



## FLANGE COUPLING ANALYSIS WITH MILD STEEL, EN-9, SAE1020, MATERIALS

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**ABSTRACT-** A Coupling is a gadget which is answerable for the employable force transmission between two shafts turning at specific RPM. Coupling is utilized to interface two unique shafts at their end and can slip or come up short contingent on as far as possible. It is the essential piece of any force transmission and may keep going for long time whenever planned and looked after appropriately. The current investigation of this paper is to diminish the most extreme pressure by choosing a reasonable material for spine coupling. For this reason, displaying of the unbending rib coupling is completed in scoundrel apparatus strong works and dissected in ANSYS Workbench, with static and dynamic stacking conditions and determined outcomes like distortion, anxiety and shear pressure and wellbeing factor, regular recurrence esteems. From every one of these qualities tables and diagrams we can talk about the every material strength and stress esteems at long last can close our undertaking with reasonable material.

**Keywords:** RPM, spine coupling, ANSYS Workbench

### I. INTRODUCTION

#### COUPLING

A coupling is a gadget used to interface two shafts together at their finishes to send power. Couplings don't typically permit disengagement of shafts during activity, anyway there are force restricting couplings which can slip or detach when some force limit is surpassed. The basic role of couplings is to join two bits of turning hardware while allowing some level of misalignment or end development or both. Via cautious choice, establishment and upkeep of couplings, generous reserve funds can be made in diminished support expenses and vacation. In a morebroad setting, a coupling can likewise be a mechanical gadget that serves to interface the finishes of nearby parts or items

#### COUPLING MAINTENANCE AND FAILURE

Coupling upkeep is by and large a basic matter, requiring a consistently planned investigation of each coupling. It comprises of: Performing visual investigations, checking for indications of wear or weakness, and cleaning couplings routinely. Checking and changing ointment routinely if the coupling is greased up. This upkeep is required every year for most couplings and all the more oftentimes for couplings in unfriendly conditions or in requesting working conditions. Reporting the support performed on each coupling, alongside the date. Indeed, even with legitimate support, nonetheless, couplings can come up short. Hidden purposes behind disappointment, other than support, include:

- Inappropriate establishment
- Helpless coupling choice
- Activity past plan capacities.

The best way to improve coupling life is to comprehend what caused the disappointment and to address it preceding introducing another coupling. Some outside signs that demonstrate potential coupling disappointment include:

- Strange clamor, for example, shrieking, screeching or chatting
- Unreasonable vibration or wobble

- Bombed seals demonstrated by grease spillage or pollution

Couplings are typically adjusted at the processing plant before being dispatched, yet they sometimes leave balance in activity.

### Flange

A spine is an outside or interior edge, or edge (lip), for strength, as the rib of an iron shaft, for example, an I-pillar or a T-bar; or for connection to another item, as the rib on the finish of a line, steam chamber, and so forth, or on the focal point mount of a camera; or for a rib of a rail vehicle or cable car wheel. Consequently flanged wheels will be wheels with a rib on one side to hold the wheels back from running out of control. The expression "rib" is likewise utilized for a sort of hardware used to frame ribs. Lines with spines can be collected and dismantled without any problem. A rib can likewise be a plate or ring to shape an edge toward the finish of a line when affixed to the line (for instance, a wardrobe rib). A visually impaired rib is a plate for covering or shutting the finish of a line. A spine joint is an association of lines, where the interfacing pieces have ribs by which the parts are catapulted together. Albeit the word rib by and large alludes to the real raised edge or lip of a fitting, numerous flanged plumbing fittings are themselves known as 'ribs':

**FLANGE COUPLINGS** Rib Coupling is a driving coupling between rotating shafts that includes spines one of which is fixed at the completion of each shaft, the two Flanges being shot alongside a ring of shocks to complete the drive. A rib coupling planned to join two chamber shut in a flush, fixed way. This two-piece coupling unit contains a keyed tolerating side for the flanged end to be gotten to, so it may be hitched to the confining chamber end, which moreover has a flanged end. Each spine has either a male or female coupler opening so when the two completions are joined together, they are changed without causing resistance or drag in the material being experienced them. This male or female coupling method also makes a consistent affiliation that is impenetrable to moving, keeping the rib coupling sturdily set up.



Flange Couplings



Flange Couplings

## II. LITERATURE REVIEW

➤ MarenVenkaataSanil Reddy (2016) composed a note on stage synchronization in coupled turbulent fragmentary request frameworks. The control and solid stage synchronization issue between two coupled confused fragmentary request frameworks is tended to in this paper. A functioning nonlinear input control plot is developed to accomplish stage synchronization between two coupled disordered partial request frameworks. The fundamental conditions for fragmentary request Lorenz, Lü and Rössler frameworks to show disordered attractor like their number request partner.

