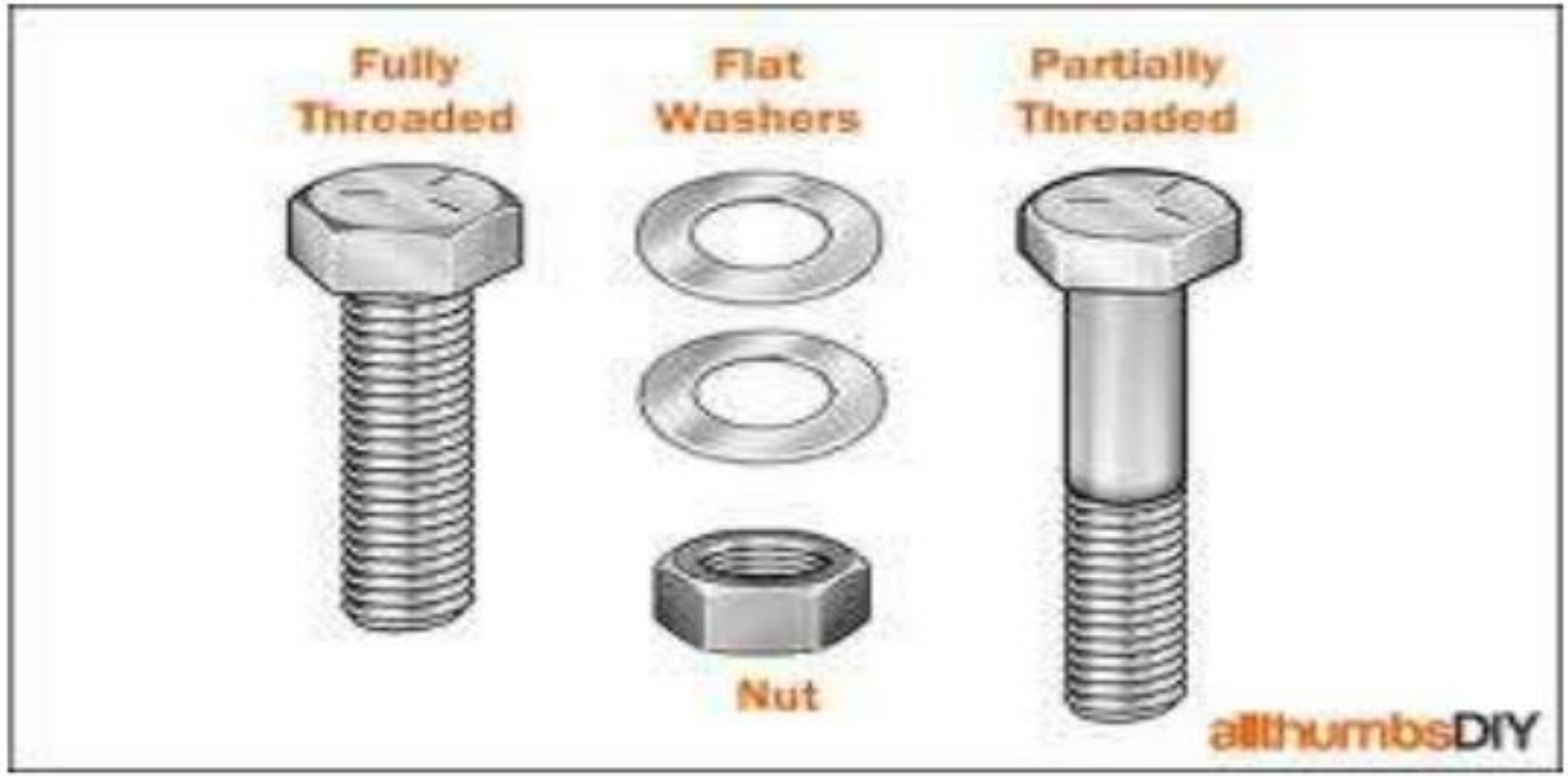
Nut and Bolts

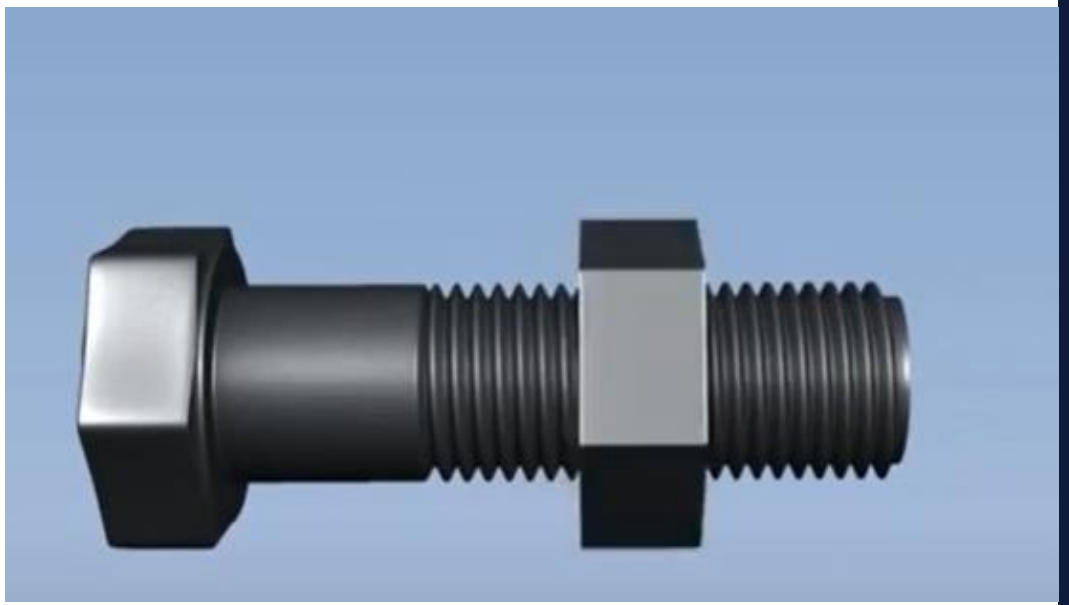
- A **nut** is a type of hardware fasteners with a threaded hole. Nuts are almost always used opposite a mating **bolt** to fasten a stack of parts together.

- The two partners are kept together by a combination of their threads' friction, a slight stretch of the bolt, and compression of the parts.
- A **washer** is a thin plate typically disk-shaped with a hole that is normally used to distribute the load of a threaded fastener.

Threads

- Thread
  - Helical ridge of uniform section formed on inside or outside of cylinder or cone
- Used for several purposes:
  - Fasten devices such as screws, bolts, studs, and nuts
  - Provide accurate measurement, as in micrometer
  - Transmit motion
  - Increase force


Fully Threaded
Flat Washers
Partially Threaded
Nut
allthumbsDIY



External thread
Internal thread

Thread Symbols

Screw Thread Terms:

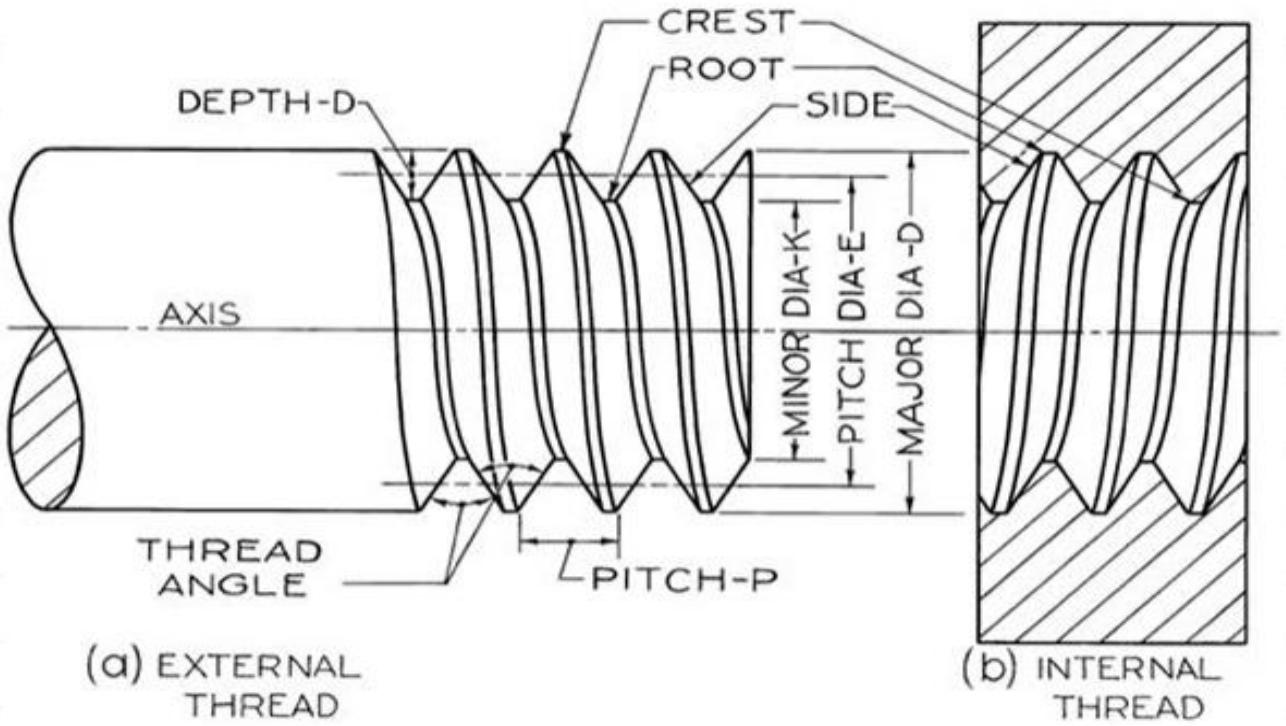
External Thread: A thread on the outside of a member, as on a shaft.

