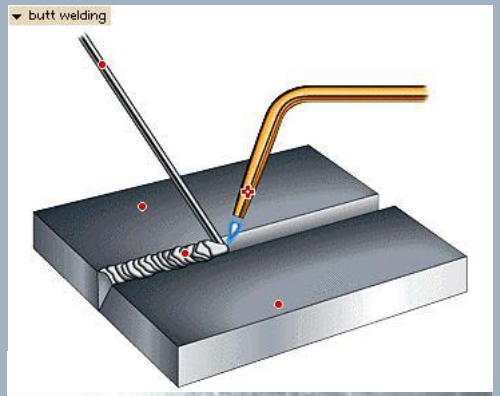
التدريب الصيفي

FASTENING TYPE

1. Permanent

Welding



Gluing

Riveting

FASTENING TYPE

2. Temporary

2.1 ***Threaded fastener***

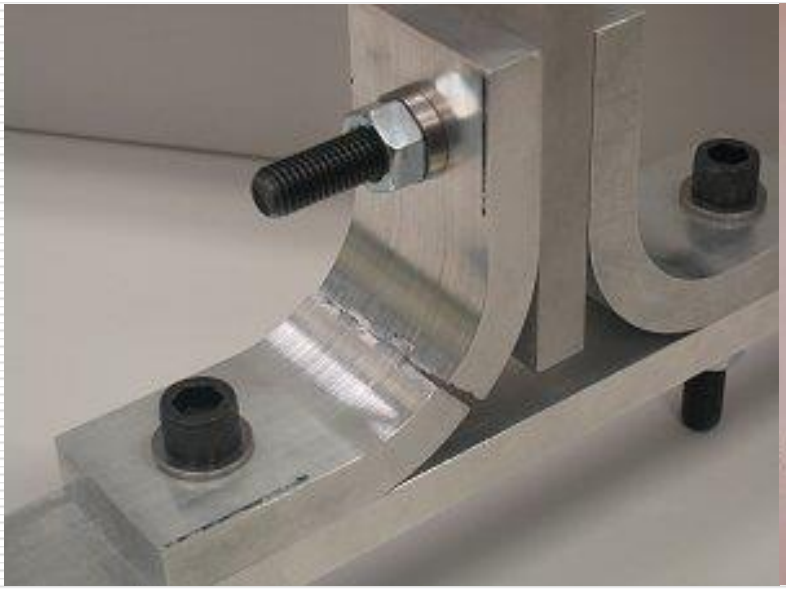
- bolts
- studs
- screws

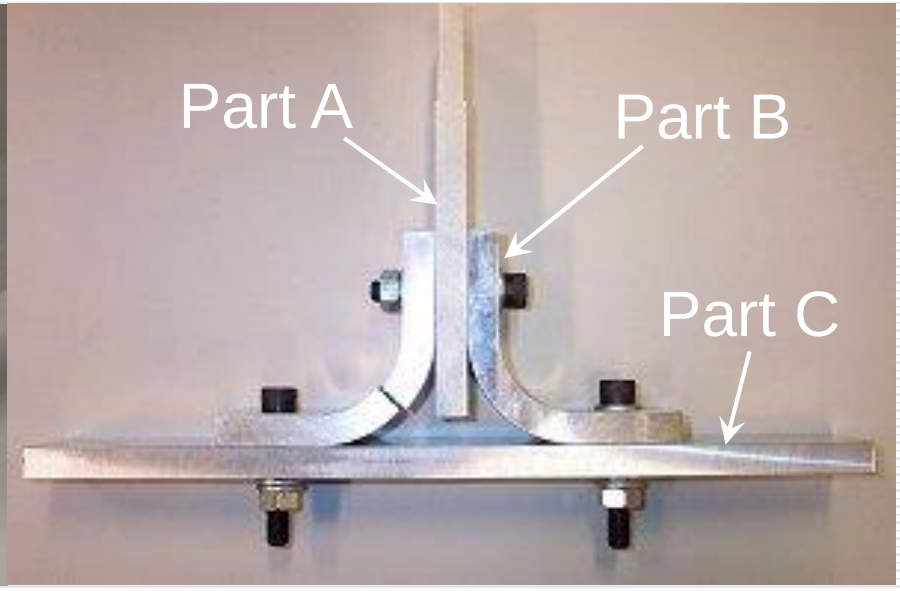
2.2 ***Non-threaded fastener***

- keys
- pin

THREAD APPLICATION

1. To hold parts together.
2. To move part(s) relative to others.





THREAD APPLICATION

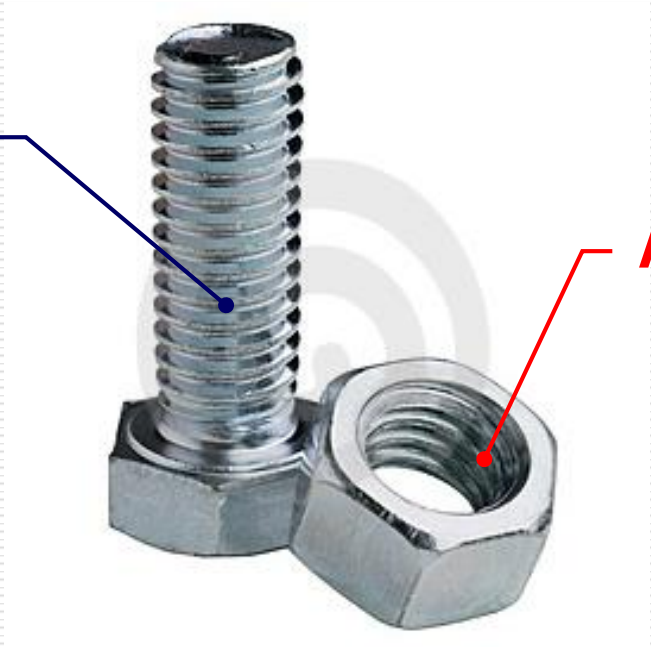
1. To hold parts together.
2. To move part(s) relative to others.

Wood working vise

Palm fruit pressing machine

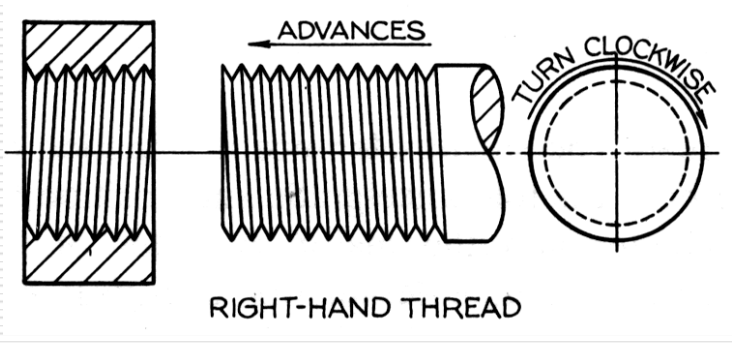
THREAD TERMINOLOGY

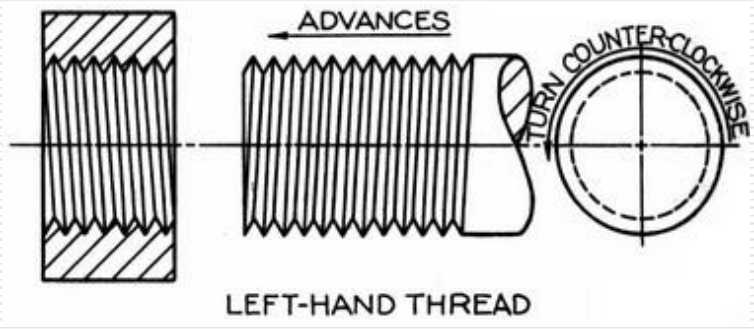
External thread	A thread cut on the ***outside*** of a cylindrical body.
Internal thread	A thread cut on the ***inside*** of a cylindrical body.

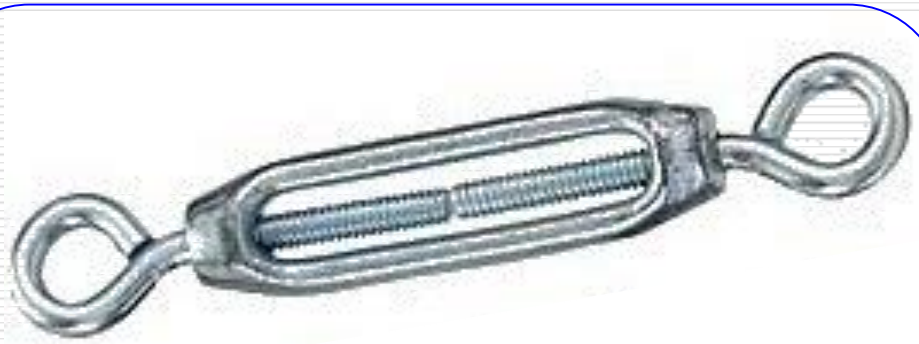


THREAD TERMINOLOGY

Right-hand thread	Thread that will ***assemble*** when turned ***clockwise***.
Left-hand thread	Thread that will ***assemble*** when turned ***counter-clockwise***.





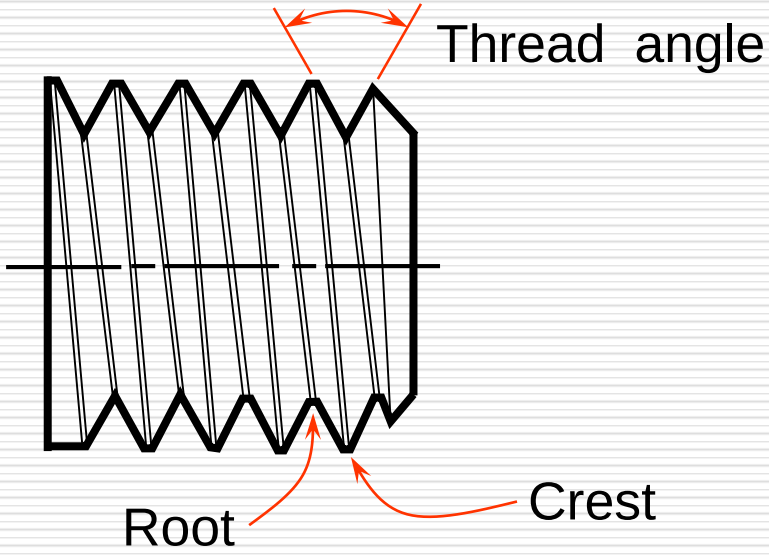


Turnbuckle use RH and LH thread at each end to double displacement.

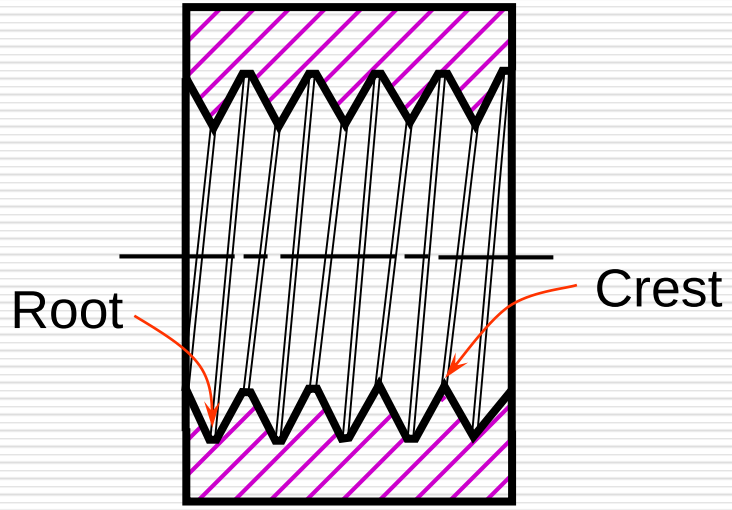
THREAD TERMINOLOGY

Crest	The ***peak edge*** of a thread.
Root	The ***bottom*** of the thread cut into a cylindrical body.
Thread angle	The angle between threads faces.

External Thread



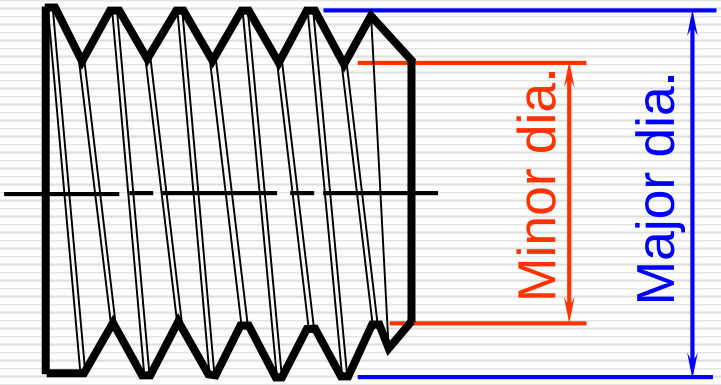
Internal Thread



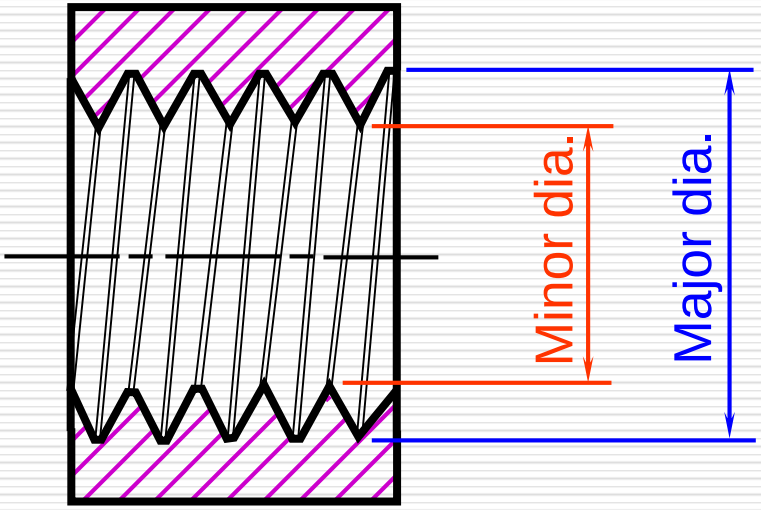
THREAD TERMINOLOGY

Major diameter	The ***largest diameter*** on an internal or external thread.
Minor diameter	The ***smallest diameter*** on an internal or external thread.

External Thread



Internal Thread



THREAD TERMINOLOGY

Pitch

The distance between crests of threads.

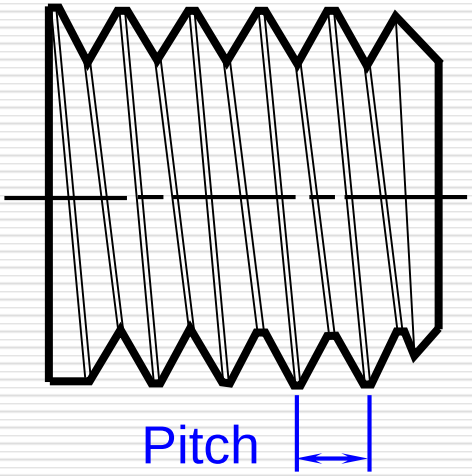
Thread pitch (English system)
The number of threads per inch

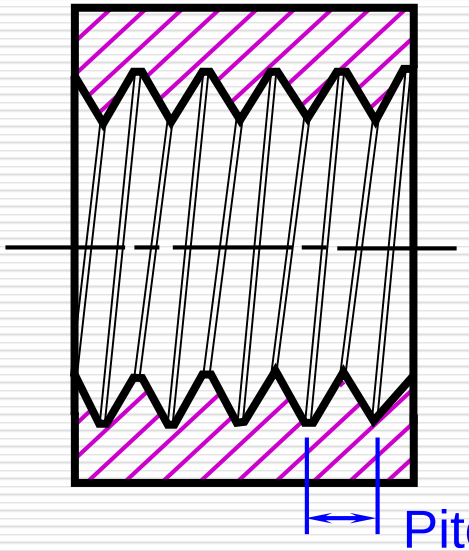
Thread pitch (Metric system)
The distance in millimeters between two adjacent threads

Lead

The distance a screw will advance when turned 360°.

External Thread





Internal Thread

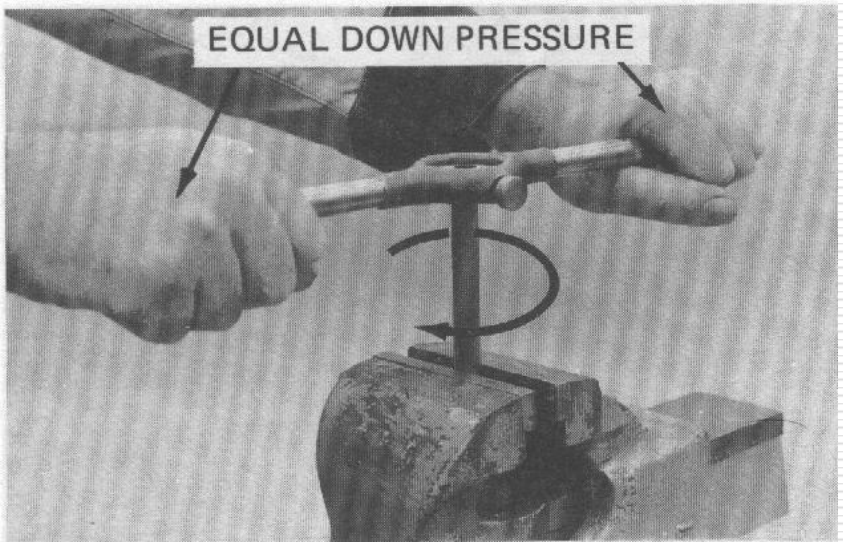
EXTERNAL THREAD CUTTING

Tools

- Threading Die

- Die stock

Operation



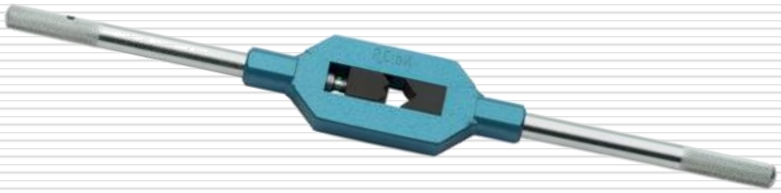
INTERNAL THREAD CUTTING

Tools

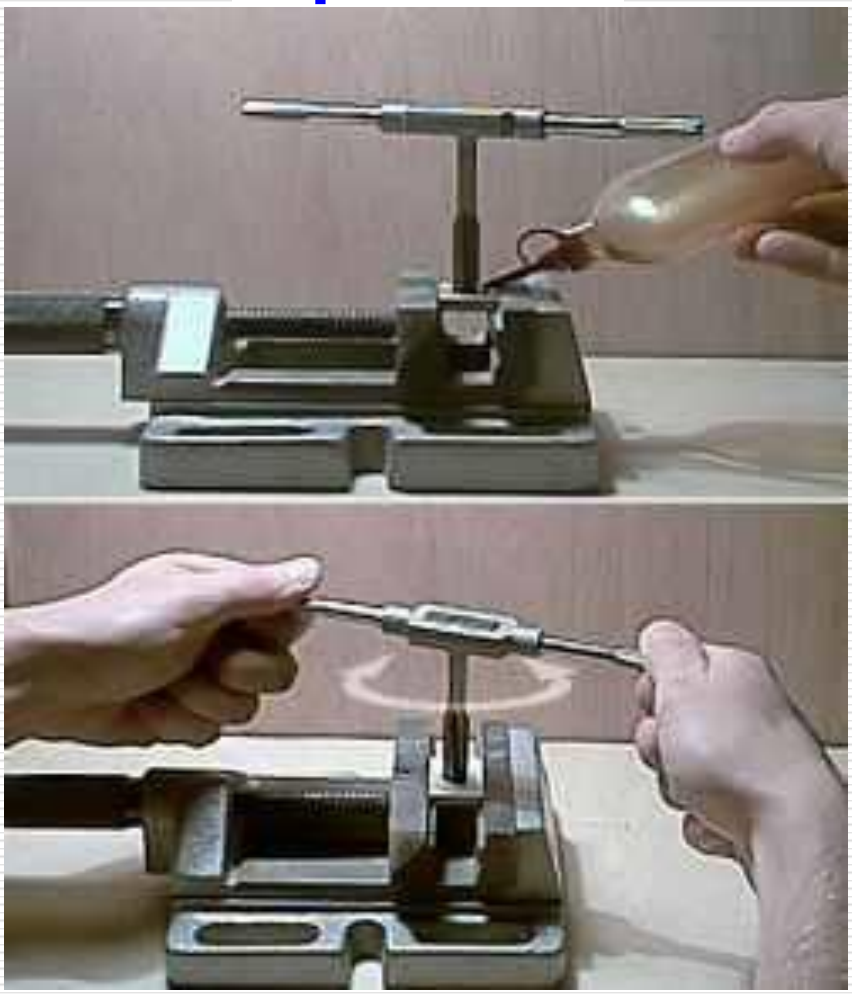
- Twist drill

- Tap

- Tap wrench



Operation



THREAD REPRESENTATION

1. ***Detailed*** representation

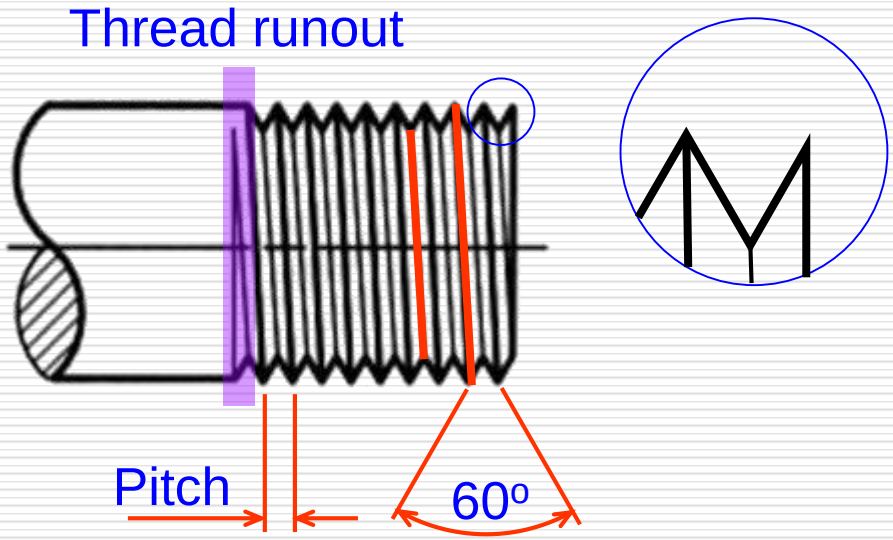
2. ***Schematic*** representation

3. ***Simplified*** representation

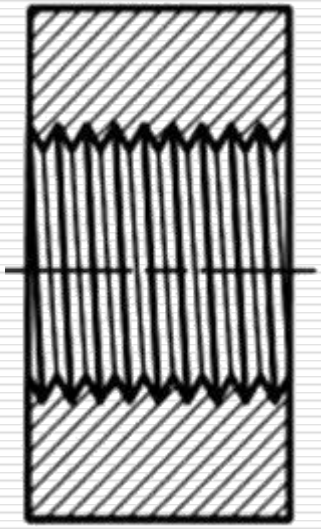
DETAILED REPRESENTATION

- Use ***slanting lines*** to represent crest and root.
- Roots and crest are drawn in ***sharp*** Vs.

