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DETAILED DESIGN CALCULATION AND ANALYSIS OF GO-KART ENGINE

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ABSTRACT

Go-karts emerged in India in 2003 from MRF, there are racing tracks for go-karting which is known as the home of go-karts in India. Many people participate in the race and becoming popular. The engine used in our go-kart is taken from Bajaj Vikrant. In this paper which basically works on increasing petroleum Based fuel and engine efficiency and give the best performance case study of single cylinder, 4 stroke, SOHC 2 valve, air-cooled, DTS-i engine. Detailed calculations regarding engine performance have been carried out and based on analysis of test results. The maximum efficiency of this engine is 50%. The engine displacement is 149.5 cc and the maximum torque of this engine is 14 Nm @ 6000 rpm. The peak power of this engine is 13 PS @ 8000 rpm and the top speed of the motor in this engine is 60-80 kmph. This engine has 14 teeth on the driver and 32 teeth on the driven. The bore diameter is 56 mm and stroke diameter is58 mm and the compression ratio of this engine is 9.8:1. Efficient operation of engines is very essential for better fuel utilization and reducing pollution. It is basically based model which is able to capture the effect of ethanol blending ratio, burnt gas Excerpt on combustion time, spark time and operating conditions.

KEY-WORDS

Go-kart, Engine Performance, Petrol engine, Compression ratio

INTRODUCTION

An engine is a mechanical device that converts the chemical energy of a fuel into thermal energy and uses this thermal energy to do mechanical work. In a Four stroke petrol engine, the stroke of the piston is four times and the total rotation of the crank is 720 degrees. In this the piston reaches TDC twice and BDC twice and there are four processes in the stock to complete one cycle. petrol engine is internal combustion engine in which oxidation and combustion of fossil fuels take place combustion chamber. in one ic expansion of the engine at high temperatures and pressure gases produced by combustion apply direct force to the component of the engine, such as piston. This document gives a brief description of how the go kart drive system is designed, manufacturing and selecting the best propulsion system to get the most out of the kart. It is also related to sprockets that play a important role in the transmission of energy to other system(R1). In this engine petrol is used as a fuel with Maximum Power of 11.8 Bhp @ 7500 rpm and Maximum Torque of 13 Nm @ 5500 rpm. It has 2 valves per cylinder and It has 57 x 59mm Bore x Stroke with compression ratio of 9.8:1. This engine has 5 speed transmission which give flexibility to use it according to our need. we use DTSI Bajaj Vikrant v15 model, the weight of this engine is 26.1kg and the Cubic capacity 150, Double spark engine and Battery Capacity of this engine is 12 V/4 Ah. a Theoretical study of various strategies for waste heat recovery in running internal combustion engines was done by internal combustion and electric motor Organized to reduce specific fuel consumption. also it brings awareness about the various parameter that can be changed to improve the competitiveness kart which is also present in other forms of motor racing(R2). Thus, the aim of this paper is to study best performance state of the art go kart engine.

COMPONENTS, MATERIALS AND METHODS

As per the GKDC10 rulebook, single cylinder four stroke 149.5 cc. Engine has to be selected After long research and survey, we have selected Bajaj Vikrant engine with 149.5 cc.

1. Piston- The piston is manufactured by the caustic method. Aluminium alloy has been used to make it because its thermal conductivity is high, due to which the pistol can transfer easily.

