DARBHANGA COLLEGE OF ENGINEERING, DARBHANGA

COURSE FILE

OF

MACHINE DRAWING

FACULTY NAME:

Dr. MD ASJAD MOKHTAR

ASSISTANT PROFESSOR

DEPARTMENT OF MECHANICAL ENGINEERING

Time Table, Asjad, Mechanical Engineering, DCE Darbhanga						
Class Day	**I** 10:00AM to 10:50AM	**II** 10:50AM to 11:40AM	**III** 11:40AM to 12:30AM	**IV** 12:30AM to 01:20PM	**Lunch** 01:20AM to 01:50PM	**V-VII** 02:00 PM to 04:30PM
Mon				EG&D	LUNCH BREAK	M/c Drawing
Tue	PE-II (Mechatronics)		PE-VI (8^{th} sem)			
Wed	Engg. Mech.	PE-VI (8^{th} sem)		PE-II (Mechatronics)		M/c Drawing
Thurs						EG&D (ME)
Fri		PE-VI (8^{th} sem)		PE-II (Mechatronics)		EG&D (ME)
Sat						

Institute / College Name	Darbhanga College of Engineering, Darbhanga		
Program Name	B. Tech		
Course Code	PCC-ME 202, 02 1411P		
Course Name	Machine Drawing		
Lecture/Tutorial/Practical (per week)	0-0-4	**Course Credits**	**2**
Course Coordinator Name	Dr. Md Asjad Mokhtar		

1. Scope and Objectives of the course

Machine drawing is the indispensable communicating medium employed in industries, to furnish all the information required for the manufacture and assembly of the components of a machine. The aim of this course is to equip the students with proper knowledge of design and drawing that will help them excel in their work. The focus is on blending fundamental development of concepts with practical specification of components. Students of this course should find that it inherently directs them into familiarity with both the basis for decisions and the standards of industrial components. For this reason, as students transition to practicing engineers, they will find that this course indispensable. The objective of this course is to:

- Cover the basics of machine drawing and makes the student familiar with technical terms and standards used in the drawing of machine elements.
- Offer a practical approach for technical communication during design and development of any mechanical engineering component.
- Encourage students to link fundamental concepts with practical component specification.

Course Outcomes

CO1: Students must be able to understand the language of drawing and its importance.

CO2: Students must be able to identify various engineering components and its application in a machine assembly.

CO3: Students must be able to understand the assembly and disassembly of any machine and should be able draw it.

CO4: Students must be able to draw various projections and views of any machine component and the assembly.

CO5: Students must learn to work as an individual and complete the given task within constraints.

PCC-ME202	Machine Drawing	0L:0T:4P	2 Credits

Objective:

The student will acquire a knowledge of fastening arrangements such as welding, riveting the different styles of attachment for shaft. The student also is enabled to prepare the assembly of various machine or engine components and miscellaneous machine components.

Module 1: Introduction to full section, half section, revolved-section off-set section. **(2 Lectures)**

Module 2: Nut Bolts, Riveted joints, Thread profiles, Screw jack. **(3 Lectures)**

Module 3: **B**ushed bearing, pedestal, bearing, foot step bearing. **(3 Lectures)**

Module 4: Flanged coupling, flexible coupling, solid coupling. **(2 Lectures)**

Module5: Engine parts - Stuffing box, Connecting rod, Atomizer, spark plug, etc. **(2 Lectures)**

Module 6: Eccentric. **(2 Lectures)**

Module 7: Cross Head. **(2 Lectures)**

Module 8: Assembly of dissembled parts. disassembly of assembly parts. **(2 Lectures)**

Text Books:

1. Dhawan, R.K., A Text Book of Machine Drawing, S. Chand & Company, 1996.
2. Ostrowsky, O., Engineering Drawing with CAD Applications, ELBS, 1995.
3. Engineering Drawing Practice for Schools and Colleges SP: 46- 19
4. Engineering Drawing by ND Bhatt

Course Outcomes (AKU):

On successful completion of the course, the student will be able to,

1. Identify the national and international standards pertaining to machine drawing.
2. Apply limits and tolerances to assemblies and choose appropriate fits.
3. Recognize machining and surface finish symbols.

Explain the functional and manufacturing datum.

2. Course Plan

Lecture Number	Date of Lecture	Topics	Web Links for video Lecture	Text Book/ Reference Book, etc.	Page numbers of Text Books
1-2		**Introduction to full section, half section, revolved section, off-set section**		TB1, TB2	Ch. 1, 4-32
3-5		**Nut bolts, Riveted joints, Thread profile, Screw jack**			
6-7		**Bushed bearing, Pedestal bearing, Foot step bearing**			
Mid- Semester Exam (Syllabus covered from 1-7 lectures)					
8-9		**Flanged coupling, Flexible coupling, Solid coupling**			
10		**Stuffing box**			
11		**Eccentric**			
12		**Cross head**			
13		**Assembly of disassembled parts**			
14		**Disassembly of assembled parts**			

3. Evaluation Scheme

Component 1	Assignment Evaluation and class performances, attendence	20
Component 2	End Term Examination**	30
	Total	50

****** The End term Comprehensive Examination will be held at the end of the semester. The mandatory requirement of 75% attendance in all theory and practical classes is to be met for being eligible to appear in this component.

SYLLABUS

Topics	No. of Lectures	Weightage
Introduction to full section, half section, revolved section, off-set section	2	15 %
Nut bolts, Riveted joints, Thread profile, Screw jack	3	20 %
Bushed bearing, Pedestal bearing, Foot step bearing	2	15 %
Flanged coupling, Flexible coupling, Solid coupling	2	15 %
Stuffing box	1	7 %
Eccentric	1	7 %
Cross head	1	7 %
Assembly of disassembled parts	1	7 %
Disassembly of assembled parts	1	7 %

This Document is approved by:

Designation	Name	Signature
Course Coordinator	Dr. Md Asjad Mokhtar	
HOD, ME	Dr. Md Asjad Mokhtar	
Principal	Dr. Vikash Kumar	

Evaluation and Examination Blue Print:

Internal assessment is done through quiz test, assignments and practical work. Two sets of question paper are asked from each faculty and out of these two, without the knowledge of faculty, one question paper is chosen for concerned examination. Examination rules are uploaded on the student's portal. Evaluation is a very important process and the answer sheets of sessional tests, internal assessment assignments are returned back to the students.
The component of evaluations along with their weightage followed by the university is given below.

Assignments/ Quiz Tests/ Seminars 20%
End Term Examination 30%
(From amongst the three sessional tests best of two are considered)

List of Students

Sub:-

S.No.	Name of Student	Class Roll	Registration No.
1	Princy Kumari		20102111001
2	Gautam Kumar		20102111002
3	Niraj Kumar		20102111003
4	Akash Kumar		20102111004
5	Md Tanjeem Alam		20102111005
6	Ankit Raj		20102111006
7	Md Intkhab Alam		20102111007
8	Ranjan Kumar		20102111008
9	Abhishek Raj		20102111009
10	Prashant Mishra		20102111010
11	Saurabh Kumar Suman		20102111011
12	Shashi Kumar Das		20102111012
13	Anubhav		20102111013
14	Anzarul Hasan		20102111014
15	Sonu Kumar Sah		20102111015
16	Supriya Kumari		20102111016
17	Ratnapriya		20102111017
18	Vijay Kumar		20102111018
19	Rohit Kumar		20102111019
20	Mintu Kumar		20102111020
21	Suraj Kumar		20102111021
22	Gaurav Kumar Gautam		20102111022
23	Vishal Gaurav		20102111023
24	Nitish Raj Gupta		20102111024
25	Kumar Arnav		20102111025
26	Vicky Kumar		20102111026
27	Harsh Raj		20102111027
28	Sumit Raj		20102111028
29	Prince Ranjan		20102111029
30	Anurag Kumar Ranjan		20102111030
31	Nityanand Raj		20102111031
32	Navneet Raj		20102111032
33	Gaurav Kaushik		20102111033

34	Kundan Kumar		20102111034
35	Gaurav Kumar		20102111035
36	Rahul Kumar		20102111036
37	Rajkamal Kumar		20102111037
38	Anil Kumar		20102111038
39	Sourabh Kumar		20102111039
40	Harshit Sharma		20102111040
41	Ravi Kumar		20102111041
42	Pralay Bharti		20102111042
43	Abhinash marandi		20102111043
44	Ujjwal Kumar		20102111044
45	Megha Rani		20102111045
46	Unnnati Swraj		20102111046
47	Mohammad Ali Imam		20102111047
48	Abhinav Kumar		20102111048
49	Abhishek Raj		20102111049
50	Basit Raza		20102111050
51	Abhishek Kumar		20102111051
52	Varsha Kumari		20102111052
53	Raman Paswan		20102111053
54	Manikant Kumar		20102111054
55	Utsav Kumar Ranjan		20102111055

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Tutorial Sheet – 1, Machine drawing

(Basic concepts, Orthographic view, Dimensioning, Sectioning,)

Q1. With free hands, draw different types of line used in drawing, viz. outlines, dimension line etc.

Q2. Give dimensions of the following component (Fig. 1). (a) Using aligned system (b) Using unidirectional system.

Q3. Draw full and half sectional views of component shown in Fig 2.

Q4. Draw three orthographic views (multiview projection) of the following component.

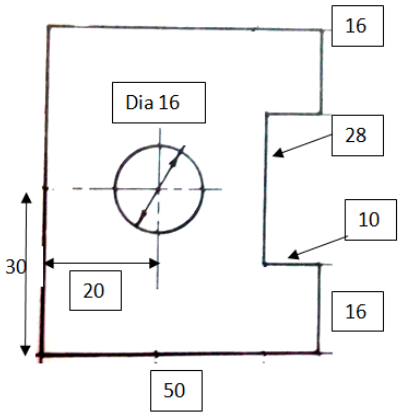

Fig 1

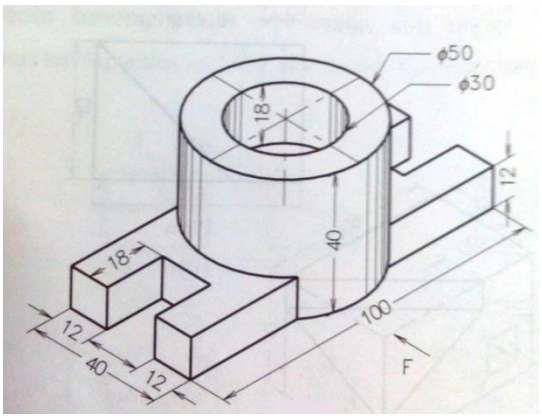

Fig 2

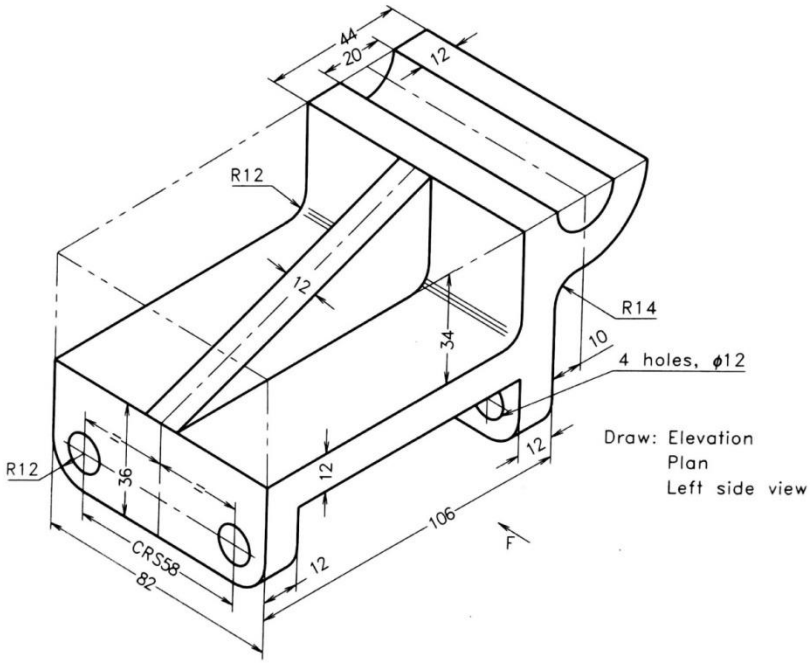

Fig 3

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Tutorial Sheet – 2, Machine drawing

(Screw Threads)

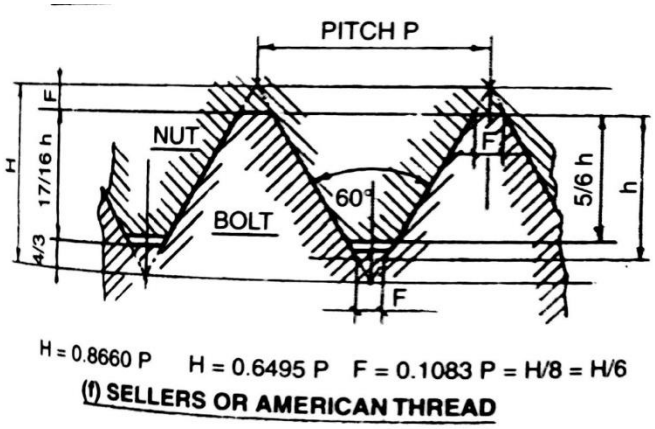
Q1. Show on a sketch, the following features or dimensions on a V-thread section: fundamental triangle, truncation, flank angle, thread angle, and thread depth.

Q2. Draw the following thread sections, to a full scale size, and give all the standard proportions (P= 40mm).