External thread



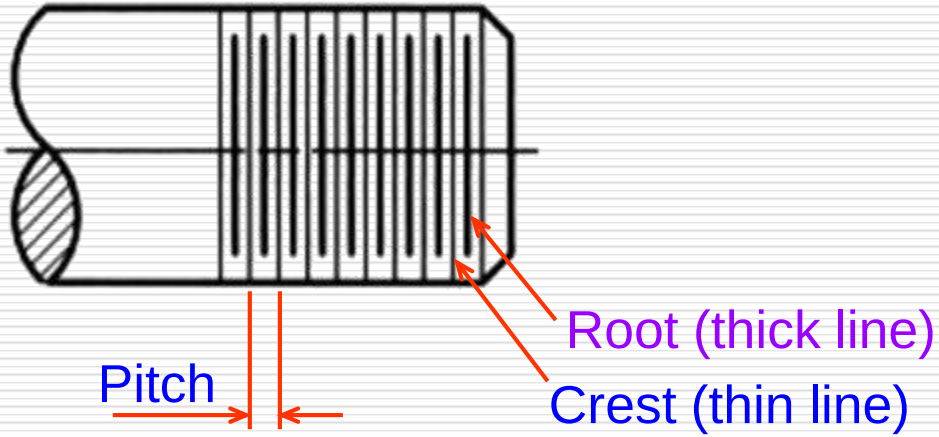
Internal thread



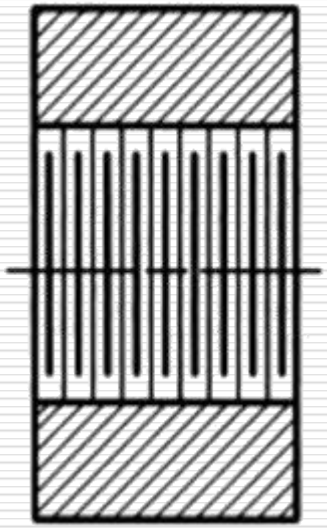
SCHEMATIC REPRESENTATION

- Use alternate ***long*** and ***short*** lines for representing ***crests*** and ***roots*** of the thread, respectively.

External thread



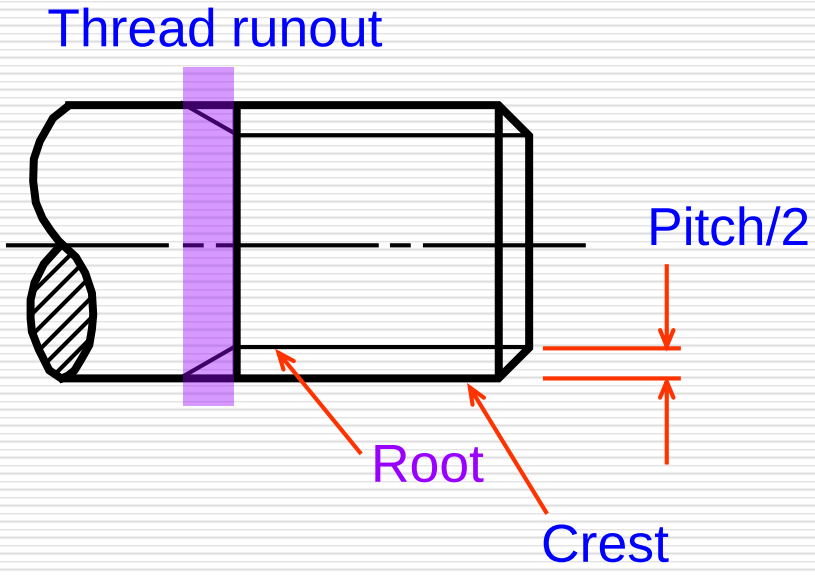
Internal thread



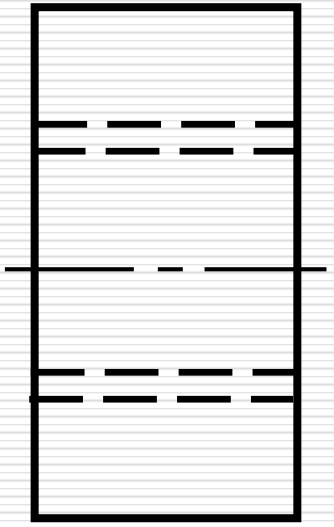
SIMPLIFIED REPRESENTATION

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

External thread



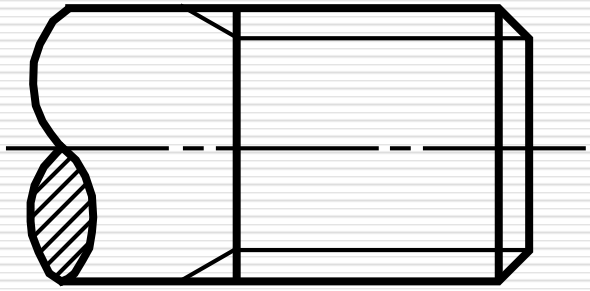
Internal thread



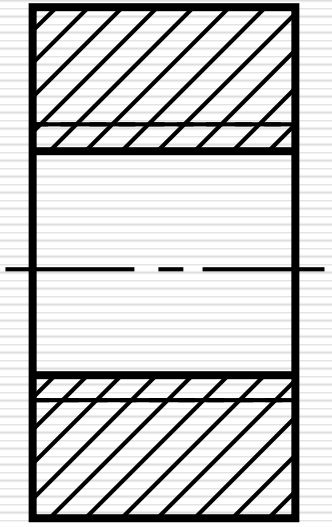
SIMPLIFIED REPRESENTATION

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

External thread



Internal thread

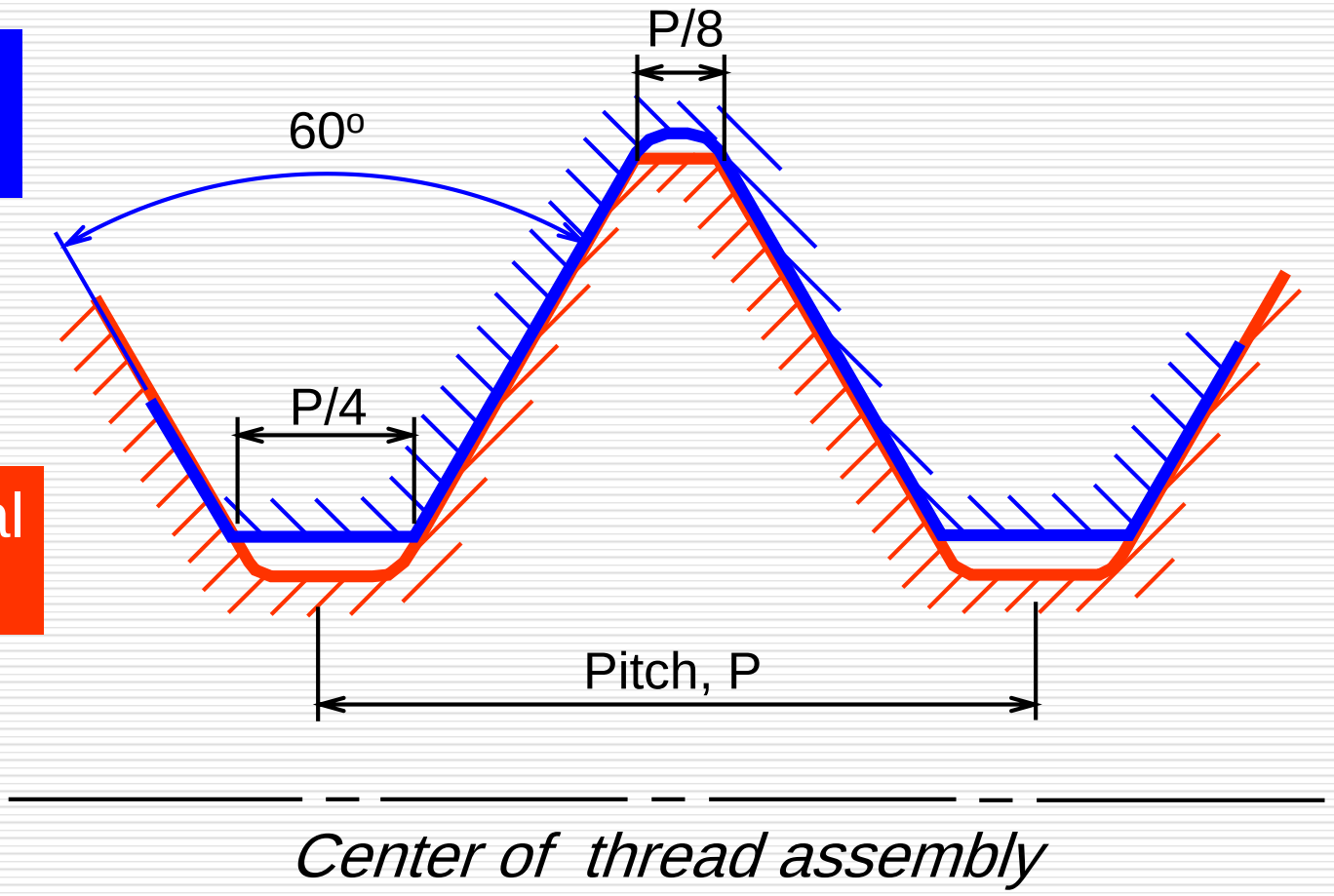


Sectional view

ISO (METRIC) THREAD

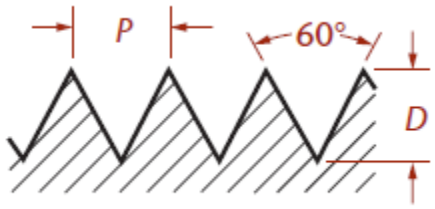
Internal thread

External thread

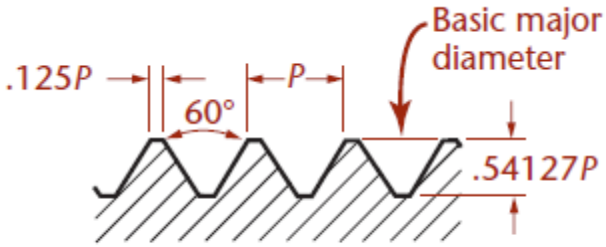


Thread assemble occurs if and only if both (internal & external) thread have an equal ***nominal size (****or diameter****)*** and ***pitch***.

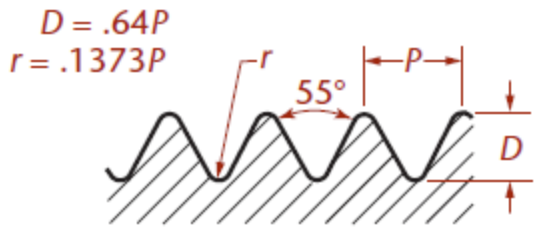
Screw Thread Forms



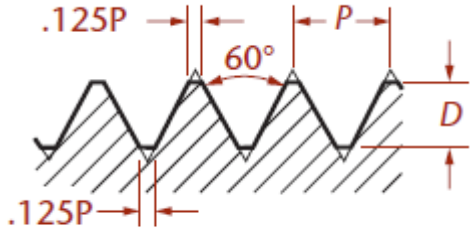
(a) Sharp V



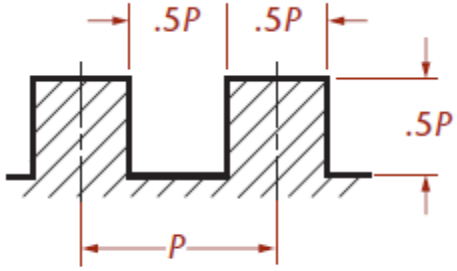
(a) Metric



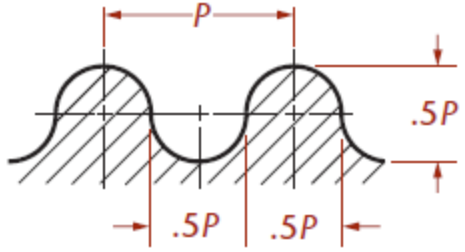
(a) Whitworth standard



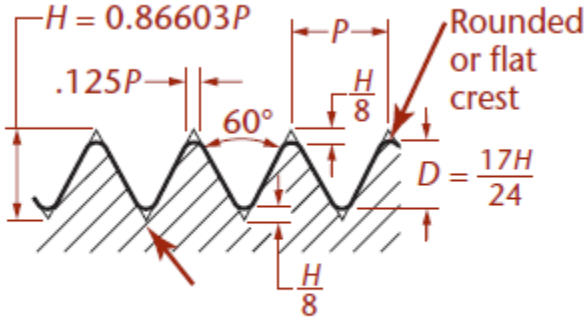
(b) American national



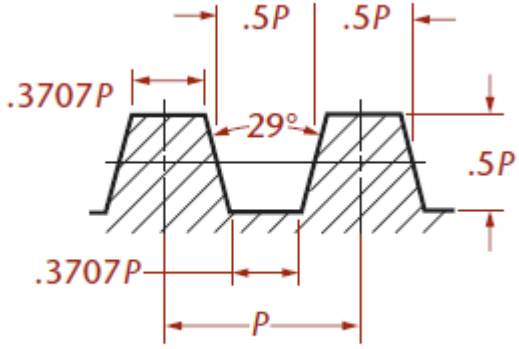
(b) Square



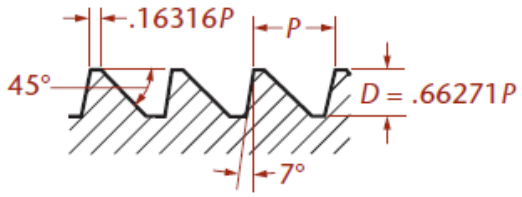
(b) Knuckle



(c) Unified (external)



(c) Acme (general-purpose)



(c) Buttress

METRIC COARSE THREAD

[Table 9.1]

Nominal size	**Major diameter**	**Pitch**	Minor diameter	Tap drill size
M6	6.00	1.00	4.92	5.00
M8	8.00	1.25	6.65	6.75
M10	10.00	1.50	8.38	8.50
M12	12.00	1.75	10.11	10.00

Metric thread

Minor diameter ≈ Tap drill size

In thread ***drawing***, the following relationship is used.

Minor diameter = ***Major*** diameter – Pitch

METRIC FINE THREAD

[Table 9.2]

Nominal size	**Major diameter**	**Pitch**	Minor diameter	Tap drill size
M8	8.00	0.75	7.188	7.25
		1.00	6.917	7.00
M10	10.00	0.75	9.188	9.25
		1.00	8.917	9.00
		1.25	8.647	8.75

Minor diameter ≈ Tap drill size

In thread ***drawing***, the following relationship is used.

Minor diameter = ***Major*** diameter – Pitch

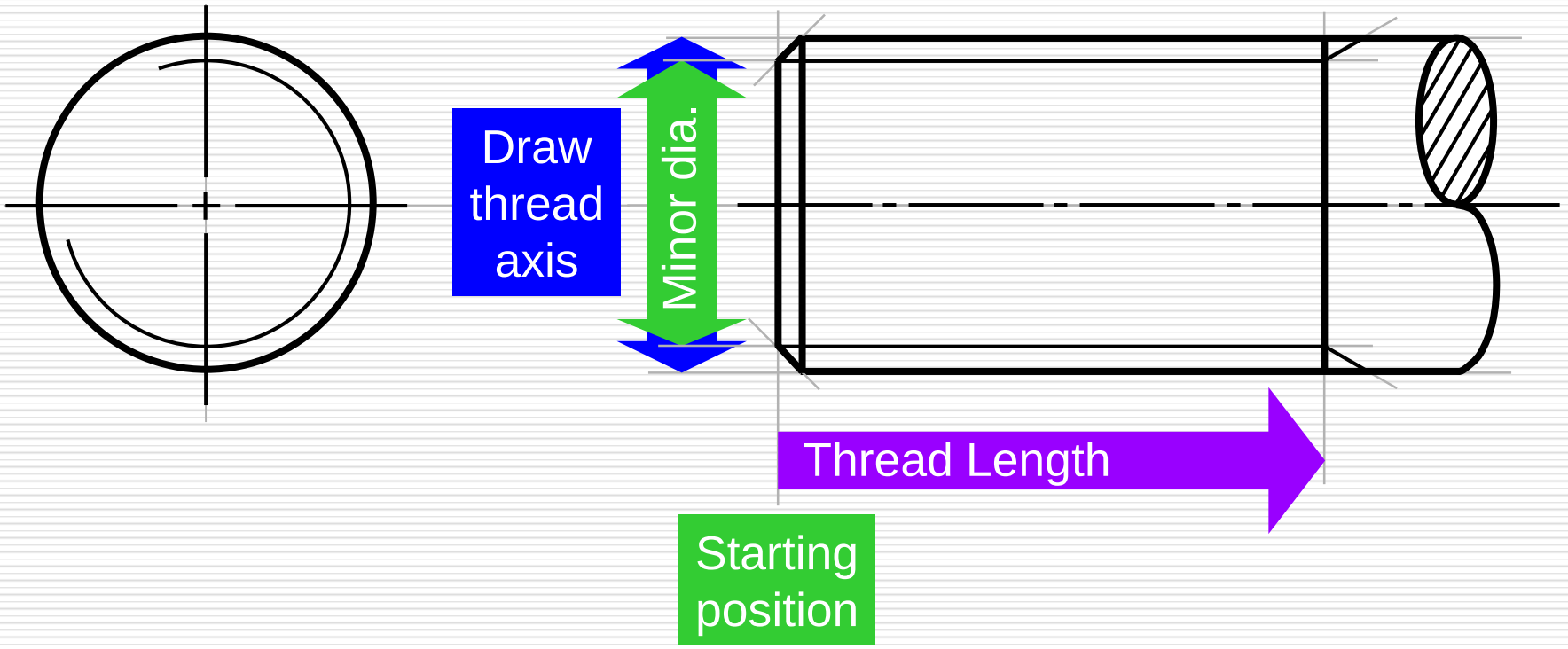
DRAWING STEPS OF EXTERNAL THREAD

Draw an arc that represents a root.

Draw a circle that represents a crest.

