CHAPTER 6

COUPLINGS

6.1 INTRODUCTION

Shafts as we have learnt in the previous chapters are mechanical/machine parts that are commonly used to transmit power from one end of the machine/unit to another. But what, if these ends are distance apart and moreover the shafts are made of limited lengths for ease of transportation. So in such a case, we would connect them to form a long transmission shaft, as we have done in case of joints in the earlier chapter.

Similarly even in case of power transmission between a different machine to a unit, as seen, between a motor and a generator or pump, the shafts need to be joined together to transmit rotary motion between shafts of same unit, as well as of different machines / unit. And to do so, we have devices known as "couplings" which are used to "join two shafts".

Several types of couplings are available depending upon the type of transmission and relative position of the shaft. In this book, we will be discussing only the widely used type i.e. Flange Coupling.

In an automobile

COUPLING

Fig. 6.1

6.2 FLANGE COUPLINGS

This is a standard form of coupling and is extensively used. It can be seen in large power machines and is used for heavy loads.

It is classified into two types depending upon its shape:

a. Unprotected Flange Coupling

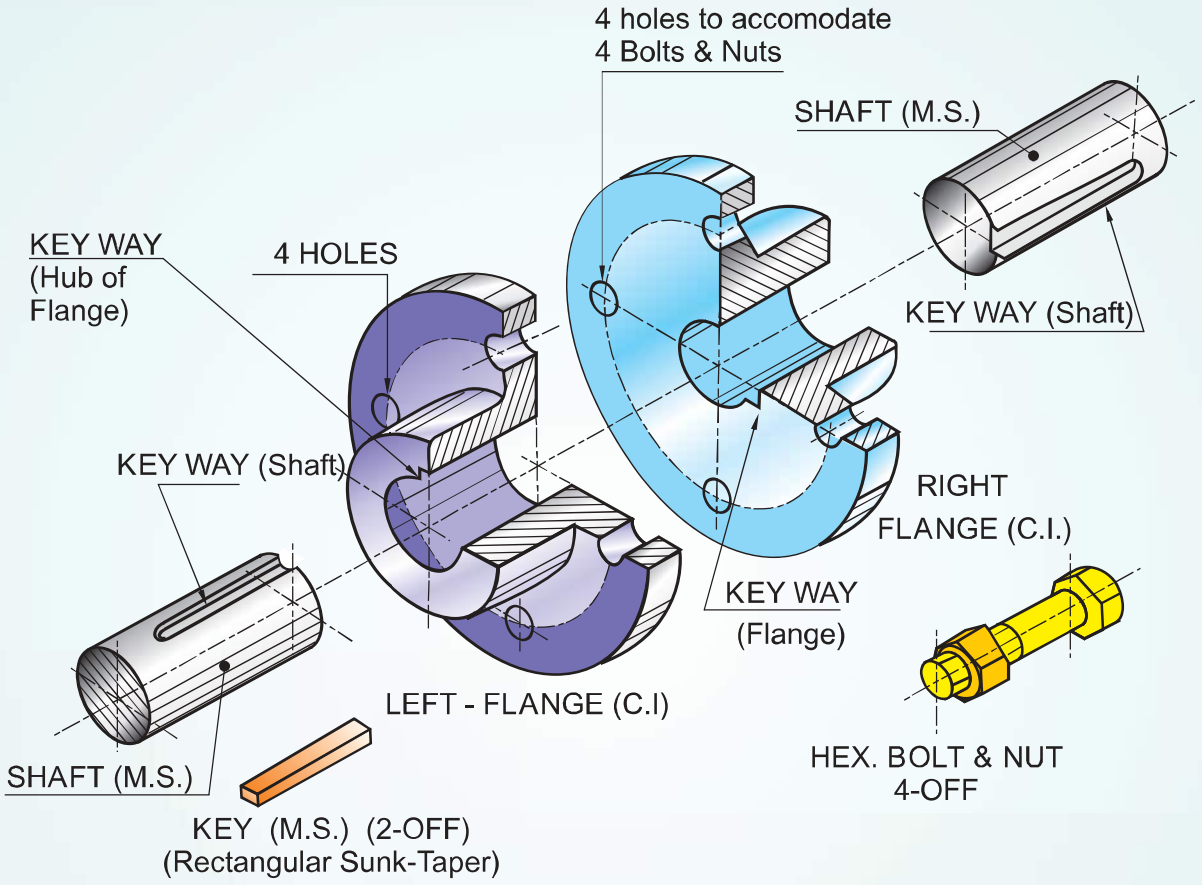
b. Protected Flange Coupling.

6.2.1 UNPROTECTED FLANGE COUPLING

As the name suggests, this type of coupling also has flanges (projected rim) and resembles the Flange Pipe Joint learnt in the previous chapter. Let us know more about its parts and see, why it is called as 'unprotected'.

The Unprotected Flange Coupling has two similar cast iron flanges, (left & right) with the shape similar to the flanges in the 'flanged pipe joint'. But these flanges have keyways in the hubs, so

that the ends of the shafts to be connected can be keyed to the flanges with separate rectangular sunk type keys. Even the shafts also have keyways, which are assembled at right angles, so that the key of one shaft does not slide into the other. These keys are usually driven from inside faces of the flanges for easy fitting.



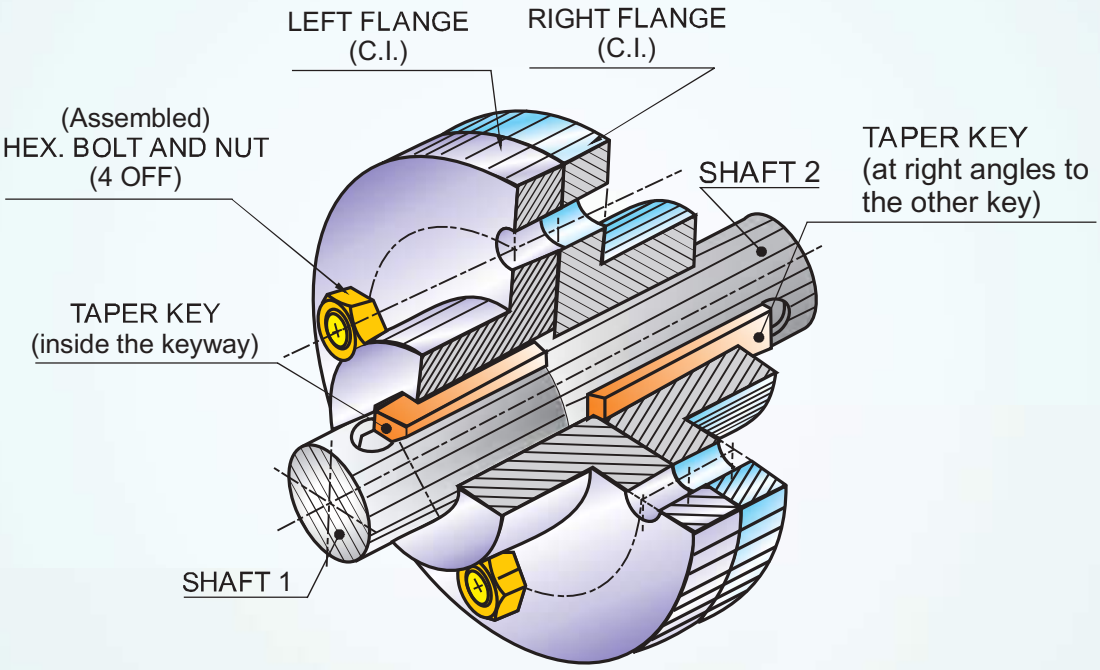
DETAILS OF AN UNPROTECTED FLANGE COUPLING

Fig. 6.2

Here also, the faces of the flanges are kept at right angles to the axis for proper alignment. Now, to get the perfect alignment of shafts, one of the flanges may have a projected circular extension on the outside and thus the other flange will, have a corresponding slot / recess. This gives the flanges a perfect fit and this kind of arrangement being similar to the spigot and socket joint, is termed as 'spigot and socket centering'. There may also be some clearance (gap) between this kind of fit, to adjust the shaft.

The faces of the two flanges are then held together with the help of bolts and nuts (4 or more). These may be square headed or hexagonal headed. The bolts should be an exact fit, so that the power can be transmitted properly from one shaft and flange to another.

It can also be noticed, as shown in Fig. 6.3 that the bolt and nuts lie outside, (exposed) and during rotation of shafts as well as flanges, they are not visible to the workers. This might hurt them or their clothes may get entangled. Hence this flange coupling get the name as 'Unprotected Flange Coupling'.



ASSEMBLY OF AN UNPROTECTED FLANGE COUPLING

Fig. 6.3

To avoid such mishaps, the shape of the flange is slightly modified, which will be discussed further in the next type of flange coupling.