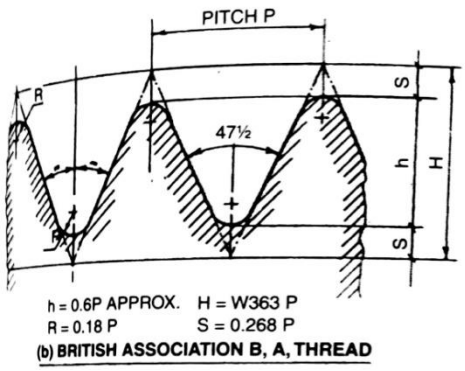
I. British Standard Whitworth (BSW)
II. British Association (B. A.) Thread
III. U.S. standard of seller's thread
IV. Square Thread
V. Acme Thread
VI. Knuckle Thread

Q3. Sketch the conventional representation of the following:

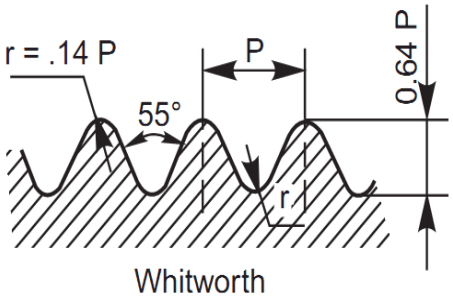
i. External Threads
ii. Internal Threads

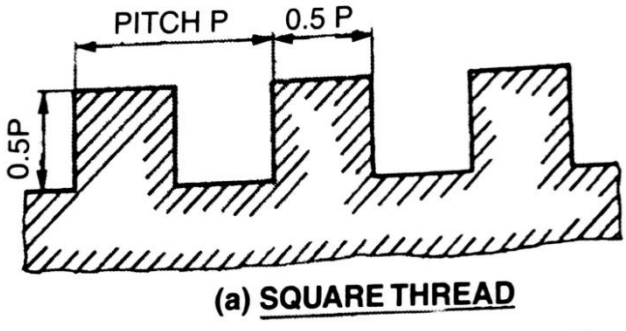


(f) SELLERS OR AMERICAN THREAD

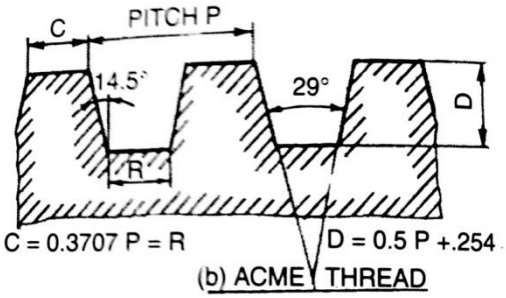


(b) BRITISH ASSOCIATION B, A, THREAD

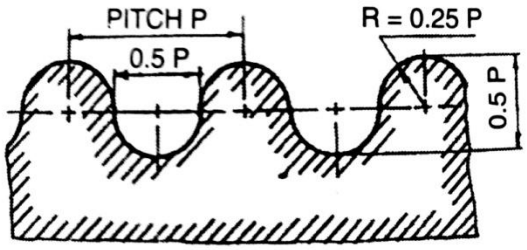




(a) SQUARE THREAD



(b) ACME THREAD

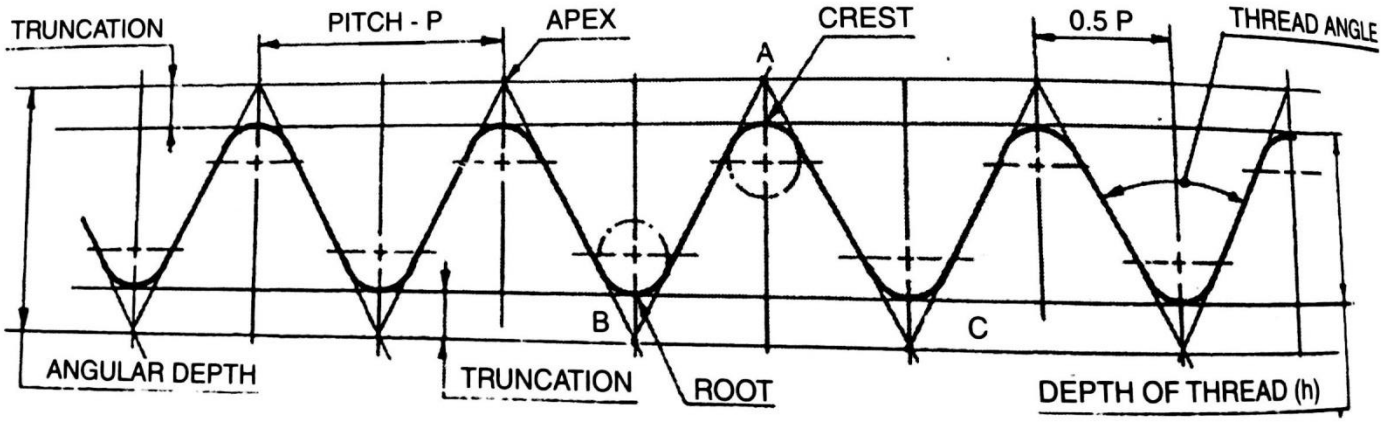


P

(b) KNUCKLE JOINT

Solution

1.



ABC IS THE FUNDAMENTAL TRIANGLE

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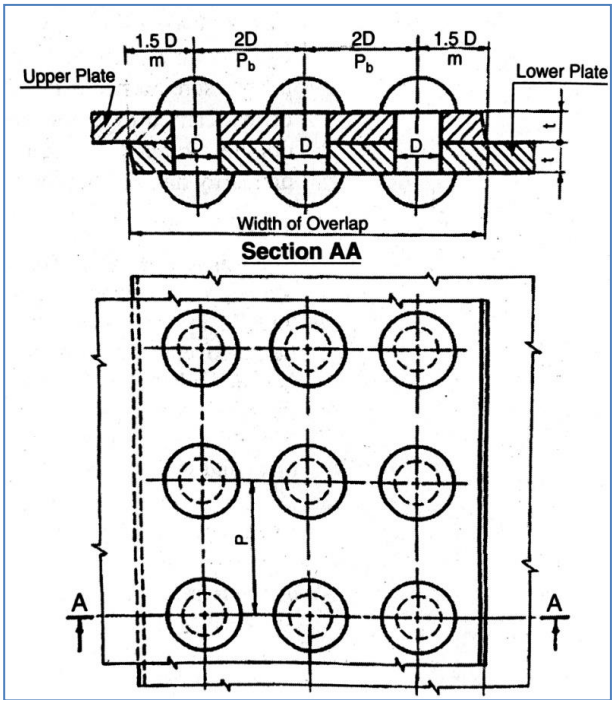
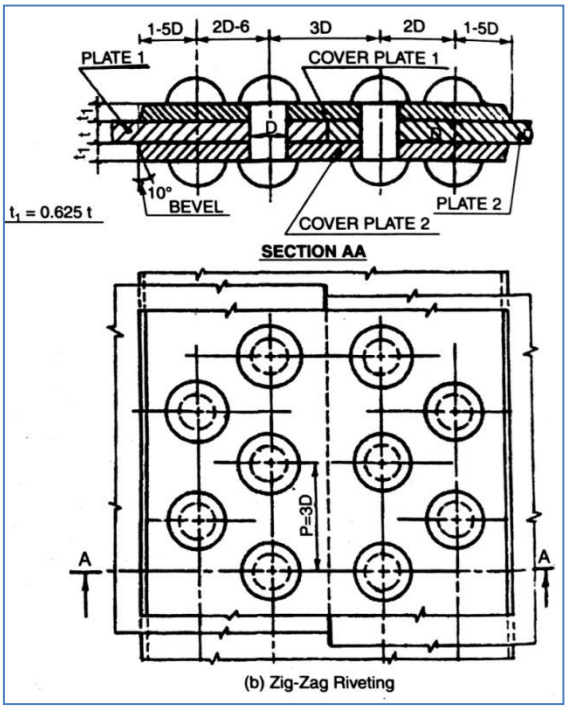
Tutorial Sheet – 3, Machine drawing

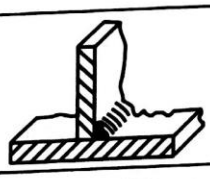
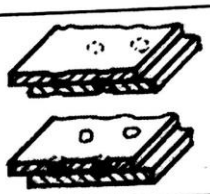
(Riveted Joint and Welded Joint)

Q1. Draw the Full sectional front view and top view of riveted joint shown in following figures. Also name the type of riveted joint.

Q2. Draw different elementary and supplementary welding symbols with their names.





DESIGNATION	ILLUSTRATION	SYMBOL
Butt weld between plates with raised edges (melted down completely).		
Square butt weld		
Single-V bult weld		
Single-bevel butt weld		
Single-V butt weld with broad root race		
Single-bevel butt weld with broad root face		
Singel-U butt weld (parallel or stoping sides)		
Single-J butt weld		
Backing run; back or backing weld		
Filter weld		
Filter weld; or Slot weld		
Spot weld		
Seam weld		

SHAPE OF WELD SURFACE	SYMBOL
(a) Flat (usually flush)	
(a) Convex	
(a) Concave	

Table 17.3.

DESIGNATION	ILLUSTRATION	SYMBOL
Flat(flush) single-V butt weld		
Convex double-V butt weld		
Concave fillet weld		
Flat (flush) single-V butt weld with flat (flush) backing run		

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Tutorial Sheet – 4, Machine drawing

(Temporary Fasteners: Nuts, Set Screw, Machine Screw and Washer)

Q1. Draw atleast two views of each of the following nuts:

(a) Standard Hexagonal Nut (b) Castle Nut (c) Cap Nut

(d) Square Nut (e) Ring-collar Nut (f) Capsten Nut

Draw the nominal diameter (D) = 25 mm and indicate all necessary proportions, in terms of D, on the views.

Q2. Differentiate plain and Chamfered washer with the help of drawing. Take D = 24 mm.

Q3. Draw the following Grub Screws (Take D=16 mm)

(a) Flat Point (b) Cone Point (c) Cup Point

Q4. Draw the following cap and machine screws (Take D = 24 mm).

(a) Flat Counter Sunk (b) Rounded Counter Sunk (c) Cylindrical (Cheese) (d) Fillister

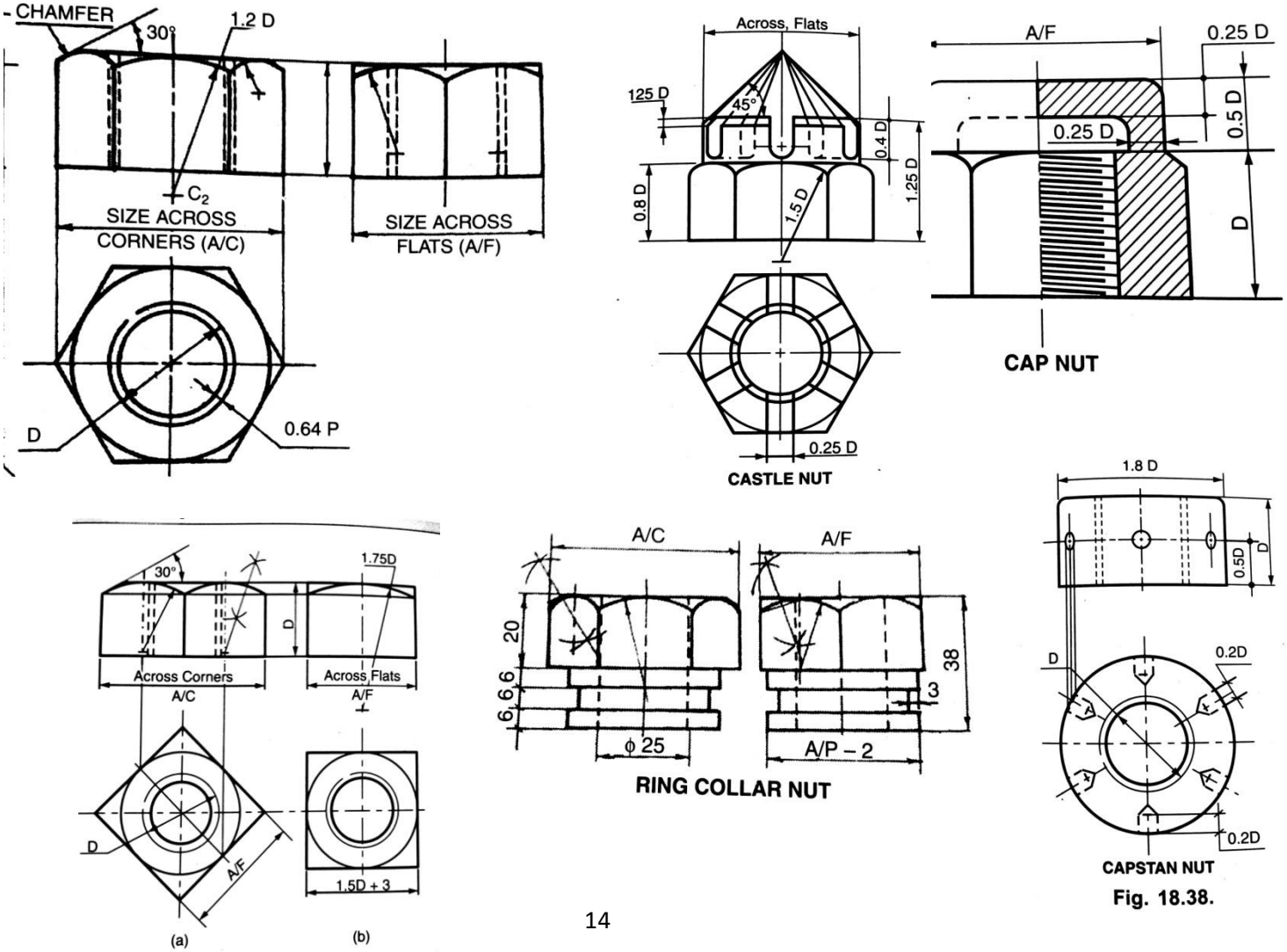
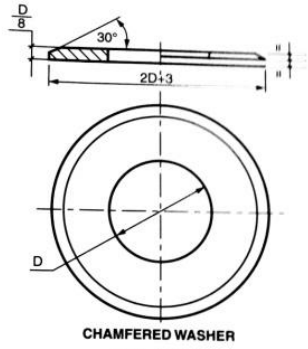
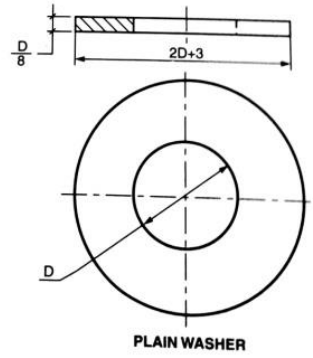


Fig. 18.38.