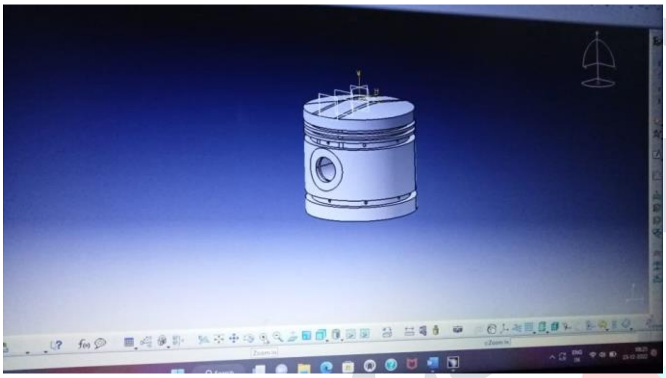

Fig.2.1 Cad model of piston

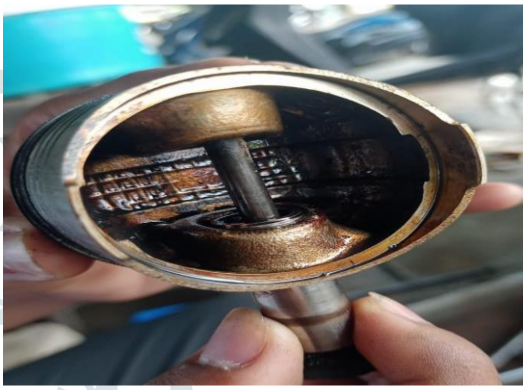

Fig2.1 piston

2. Piston Ring- The piston ring has three group cuts to which the piston ring is attached. The piston ring is manufactured through pot casting method and cast iron and high elastic material have been used to make it.

Fig.2.2 piston ring

3. Crank shaft- The crank shaft is a rotational shaft that changes the reciprocating motion of the piston into rotational energy or rotational motion. It has been manufactured through casting method and alloy steel has been used to make it.

Fig.2.3 crank shaft

4. Fly Wheel- Flywheel stores energy in the engine. The flywheel has been manufactured through casting method and cast iron has been used to make it.

Fig.2.4 Fly wheel

5. Cam Shaft- Grinding and case hardening method has been used to make cam soft. It is made of plain carbon steel.

Fig.2.5 cam shaft

6. Cylinder block- The cylinder block is manufactured through casting and forging and machinery methods. Ductile cast iron and low carbon steel have been used to make it.

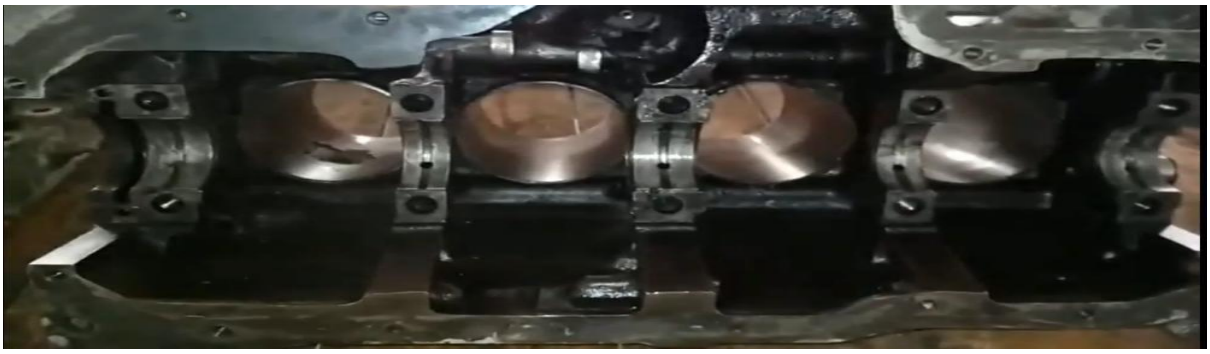

Fig.2.6 Cylinder block

7. Cylinder head- Aluminium alloy has been used to make the cylinder head and it has been manufactured through casting method.

Fig.2.7 Cylinder head

8. Connecting rod- Forging method has been used to make the connecting rod. It is made of low carbon steel material.

Fig.2.8 connecting rod

9. Crank case- It has been manufactured through casting method and iron aluminium and magnesium have been used to make it.

Fig.2.9 Crank case

10. Intake and Exhaust valve- Stainless-steel nickel chromium phosphorus bronze metal is used to make the intake and exhaust valves.

Fig.2.10 intake and exhaust valve

11. Spark plug- Its electrode is made of high nickel alloy. The insulator is made of aluminium oxide chromic and the spark plug cell is made of steel wire.

12. Bearing- It is made by aluminium alloy copper alloy and chrome steel.

Fig.2.12 Bearing

13. Carburettor- The moulded body of the carburettor is made of lightweight alloy and the stationary body is made of strong metal.