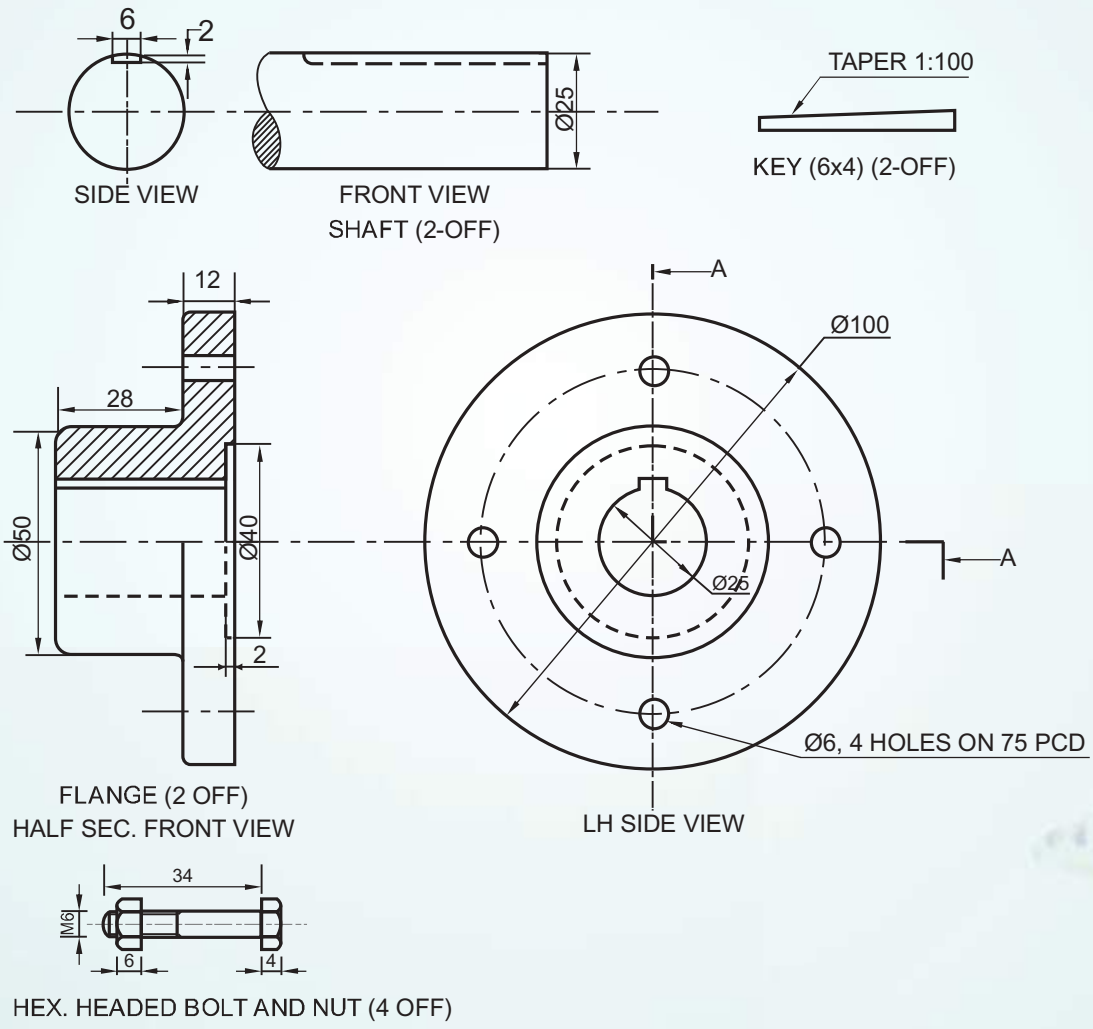
Example :

Fig 6.4 shows the details of an 'Unprotected Flange Coupling'. Assemble the details and draw the following views of the assembly using scale full size.

a. Front view, top half in section.

b. Left side view.

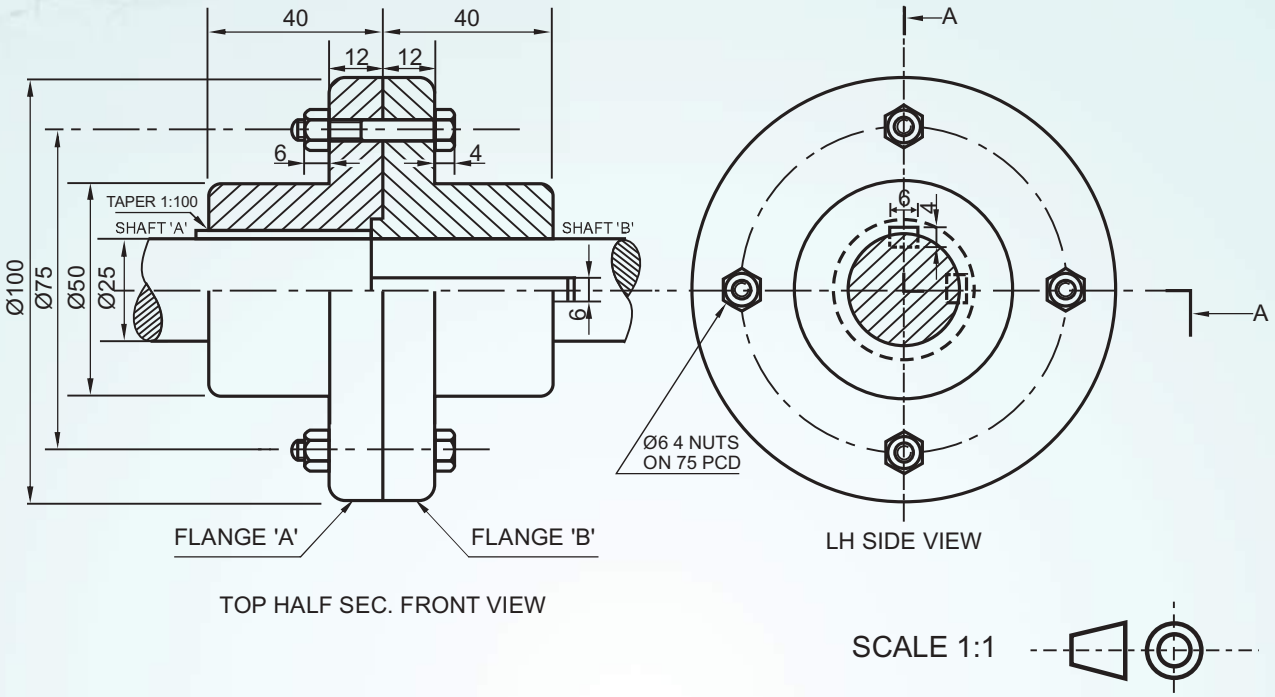
Print title and scale used. Draw the projection symbol. Give important dimensions



DETAILS OF AN UNPROTECTED FLANGE COUPLING

Fig. 6.4

Solution:



ASSEMBLED VIEW OF AN UNPROTECTED FLANGE COUPLING.

Fig. 6.5

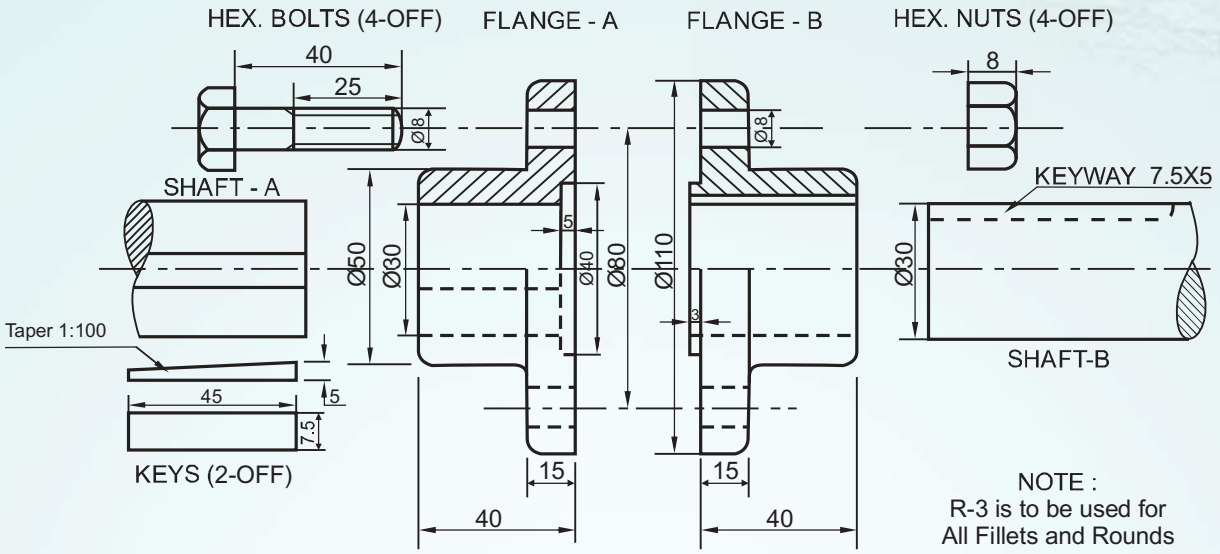
Example :

Fig 6.6 shows the parts of an Unprotected Flange Coupling (having socket and spigot arrangement). Assemble these parts correctly and then draw the following views to a scale full size:

a. Front view, upper half in section

b. Side view, as seen from right.

