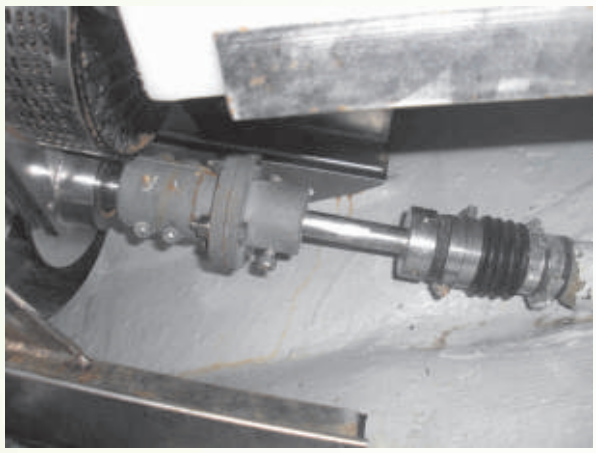
CHAPTER 6

SHAFT COUPLINGS

Shafts as we have learnt in the previous chapters, 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. Moreover the shafts are made of limited lengths for ease of transport arts, so in such a case, we would connect the shafts to form a long transmission shaft, as we have done in case of joints in the earler chapter.

Similarly Even in case of power transmission between different machine to unit, as seen, between a motor and a generator or pump, the shafts need to be joined together a 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".



(a) In an automobile

(Connecting shafts of Different machines)

(b) under a locomotive

(Connecting shafts of the same unit)

SHAFT COUPLINGS

Fig. 6.1

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.

6.1 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.

(a) Unprotected

(b) Protected

DIFFERENT TYPES OF FLANGE COUPLINGS

Fig 6.2

Let us study these type of Flange Couplings in detail.

6.1.1 UNPROTECTED FLANGE COUPLING

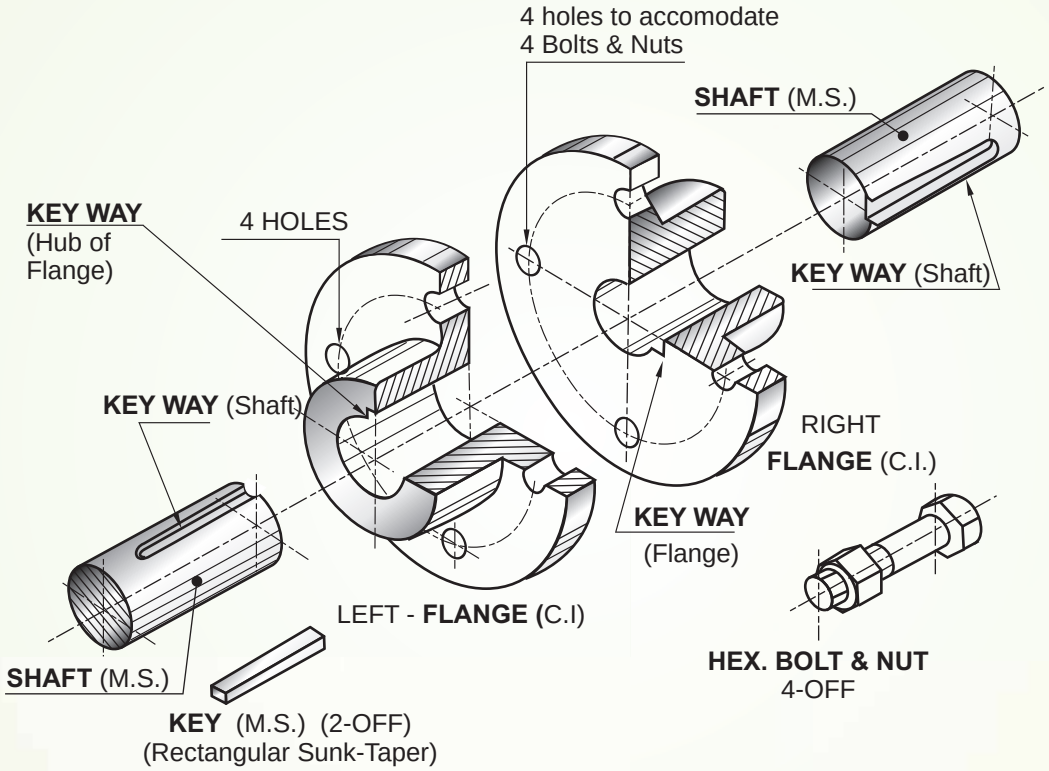
As the name suggests, this type of coupling also has flanges (projected rim) and resembles the Flange Pipe Joint learnt in the previous chapter. Let us know more about its parts and see, why it is called as 'unprotected'.

THE UNPROTECTED FLANGE COUPLING CONNECTS THE SHAFTS FROM A PUMP TO THAT OF A ENGINE

Fig 6.3

6.1.1.1 Features:

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.



