1. HEXAGONAL NUT

Its drawing is shown completed in two stages by two different methods, in Fig. 18.23 (ISO system) and Fig. 18.24 (BSW). First method shown in Fig. 18.23 should be preferred, while second method can still be used for drawing purposes. Nuts are to be used for drawing frequently in drawing, therefore, it is extremely important to have a clear idea of drawing the nuts. The usual proportions, for ordinary hexagonal nuts, are as follows:

Size across flats, A/F = 1.25 D + 6 mm for bolts less than 12 mm in diameter.
Or = 1.5 D + 3 mm for bolts more than 12 mm in diameter. In general A/F = 1.5 D.

Size across corners = 1.55 x distance across flats. It can be obtained by construction, or, for drawing, it can be taken approximately = 2 D.

Height of nut = 0.9 D to D, e.g., 0.9 D in general case and D in heavy cases.

Radius of front chamfer = 1.5 D in general case, 1.5 D + 3 mm in heavy cases (SI system), (Radius of front chamfer is 1.2 D for BSW hexagonal nuts and is as well fairly accurate for drawing purposes).
Chamfer at top = 30° to base of nut.

HINTS ON DRAWING A HEXAGONAL NUT

1. Work out the required dimensions i.e. nominal diameter of bolt, height of nut, size across flats, radius of front chamfer and radius of crest of the thread, etc.

2. Draw the centerlines, horizontal and vertical, to locate the center of circles in to view.

3. Commence drawing from top view, as it contains circles. Draw the two circles for roots and crests of threads and also draw the third circle for chamfer on the nut.

