate turbine blade sections and forms. Larger units are cast individually. For smaller sizes the foundry will cast multiple wheels using a tree configuration.

Shaft and Turbine Wheel Assembly:

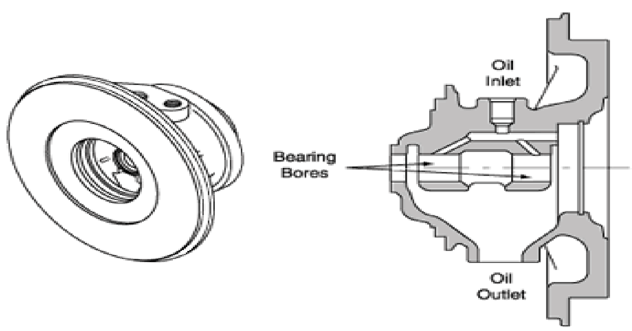
The forged steel shaft is friction welded to the turbine wheel. The turbine blade edges are machined for accurate trim within the turbine housing. The shaft bearing journals are induction hardened and ground for dimensional accuracy.

Journal Bearing Arrangment:

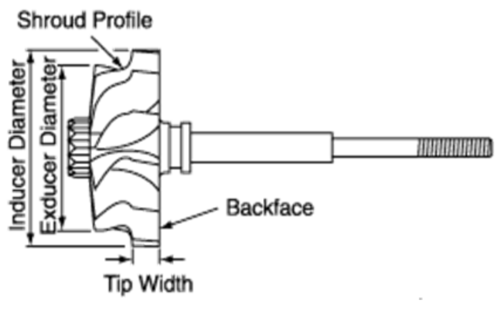
Journal bearings are manufactured from specially developed bronze or brass bearing alloys. The manufacturing process is designed to create geometric tolerances and surface finishes to suit very high speed operation.

Thrust Bearing:

Hardened steel thrust collars and oil slingers are manufactured to strict tolerances using lapping. End thrust is absorbed in a bronze hydrodynamic thrust bearing located at the compressor end of the shaft assembly. Careful sizing provides adequate load bearing capacity without excessive losses.



Turbine Wheel



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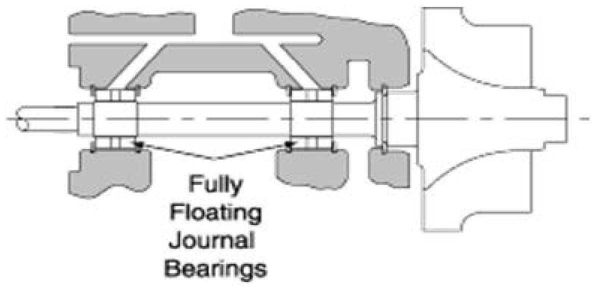


IV. COMPRESSOR IMPELLER AND FASTENER

Compressor impellers are produced using a variant of the aluminium investment casting process. A rubber former is made to replicate the impeller around which a casting mould is created. The rubber former can then be extracted from the mould into which the metal is poured. Accurate blade sections and profiles are important in achieving compressor performance. Back face profile machining optimises impeller stress conditions. Boring to tight tolerance and burnishing assist balancing and fatigue resistance. The impeller is located on the shaft assembly using a threaded nut.

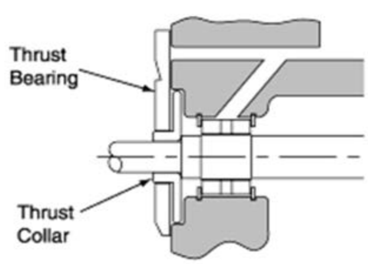
Compressure Cover:

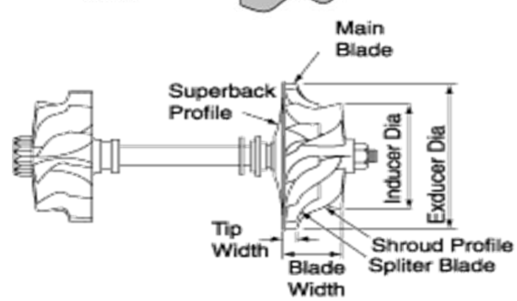
Compressor housings are also made in cast aluminium (cast iron for high-pressure applications). Various grades are used to suit the application. Both gravity die and sand casting techniques are used. Profile machining to match the developed compressor blade shape is important to achieve performance consistency.