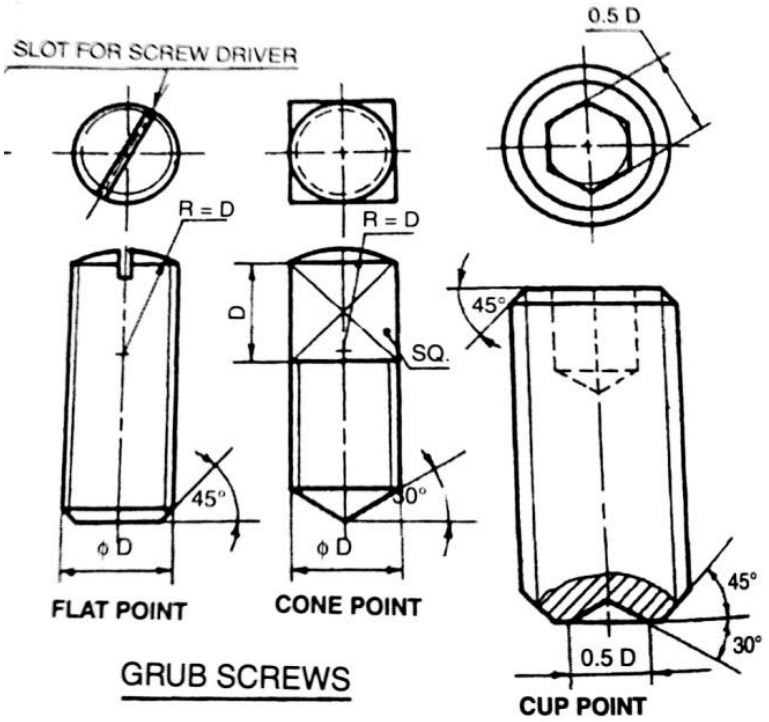


CHAMFERED WASHER

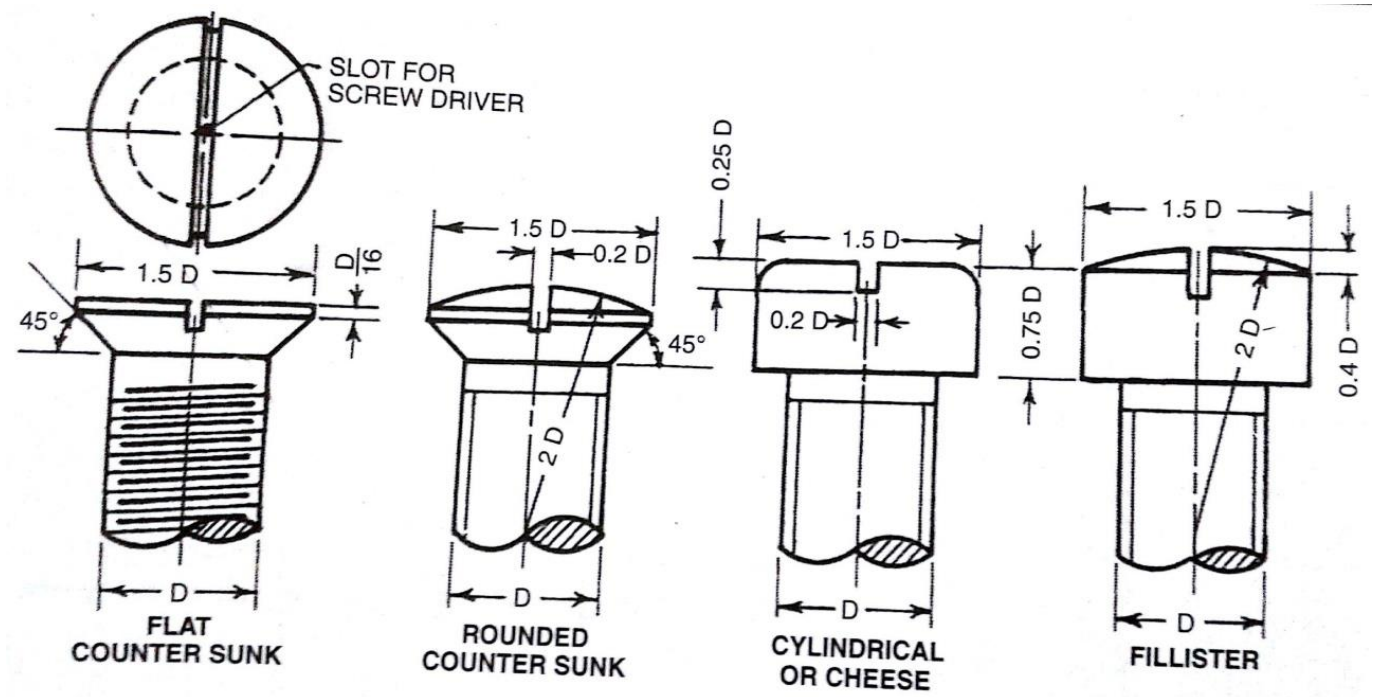
Fig. 18.39.



PLAIN WASHER



GRUB SCREWS



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Tutorial Sheet – 5, Machine drawing

(Temporary Fasteners: Bolts assembly, Locking devices, Foundation bolts)

Q1. Draw the FV and RHSV of hexagonal headed bolt, double chamfered nut, lock nut and washer assembly. (Take D = 24 mm and P = 3 mm, Chamfer angle = 30^0).

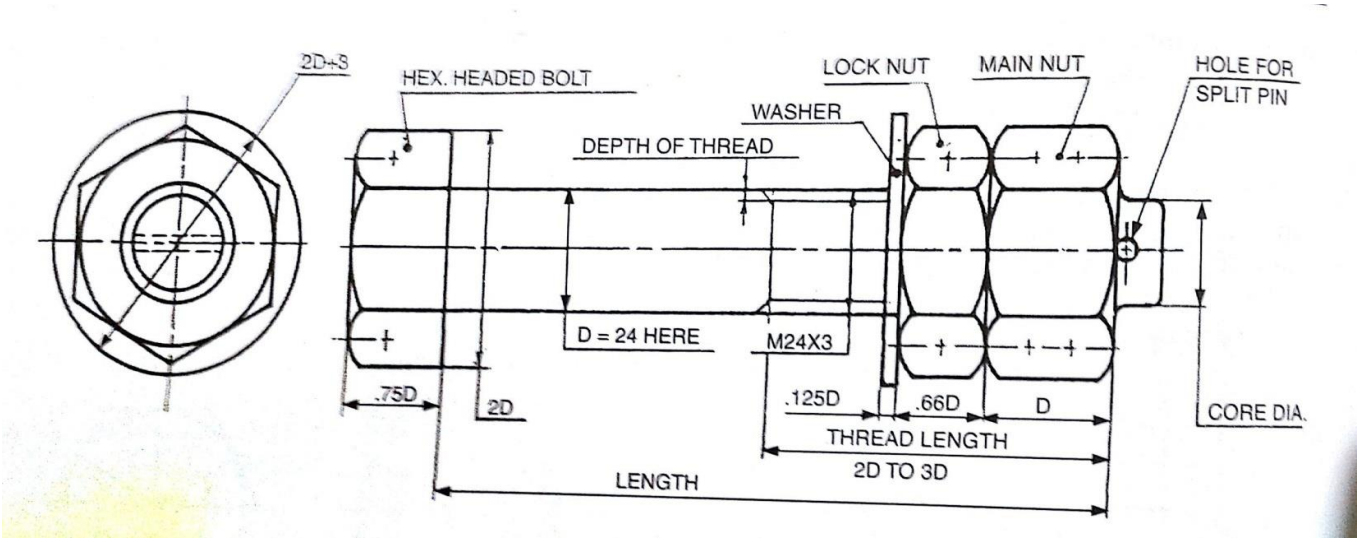
Q2. Draw the following locking devices:

a. Sawn Nut (Wile's Lock Nut)
b. Simmond's Lock Nut

Q3. Illustrate the use of Stud with the help of FV of Stud assembly (Take D = 20 mm).

Q4. Draw the following foundation bolts:

a. Rag bolt
b. Lewis Bolt



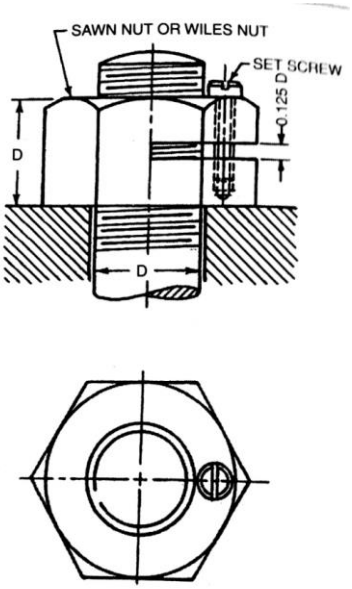


Fig. 18.62. Swan Nut

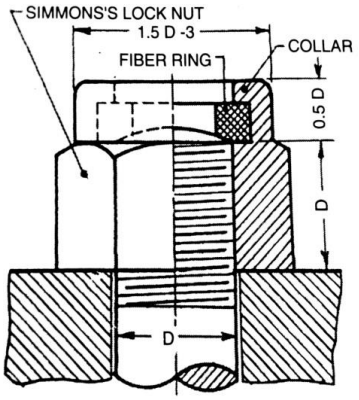
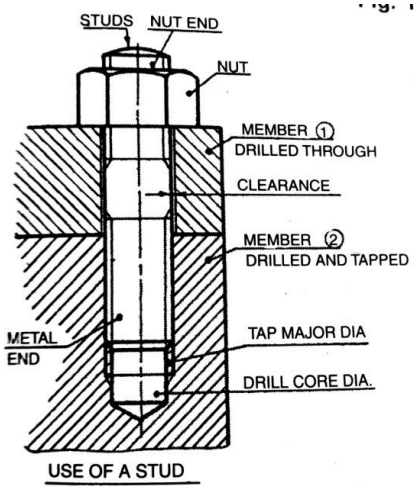
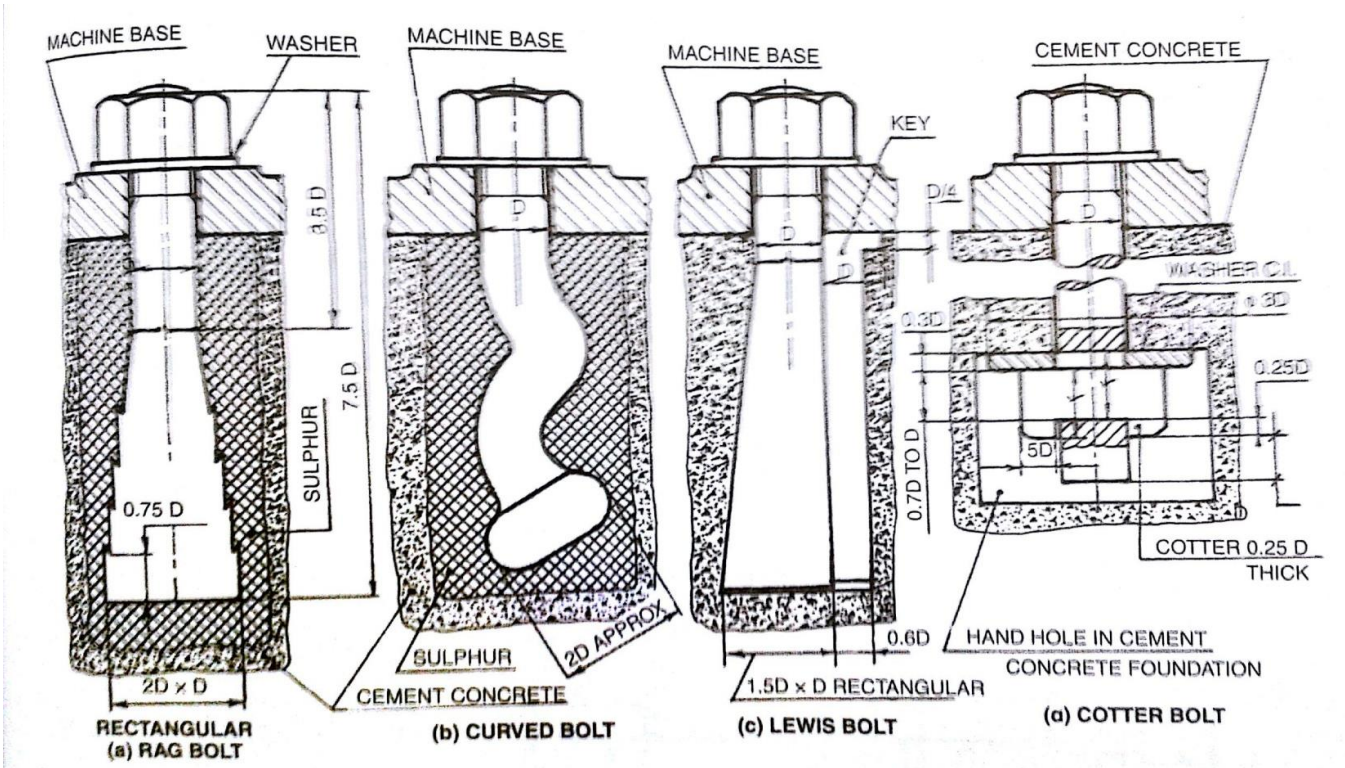


