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Design and Analysis of HG 25 Gear Box For Marine Engine

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ABSTRACT

Marine engines are responsible for Driving of the vessel from one port to another. Whether it's of a small ship plying in the coastal areas or of a massive one voyaging international waters A gearbox Consume 35 % of external forces and transmits power from two engines operating with different speeds This the Paper Showing the design, & manufacturing of helical gears for marine Operations aim behine this design is low weight and more accuracy gears. Such gear box is Available in fishing boat in which marine engine is used. It requires high load carrying capacity, strength, torque Also it must be operated efficiently. There are various types of engines are available which are ranges from 220HP to 500HP and for this engine 10 to 12 types of gear box are available. We are going to design the gear box for 500 HP engine and then analysis to check the performance of engine

Keywords: Marine Engine Wear Stress Torque analysis

1. Introduction

The main function of a marine gearbox system is to develop and transmit the torque over the required speeds. The paper showing the work of design a gear train system which transmit a power of 500 HP and 2000 RPM. A gear is rotating machine part which transmit torque with the help of cut teeth, which mesh with another. Gear influence the speed, magnitude and direction of power source. When two gears meshes with different no. of teeth giving mechanical advantage is produced with both the rotational speeds and the torques of both differentiating in a simple relationship. this engines is operated with high speeds and large stresses also with deflections in the gears & rotating component. For the safe functioning of engine, these two factors have to minimize. In this work, structural analysis on a high speed helical gear used in marine engine have been carried out. The main aim in this Paper is designing the Gear train for HG 25 gearbox which withstand at high speed and high load. Also operate marine engine efficiently and smooth for different condition, and increases its working life read these instructions carefully.

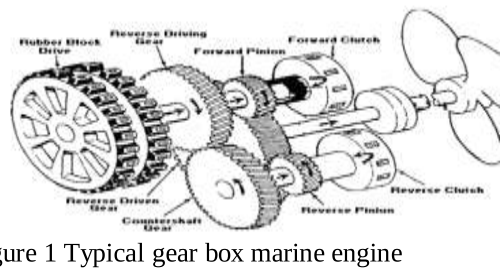

Figure 1 Typical gear box marine engine

2. Objectives

The main My aim in this project is to design Gear Box for HG 25 for500HP,gear box which should not be fail at high speed and high load. For fishing, boats need to stay longer time in the sea so our aim is tooperate marine engine efficiently and smooth for different conditions ,and increases its working life.

3. Design and Calculations

Design Calculations

- Design for Single Stage Gear box: As normal pressure angle (Øn) = 25^o

Helix angle Ψ = 15^o

Pinion speed Np = 2000 rpmCentre Distance = 261mm

- Calculate actual number of teethWe have reduction ratio 3:1

Zp = 31

Zg = 95

Speed of output shaftNg = N1/i

= 666.66

- Calculate face width (b)b= 1.15 × π ×Mn /sin(15) b=55.83
- Calculate virtual number of teethFor pinion

Z'p = Zp /$\cos^3$Ψ

= 34.39

For gear

Z'g = Zg /$\cos^3$Ψ

= 105.41

Calculate lewis form factor

Y'p=0.484- −(2.87/$Z'p$)Y'p=0.4005

Y'g=0.456

- Decide Pinion is weaker or gearSut for EN353 = 835

б b=Sut

03

бb=278.33

(бb)p*Y'p=111.47(бb)g*Y'g=126.91

So pinion is weaker

- Calculate Beam StrengthSb=(бbp * Y'p) * Mn * b Sb= 24893.48

Calculate wear strength

Sw = $dp*b*k*$Q/cos2т

dp=(Zp Mn)/ cos т

=128.37 b=55.83 k=6.7600

Q= 2 Zg/(Zg+Zp)Q=1.508

Sw= 78305

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- Tangential load Factor
- – Pt=^{P}

V

P=372.85 Kw

V=13.44 m/sPt= 27.74 N

- Calculate Effective Load based on primary estimation Peff= (Cs/Cv) Pt

Cs = 2

Cv= 5.6

5.6+√V

Cv= 0.60436

Hence Peff = 91.800Now for safe Design Peff * FOS < Sw

- Error in pinion, for grade

Ep = 8+0.63(Mn+0.25× √dp)

=12.30 micron Ep = 0.0123mm Eg = 0.013mm e=Ep+Eg

= 0.0123+0.0136e=0.0259

- Deformation factor (c)C=11500*e

= 297.85

- Maximum tangential load Ptmax =Cs*km*Pt

Km=1

Ptmax =55.4800

- Calculation for Dynamic load (Fd)