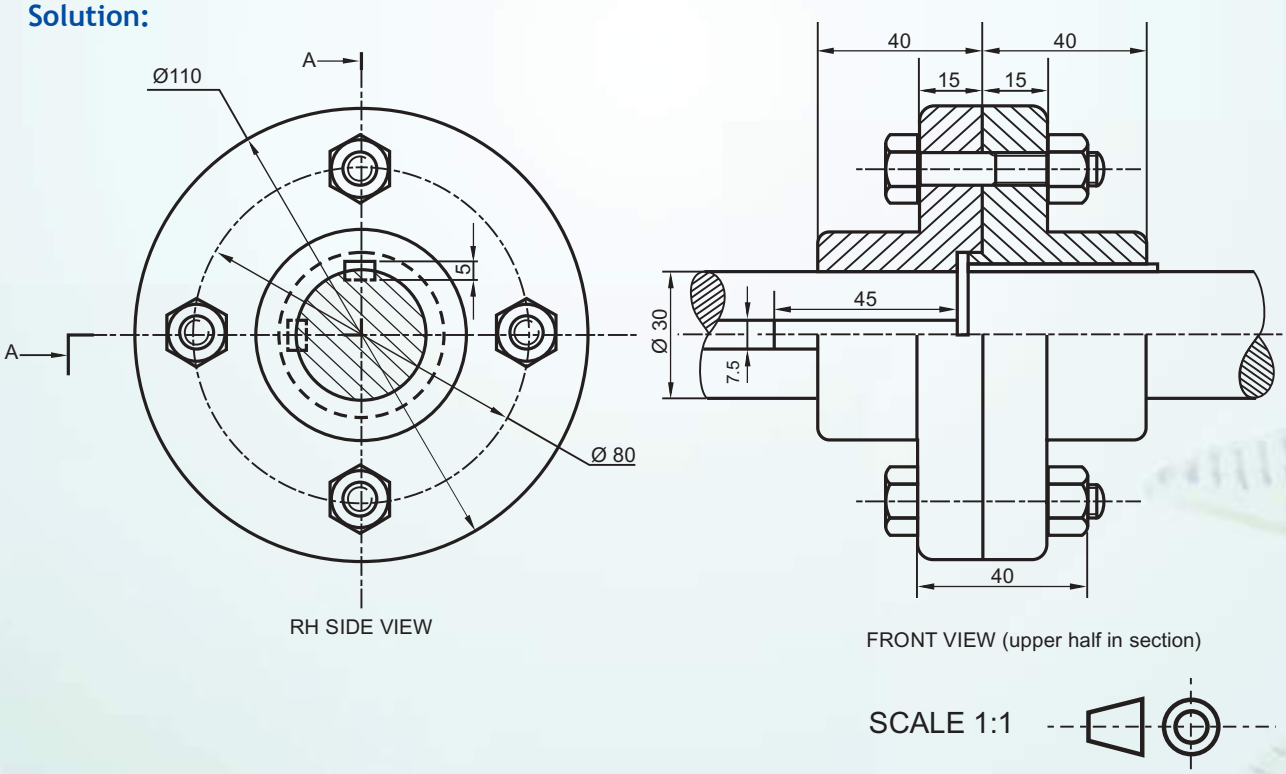
Print title and scale used. Draw the projection symbol. Give important dimensions.



DETAILS OF AN UNPROTECTED FLANGE COUPLING

Fig. 6.6

Solution:



ASSEMBLED VIEWS OF AN UNPROTECTED FLANGE COUPLING

Fig. 6.7

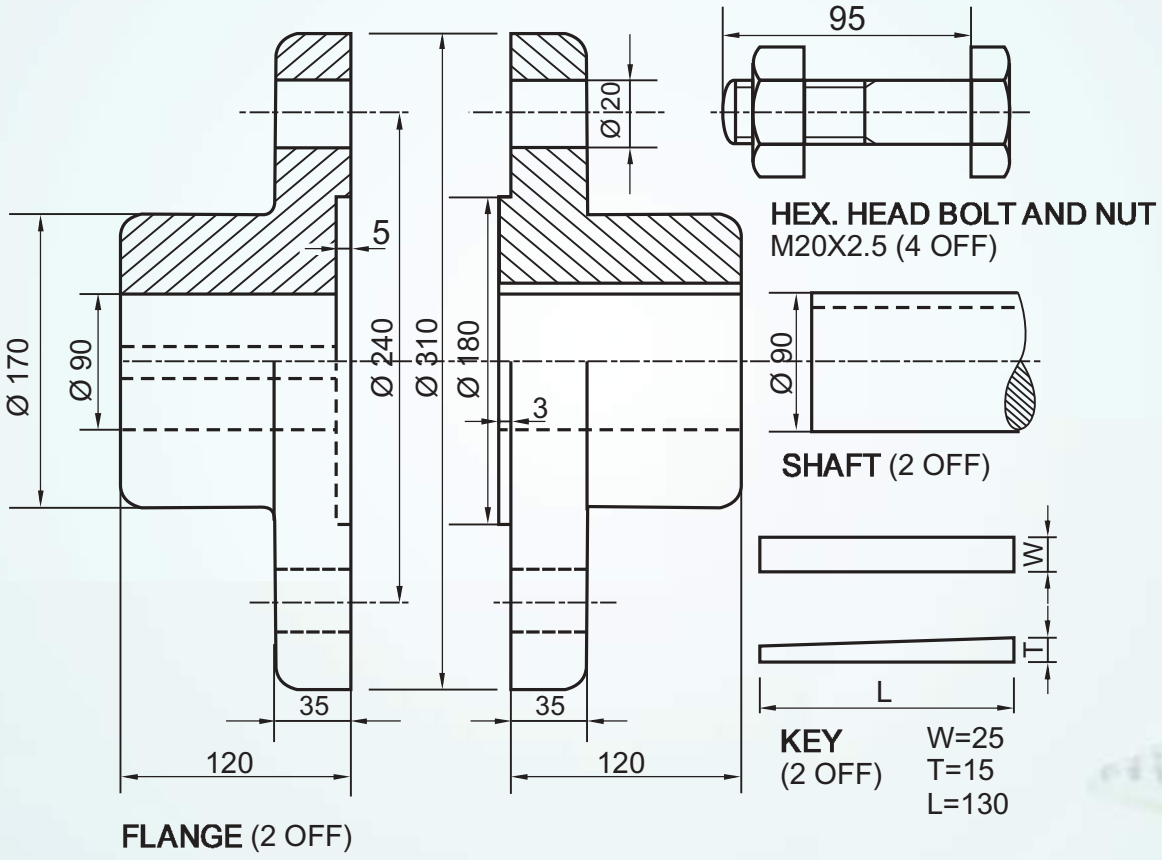
Exercise :

Fig 6.8 shows details of an unprotected Flange Coupling. Assemble these parts and draw the following orthographic views to scale 1:1.

a. Front view, upper half in section

b. Right hand side view, without section.

Show the dimensions properly. Print title and scale used and draw the projection symbol.



DETAILS OF AN UNPROTECTED FLANGE COUPLING

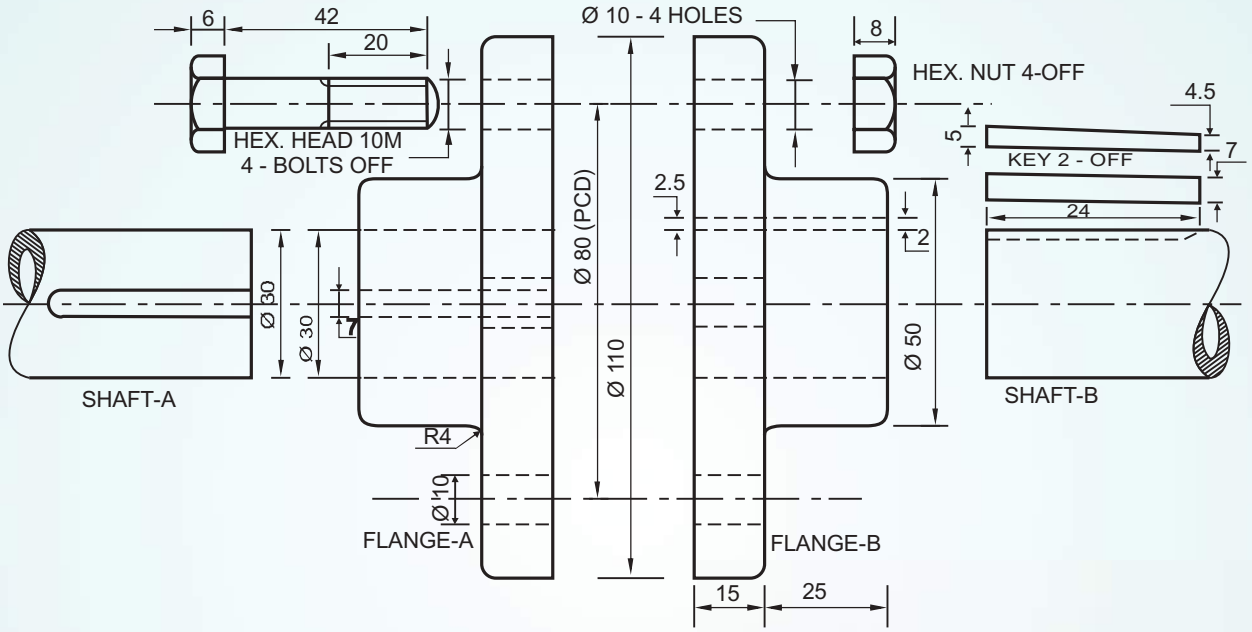
Fig. 6.8

Exercise :

The given figure shows the details of the parts of Unprotected Flange Coupling. Assemble these parts and draw to scale 1:1, the following views of the assembly.

(a) Front view, lower half in section

(b) Right side view



UNPROTECTED FLANGE COUPLING

Fig. 6.9

Example :

Figure shows the assembled views of an UNPROTECTED FLANGE COUPLING. Dis-assemble the parts and then draw the following views of the following parts to full size scale, keeping them in the same position with respect to H.P. and V.P.

