

Fig.2.2 Conventional representation of threads

Thickness of bolt head = $0.8d$

Length of bolt = As specified

Thread length = $2d + 6\text{mm}$ (for $l < 150\text{ mm}$)
 $= 2d + 12\text{mm}$ (for $l > 150\text{ mm}$)

The Fig.2.3 shows the front and side view of a hexagonal headed bolt across flats having nominal diameter d with standard proportions.

Example 2.1 : Draw the front and side view of ISO threaded hexagonal bolt and nut of 100 mm long with a threaded length of 50 mm looking across flats. Nominal diameter of bolt is 20 mm.

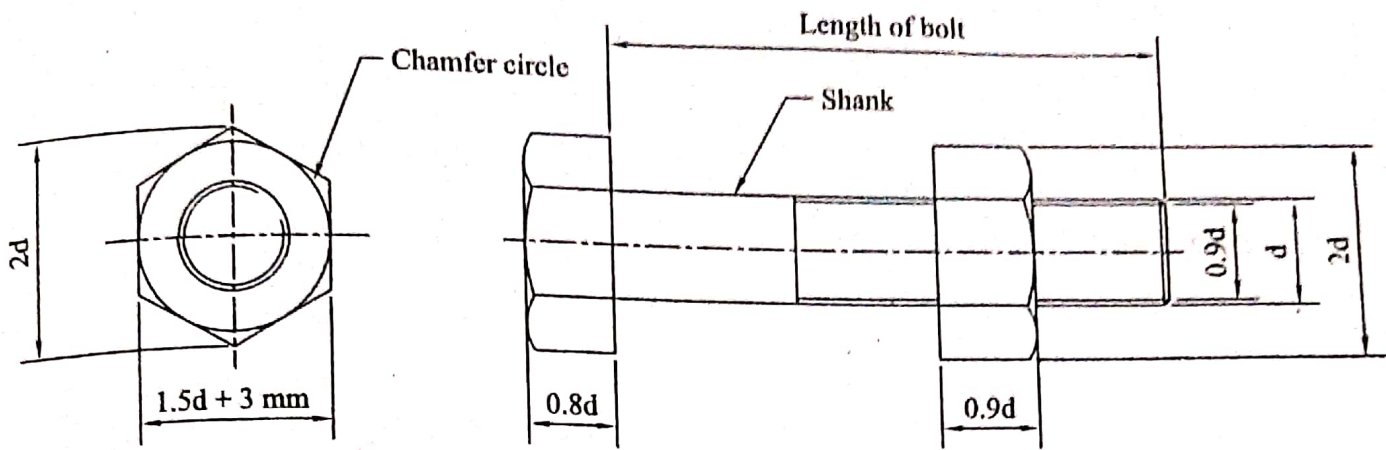


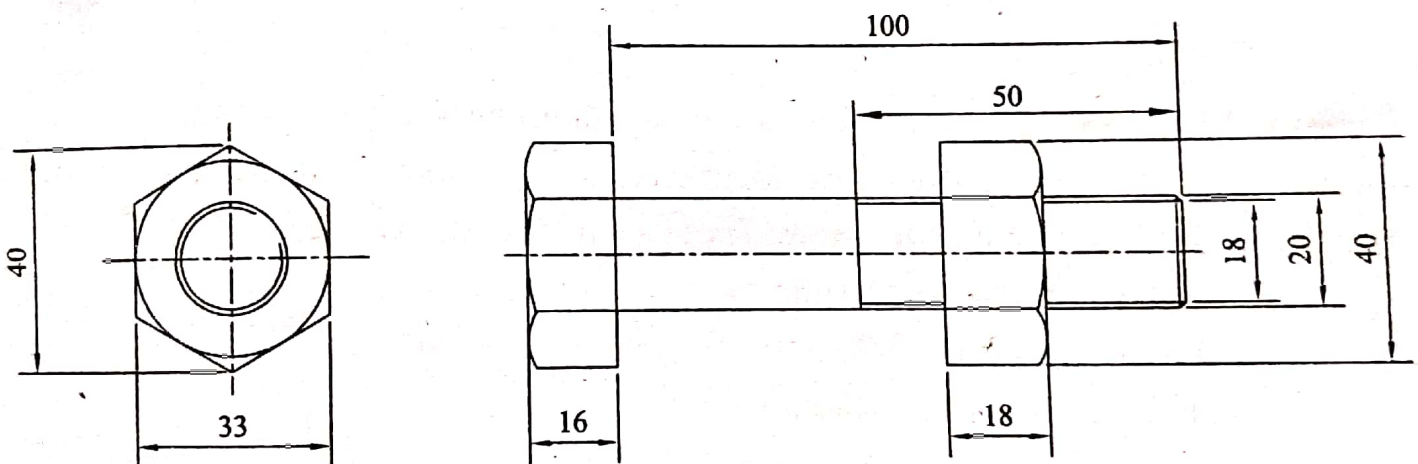
Fig.2.3 Front and side view of a hexagonal headed bolt across flats

Ans : For a nominal diameter of 20 mm. The standard proportions are:

Thickness of bolt head = 16 mm

Thickness of nut head = 18 mm

Width across flats = 33 mm



All dimensions are in mm

Fig.2.4

2.6 Front and Side View of a Hexagonal Headed Bolt Across Corners

The standard proportions for hexagonal headed bolt across corners is same as that of hexagonal headed bolt across flats.

Major or nominal diameter of bolt = d

Thickness of nut = $0.9d$

Width of nut across flat surfaces, $W = 1.5d + 3 \text{ mm}$

Radius of chamfer, $R = 1.5d$

Thickness of bolt head = $0.8d$

Length of bolt = As specified

Thread length = $2d + 6\text{mm}$ (for $l < 150\text{ mm}$)
 $= 2d + 12\text{mm}$ (for $l > 150\text{ mm}$)

The Fig.2.5 shows the front and side view of a hexagonal headed bolt across corners having nominal diameter "d" with standard proportions.