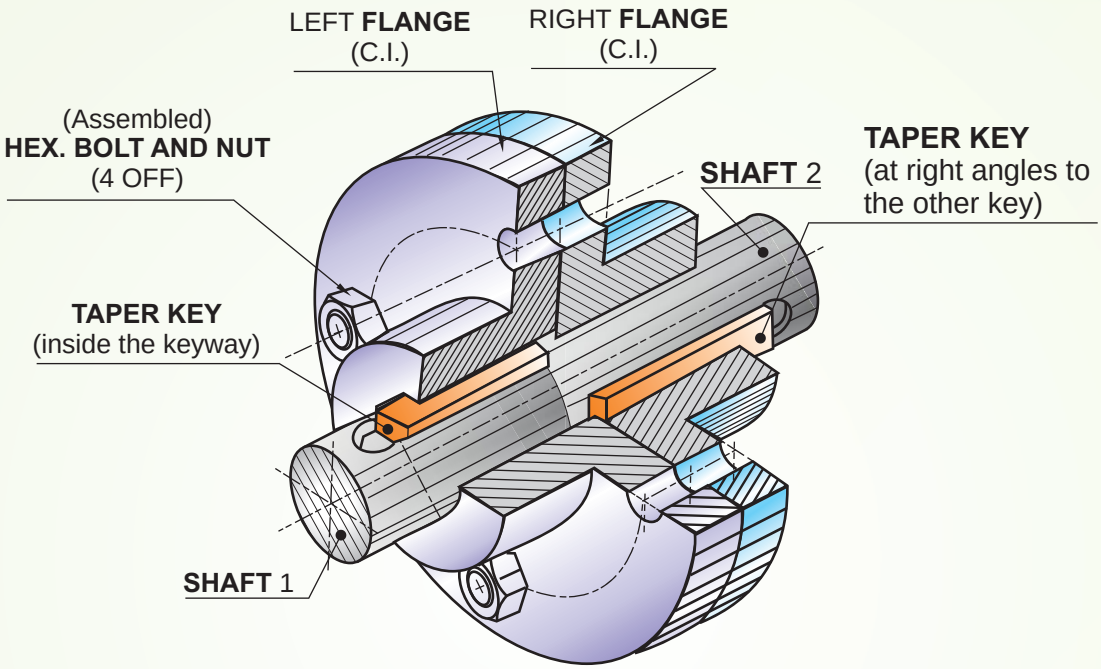
DETAILS OF AN UNPROTECTED FLANGE COUPLING
(HALF SEC. PICTORIAL VIEW)

Fig 6.4

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 centring'. 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. 6.5 that the bolt and nuts lie outside, (exposed) and during rotation of shafts, as well as flanges, they are not visible to the workers, and thus might hurt them or their clothes, may get entangled. Hence this flange coupling get the name as Unprotected Flanges Coupling.



ASSEMBLY OF AN UNPROTECTED FLANGE COUPLING
(HALF IN SECTIONAL PICTORIAL VIEW)

Fig 6.5

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

6.1.1.2 Orthographic Views

With the help of an example, let us learn to assemble the different parts of the 'Unprotected Flange Coupling' and draw the required orthographic views, including the sectional view.

Example 1: Fig 6.6 shows the details of an 'Unprotected Flange Coupling'. Assemble the details and draw the following views of the assembly using scale full size.

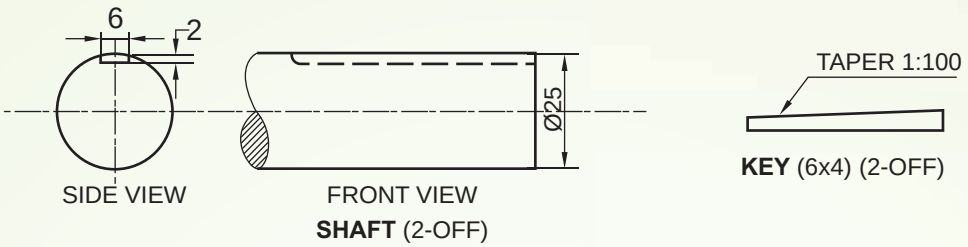
a. Front view, top half in section.

b. Left side view.

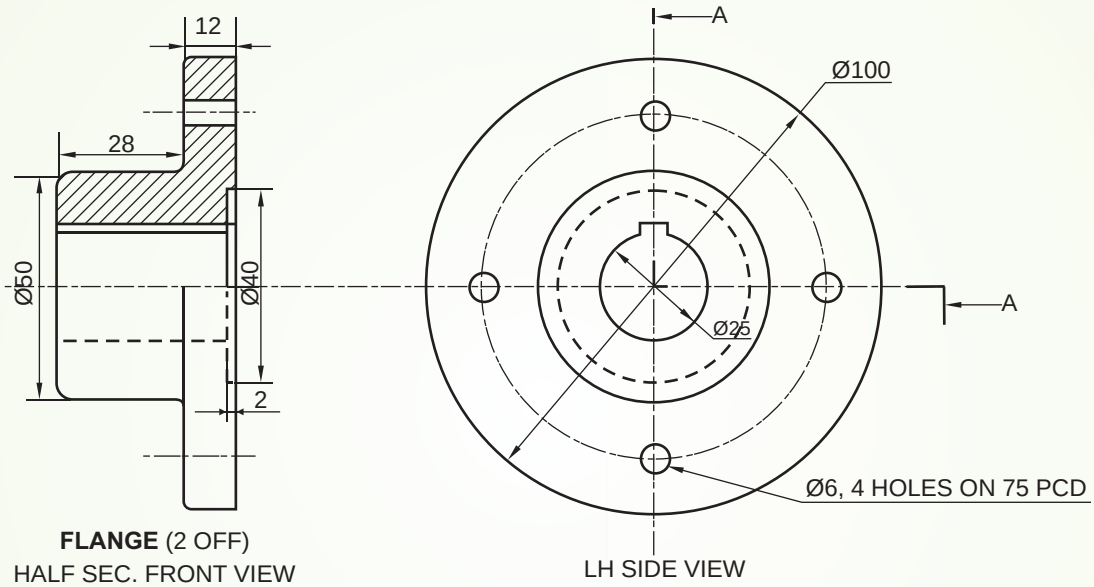
Print title and scale used. Draw the projection symbol. Give important dimensions

Solution: In fig 6.6, the orthographic views of different parts are shown. Let us assemble them as learnt and then draw the orthographic views.

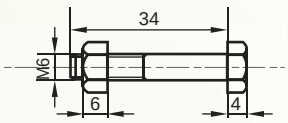
(i) It can be seen flange is given as (2-OFF), i.e. two flanges of same dimensions. Similarly, the shafts, keys and even bolts and nuts have same dimensions.



