

## TIE-ROD AND PIPE JOINTS

Machines use various parts which are joined in several ways for the machine to function as whole. We have learnt about some devices like fasteners (temporary & permanent) and some simple joints to join two rods in the previous chapters. Let us now learn some more miscellaneous joints which are commonly used, viz.

- (a) TIE-ROD JOINT/TURNBUCKLE
- (b) FLANGED PIPE JOINT

### 5.1 TIE-ROD JOINT

In our day to day life, we may come across rods/machine parts which are subjected to push and pull and this joints need to be tightened or loosened as in the case of wires of electric poles, cables, a sailboat's standing, rigging wires or even in boxing rings.



(a) In cables/ guy wires



(b) In electric poles.



(c) In boxing rings

### USE OF TURNBUCKLE

Fig. 5.1



In such cases, an adjustable joint known as 'turnbuckle' is used. It serves as a joining device between the ropes and the posts or rods.

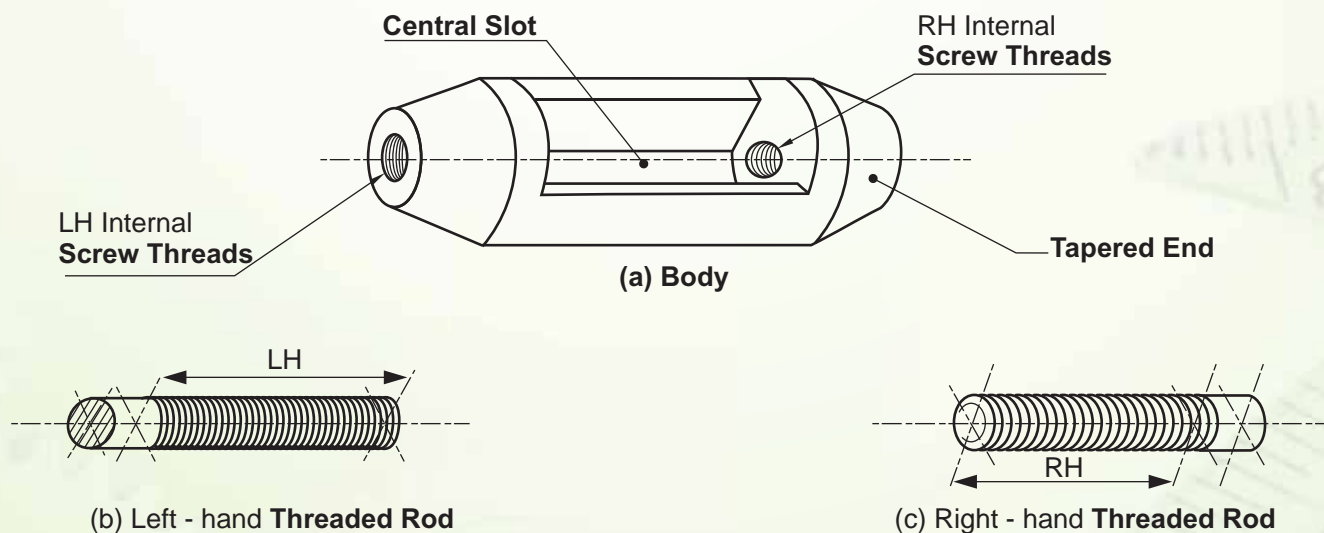


### COMMERCIAL TYPE TURNBUCKLE.

Fig 5.2

#### 5.1.1 FEATURES:

The 'turnbuckle' consists of an elongated metal tube (body) which is cylindrical in shape and has tapered ends. Its central portion has a slot to aid tightening and loosening of rods by tommy bar. Each tapered end of the body has threaded holes with opposite internal screw threads, i.e. Right hand (RH) threads at one end and left-hand (LH) threads at the other, as shown in Fig 5.3 (a)



### DETAILS OF A TURNBUCKLE

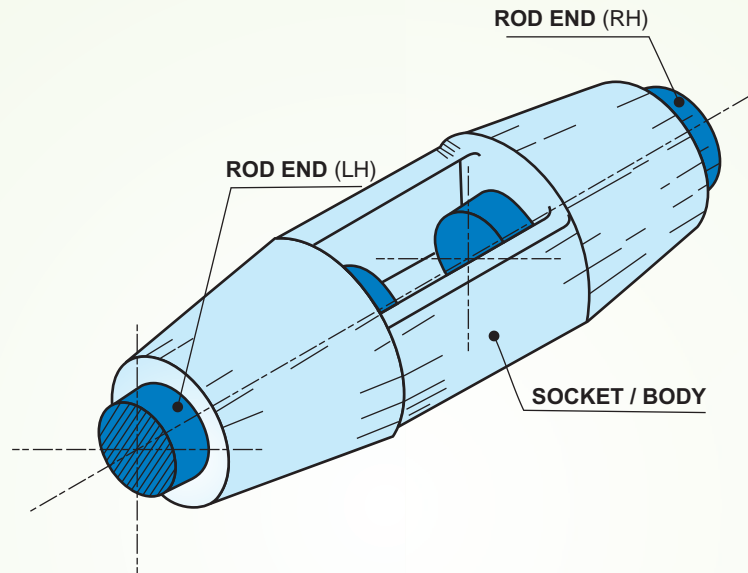
Fig 5.3

## TIE-ROD AND PIPE JOINTS



(We have discussed about the conventional representation of screw threads (RH & LH) in the previous chapter, refer section 3).

Even the two rods / ring bolts have threads of opposite hand, which are screwed in and out of the body simultaneously to adjust the pull/ push (tension) or length, without twisting the wires or attached cables.