- Salnkhe R.T., Mr. Patil (2013) The quest for reasons of machine device vibrations and insecurities showed up toward the start of the twentieth century. This is a consequence of immense improvement in metal expulsion measure. In the only remaining century machine instruments saw an extensive development and turned out to be all the more impressive, exact, inflexible and programmed. This development was fuelled by broad industry improvement, particularly on account of aviation, shaping and car enterprises. In any case, with every one of these enhancements in the assembling area, new constraints and difficulties additionally showed up
- Chandra Shekar Katta, KamaanaSrinuvasa Rao (3) this paper shows that the primary investigation of spine coupling exposed to static burden. An outline of shaft coupling and utilization of various composite materials can be gotten from this paper. Result correlation shows that dark cast iron is superior to composite material (Aluminum, silicon, carbide) for rib material. . Strong works and ANSYS programming is utilized for displaying and examination work individually.
- MarenVenakata Sunil Reddy, C.Raghunatha Reddy (4) this paper shows that the metallographic examination, hardness estimation and crack investigation of an all inclusive joint. Spectroscopic examination has additionally completed by limited component strategy. Four distinct materials has been looked at through ANSYS programming which shows that dark cast iron is a best material than tempered steel, cast iron and chilled cast iron.
- Mr. S.B. Jaisawal, Prof. M.D. Pasarkar (5) in this paper creator has dealt with high water transmission coupling. He recommended that rib is a basic piece of coupling consistently requires consideration during activity. Creator prescribes composite steel material for rib to be weld for better weld capacity through its examination work. ANSYS workbench 11.0 had utilized for examination work.
- Vinodh Kumar S, Sampath V and Bhaskar P (6) this paper manages enhancement of plan of car drive shaft (propeller shaft) gathering by utilizing the composite materials. For this reason material, for example, Eglass/Epoxy and Carbon Epoxy is utilized. Composite material outcomes in less weight, high strength, and high solidarity to weight proportion, and enormous firmness. Along these lines utilization of composite material is expanding in designing application

## DESIGN CONSIDERATIONS

Considering a standard motor with Power = 37.5 kW and RPM = 180

Assuming design torque to be 1.5 times the rated torque

Hub diameter,  $d_h = 2d = 2 * 60 = 120$  mm

Hub length,  $l_h = 1.5d = 1.5 * 60 = 90$  mm

Bolt circle diameter,  $d = 3d = 3 * 60 = 180$  mm

Flange thickness,  $t = 0.5d = 0.5 * 60 = 30$  mm

Web thickness,  $t_1 = 0.25d = 0.25 * 60 = 15$  mm

Diameter of spigot and recess,  $d_r = 1.5d = 1.5 * 60 = 90$  mm

Outside diameter of flange,  $d_0 = 4d + 2t_1 = 4 * 60 + 2 * 15 = 270$  mm

Hub diameter  $D = 2 X d = 2 X 85 = 170$ mm

B) Length of hub =  $1.5 X d = 1.5 X 85 = 127.5$ mm $\approx$ 130mm

C) Key dimensions  $b = 22$ mm;  $h = 14$ mm (from reference table)

D) Flange thickness  $t_f = 0.5d = 0.5 X 85 = 42.5$ mm

Hence the design is safe. Since the induced shear stress for the hub material cast iron is less than permissible value.

## DESIGN FOR KEY

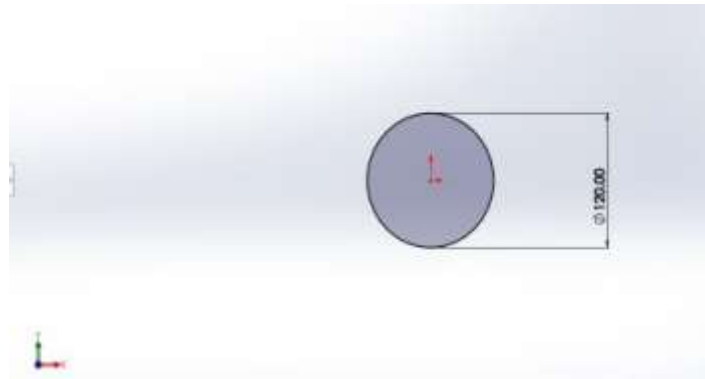
Width of key = 22mm; thickness of key = 14mm; length of key = 130mm

IV) Design for Bolts (4 bolts for shaft diameter from 40 to 100mm)