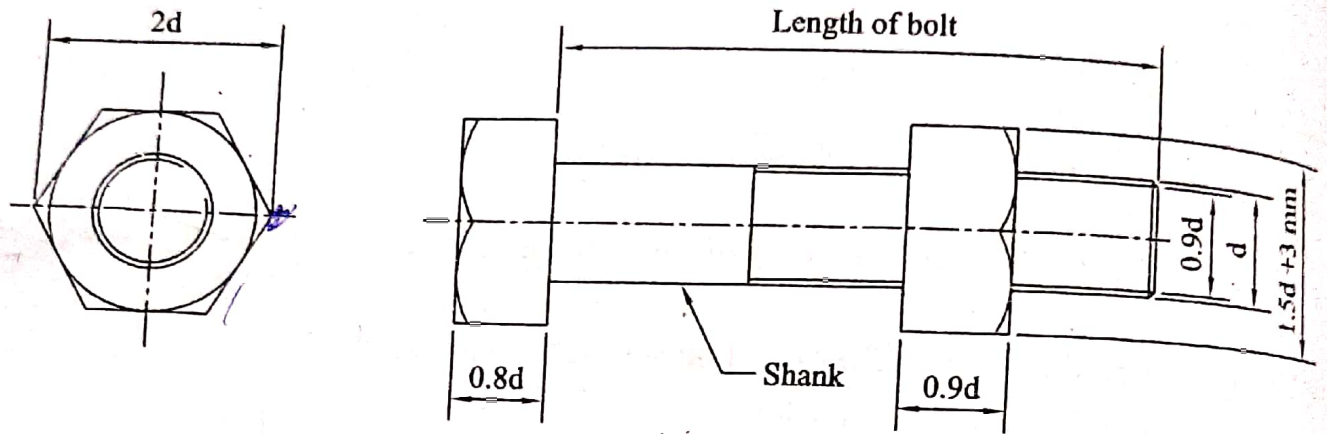


Fig.2.5 Front and side view of a hexagonal headed bolt across corners

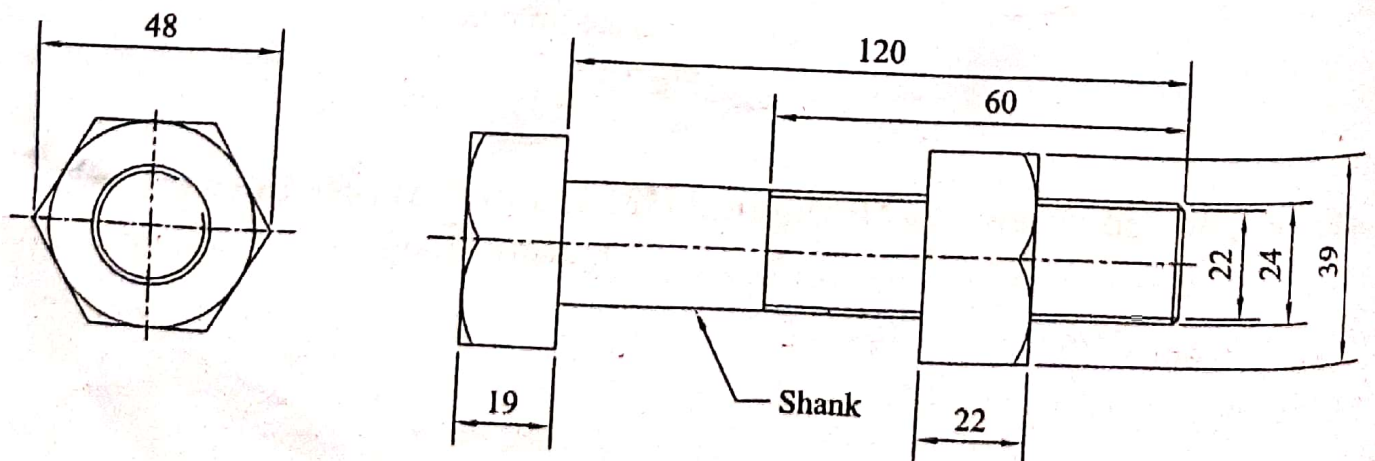
Example 2.2 : Draw the front and side view of ISO threaded hexagonal bolt and nut of 120 mm long with a threaded length of 60 mm looking across corners. Nominal diameter of bolt is 24 mm

Ans : For a nominal diameter of 24 mm. The standard proportions are:

Thickness of bolt head = 19 mm

Thickness of nut head = 22 mm

Width across corners = 48 mm



All dimensions are in mm

Fig.2.6

2.7 Front and Side View of a Square Headed Bolt Across Flats

The square head bolt and nut are drawn to the proportions given as below.

Major or nominal diameter of bolt = d

Thickness of nut = $0.9d$

Width of nut across flat surfaces, $W = 1.5d + 3 \text{ mm}$

Radius of chamfer, $R = 1.5d$

Thickness of bolt head = $0.8d$

Length of bolt = As specified

Thread length = $2d + 6 \text{ mm}$ (for $l < 150 \text{ mm}$)

= $2d + 12 \text{ mm}$ (for $l > 150 \text{ mm}$)

The Fig.2.7 shows the front and side view of a square headed bolt across flats having nominal diameter " d " with standard proportions.