### ASSEMBLY OF A TURNBUCKLE (PICTORIAL VIEW)

Fig 5.4

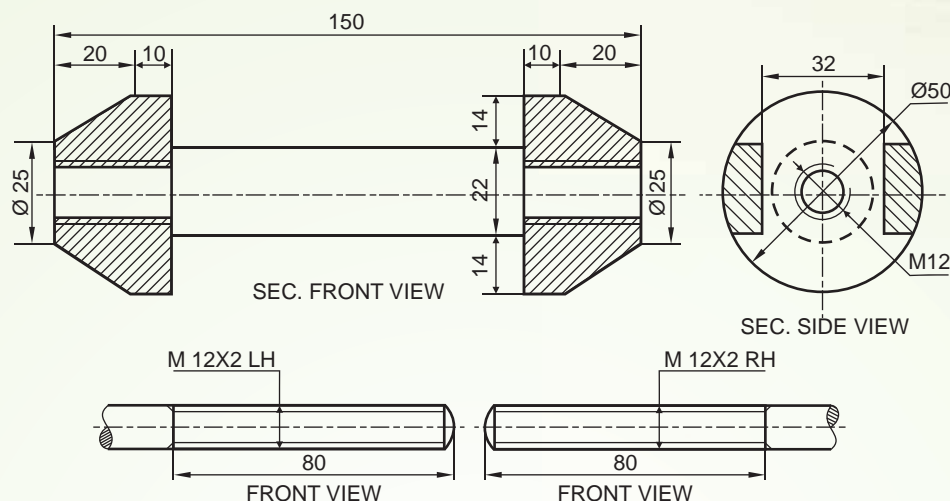
#### 5.1.2 Orthographic views

Now, let us understand their orthographic views, with the help of an example and move on to assembly of different parts of the 'Turnbuckle' and then drawing of the required sectional views.

**Example 1** The fig 5.5 shows details of the parts of a Turnbuckle. Assemble these parts correctly and then draw its following views to scale 1:1, inserting 50mm threaded portion of each rod inside the body of Turnbuckle.

- (a) Front view, upper half in section.
- (b) Top view.
- (c) Side view as viewed from left.

Write heading and scale used. Draw projection symbol. Give important dimensions.



## DETAILS OF A TURNBUCKLE

Fig 5.5

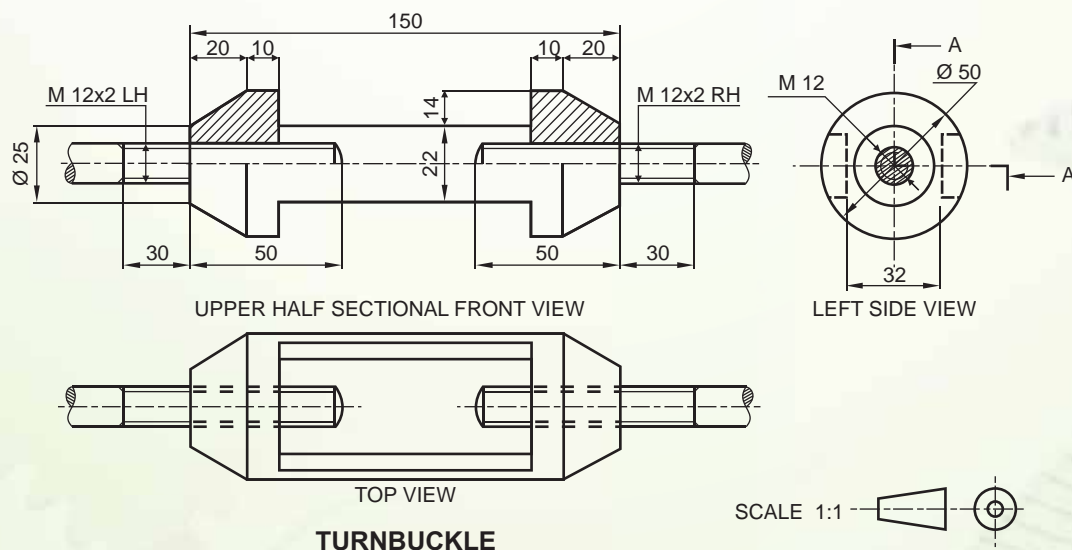
### Solutions:

The above fig 5.5 shows orthographic views of different parts of a "Turnbuckle". Let us assemble them correctly to obtain/ draw the required views.

The internal diameter of threaded holes of the body and diameter of the rods are same, so the LH (Left-hand) Threaded rod will be fitted from the left- side of the body and similarly the RH Threaded rod from the right side.

### Point to remember :

- (1) Only 50mm of the threaded portion of the rods will be inside the turnbuckle, the remaining 30mm portion will be shown outside the body as can be seen in the Fig. 5.6 below.