4. Outside the chamfering circle, complete the hexagon with 30° - 60° triangle and T- Square of drafter.

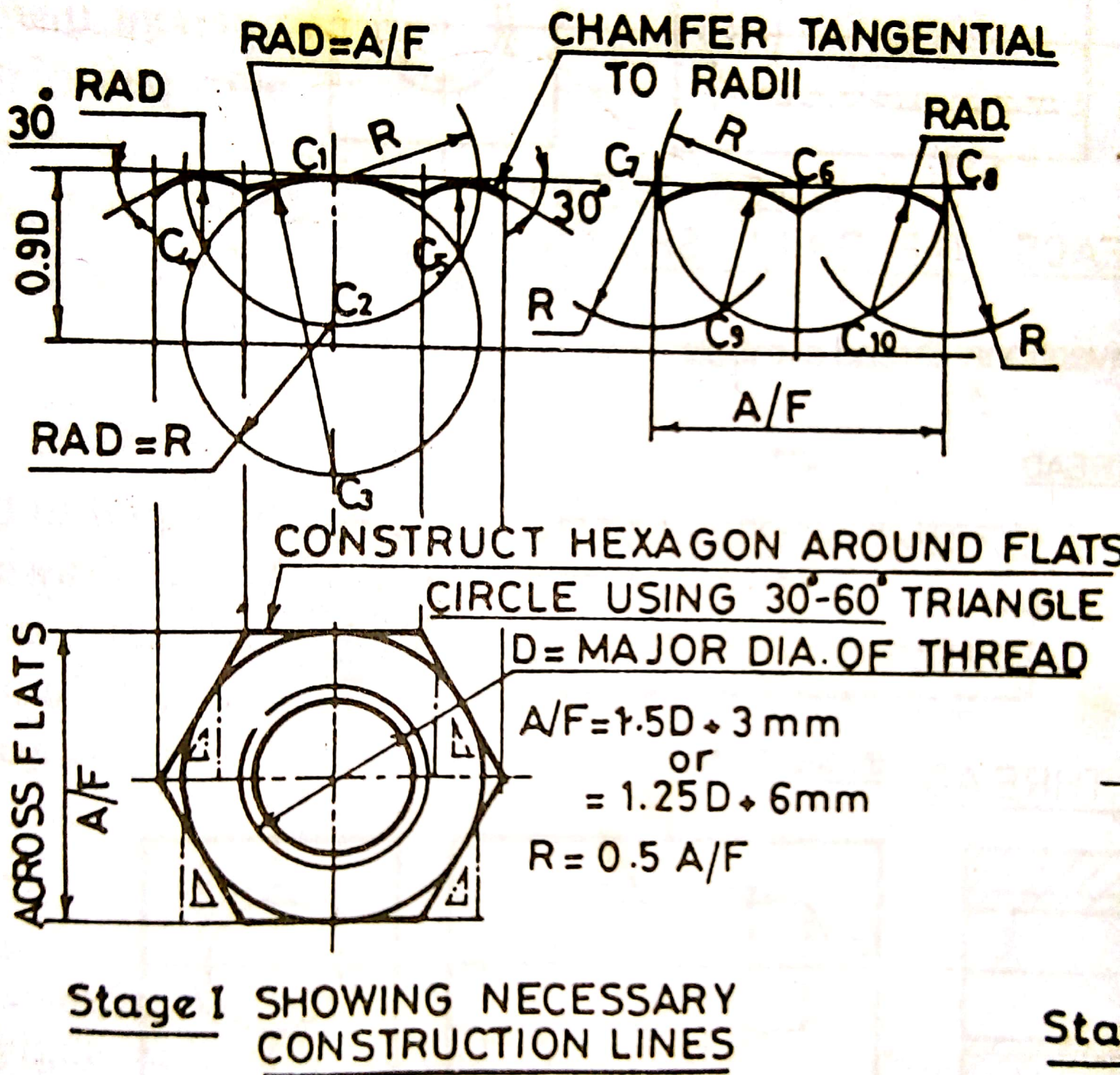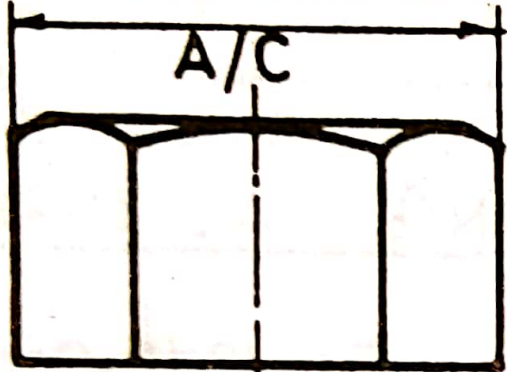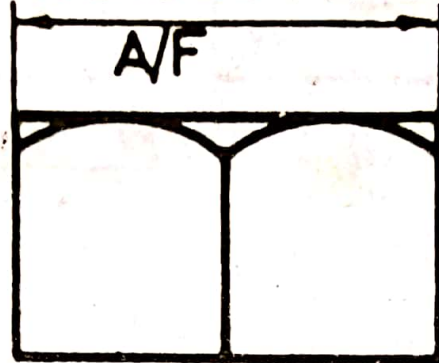5. Project the corners of the hexagon, thus drawn, to front view and draw two parallel horizontal

RAD=A/F   CHAMFER TANGENTIAL
              TO RADII

30° RAD   RAD.
0.9D   C₁   R   R   C₇   R   C₅   C₆
        C   C₄   30°
RAD =R   C₂   R   C₉   C₁₀   R

              C₃   A/F

CONSTRUCT HEXAGON AROUND FLATS
CIRCLE USING 30°-60° TRIANGLE
D= MAJOR DIA. OF THREAD
A/F=1.5D + 3 mm
        or
    = 1.25D + 6mm
R = 0.5 A/F

