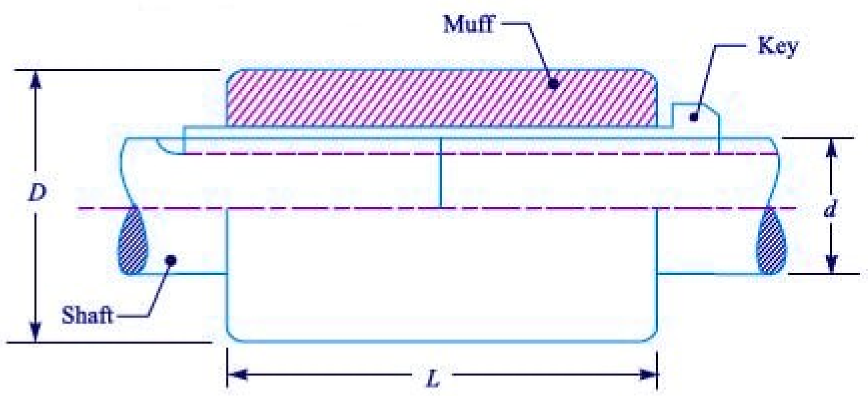
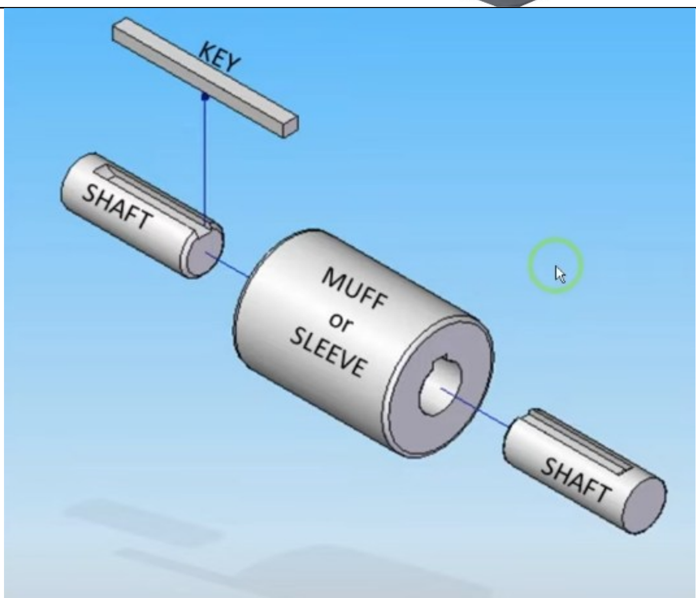
DESIGN OF MUFF COUPLING

Muff coupling (also called sleeve coupling) is a type of rigid coupling used to connect two shafts. It consists of a hollow cylindrical sleeve (muff) that fits over the ends of two shafts and is secured using a key and set screws or a pin.





Applications:

- Low to medium torque applications.
- Pumps, compressors, and small machinery.
- Situations where precise alignment is maintained.

Advantages:

- Simple and inexpensive.
- Easy to manufacture and install.
- Compact design.

Disadvantages:

- No flexibility; misalignment can cause stress.
- Difficult to dismantle for maintenance.
- Cannot absorb shocks or vibrations.

Design

Design a Muff Coupling to transmit 15KW power at 200 rpm. The allowable shear stress and crushing stress for the shaft and key material are 60 N/mm2 and 110 N/mm2 respectively. The allowable shear stress for the Cast Iron Muff is 18 N/mm2.

Using the above data, design a safe Muff Coupling and using the designed values make an assembly model and extract the following Views

a. Sectional Front View

b. Front View

c. Bill of the Material

Solution:

Given:

Power P = 15KW

Speed N = 200 rpm

Alllowable shear stress for shaft and Key τ = 60 N/mm2

Allowable crushing stress for shaft and key τ_c = 110 N/mm2

Allowable Shear stress for CI muff $(\tau_a)_{muff}$ = 18 N/mm2

1. Design of Shaft

a. Torque transmitted by the Shaft,

$T = \frac{9.55 \times 10^6 (P)}{N}$	Eq 3.3(a) DDHB
$T = \frac{9.55 \times 10^6 (15)}{200}$ = 716.25x10^3 Nmm	
b. Diameter of the Shaft	
$D = \sqrt[3]{\frac{16T}{\pi \tau_a}}$	Eq. 13.3 (a) DDHB
$D = \sqrt[3]{\frac{16 * 716.25 * 10\hat{}3}{\pi * 60}}$ = 39.32 mm From DDHB table number 3.5(a)	
Standard Diameter D = 40 mm	