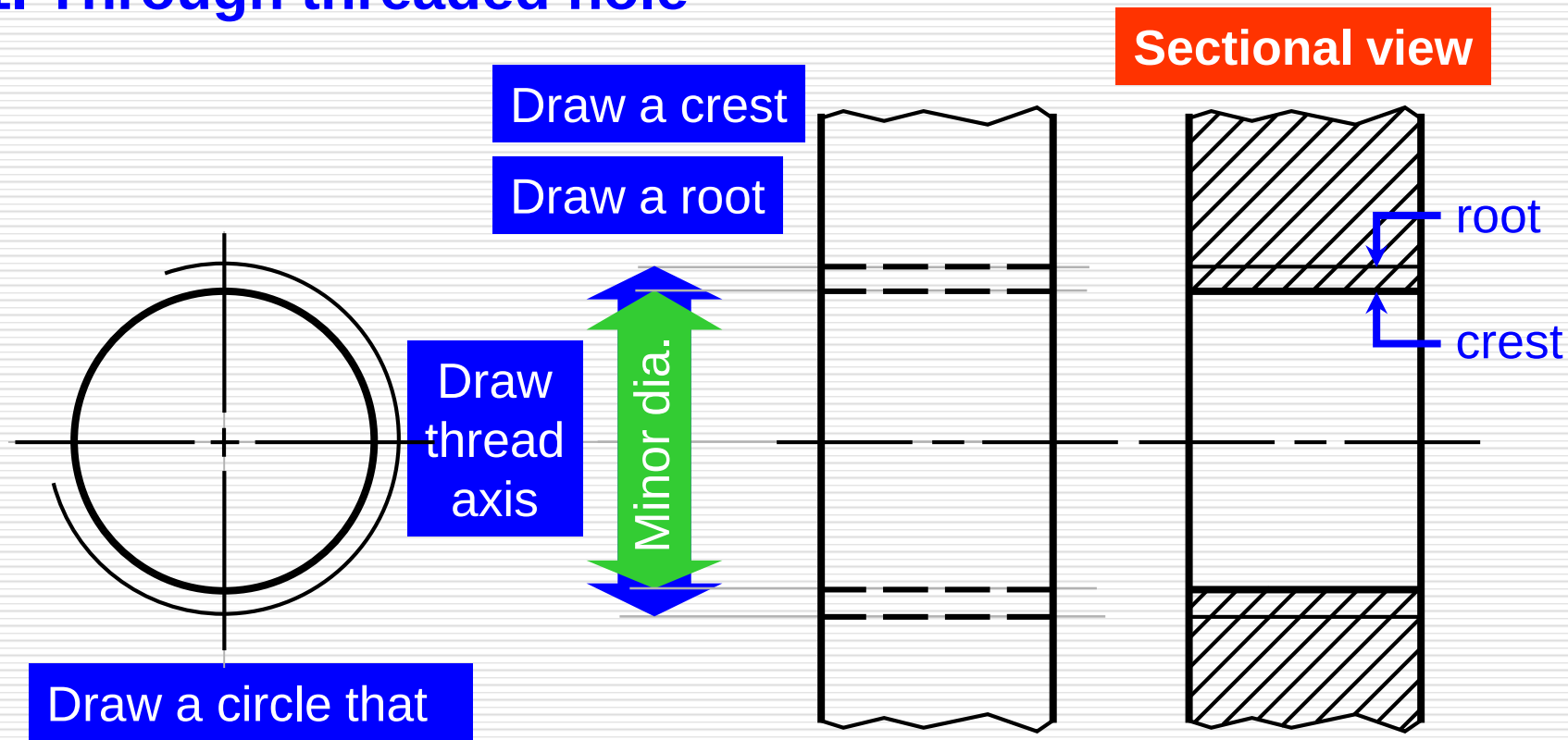
Draw 45° Chamfer

Draw line making 30° with thread axis



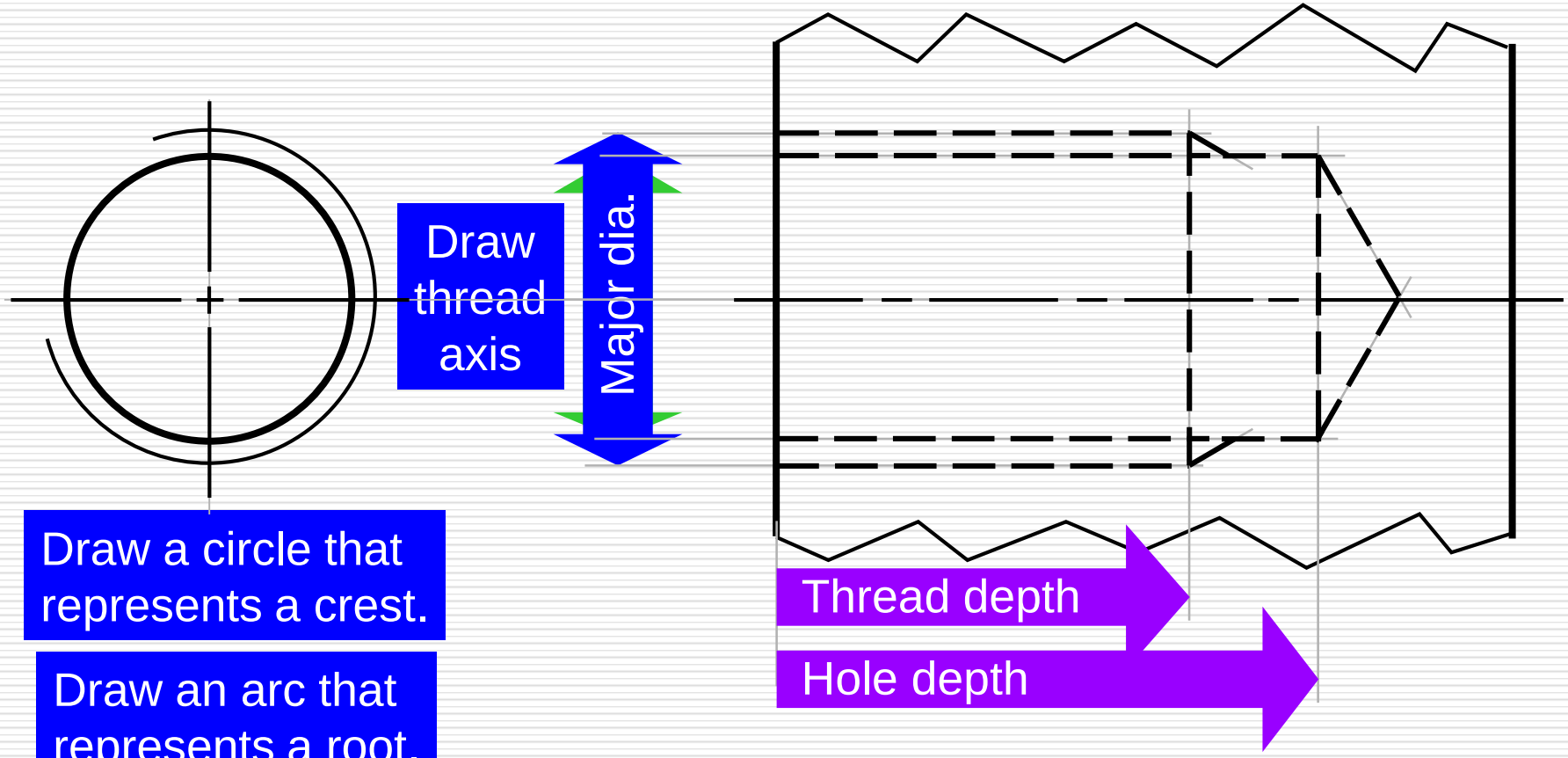
DRAWING STEPS OF THREADED HOLE

1. Through threaded hole



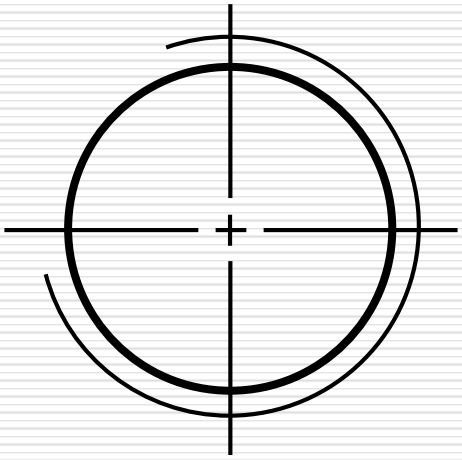
DRAWING STEPS OF THREADED HOLE

2. Blinded threaded hole

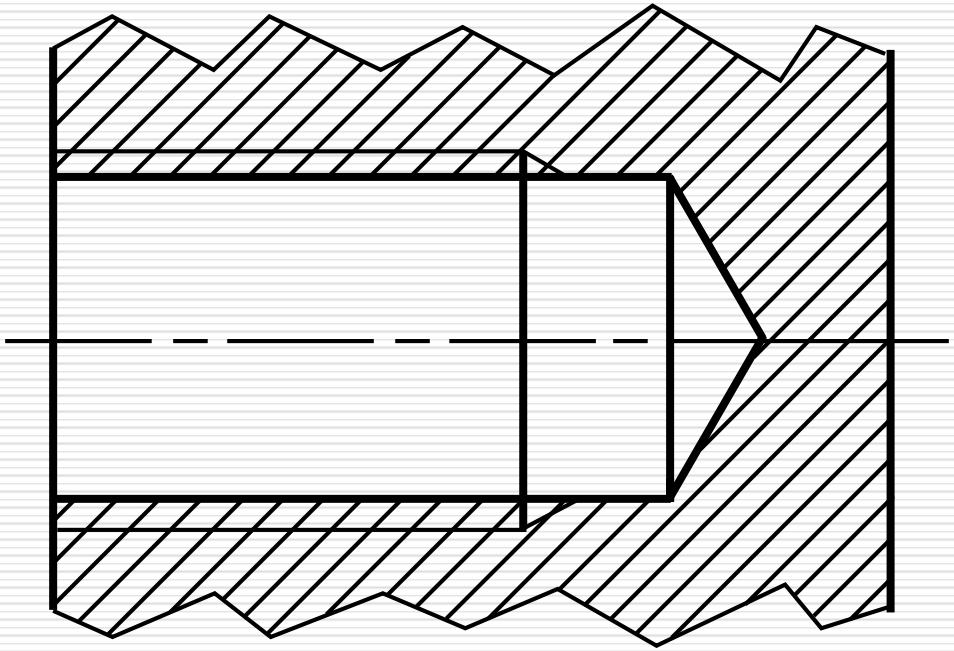


DRAWING STEPS OF THREADED HOLE

2. Blinded threaded hole

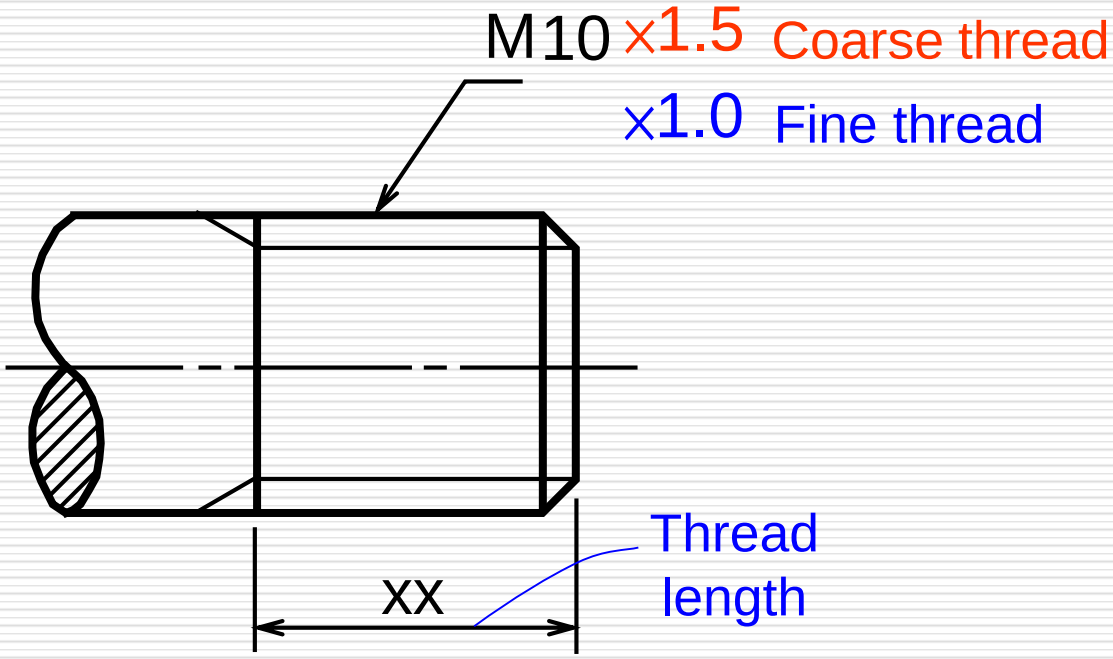


Sectional view



DIMENSIONING EXTERNAL THREAD

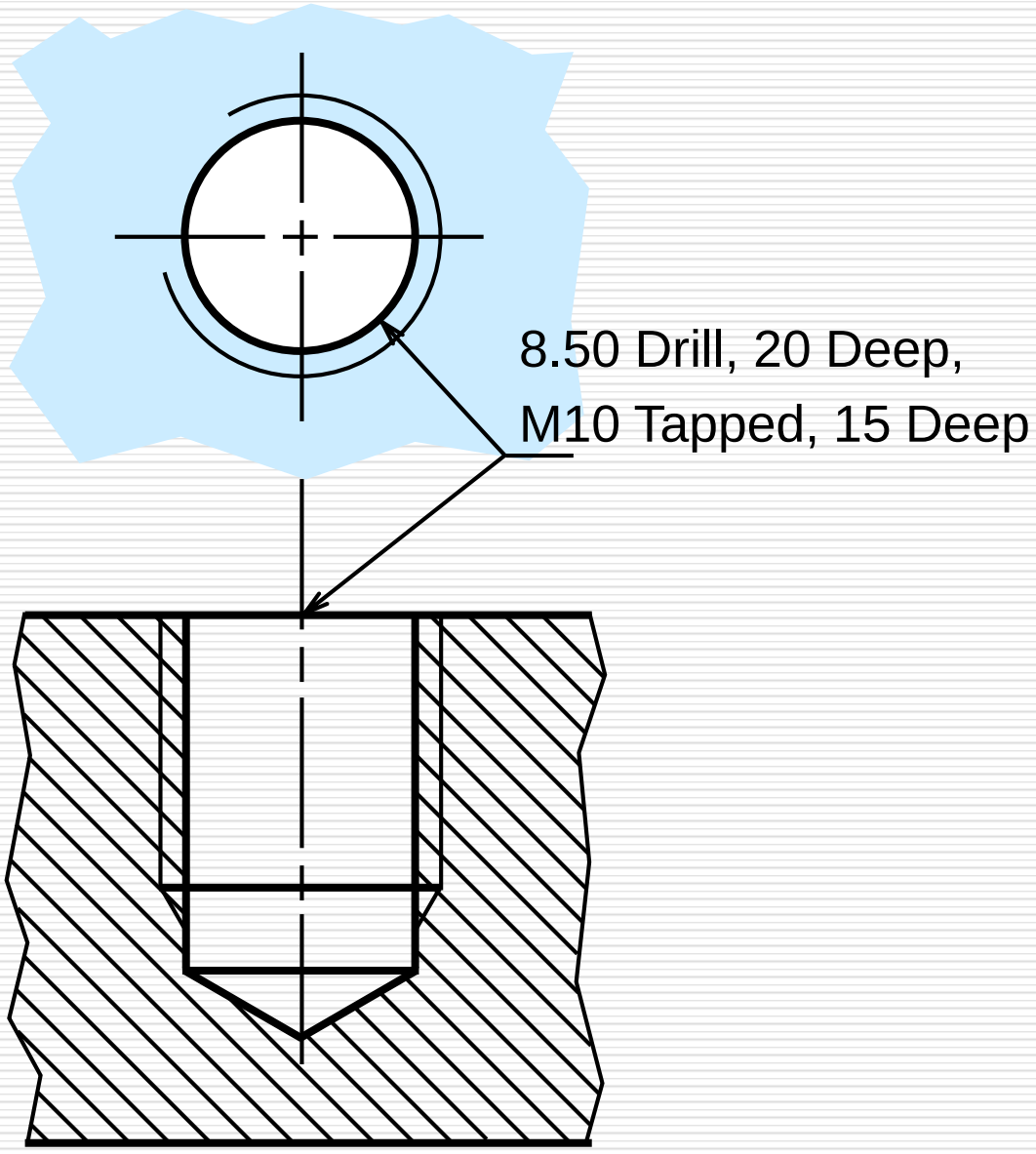
- Use ***local note*** to specify :- ***thread form***, ***nominal size***, ***pitch*** (if it is a fine thread)
- Use ***typical method*** to specify :- ***thread length***.



DIMENSIONING THREADED HOLE

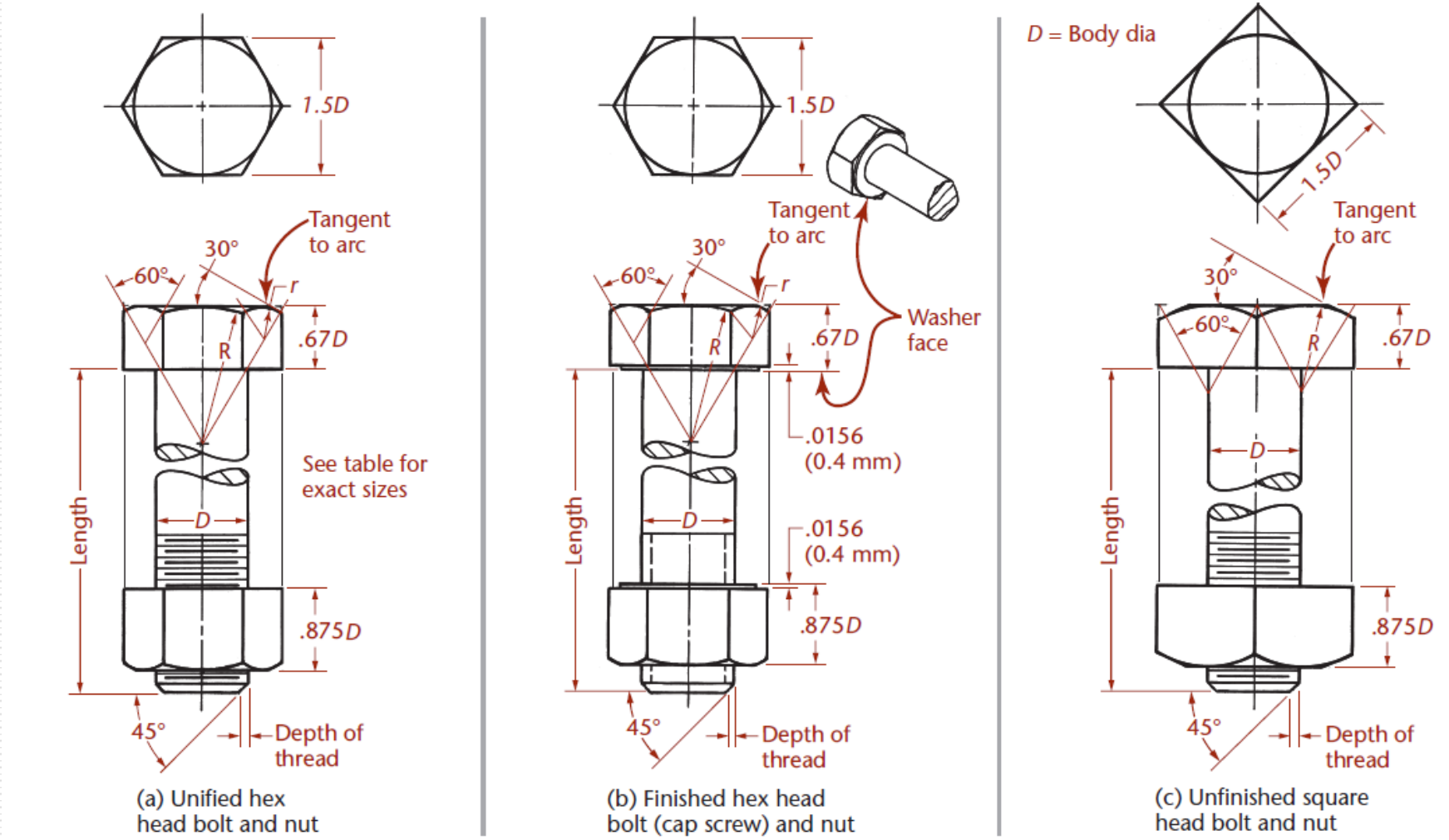
Use ***local note*** to specify

1. Tap drill size
2. Drill depth
3. Thread form
4. Nominal size
5. Pitch
6. Thread depth



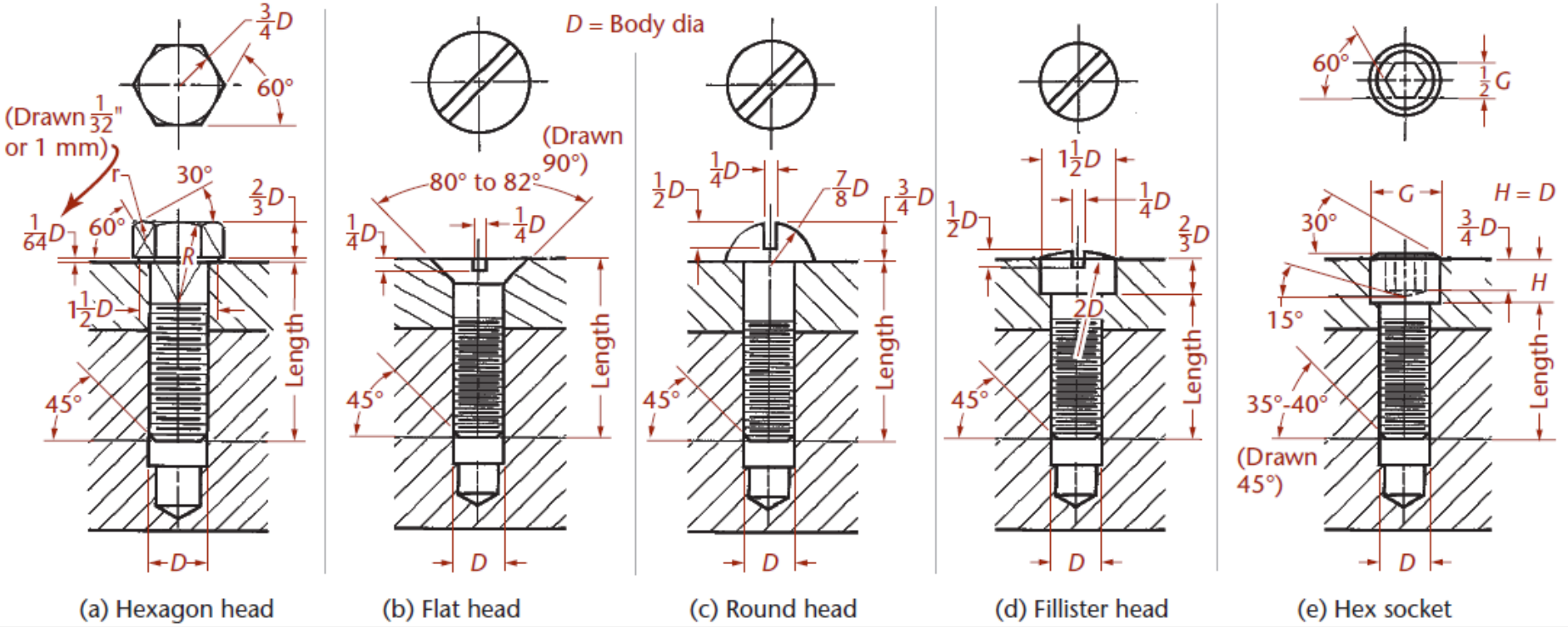
DRAWING STANDARD BOLTS

Bolt Proportions (Regular)



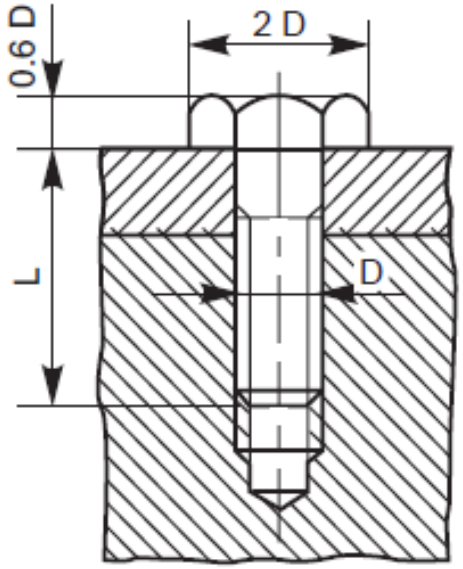
STANDARD CAP SCREWS

Cap screws are normally finished and are used on machine tools and other machines when accuracy and appearance are important.