Fd = 21(bc+$Ftmax$) /21v+(√bc+$Ftmax$)

Fd =15122 N

Peff = Ptmax+Fd15419.85N

For safe design ,Peff *Fos < Sw 23129 < 78305

Design is safe

CAD Model of Drive Pinion

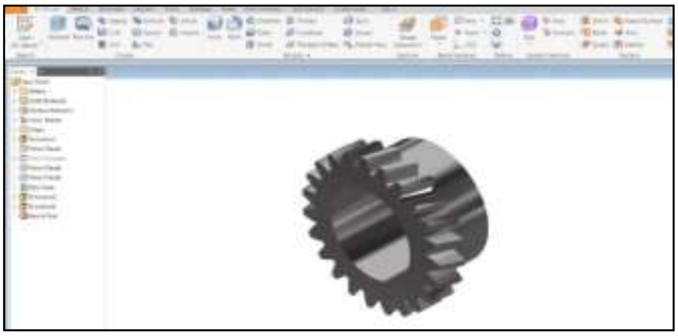

Figure 2 CAD Model Pinion Isometric view

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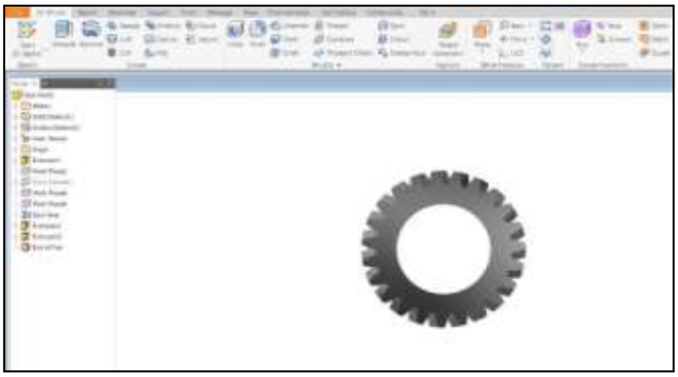