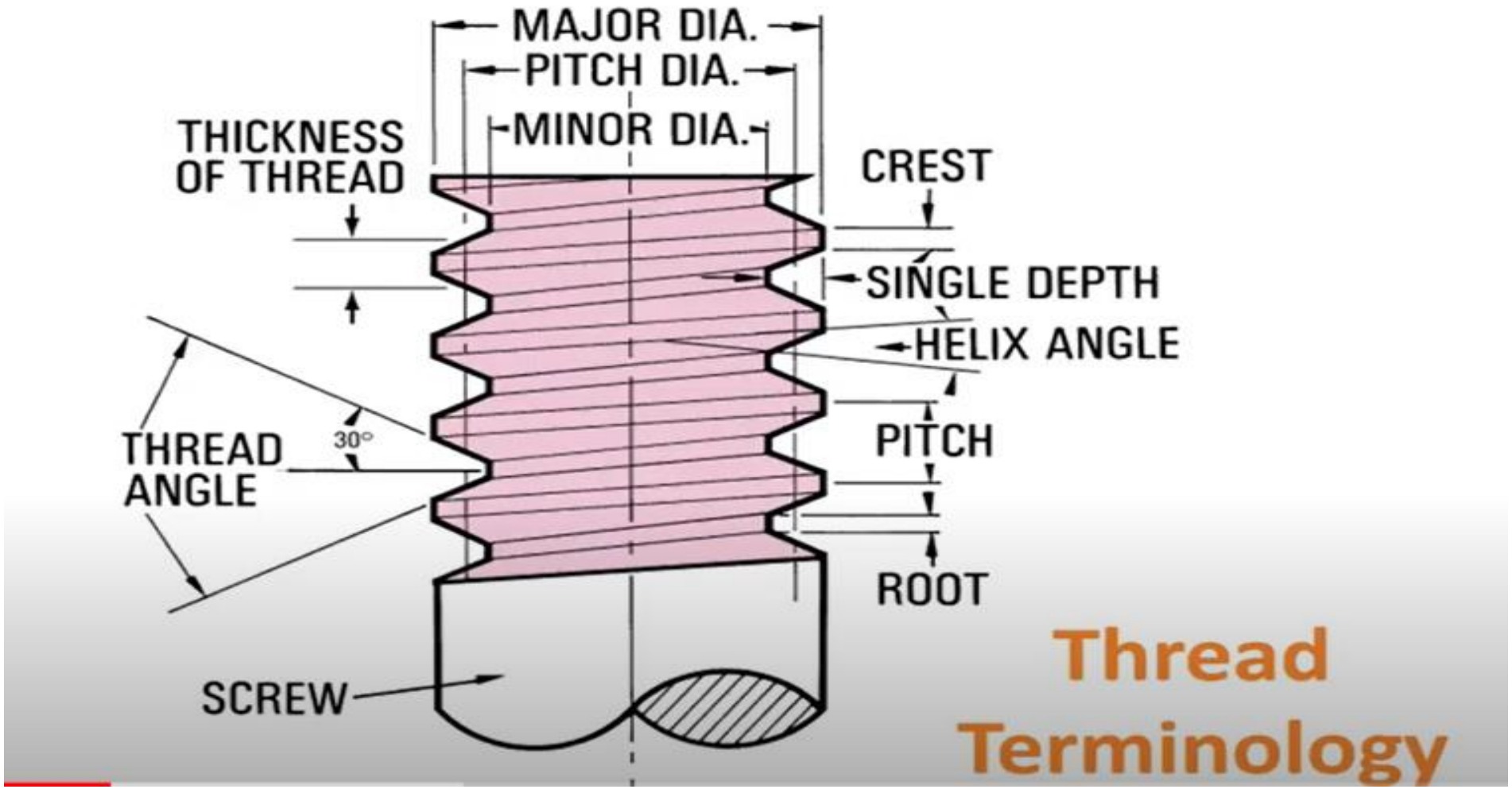
Internal Thread: A thread on the inside of a member, as in a hole.

Major Diameter: The largest diameter of a screw thread.

Minor Diameter: The smallest diameter of a screw thread.

Pitch: The distance from a point on a screw thread to a corresponding point on the next thread measured parallel to the axis. The pitch (P) is equal to 1 divided by the number of threads per inch.




MAJOR DIA.
PITCH DIA.
MINOR DIA.
THICKNESS OF THREAD
CREST
SINGLE DEPTH
HELIX ANGLE
PITCH
ROOT
THREAD ANGLE
30°
SCREW
Thread Terminology

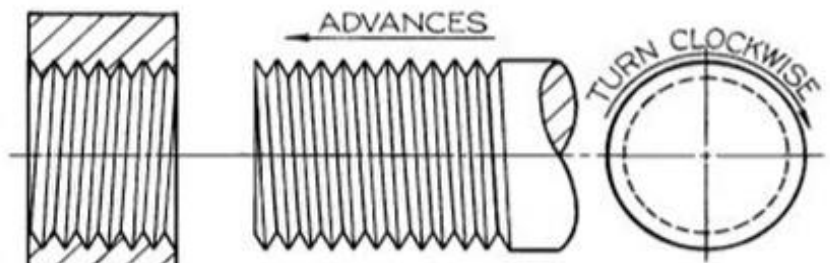
Thread Symbols

Right-hand and left-hand threads:

A right-hand thread is one that advances into a nut when turned clockwise (figure a).

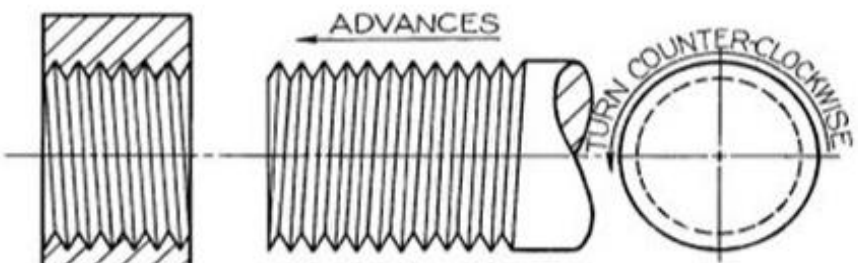
A left-hand thread is on the advances into a nut when turned counterclockwise (figure b).

A thread is always considered to be right-handed unless specified otherwise. A left-handed thread is always labeled (LH) on a drawing.



RIGHT-HAND THREAD

(a)



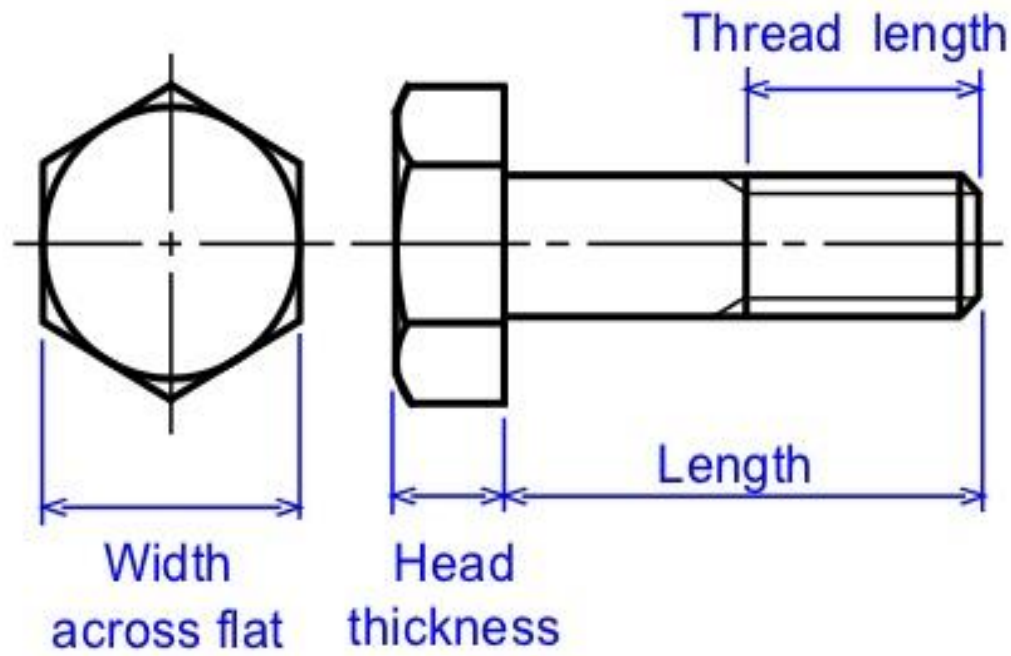
LEFT-HAND THREAD

(b)

BOLT : Terminology

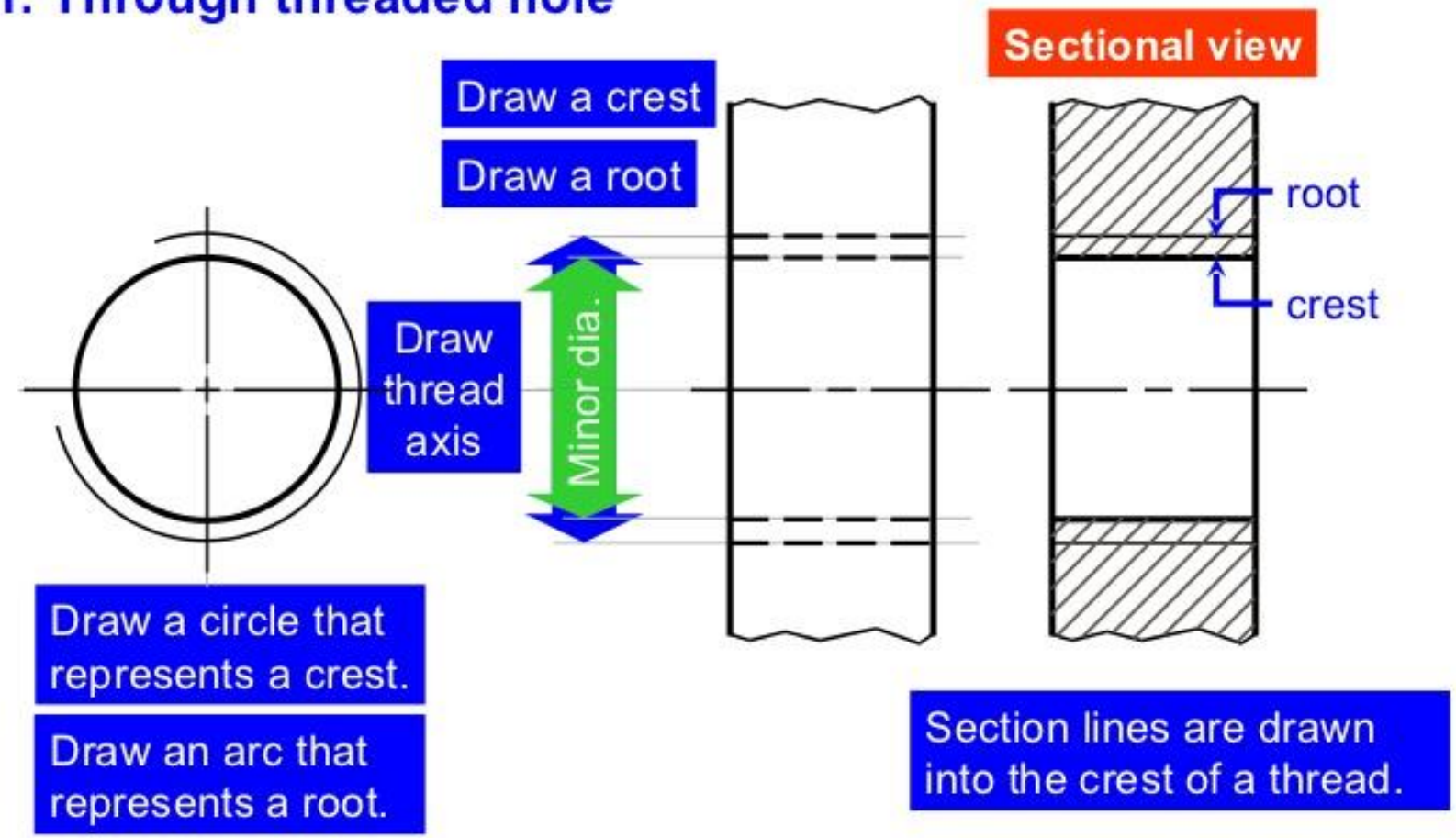
Bolt is a threaded cylinder with a head.