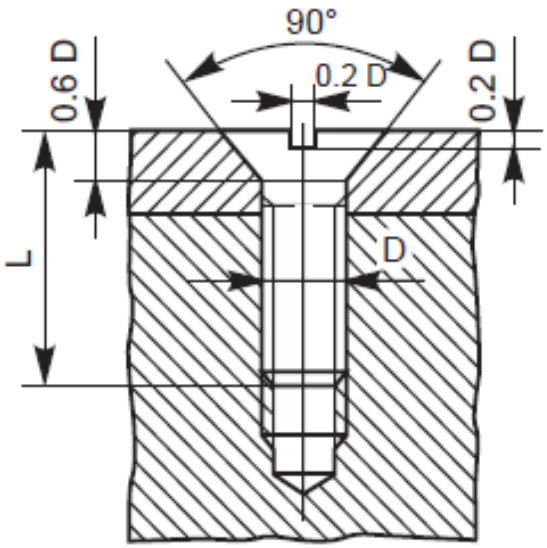


(a) Hexagon head (b) Flat head (c) Round head (d) Fillister head (e) Hex socket

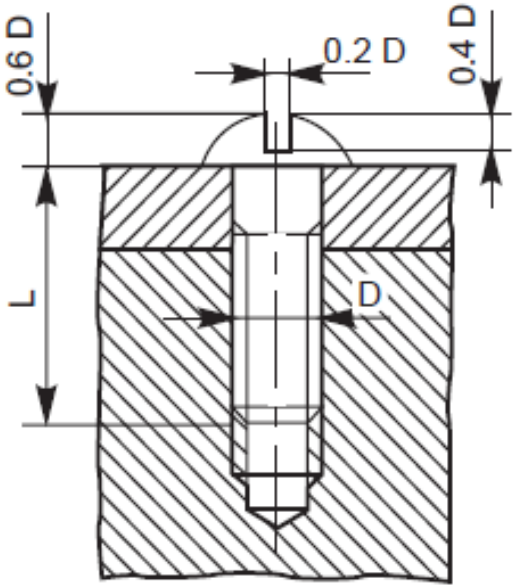
Screws



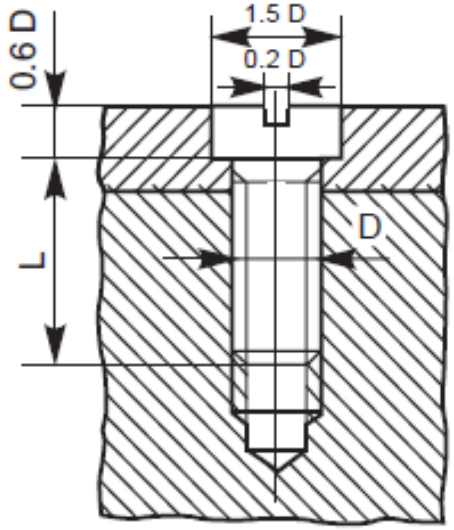
Hexagonal head



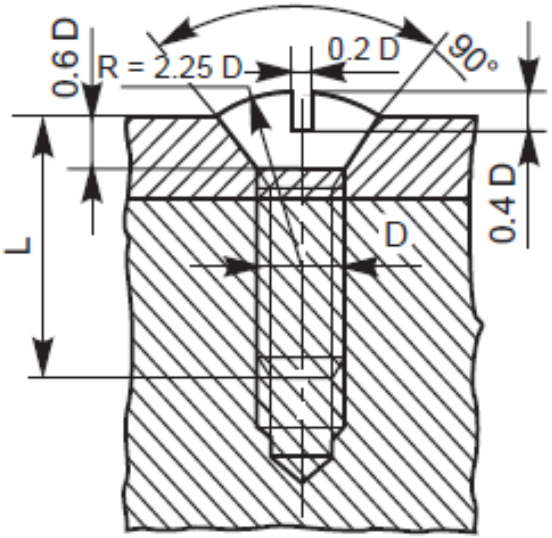
Flat head



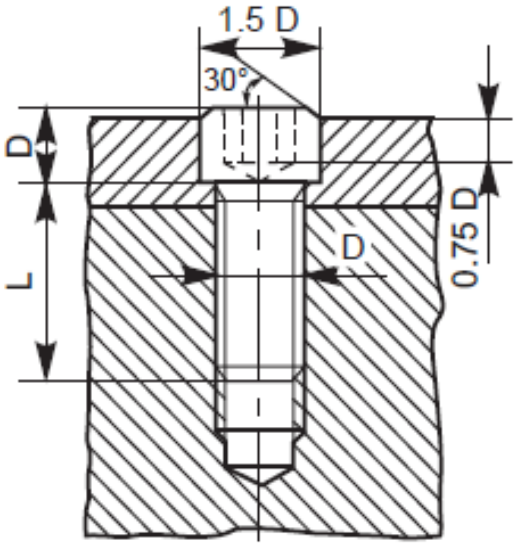
Round head



Cheese head



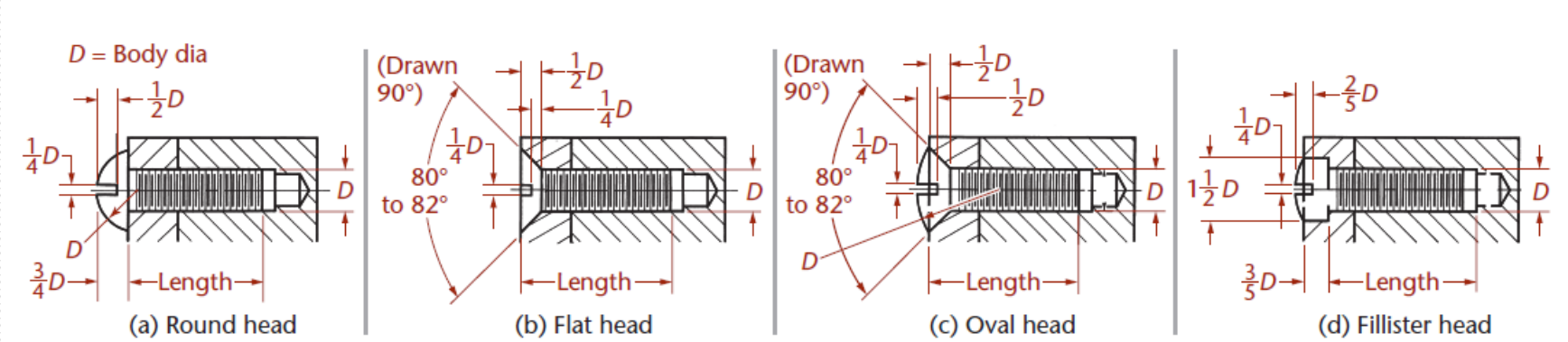
Oval head



Socket head

STANDARD MACHINE SCREWS

Machine screws are similar to cap screws but are usually smaller (.060" to .750" diameter) and the threads generally go all the way to the head.



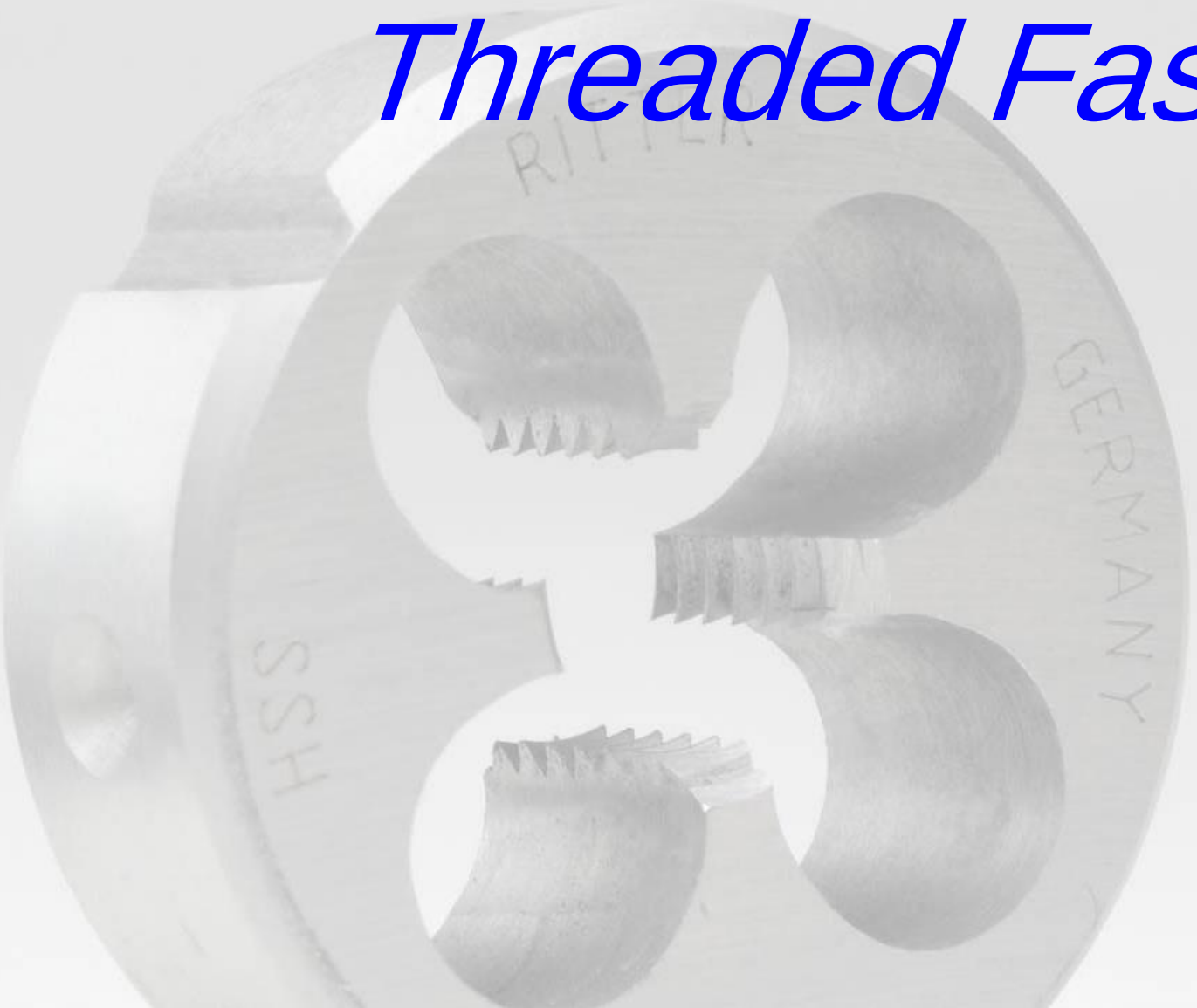
Clearance holes and counterbores should be made slightly larger than the screws. Typical machine screw notes are…

Example (complete)
NO. 10 (.1900) -32 NF-3 × 5/8
FILLISTER HEAD MACHINE SCREW

Example (abbreviated)
NO. 10 (.1900) × 5/8 FILH MSCR

Example (metric)
M8 × 1.25 × 30 SLOTTED PAN HEAD MACHINE SCREW

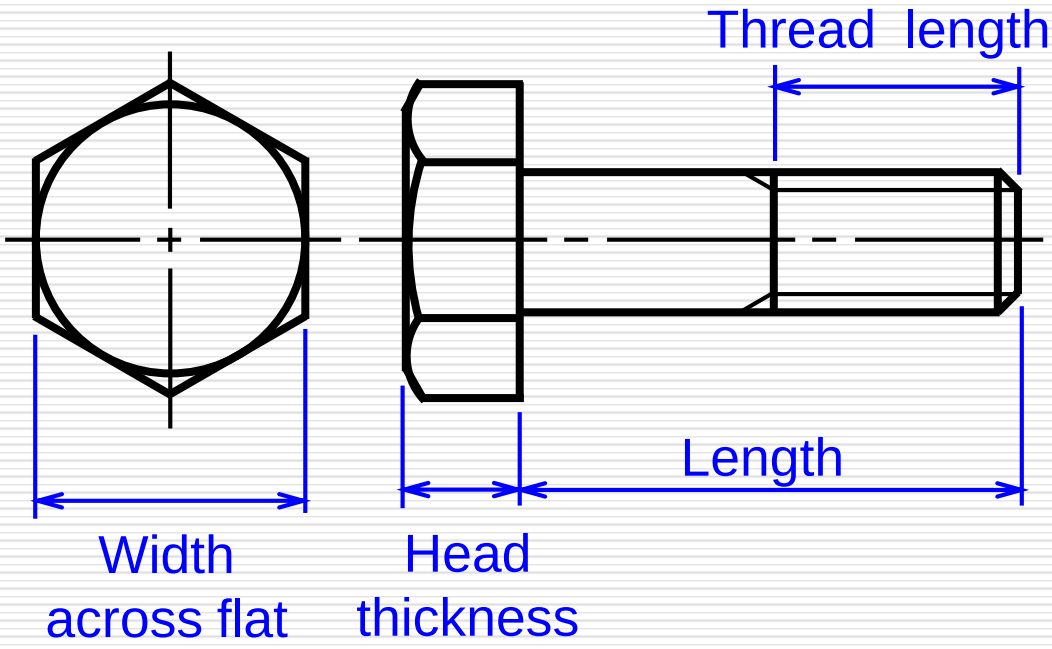
Threaded Fastener



BOLT : Terminology

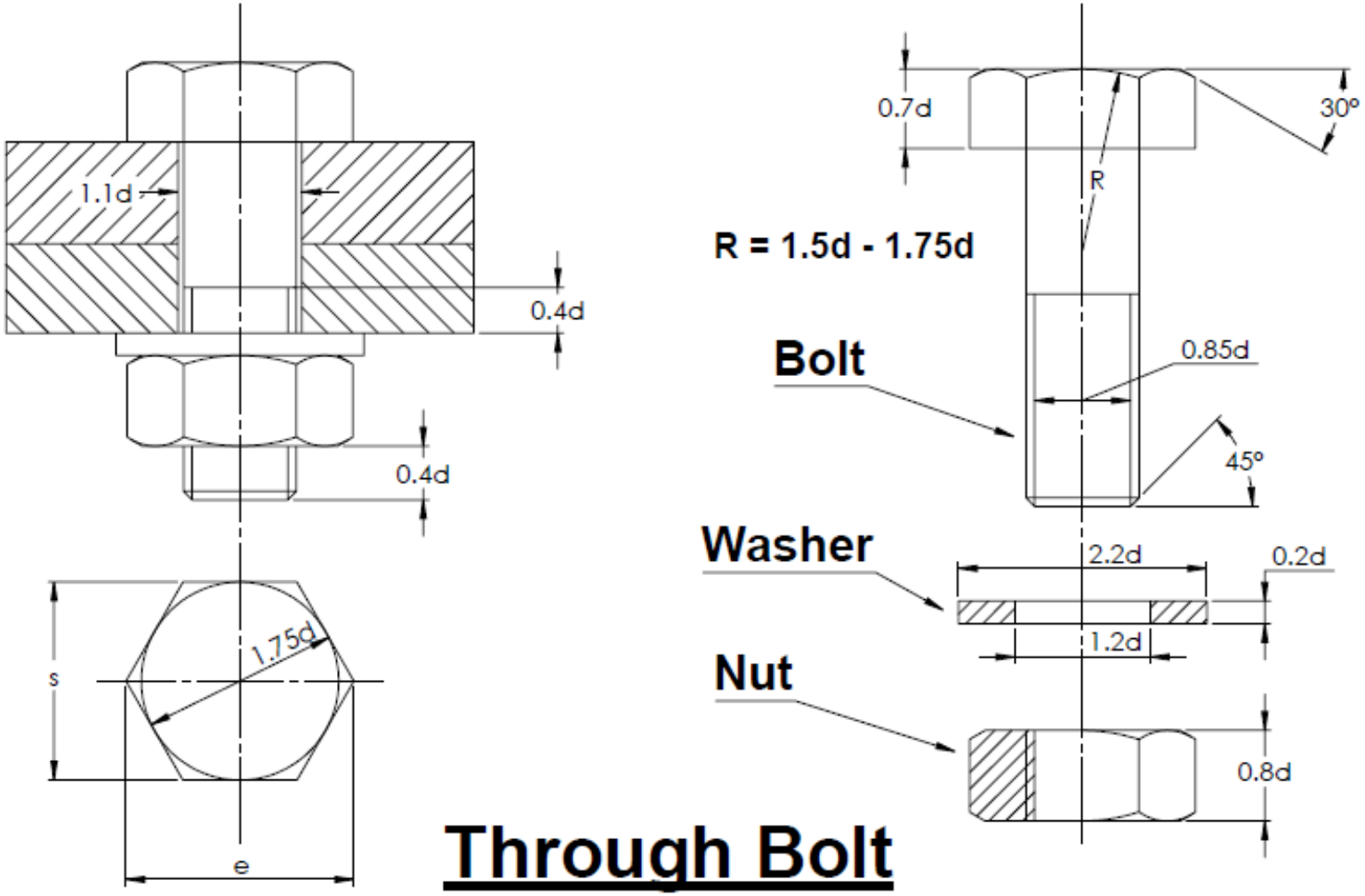
Bolt is a threaded cylinder with a head.

Hexagonal head bolt and nut



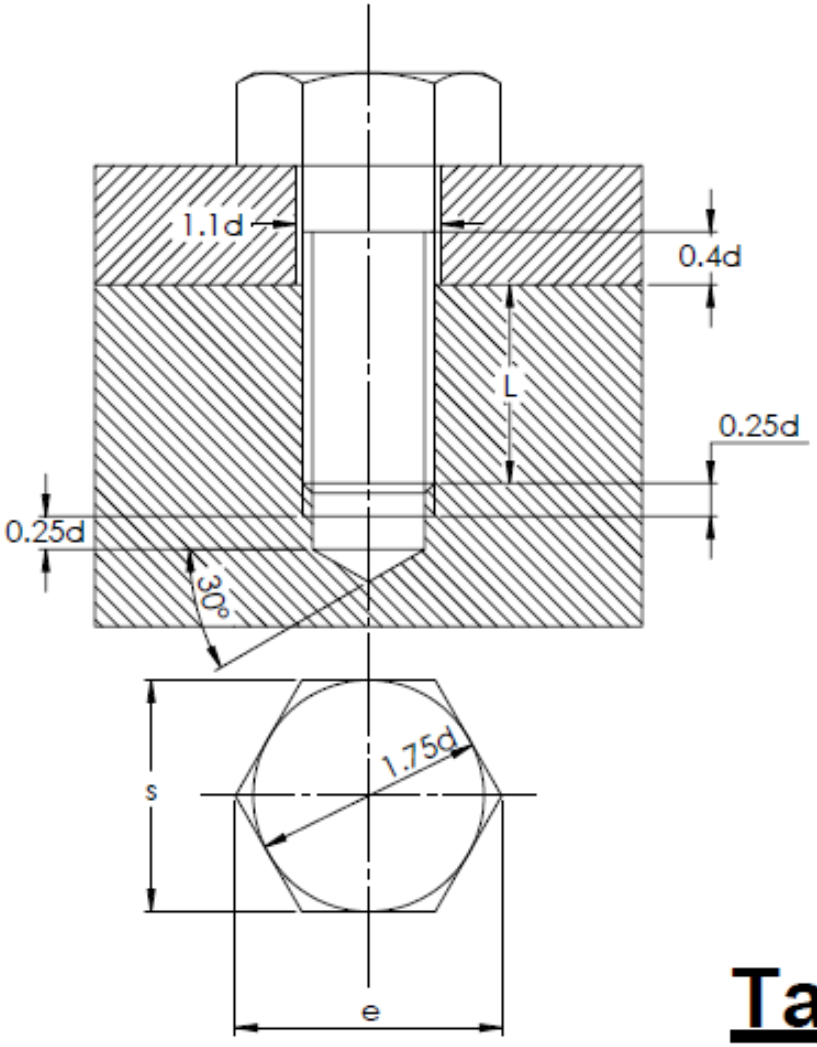
Dimensions of bolt's head are listed in table 9.4.