SHAFT (2-OFF)



FLANGE (2 OFF)
HALF SEC. FRONT VIEW



HEX. HEADED BOLT AND NUT (4 OFF)

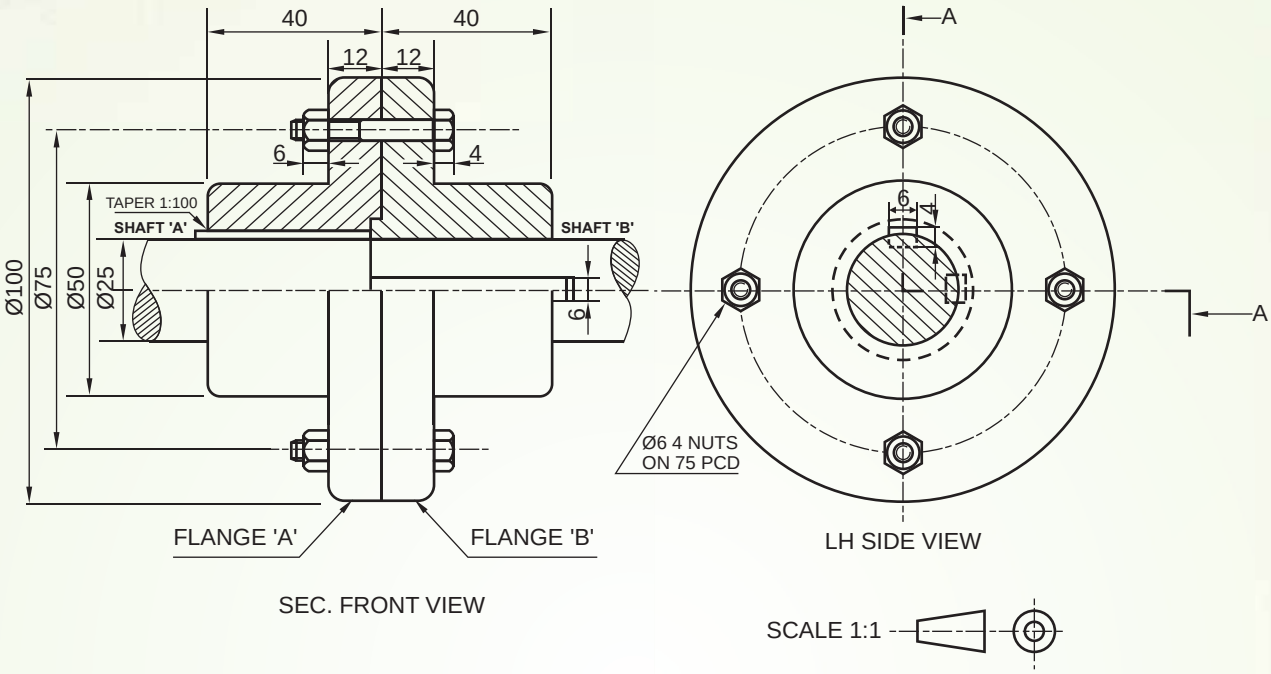
DETAILS OF AN UNPROTECTED FLANGE COUPLING

Fig 6.6

(ii) Also note, the two flanges are arranged in a socket and spigot arrangement with a recess / extension of 2 mm.

(iii) Even the keys are rotated at right angles to each other. One is placed on top of the shaft and the other near the axis, centrally. Also notice, the width of the keys drawn in the front view vary as shown in fig 6.7.

(i) The keys may not be more than 3 mm beyond the bosses of the flanges and the keyways need not extend more than 15 mm beyond the ends of the keys.



ASSEMBLED VIEW OF AN UNPROTECTED FLANGE COUPLING.

Fig 6.7

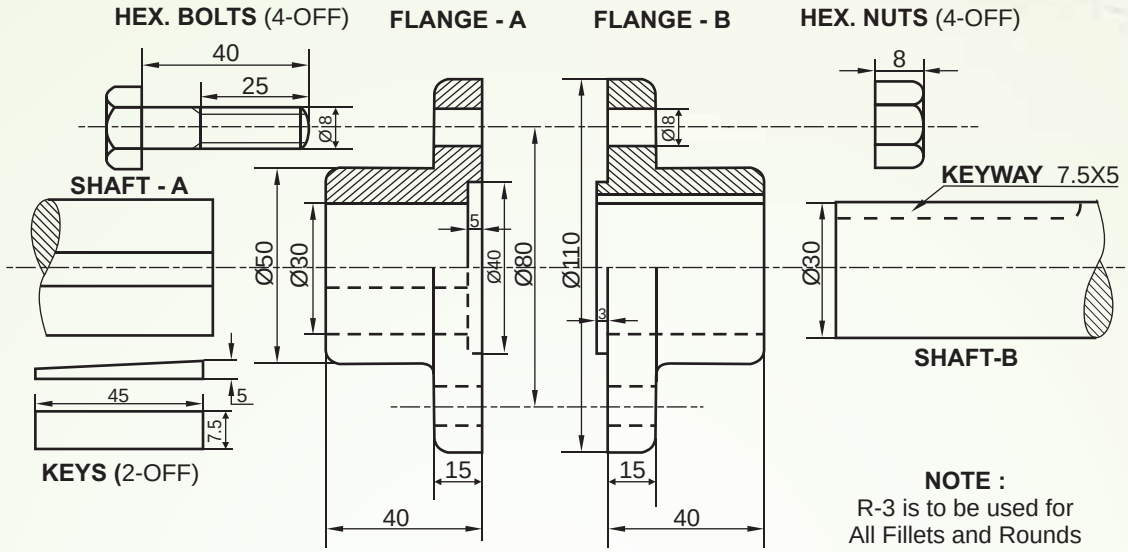
Let us consider another example and draw the assembled views properly.