Hexagonal head bolt and nut

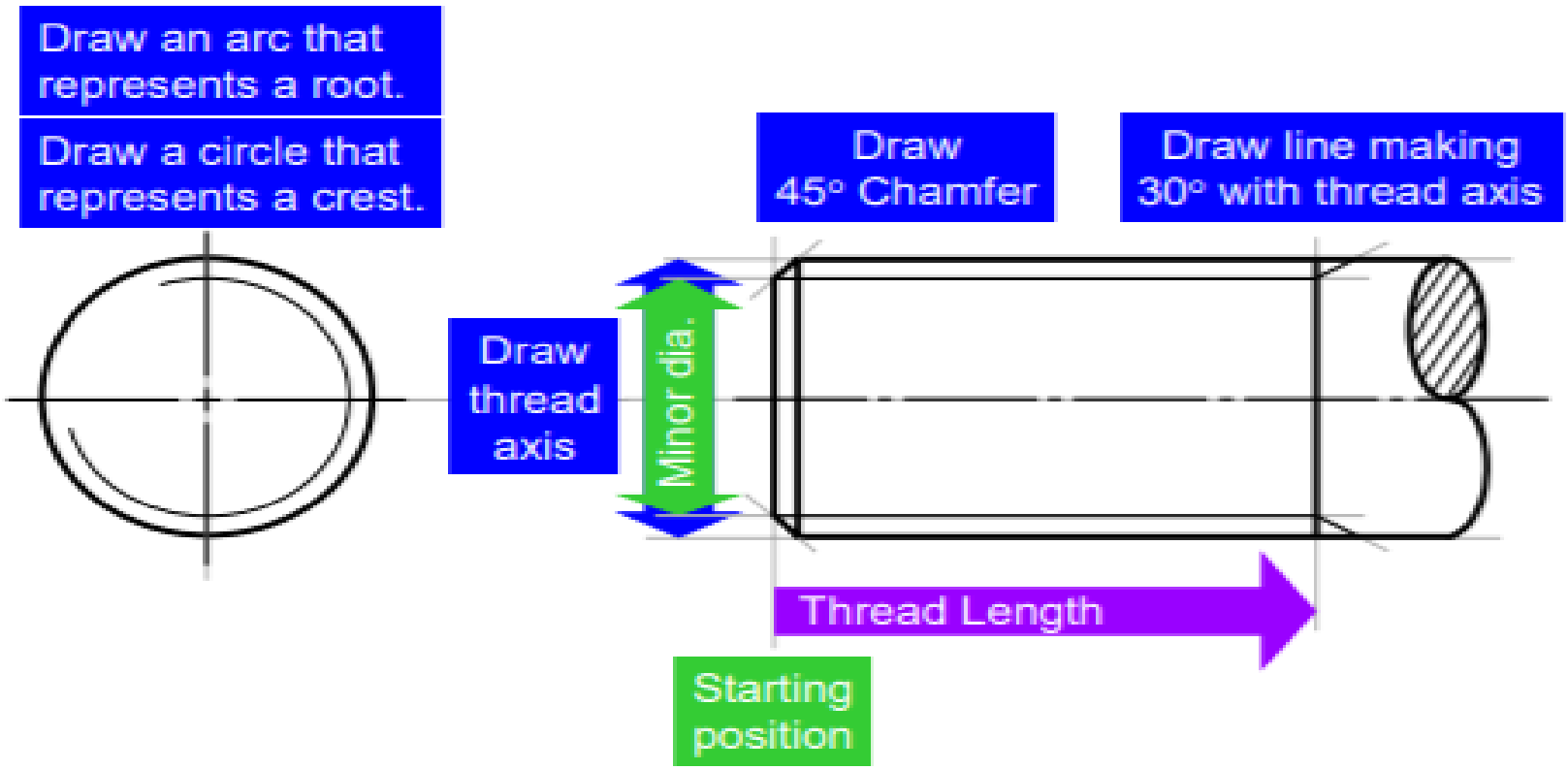


DRAWING STEPS OF THREADED HOLE

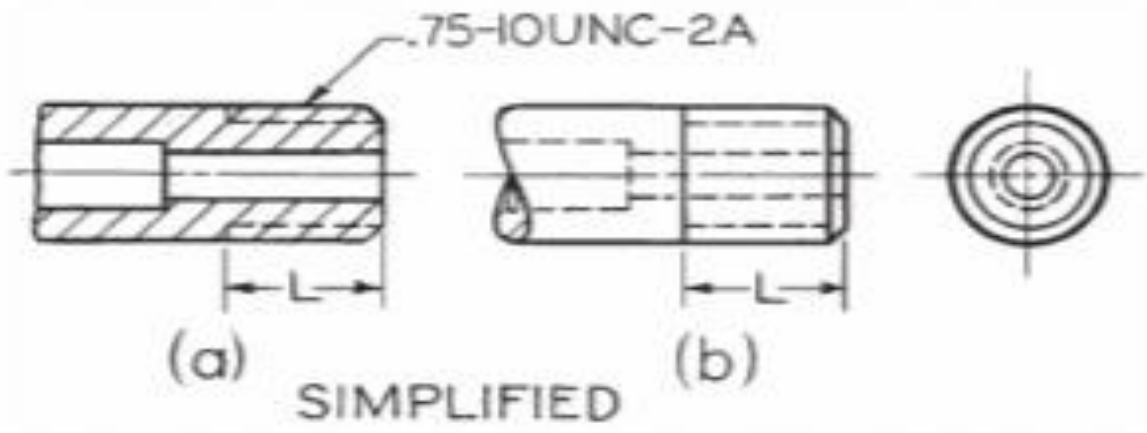
1. Through threaded hole

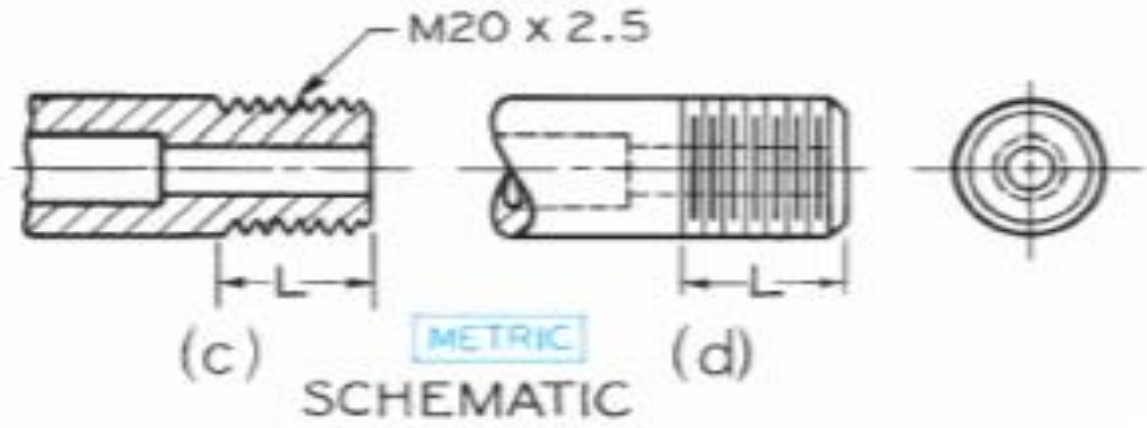


DRAWING STEPS OF EXTERNAL THREAD

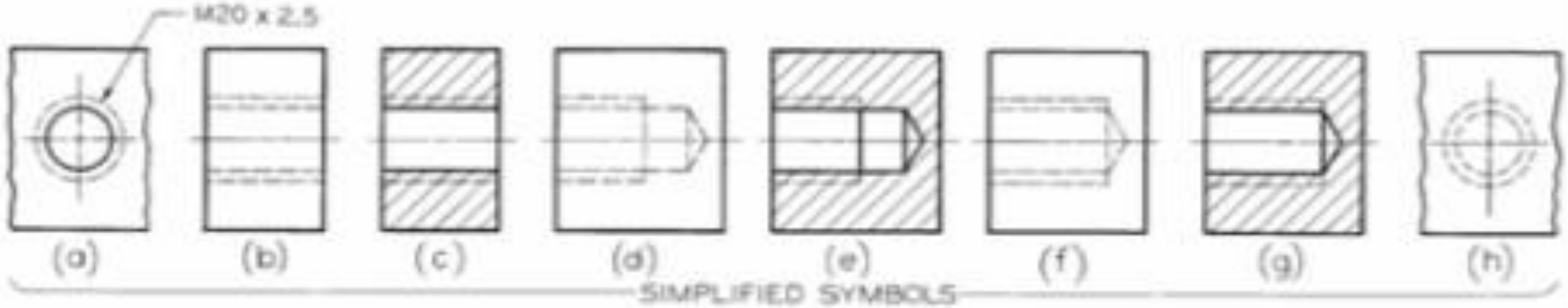


External Thread Symbols





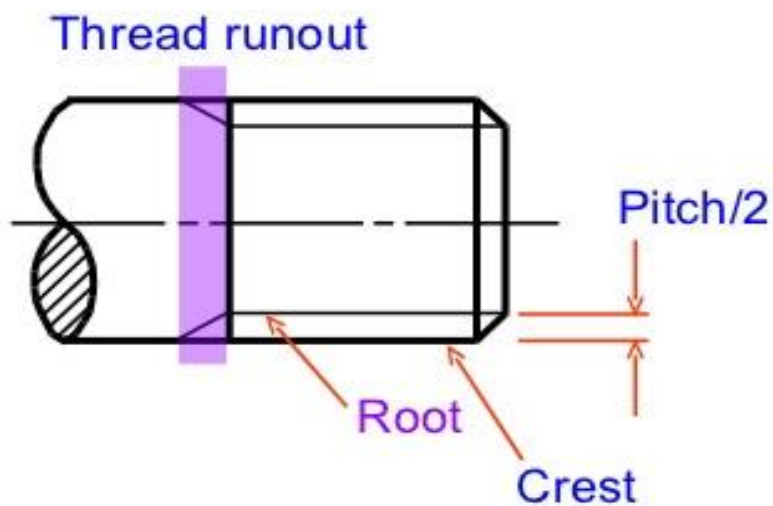
Internal Thread Symbols



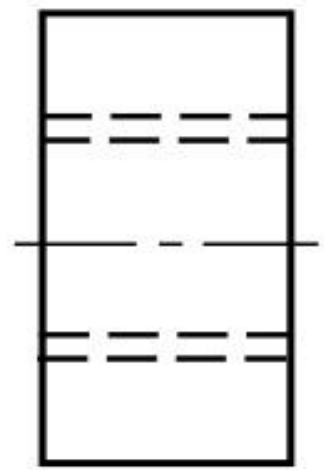
SIMPLIFIED REPRESENTATION

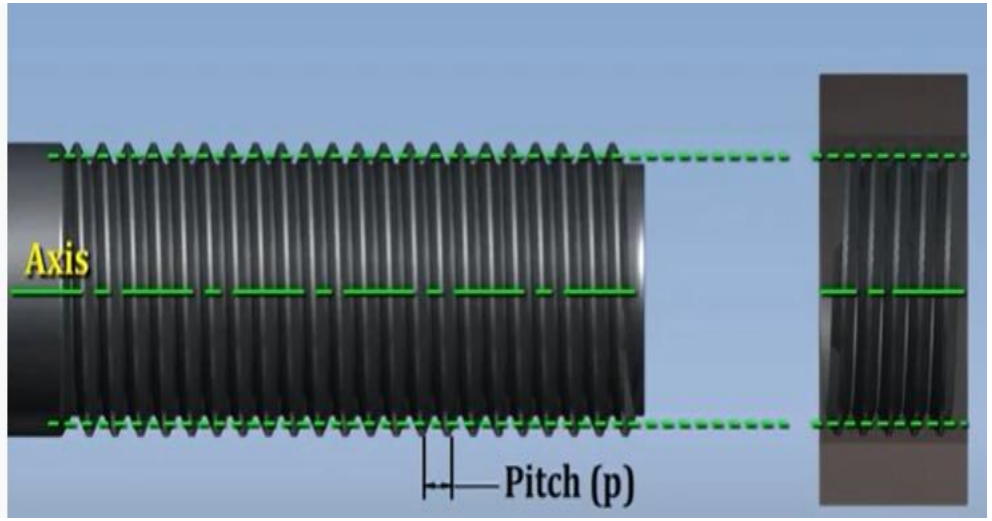
- Use ***thick continuous lines*** for representing ***crest*** and ***thin continuous lines*** for representing ***root*** of the thread, respectively.