Fig.2.13 Carburettor

14. Fuel injector- fuel injector is made with the help of carburizing steel.

Fig.2.14 Fuel injector

15. Intak and exhaust manifold- Intake and exhaust manifold made of aluminium alloy.

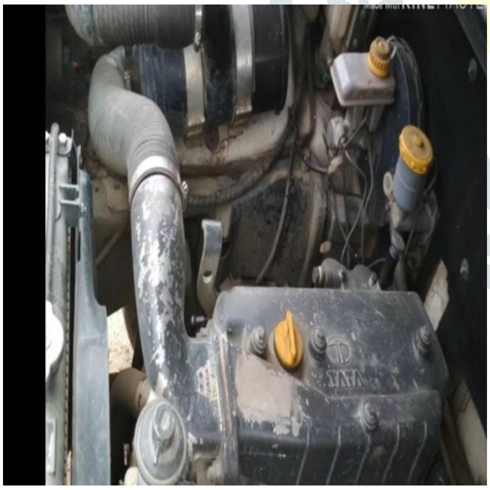

Fig.2.15 Intak manifold

Fig.2.15 Exhaust manifold

16. Piston pin- piston pin made of plain carbon steel.

Fig.2.16 piston pin

17. Push rod- push rod made of steel.

Fig.2.17 push rod

18. Rocker arm- The rocker arm is manufactured by forging method and medium carbon steel is used for making it.

Fig.2.18 Rocker arm

19. Clutch housing

Fig.2.19 Clutch housing

20. Gasket- Gaskets are made of paper, rubber, silicone, metal, cork, neoprene, nitrile rubber, fiberglass, plastic polymers.

Fig.2.20 Gasket

21. Oil pan- Oil pin made of low carbon steel & aluminium alloy.

Fig. 2.21 oil pan

22. Muffler- Muffler made of cast iron.

Fig.2.22 Muffler

23. Catalytic Converter- Catalytic converter made of platinum, palladium and rhodium.

Fig.2.23 Catalytic converter

24. Valve spring- Valve spring made of oil tempered wire steel, stainless steel, copper, bronze brass, Exotic alloy.

Fig.2.24 Valve spring

25. Chamber-

Fig.2.25 chamber

26. Gear box

Fig.2.26 Gear box

27. Driven Sprocket

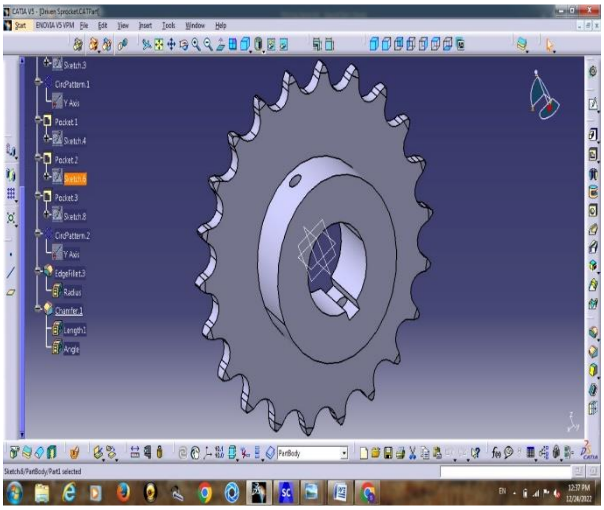

Fig2.27 Cad model of driven sprocket

Fig.2.27 Driven sprocket

Fig. 2.28-2.29 Engine

Hydrocarbon fuel used as a prime mover in the interior combustion engine, i.e. petrol and diesel are fossil fuels and come under category of non – renewable sources of energy(R3). After endless research and various observations, we have chosen the 149.5cc DTSI engine of the Vikrant. For the purpose of selection we have derived several parameters like performance characteristics, better efficiency and load factor for better results. There was only one thing behind this effort of ours that the transfer of power is taking place on such a large scale. The engine should be easily transferred to the rear wheels. Without these components we cannot transfer any kind of power to propel our go kart optimally. We have selected 14 teeth on the driver and 32 on the rear for better output speed and torque. The purpose of Driven Sprocket Teeth is better power transmission in our go karts. The output speed and torque depend on the gear ratio.

gear ratio - no. of driven teeth / no. of driver teeth.

if we will increase the no. of teeth of driven sprocket the we will get maximum torque with minimum speed but our requirements Is the maximum speed with better efficiency then we are focusing decrease the no of teeth in the driven sprocket. later then deciding teeth and observing various parameters the results we found that we should preparing our cad model in Catia software and used the Ansys software for the analysing various load and other factors which is taken place. after the analysing we found that it will assist in our performance characteristics and various types of loads acted on the power transmission system like chain and sprocket system. there are two elementals type of the power transmission system i.e manual and automatic. we are working on the manual transmission system for the better performance after various consideration and research. This research for decreasing cost and fuel consumption in internal combustion engine and technical innovation the study continues. Engine through efficiency improving efforts build revisions have increased today. For example, parallel to the development advanced technology ceramic coating application in internal combustion engine are fast(R4).