(a) FLANGE-A

(i) Upper half sectional front view

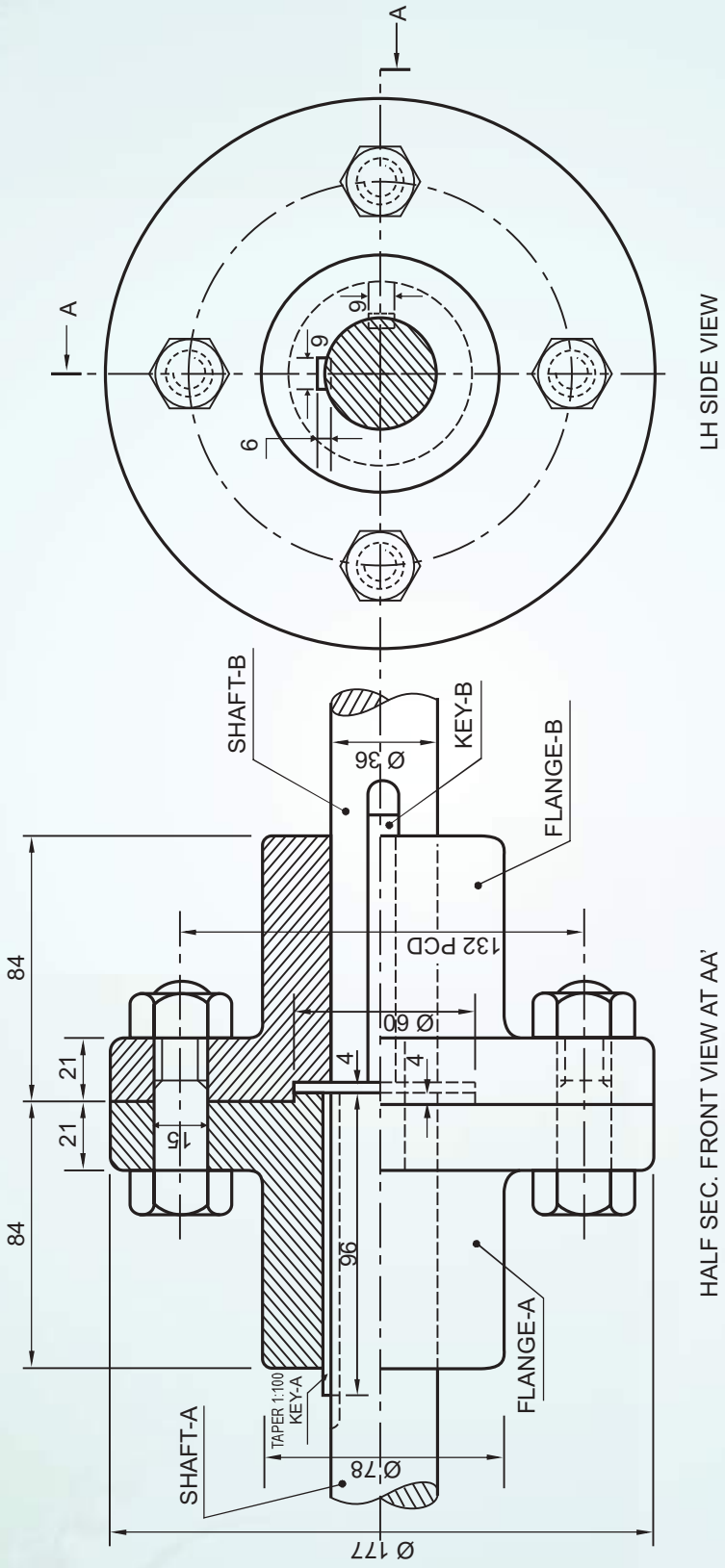
(ii) Right-hand side view

(b) KEY-A

(i) Front view

(ii) Top view

(ii) LH side view

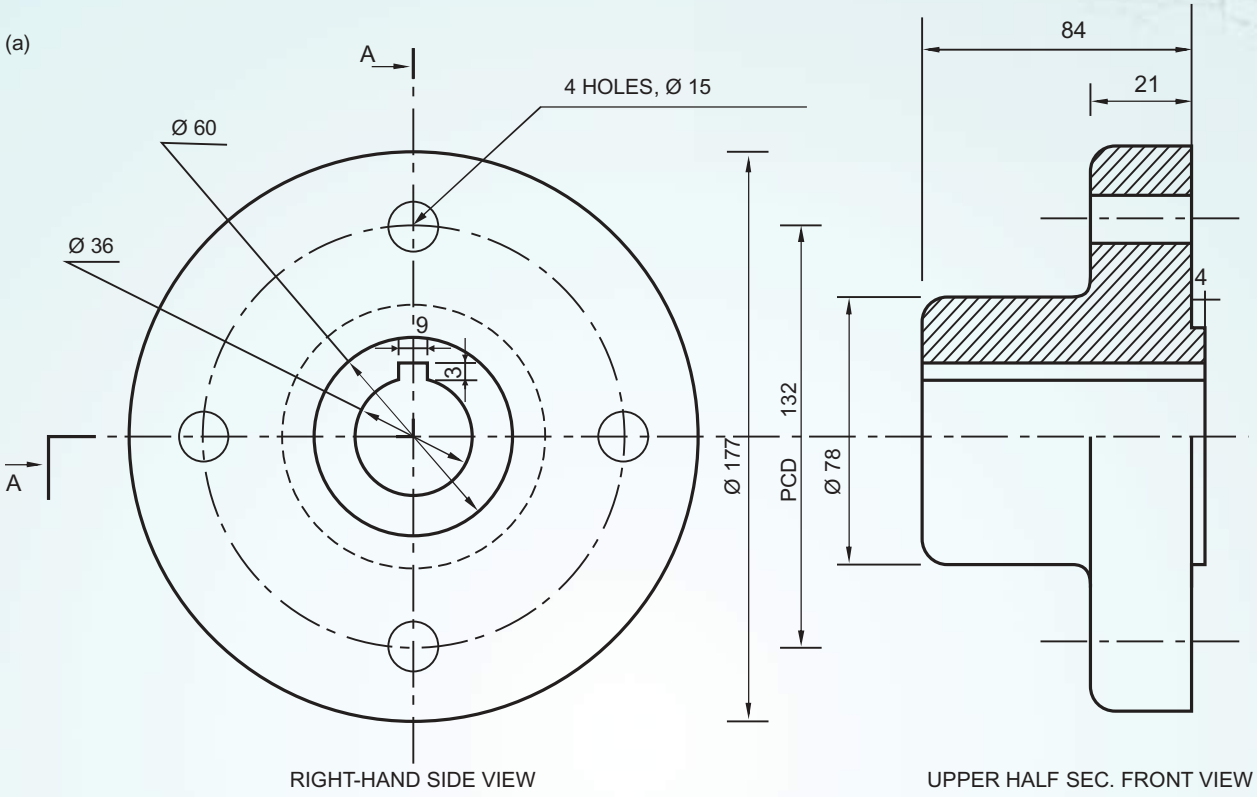


UNPROTECTED FLANGE COUPLING

Fig. 6.10

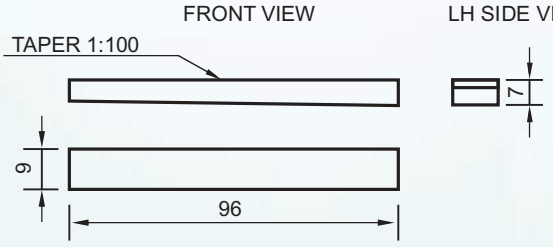
Solution:

(a)



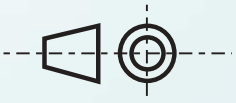
FLANGE-A

(b)



KEY-A

SCALE 1:1



UNPROTECTED FLANGE COUPLING (DISASSEMBLY)

Fig. 6.11

Exercise :

The figure given below shows the assembly of Unprotected Flange Coupling. Disassemble the parts correctly and then draw to scale 1:1, the following views of the components, keep the same position of both Flange A and hexagonal nut with respect to V.P. and H.P.