Figure 3 Front View CAD pinion

Stress & Deformation Analysis of Drive Pinion Von Mises Stress Analysis

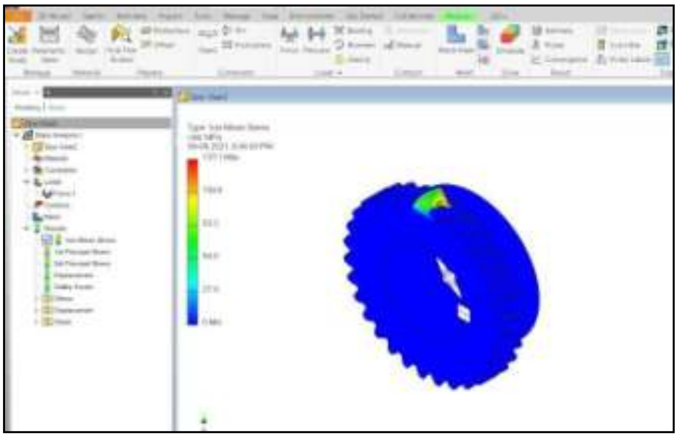

Figure 4 Stress Analysis of Pinion

Deformation Analysis

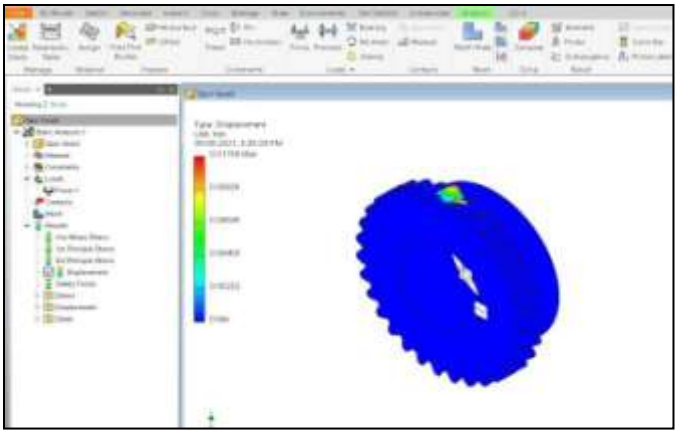

Figure 5 Deformation Analysis of Pinion

CAD Model of Output gear

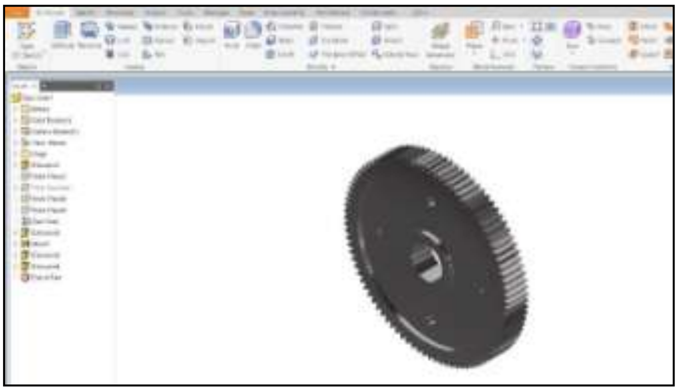

Figure 6 CAD Model of Output Gear Isometric View

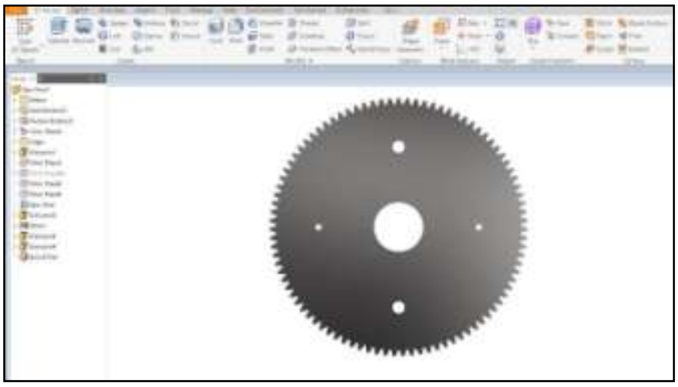

Figure 7 CAD Model of Output Gear Front View

Stress & Deformation Analysis of Output Gear

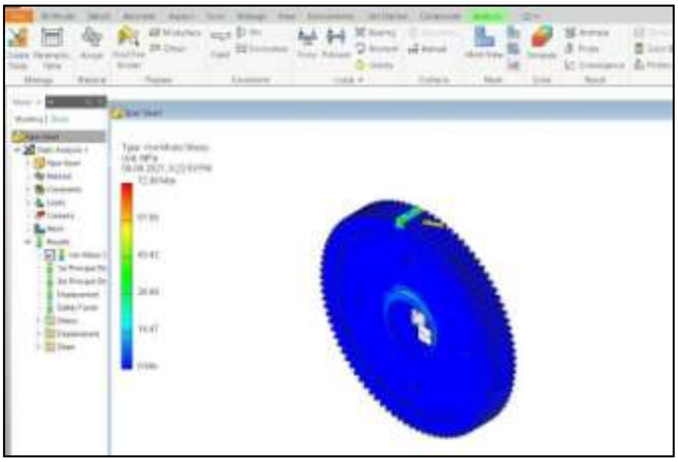

Figure 8 Stress analysis of output gear

Deformation Analysis

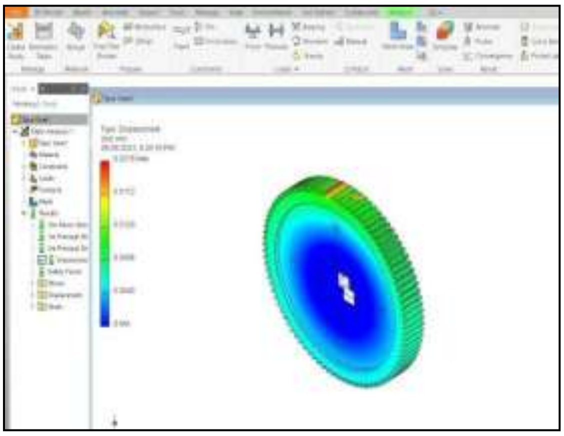

Figure 9 Deformation analysis of output gear

Acknowledgments

It is indeed a great pleasure and moment of immense satisfaction for we to present a project report on "Design of Gear train for HG13Gearbox used in Marine Engine" amongst a wide panorama that provided us inspiring guidance and encouragement, we take the opportunity to thanks to thanks those who gave us their indebted assistance. We wish to extend our cordial gratitude with profound thanks to our guide Prof (Dr) H. V. Shete AMGOI vathar, Mr Potadar Assistant manager and Mr V K Sankpal Associate wise president Ghadge Patil Industries Ltd Kolhapur for his everlasting guidance. It was his inspiration and encouragement which helped us in completing our research

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