SPECIFICATIONS

Engine - 4 stroke

Bore× stroke - 56mm × 58.6mm

Engine displacement – 149.53cc

Compression ratio – 9.8:1

Idling speed – 1400+/- 100 RPM

Maximum net power – 13 PS at 8000 RPM

Maximum net Torque – 13 Nm at 6000 RPM

Ignition system – DC

Spark plug – 2 Nos

Spark plug gap – 0.7 – 0.8 mm

Gear shifting pattern – 1 down 4 Up

Engine Lubrication – Forced lubrication

Starting Aid – self start

Front brake – Disc brake

Rear brake – Drum brake

Fuel tank capacity – 13 litres

Usable reserve – 1.7 litres

Unusable reserve – 1.1 litres

Clutch – wet, multi plate

Gear box – 5 Speed

Emission type – bs4

Speedometer – Analogue

Odometer – Analogue

Seat type – Single

Fuel Gauge – Digital

ARAI Mileage – 57 Kmpl

Dimensions

Length – 2044mm

Width – 780mm

Height – 1069mm

Wheel base – 1315mm

Ground clearance – 165mm

Weight – 26.1 kg

DESIGN AND WORKING OF ENGINE

An engine is a simple machine that transforms heat energy to mechanical energy. the engine does This occurs either through internal or external combustion. Combustion is the act of burning. internal means The inside or enclosed air-fuel ratio is kept constant at a given load. The traditional way to accomplish this is to use a single throttle Valve in carburetor. At constant engine speed, throttle At full load the valve is wide open and there is pressure in the intake The manifold is close to atmospheric. When the throttle valve is closed slowly, the output of the engine decreases because A small amount of mixture enters the cylinder(R5). The main focus is on product quality, rapid design and development and ultimately a Affordable product. Industries need to upgrade to survive in this challenging market technology, skills to offer effective products. Design and analysis of complex components It is now convenient to use finite element methods(R6). The maximum speed @lowest ratio of the transmission system is 85km/hr. there are a total of four strokes in one engine suction, compression, expansion or power and exhaust(R7). India is one of the fastest developing countries with steady economic growth, which increases the demand for transportation manifold(R8).

Calculation:

No. of teeth on driver sprocket, T1= 14

No. of teeth on driven sprocket, T2= 32

Final deive ratio = T2/T1= 32/14= 2.285

Torque at engine:

Let t_e be the torque at engine

T_e = power*60/2πN

T_e = 14 N-m.

Maximum speed:

Let V be the maximum speed.

V= π*Diameter of wheel * wheel rpm/60

V= (3.14*0.322*1700)/60

V= 28.64m/s.

Torque at wheel (T_w):

Let T_w= torque at engine * final gear ratio * 1st gear ratio* transmission efficiency

= 14* 1.72*2.81*0.85

Here, the transmission efficiency is assumed to be 0.85

T_w = 57.51N-m.

Tractive force = Tw/ Wheel radius

57.51/0.161

=357.2N.

Total Resistance:

Total resistance= rolling resistance + air resistance.

Rolling resistance:

Rolling resistance= Coefficient of rolling resistance*Weight of Kar

0.02*175*9.81

= 34.335N.

Air resistance = Ka*v^2

Ka= (Density of air*Drag coefficient *A)/2

A= Area of kart = height* breadth

= 7.68

Grade resistance = w* sinΘ

Θ= 3degree where Θ is angle of slope

1700*sin3 degree

= 88.97N

Total resistance:

34.33+7.68+88.97= 130.98N

Total resistance= 130.9

CONCLUSION

IC engine performance characteristics the design and development of go karts with high safety and low production cost have been seen to be accomplished and this design has been put into use and concrete work.it involves a design process that uses the solid works and ANSYS software packages to build models, simulating and assisting in the analysis of the entire vehicle. The go-kart has been designed by the team REC DES club student from the GOVT Engineering college Rewa (M.P). Extensive research and design work of each major assembly and component of the carriage. The entire kart has been designed keeping in mind that it should be able to withstand the racing conditions without failure.

Fig (6.1) Fabricated engine in Go- kart

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