Example 2 : Fig 6.8 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.

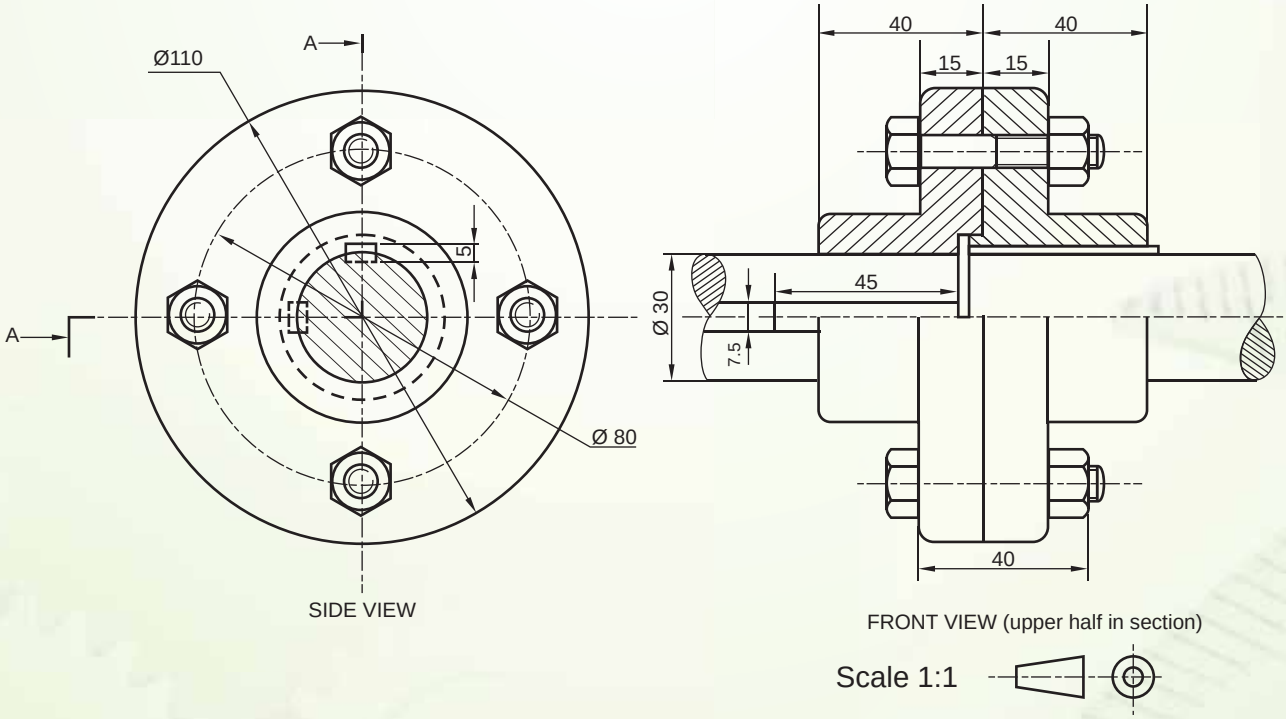
Print title and scale used. Draw the projection symbol. Gives important dimensions.



DETAILS OF AN UNPROTECTED FLANGE COUPLING.

Fig 6.8

Solution: Similar to the previous example, we will assemble the various parts correctly and then obtain the required orthographic views, including the sectional view as shown in the below fig 6.9.



ASSEMBLED VIEWS OF AN UNPROTECTED FLANGE COUPLING

Fig 6.9.

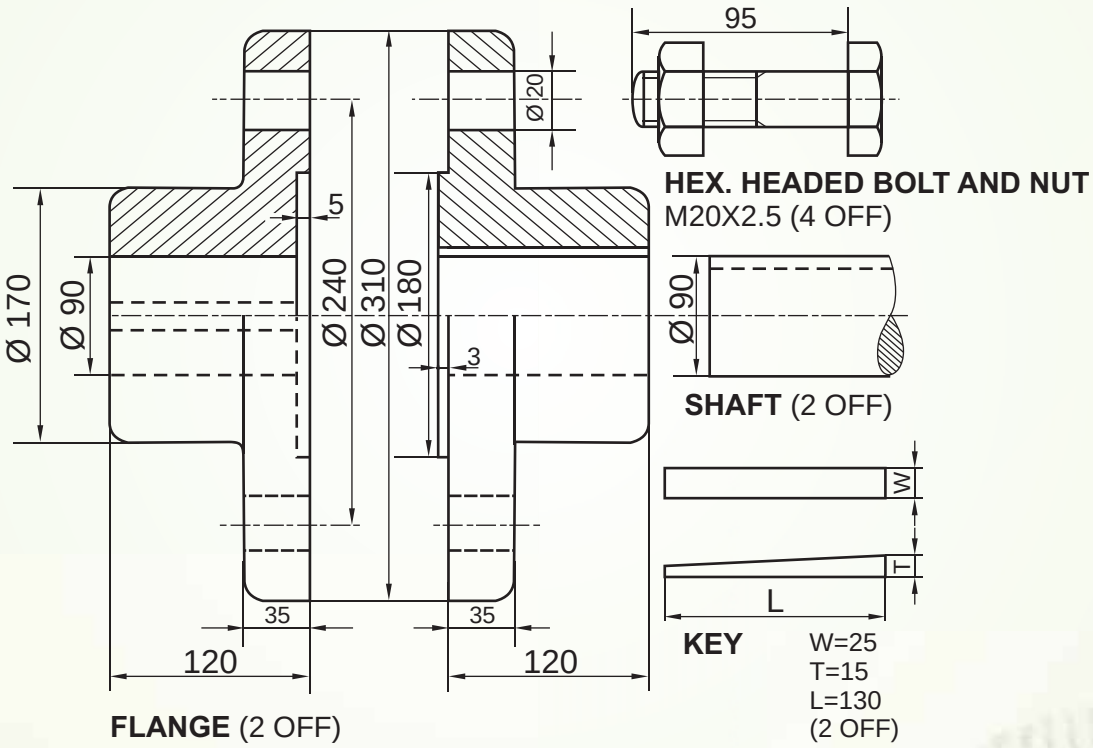
Exercise 6.1

Fig 6.10 shows details of an unprotected Flange Coupling. This figure shows one view, each of the part no. 1, 2 and 3 and two views of part no.4. Draw to a scale 1:1, the following orthographic views.

a. Elevation, 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.