Force on each bolt  $F_{tb} = 10128.62$  N

## DESIGNING PROCESS STEP BY STEP

To design flange couple assembly model here need to open solid works module then create diameter of flange, here diameter value is consider as 120mm, and after creating this circle then make it as 3d model with the help of extrude option, and here extrusion length is consider as 30mm



And the below image represent the flange coupling model extrusion length,



To create extrusion cut model now need to create a circle with a diameter of 110mm and then cut the extrusion length of 20mm,

### III. MATERIAL SELECTION

#### Mild steel

Carbon steel will be steel in which the primary interstitial alloying constituent is carbon in the scope of 0.11–1.99%. The American Iron and Steel Institute (AISI) definition says

Steel is viewed as carbon steel when no base substance is indicated or needed for chromium, cobalt, molybdenum, nickel, niobium, titanium, tungsten, vanadium or zirconium, or some other component to be added to get an ideal alloying impact; when the predetermined least for copper doesn't surpass 0.39 percent

or on the other hand when the greatest substance indicated for any of the accompanying components doesn't surpass the rates noted manganese 1.63, silicon 0.59, copper 0.59. The term "carbon steel" may likewise be utilized regarding steel which isn't hardened steel; in this utilization carbon steel may incorporate composite steels. As the carbon rate content increases, steel can get more earnestly and more grounded through warmth treating; notwithstanding, it turns out to be less malleable. Despite the warmth treatment, a higher carbon content lessens weldability. In carbon prepares, the higher carbon content brings down the softening point.

### Sae 1020

Carbon prepares is a classification of steel, which contains 0.111 to 1.98% carbon. This steel class acquires hardness and strength with heat treatment when the level of carbon content increments however the flexibility is decreased.

AISI 1020 carbon steel is a regularly utilized plain carbon steel. It has a decent mix of solidarity and malleability and can be solidified or carburized.

The accompanying segments will examine in insight concerning AISI 1020 carbon steel.

### En-9

EN9 is a medium carbon steel grade ordinarily provided in the as moved condition. It tends to be fire or enlistment solidified to create a high surface hardness with brilliant wear obstruction for a carbon steel grade.

EN9, otherwise called 070m55, accessible in breadths, pads, squares and plates with a carbon content 0.48/0.58 this is a medium carbon steel which can build up a rigidity of 699N/mm 44.99tsi. In the standardized condition EN9 can be utilized for pinion wheels, sprockets and cams.

### Applications

EN9 is utilized normally for some broad designing applications. Regular applications incorporate, shafts, tomahawks, and blades, hedges, driving rods, screws, sickles, carpentry bores and mallets.

## IV. RESULTS AND DISCUSSION

	<b>steel</b>	<b>En-9</b>	<b>Sae1020</b>
<b>Deformation(mm)</b>	0.03	0.627	0.381
<b>Stress(Mpa)</b>	151.017	152.033	150.025
<b>strain</b>	0.0081965	0.15022	0.090908
<b>Shear stress (Mpa)</b>	83.8	83.5	84.1
<b>Safety factor</b>	1.657	2.011	2.2922

From the above tables it is observe that steel material is having very less deformation values compare to other 2 materials, and among all en9 material is having high deformation values, and when comparing stress values all materials are having nearby values, and among all en-9 material is having high amount of stress and sae1020 material is having less amount of stress values, but all these stress values are under yield limit boundary conditions, so that each material is consider to be use at this boundary condition, when it compare to safety factor values, sae1020 is having highest among all, and steel is having least,

## V. CONCLUSION

In this present project flange coupling was developed and analyzed with 3 different materials in this mild steel is an existing material and remaining two are en-9 and sae1020, in order to develop the model here cad tool solid works were used to design the model and Cae Tool were used for analyzing with two different analysis static and dynamic. From the static results mild steel materials is better than en-9 in stress values but en-9 has more strength than mild steel material, but sae1020 material has better strength than two materials and also highest safety factor values. This sae1020 material reduces the stress values on the body and also increases the strength of the model. Sae1020 not only good at static load conditions but also good at dynamic loading conditions, it means to get more accurate results here we performed model analysis and calculated natural frequency values for each material and this value shows the strength of the material to withstand at vibrating conditions, in this case also sae1020 has very good frequency values compare to two other material, finally we can conclude our model can also manufacture with sae1020 instead of mild steel.

### ADVANTAGES OF SAE1020

- Reduces the stress values
- Increases the overall strength (nearly 0.389 times)

### DISADVANTAGES OF SAE1020

- 0.3% increases the weight compare to mild steel

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