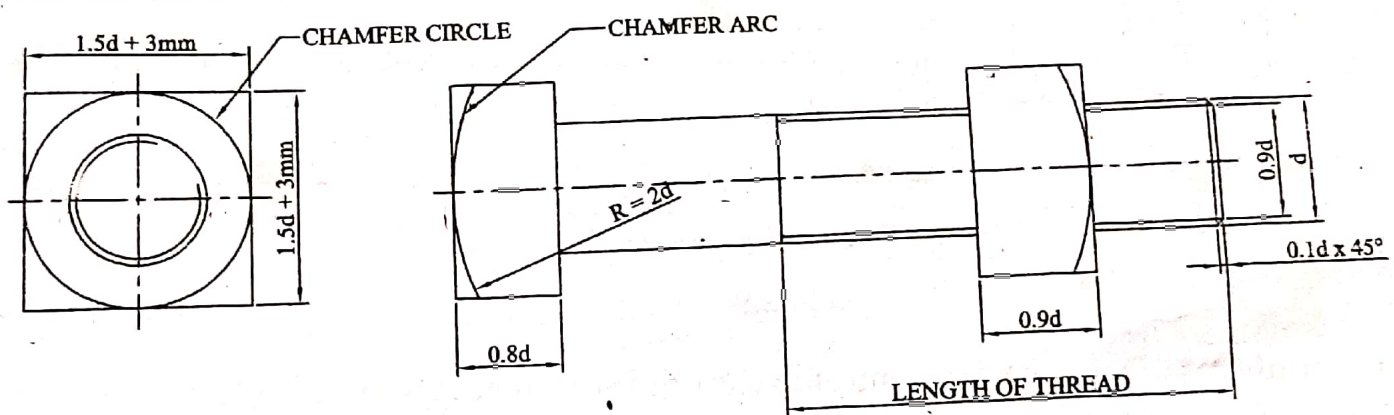


Fig.2.7 Front and side view of a square headed bolt across flats

2.8 Front and Side View of a Square Headed Bolt Across Corners

The proportions are same as that in article 2.7

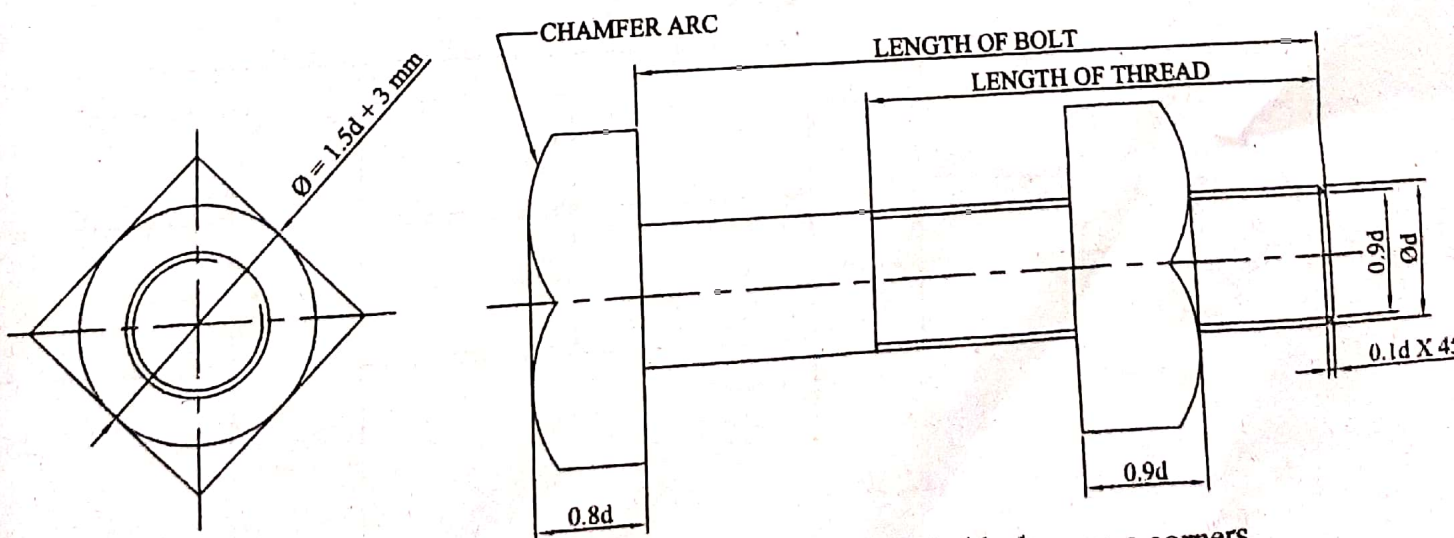


Fig.2.8 Front and side view of a square headed bolt across corners

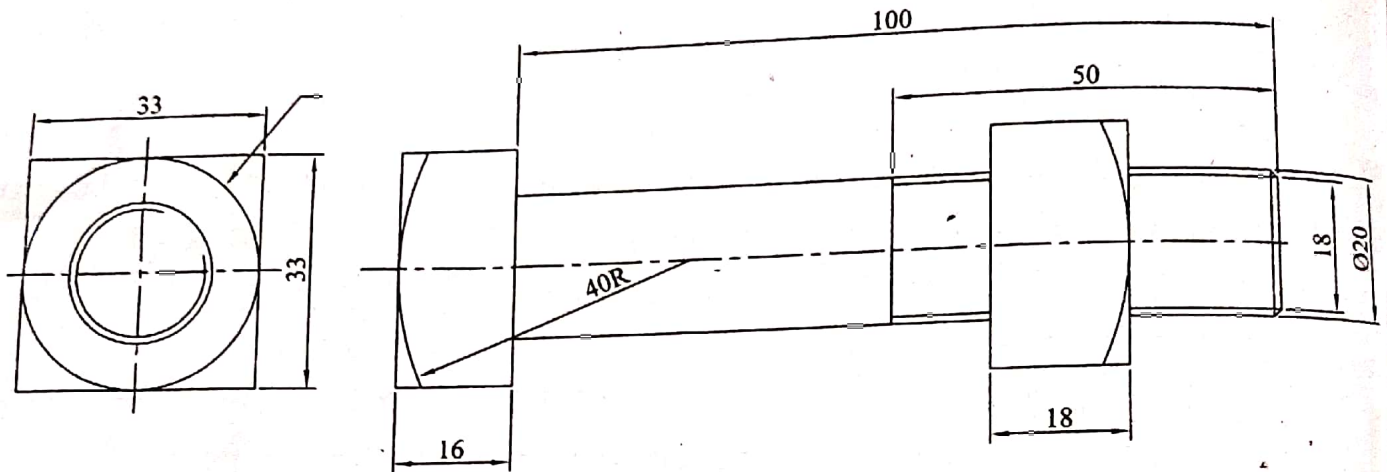
Example 2.3 : Draw the front and side view of ISO threaded square bolt and nut of 100 mm long with a threaded length of 50 mm looking across flat. Nominal diameter of bolt is 20 mm.