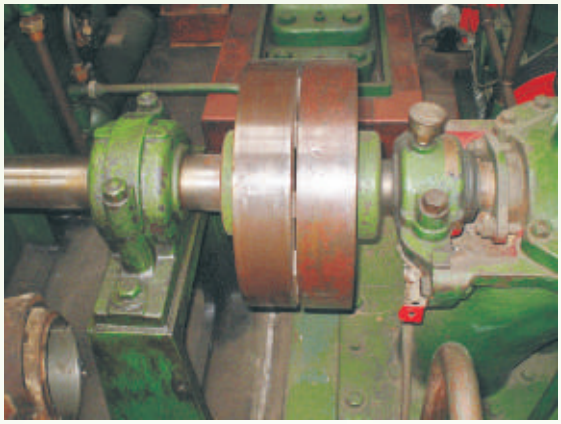


DETAILS OF AN UNPROTECTED FLANGE COUPLING

Fig 6.10

6.1.2 Protected Flange Coupling

We know, the pervious type of flange coupling (Unprotected) has a shortcoming which is overcome in this type of Flange Coupling. To do so, 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 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 thus minimizes accidents and ensures safety, Hence it is named as a 'Protected Flange Coupling'.



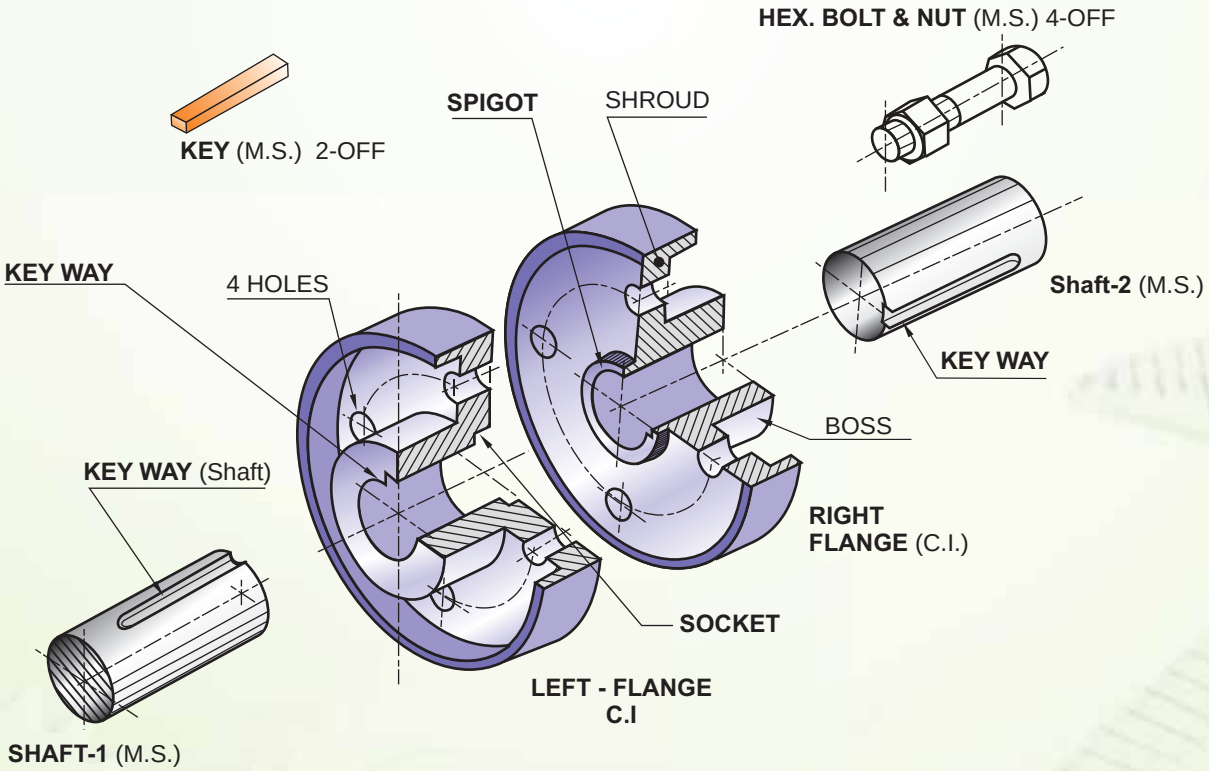
PROTECTED FLANGE COUPLING IN A DIESEL ENGINE

Fig 6.11

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

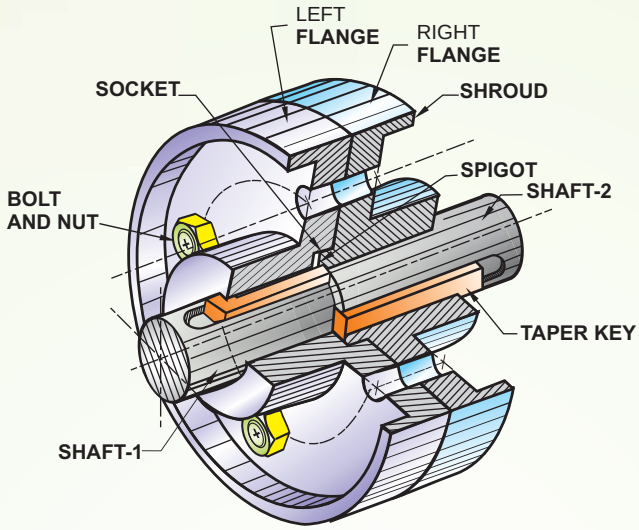
6.1.2.1 Features

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.6.12.