(a) FLANGE-A

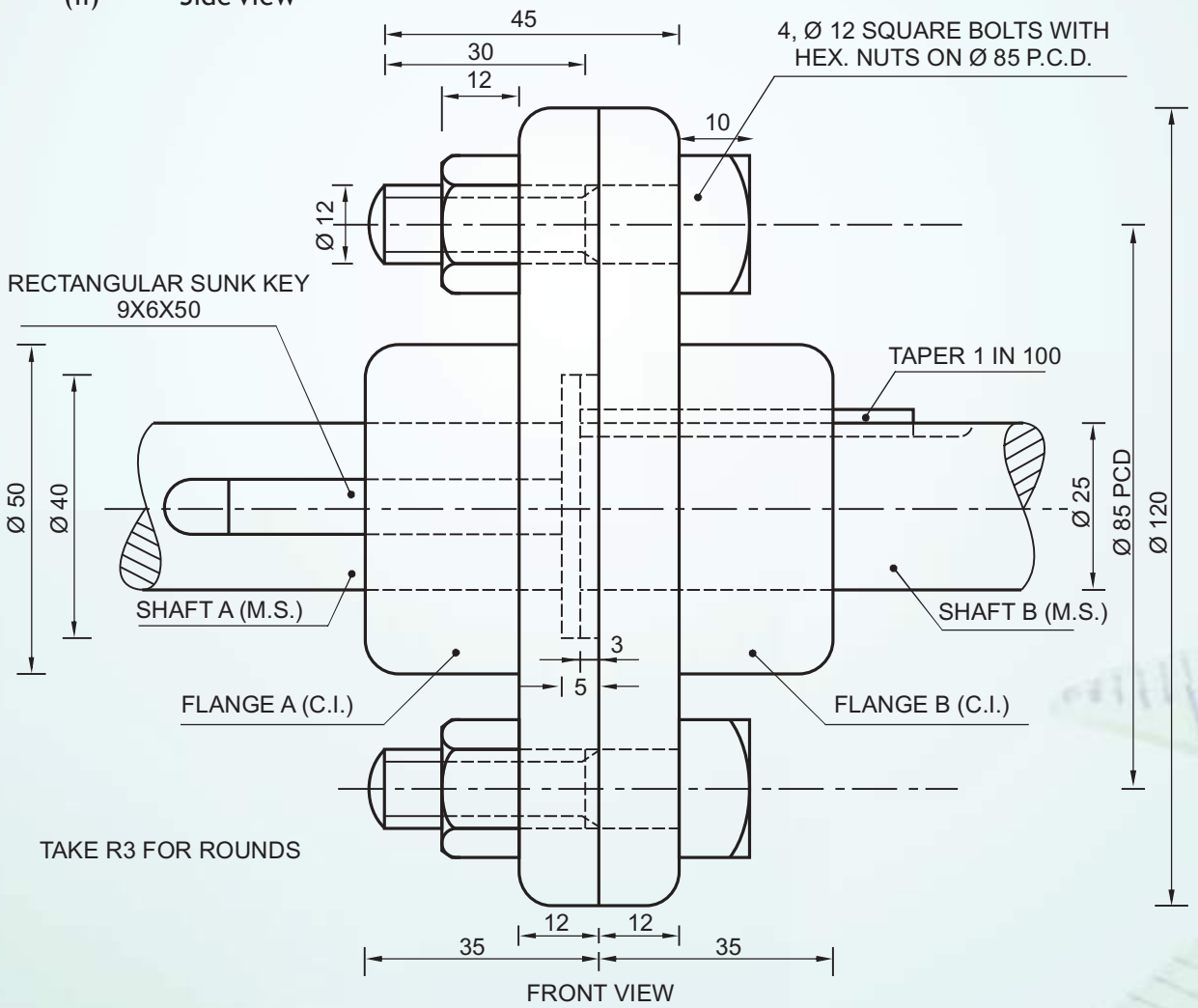
(i) Front view lower half in section

(ii) Side view, looking from left

(b) HEXAGONAL NUT

(i) Front view

(ii) Side view

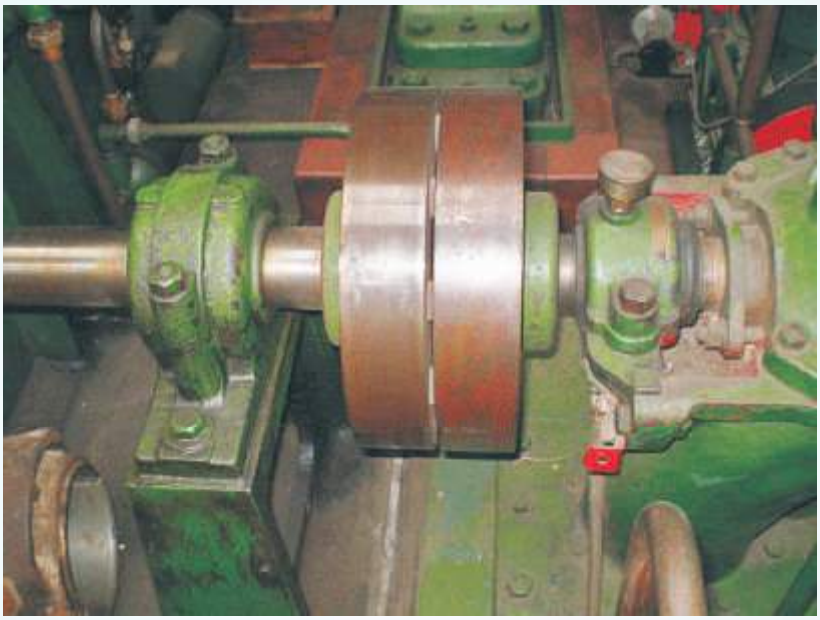


UNPROTECTED FLANGE COUPLING

Fig. 6.12

6.2.2 Protected Flange Coupling

We know, the previous type of flange coupling (Unprotected) has a shortcoming. To over come it, we need to shield/cover the protruding nuts or bolt heads. And this can be done by slightly altering the shape of the flanges. So in this type of Flange Coupling the flanges have a flared and flattened rim i.e. a projected outer ring (shroud) as shown in the figure. This overhangs over the bolt heads and nuts and minimizes accidents and ensures safety. Hence it is named as a 'Protected Flange Coupling'.

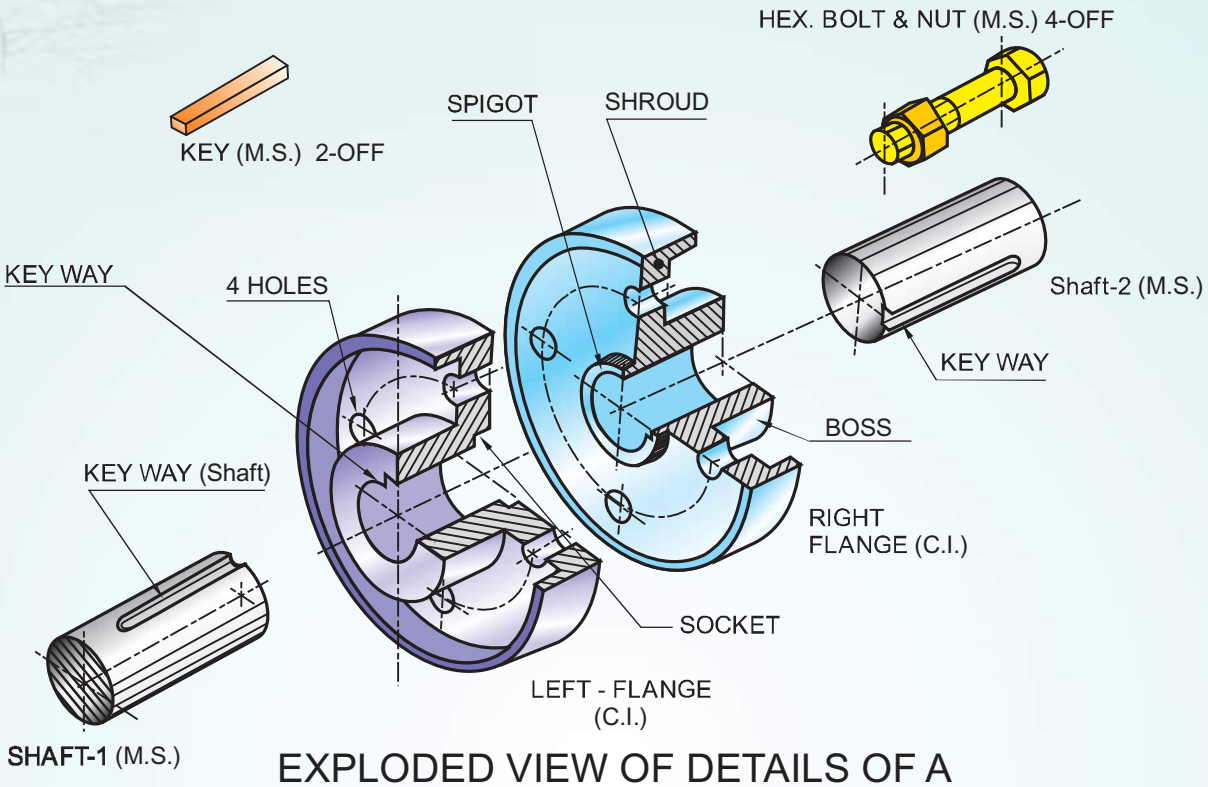


PROTECTED FLANGE COUPLING IN A DIESEL ENGINE

Fig. 6.13

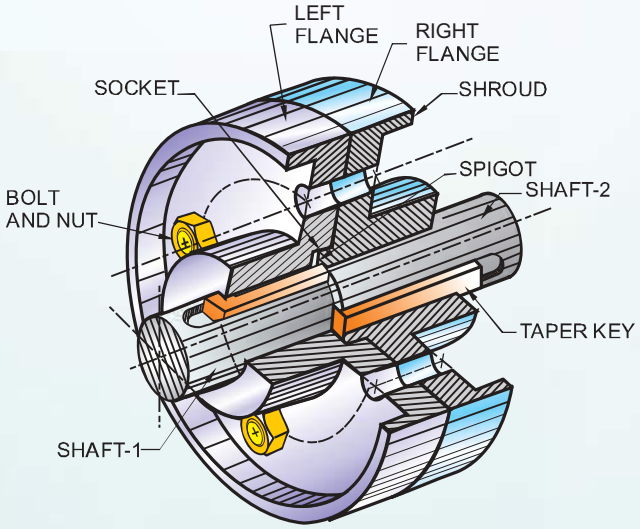
This type of coupling may be sometimes used as belt pulley.

