Design of Couplings :

Coupling is a machine element used to connect two shafts of transmission system

Purpose of Coupling

It provides the connection of shaft between two different units such as electrical motors and machines

It makes the provision for disconnection of two units for repay or alteration

It introduce machanical flexibility between two connected units.

It reduce the transmission of vibration and shafts between two connected units.

Requirements of good coupling

It transmits full power from one shaft to another

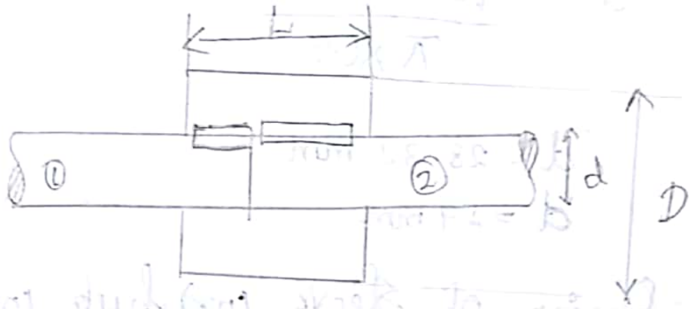
It should keep the shaft in perfect alignment

It should absorb the slight alignment that may be present between the driver and driven shaft

It is easy to connect & disconnect

It should not have any projection

1. Design of muff Coupling to connect two mild steel shaft and transmit 35 kW at 1440 rpm CI sleeve connect the shaft through two mild steel shunk keys. The maximum torque transmitted is 25% greater than average torque. Allowable shear stress for cast iron is 15 N/mm². Allowable shear stress for mild steel is 65 N/mm². Allowable crushing stress for mild steel is 160 N/mm². Assume additional data if necessary.



1) Design of shaft

$$\tau_{max} = \frac{16 T_{max}}{\pi d^3}$$

$$T_{max} = 1.25\, T_{mean}$$

$$T_{mean} = \frac{60 \times P}{2\pi N}$$

$$= \frac{60 \times 35 \times 10^3}{2 \times 3.14 \times 1440}$$

$$= 232.100 \text{ N·m}$$

$$= 232.100 \times 10^3 \text{ N·mm}$$

$$T_{max} = 1.25 \times 232 \times 10^3$$

$$= 290 \times 10^3 \text{ N·mm}$$

$P = 35\ kN$

$N = 1440\ rpm$

$\sigma_c = 160\ N/mm^2$

$\tau_{SI} = 15\ N/mm^2$

$\tau_{St} = 65\ N/mm^2$.

$$65 = \frac{16 \times 290 \times 10^3}{\pi d^3}$$

$$d^3 = \frac{16 \times 290 \times 10^3}{\pi \times 65}$$

$$d = 28.32\ mm$$

$$d = 29\ mm$$

Step:2 Design of Sleeve (or) hub (or) muff.

$D = 2d$.

$D = 2 \times 29$

$= 58\ mm$.

$L = 3.5d$

$= 101.5\ mm$

$$\tau = \frac{16\, T_{max}}{\pi D^3 (1 - k^4)}$$

$$k = d/D = \frac{29}{58} = 0.5$$

$$= \frac{16 \times 290 \times 10^3}{\pi \times (58)^3 \times (1 - 0.5^4)}$$

$$= \frac{4640000}{574652.2}$$

$= 8.07\ N/mm^2 < 15\ N/mm^2$

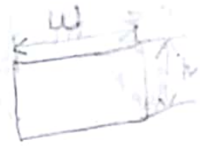
$\tau < \tau_{all}$.

Design is safe.

Scanned by CamScanner

Design of keys

i) Sunk key [Rectangular Cross section]



$w = d/4$

$= 7.25$ mm.

$h = \frac{2}{3} w$

$= 4.83$ mm.

length of key (l)

$l = L/2$

$= \frac{101.5}{2}$

$= 50.75$ mm.

$\sigma_c = \frac{4 T_{max}}{d h l}$.

$160 = \frac{4 \times 290 \times 10^3}{29 \times 4.83 \times l}$.

$l = \frac{4 \times 290 \times 10^3}{29 \times 4.83 \times 160}$

~~= 184.48 mm~~

$= 51.75$ mm.

$\tau = \frac{2 T_{max}}{d w l}$

$65 = \frac{2 \times 290 \times 10^3}{29 \times 7.25 \times l}$

$l = \frac{2 \times 290 \times 10^3}{29 \times 7.25 \times 65}$

$= 42.44$ mm.

$l = 52.08$ mm [by crushing]

Scanned by CamScanner