## ASSEMBLY OF A TURNBUCKLE (ORTHOGRAPHIC VIEWS)

Fig 5.6



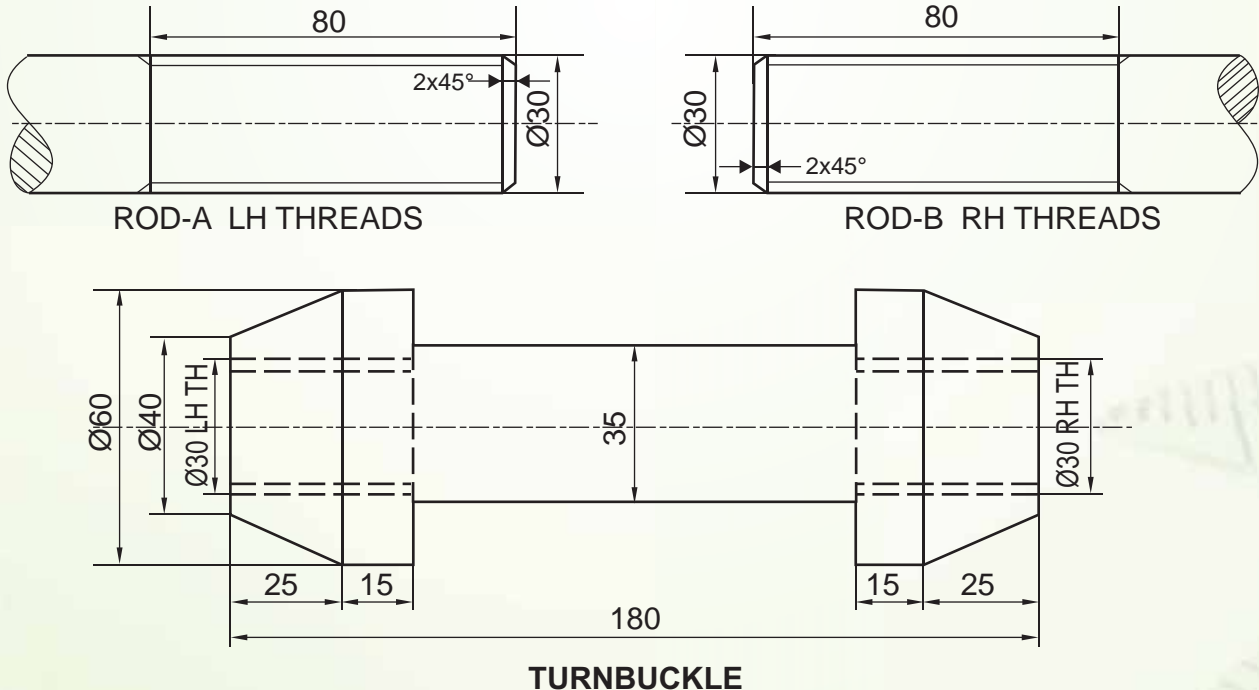
- (2) It can also be noticed that the width of the edges of the slots can be obtained from the side view.
- (3) In the sectional front view, the rods need not be locally sectioned as no intricate inner details are present, as in the previous chapter.

Let us consider another example, and draw the orthographic views of the assembled parts.

**Example 2:** The fig 5.7 shows the details of the parts of a Turnbuckle. Assemble these parts correctly, and then draw its following views to scale 1:1, inserting 60mm threaded portion of each rod inside the body of the Turnbuckle.

- (a) Front view, lower half in section.
- (b) Side- view as viewed from the right.

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



### DETAILS OF A TURNBUCKLE

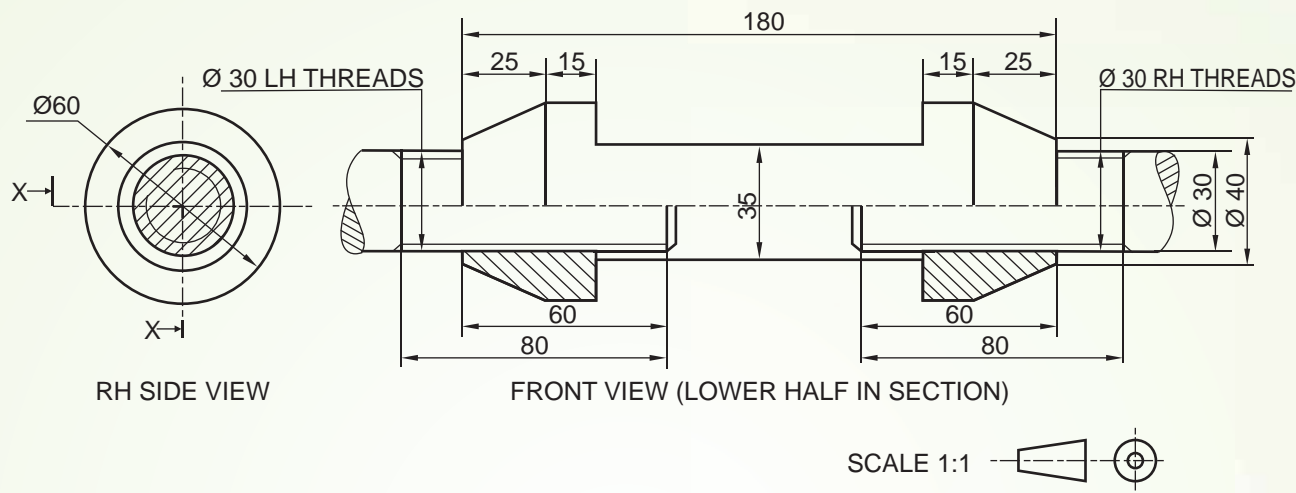
Fig 5.7





## Solution:

In the fig 5.7 given, orthographic views of the parts of a Turnbuckle" are shown. Let us assemble them correctly and obtain the orthographic views as shown below in fig 5.8