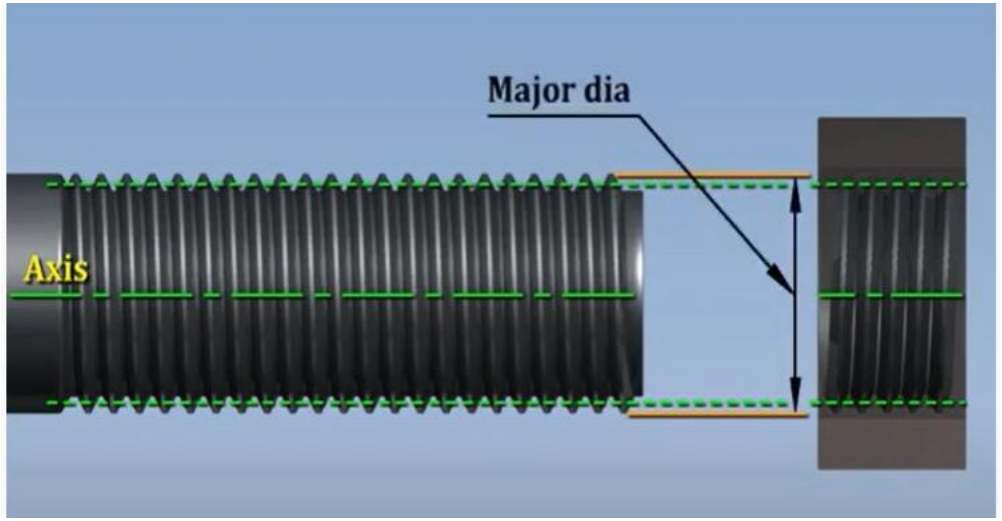
External thread

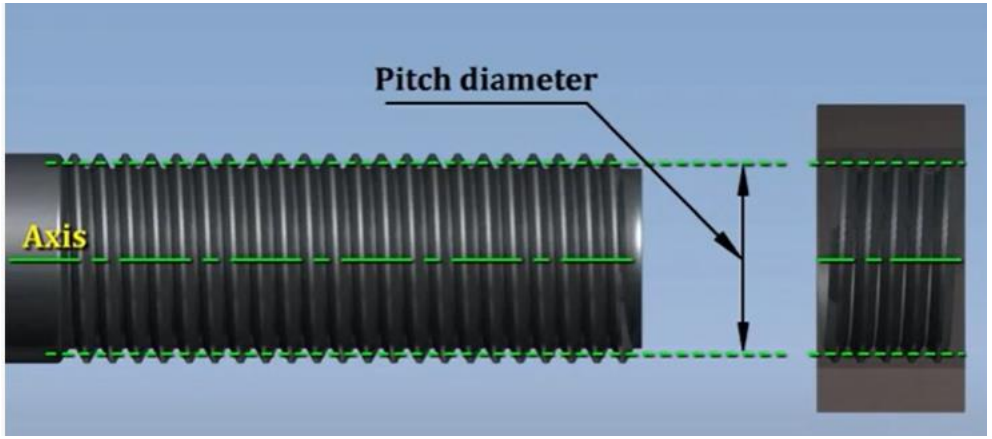


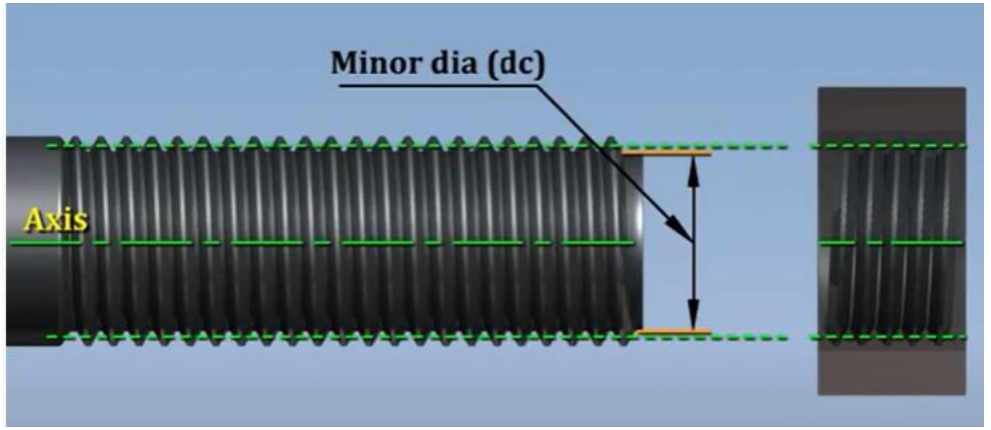
Internal thread

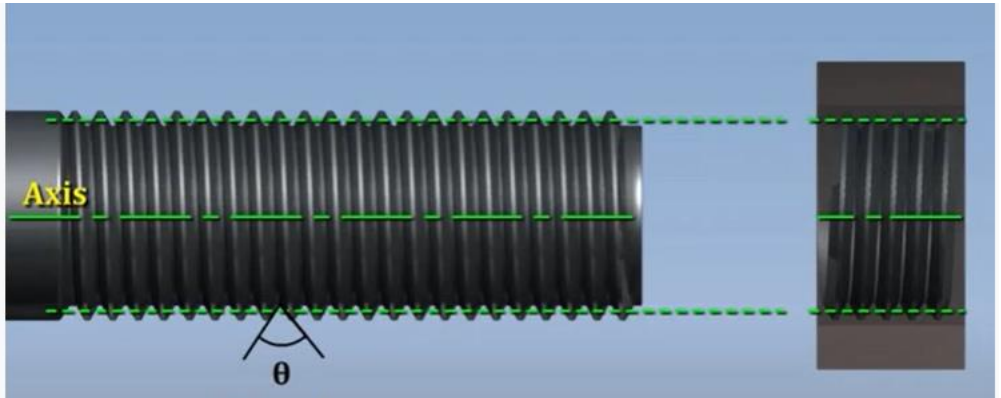


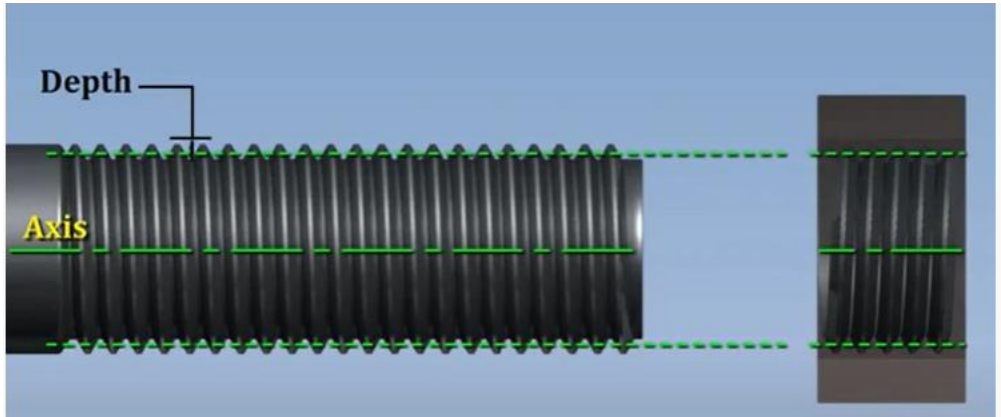

Axis
Pitch (p)


Major dia
Axis


Pitch diameter
Axis


Minor dia (dc)
Axis


Axis
θ


Depth
Axis

Thread Forms

- April, 1975 ISO came to an agreement covering standard metric thread profile
  - Specifies sizes and pitches for various threads in new ISO Metric Thread Standard
  - Has 25 thread sizes, range in diameter from 1.6 to 100 mm
  - Identified by letter M, nominal diameter, and pitch

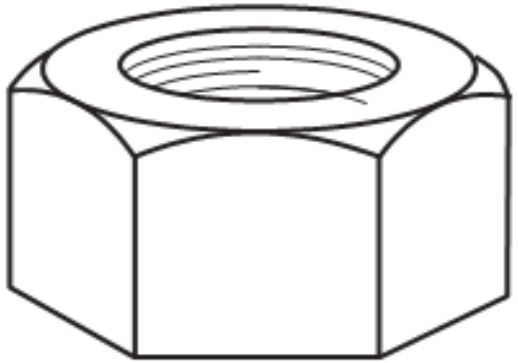
M 5 X 0.8

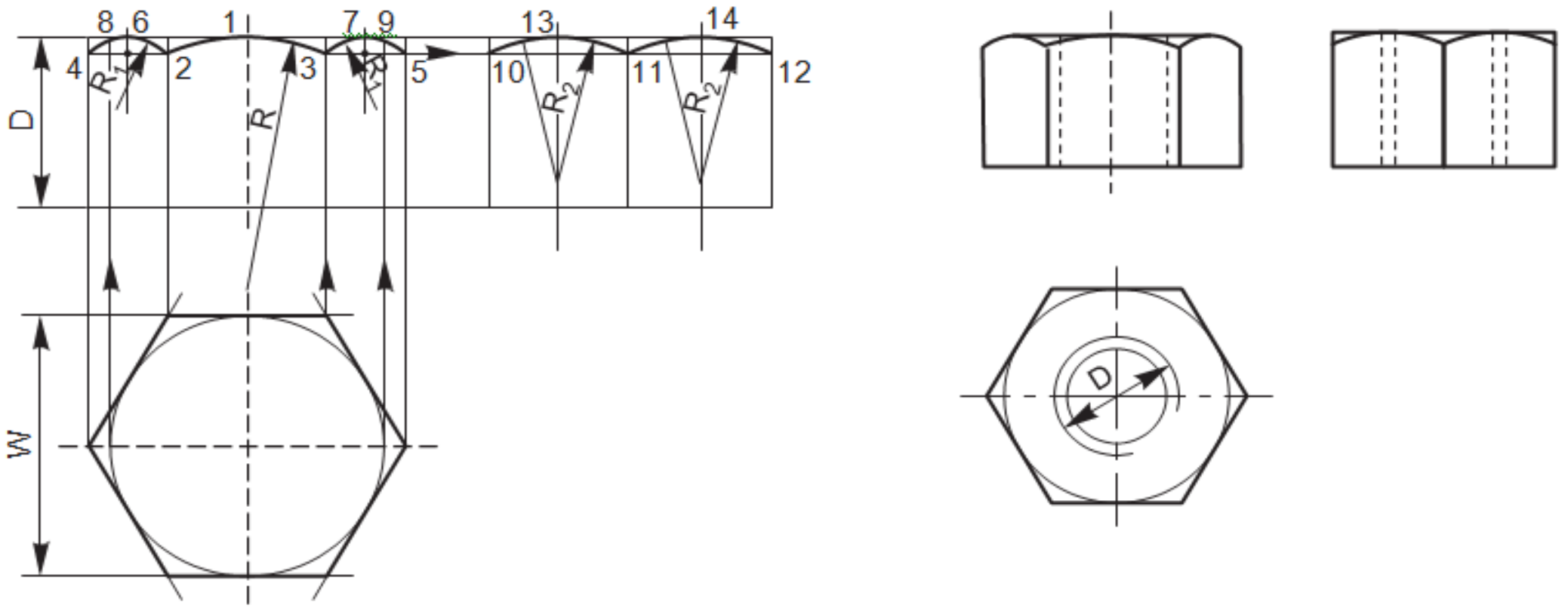
Table 55.1
ISO metric pitch and diameter combinations

Nominal Diameter (mm)	Thread Pitch (mm)	Nominal Diameter (mm)	Thread Pitch (mm)
1.6	0.35	20	2.5
2	0.4	24	3
2.5	0.45	30	3.5
3	0.5	36	4
3.5	0.6	42	4.5
4	0.7	48	5
5	0.8	56	5.5

Portion of table taken from textbook

Empirical relations for Hexagonal Nut
Major or nominal diameter of bolt = D
Thickness of nut, T = 0.8 D to D
Width of nut across flat surfaces, W = 1.5D + 3 mm
Radius of chamfer, R = 1.5D