Fig. 18.66. Simmond's Lock Nut





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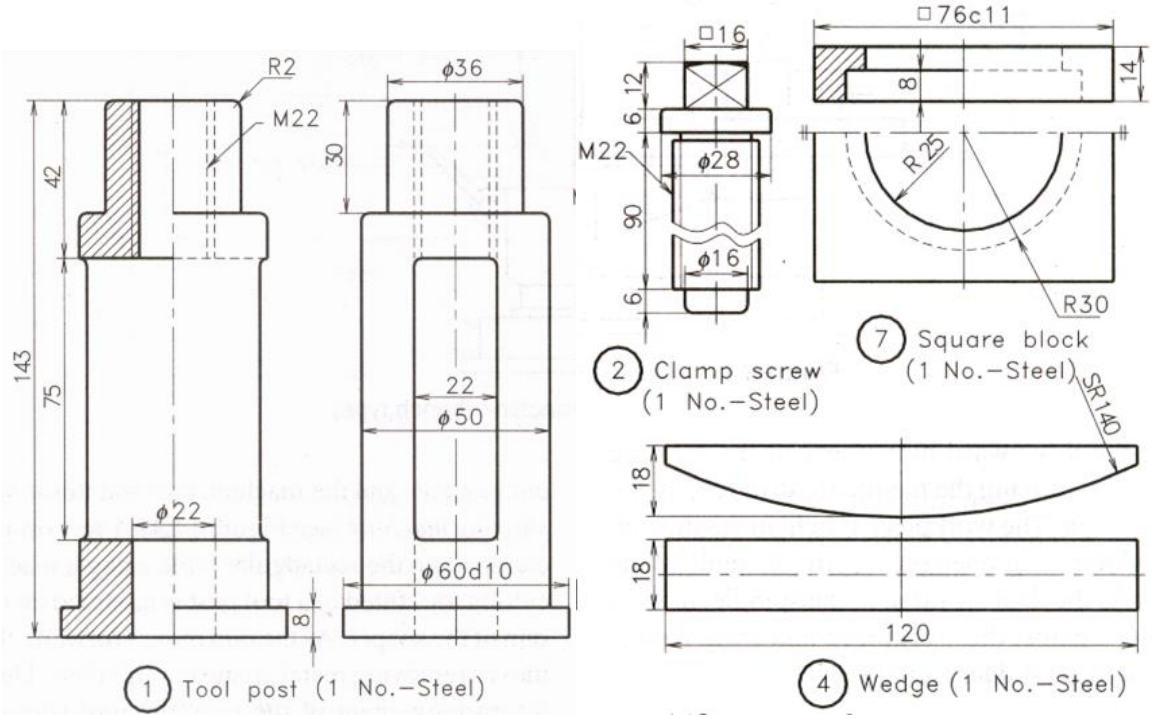
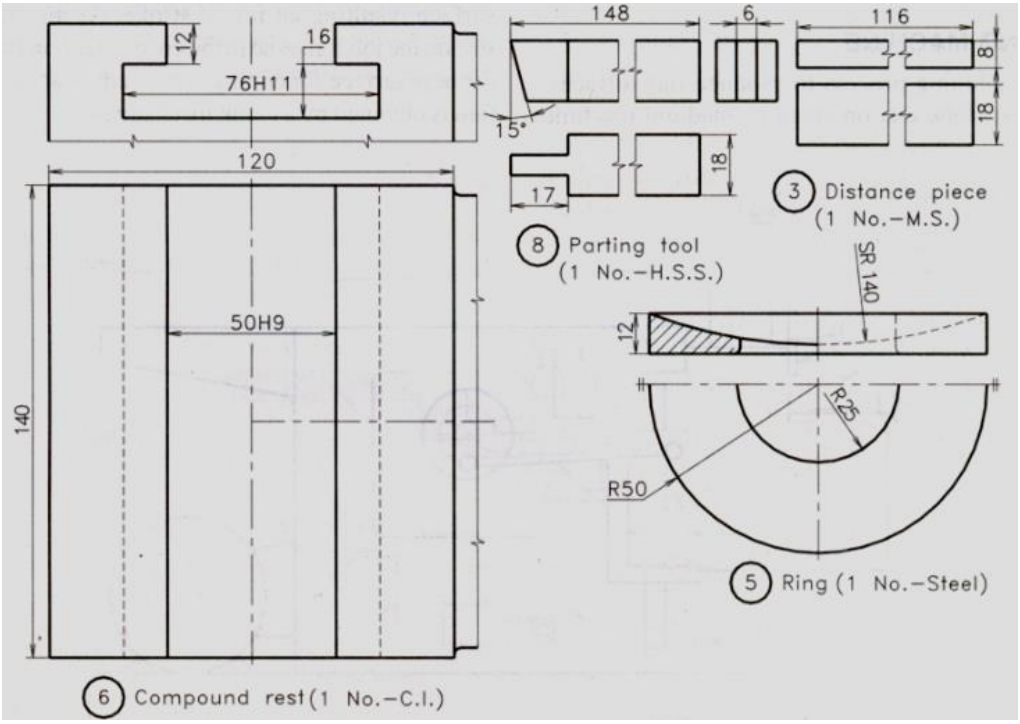
Tutorial Sheet – 6, Machine drawing

(Assembly Drawing Tool Post)

Q1. Draw the FV and RHSV of assembly of single point tool post with BOM.. Components drawings are given below.





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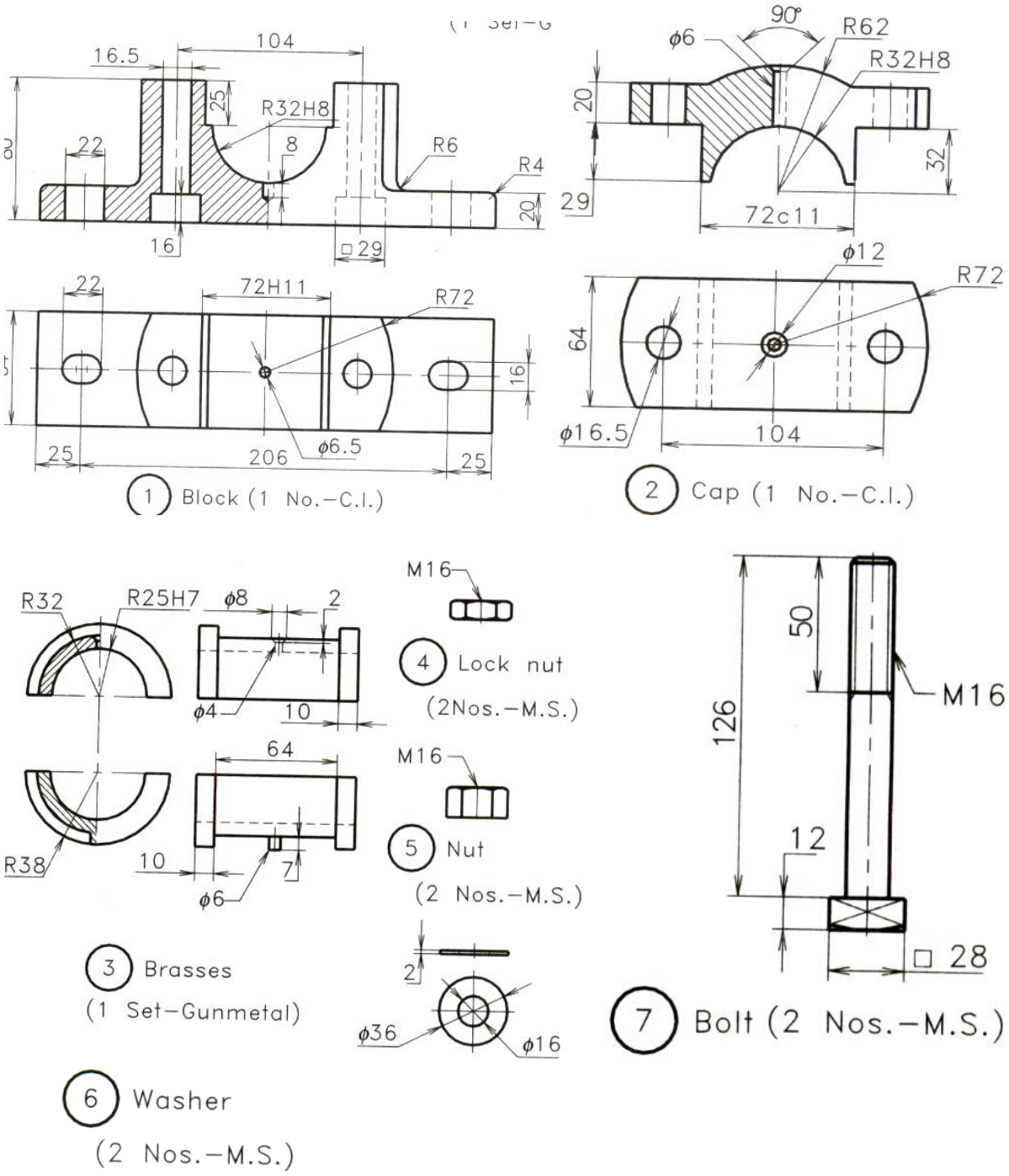
Tutorial Sheet – 7, Machine drawing

(Assembly Drawing Plummer Block)

Q1. Draw the FV and RHSV of assembly of Plummer block with BOM. Components drawings are given below.



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Work Sheet – 1, Machine Drawing

1. Draw the thread profiles of square thread and ACME thread.
2. Draw the Rag foundation bolt with D = 30mm.
3. Draw sectional front view and top view of single row combined lap and butt joint with D = 20 mm of rivet.
4. Draw any four types of machine and cap screws.
5. Draw sectional front view and right side view of the protective flanged coupling with shaft dia as 30 mm.
6. Draw sectional front view and top view of the triple riveted butt joint with double straps(zig zag type) with dia of Rivet as 18 mm.
7. Draw hexagonal headed bolt and nut with dia of bolt as 30 mm.
8. Draw two views of bushed types flanged coupling with D=30 mm.
9. Draw the sectional front view and top view of the double riveted double strap zig zag butt joint with dia of the rivet as 14 mm.
10. Draw sectional front view and right side view of compression type as muff coupling with dia. of shaft as 25mm.
11. Draw the sectional front view and top view of the double riveted double strap zig zag butt joint with dia of the rivet as 14 mm.
12. Sketch the schematic representation of threaded parts.

    a) V – threads, b) Square threads.

13. Draw plan and sectional elevation of double riveted zig – zag lap joint to join two plates of 10 mm thickness.
14. Draw proportionate diagram of Sleeve and cotter joint to connect two shafts of Ø 30mm.

Machine Drawing

Credit 2 - 0L-4P

Introduction

Md Asjad Mokhtar
Assistant Professor, ME
DCE, Darbhanga
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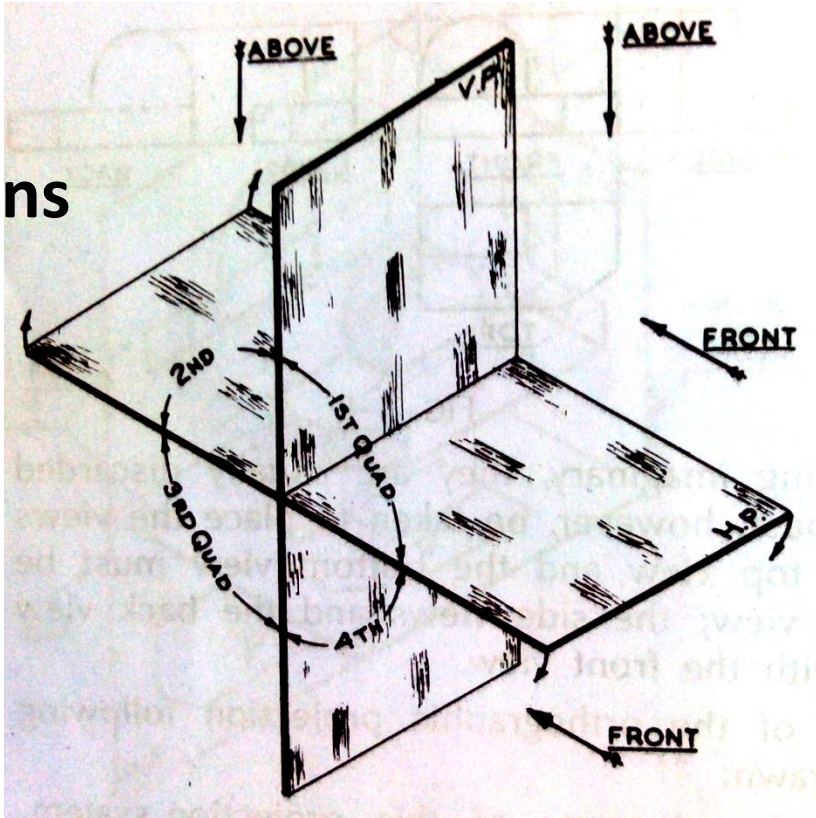
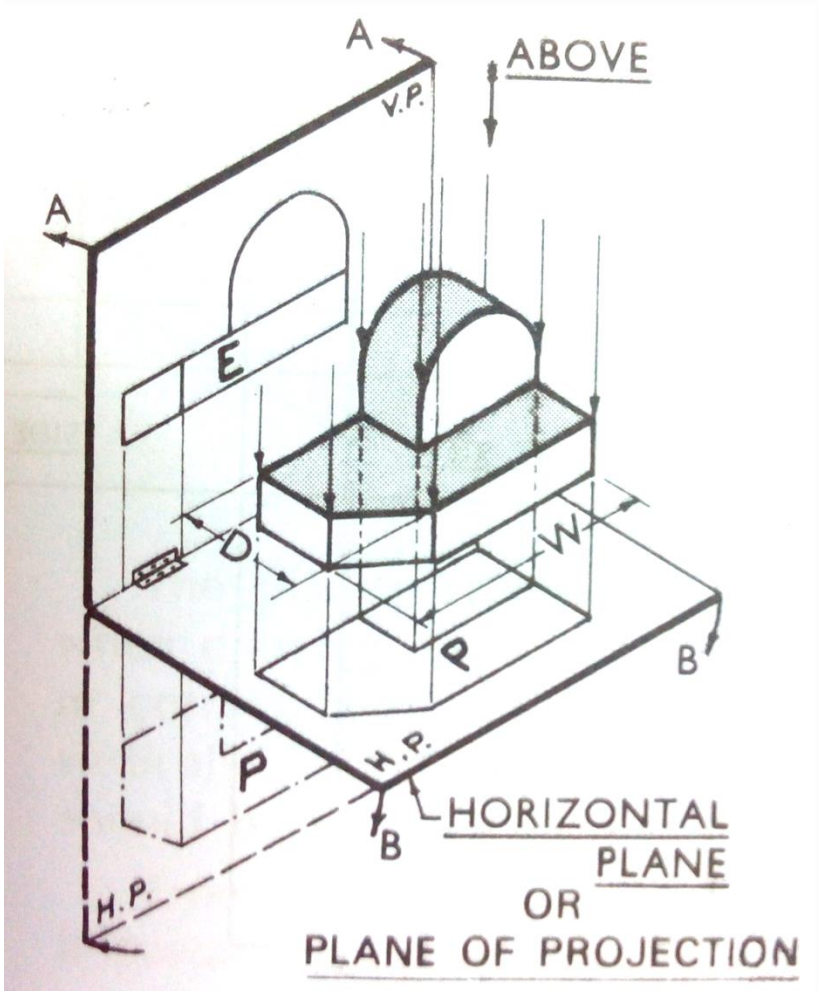
9999914381