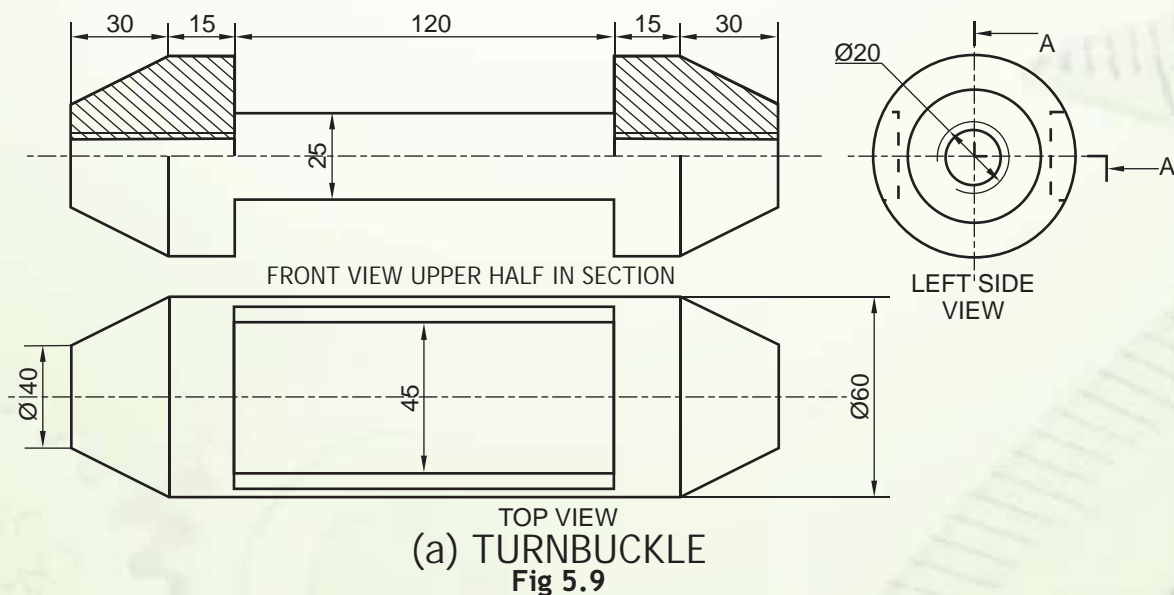


## ASSEMBLED ORTHOGRAPHIC VIEWS OF A TURNBUCKLE.

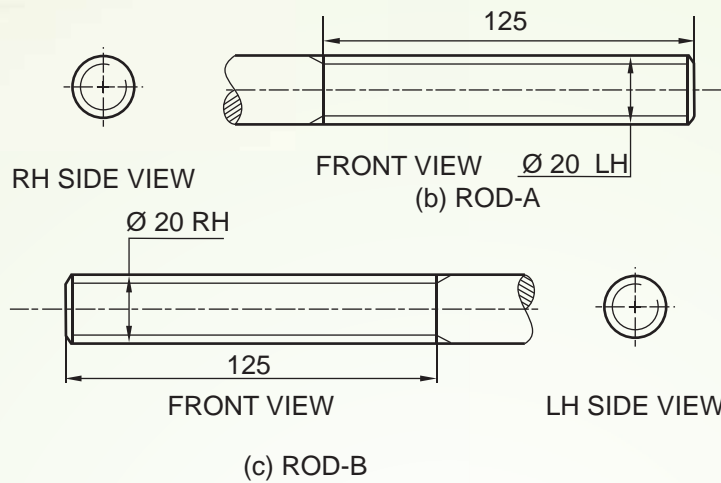
Fig 5.8

## Exercise 5.1

1. Figure 5.9 and 5.10 shows the disassembled views of the parts of a Turnbuckle. Assemble the parts correctly, and then draw the following views to scale 1:1, keeping the same position with respect to HP and VP:
  - (a) Half sectional elevation, upper half in section.
  - (b) Plan.



(a) TURNBUCKLE  
Fig 5.9



## ORTHOGRAPHIC VIEWS OF DETAILS OF A TURNBUCKLE

Fig.5.10

Print the title and scale used. Give six important dimensions.

### 5.2 PIPE-JOINTS

Those long hollow cylinders or 'pipes' are a regular feature, be it the pipes that bring water from treatment plants to your home or the drainage pipes or even the roadside long gas pipe-line.



(a) A GAS PIPELINE



(b) Discharge from a factory



(c) Drinking from a water pipe

### USES OF PIPES

Fig 5.11

Since ages, we know pipes have been extensively used as carriers of fluids like water, oil, steam gas, waste, for water supply systems, oil refineries, chemical plants, sewage piping system etc. And these pipes may be made of different materials like cast-iron, steel, wrought iron, plastic or concrete as per the requirement; but they "can't be made of a desired length" for a particular use, due to constraints of manufacturing, transportation, storing and handling difficulties. So pipes of standard length are taken and joined together, depending upon the material and purpose for which it is used.

The most common among them is the 'Cast Iron Flange Joint' which we will discuss in detail.

#### 5.2.1 CAST-IRON FLANGE PIPE JOINT

As the name suggests, this type of joint is used for cast-iron (C.I.) pipes, which are usually of large diameter not less than 50 mm and used mostly for low-pressure applications, such as underground sewer pipes, water and gas lines and drainage in buildings. We can also see this type of joint in the water outlet pipes installed in several schools as a fire safety measure.