EXPLODED VIEW OF DETAILS OF A PROTECTED FLANGE COUPLING (HALF IN SECTION)

Fig 6.12



ASSEMBLED PICTORIAL VIEW OF A PROTECTED PLANGE COUPLING (HALF IN SECTION)

Fig.6.13

6.1.2.2 Orthographic Views

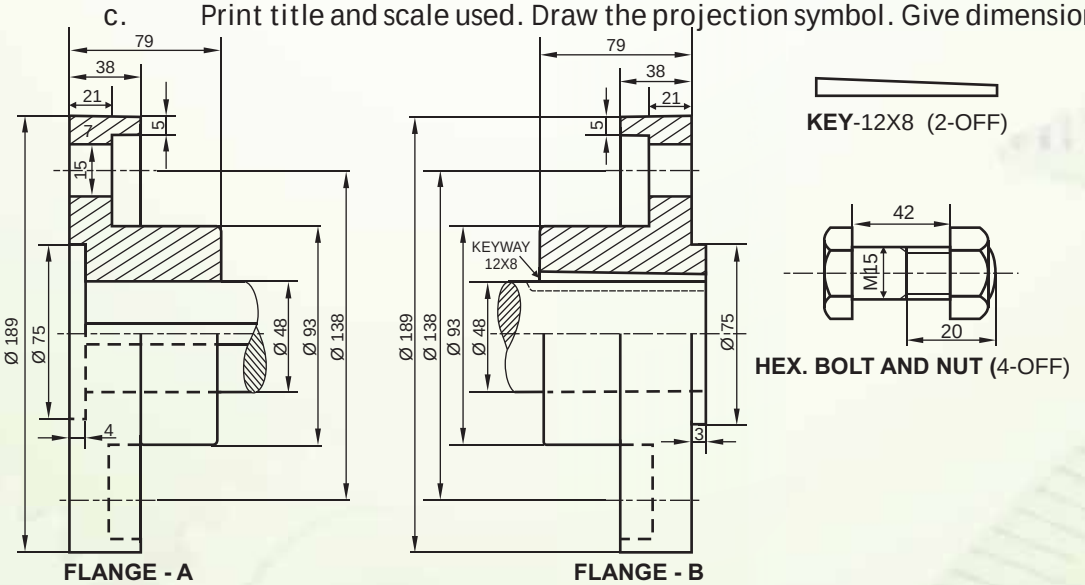
Let us learn to assemble different parts of a 'Protected Flange Coupling' and draw the respective orthographic views, with the help of an example:

Example 3: fig 6.14 shows details of the parts of a 'protected typed flange coupling'. Assemble the parts correctly and then draw the following views to scale full size:

a. Half sectional front view (upper half in section).

b. Side view, as seen from left.

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

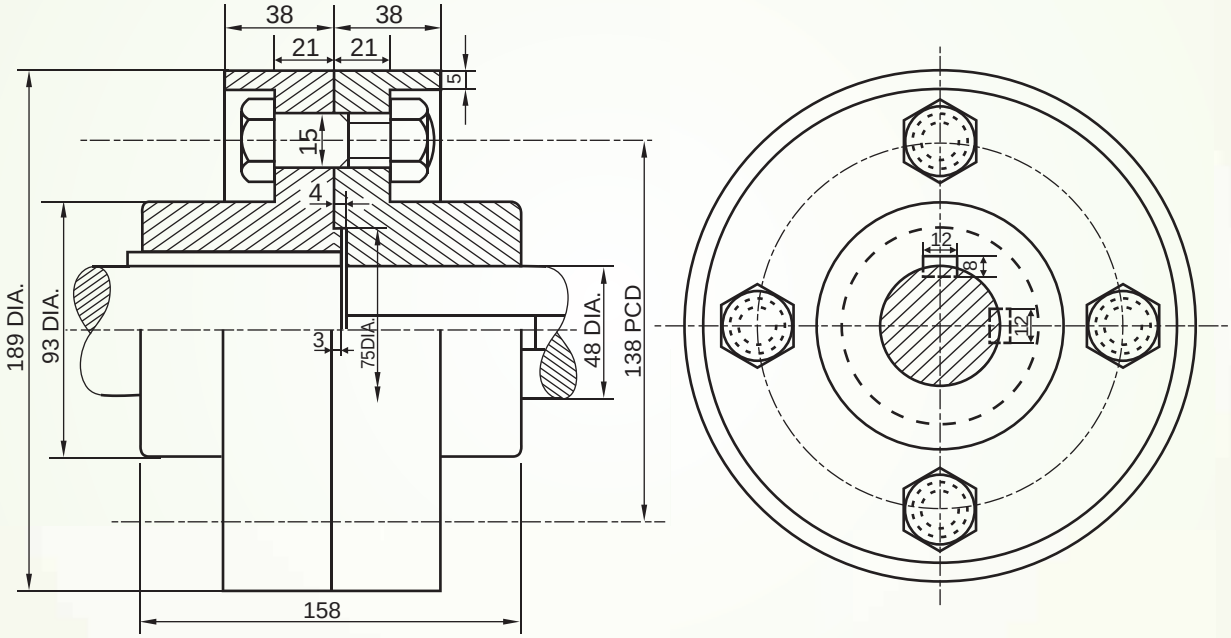


DETAILS OF A PROTECTED FLANGE COUPLING

Fig 6.14

Solution: Details of the Protected Flange Coupling are shown in Fig 6.14. Let us assemble them properly and draw the required orthographic views.