The 'Protected type Flange Coupling' contains the same parts and is assembled in the same way as an 'Unprotected type Flange Coupling'. The only difference lies in the shape of the flange with its projected ring (shroud) as shown in Fig. 6.14.



EXPLODED VIEW OF DETAILS OF A PROTECTED FLANGE COUPLING

Fig. 6.14



ASSEMBLED PICTORIAL VIEW OF A PROTECTED FLANGE COUPLING

Fig. 6.15

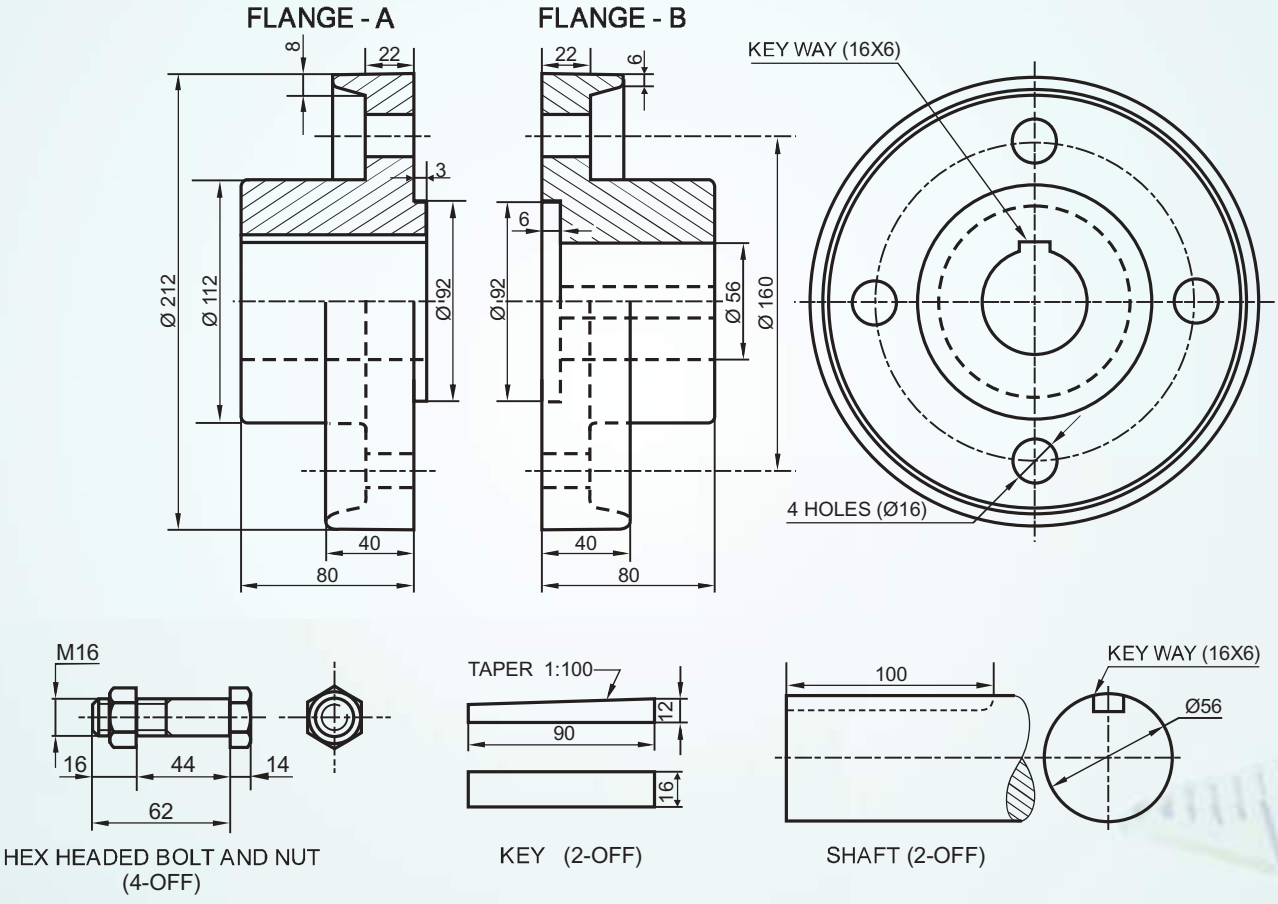
Example :

Figure 6.16 shows details of the parts of a Protected Flange Coupling. Assemble these parts correctly and draw the following views to scale full- size:

a. Elevation, Top - half in section

b. End view, as seen from right.

Print title, scale used. Draw the projection symbol. Give main dimensions.



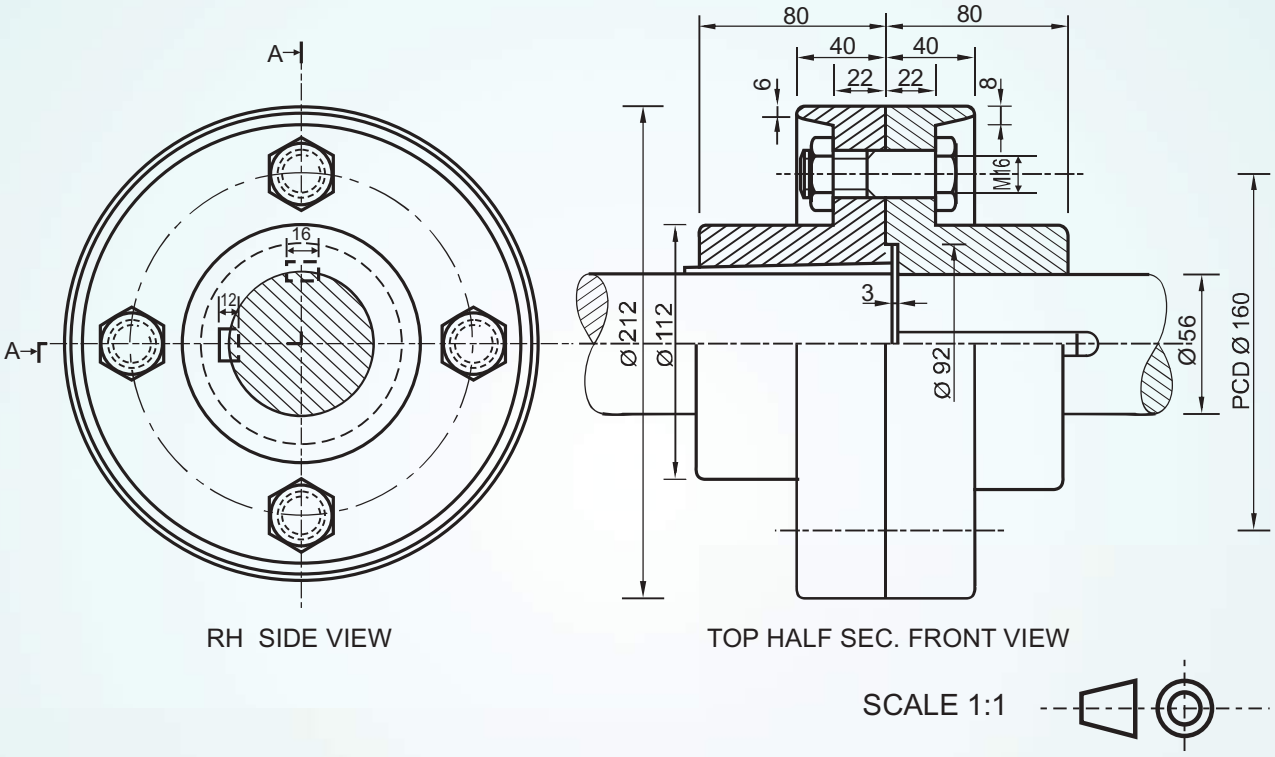
DETAILS OF A PROTECTED FLANGE COUPLING

Fig. 6.16

Solution:

Let us assemble the different parts and draw required views in the similar manner as done in the previous example.

A slight variation is seen in the spigot and socket arrangement. It can be seen that a gap (Clearance) of 3 mm is present between them as shown in fig 6.17.