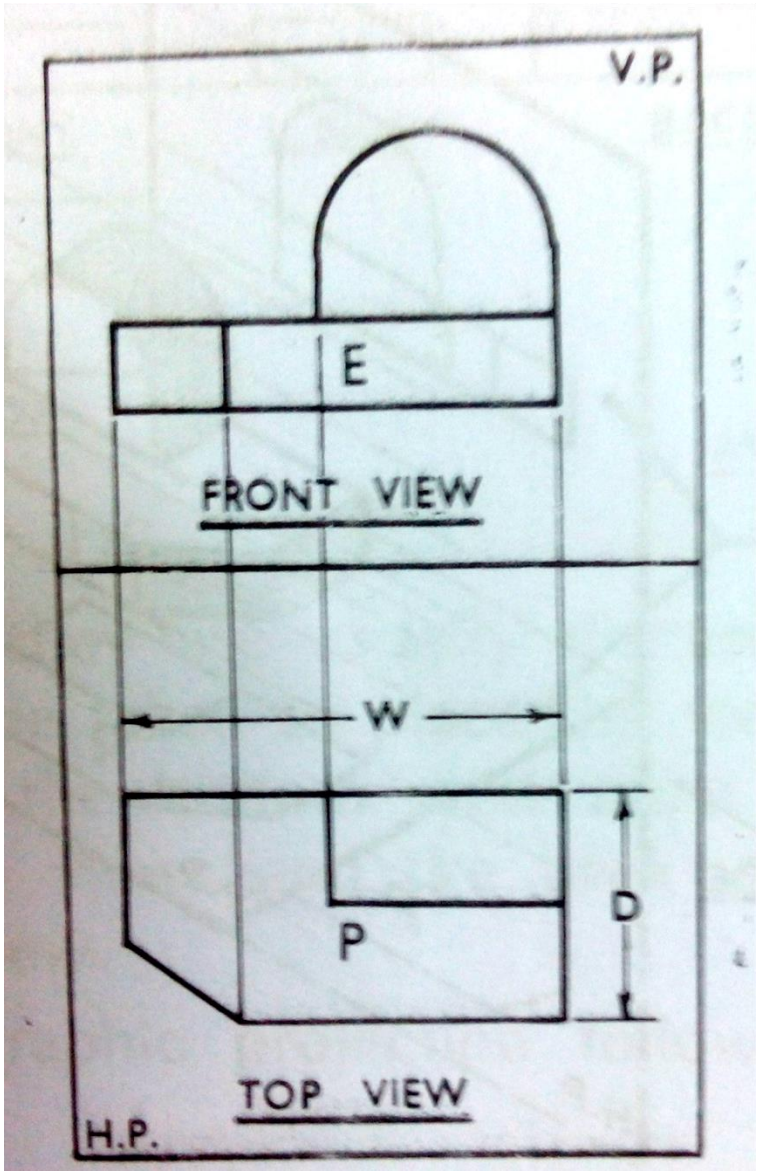
Introduction

- Drawing is the *language* of the engineers
- How to describe the design of **a machine or a component**
  - By describing in words
  - By pictorial views
  - By **orthographic representations**
    - **First angle projection**
    - **Third angle projection**

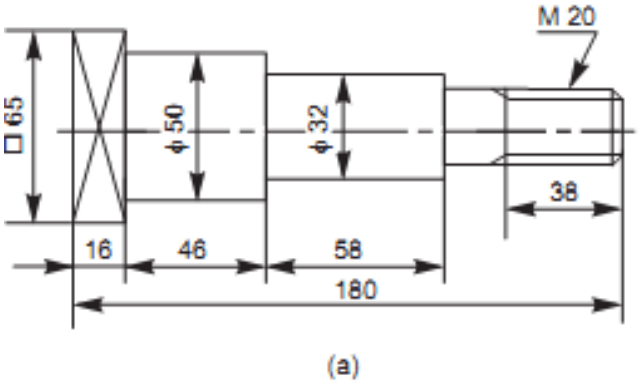


First angle projection

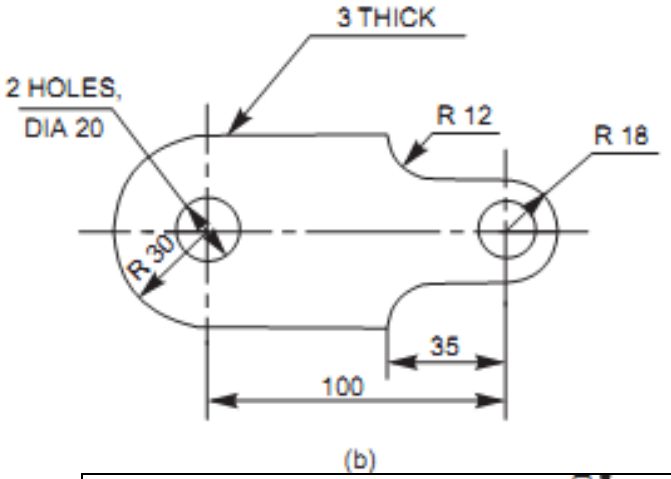




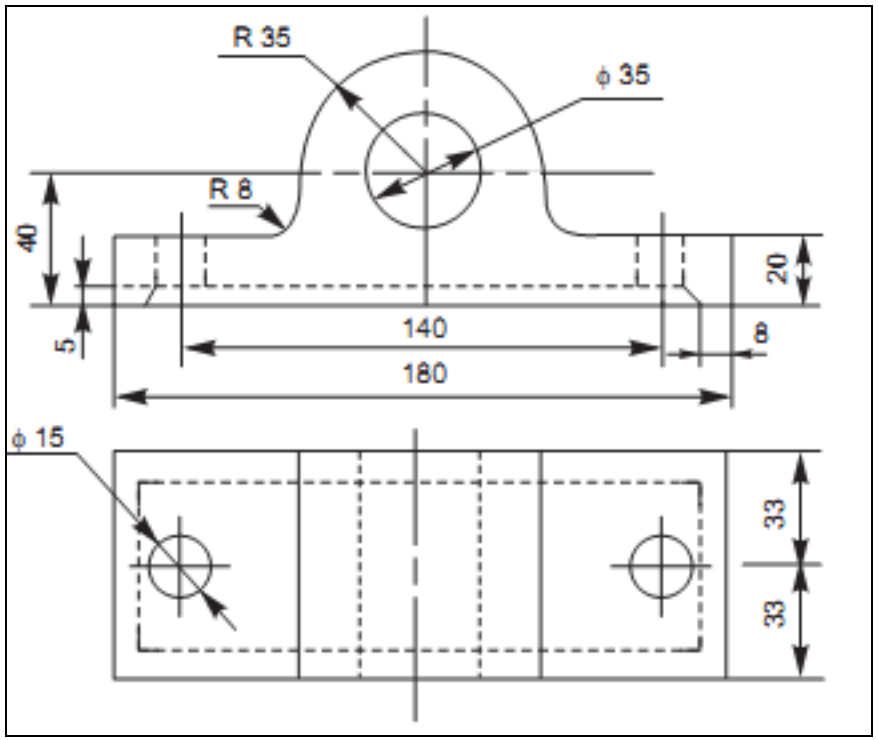
One view, **Two** views and **Three** views drawing

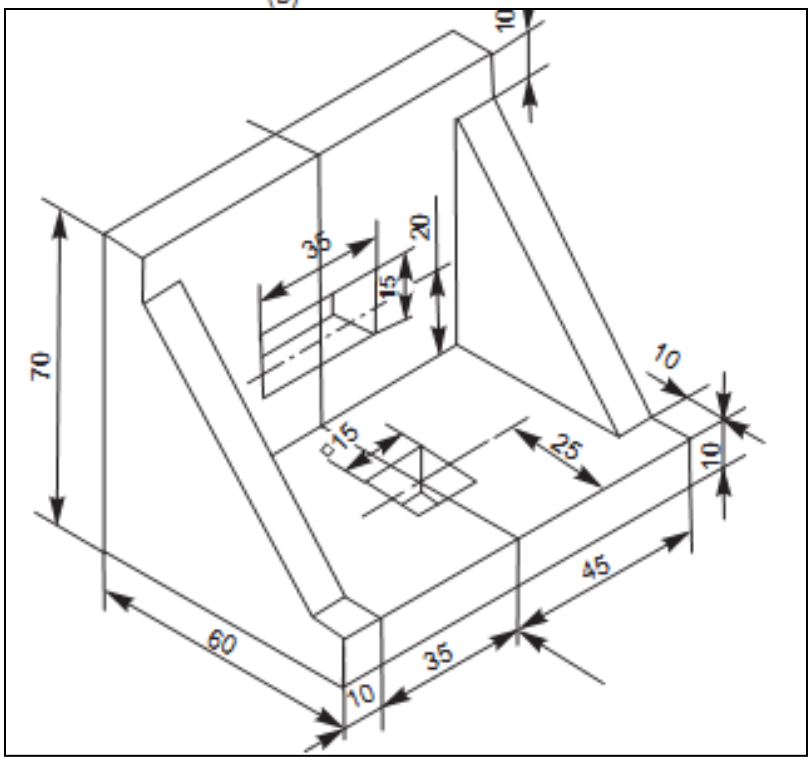


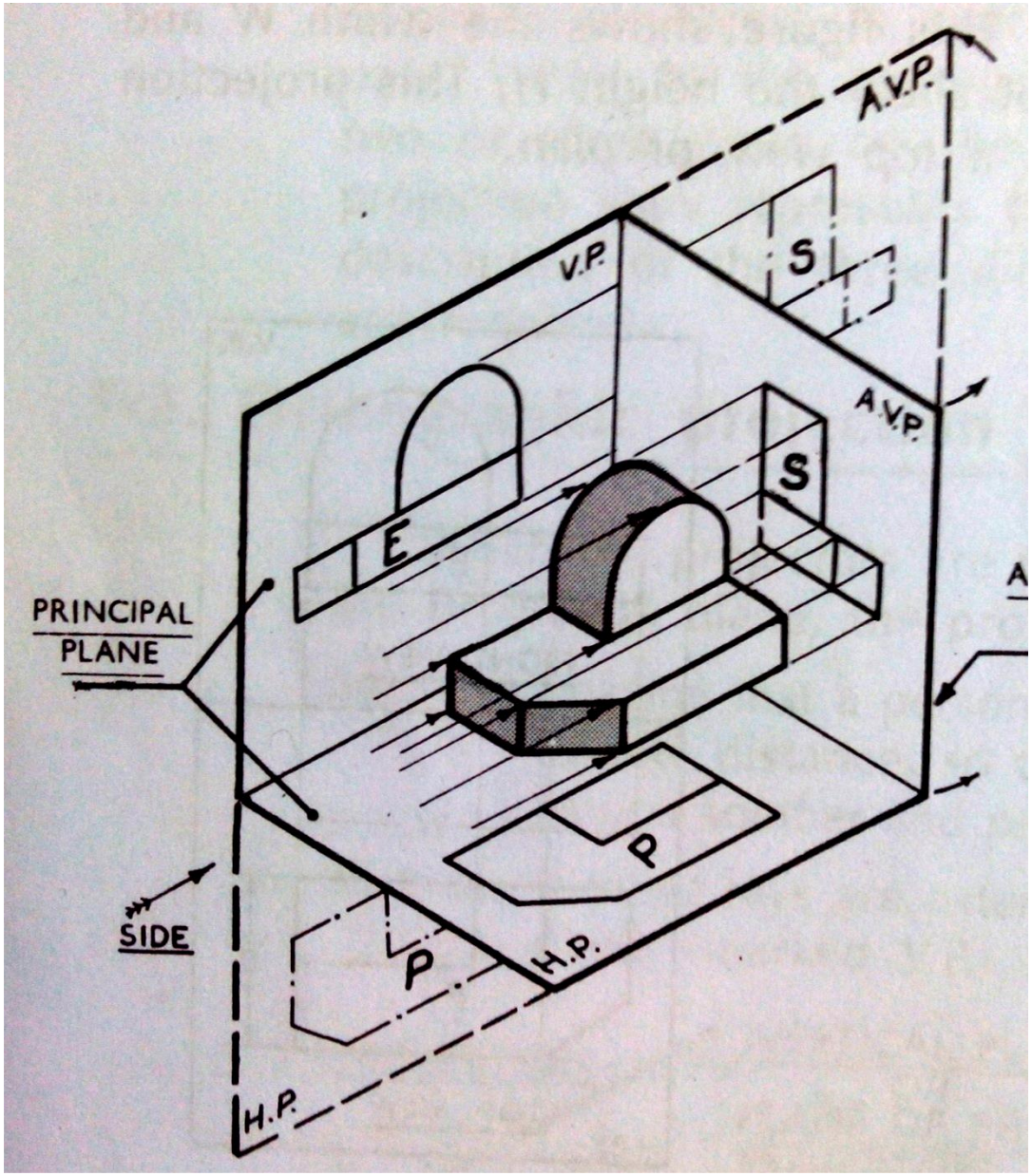
(a)