(a) Gas Production Plant



(b) Water Pipe

### SOME APPLICATIONS OF FLANGE JOINT

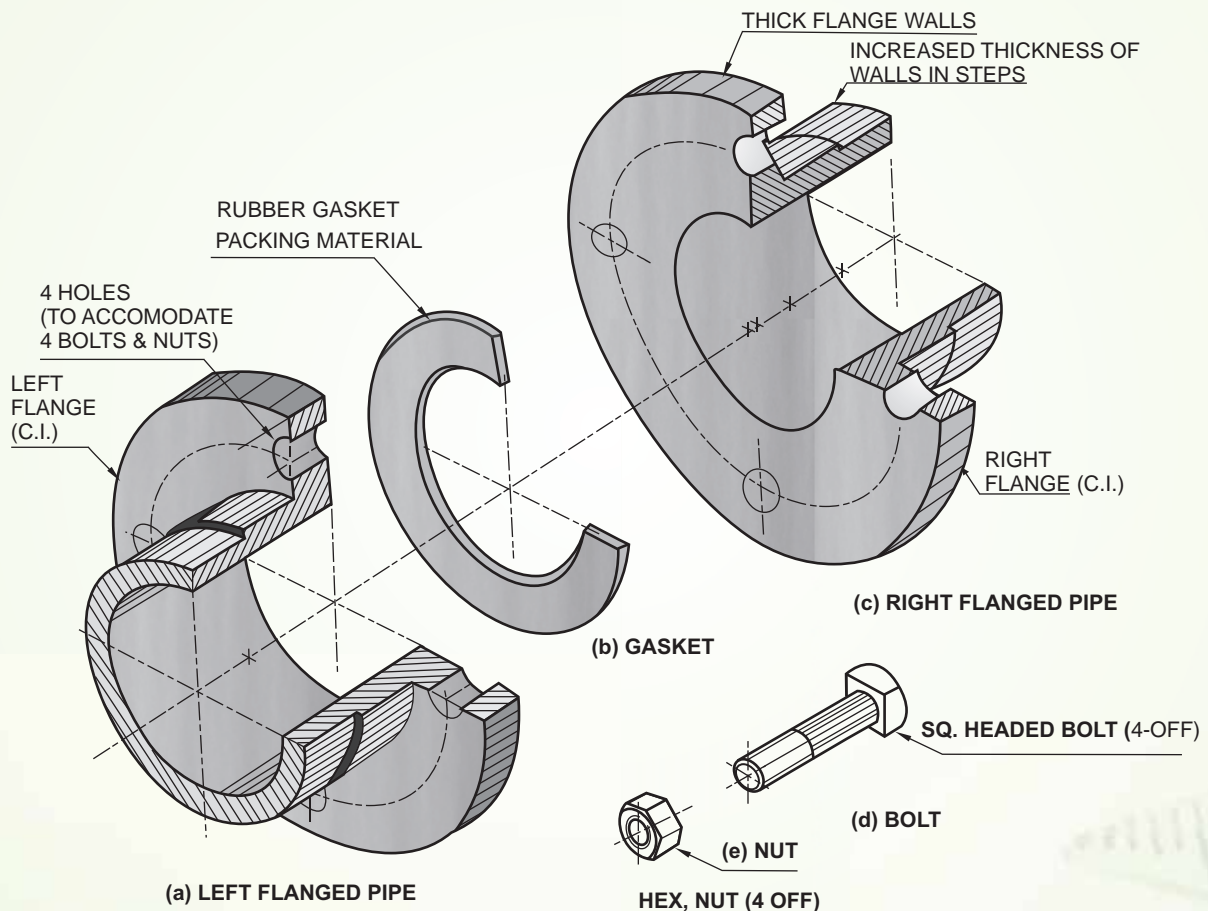
Fig. 5.12





### 5.2.1.1 FEATURES:

In this type of joint, both the hollow cylindrical pipes have a projected circular ring/ flared rim on their ends, which is known as 'flange', as shown in fig 5.13. It serves to hold the pipe in place, give it strength and also attach to another flange. The flanges are made thicker than the pipe-walls for strength. Greater strength may be required when pressure is high; so the thickness of the pipe-walls is increased for short lengths in steps, as indicated in the fig 5.13. We also know pipes carry liquids and gases and they need to be



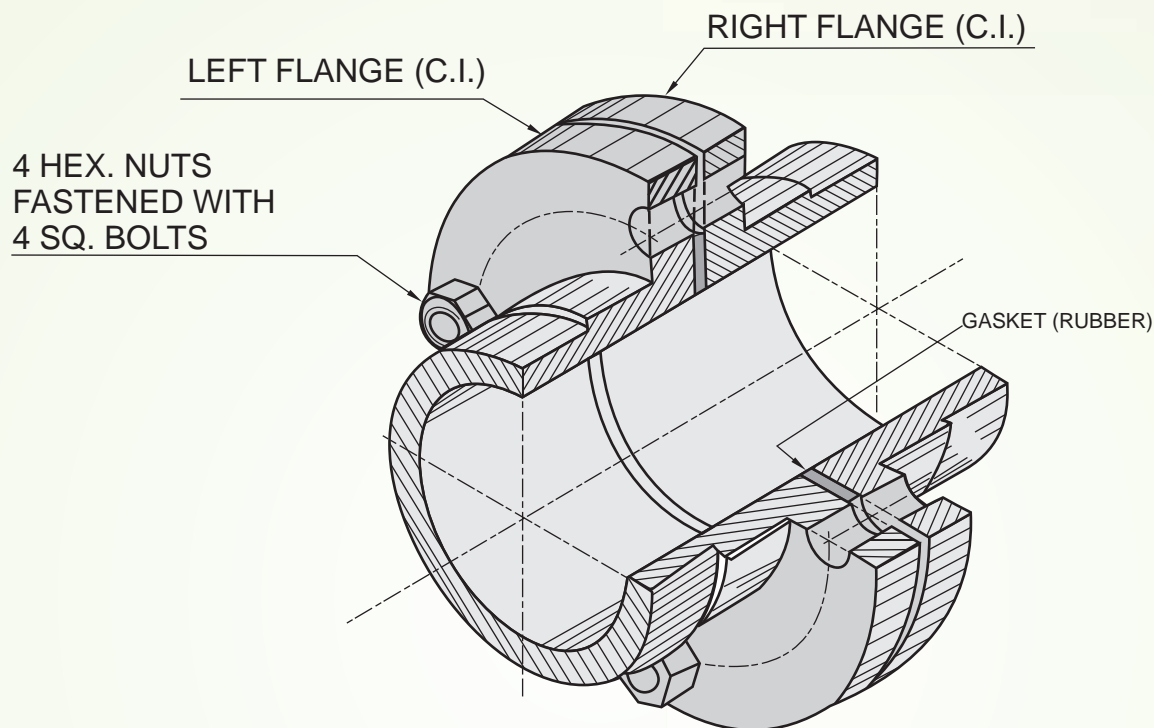
### DETAILS OF A FLANGE PIPE JOINT (HALF SECTIONAL PICTORIAL VIEW)