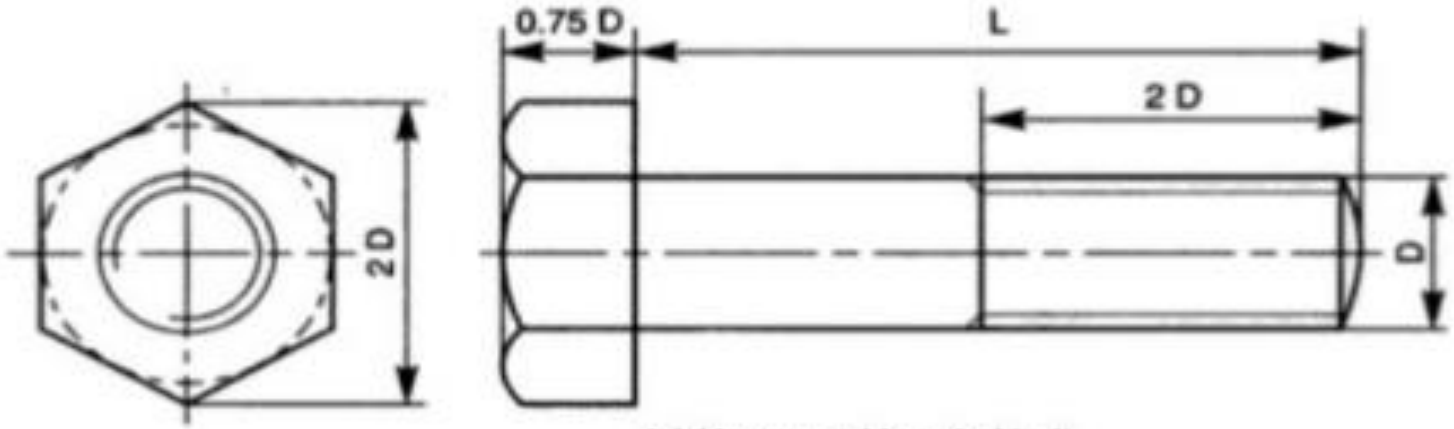


Method of drawing views of a hexagonal nut (Method I)

2-14 Method of drawing hexagonal head bolt and nut

Hexagonal and Square Headed Bolts

Figure shows the two views of a hexagonal headed bolt and square headed bolt, with the proportions marked.

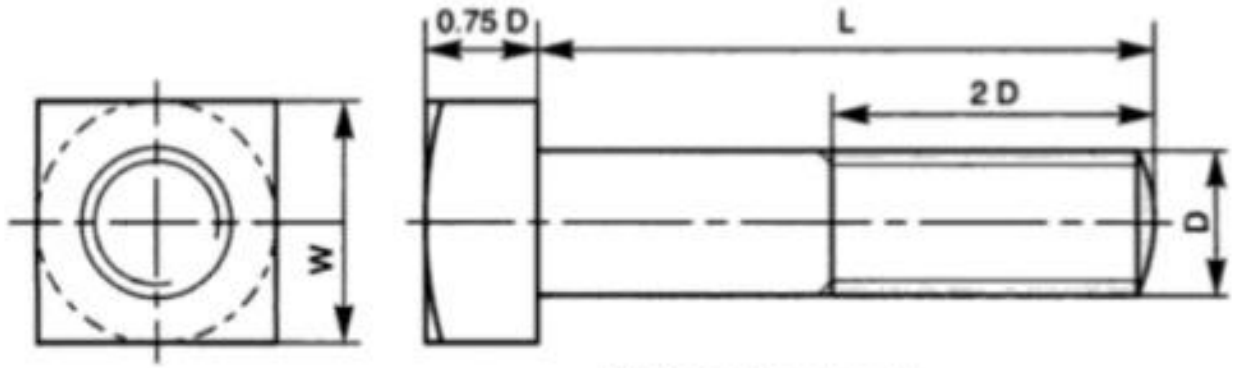


(a) Hexagonal headed bolt

2-15 Method of drawing a square head bolt and nut

Hexagonal and Square Headed Bolts

Figure shows the two views of a hexagonal headed bolt and square headed bolt, with the proportions marked.



(b) Square headed bolt

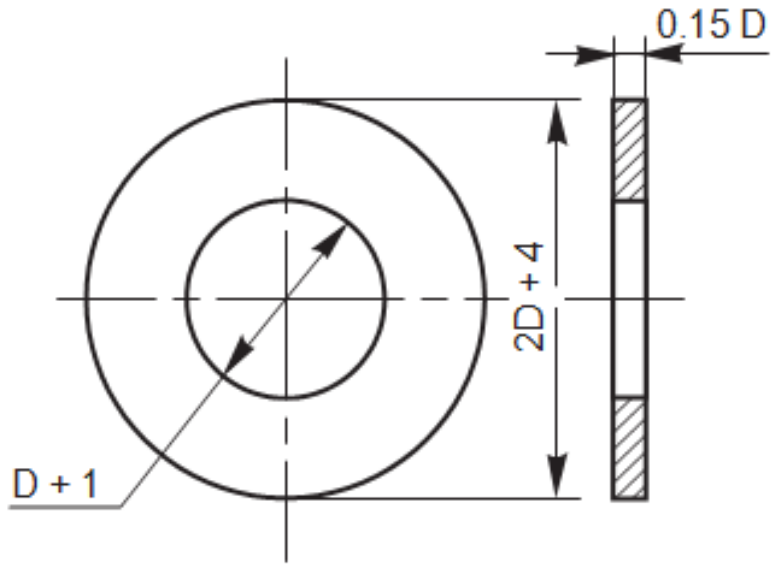
Fig.

HEXAGON BOLT AND NUT (a)

SQUARE BOLT AND NUT (b)

Washers

A washer is a cylindrical piece of metal with a hole to receive the bolt. It is used to give a perfect seating for the nut and to distribute the tightening force uniformly to the parts under the joint. It also prevents the nut from damaging the metal surface under the joint. Figure below shows a washer, with the proportions marked.

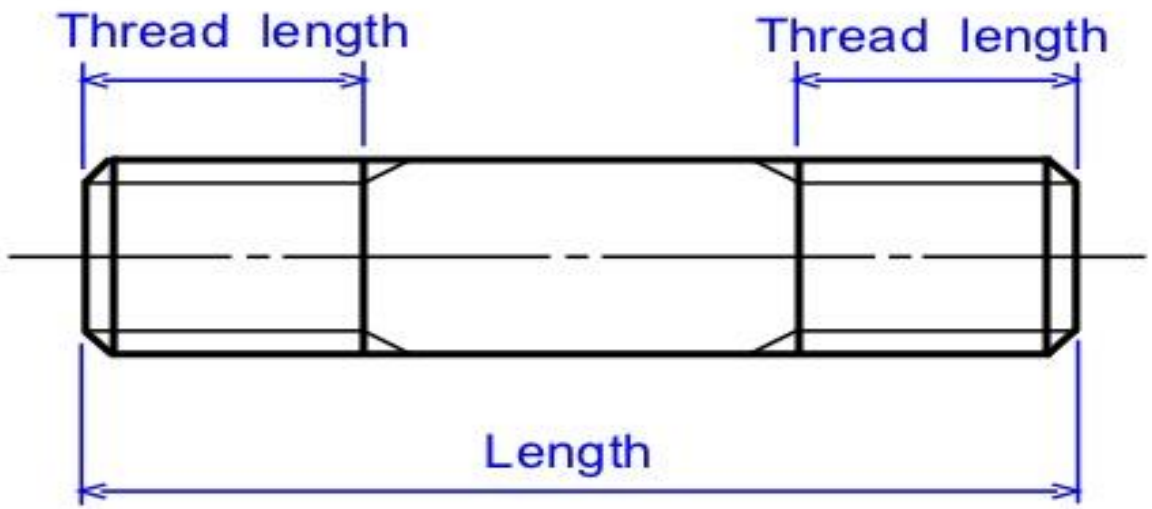


Washer

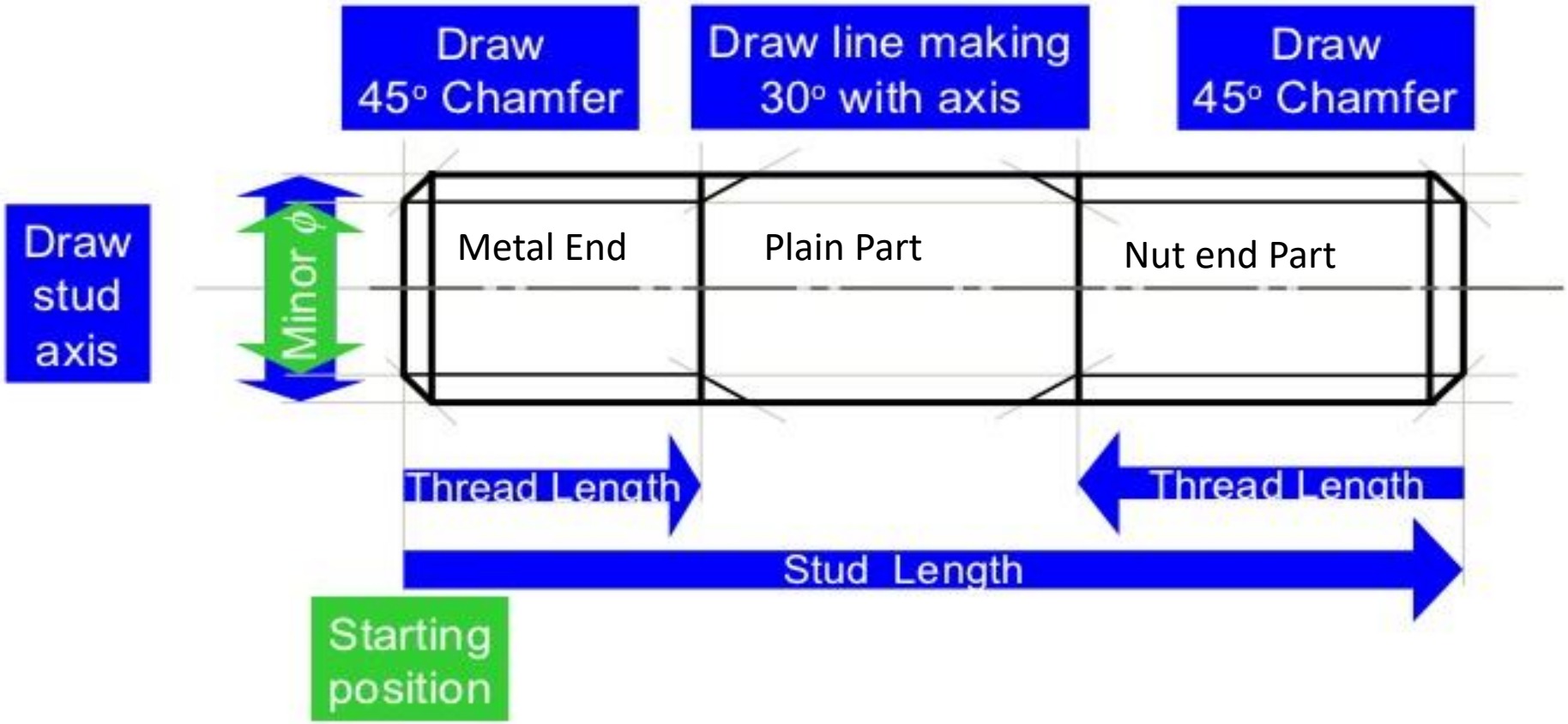
STUD : Terminology

Stud is a *headless* bolt, threaded at both ends.

