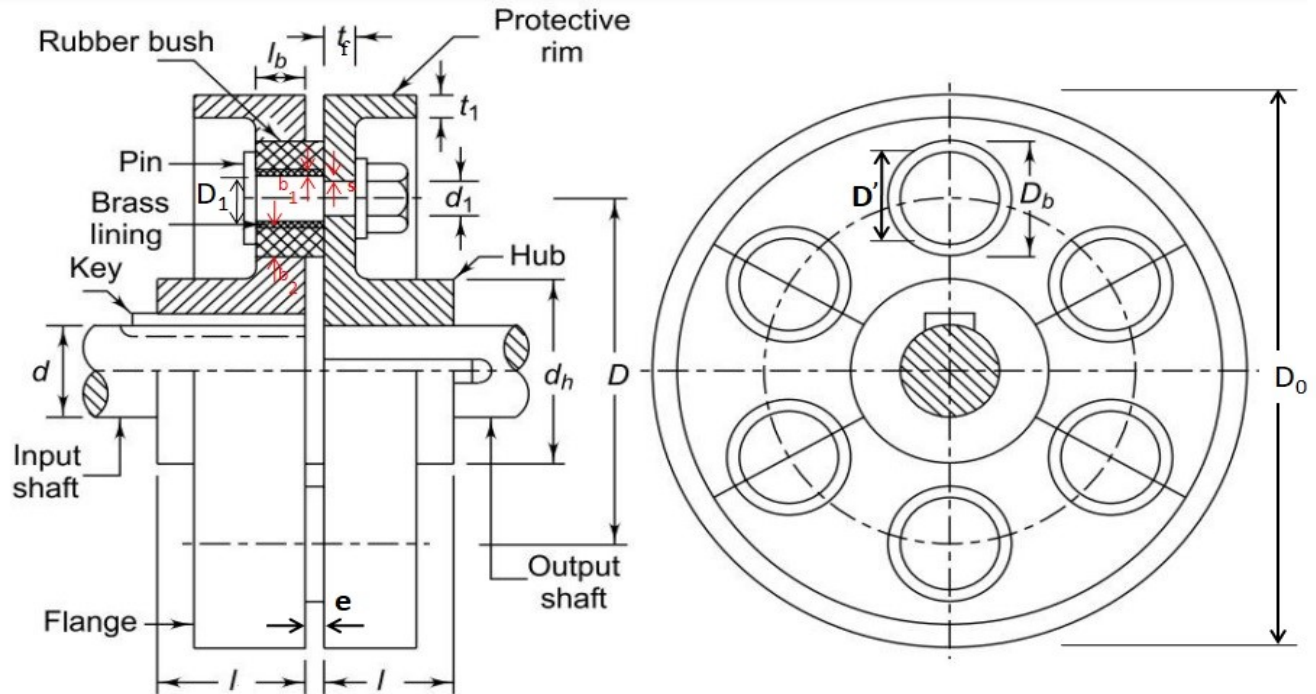


## **Standard size of Rod/Shaft/Tube/Bolts**

<b>Range of Size</b>	<b>Increment steps</b>
0-10	1mm
10-24	2mm
24-45	3 mm
45-100	5 mm
>100	10 mm

## Bushed Pin Flexible Coupling

**Design 4:** Design a bushed pin flexible coupling for joining shafts of 50 mm diameter rotating at 1200 rpm and transmitting a power of 30/35/40/50 kW. Bearing pressure ( $p_b$ ) is 0.35 MPa. The allowable stress in pin material is 65 MPa. Allowable shear stress in hub and shaft is not to exceed 45 MPa. In key,  $\tau_{per} = 50$  MPa and  $\sigma_{c_{per}} = 80$  MPa



### Design Steps:

1. Diameter of shaft,  $d = 50$  mm

No. of pins,  $n = 0.02d + 5$  (Even number)

Nominal Diameter of bolts,  $d_1 = \frac{0.5d}{\sqrt{n}}$  (std. size)