2. Design of Muff

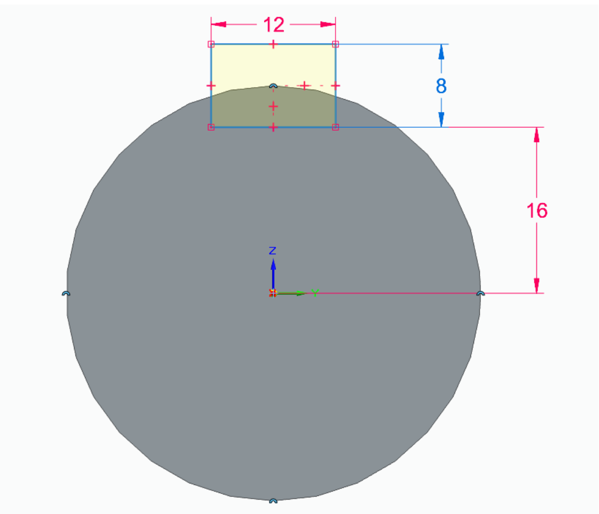
a. Diameter of Muff (Hub)	
D1 = 1.5 D	Eq. 13.3 (c) DDHB
D1 = 1.5 * 40 = 60 mm	
b. Length of the Muff	
L = 2.5 D + 50 mm	diagram 13.2 (a) DDHB
c. Check for Shear Stress in Muff	
Torque Transmitted by the Muff, $T = \frac{\pi}{16} \left[\frac{D_1^4 - D^4}{D} \right] \tau$	Eq. 13.3 (b) DDHB
$716.25\text{x}10\hat{}3 = \frac{\pi}{16} \left[\frac{60^4 - 40^4}{40} \right] * \tau$	
$(\tau_{muff})_{ind} = 14.03 \frac{N}{mm\hat{}2}$	
As, $(\tau_{muff})_{ind} < (\tau_{muff})_a$ 14.03 N/mm2 < 18 N/mm2 Design is Safe	