Drawing representation

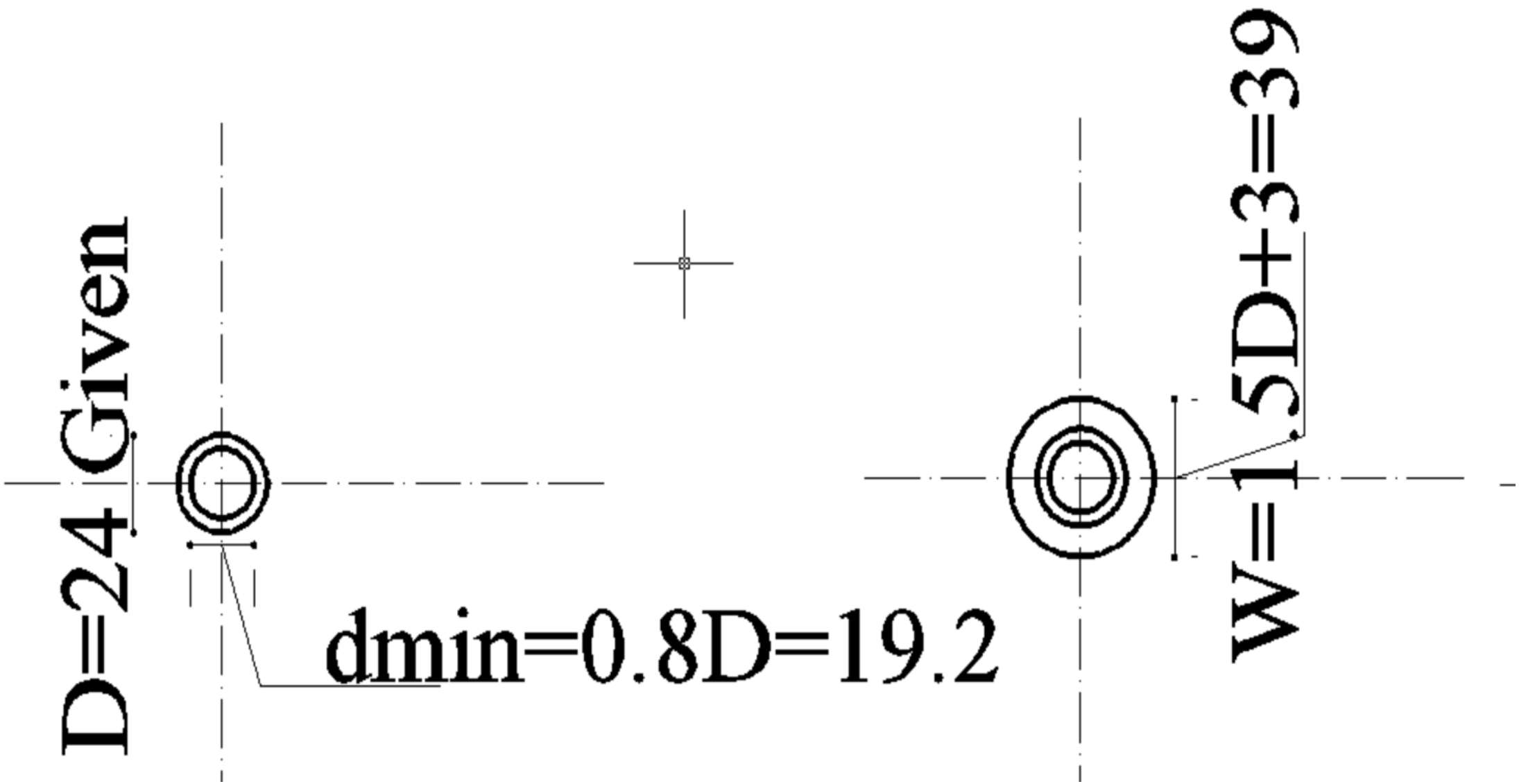


STUD : Drawing steps

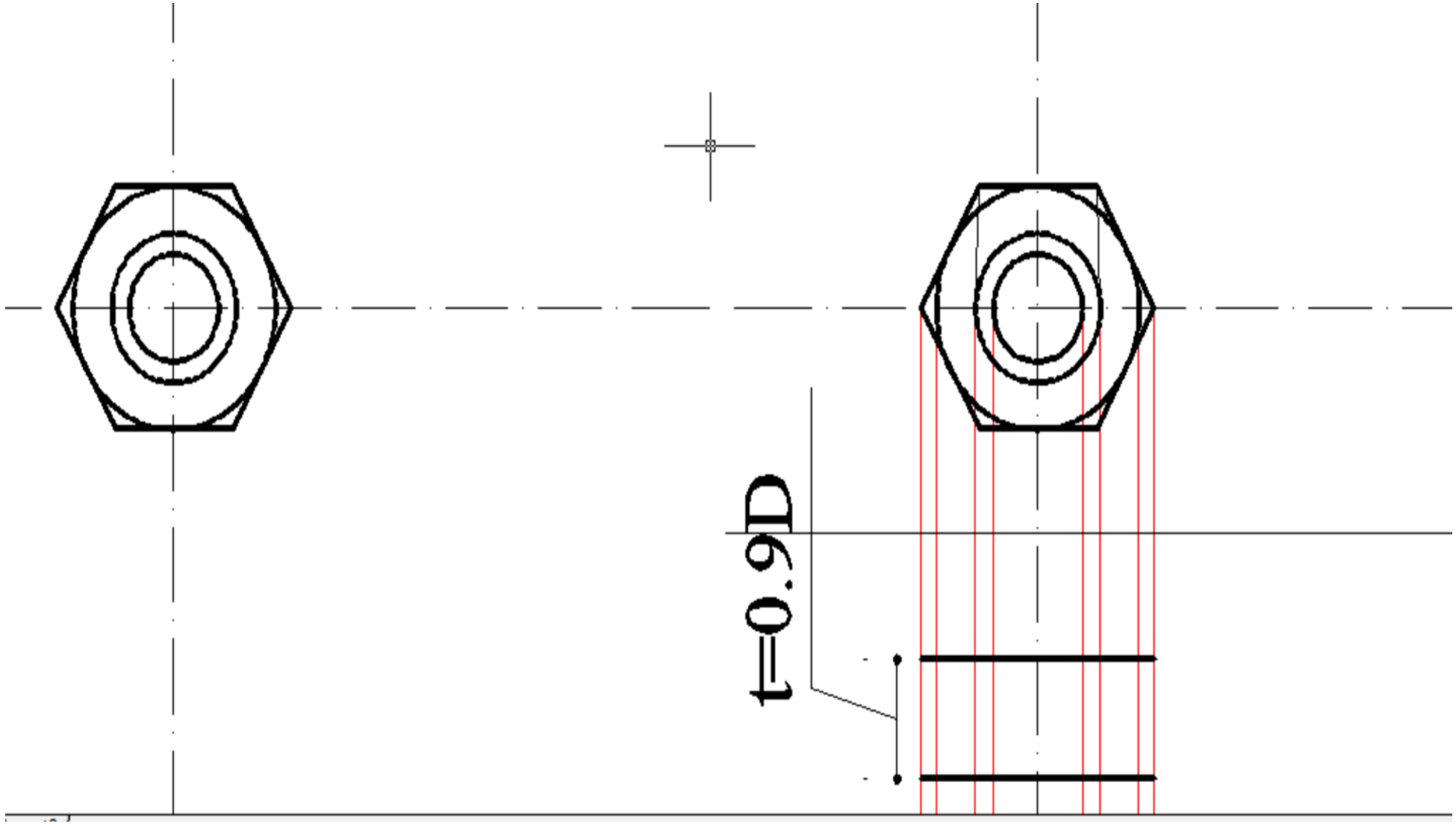


Diameter =D, Thread Diameter =0.8D, Height of Metal End = 1.5 D, Plain Part=D, Nutend Part =2D