Fig. 5.13

tight and leak-proof. In order to do so, a mechanism similar to the one, we use in pressure cookers is utilized i.e., here also we have a similar thin circular packing ring/gasket of soft material, such as Indian rubber, canvas etc. coated with red lead. This is placed in between the faces of the two flanges. For perfect alignment, these faces are machined at right angle to the axes of the pipes. Then these flanges with the gasket in between are connected together by means of nuts and bolts which are fitted through the holes in the flanges. (The bolts and nuts may be square-headed or hexagonal-headed in shape.)



Thus, it can be seen that flange joints help in easy and fast disassembly to withstand higher pressures.



**ASSEMBLY OF CAST - IRON FLANGED JOINT  
(HALF IN SECTION - PICTORIAL VIEW)**

**Fig. 5.14**

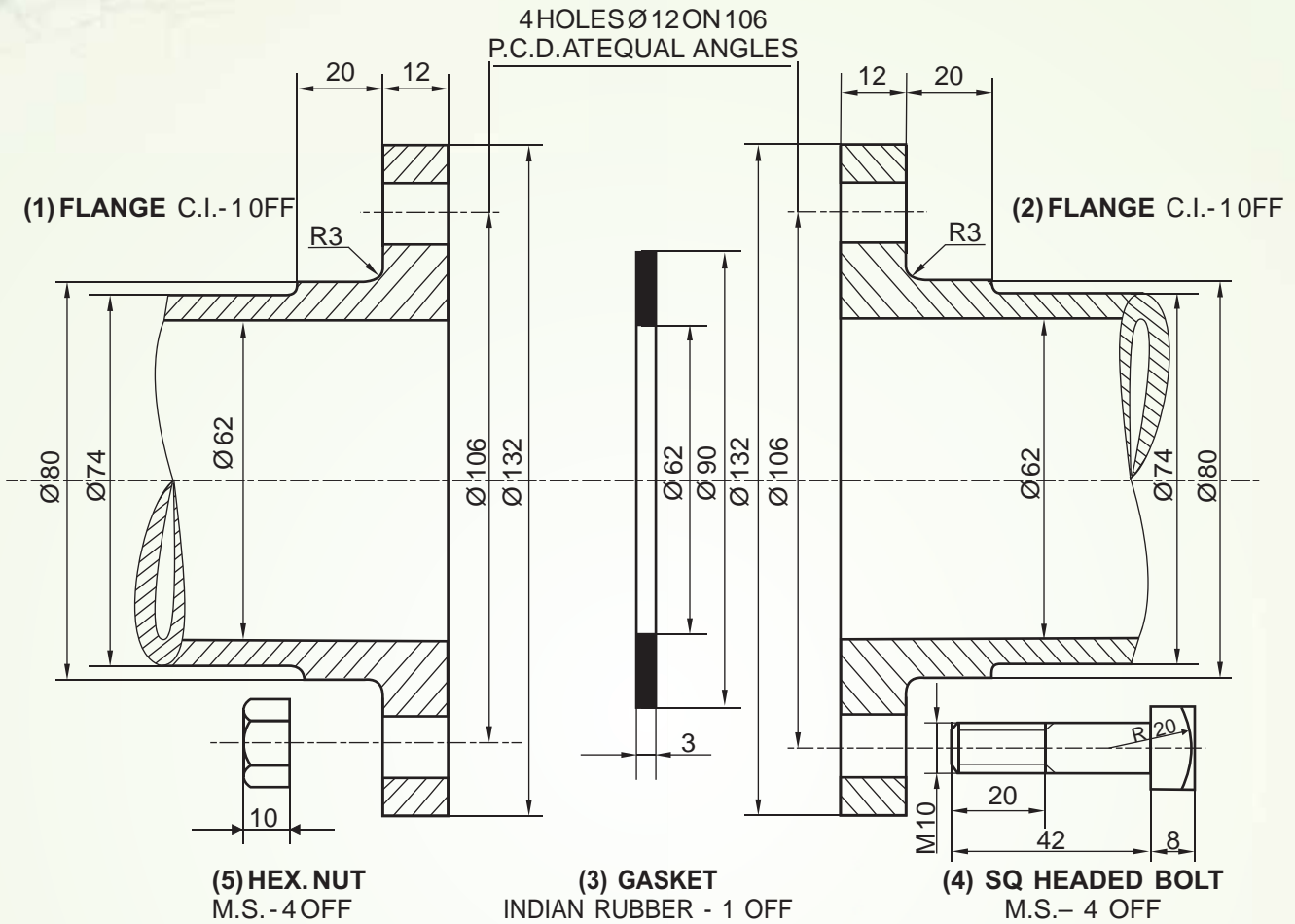
### 5.2.1.2 ORTHOGRAPHIC VIEWS

Let us now understand the orthographic views of different parts of the Flanged Pipe Joint and learn to assemble them correctly. And then draw the sectional view & other orthographic views of the assembly.

**Example 1:** Figure 5.15 shows the details of the parts of a Flanged Pipe Joint. Assemble these parts correctly and then draw to scale 1:1, its following views:

- Front view, upper half in section.
- Side view, as viewed from left.