ASSEMBLY OF A PROTECTED FLANGE COUPLING

Fig. 6.17

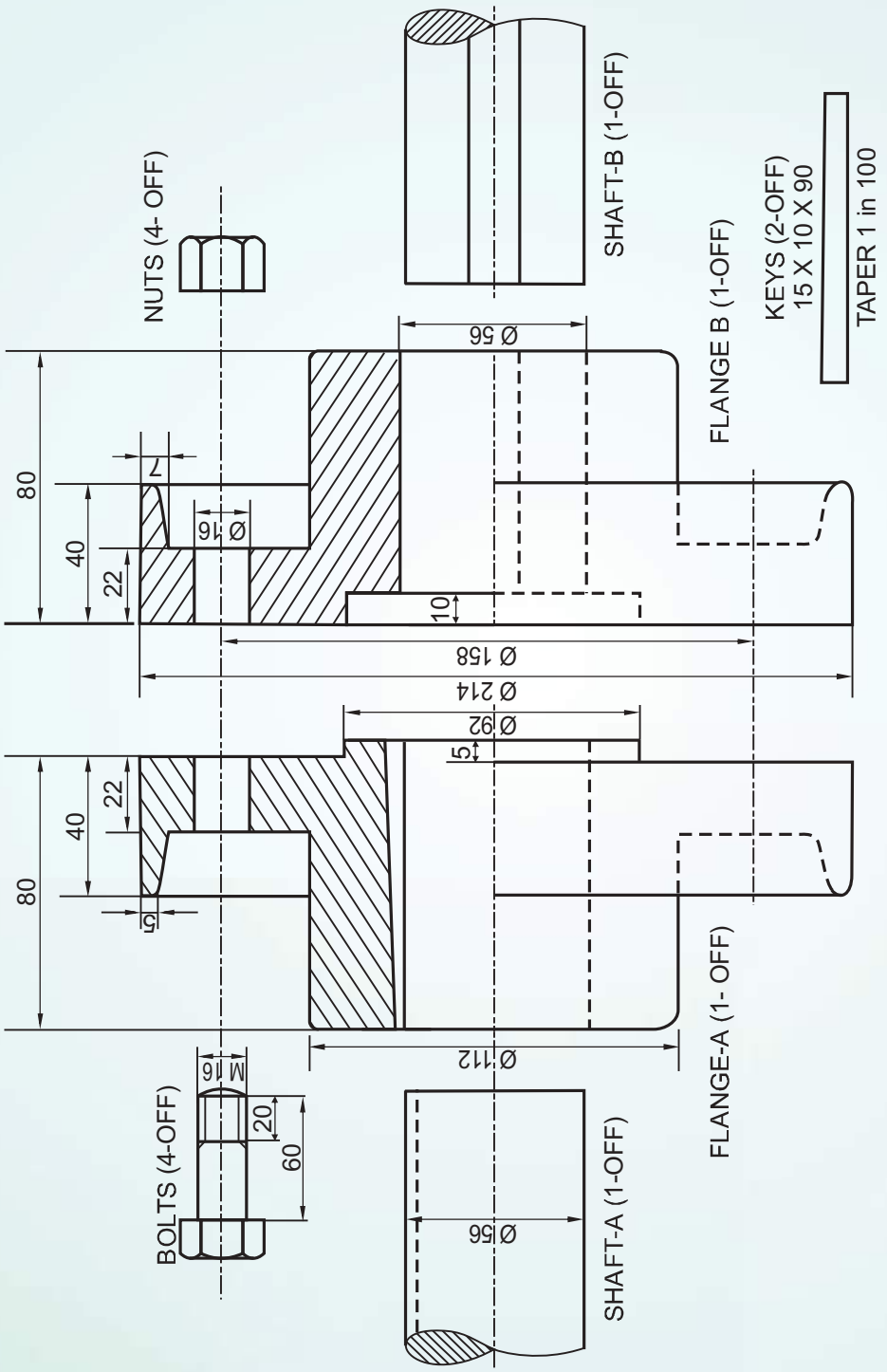
Exercise :

1. Fig. 6.18 shows the details of the parts of a 'Protected Flange Coupling'. Assemble them correctly and draw the following views to scale 1:1.

   a. Lower half - sectional front view

   b. Left hand side view

Print the title and scale used. Draw the projection symbol. Give important dimensions.



DETAILS OF A PROTECTED FLANGE COUPLING

Fig. 6.18

Example :

Figure shows the assembly of parts of a PROTECTED FLANGE COUPLING. Dis-assemble the parts and then draw the following views of the following components to scale 1:1, keeping them in the same position with respect to H.P. and V.P.

(a) FLANGE-A

(i) Front view upper half in section

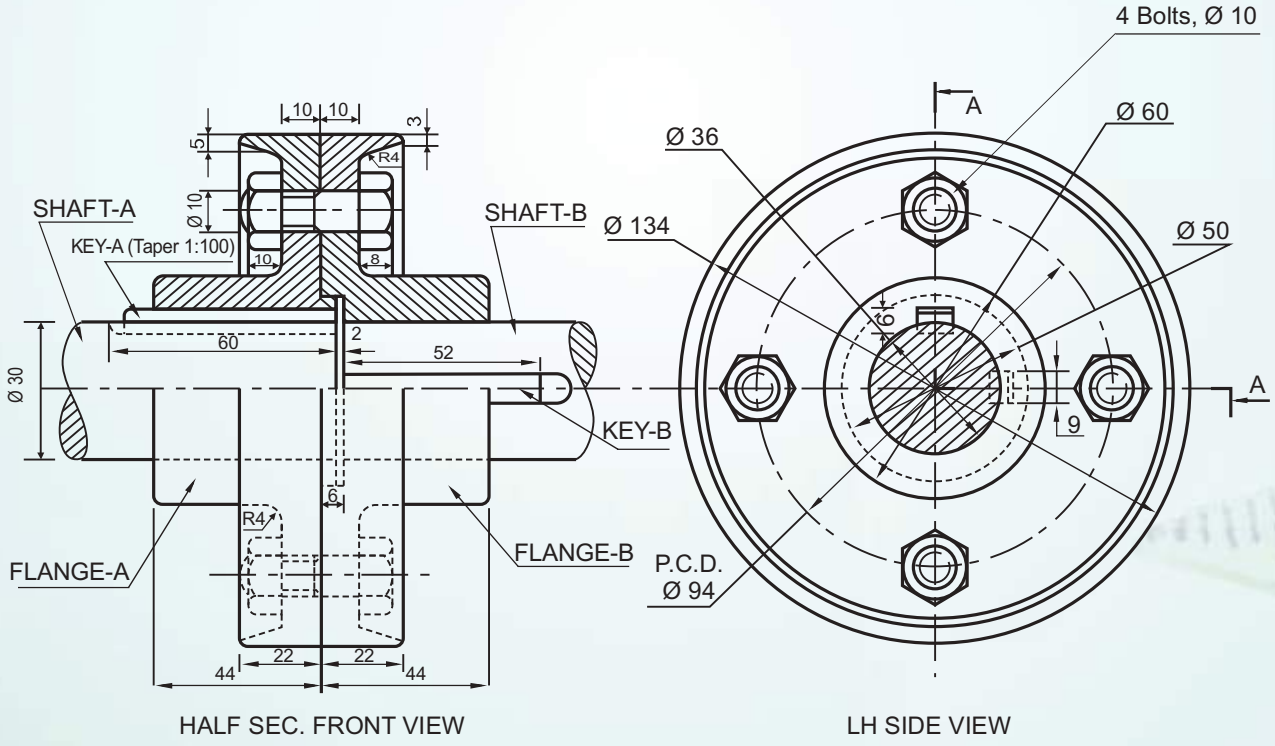
(ii) Left hand side view

(b) SHAFT-B

(i) Front view

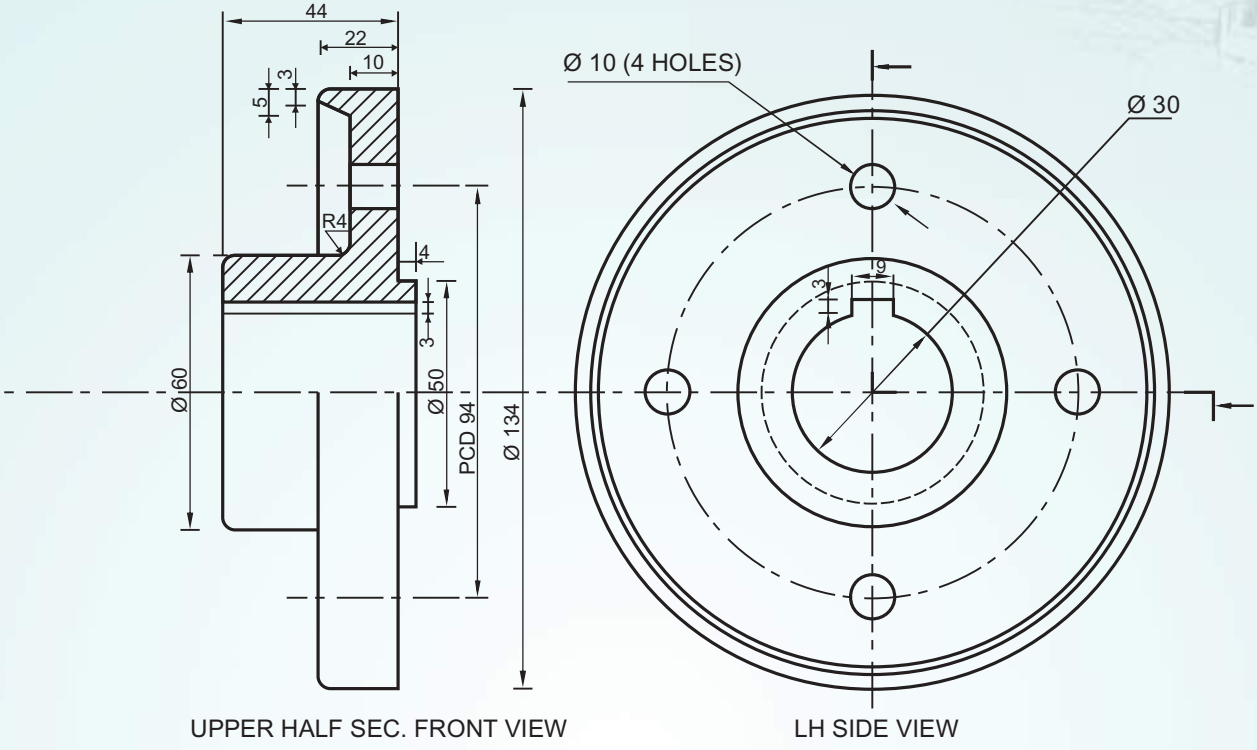
(ii) LH side view

Print titles, scale used. Draw the projection symbol. Give main dimensions.