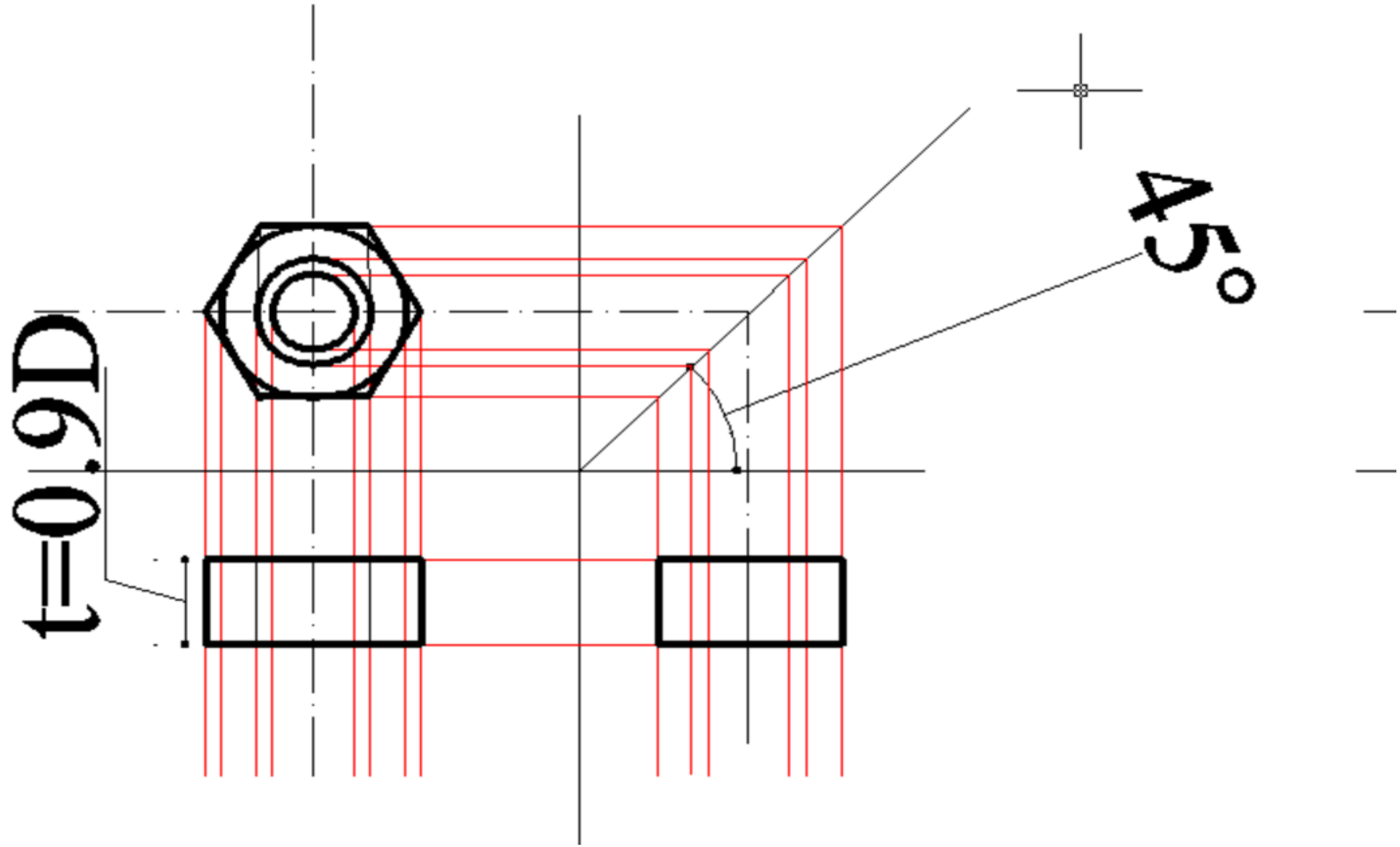
Step First



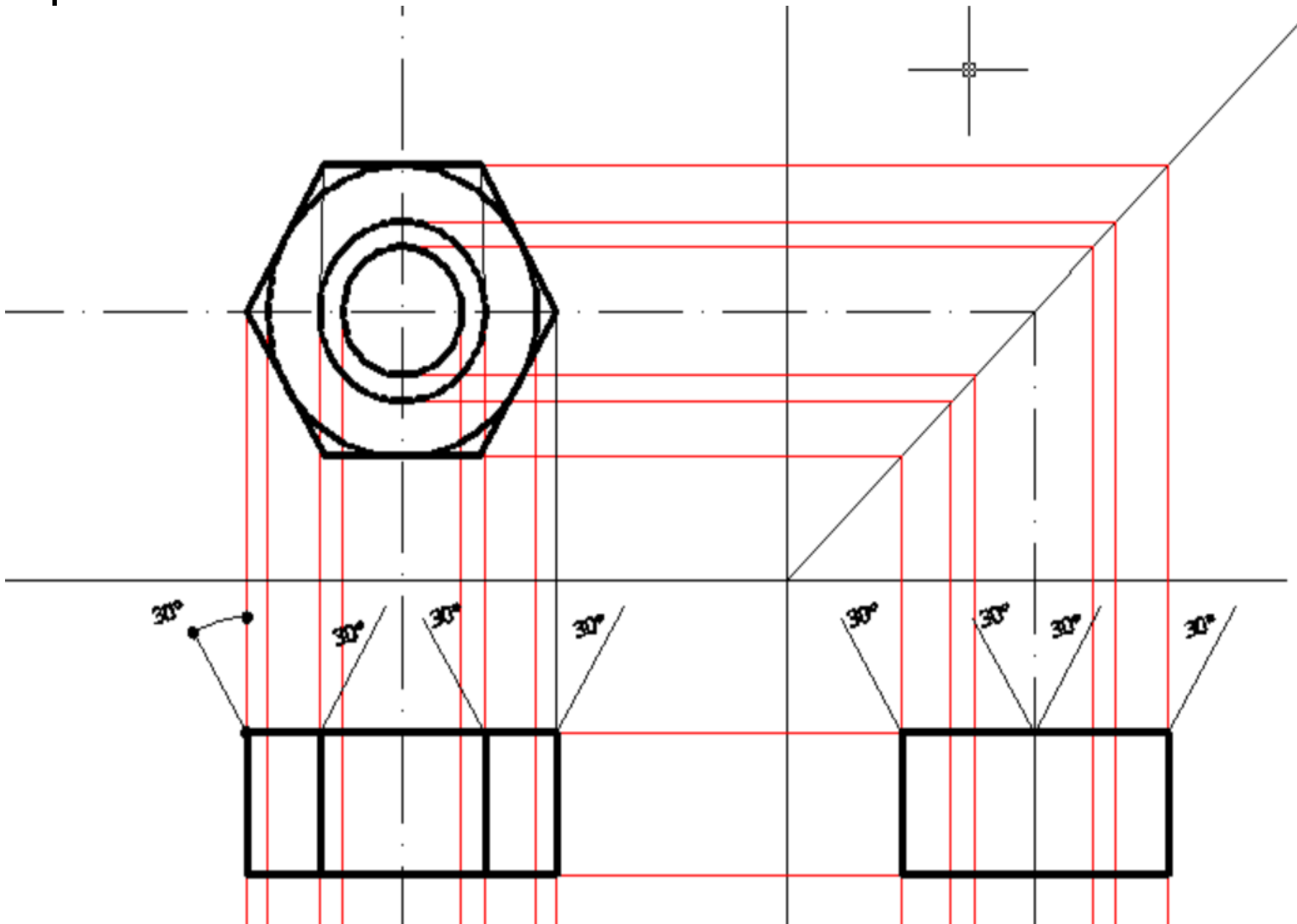
Step Second



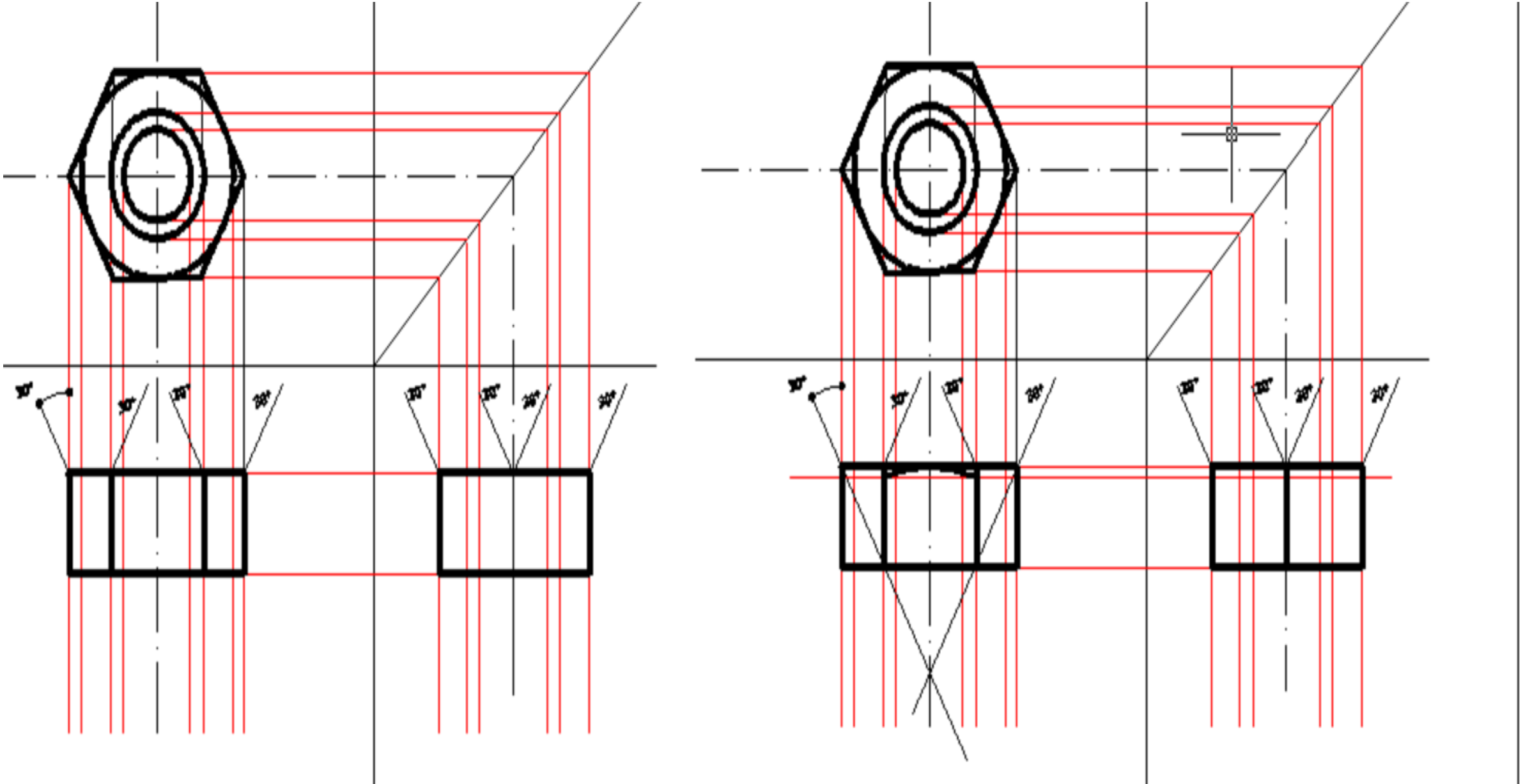
Step Third



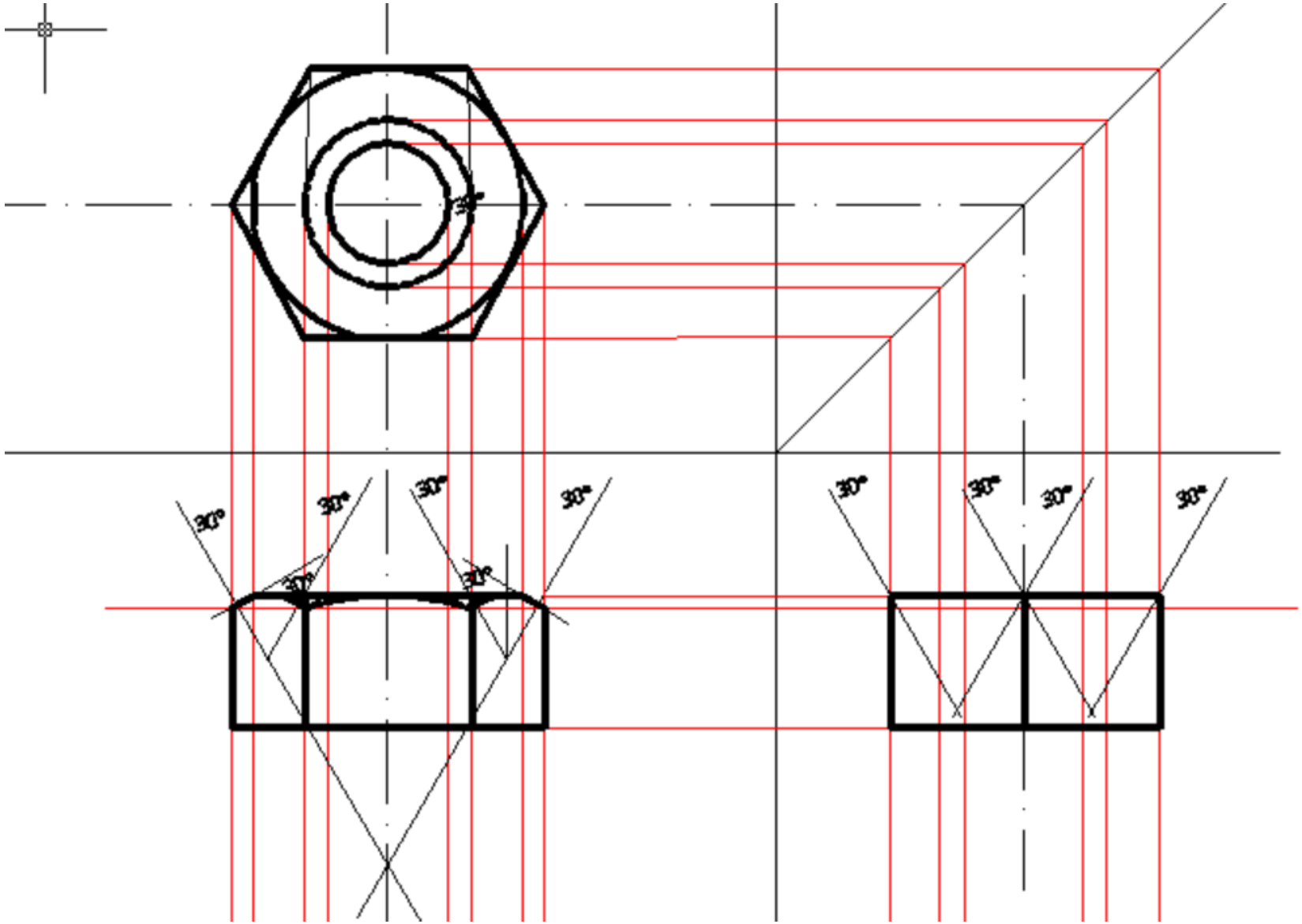
Step 4



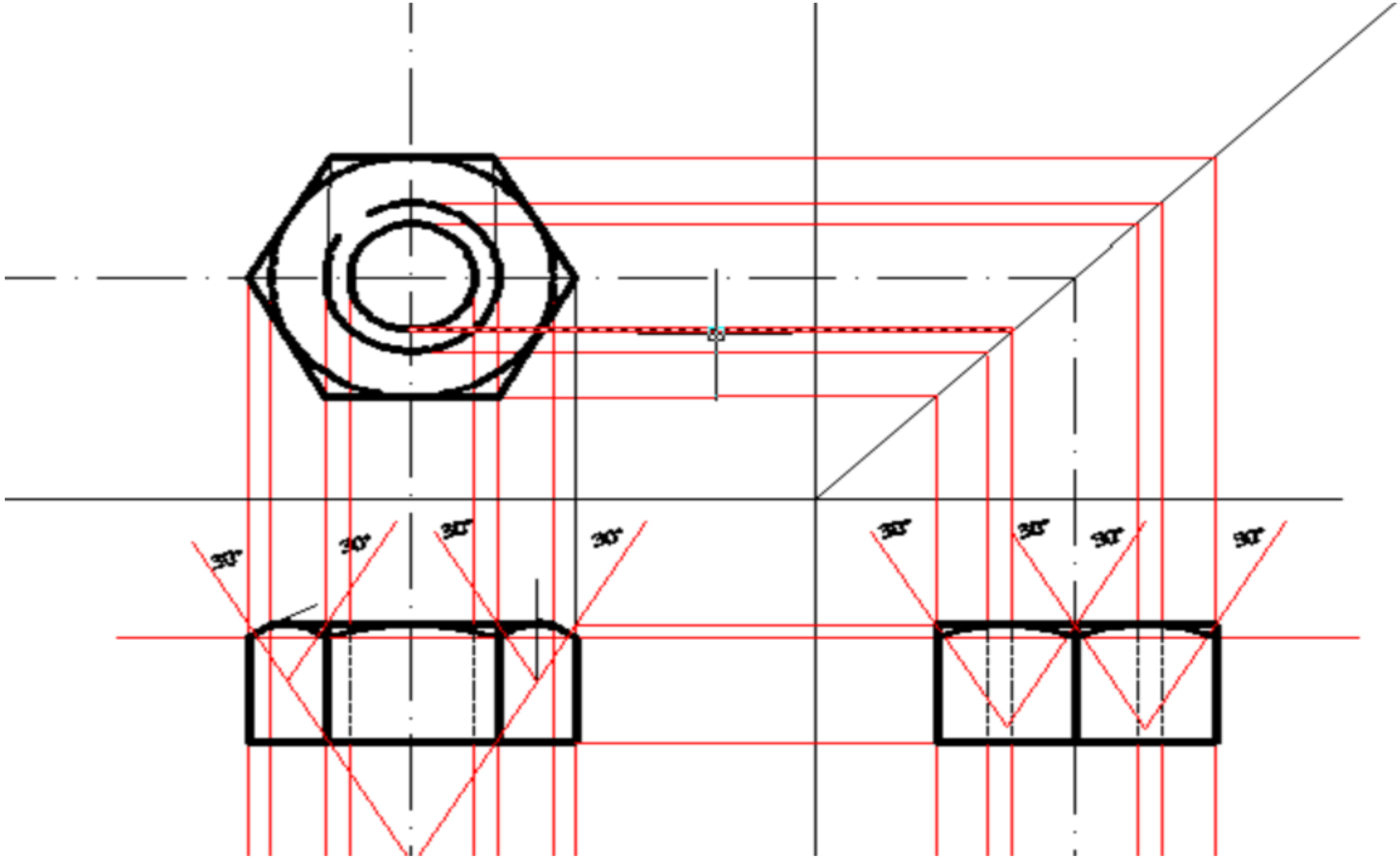
Step 5



Step 6



Step 7



Hexagonal Bolt

Empirical relations :

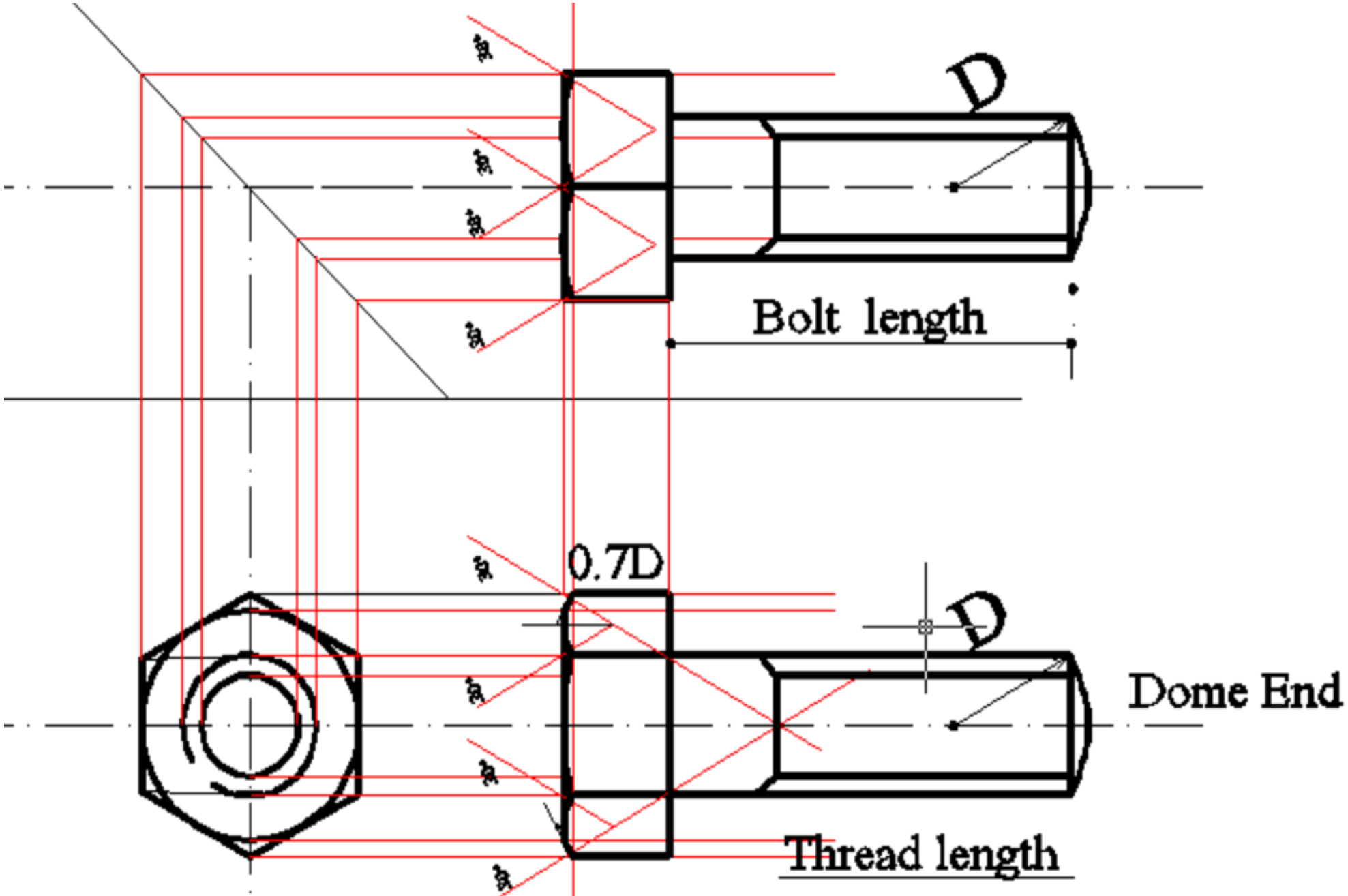
- Major or nominal diameter of bolt = D
- Thickness of nut, T = 0.7D (Vary)