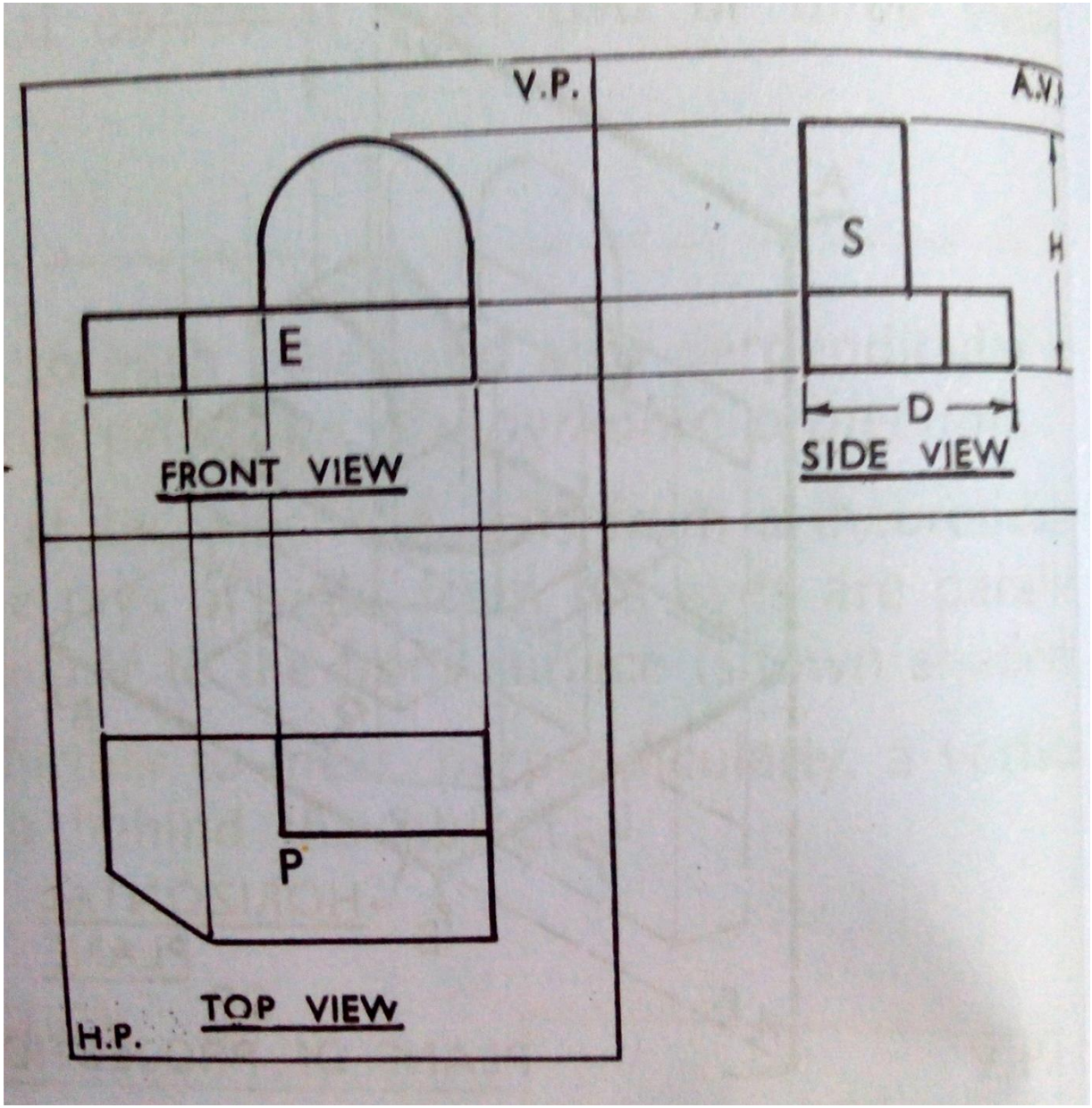


(b)

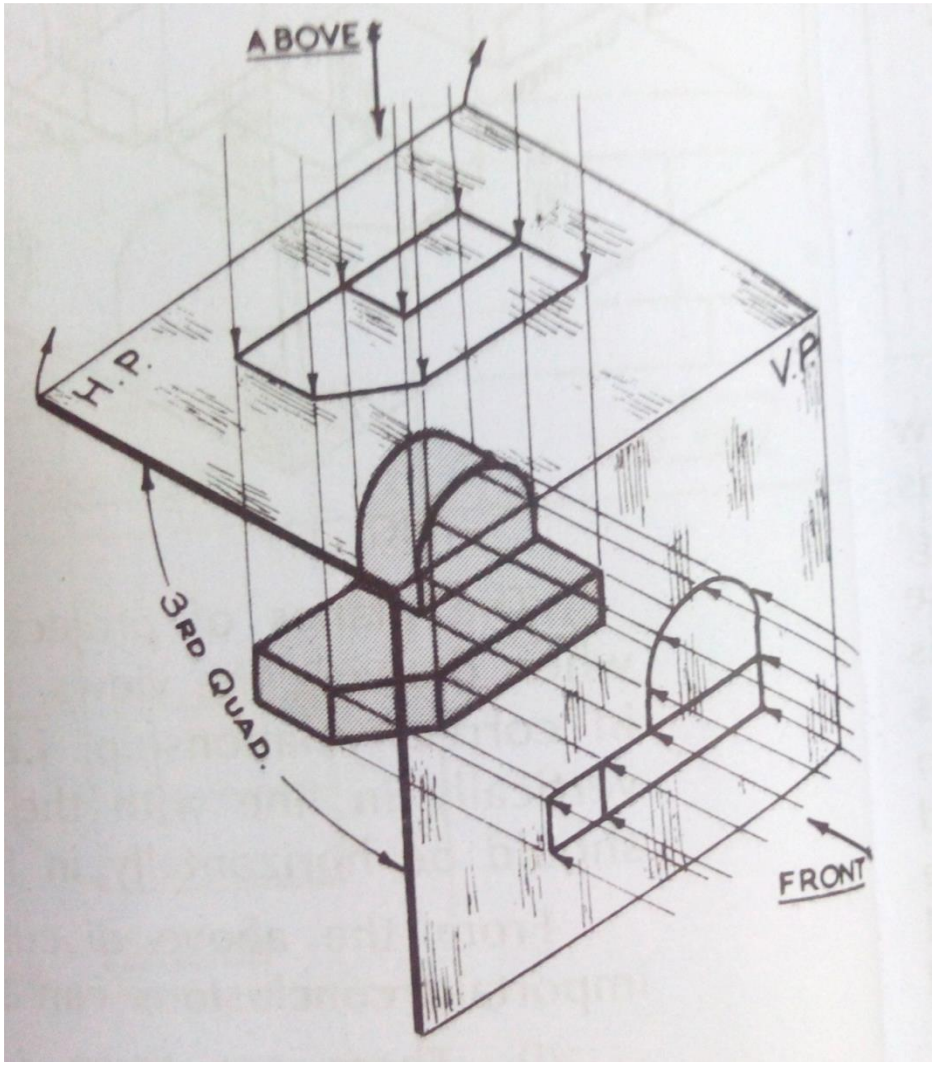


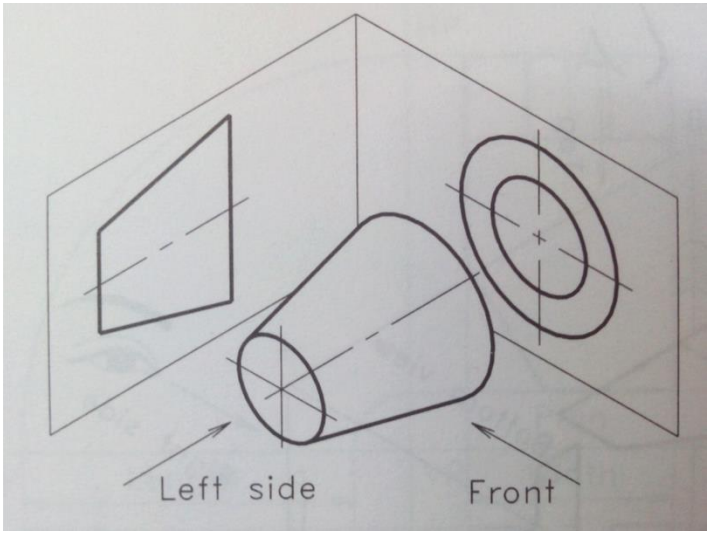


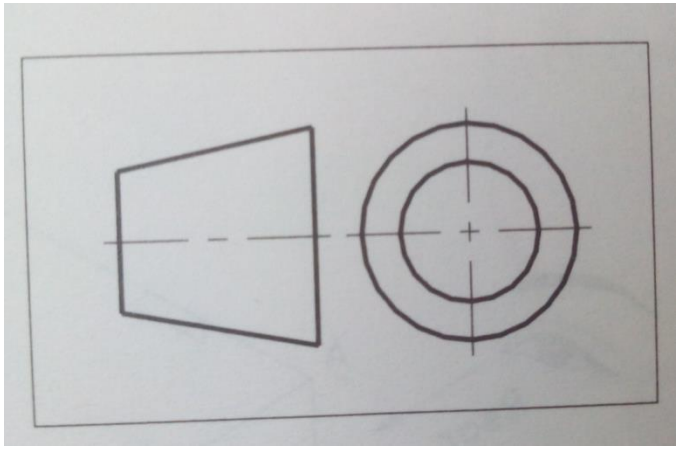

A.V.P.
V.P.
S
A.V.P.
S
E
PRINCIPAL
PLANE
P
SIDE
P
H.P.
H.P.

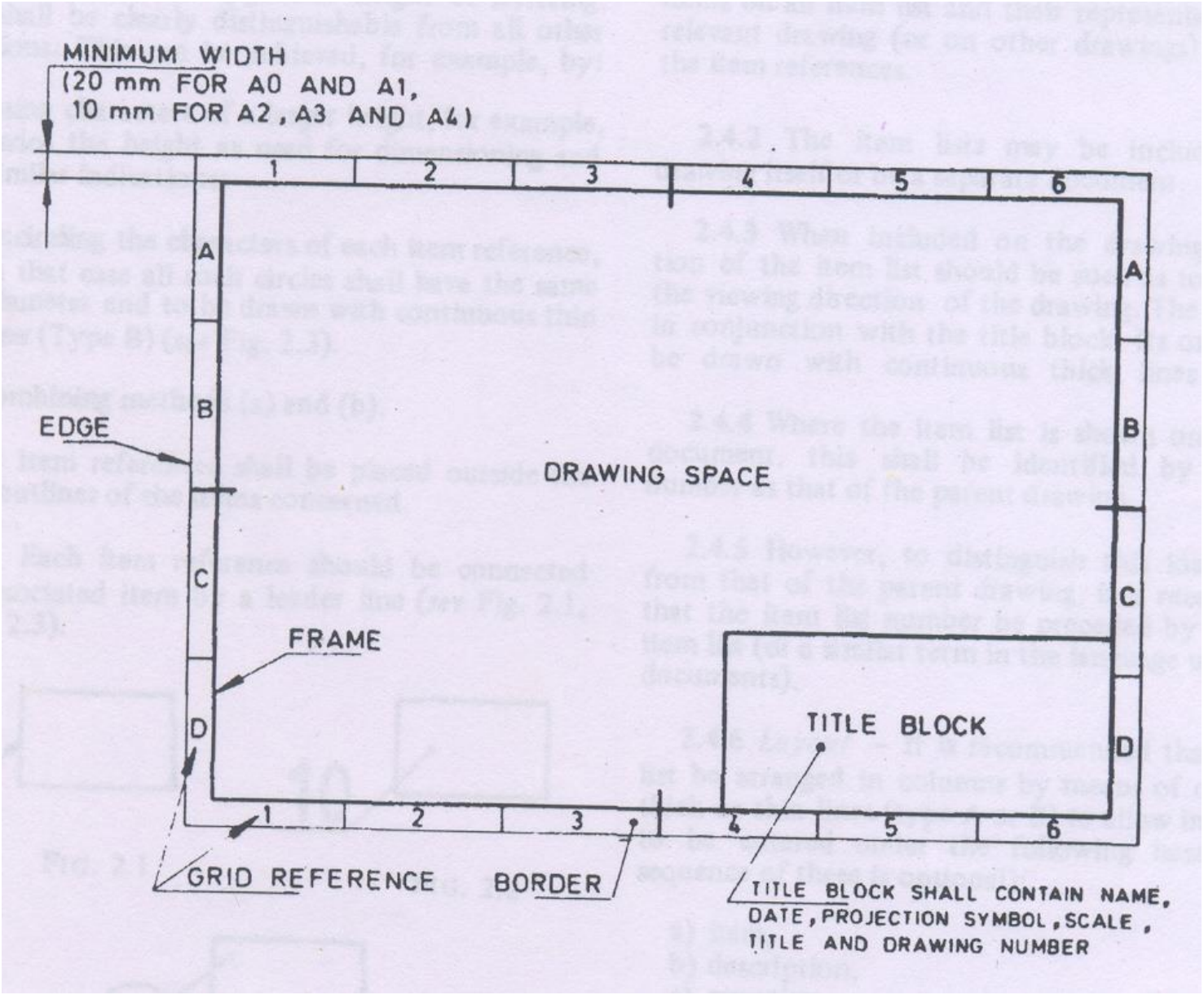

V.P.
A.V.I
S
H
E
D
FRONT VIEW
SIDE VIEW
P
TOP VIEW
H.P.