Bearings:

Bearings are intended to direct the motion of shafts and axles and forces acting on them. Bearing is an machine element which support another moving machine element (known as journal). It permits a relative motion between the contact surfaces of the members, while carrying the load. In order to reduce frictional resistance and heat generated, a layer of fluid may be provided. Types of bearings are,

- Radial bearing.
- Thrust bearing.





V. CONSTUCTION OF TURBO CHARGERED ENGINE

Frame:

In a two-wheeled vehicle including a main frame, a rear arm which is generally triangular in side elevation, said rear arm having a front end pivotally connected to said main frame, and a suspension mounted between the top of said rear arm and said main frame, said main frame comprising a pair of horizontally opposed metal plate members joined together at their forward portions and diverging from one another from a mid-portion to their rear portions, whereby to form a bifurcated portion; and a generally V-shaped inner plate bent around generally upright axes covering the insides of said metal plate members where they diverge, said metal plate members being continuously welded to one another in said formed portion, and to said inner plate where they diverge from one another, whereby said inner plate reinforces said frame where the metal plate members diverge, and forms, there within a chamber in which said suspension is mounted.

Apparatus according to claim including said suspension means connected to said inner plate, and said rear arm pivotally mounted to said main frame and pivotally connected to said suspension means to cause said suspension means to shorten and elongate as said rear arm deflects up and down. Apparatus according to claim including said suspension means connected to said inner plate, and said rear arm pivotally mounted to said main frame and pivotally connected to said suspension means to cause said suspension means to shorten and elongate as said rear arm deflects up and down.

Main frame includes a tank rail portion and a bent portion extending from the rear end of the tank rail portion. A steering head pipe is welded to the front end of the tank rail portion. That portion of the main frame which extends from the rear half of the tank rail portion to the top of the bent portion is bifurcated to define a suspension chamber therein. The metal plate members and project laterally to some extent, with their inner faces departing from each other in the region from the rear half of the rear tank rail portion to the bent portion , and an inner plate is welded to close the inside opening. The area surrounded by the inner plate defines the suspension chamber.

The suspension chamber vertically extends through the main frame as is evident from. The metal plate members and are joined to each other at the bottom of the bent portion. A bracket having a channel-shaped side elevation is welded to the inner plate at the front end of the suspension chamber as shown in. In the bent portion, the metal plate member is

formed with a circular opening, an air cleaner disposed beside the bent. Air entering the air cleaner flows into the main frame through it. Air entering the main frame through is drawn into the cylinders of an engine through the intake pipes connected to the tank.

A pair of transversely spaced brackets is rigidly secured to the main frame in depending relationship from the bent portion thereof. A cylindrical bearing pipe extends through the brackets and is secured there to. A rear arm is pivotally connected to the bearing pipe.

A V-shaped engine has a pair of cylinders and disposed one behind the other longitudinally of the vehicle. A channel-shaped bracket is secured to the head of the front cylinder, and extends across the tank rail portion of the main frame in spaced apart relation. The bracket is secured to the front end of the tank rail portion by collars. A bracket having a pair of transversely spaced, downwardly inclined mounting surfaces is secured to the head of the rear cylinder. A pair of brackets each disposed opposite to one of the mounting surfaces of the bracket is welded to the main frame. The brackets and are resiliently connected to each other by rubber bushes not shown. A crank case for the engine is secured to the main frame by the brackets.

Engine mounting:

Avail form us a wide range of auto engine mountings, which is highly preferred over other substitutes available in the market owing to features such as easy installation, great compressive strength and lower stiffness. The entire range is specially designed to sustain large compressive thrust forces with minimum deformation. With its unmatched features our range of mountings is widely used in trucks, crushers, tractors, grinders and other heavy machines and equipment.