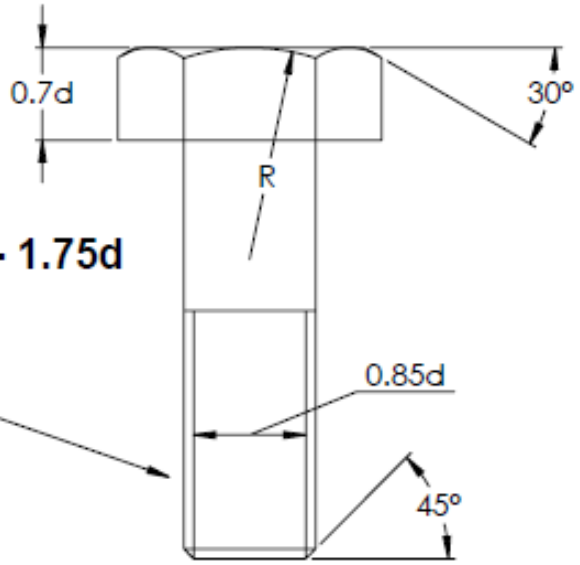
Fasteners Bolts



Through Bolt

Fasteners Bolts





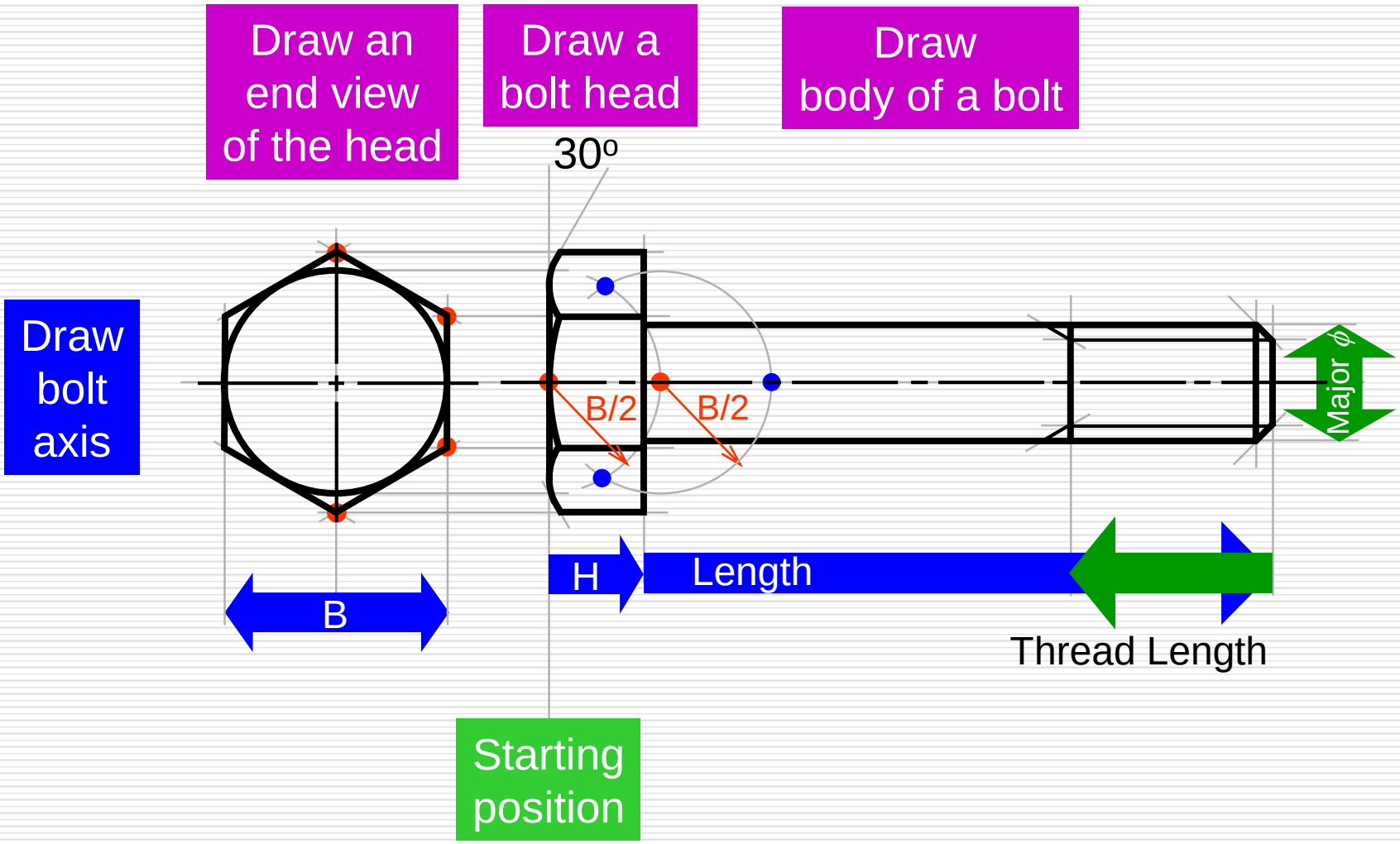
R = 1.5d - 1.75d

Bolt

L = d for Steel
L = 1.5d for Cast Iron (C.I.)

Tap Bolt

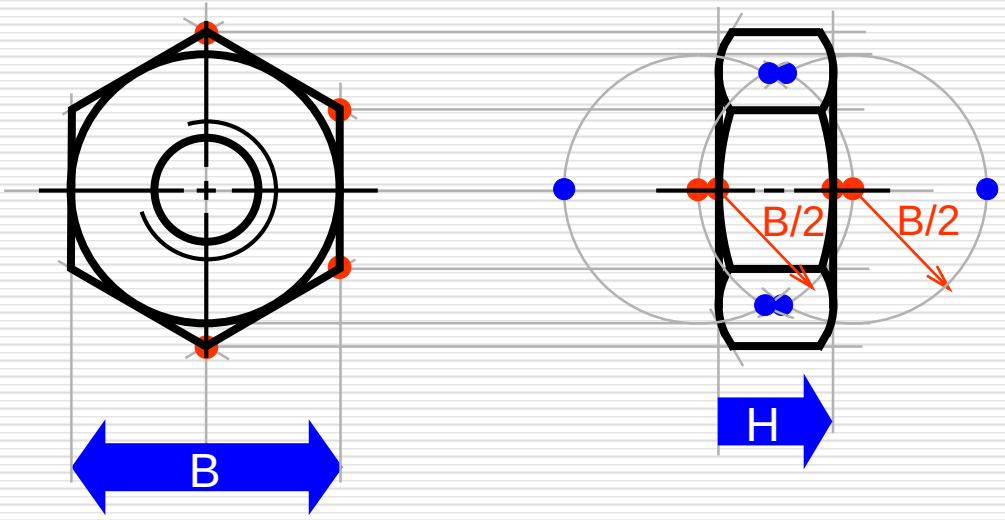
BOLT : Drawing steps



NUT : Drawing steps

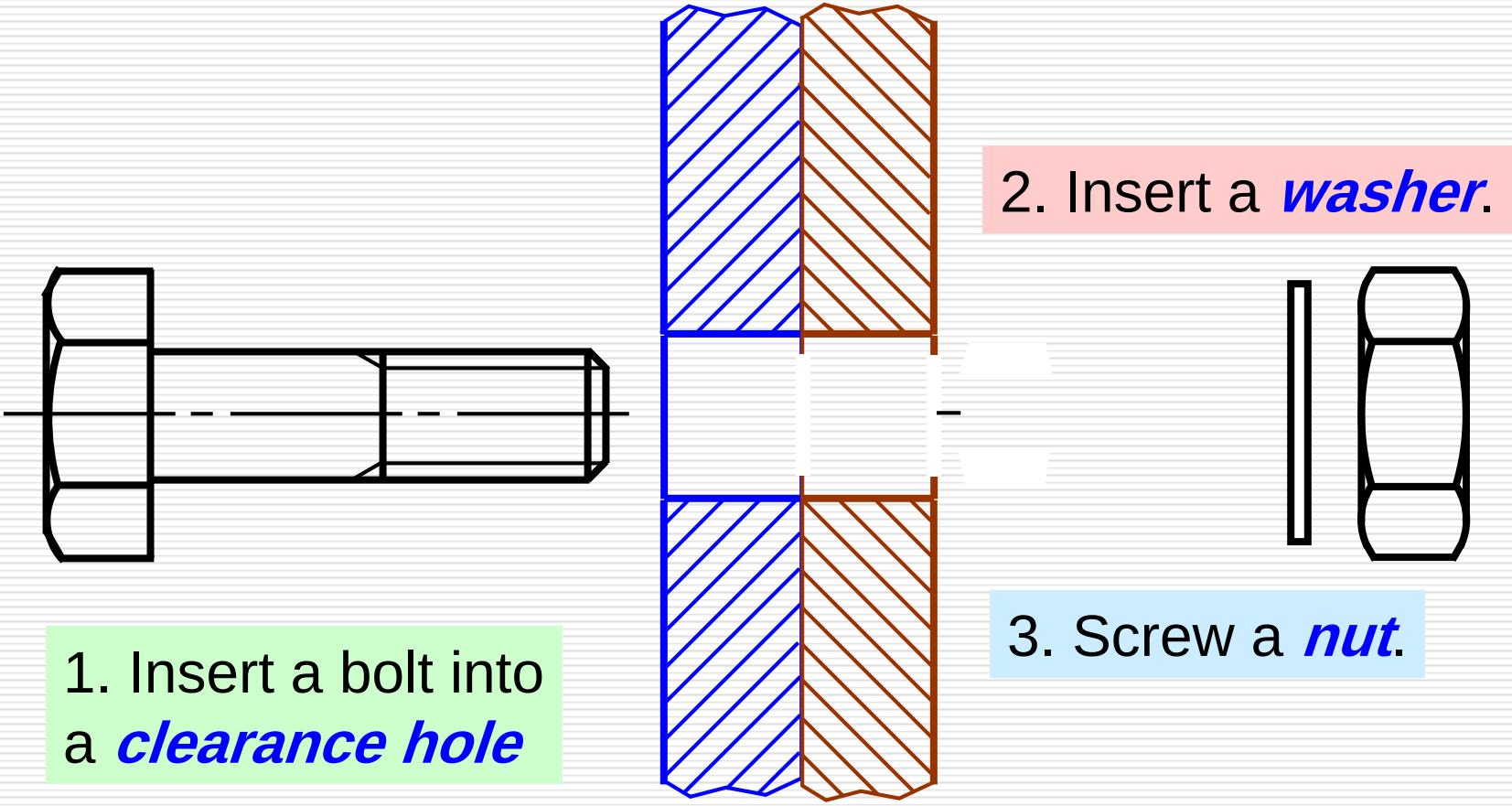
Dimensions of the nut are given in Table 9.14.

Draw an end view of the nut



Dash lines represent a threaded hole are omitted for clarity.

BOLT : Application



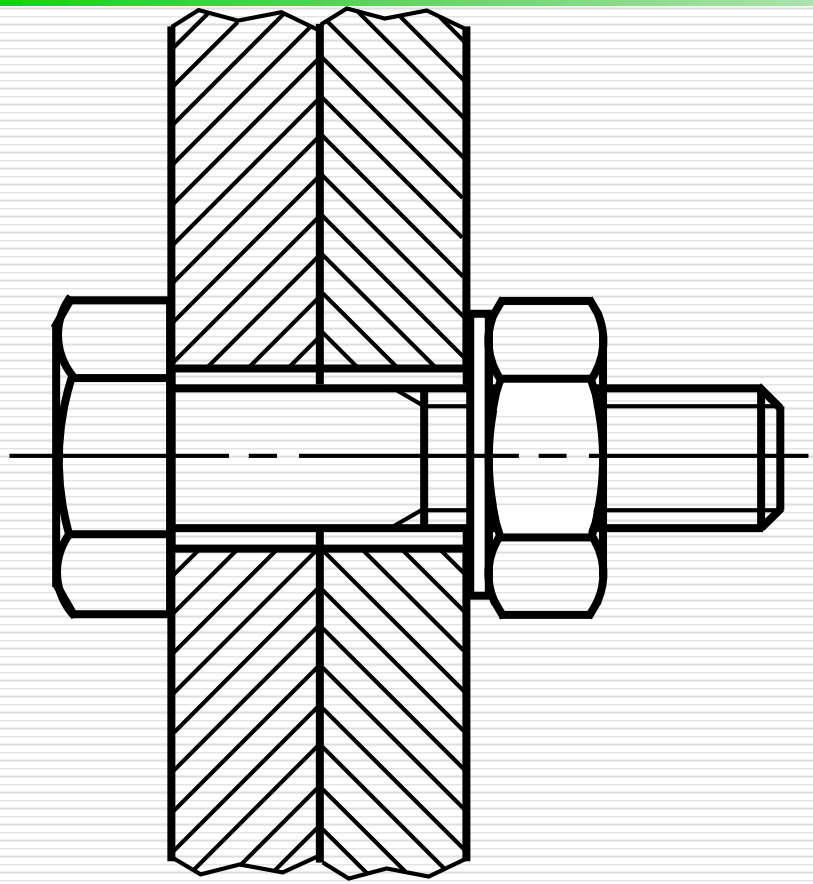
1. Insert a bolt into a ***clearance hole***

2. Insert a ***washer***.

3. Screw a ***nut***.

Let’ s think together…

- What do you think about the following suggestions for design ***improvement***?



(A) Nothing have to be changed.

(B) Use shorter bolt with the same thread length.

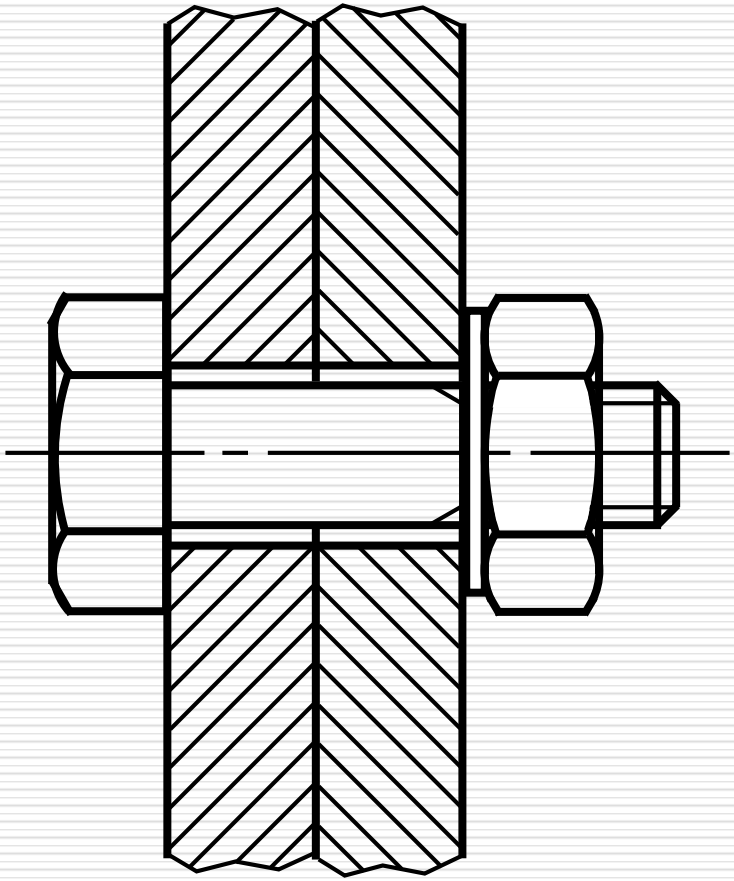
(C) Reduce the thread length.

(D) Add washer or nut.

Correct | Inappropriate | Wrong

Let’ s think together…

- What do you think about the following suggestions for design ***improvement***?



(A) Nothing have to be changed.

(B) Use a bolt of this length but has a longer thread length.

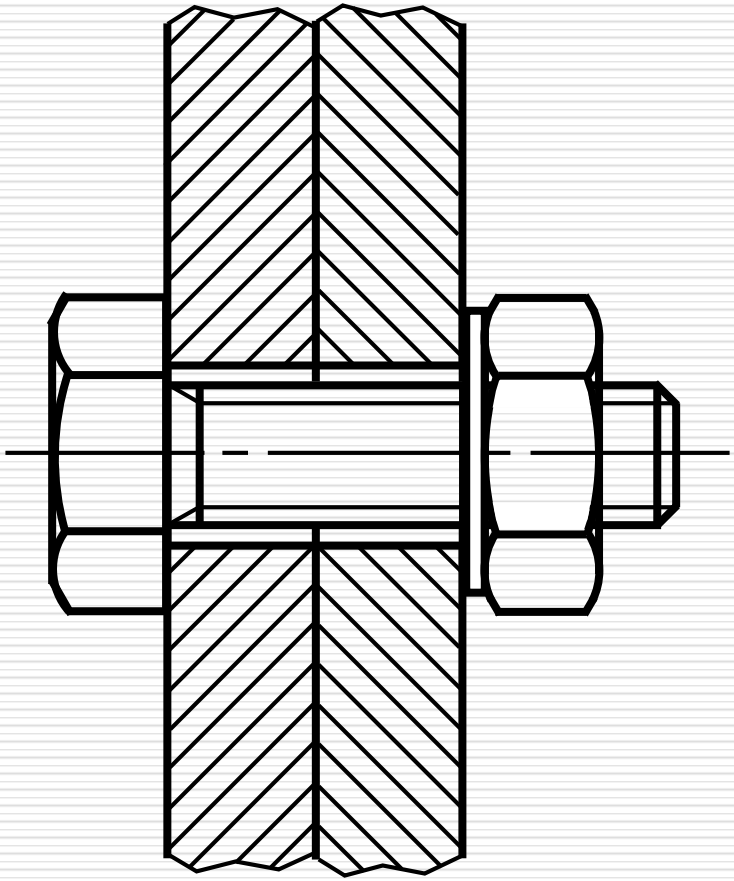
(C) Use a longer bolt with the same thread length.

(D) Add washer.

Correct | Inappropriate | Wrong

Let’ s think together…

- What do you think about the following suggestions for design ***improvement*** ?



(A) Nothing have to be changed.

(B) Use a bolt of this length but has a shorter thread length.

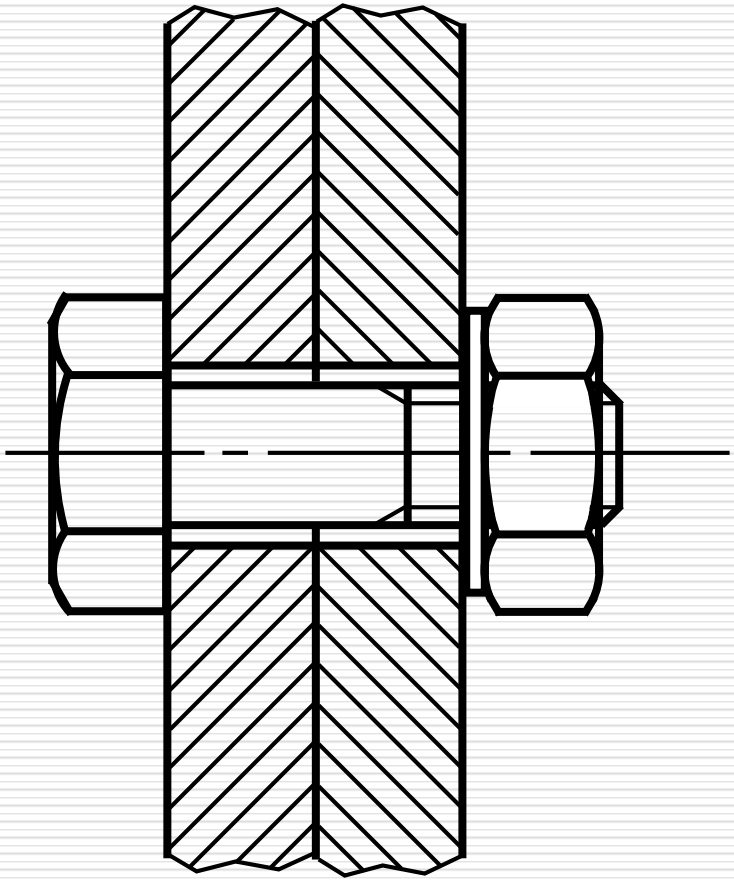
(C) Use a longer bolt with the same thread length.

(D) Add washer.

Correct | Inappropriate | Wrong

Let’ s think together…

- What do you think about the following suggestions for design ***improvement***?



(A) Use a bolt of this length but has a shorter thread length.

(B) Use a longer bolt with the same thread length.

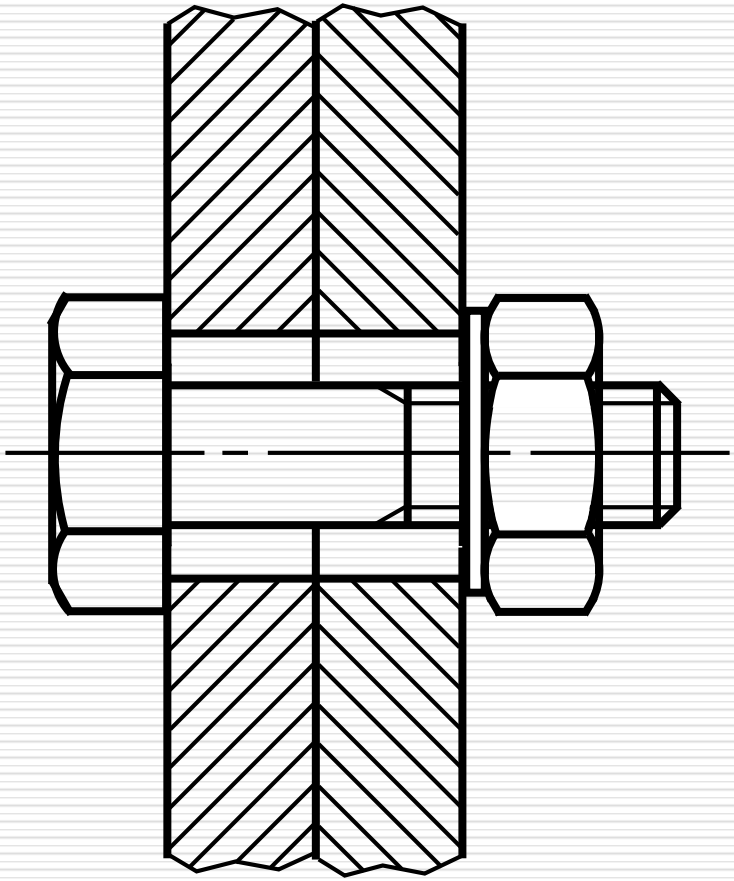
(C) Use a longer bolt by increasing a thread length

(D) Remove washer.

Correct | Inappropriate | Wrong

Let’ s think together…

- What do you think about the following suggestions for design ***improvement*** ?



(A) Increase the bolt diameter.

(B) Use washer with larger outside diameter.

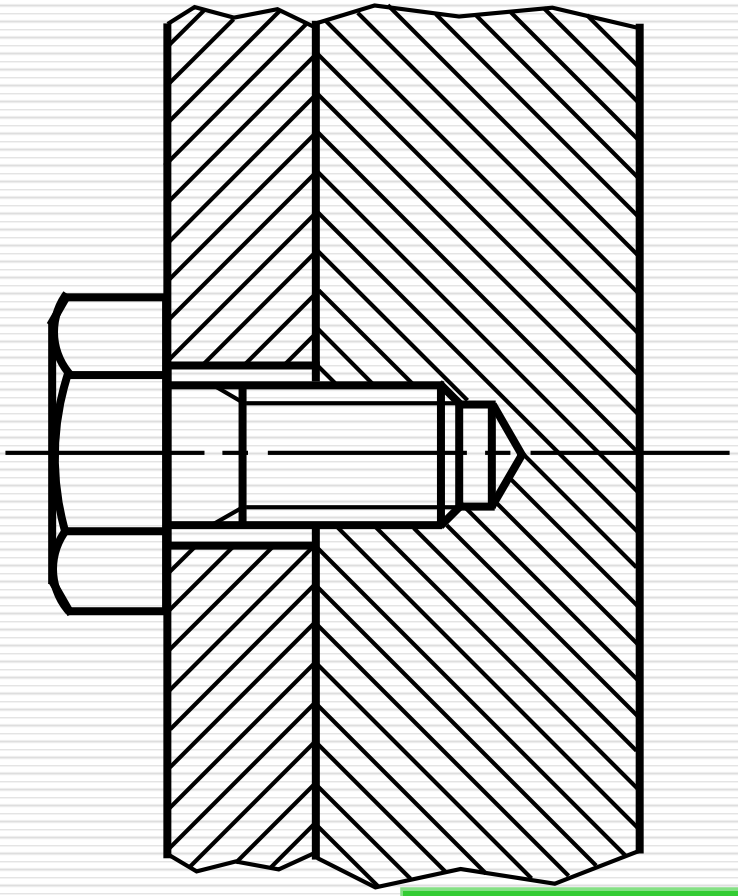
(C) Reduce the hole diameter.