Write heading and scale used. Draw projection symbol. Give six important dimensions



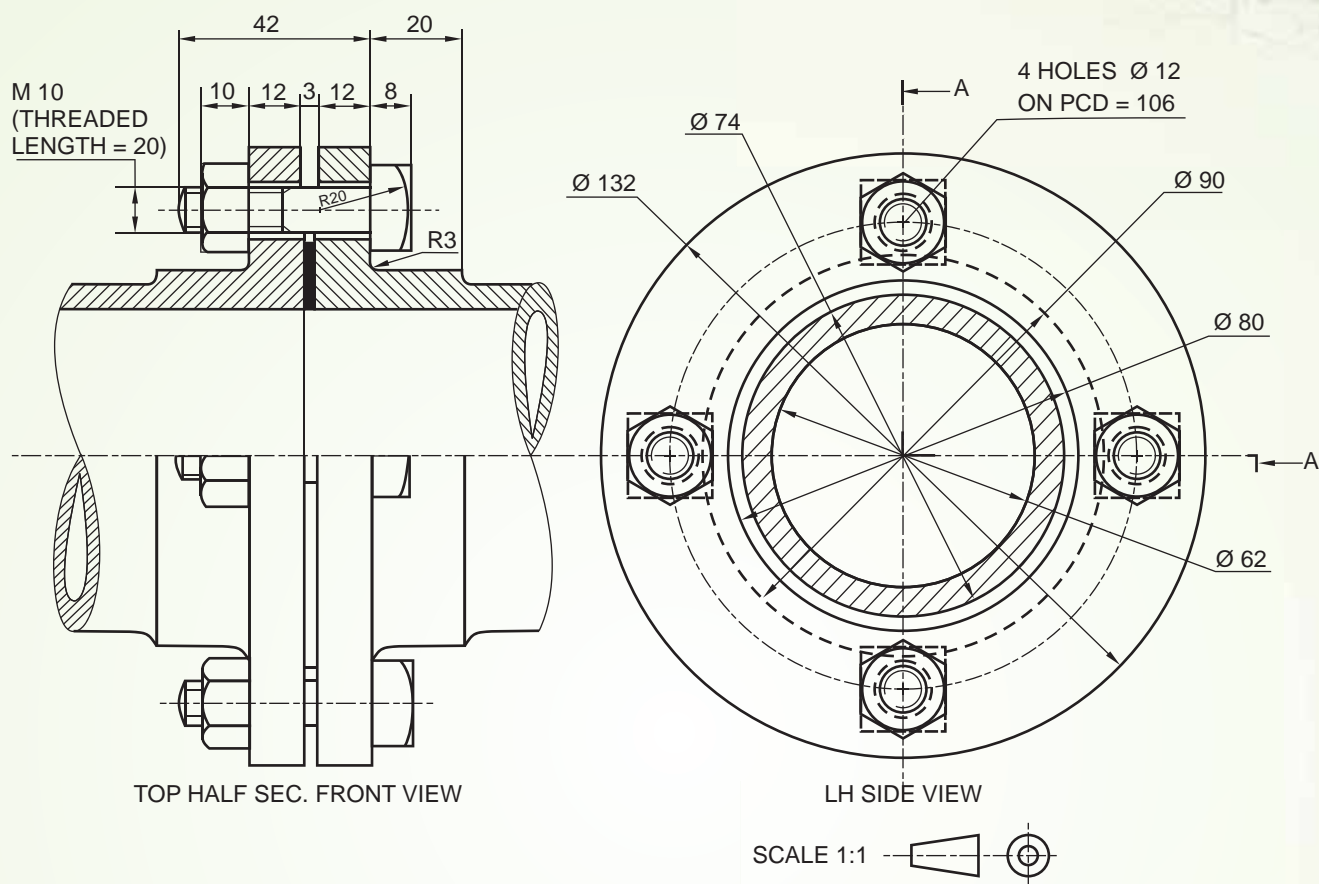
## DETAILS OF A FLANGED PIPE JOINT

Fig 5.15

### Solution:

In the figure 5.15, the front view of all the parts of the Flanged Pipe Joint are shown. Let us assemble these parts as learnt in the previous section.

- As discussed earlier, the gasket is placed between the two flanges. (It can be seen, the inner diameters of all the three parts i.e. the two flanges and the gasket are same ( $\varnothing 62$ ) and all will be in a line.)



## ASSEMBLY OF A FLANGED PIPE JOINT

Fig 5.16

2. Then, the four square (SQ) headed bolts are fitted in the holes as shown in the flanges centrally; the distance between the axes of holes being  $\varnothing 106$  (PCD). (It can be seen, the holes are of  $\varnothing 12$  and the bolts & nuts have diameter 10mm, so a gap (clearance) of 1mm is present around and is shown in the top and bottom of the shank of the bolt, placed in the holes, in the front view.) Refer Fig 5.16.
3. Since, sectional front view (upper half in section) is asked, so both the flanged pipes are sectioned in opposite directions, as they are different machine parts. The gasket, being a thin section, may be shown entirely black as per SP-46 : (2003) BIS specifications (10.2.3). Notice the cross-section of the pipe (to represent a hollow cylindrical section.)
4. In the side view, which is a complete view, all the bolts and nuts (bolt head in hidden lines) are shown on the ring of diameter 106, i.e. PCD (pitch circle diameter).