Ans : For a nominal diameter of 20 mm. The standard proportions are:

Thickness of bolt head = 16 mm

Thickness of nut head = 18 mm

Width across flats = 33 mm



All dimensions are in mm

Fig.2.9

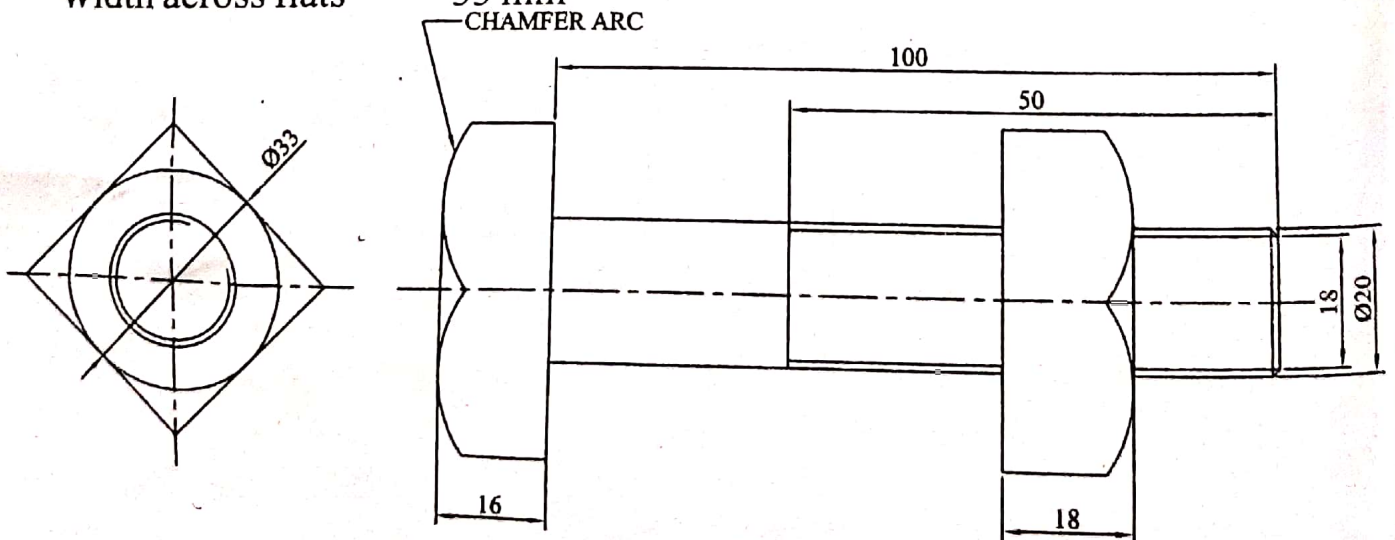
Example 2.4 : Draw the front and side view of ISO threaded square bolt and nut of 100 mm long with a threaded length of 50 mm looking across corner. Nominal diameter of bolt is 20 mm.

Ans : For a nominal diameter of 20mm. The standard proportions are:

Thickness of bolt head = 16 mm

Thickness of nut head = 18 mm

Width across flats = 33 mm



All dimensions are in mm

Fig.2.10

2.9 Cylindrical or Cheese Head Bolt

Fig.2.11 shows the standard proportions of cylindrical or cheese head bolt. The rotation of the bolt head is prevented by a stop pin. The stop pin may be driven into the shank with its axis perpendicular to the axis of the bolt immediately below the head as shown in Fig.2.11A. The stop pin may also be driven into the head adjacent to the shank with axis parallel to the axis of the bolt as shown in Fig.2.11B. These type of bolt heads are used when projecting corners of the bolt head are undesirable, or when the space accommodating the bolt head is limited as in the big ends of the connecting rods, eccentrics, cross heads, etc.

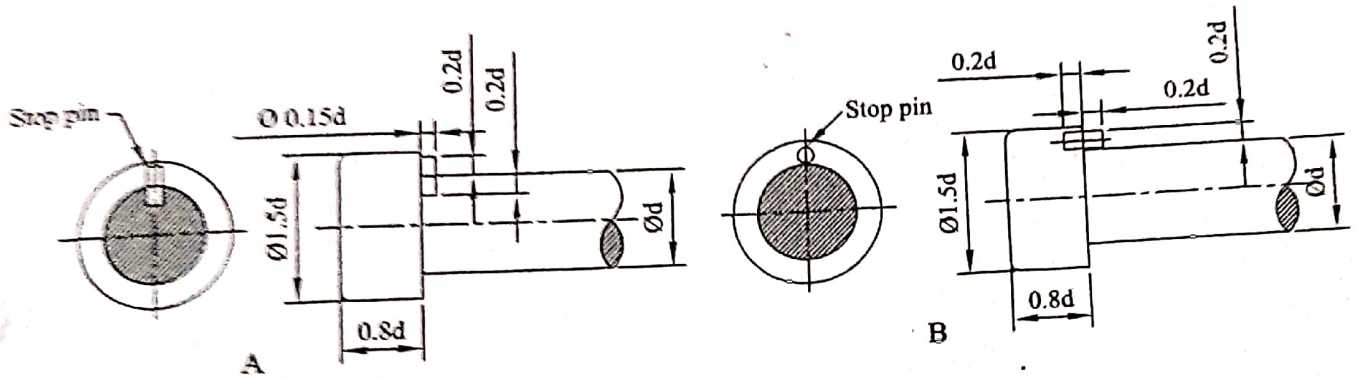


Fig.2.11 Cylindrical or Cheese head bolt

Example 2.5 : Draw the two views of cylindrical head bolt of 20mm diameter in the axis horizontal position with stop pin (a) perpendicular the axis (b) parallel to the axis. Indicate all the dimensions according to the standard proportions.