(D) Add washer at bolt head.

Correct | Inappropriate | Wrong

Let’ s think together…

- What do you think about the following suggestions for design ***improvement*** ?



(A) Nothing have to be changed.

(B) Use a bolt with shorter thread length.

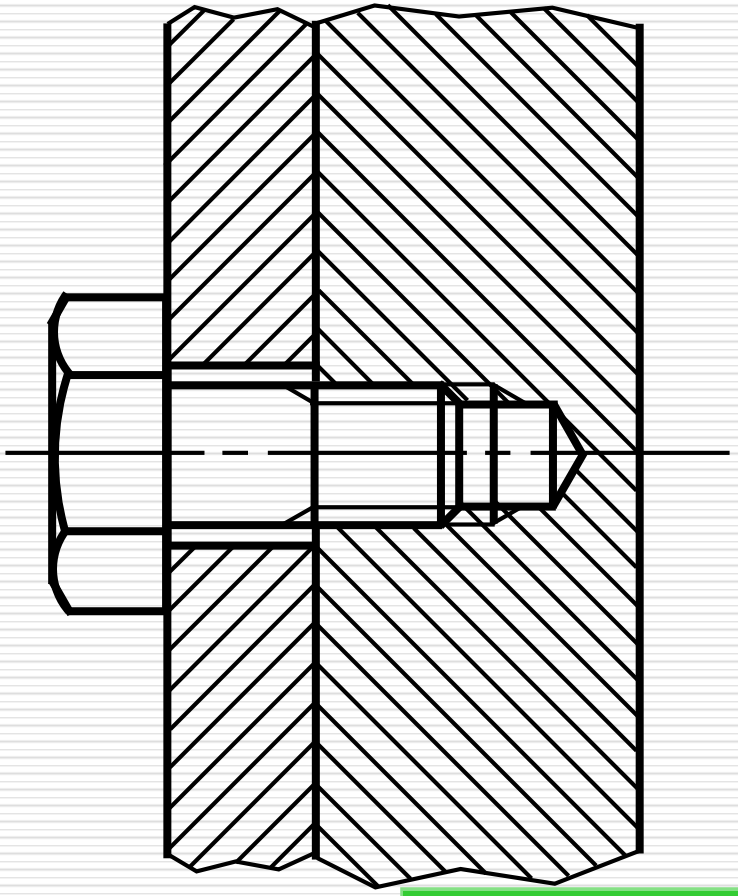
(C) Add washer.

(D) Increase drill and thread depths.

Correct | Inappropriate | Wrong

Let’ s think together…

- What do you think about the following suggestions for design ***improvement*** ?



(A) Nothing have to be changed.

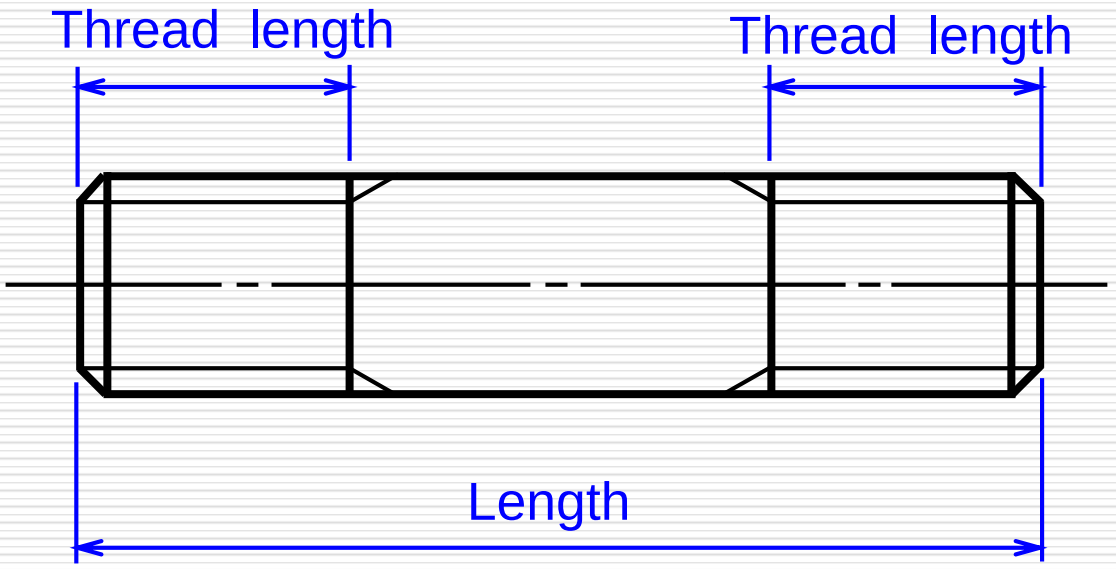
(B) Use a bolt with slightly longer thread length.

Correct | Inappropriate | Wrong

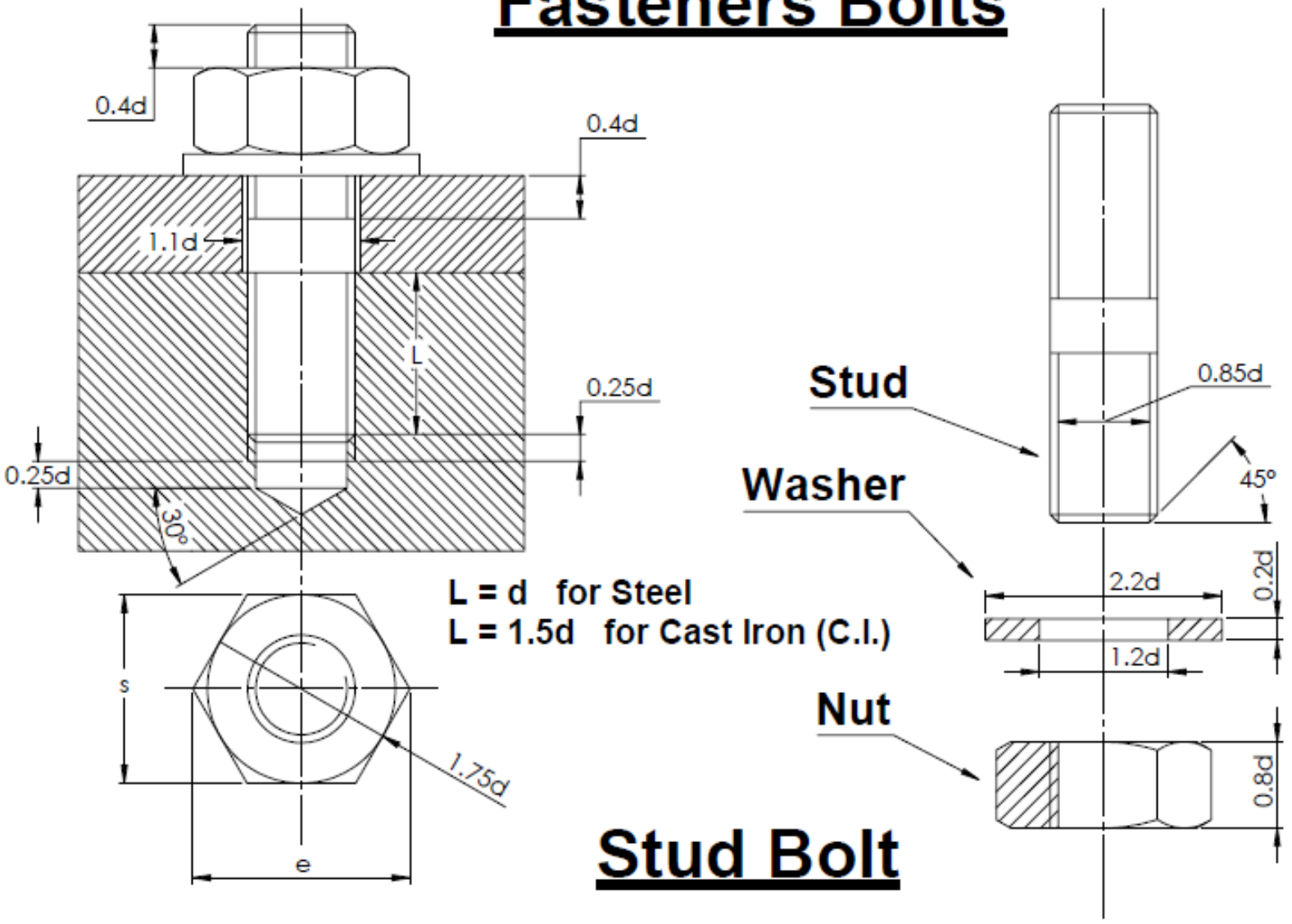
STUD : Terminology

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

Drawing representation



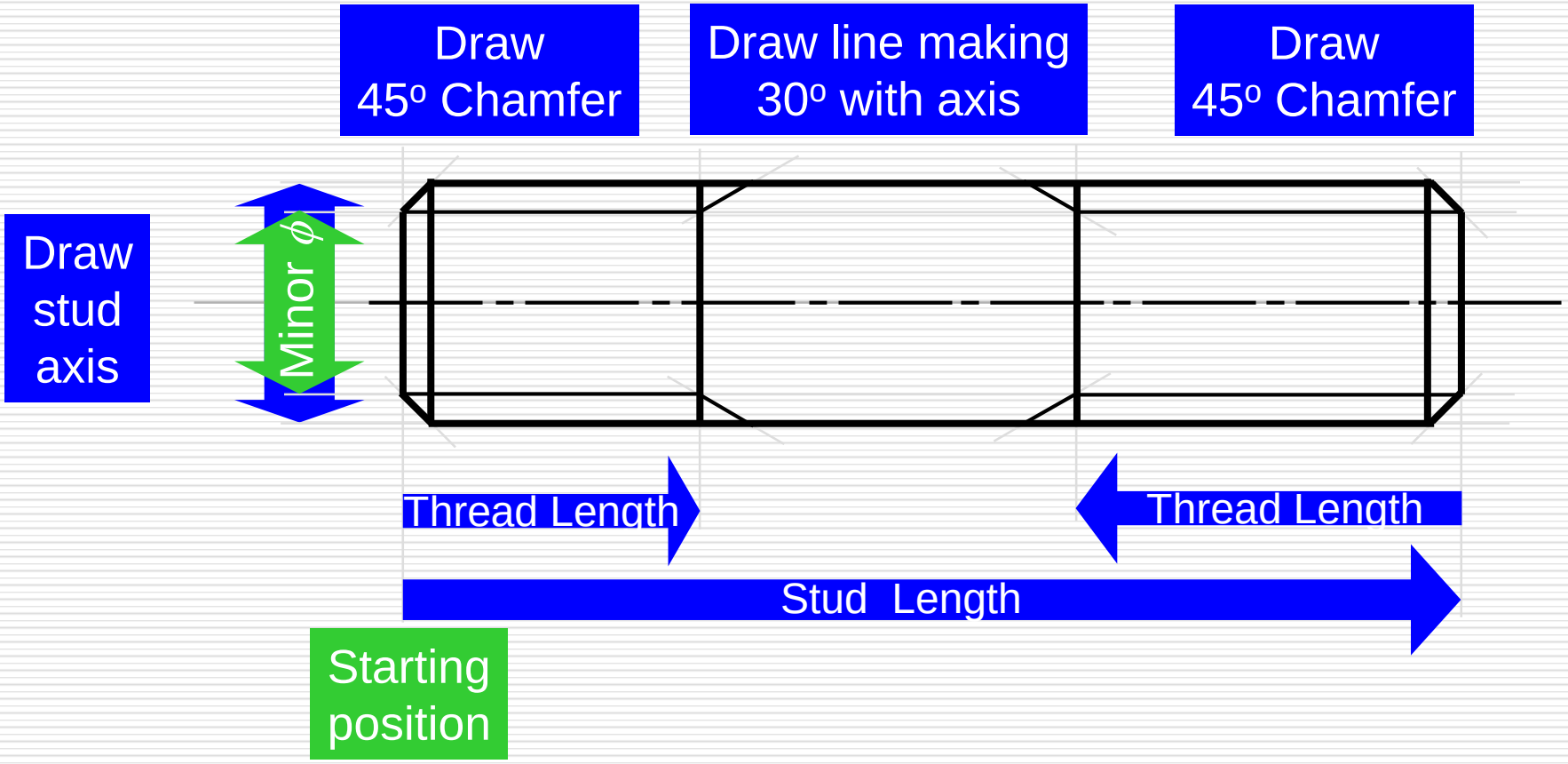
Fasteners Bolts



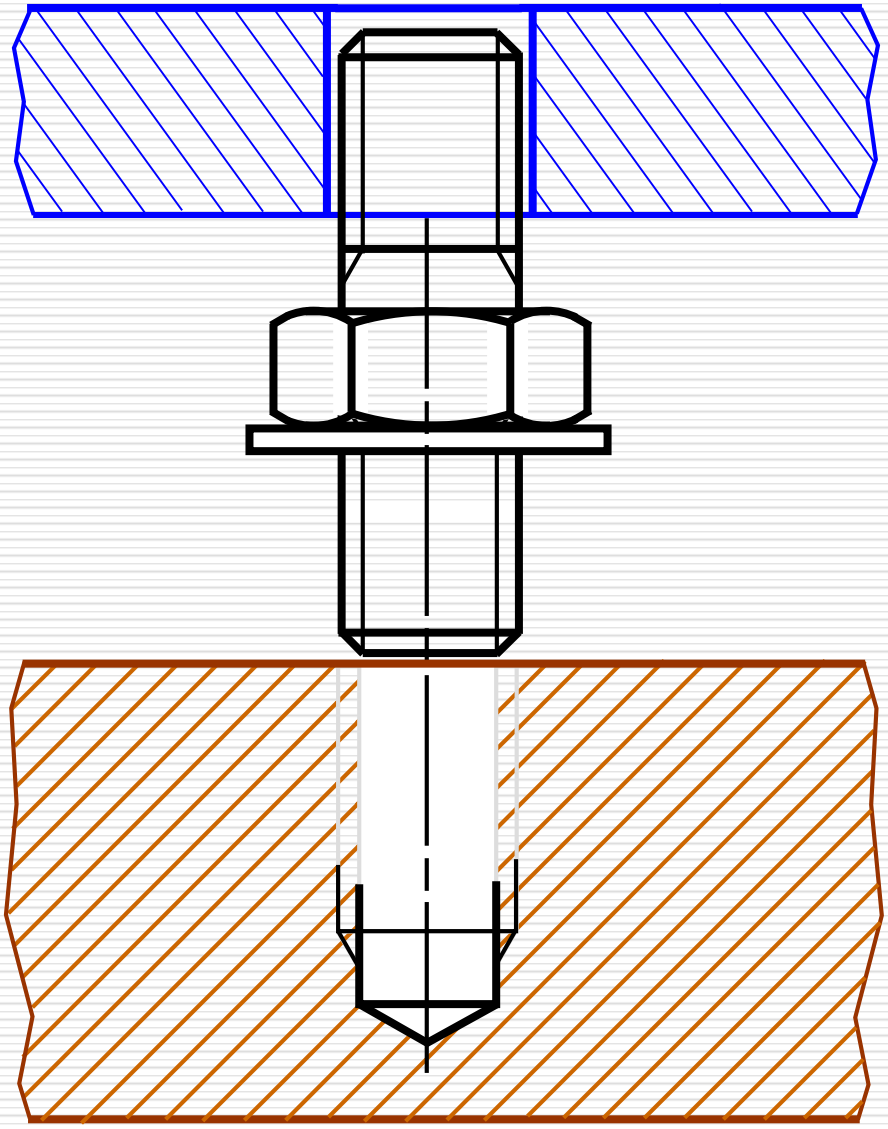
L = d for Steel
L = 1.5d for Cast Iron (C.I.)

Stud Bolt

STUD : Drawing steps

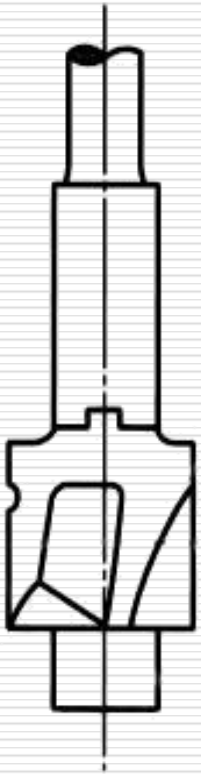


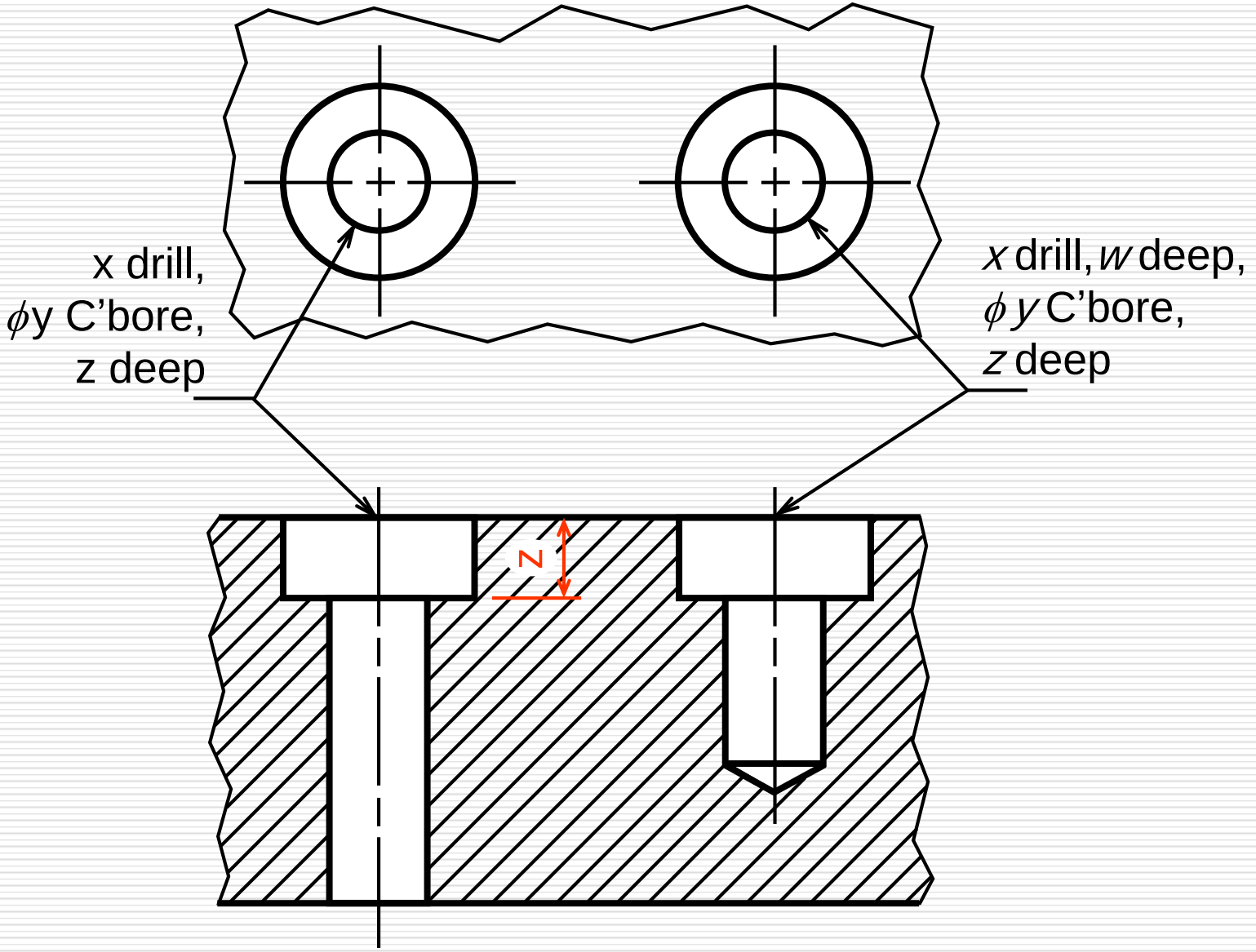
STUD : Application



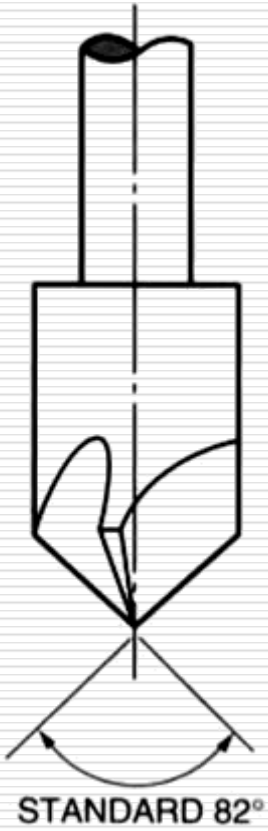
1. Drill a hole.
2. Tap a hole.
3. Screw a stud.
4. Place the part to be fastened.
5. Insert washer and fastened a nut.