ACROSS FLATS   A/F

Stage I SHOWING NECESSARY
        CONSTRUCTION LINES   Sta

Fig. 18.24 Drawing projections of a Standard Hexag

ACROSS CORNERS

A/C

FRONT VIEW

ACROSS FLATS

A/F

LEFT SIDE VIEW

FLATS
IGLE
EAD
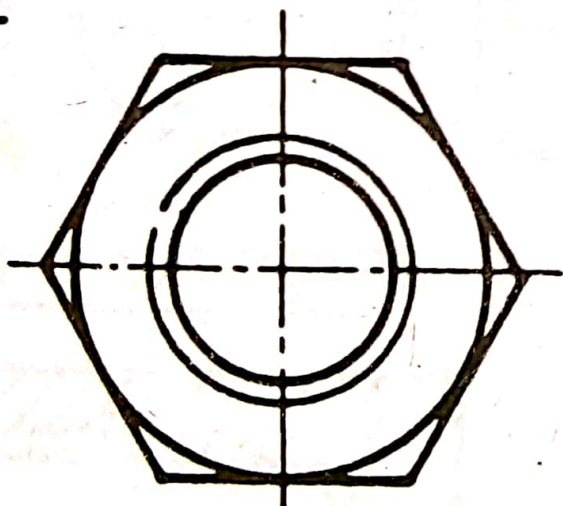
PREFERRED METHOD
ACCORDING TO SI SYSTEM

TOP VIEW

Stage II   COMPLETED VIEWS

STAGE 1

CHAMFER

SIZE ACROSS CORNERS (A/C)

SIZE ACROSS FLATS (A/F)

STAGE 2

Fig. 18.25 Drawing a Hexagonal Nut (BSW)
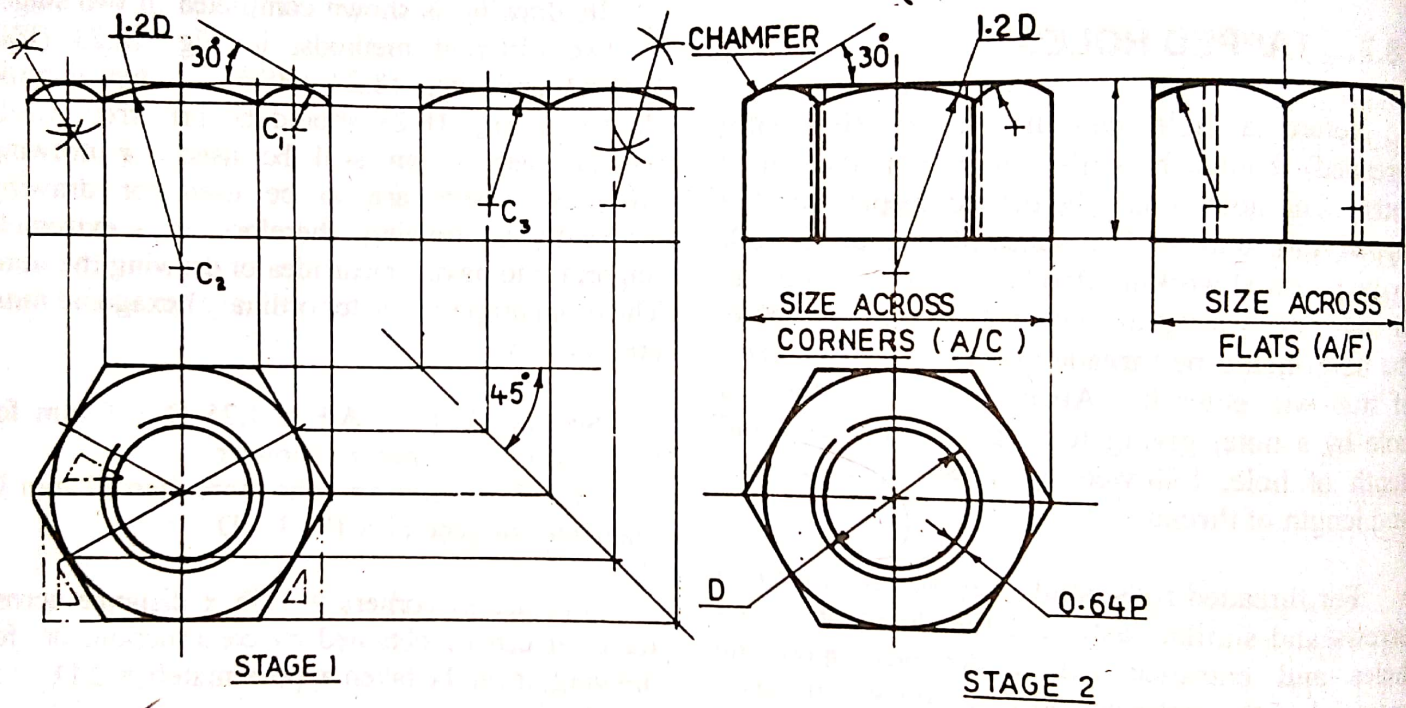
30°

