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A PATH FOR HORIZING YOUR INNOVATIVE WORK

DESIGN AND ANALYSIS OF COUPLING USING ANSYS

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Abstract: Coupling is a mechanical device which used widely in many big and small scale applications. Couplings being the more accessible components within the machine are often modified to tune the overall system. This paper presents the concept of reducing maximum shear stresses by adding a new material between shaft and hub. The modeling of rigid flange coupling is done in CREO 2.0 and analysis of rigid flange coupling is carried out with the help of ANSYS 15 Software for calculated torque.

Keywords: ANSYS 15, CREO 2.0, Flange couplings, Shear stresses.

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INTRODUCTION

A coupling is a device used to connect two shafts together at their ends for the purpose of transmitting power. The primary purpose of couplings is to join two pieces of rotating equipment while permitting some degree of misalignment or end movement or both. The shafts that are connected by the coupling can be disengaged only after dismantling the coupling. The shafts connected by coupling may have collinear axes, intersecting axes or axes that are parallel at small distance apart. There are two types of couplings,

1. Rigid coupling

2. Flexible coupling

RIGID FLANGE COUPLING: It consists of two flanges, each flange is mounted on the shaft end and keyed to it. Two flanges are put together in position with help of nut and bolts. Flange couplings generally classified into three types

1. Protected rigid flange coupling

2. Unprotected rigid flange coupling

3. Marine rigid flange coupling

Fig. 1 Unprotected Rigid Flange Coupling

Calculations:

Mild steel, Ti alloy

Power 0f turbine = 660 Mw

Speed of turbine = 3000 rpm

Mild steel

Young's modulus	**2.1E+11 Pa**
Poisson's ratio	0.3
Tensile Yield strength	2.25E+08 Pa
Compressive yield strength	2.25E+08 Pa
Tensile ultimate strength	4.905E+08 Pa
Compressive ultimate strength	0 Pa
Density	7850 k m^-3

Ti alloy

Young's modulus	**9.6E+10 Pa**
Poisson's ratio	0.36
Tensile Yield strength	9.3E+08 Pa
Compressive yield strength	9.3E+08 Pa
Tensile ultimate strength	1.07E+09 Pa
Compressive ultimate strength	0 Pa
Density	462 k m^-3

The coupling is to be designed to operate at 3000 RPM and the power is 660 Mw. Three parts are to be designed they are,

1. Hub and Key

2. Flange Plate

3. Bolt

Torque = $\frac{Power *60}{2\,\pi * Speed}$ = 2100.845 * 10^6 N-mm

1. Inner diameter of hub = Diameter of shaft = 425 mm

Outer diameter of hub = 2*d =850 mm

Length of hub = 1.5 * d = 637.5 mm

2. For key , $\frac{w}{t}$ = 1.25

Width = 100 mm and thickness = 80 mm

3. Inner diameter of flange = 850 mm

Outer diameter of flange = 2*850 = 1700 mm

Thickness = 0.5*d = 212.5 mm

3. Length of bolt = 2 * thickness of flange = 425 mm

MODELING

Fig 2. Model of Coupling

ANALYSIS:

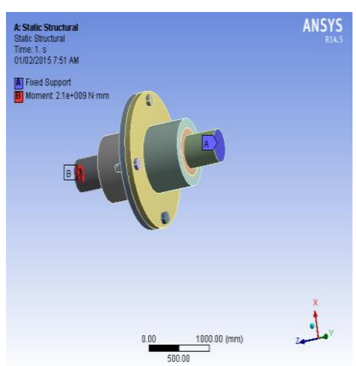

Fig 3. Static analysis of Coupling

RESULT:

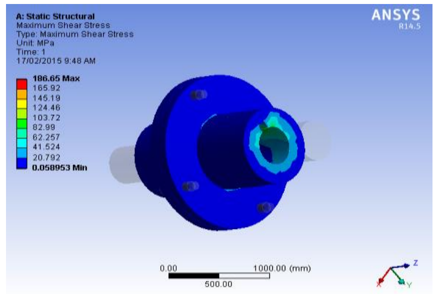

Fig 4.

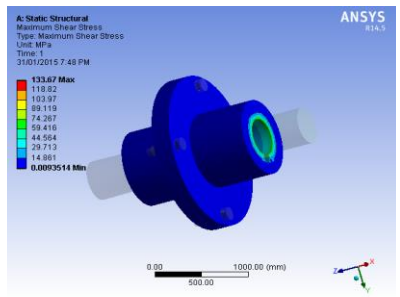

Fig. 5

CONCLUSION:

After comparing both the results, we can find that the shear stresses developed in the flange coupling with Ti alloy ring are less than the shear stresses developed in coupling without Ti alloy ring

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