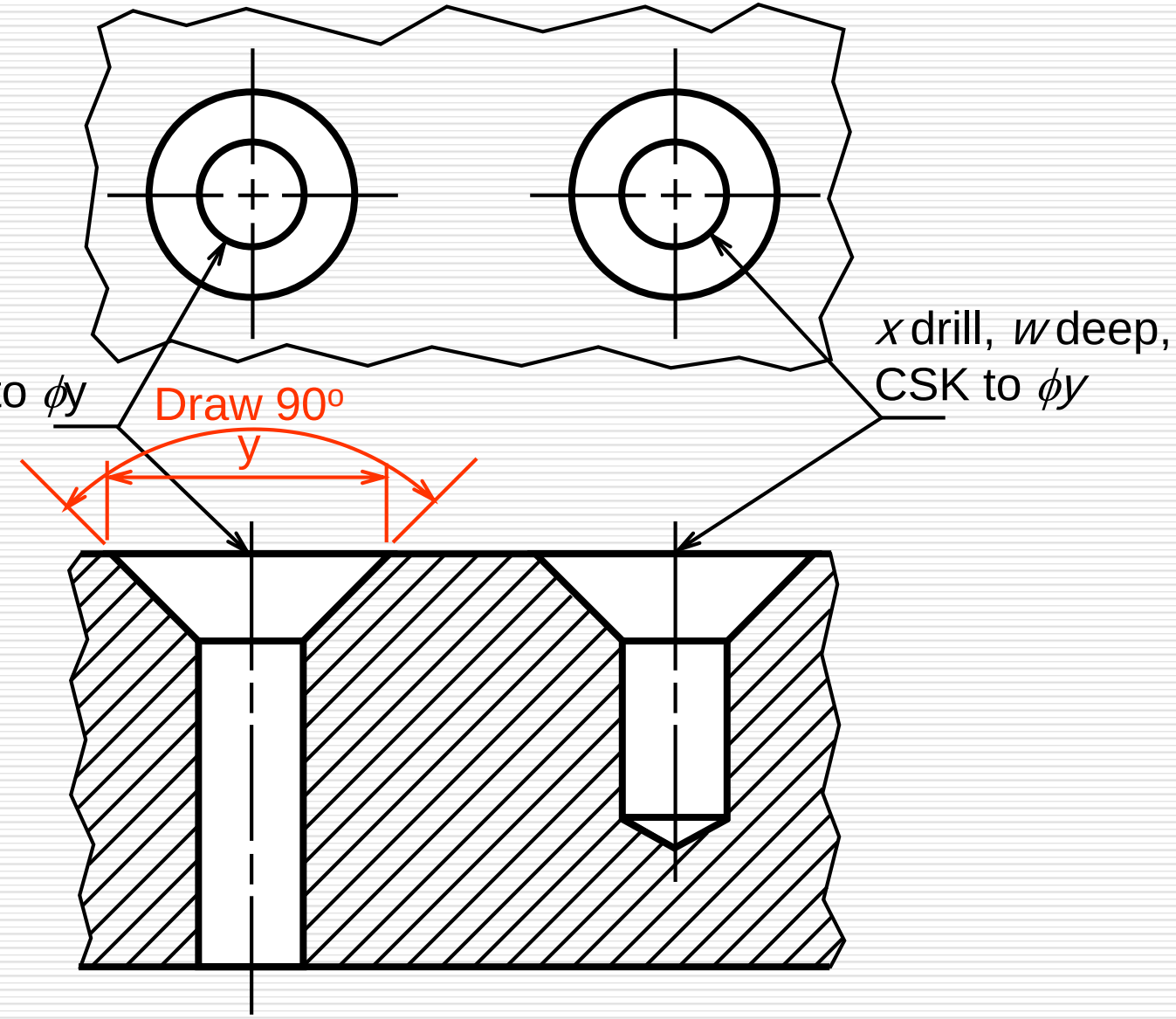
CAP SCREW : Counterbore hole





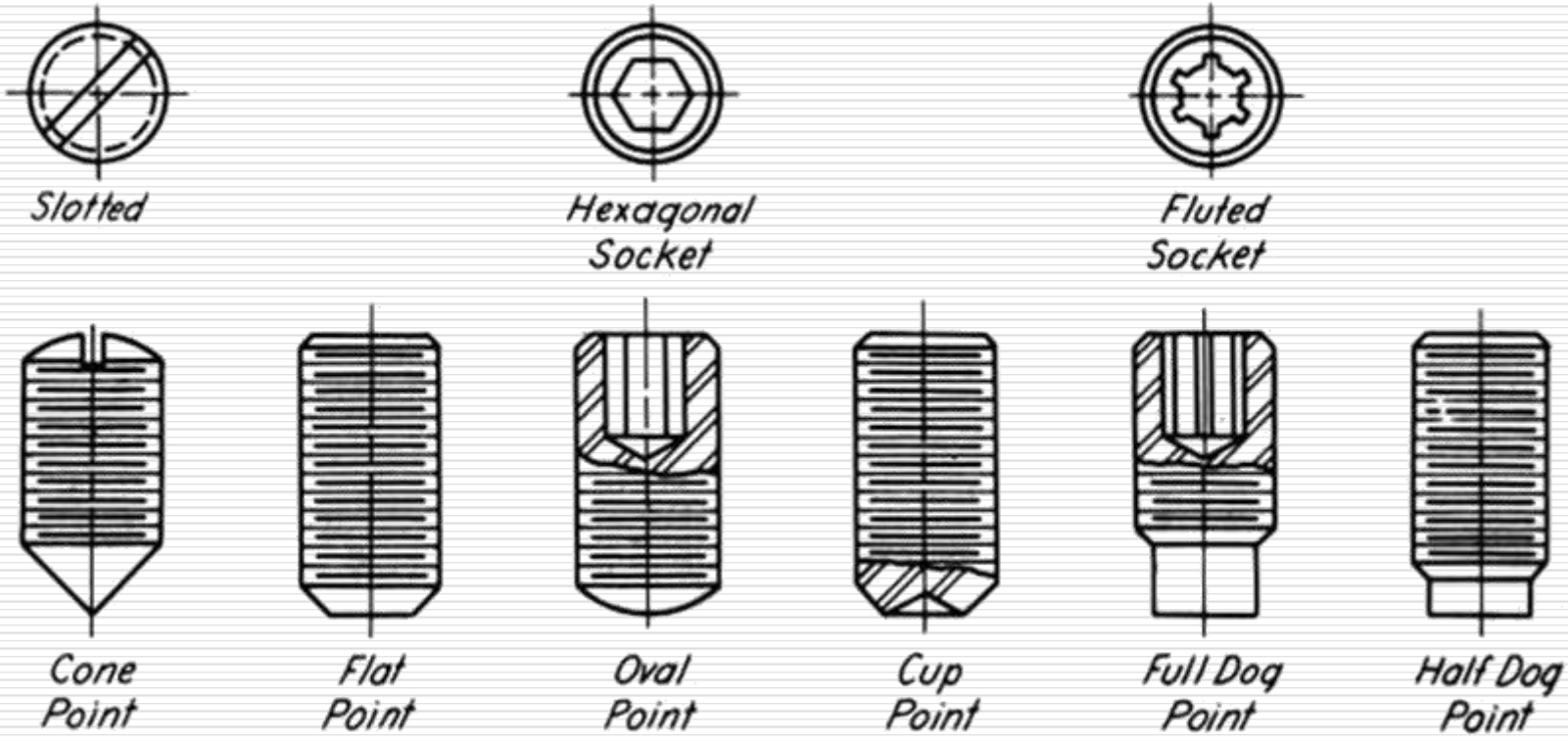
CAP SCREW : Countersink hole



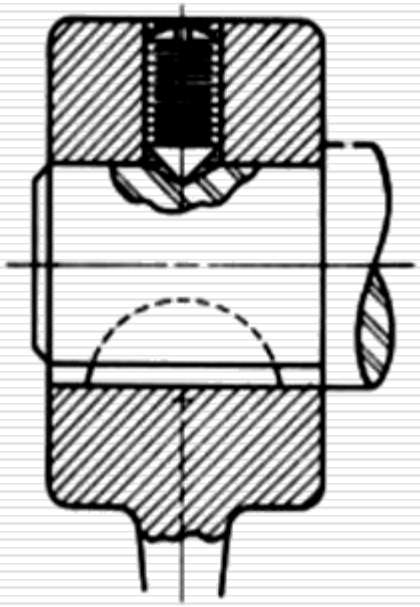


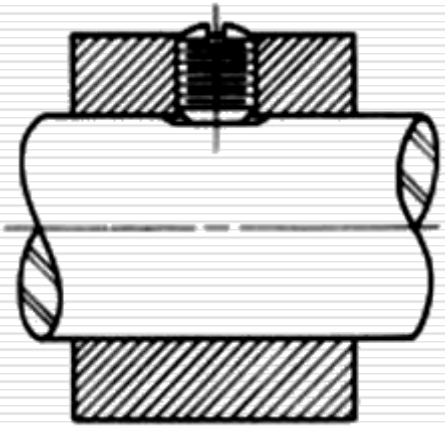
SET SCREW : Terminology

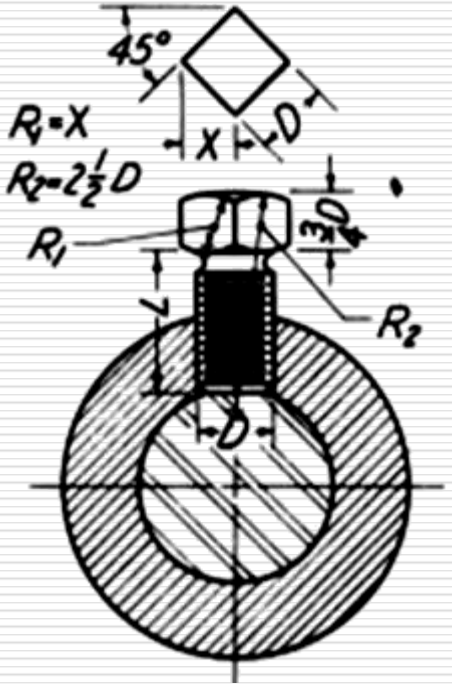
Set screw is a threaded cylinder used to prevent rotation or movement between parts.



SET SCREW : Application



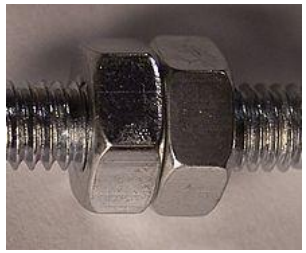




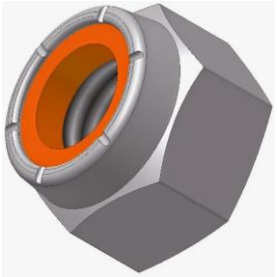
- Setscrew

- washer

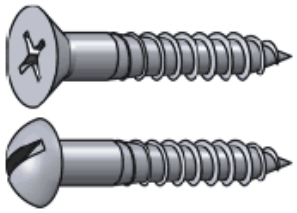
- Nuts
  - Slotted nut
  - jam nut



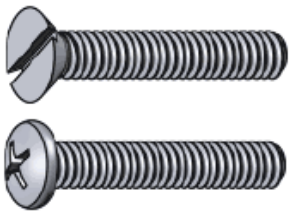
- Prevailing torque locknut



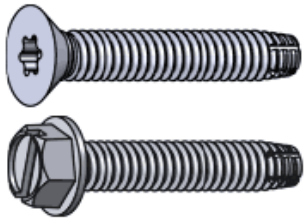
Design (Configuration)



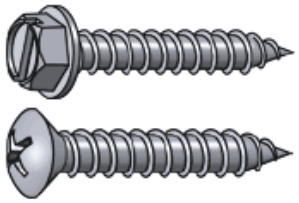
Wood Screws
Screws with a smooth shank and tapered point for use in wood. Abbreviated WS



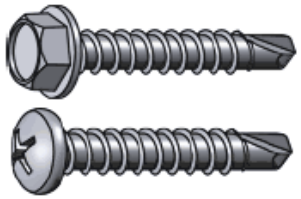
Machine Screws
Screws with threads for use with a nut or tapped hole. Abbreviated MS



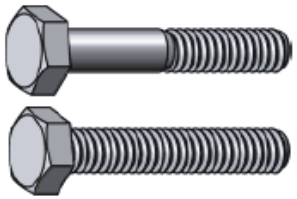
Thread Cutting Machine Screws
Machine screws with a thread cutting (self tapping) point.



Sheet Metal Screws
Fully threaded screws with a point for use in sheet metal. Abbreviated SMS



Self Drilling SMS
A sheet metal screw with a self drilling point.



Hex Bolts
Bolts with a hexagonal head with threads for use with a nut or tapped hole. Abbreviated HHMB or HXBT.

Carriage Bolts
Bolts with a smooth rounded head that has a small square section underneath.

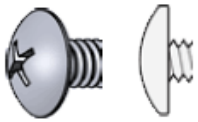
Lag Bolts
Bolts with a wood thread and pointed tip. Abbreviated Lag.

Design (Head Style)

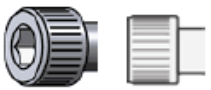
Flat
A countersunk head with a flat top.
Abbreviated FH

Oval
A countersunk head with a rounded top.
Abbreviated OH or OV

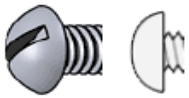
Pan
A slightly rounded head with short vertical sides.
Abbreviated PN



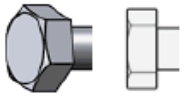
Truss
An extra wide head with a rounded top.



Socket Cap
A small cylindrical head using a socket drive.



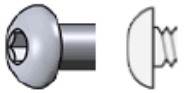
Round
A domed head.
Abbreviated RH



Hex
A hexagonal head
Abbreviated HH or HX

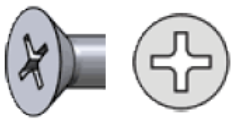
Hex Washer
A hex head with built in washer.

Slotted Hex Washer
A hex head with built in washer and a slot.

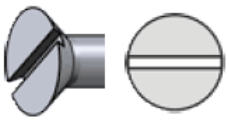


Button
A low-profile rounded head using a socket drive.

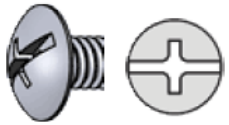
Design (Drive Type)



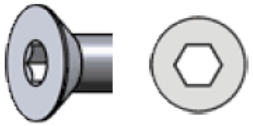
Phillips and Frearson
An X-shaped drive.
Abbreviated PH



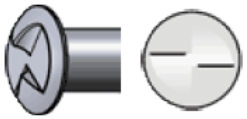
Slotted
A slot in the head.
Abbreviated SL



Combination
A combination of slotted and Phillips drives.
Abbreviated combo



Socket, Hex or Allen
A hexagonal hole for use with an Allen wrench.



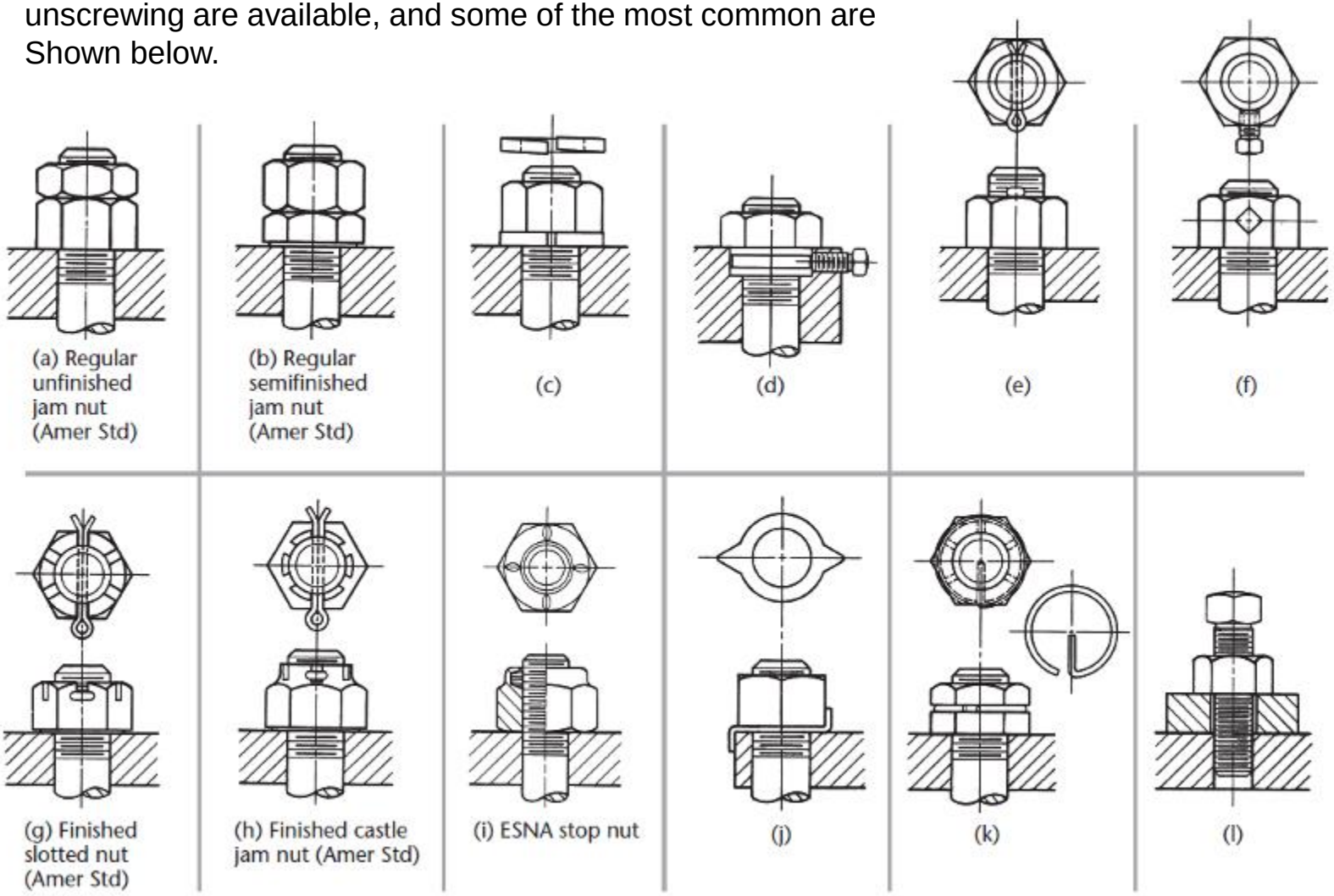
One Way
Installs with a normal slotted driver but can not be removed without special tools.

Square
Also known as Robertson drive.
Abbreviated SQ or SD.

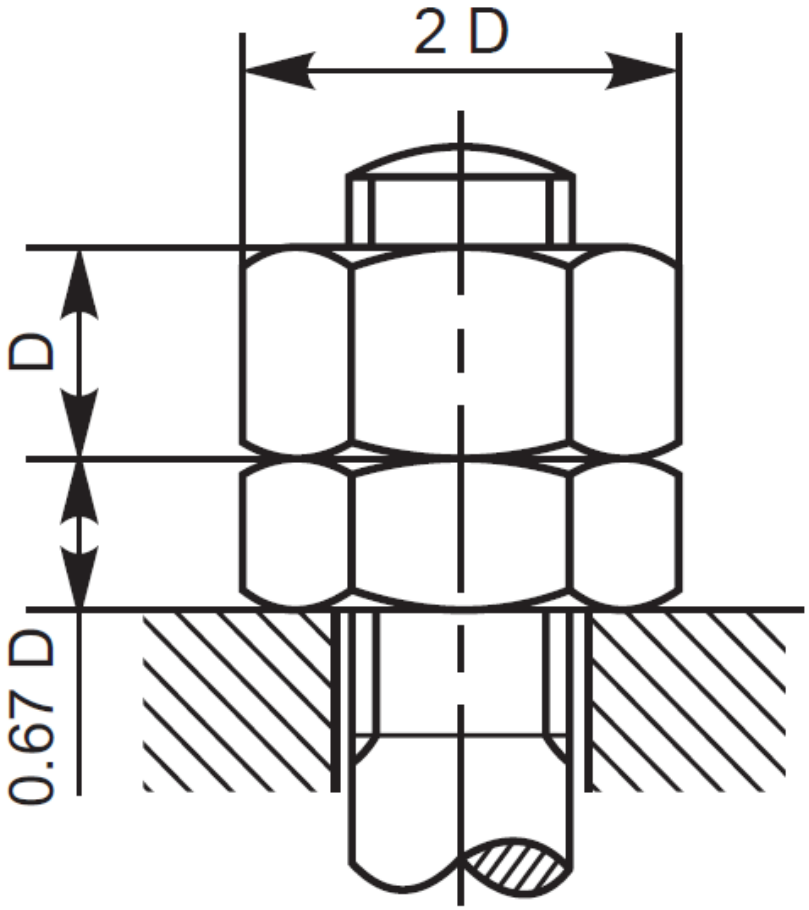
Torx
A six-pointed star pattern, specifically designed to prevent cam-out and stripped heads.