1.75D

ACROSS CORNERS

A/C

ACROSS FLATS

A/F
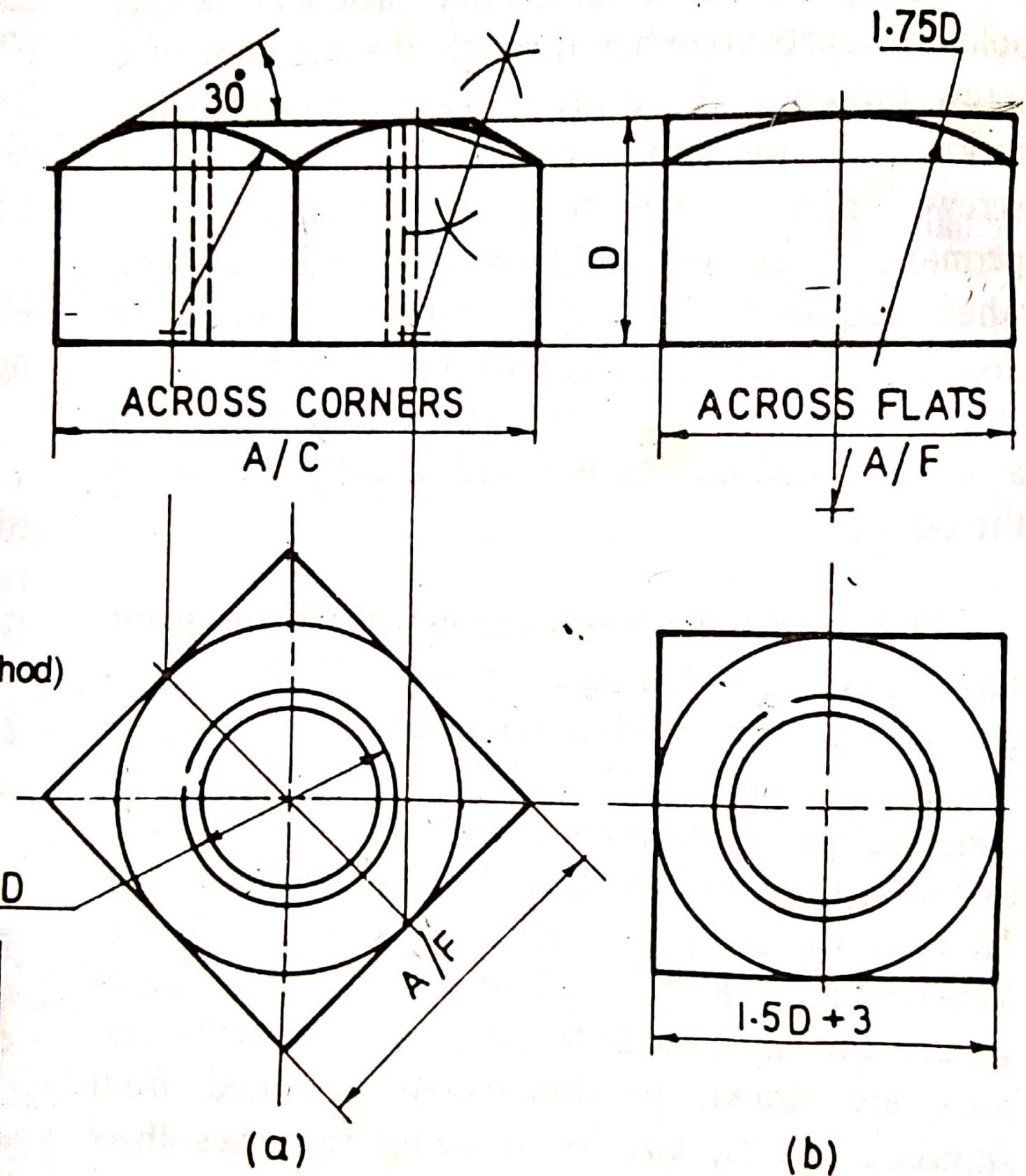
D

hod)