**Example 2** Fig 5.17 shows the details of a Flanged Pipe Joint. Assemble these parts correctly, and then draw the following views to a scale full size:

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

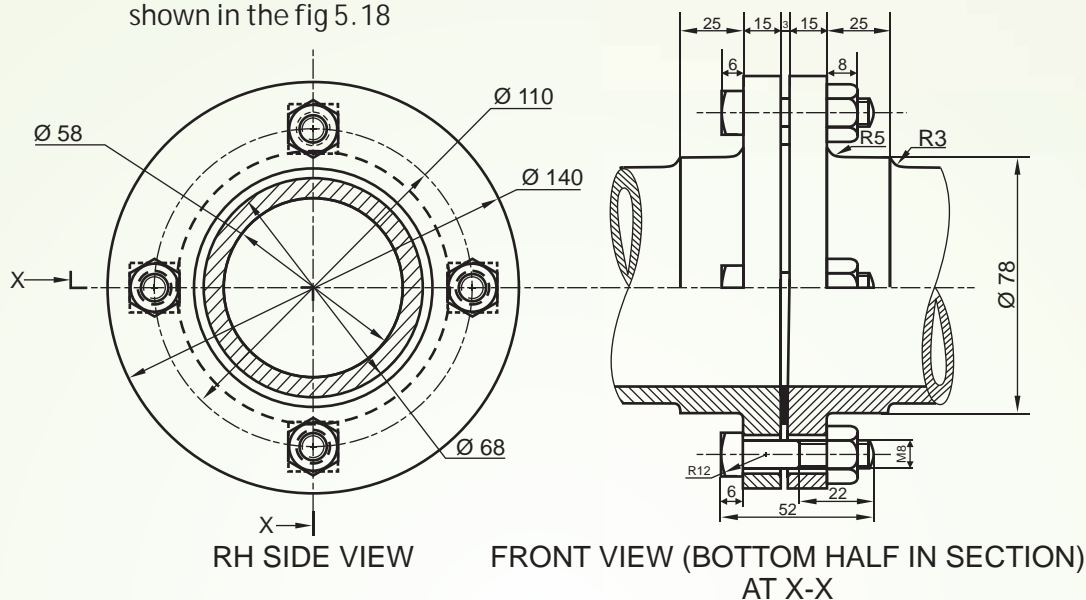


# ENGINEERING GRAPHICS



## Solution:

In the above given fig 5.17, the orthographic (front) views of different parts are given. Let us assemble them properly and then draw the required views, as shown in the fig 5.18



## ASSEMBLY OF A FLANGED PIPE JOINT

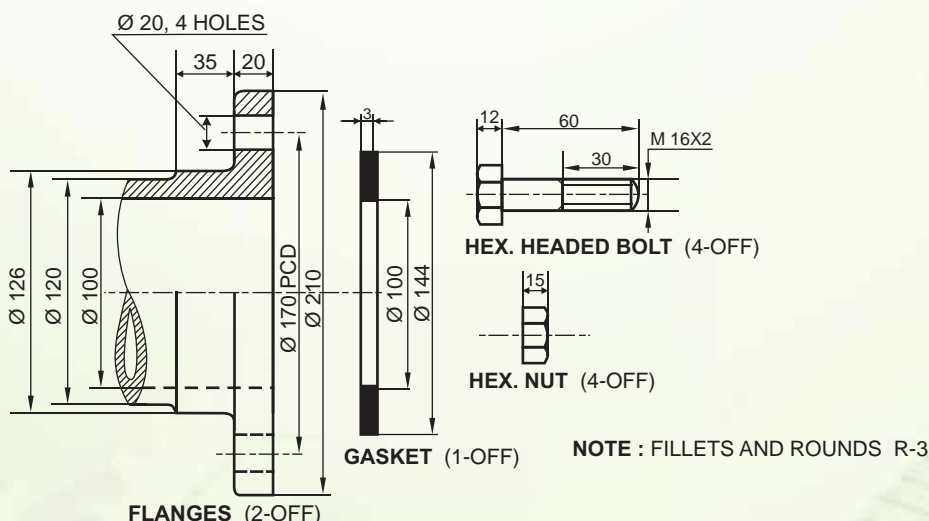
Fig 5.18

## Exercise 5.2

Figure 5.19 shows the details of parts of the Flanged Pipe Joint. Assemble these parts correctly and then draw the following views to full-size scale:

- Upper half sectional front view
- Left-hand side view.

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



## DETAILS OF A FLANGED PIPE JOINT

Fig 5.19



### WHAT HAVE WE LEARNT

1. Turnbuckle/Tie-rod Joint is an adjustable temporary joint, which connects the ends of two rods axially when they are subjected to push/pull (tensile) forces.
2. It consists of:
  - (a) **Body:** A hollow cylinder with tapered ends having threaded holes & a central slot.
  - (b) **Left-hand (LH) threaded rod:** The rod end as left-hand threads.
  - (c) **RH-threaded rod:** This rod end has opposite hand threads (i.e. right-hand screw threads)
3. The threaded rod ends are screwed in or out of the body to tighten or loosen the joint or adjust the length.
4. Turnbuckle is used in the guy ropes, wires of electric poles, rigging wires of ship, wrestling rings etc.
5. 'Pipes' are used to transfer liquids or gas from one place to another, and are made of various materials like cast iron, steel, copper, concrete, plastic etc.
6. Pipes are connected to each other in different ways; known as 'Pipe Joints' to increase the length or to connect two different fittings.
7. Several type of pipe joints are available, which depend upon the material and type of service.
8. 'Flange Pipe Joint' is used to connect large diameter pipes, especially cast-iron pipes.
9. It consists of:
  - (a) **Flanged pipes:** The pipes have integral flared rim at the ends (flange) and may have thicker walls in steps for strength.
  - (b) **Gasket:** A circular thin ring of soft material, placed between the flanges to keep the joint leak-proof.
  - (c) **Nuts & bolts:** Used to fasten the two flanges. May be hexagonal or square headed.
10. The two cast iron pipes with integral flanges are connected together by means of bolts and nuts, and the gasket/packing material in between the flanges, to keep it tight & leak-proof.
11. Flange Pipe Joint can be seen in underground water system, gas lines, drainage systems etc.