Ans : Fig.2.12

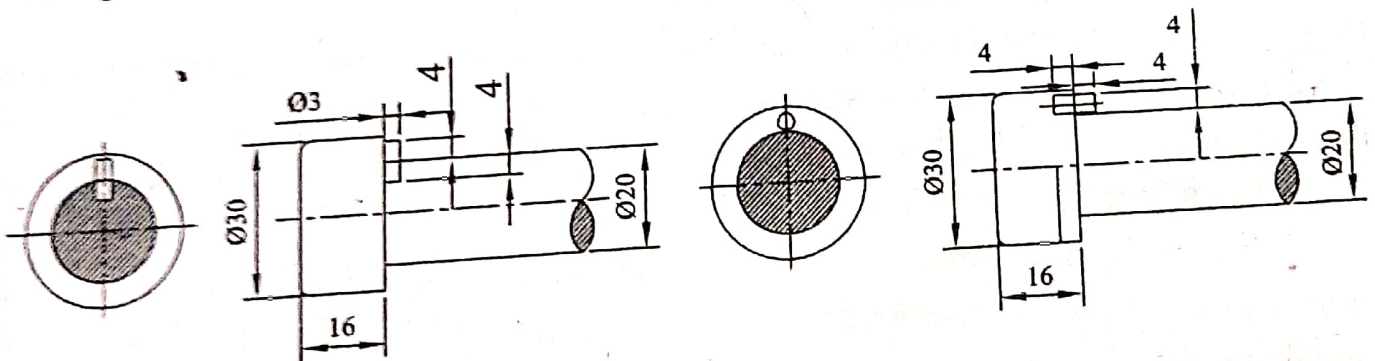


Fig.2.12

2.10 Eye Bolt

In order to facilitate lifting of heavy machinery, like electric generators, motors, turbines, etc., eye bolts are screwed on to their top surfaces. For fitting an eye bolt, a tapped hole is provided, above the centre of gravity of the machine (Fig. 2.13).

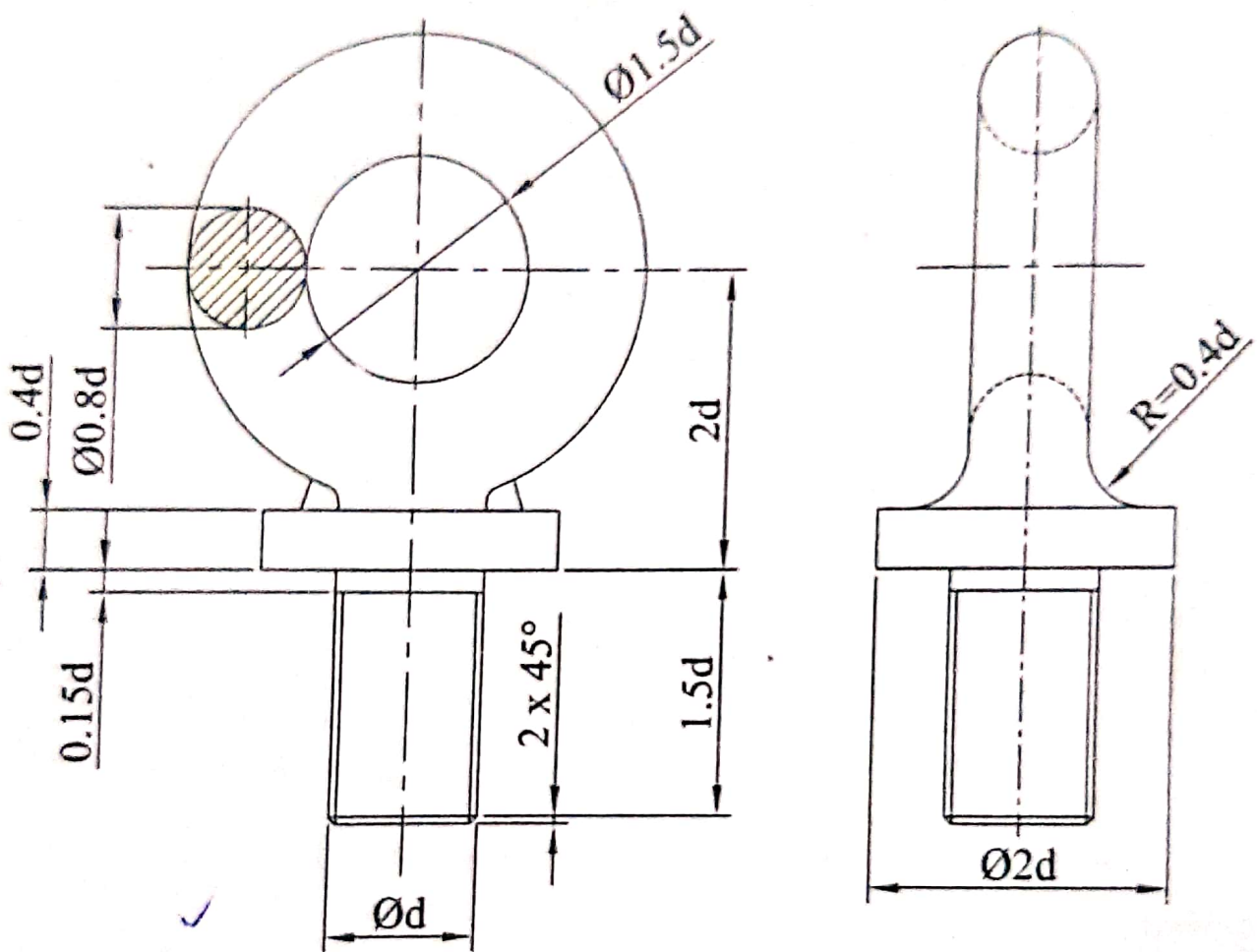


Fig.2.13 Eye bolt

In this arrangement, the split pin is inserted through a hole in the bolt body and touching just the top surface of the nut. Then, the ends of the pin are split open to prevent it from coming out while in use (Fig. 2.15).