Take step size,  $s = 2-3$  mm

Enlarged diameter of pins,  $D_1 = d_1 + 2s$

Brass/Bronze Lining thickness,  $b_1 = 1-3$  mm

Rubber bush thickness,  $b_2 = 6-8$  mm

Outer diameter of the bush,  $D_b = D_1 + 2b_1 + 2b_2$

Diameter of pin head,  $D' = D_b - 4$

Clearance,  $e = 3-5$  mm

Hub diameter,  $d_h = 2d$

Bolt pitch circle diameter,  $D = 3d$

Outer diameter of the flanges,  $D_0 = 4d$

Hub length = Effective Key Length =  $l = 1.25d$  to  $1.5d$

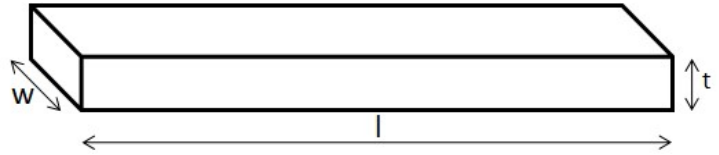
Flange thickness,  $t_f = 0.5d$

Thickness of protecting rim,  $t_1 = 0.25d$

**Assuming rectangular key**

Width of key,  $w = \frac{d}{4} t o \frac{d+13}{4}$

Thickness of key,  $t = \frac{d}{6} t o \frac{d+13}{6}$

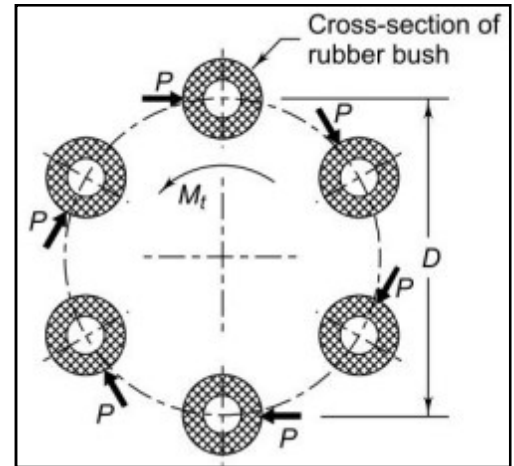


2. Force acting on each pin

$P = \frac{2\pi NT}{60}$  Watts, find torque 'T' in Nmm

Force per pin, F

$$F = \frac{T}{n \left(\frac{D}{2}\right)}$$



3. From bearing consideration,

Effective length of the bush in contact with the input flange,

$$l_b = \frac{F}{p_b D_b}$$

Bending Moment,  $M = F \left(\frac{l_b}{2} + e\right)$

Section Modulus,  $Z = \frac{\pi}{32} d_1^3$

Bending Stress,

$$\sigma_b = \frac{M}{Z}$$

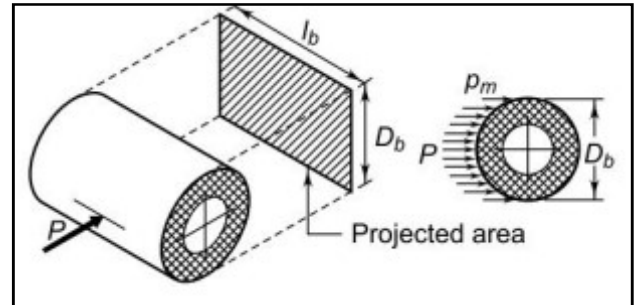
Shear stress,

$$\tau = \frac{F}{\frac{\pi}{4} d_1^2}$$

Principal stress,

$$\sigma_p = \frac{1}{2} \left[ \sigma_b + \sqrt{\sigma_b^2 + 4\tau^2} \right]$$

Check that  $\sigma_p < \sigma_{per\ pin}$ , else go to step 1 and reiterate



4. Shear stress in hub

$$\tau_{hu} = \frac{16T}{\pi d_h^3 (1 - k^4)} \text{ where } k = \frac{d}{d_h}$$

Check that  $\tau_{hub} < \tau_{per\ hub}$

5. Shear stress in hub/flange section

$$\tau_{flange} = \frac{T}{\pi d_h t_f \left(\frac{d_h}{2}\right)}$$

Check that  $\tau_{flange} < \tau_{per\ flange}$

6. Stresses in key

Shear stress in key,

$$\tau_{key} = \frac{T}{(w \times l) \left(\frac{d}{2}\right)}$$

Check that  $\tau_{key} < \tau_{per\ key}$

Compressive stress in key,

$$\sigma_{c\ key} = \frac{T}{\left(\frac{t}{2} \times l\right) \left(\frac{d}{2}\right)}$$

Check that  $\sigma_{c\ key} < \sigma_{c\ per\ key}$

## VIVA QUESTIONS

1. What is the necessity of a flexible coupling?
2. What makes a flexible coupling flexible?
3. What is the nature of stresses in the pin of bushed pin type flexible coupling?
4. What purpose is served by clearance between two flanges of a pin bushed flexible coupling?