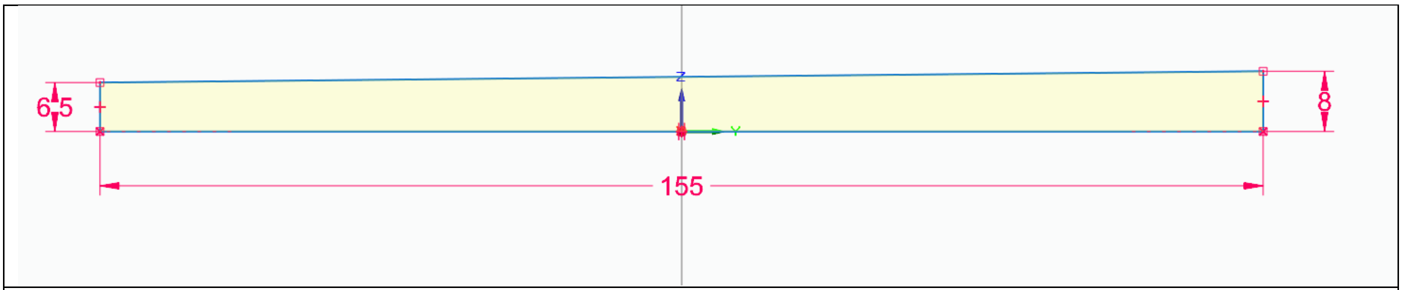
3. Design of Key

Assume taper sunk key with taper 1:100

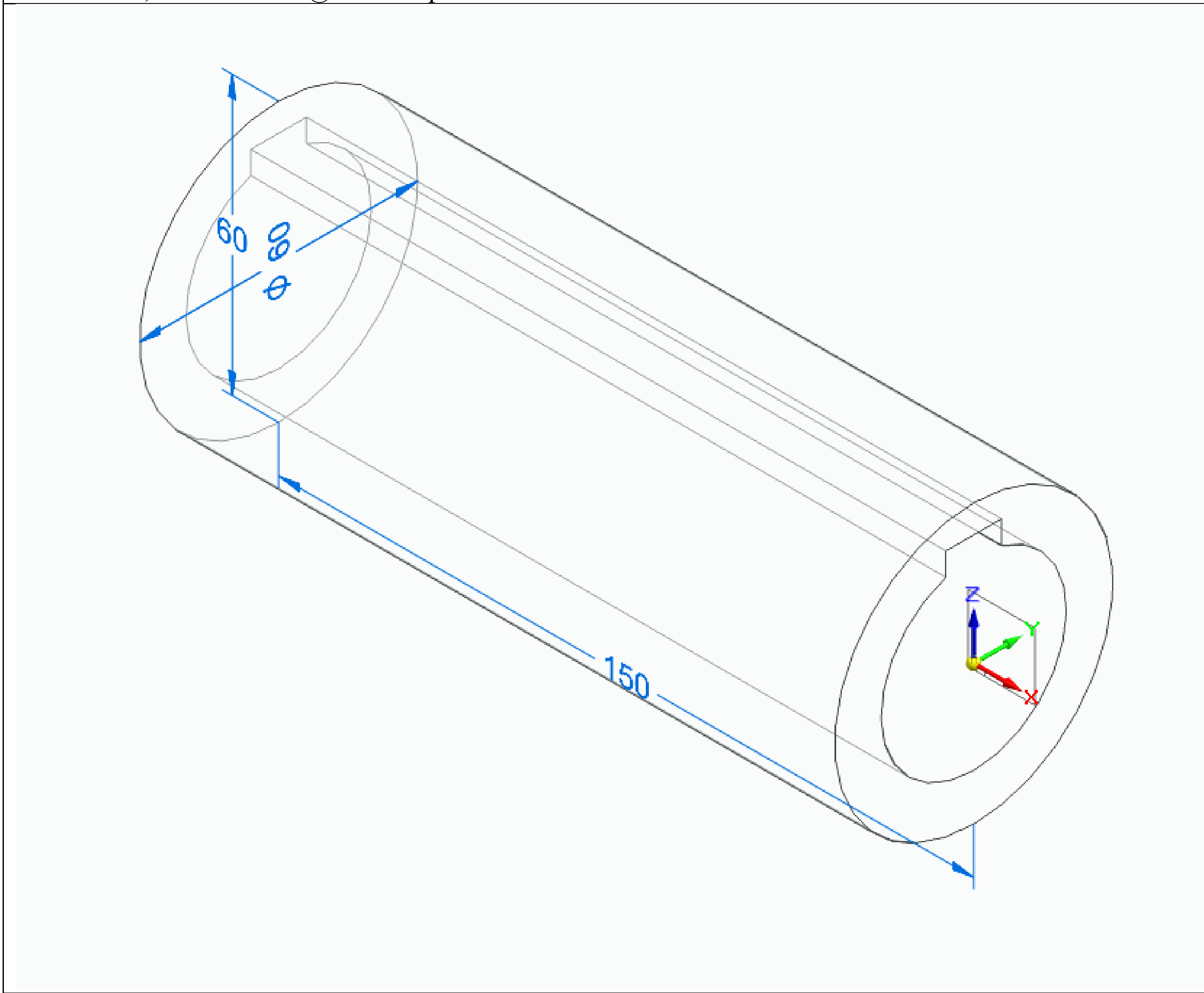
a. From Table 4.2 of DDHB, for shaft diameter 40mm , Width of the key b = 12 mm, Height h = 8 mm	
b. Length of the Key l = L + 5mm = 150 +5	
l = 155 mm	
c. Check for Shear Stress in Key $T = 0.5 * \tau * b * D * l$ 716.25x10^3 = 0.5 x 12 x 40 x 155 x τ	Eq. 4.5 (a) DDHB, neglecting negative terms
$\tau = 19.25\ N/mm2$	
As $\tau_i < \tau_a$ 19.29 N/mm2 < 60 N/mm2 Design is Safe	
d. Check for Crushing stress in Key Torque Transmitted, $T = 0.25 * \sigma_b * h * D * l$	Eq. 4.4 (b) DDHB
716.25x10^3 $= 0.25 * \sigma_b * 8 * 40 * 155$	
$\sigma_b = 57.76\ N/mm2$	
As the crushing stress of the key induced < Allowable crushing stress 57.76 N/mm2 < 110 N/mm2 Design is Safe	

Designed Values

	b = 12 mm h = 8 mm



l = 155 mm, h1 = 6.5 mm @ 1:100 taper



Muff Length = 150 mm,
Diameter of the muff D1 = 60 mm

Note:

1. Students need to use these values to make 3D Part models of each component and assemble them in Solid Edge Software.
2. Should Take Print of each components and final Assembly in Orthographic View.
3. Final Picture should be a draft of the assembly with its Sectional Front View
4. The Draft should contain the Part List