D

A/F

1.5D + 3

(a)

(b)

Fig. 18.27 Method of drawing a Square Nut

(First Angle projection) (Second method)

2. SQUARE NUT

The usual proportions for a square nut, in terms of the diameter of the bolt of stud on which it is to be used, are as follows:

Size across flats = 1.5 D + 3 mm, for bolts more than 12 mm in diameter.
Or 1.5 D + 6 mm, for bolts less than 12 mm in diameter.

In general A/F = 1.5 D

Size across corners = $\sqrt{2}$ x size across flats.
Or A/C = 1.414 x size across flats.

Height or thickness = 0.8 D to D. In general it is taken as 0.9 D.

Radius of front chamfer = 1.5 D to 1.75 D. In general it is taken as 1.5 D and 1.5 D + 3 mm in heavy cases (SI system).

Angle of chamfer = 30° to the base of nut, actually it is 25°.

1. HEXAGONAL HEADED BOLT

It is the most commonly used form of bolt. The proportions of the bolt depend upon the thickness of the parts to be held. Outside of the head is chamfered at 30° to the base as in the case of a hexagonal nut. The threaded end is also chamfered to a spherical of comical shape. The thickness of the head of the bolt is 0.7 D to 0.8 D, which is less than the thickness of a corresponding hexagonal nut as it is a solid prism not having a hole like the nut. Other proportions are same as in a hexagonal nut.
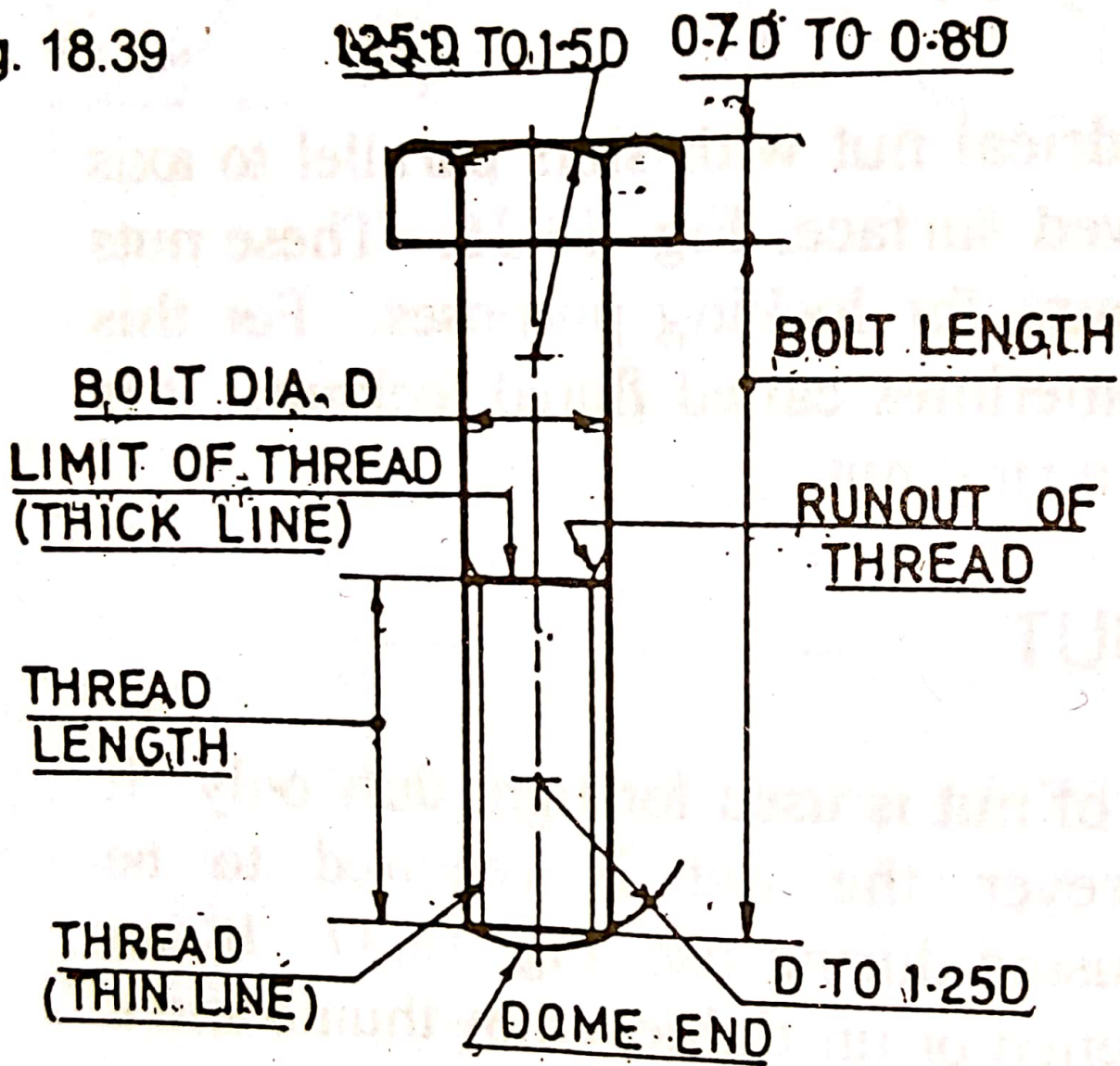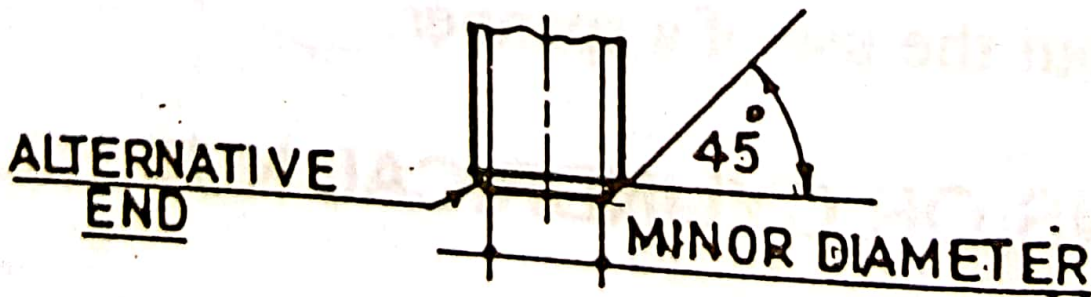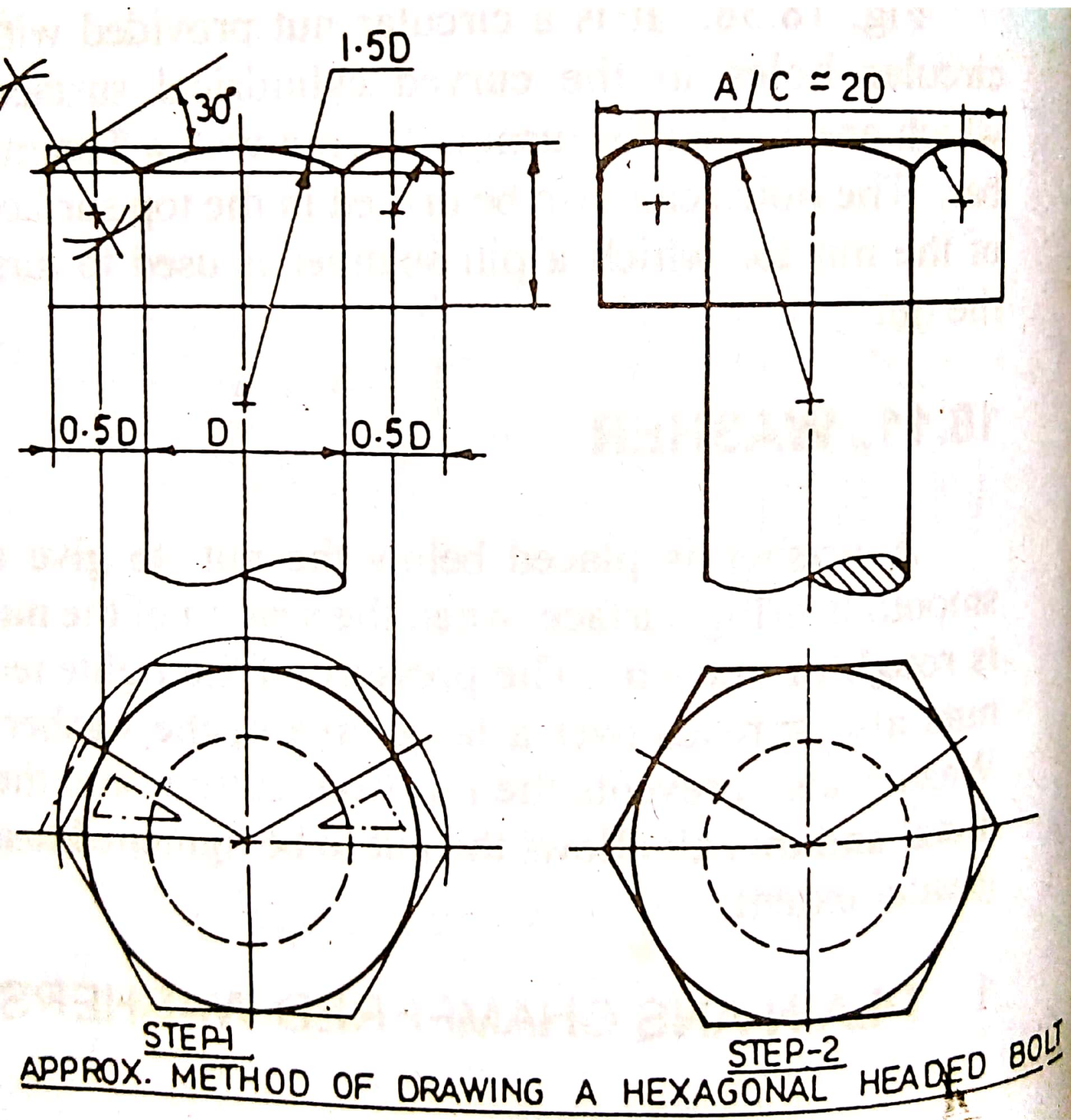
Fig. 18.39