PROTECTED FLANGE COUPLING

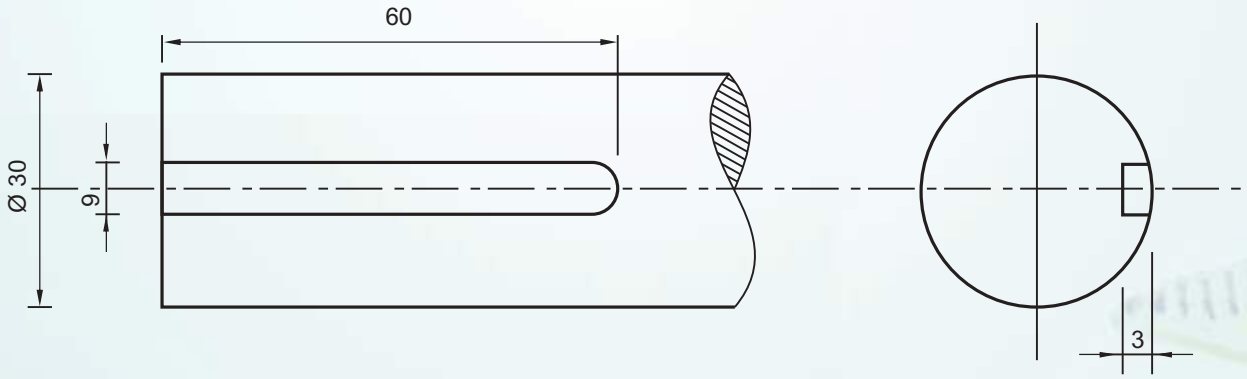
Fig. 6.19



UPPER HALF SEC. FRONT VIEW

LH SIDE VIEW

FLANGE-A

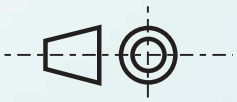


FRONT VIEW

SHAFT - B

LH SIDE VIEW

SCALE 1:1



PROTECTED FLANGE COUPLING (DISASSEMBLY)

Fig. 6.20

Exercise :

The figure given below shows the orthographic views of the assembly of a Protected Flange Coupling. Disassemble the parts and then draw the following views of the following parts to scale 1:1, keeping the same positions of both the Flange B and the Shaft B, with respect to V.P. and H.P.

(a) FLANGE-B

(i) Front view, showing upper half in section

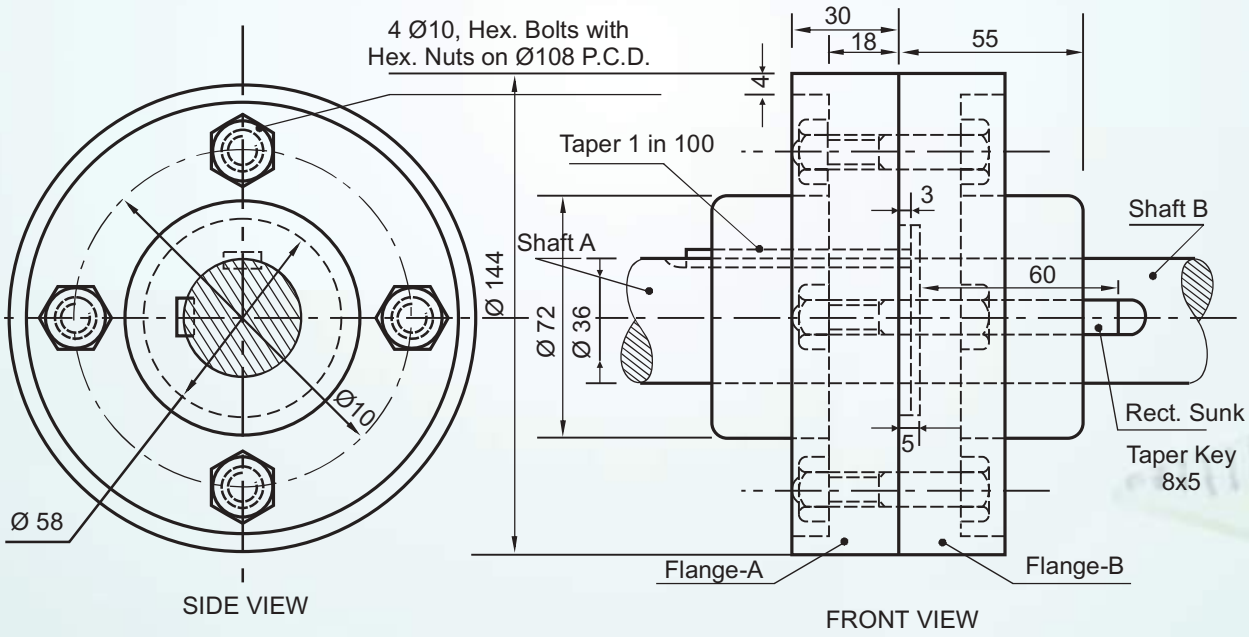
(ii) Side view, viewed from the right

(b) SHAFT-B

(i) Front view

(ii) Side view, viewed from the left

Print titles, scale used. Draw the projection symbol. Give main dimensions.



PROTECTED FLANGE COUPLING

Fig. 6.21

Exercise :

The figure given below shows the assembly of a Protected Flange Coupling. Disassemble the parts and then draw its views of the the following parts to scale 1:1, keeping the same positions of both the Flange A and rectangular sunk Taper Key-A with respect to H.P. and V.P.

(a) FLANGE-A

(i) Front view, lower half in section

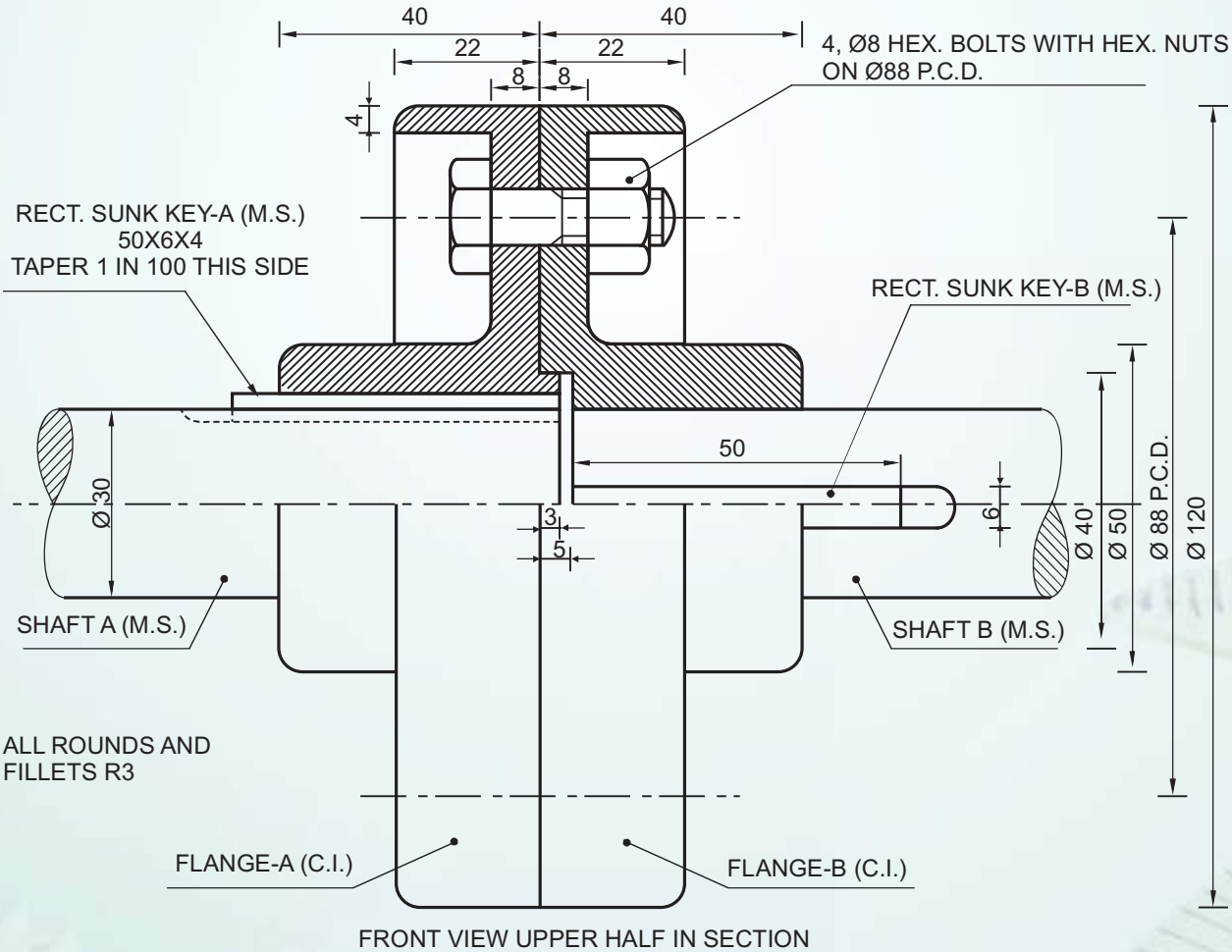
(ii) Side view looking from left

(b) RECTANGULAR SUNK TAPER KEY-A

(i) Front view

(ii) Top view

Print titles, scale used. Draw the projection symbol. Give main dimensions.



FRONT VIEW UPPER HALF IN SECTION

PROTECTED FLANGE COUPLING

Fig. 6.22