We worked to our clients a comprehensive range of auto engine mountings that is heavy duty mountings manufactured from finest quality raw material. Our range of auto engine mountings is designed & constructed in various types as per the area of application. Owing to their unbeatable quality, our product range is heavily used in automotive industry for trucks, tailors, car engines, generator sets & other industrial machinery.

We put forth for our clients a wide range of Engine Mountings in different dimensions and shapes as per the areas of application. High grade quality steel and components are used to manufacture this range to fulfill the requirement of the automobile industry. Our range of Engine Mountings is widely appreciated for its dimensional accuracy, performance and strength.

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We put forth for our clients a comprehensive range of Metal Parts for engineering and auto Mobile items. Especially designed for diverse application across engineering and automobile industry, this range is manufactured from superior quality raw material in desired dimensions. High tensile strength, anti corrosive features, low maintenance and consistent performance are some of the essential features of our range of metal parts for engineering & auto mobile items.

VI. TURBO CHARGER COUPLER

A turbo assembly may include a coupling member, a heat shield, and a turbo mechanism. The coupling member may include first and second ends and an annular body extending between the first and second ends. The first end may fix the coupling member to an exhaust manifold of an engine and the annular body may define an exhaust gas channel that receives exhaust gas from the exhaust manifold. The annular body may include a coolant passage that receives a coolant fluid. The heat shield may extend axially within the exhaust gas channel and radically between the annular body and an exhaust gas flow within the exhaust gas channel to limit an amount of heat transferred from the exhaust gas to the annular body. The turbo mechanism may include a housing fixed to the second end of the coupling member and in communication with the exhaust gas channel to receive the exhaust gas.

The invention relates more specifically to a brake master cylinder for a motor vehicle, of the type which comprises a substantially axial body inside a bore of which is slide ably mounted at least one axial piston which is capable of being actuated by a driver of the vehicle between a rear rest position and a forward braking force application position, and which is returned elastically toward its rear rest position, of the type in which the bore comprises two seals, front and rear, which are interposed between the piston and the bore, the front seal delimiting, in the bore, a rear supply chamber and a front pressure chamber, of the type in which the body comprises a radial supply duct which connects an external hydraulic fluid reservoir to the rear supply chamber and which opens out between the two seals, of the type in which the body comprises a braking circuit supply hole which opens into the front pressure chamber, of the type in which the piston comprises a bore, open to the front, communicating on the one hand with the front pressure chamber and on the other hand with the periphery of said piston by way of at least one hole which, when the piston occupies its rear rest position, is arranged between the two seals so as to open communication between the front pressure chamber and the rear supply chamber and which, when the piston is moved axially forward toward its application position, is capable of passing beyond the front seal in order to isolate the front pressure chamber from the rear supply chamber and thus allow a braking pressure to be established in the front pressure chamber, of the type in which at least each front seal is accommodated in a groove in the body of the master cylinder and comprises three concentric lips with an axial orientation, in particular.

A first inner lip of which a free end is arranged in contact with the periphery of the piston, a second central lip of which the free end is arranged, in a rest position, in contact with a front face of the groove, and a third outer lip of which a free end is arranged, in a rest position, in contact with a peripheral bottom face of the groove, the second central lip and the third outer lip being capable, when the front pressure chamber is exposed to a partial vacuum caused by the return of the piston from its forward application position to its rest position or else by the activation of a trajectory control device forming part of the braking circuit, of separating from the front face and from the bottom peripheral face of the groove so as to respectively allow the reservoir to be resupplied by means of the front pressure chamber or else the front pressure chamber to be resupplied by the reservoir.

VII. CONCLUSION

An attempt has been made in this project, the exhaust gas is used to rotate the turbine , which in turn to rotates the impeller connected it . Our fore most aim in selecting this project is to use efficiency turbo charging. It is also good with regard to economical considerations and engine efficiency.

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