A LECTURE NOTE
ON
TH.2 DESIGN OF MACHINE ELEMENTS
SEMESTER -5

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Sr. Lecture Mechanical Engineering

Mechanical Engineering

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Shaft Coupling :-

Shafts are usually available upto 7 m length. In order to have a greater length, it becomes necessary to join two or more pieces of the shaft by means of a coupling

Purpose -

1) To provide for the connection of two or more shafts
2) To provide for misalignment of the shaft / To introduce mechanical flexibility.
3) To reduce the transmission of shock loads from one shaft to another.
4) To introduce protection against overload.
5) It should have no projecting parts.

Requirements of a good shaft coupling :-

1) It should easy to connect or disconnect.
2) It should transmit the full power from one shaft to the other shaft without losses.
3) It should hold the shaft in perfect alignment.
4) It should reduce the transmission of shock loads from one shaft to another.
5) It should have no projecting parts.

Types of shaft Coupling

Rigid coupling

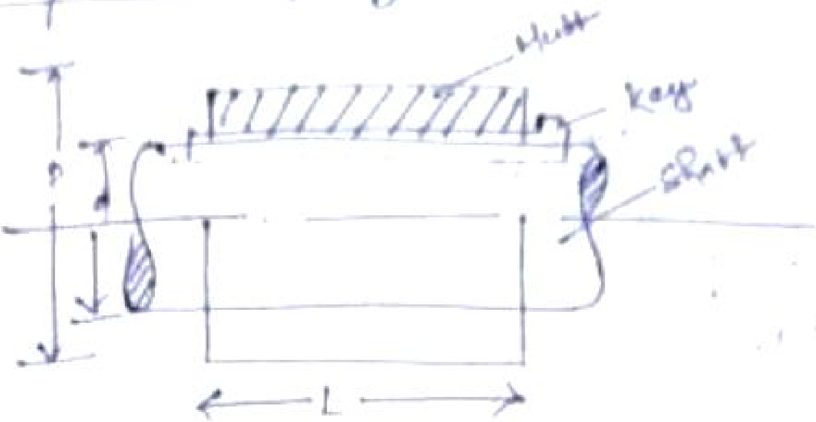
1) Sleeve/muff
2) Clamp/Compression/split muff
3) Flange coupling

Flexible coupling

1) Bushed pin type coupling.
2) Universal coupling.
3) Oldam coupling.

Shaft Coupling :-

Sleeve/ muff. coupling :-



$D = 2d + 13mm$

$L = 3.5d$

Design of sleeve :- T = torque

τ_c = shear stress.

$$T = \frac{\pi}{16} \tau \left(\frac{D^4 - d^4}{D} \right) \quad \because K = d/D$$

$$= \frac{\pi}{16} \tau D^3 (1 - K^4)$$

Design of key :-

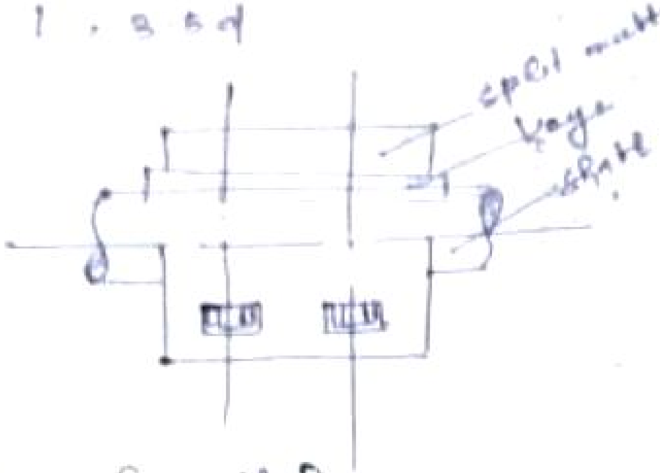
$$l = \frac{L}{2} = \frac{3.5d}{2}$$

Subjected to shearing $T = l \times w \times \tau \times \frac{d}{2}$

Subjected to crushing $T = l \times \frac{t}{2} \times \tau_c \times \frac{d}{2}$

Clamp/Compression Coupling :- / Split muff coupling.

D = 2d + 13 mm
l = 3.5 d



1) Design of muff }
2) Design of key } same as to muff coupling

3) Design of Bolts/Clamping bolts.

T = torque transmitted by shaft
d = dia of shaft
d_b = root/effective dia of bolt
n = no. of bolts.
σ_t = p tensile stress for bolt material
μ = coefficient of friction betn muff & shaft
L = length of muff

Force exerted by each bolt (F) = stress (σ) × area (A)

$$= \sigma_t \times \frac{\pi}{4}(d_b)^2$$

Force exerted by bolts on each side of shaft

$$= \frac{\pi}{4}(d_b)^2 \times \sigma_t \times \frac{n}{2}$$

Let (p) be the pressure on shaft and muff surface due to the force, then the uniform pressure distribution over the surface,

$$p = \frac{\text{force}}{\text{Projected area}}$$

$$= \frac{\frac{\pi}{4}(d_b)^2 \times \sigma_t \times \frac{n}{2}}{L \times d \times \frac{1}{2}}$$

∴ Frictional force between each shaft & muff

$$F = \mu \times \text{pressure} \times \text{area}$$

$$= \mu \times p \times \frac{\pi d L}{2}$$

$$= \mu \times \frac{\frac{\pi}{4}(d_b)^2 \times \sigma_t \times \frac{n}{2}}{L \times d \times \frac{1}{2}} \times \frac{\pi}{2} dL$$

$$= \mu \times \frac{\pi^2}{4}(d_b)^2 \times \sigma_t \times \frac{n}{2}$$

$$= \mu \times \frac{\pi^2}{8} \times d_b^2 \times \sigma_t \times n$$

Torque that can be transmitted by the coupling

$$T = F \times \frac{d}{2}$$

$$= \mu \times \frac{\pi^2}{8} \times d_b^2 \times \sigma_t \times n \times \frac{d}{2}$$