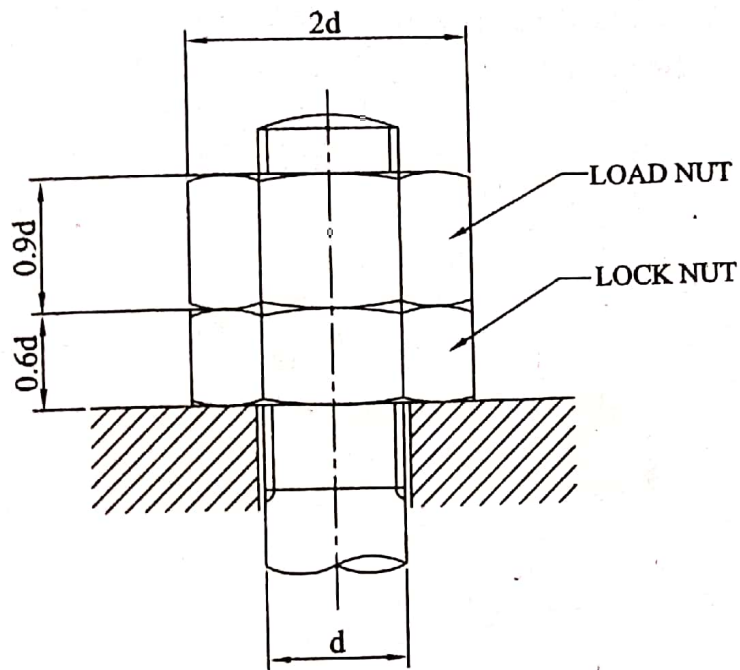


Fig.2.14 Lock nut

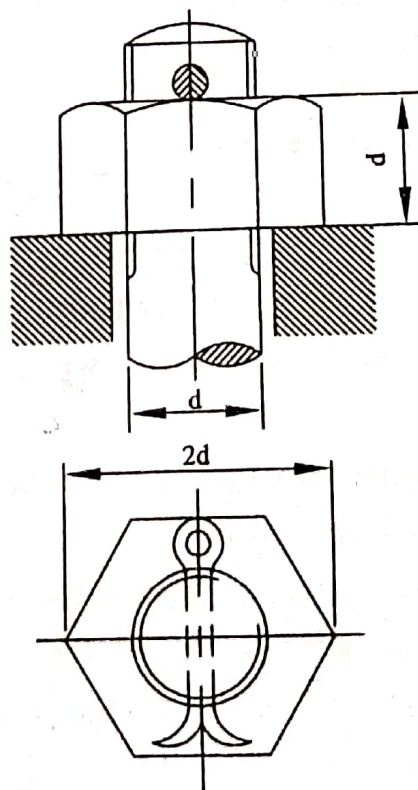


Fig.2.15 Locking by a split pin

2.11.3 Locking by a Castle Nut

A castle nut is a hexagonal nut with a cylindrical collar turned on one end. Threads are cut in the nut portion only and six rectangular slots are cut through the collar. A split pin is inserted through a hole in the bolt body after adjusting the nut such that the hole in the bolt body comes in-line with slots. This arrangement is used in automobile works (Fig. 2.16).

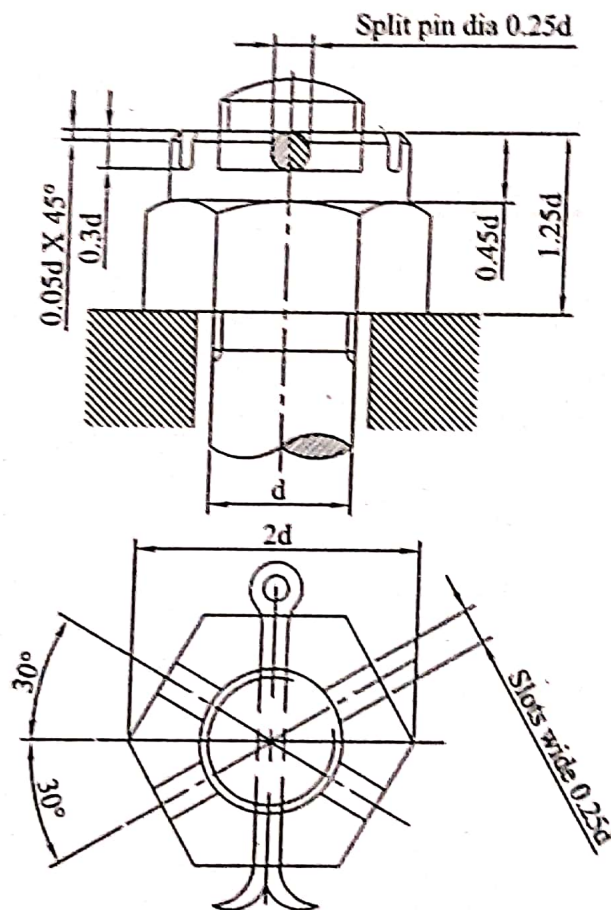


Fig.2.16 Castle nut

joint. It also prevents the nut from damaging the metal surface under the joint. Figure 2.18 shows a washer, with the proportions marked.