First angle projection



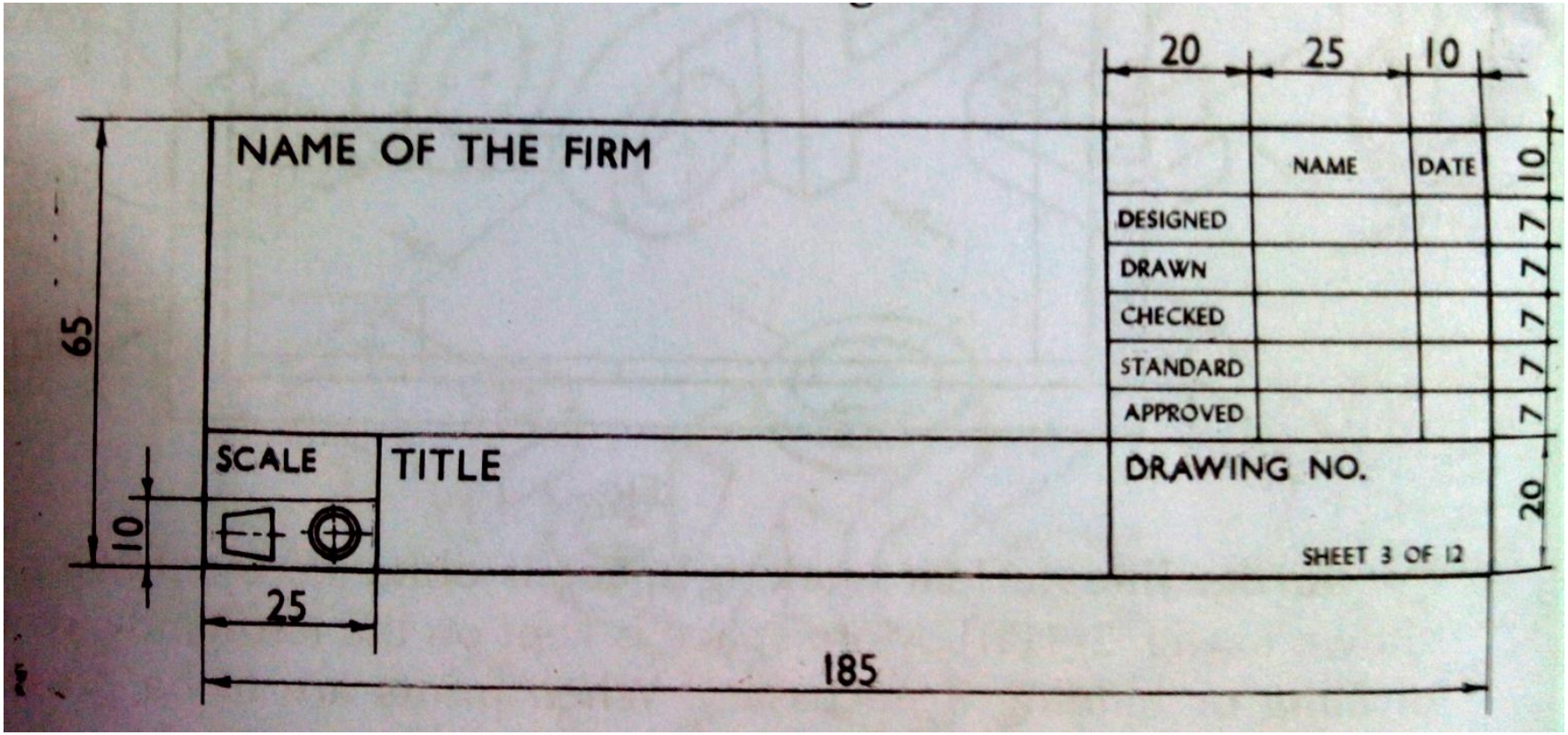





MINIMUM WIDTH
(20 mm FOR A0 AND A1,
10 mm FOR A2, A3 AND A4)
1
2
3
4
5
6
A
B
C
D
EDGE
DRAWING SPACE
FRAME
TITLE BLOCK
GRID REFERENCE
BORDER
TITLE BLOCK SHALL CONTAIN NAME,
DATE, PROJECTION SYMBOL, SCALE,
TITLE AND DRAWING NUMBER

Title Block

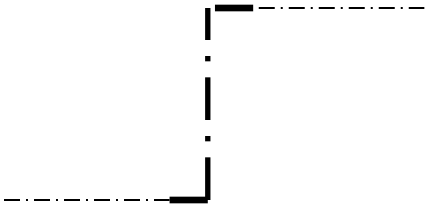
the title block containing the identification of the drawing (registration number, title, origin, etc)



TYPES OF LINES:-

		General applications-
A	Continuous thick	Visible outlines
B	Continuous thin	•Imaginary lines of intersection. •Dimension lines. •Projection lines. •Leader lines. •Hatching, short center lines.
C	Continuous thin Freehand.	Limits of partial and Interrupted views
D	Continuous thin Straight with zigzag.	Long break line.
E	Dashed thick.	•Hidden outlines. •Hidden edges.

TYPES OF LINES:-

			General applications-
F		Dashed thin.	•Hidden outlines. •Hidden edges.
G		Chain line	•Center lines. •Lines of symmetry. •Line of trajectories.
H		Chain thin, thick at ends and changes the direction	•Cutting planes.
J		Thick chain line	•Indication of lines or surfaces to which special requirement applies.

TYPES OF LINES:-

			General applications-
K		Thin chained double Dashed.	•Outlines of adjacent parts. •Alternative and extreme positions of movable parts. •Centroidal lines. •Initial outlines prior to forming. •Parts situated in front of cutting plane.

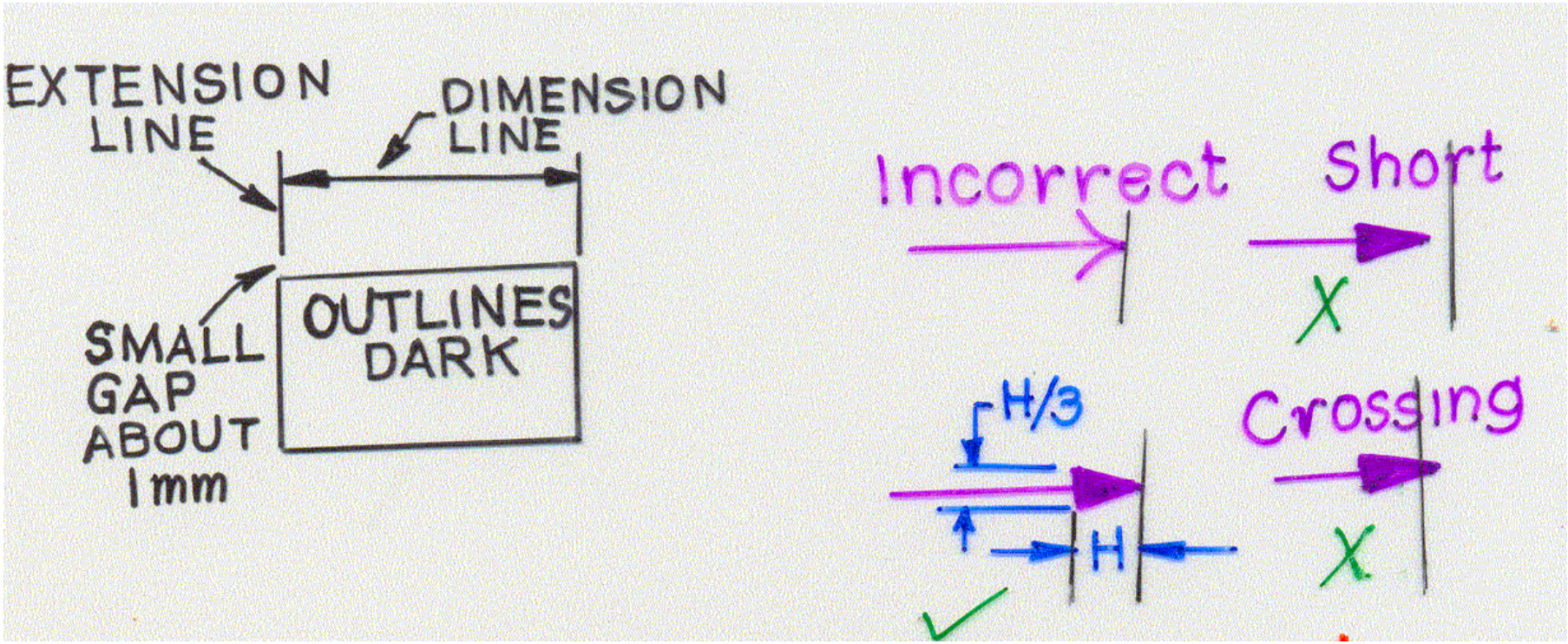
Lines	Pencil
•Initial work and construction lines. •Outlines, dotted lines, section plane lines, dimension lines, arrowheads •Centre lines, section lines	H 2H 3H or 4H

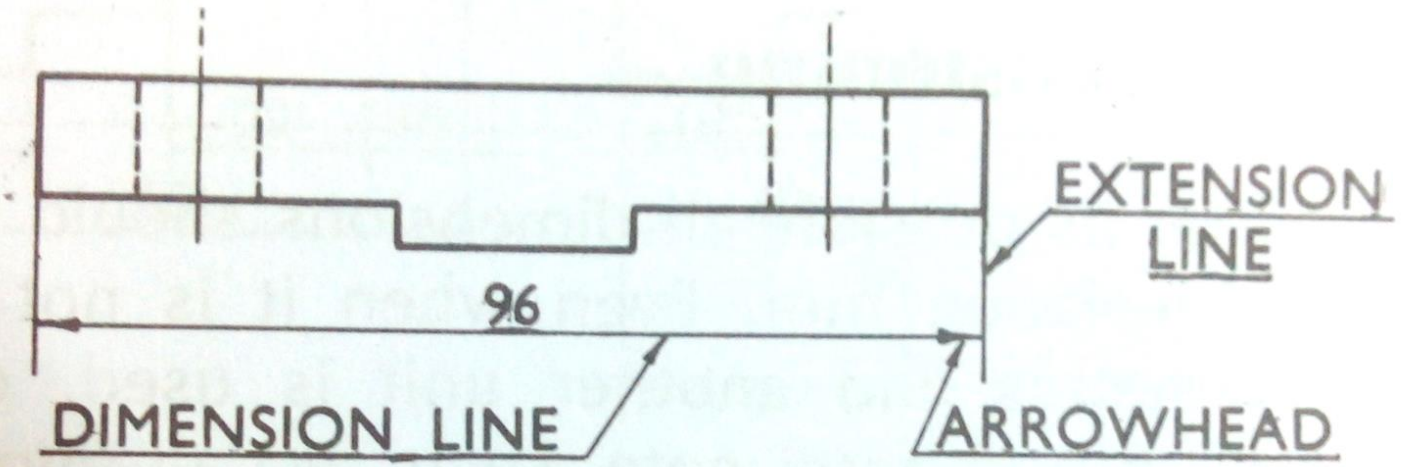
DIMENSIONING

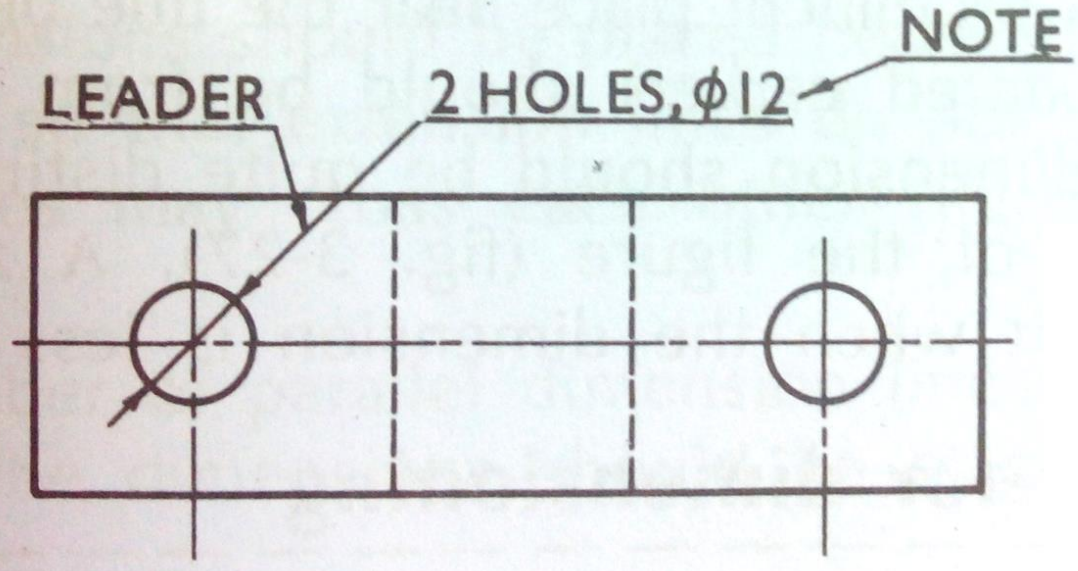
Orthographic Views convey the *shape* information

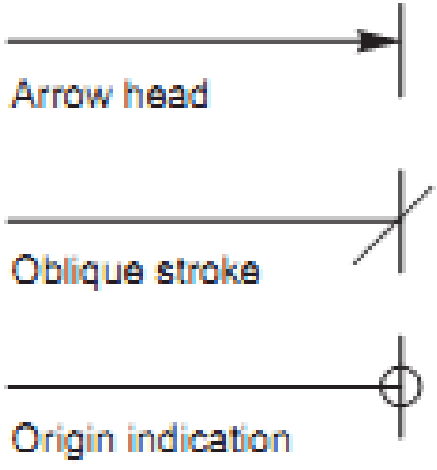
Dimensioning is required to convey the exact *size* of the object left after a series of manufacturing operation have taken place.

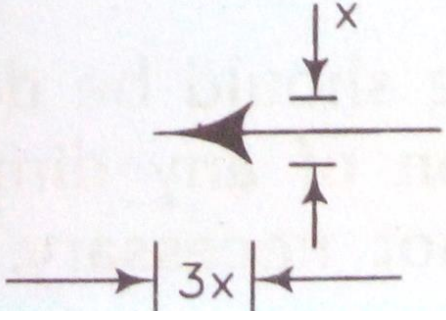
Elements of Dimensioning - The elements of dimensioning include the projection line, dimension line, leader line.









