International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 08 | Aug - 2021 ISSN: 2582-3930

Design of HG 25 gear box for marine Engine

For Ghatge Patil Industries Ltd Uchgaon Kolhapur

Miss Shweta Khankal[1] M.Tech Design Engineering AMGOI Vathar Tarf Vadgaon

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 behind 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,

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.

2. Body of Paper

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

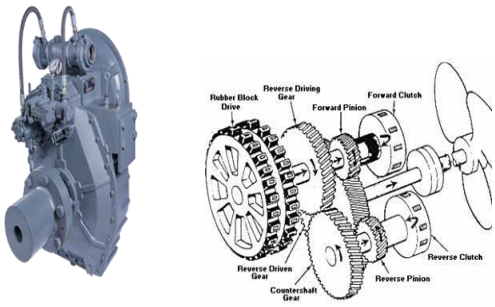

Fig:- general diagram of gear Box

3. Design for drive Pinion:

As normal pressure angle (Øn) = 25°

Helix angle Ψ = 15°

Pinion speed Np = 2000 rpm

Centre Distance = 261mm

□ Calculate actual number of teeth

We have reduction ratio 3:1

Zp = 31

Zg = 95

Speed of output shaft

Ng = N1/i

= 666.66

□ Calculate face width (b)

b= 1.15 × π ×Mn /sin(15)=70 mm

b=70

 Calculate virtual number of teeth

For pinion

Z'p = Zp /cos 3 Ψ

= 34.39

For gear

Z'g = Zg /cos 3 Ψ

= 105.41

Calculate lewis form factor

$Y'p=0.484-(\frac{2.87}{z'p})$

Y'p=0.4005

Y'g=0.456

 Decide Pinion is weaker or gear

Sut for EN353 = 835

$Gb=\frac{sut}{3}$

Gb=278.33

(Gb)p*Y'p=111.47

(Gb)g*Y'g=126.91

So pinion is weaker

 Calculate Beam Strength

Sb=(Gbp * Y'p) * Mn * b

Sb= 24893.48

 Calculate wear strength

$Sw=\frac{dp\times b\times k\times Q}{cos^2\varphi}$

dp=(Zp Mn)/ cos

=128.37

b=70

k=6.7600

Q= 2 Zg/(Zg+Zp)

Q=1.508

Sw= 97308.36

 Tangential load Factor

$Mt=\frac{60*10^6*kW}{2*\pi*n_p}$

=1756402.121Nmm

 Tangential Force (Pt)

$Pt=\frac{2\,Mt}{Dp}$

=27366.68N

Radial Component (Pr)

$Pr = Pt(\frac{Tan\,\alpha}{Cos\varphi})$

=13211.46N

Axial Componant = Pa

Pa=Pt Tan φ

=7332N

 Calculate Effective Load b0ased on primary estimation

Peff= (Cs/Cv) Pt

Cs = 2

$Cv=\frac{Cs}{Cv}Pt$

Cv= 0.60436

Hence

Peff = 45282.08 N

Now for safe Design

Peff * FOS < Sw

45282.08*2 <97308.36

Design is safe

4.Design of clutch Gear:-

$M=\frac{PCD}{Z}$

M= module

Z=Number of teeth

PCD=Pitch circle diameter

$4=\frac{161}{z}$

Z=39

Face width for helical gear is

$b = \frac{1.15 \times \pi \times Mn}{sin\emptyset}$

b= face width of helical gear

Mn=Normal module

φ=Helix angle =15°

b= 41.50mm

 Calculate wear strength

$Sw=\frac{dp \times b \times k \times Q}{cos^2 \varphi}$

dp=(Zp Mn)/ cos

=161.56

b=41.50

k=6.7600

Q= 2 Zg/(Zg+Zp)

Q=1.508

Sw= 82034.04

 Tangential load Factor

$Mt = \frac{60 * 10^6 * kW}{2 * \pi * n_p}$

=1756402.121Nmm

 Tangential Force (Pt)

$Pt=\frac{2\ Mt}{Dp}$

=21818.65N

Radial Component (Pr)

$Pr = Pt(\frac{Tan\ \alpha}{Cos\varphi})$

=10533.11N

Axial Componant = Pa

Pa=Pt Tan φ

=5846.28N

 Calculate Effective Load b0ased on primary estimation

Peff= (Cs/Cv) Pt

Cs = 1

$Cv=\frac{Cs}{Cv}Pt$

$Cv= \frac{5.6}{5.6+\sqrt{v}}$

$V=\frac{\pi dN}{60*10^3}$ =16.85

Cv=0.57

Hence

Peff = 38278.33 N

Now for safe Design

Peff * FOS < Sw

38278.33*2 <97308.36

5. CONCLUSION

The analytical design calculations we have done are correct and maintaining Factor of Safety 2 Hence it can be said that the aim of the project –Design of Gear box of HG 25 Gearbox used in marine engine‖ can be achieved successfully.

ACKNOWLEDGEMENT

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 reserch

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