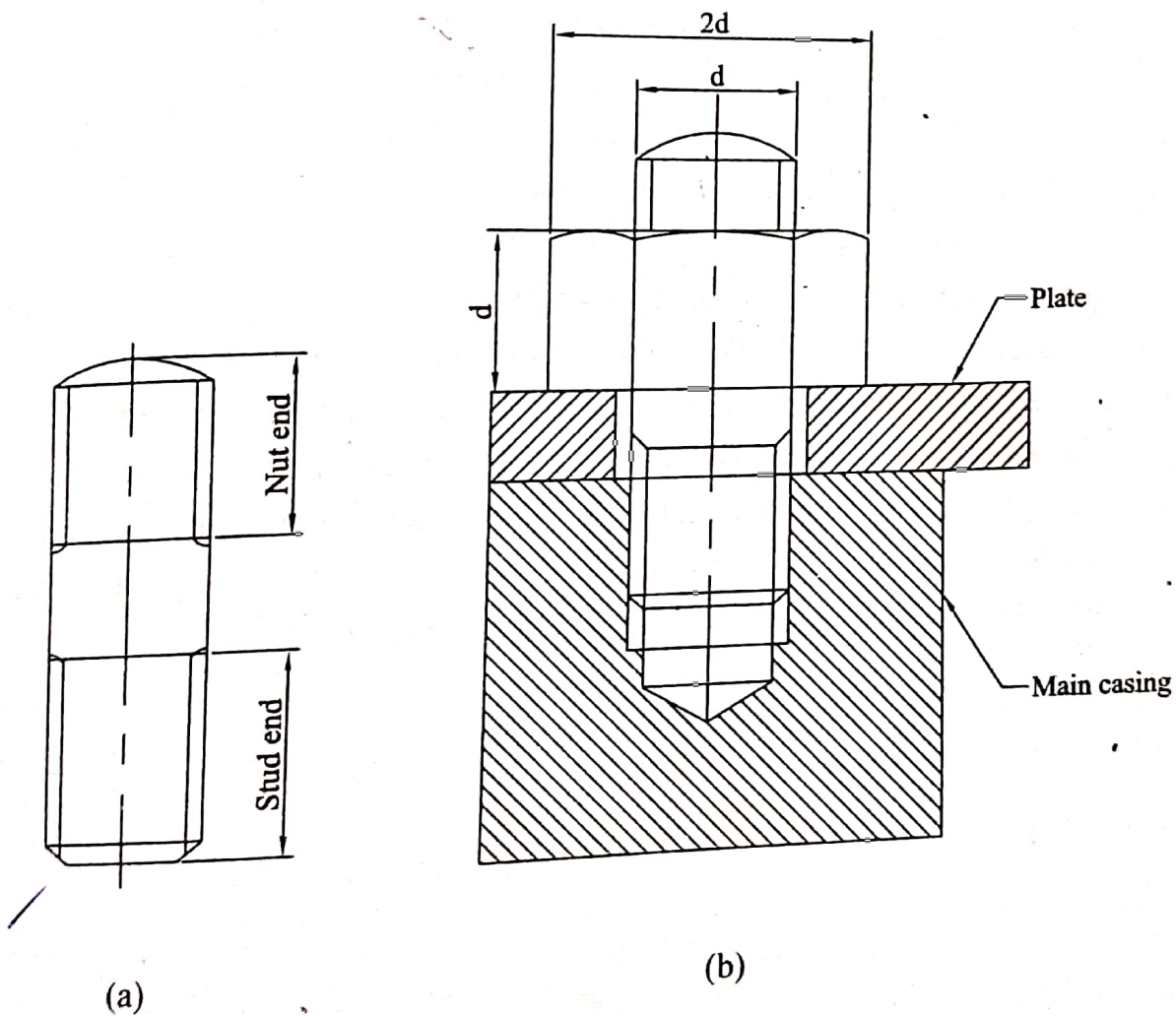


FIG 2.17 (a) Stud (b) Stud joint

2.15 Keys

Keys are machine elements used to prevent relative rotational movement between a shaft and the parts mounted on it, such as pulleys, gears, wheels, couplings, etc. Figure 2.20 shows the parts of a keyed joint and its assembly. For making the joint, grooves or keyways are cut on the surface of the shaft and in the hub of the part to be mounted. After positioning the part on the shaft such that both the keyways are properly aligned, the key is driven from the end, resulting in a firm joint. For mounting a part at any intermediate location on the shaft, first the key is firmly placed in the keyway of the shaft and then the part to be mounted is slid from one end of the shaft, till it is fully engaged with the key.

Keys are classified into three types, viz., saddle keys, sunk keys and round keys.