Locknuts and Locking Devices

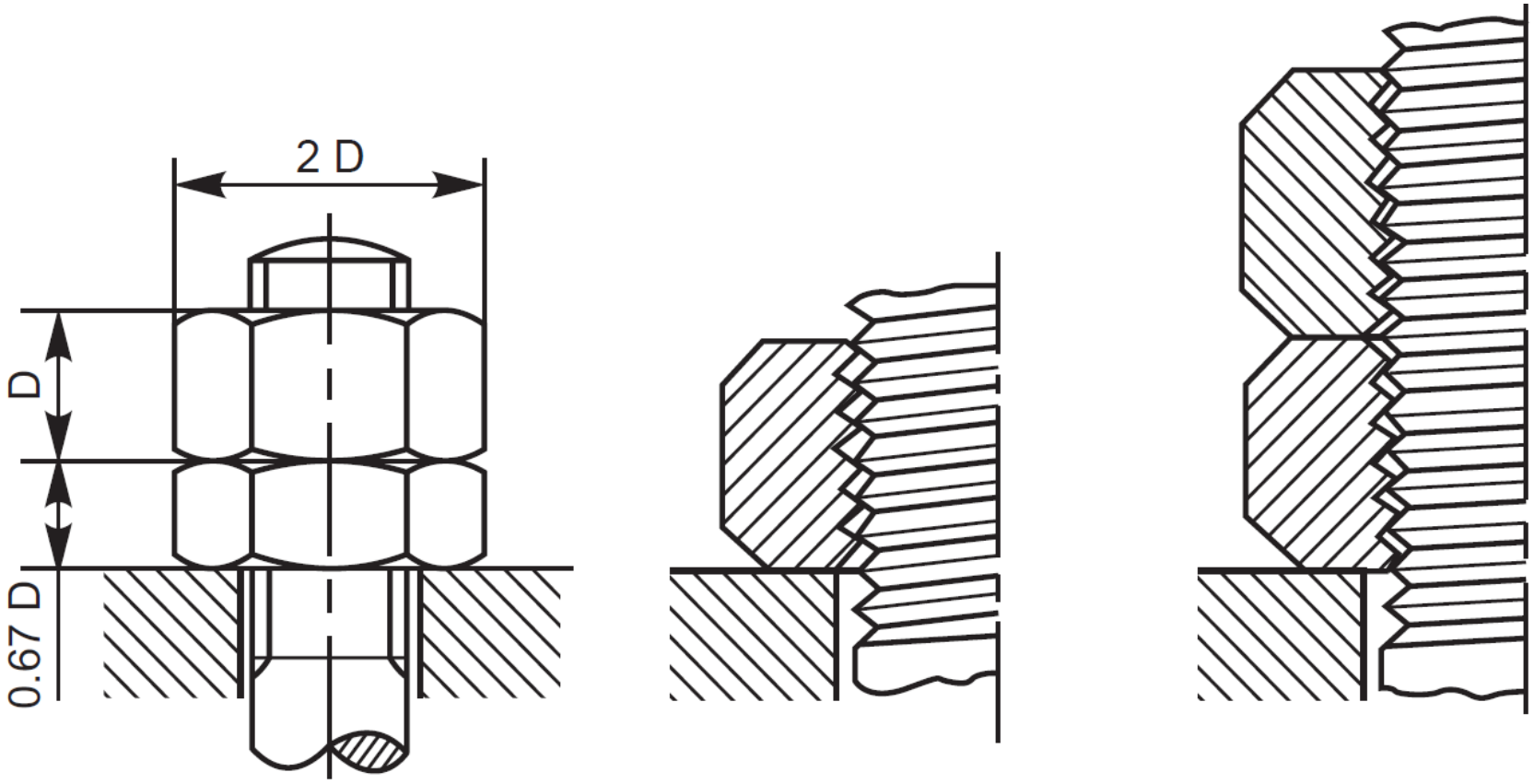
Many types of special nuts and devices to prevent nuts from unscrewing are available, and some of the most common are Shown below.



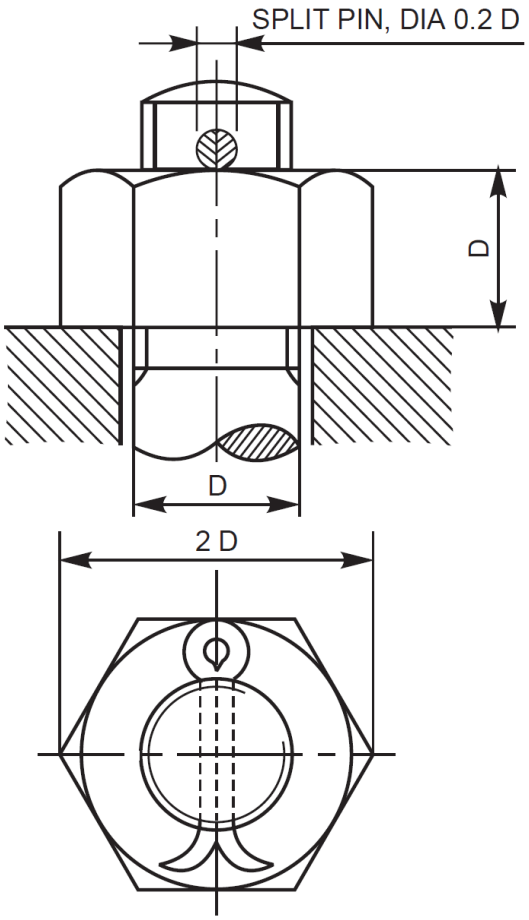
Lock nut



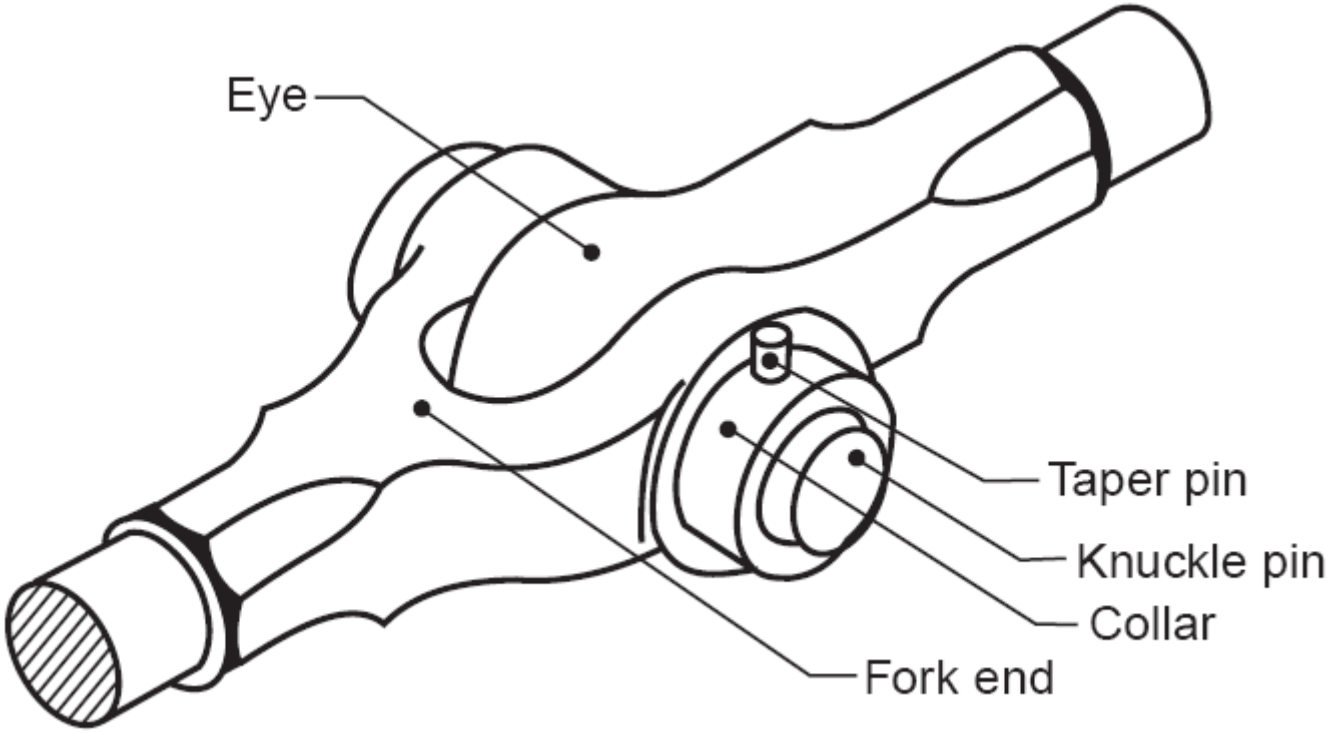
Lock nut



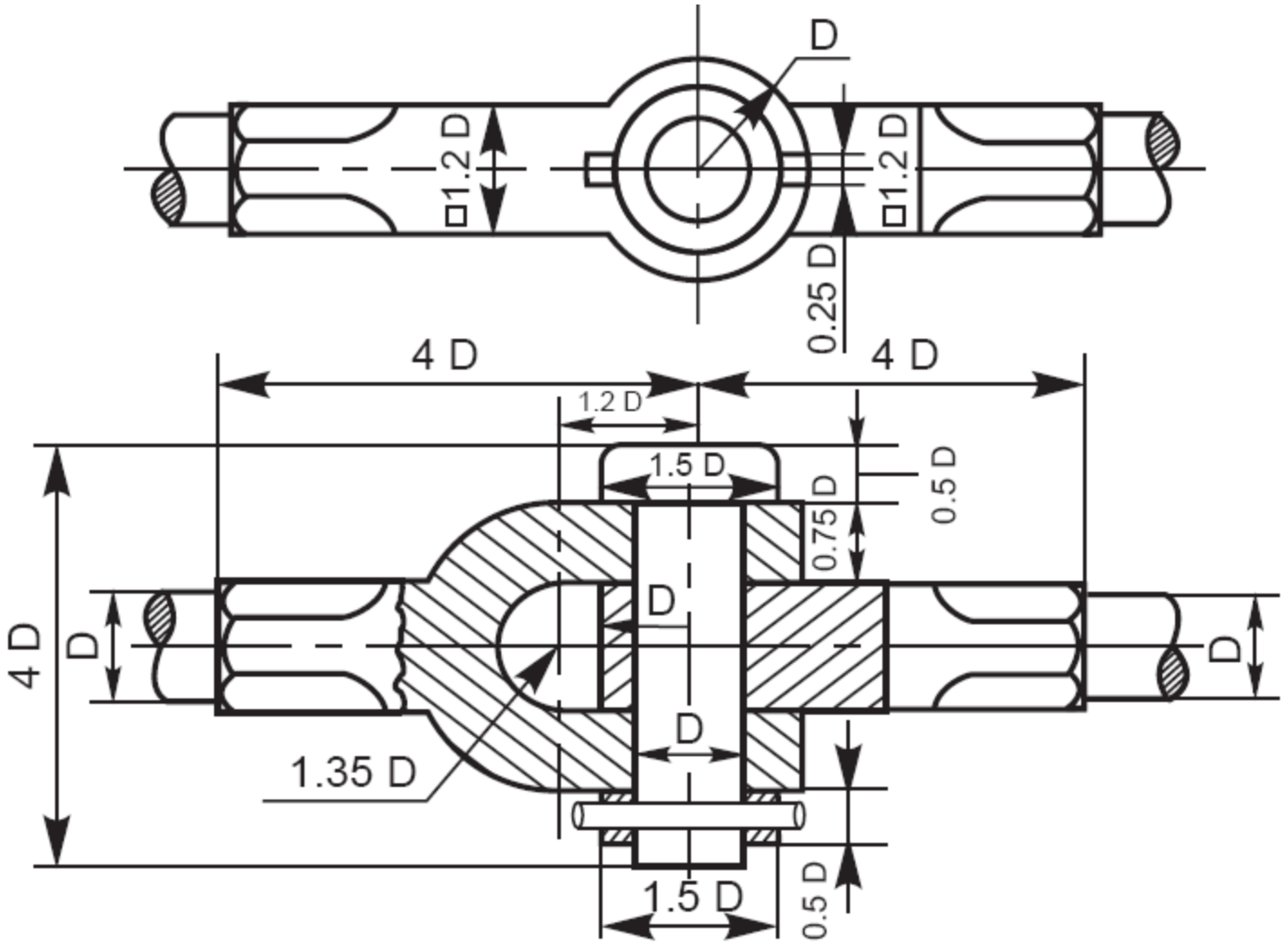
Locking by split pin



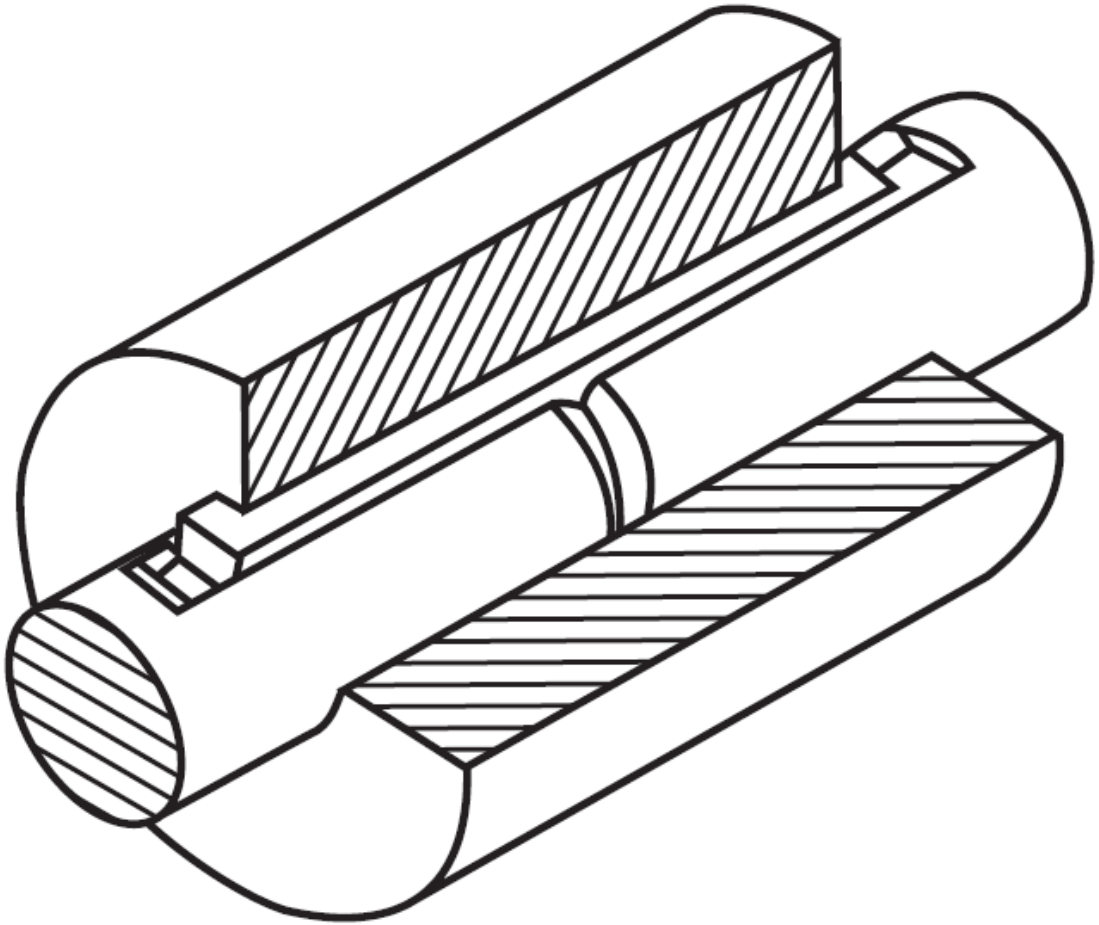
Knuckle Joint



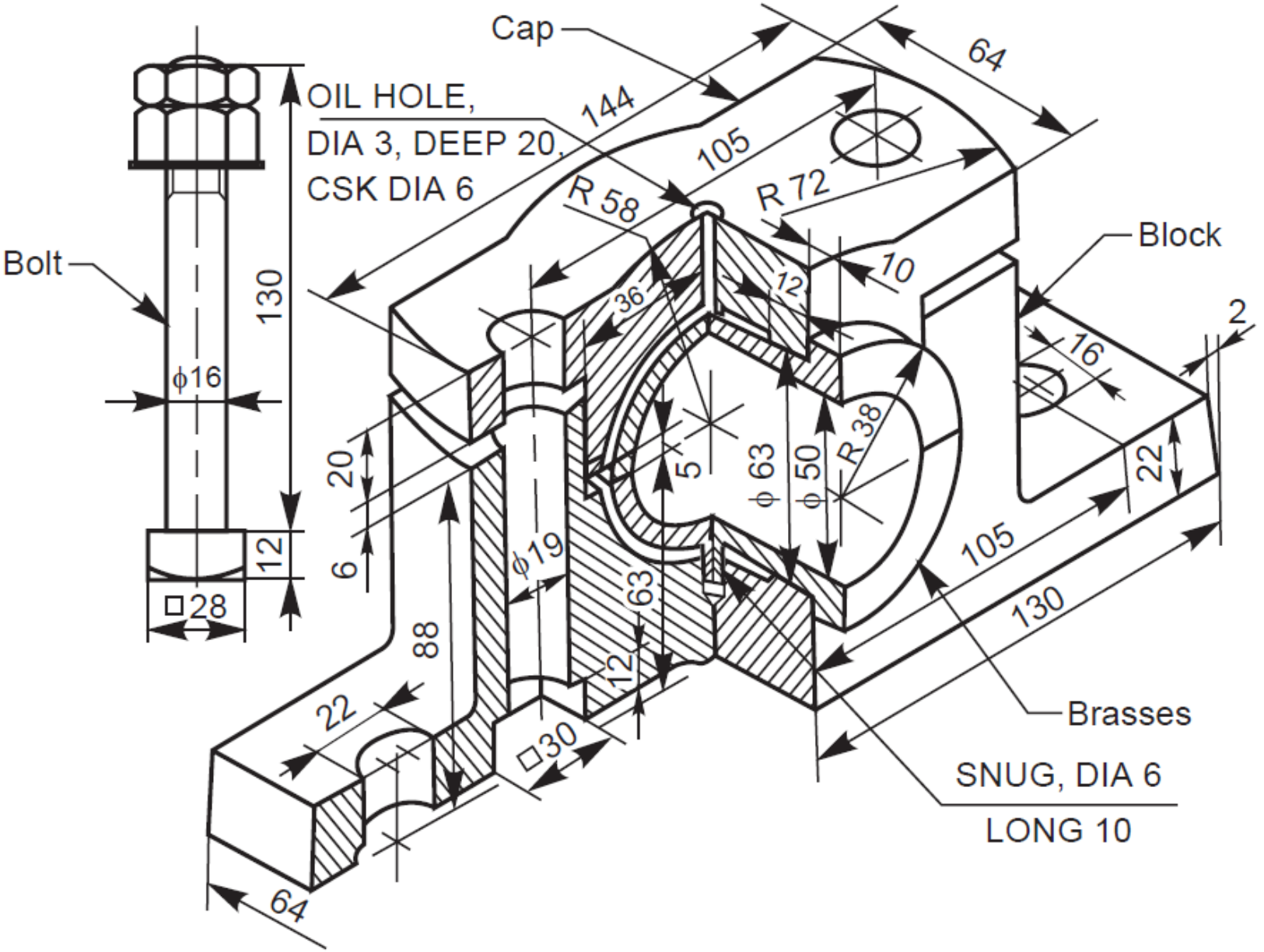
Knuckle Joint



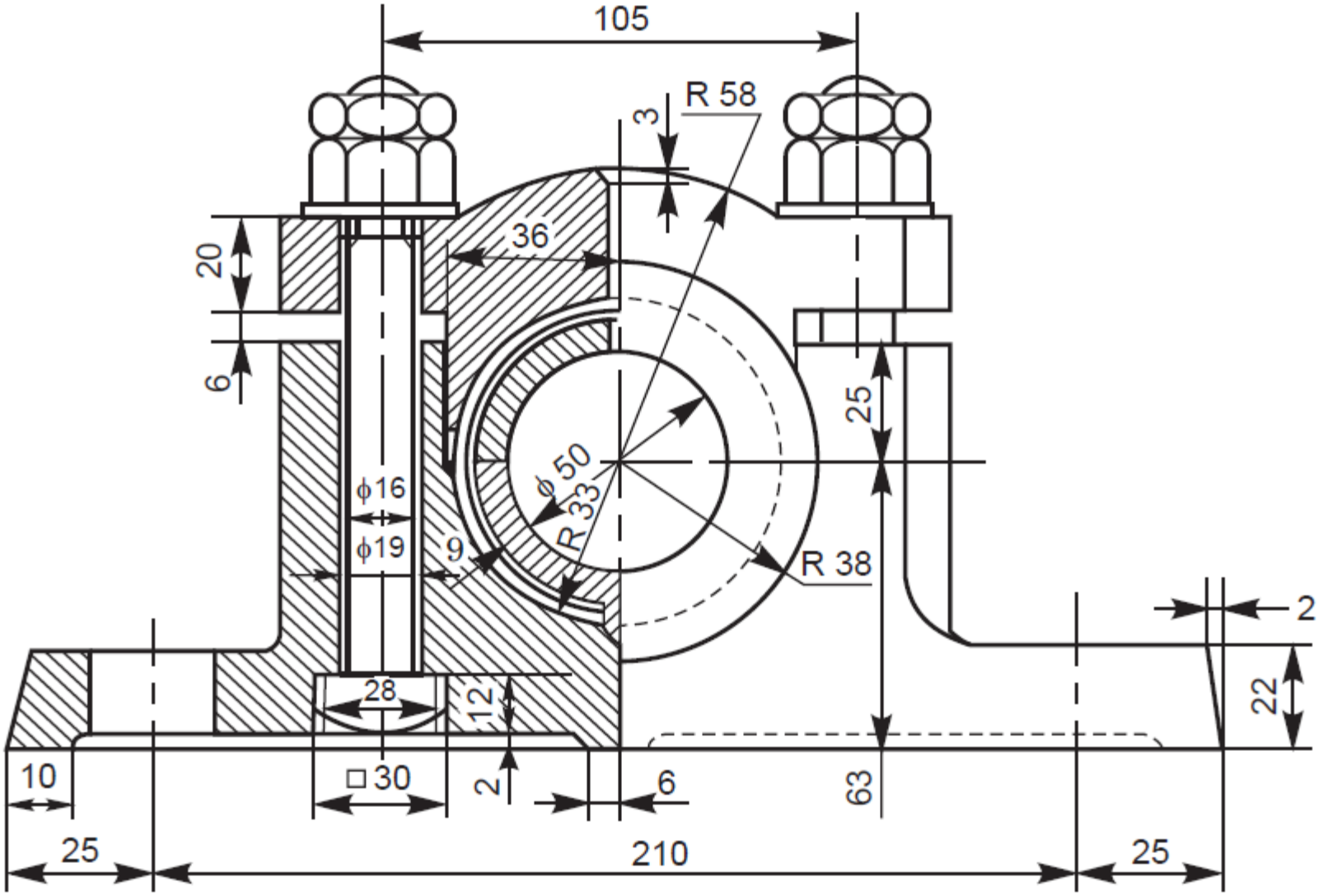
Muff coupling



Plummer block



Front view of plummer block



Screw jack