Fig. 18.40

Fig. 18.42

1·25D TO 1·5D

0·7 D TO 0·8D

BOLT LENGTH

BOLT DIA. D

LIMIT OF THREAD
(THICK LINE)

RUNOUT OF
THREAD

THREAD
LENGTH

THREAD
(THIN LINE)

D TO 1·25D

DOME END

ALTERNATIVE
END

45°

MINOR DIAMETER

1·5D

30°

A/C ≃ 2D

0·5D   D   0·5D

STEP-1

STEP-2

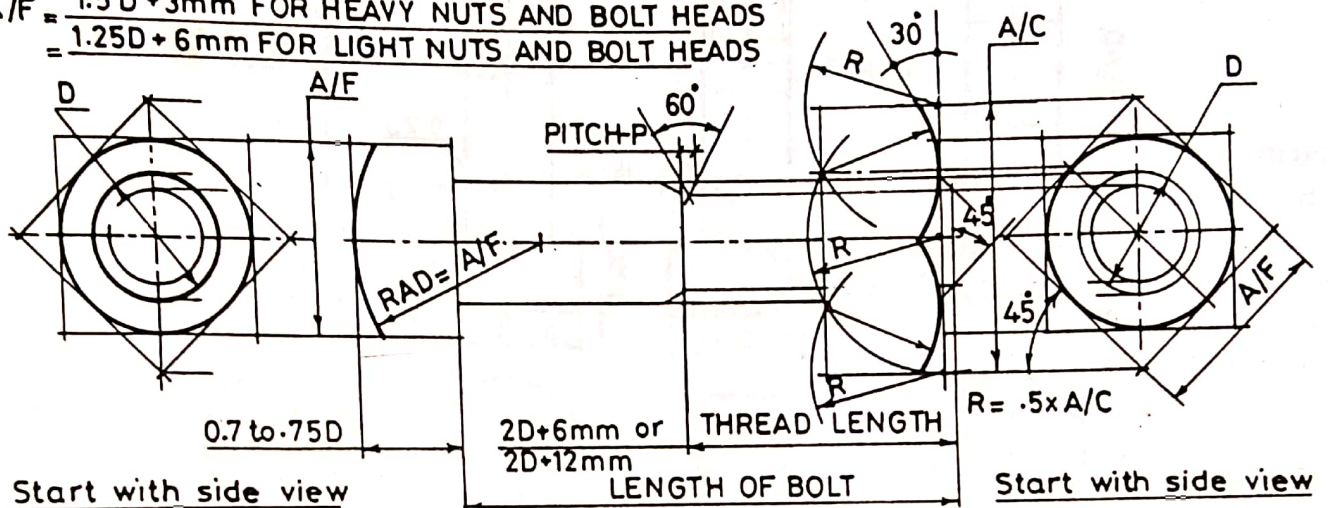APPROX. METHOD OF DRAWING A HEXAGONAL HEADED BOLT

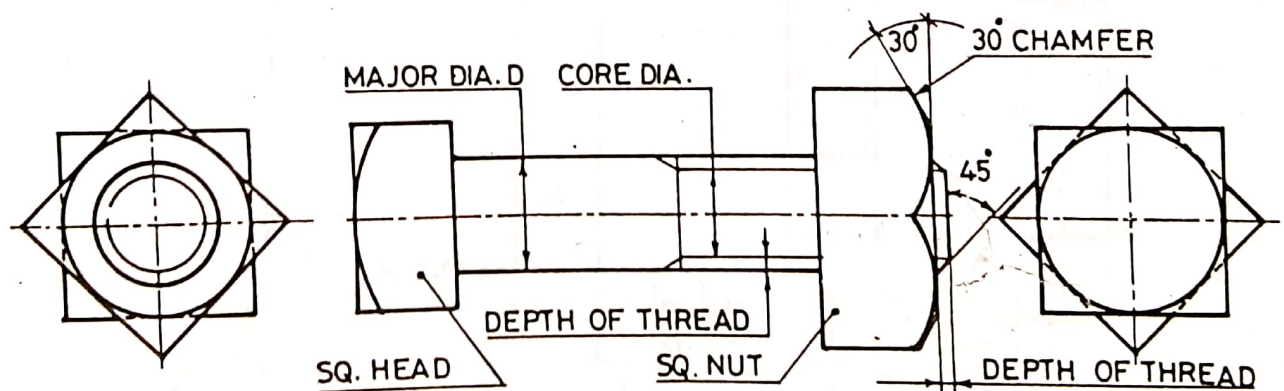Fig. 18.44 (second method) (First Angle Projection)

2.   SQUARE HEADED BOLT

The general proportions of a square headed bolt are shown in Fig. 18.47. This type of bolt is frequently used on machine parts where the head is to be accommodated in a recess in a member. The recess, too, is cut square and slightly larger than the head. The provision prevents the rotation of the bolt in bolthole when the nut is screwed on or off.

A/F = $\dfrac{1.5D + 3mm}{1.25D + 6mm}$ FOR HEAVY NUTS AND BOLT HEADS
FOR LIGHT NUTS AND BOLT HEADS

D   A/F   PITCH-P   60°   R   30°   A/C   D

RAD = A/F   R   45   A/F

R   45   R= .5x A/C

0.7 to .75D   2D+6mm or   THREAD LENGTH
2D+12mm

Start with side view   LENGTH OF BOLT   Start with side view

STAGE I– Showing all construction lines.

MAJOR DIA. D   CORE DIA.   30°   30 CHAMFER

45°

DEPTH OF THREAD

SQ. HEAD   SQ. NUT   DEPTH OF THREAD

STAGE II– FINISHED VIEWS

Fig. 18.47 Square headed bolt and square nut assembly