- Width of nut across flat surfaces, W = 1.5D + 3 mm
- Radius of chamfer, R = 1.5D
- Length of bolt L= 3D to 20D
- Length of Thread Portion

➢L1=2D+5 upto dia 80

➢L1= 2D+10 Upto 81 to 200mm

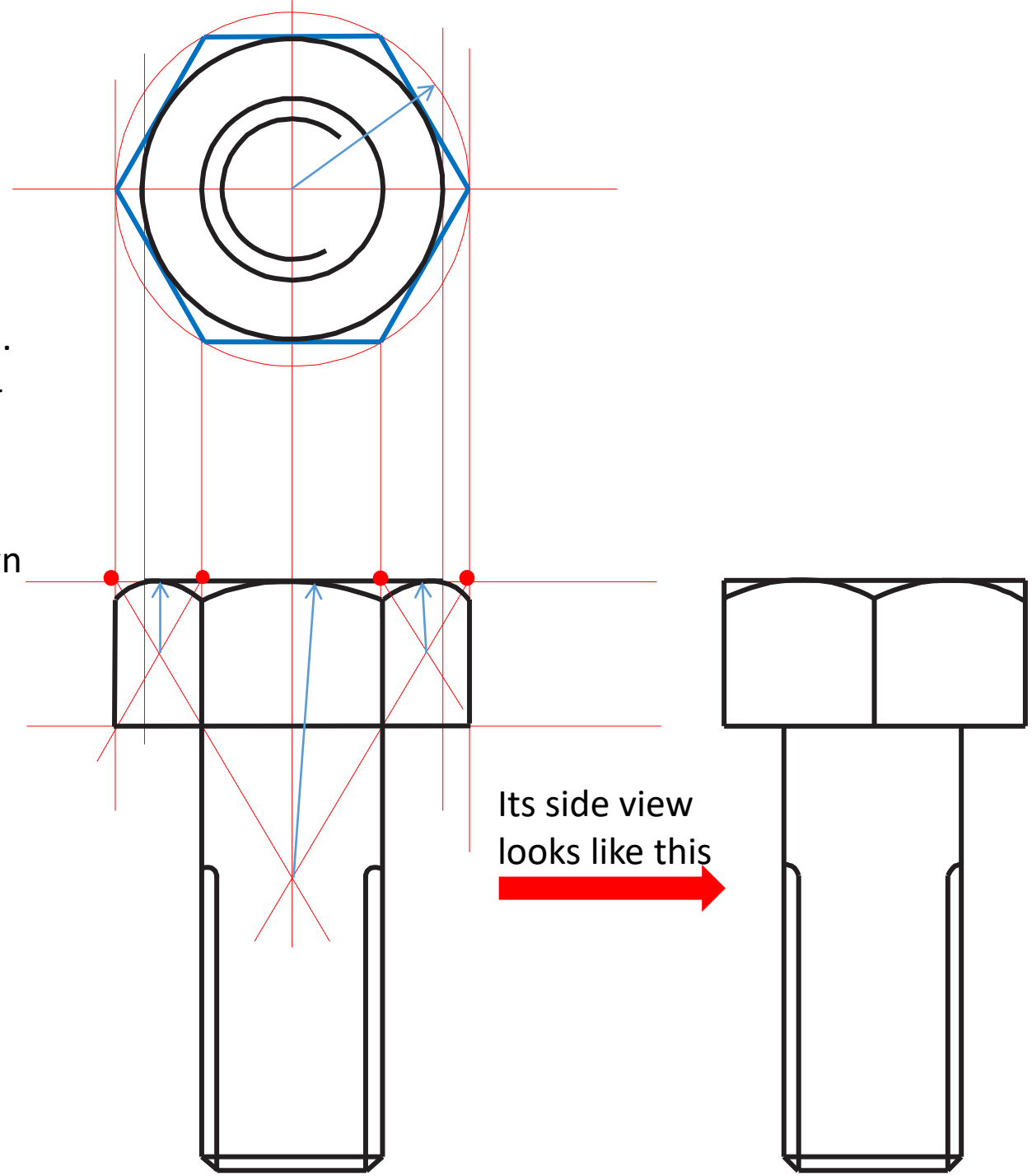
➢L1=2D+20 above 200mm

Hexagonal Bolt



Draw hexagon inside the red circle

Draw a circle of given nearest M. multiplication of 4.e.g.M24=R24

Draw line of 45 degree as shown in figure from the given point…

Draw a circle of radius…