

Design and Analysis of Clutch Plate Using Steel Material [En – Gjs-400 -15steel]

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Abstract : Clutch plates are usually made of cast iron and high carbon steels. The properties of cast iron have high compressive strength, low tensile strength and no ductility. It can be easily machined. Due to this reason, it is suitable for the clutch plate but its cost is high. In order to reduce the cost of clutch plate material without affecting the life and effectiveness of the clutch plate, we modify other material low carbon steel for clutch plate.

Keywords: low carbon steel, effectiveness.

I. Introduction

A Clutch is a mechanism designed to disconnect and reconnect the driving and driven members. It is a device, which enables one rotary drive shaft to be coupled to another shaft, either when both the shafts are stationary or when there is a relative motion between them. The main function of the clutch is to enable smooth transmission of a rotary motion of an engine crankshaft to a stationary or slowly revolving output shaft (gearbox shaft) without snatch and it also enables rapid disengagement and re-engagement of the engine from the transmission while one or both in motion, for gear changing and emergency stops.

The material which is used in this pressure plate is grey cast iron (FG300). The property of grey cast iron has high hardness, low tensile strength, no ductility and it can be easily machined. We analyzed this material to obtain the stress in the pressure plate. After obtaining the values, we use different materials but with suitable properties to obtain a better stress and functions of pressure plate. Hence, we use steel En GJS-400-15 as optional material to grey cast iron. These materials also have similar properties of grey cast iron. We analyze these two materials to obtain the stress in the materials. Then, we compare the stress values of all materials and take out the best. The advantage of this project is to reduce the cost of clutch plate without affecting the function and life of clutch plate.

II. Material Speciation

Pressure Plate

Pressure plate is made up of Grey cast iron material (FG 300) which is woven with solid center. It has ten splines on hub which is linked with shaft. It has six holes with 29mm diameter on pitch circle of 180 mm radius. It has 30 holes with 4mm diameter which is connected with support links.

III. Calculation

Outer radius of friction face $r_1 = 150$ mm

Inner radius of friction face $r_2 = 95$ mm

By Uniform Pressure Theory

Mean Effective Radius $\frac{2}{3} \times (r_1^3 - r_2^3 / r_1^2 - r_2^2)$

$\frac{2}{3} \times [150^3 - 95^3] \div [150^2 - 95^2]$

=124mm

5.1FORCE

For analyzing stress on pressure plate, the given torque is applied as Force on friction disc,

Torque (T) = $n \mu W R$

Here $F = n \mu W$

$F = 1308.186$ N

$R = 124$ mm

No. of contact surface, $n = 2$

5.2 AXIAL THRUST

Torque (T) = 163000 N-mm specification)

Torque (T) = n μ W R

163000 = 2x0.3xWx124

W = 2190.86 N

Table.1 Chemical Properties Of En- Gjs-400- Steel

| SL.NO | ELEMENT | TYPICAL |
|-------|-------------|------------|
| 1 | CARBON | 3.25-3.70 |
| 2 | SILICON | 2.40-3.00 |
| 3 | MAGANESE | 0.10-0.30 |
| 4 | SULPHUR | 0.015-0.08 |
| 5 | PHOSPHOROUS | 0.04-0.07 |
| 6 | ALLOY | RESIDUAL |

Table.2 Mechanical Properties Of En- Gjs-400- Steel

| SL.NO | PROPERTIES | EN-15 STEEL |
|-------|----------------------|------------------------------|
| 1 | TENSILE STRENGTH | 400 |
| 2 | BRINELL HARDNESS | 130-180[10mmDIA BALL 3000KG] |
| 3 | YOUNGS MODULUS (MPa) | 210000 |
| 4 | POISSON RATIO | 0.3 |
| 5 | DENSITY (KG/M3) | 7850 |

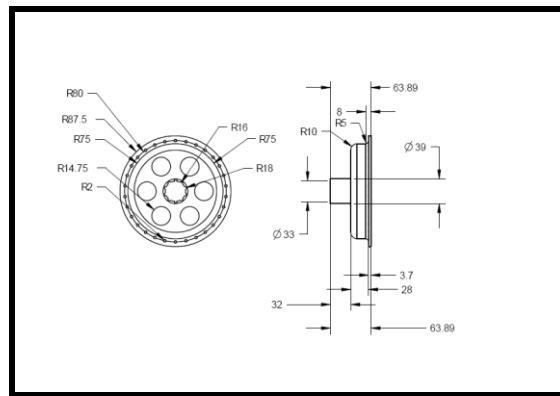


Figure1. Detail drawing of clutch plate

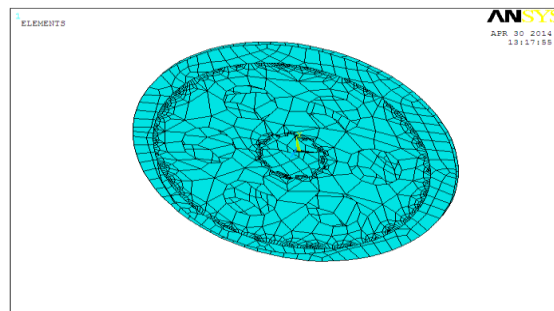


Fig 7.3 Ansys meshed drawing of clutch plate

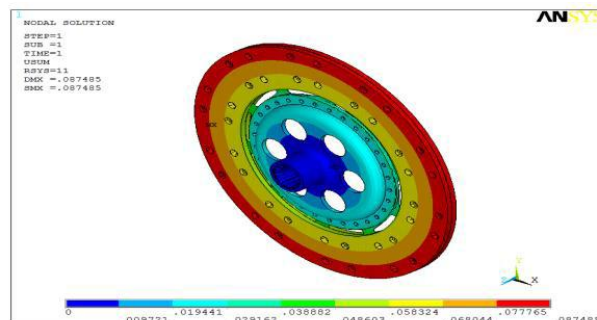


Figure2. Maximum von mises stress in MPa (pressure plate)

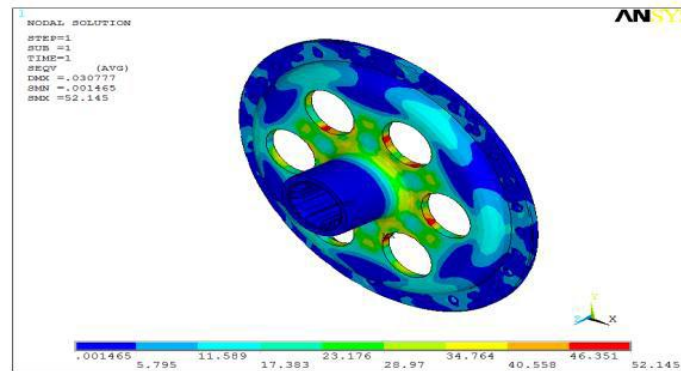


Figure4.Maximum deformation in mm (pressure plate)

IV. Conclusion

Maximum deformation in mm (pressure plate) After analyzing the materials, we found out von mises stress in MPa (overall component) that the suitability of EN GJS-400-15 steel for the production of clutch plate is better than Grey Cast Iron(FG300) . En 15 steel reduces the Stress on the support link is 167.911 MPa, where as the yield stress of FG300 is 181.033, so the life of the material should be high. Stress on the pressure plate is reduced to 46.937 MPa, whereas stress on grey cast iron is 52.145 MPa

Acknowledgements

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