1. Here also, it can be seen that the flanges have 'spigot and socket arrangement'.
2. The parts are assembled in the similar manner as we had done for the questions based on 'Unprotected Flange Coupling'.
3. The only variation which can be seen here is that bolt and nut are not visible in the lower half which is without section in the front view.
4. The side view also has an extra circular ring for the 'shrouded flanges.



FRONT VIEW (UPPER HALF IN SECTION)

LH SIDE VIEW

Scale 1:1

ASSEMBLY OF A PROTECTED FLANGE COUPLING

Fig 6.15

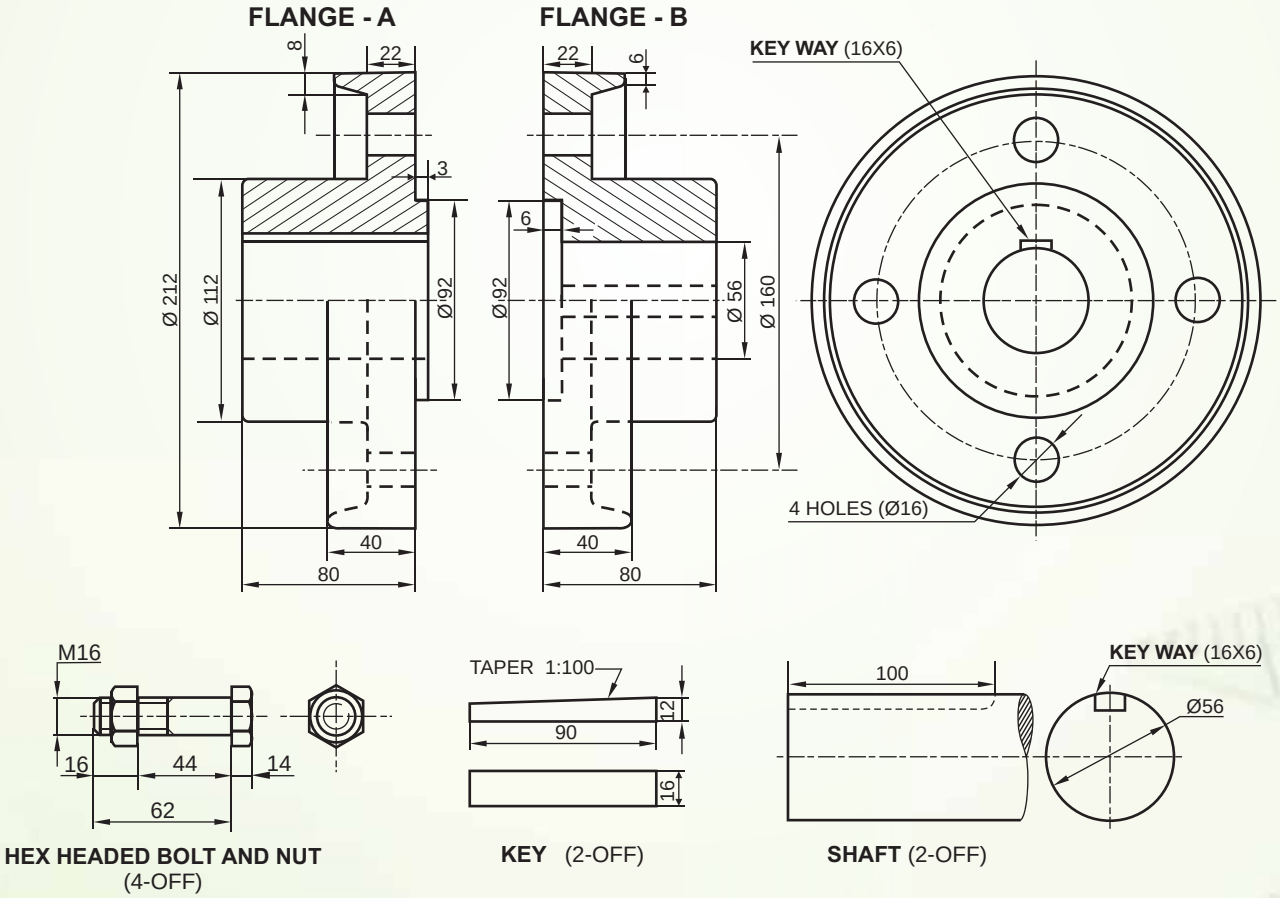
Let us take another example, and draw the required assembled views.

Example 4: 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 dimension.