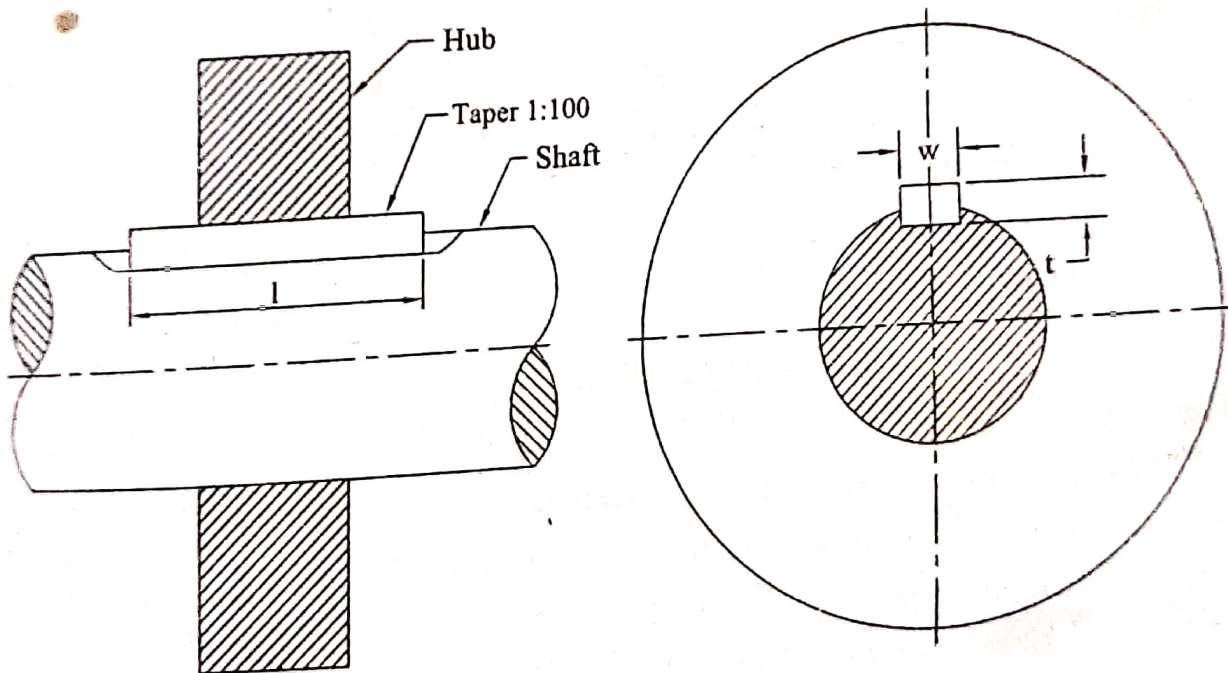


Fig.2.20 Keyed joint

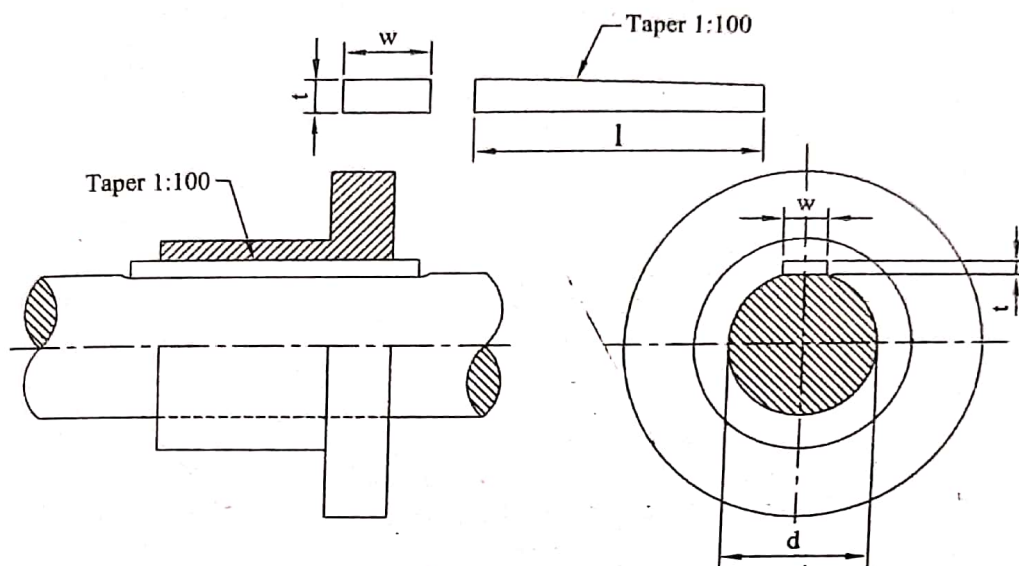


Fig.2.22 Flat saddle key

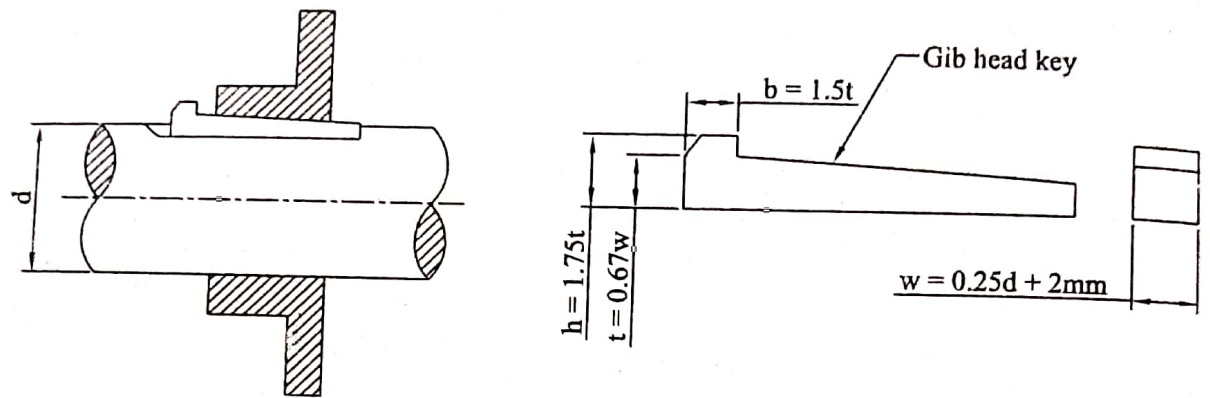


Fig.2.23 Gib head key

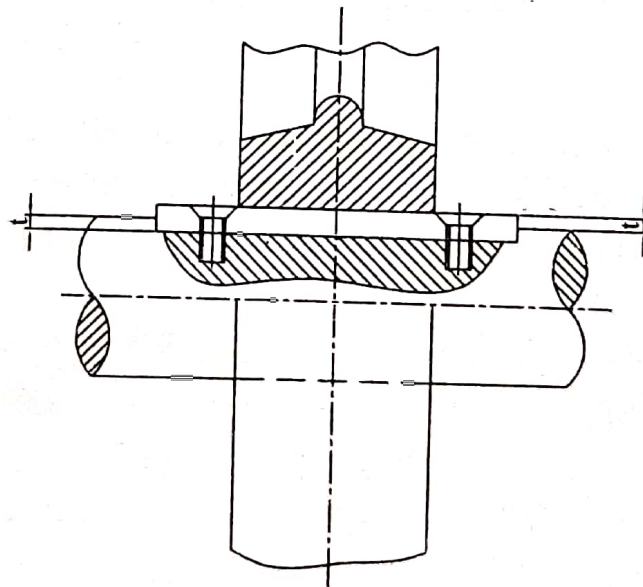


Fig.2.24 Feather key