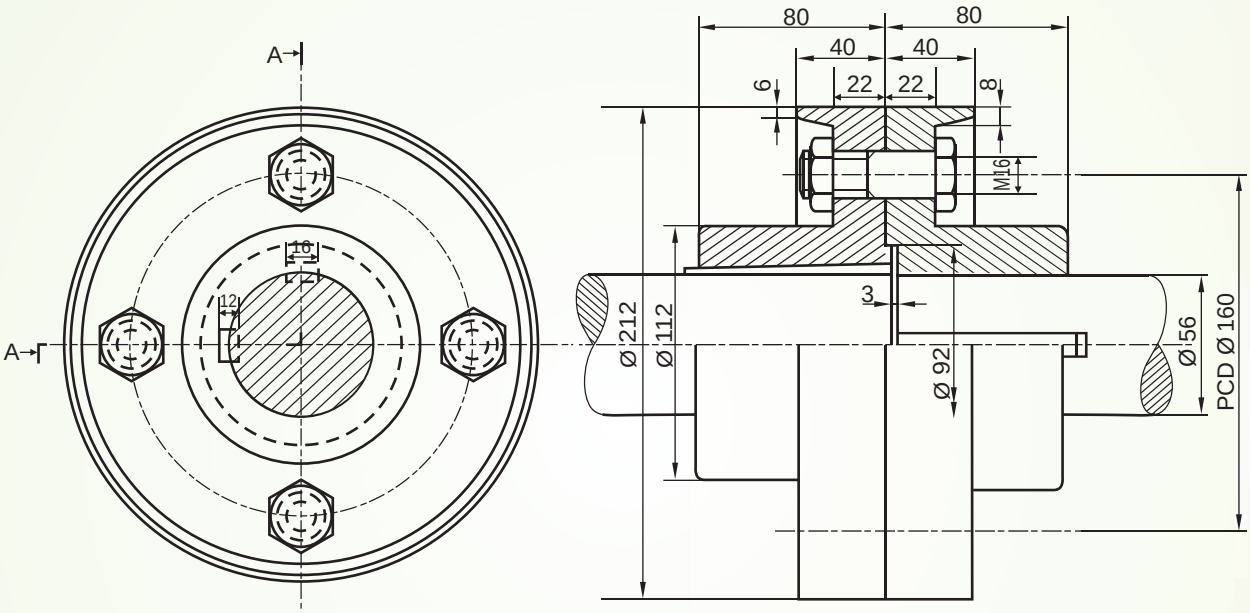


DETAILS OF A PROTECTED FLANGE COUPLING

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

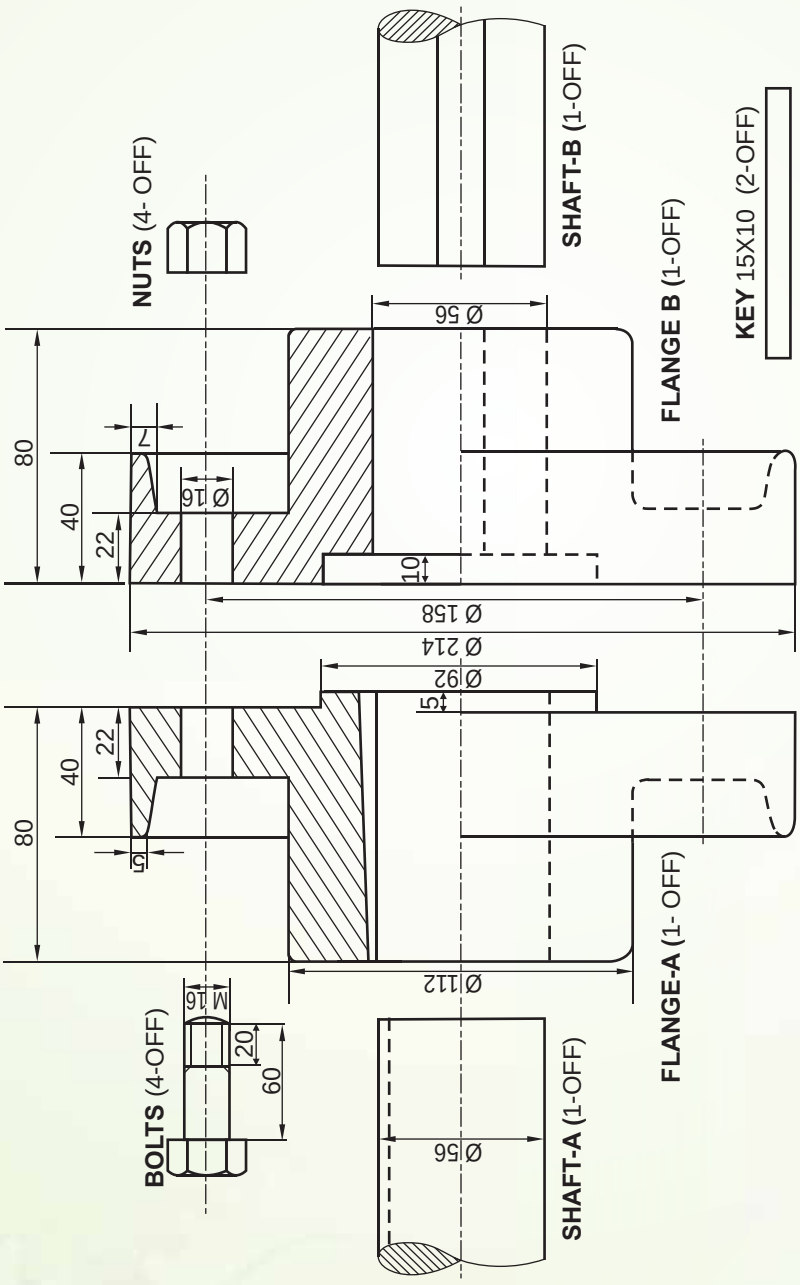
Fig 6.17

Exercise 6.2

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. Half - sectional Front view, lower half in section

   b. Left hand side view



DETAILS OF A PROTECTED FLANGE COUPLING

Fig 6.18

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

WHAT WE HAVE LEARNT

1. Coupling are devices used to join two shafts end to end. This may be done to increase the length of the shaft or to connect shafts of different machines.
2. Flange Coupling is a type of shaft coupling which is widely used.
3. 'Flange Coupling' uses two 'Flanges' (one for each shaft), fixed with keys (sunk taper) and joined with bolts and nuts (square or hexagonal).
4. There are two type of Flange Coupling

a. Protected

b. Unprotected.

5. 'Protected Flange Coupling' is Provided with an extended protruding ring in the flange to cover the heads of bolts & nuts, to avoid any injury from them while rotating.
6. A step of 2-3 mm on one flange and groove in the other (Spigot and socket arrangement) is also provided for good alignment.