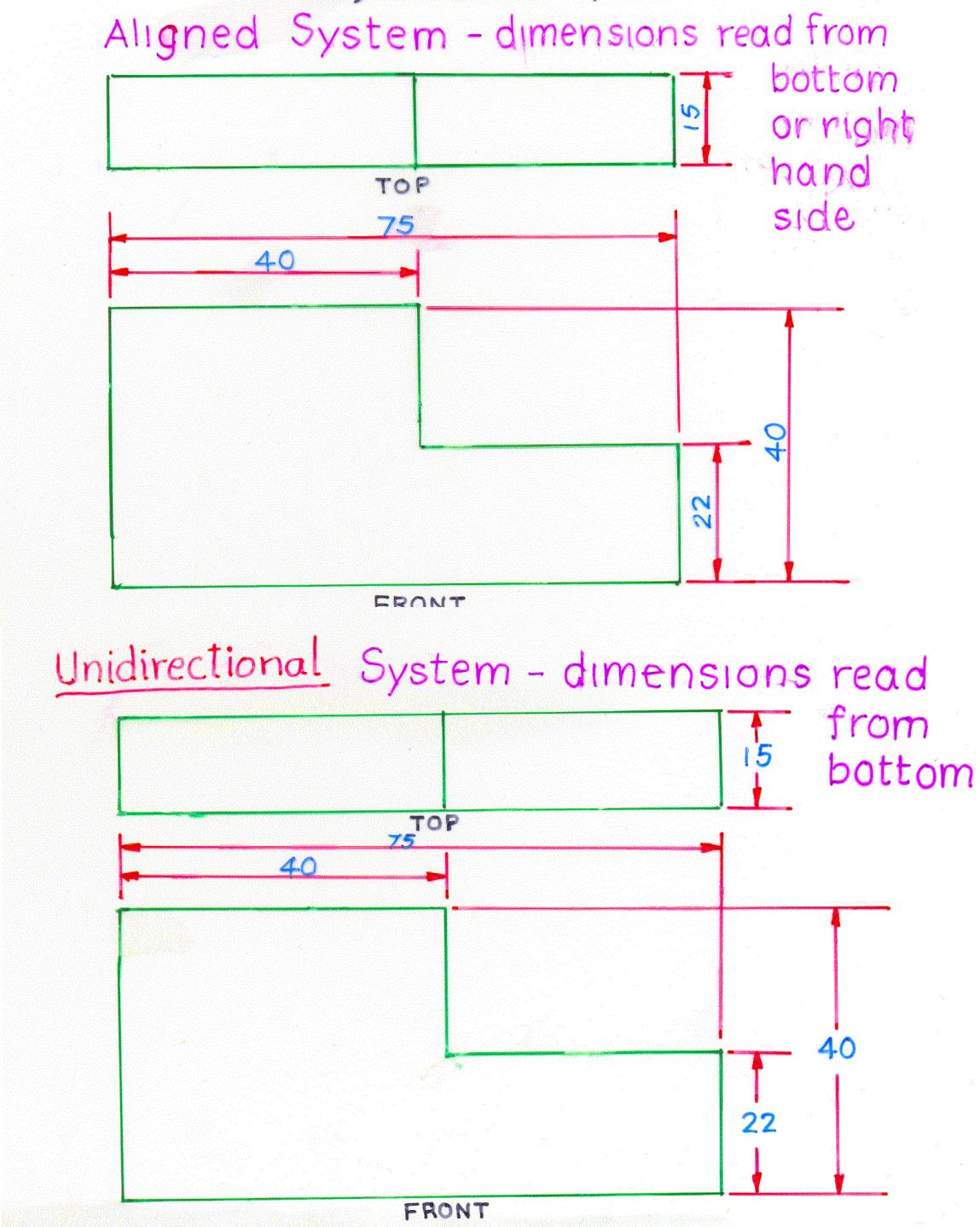


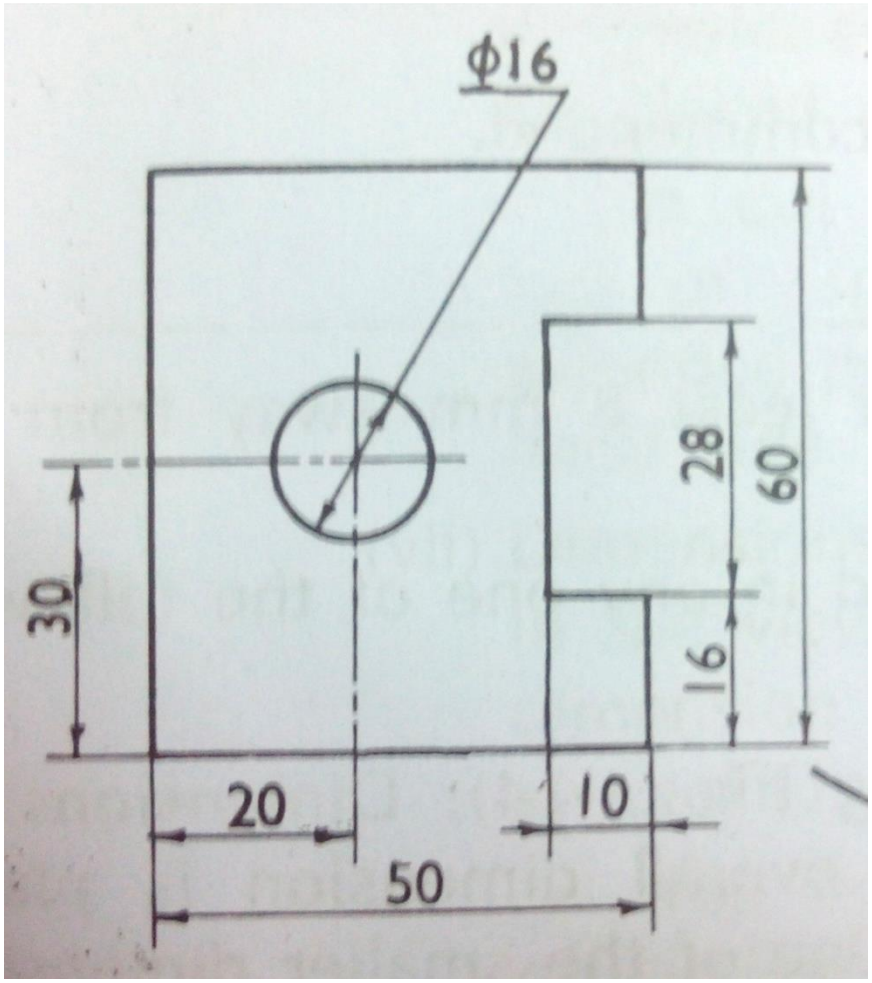
Termination of Dimn. line

TWO MAJOR METHODS OF DIMENSIONING

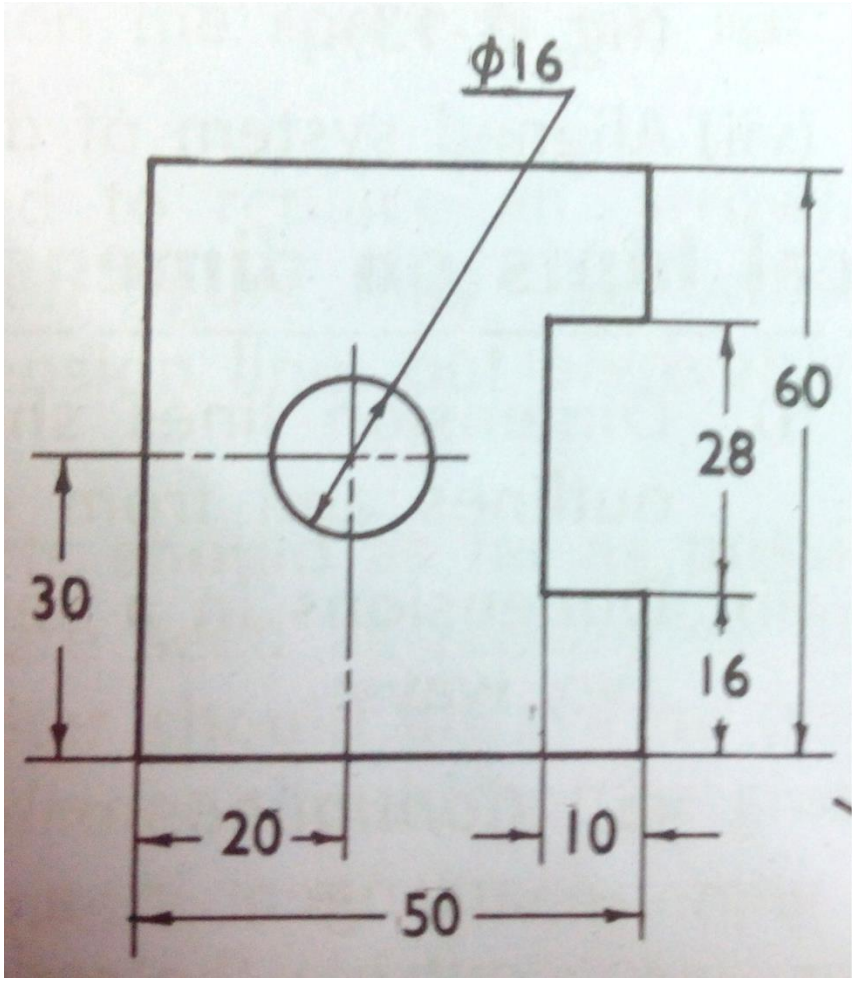
1. Aligned System

2. Unidirectional System



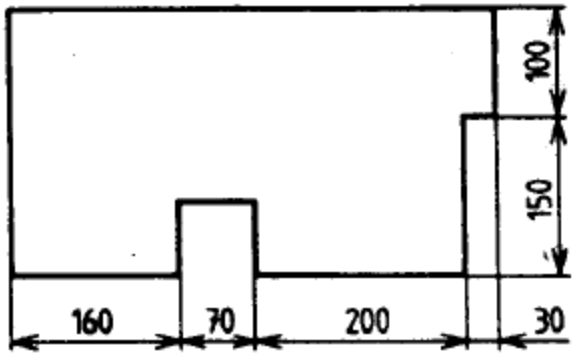


Aligned System

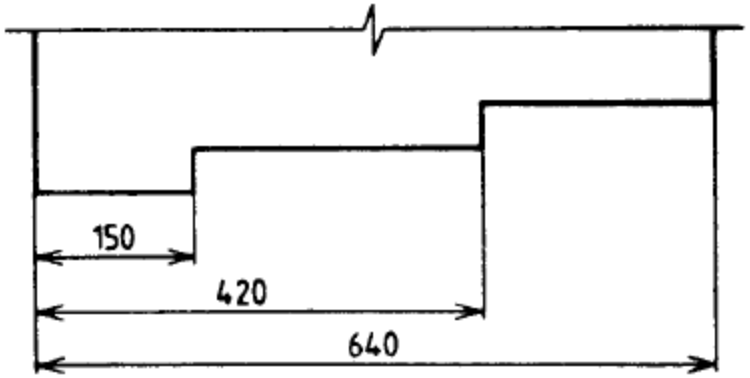


Unidirectional System

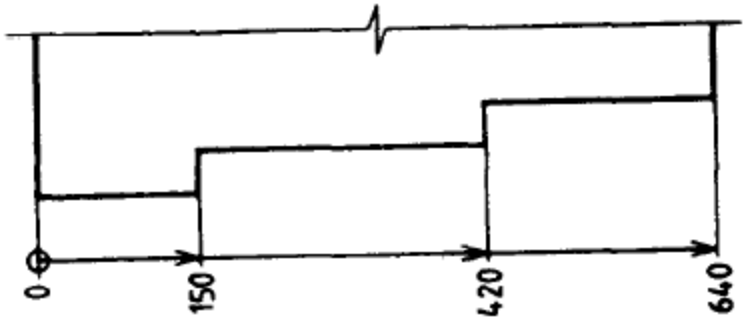
Chain *Dimensioning* - Chains of single dimensions should be used only where the possible accumulation of tolerances does not impinge on the functional requirements of the part.



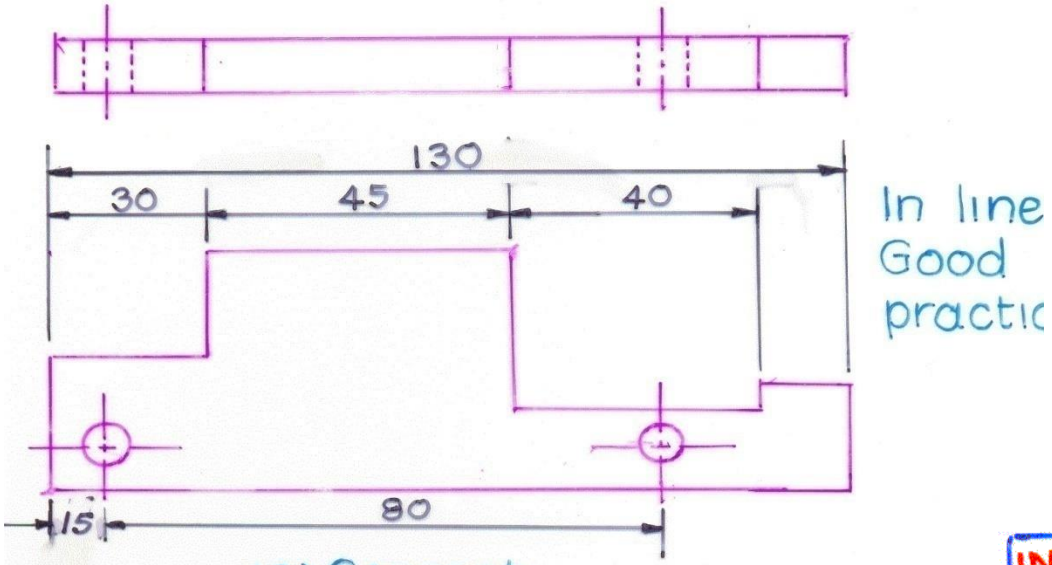
Parallel dimensioning is the placement of a number of single dimension lines parallel one to another and spaced out so that the dimensional values can easily be added in.



Superimposed running

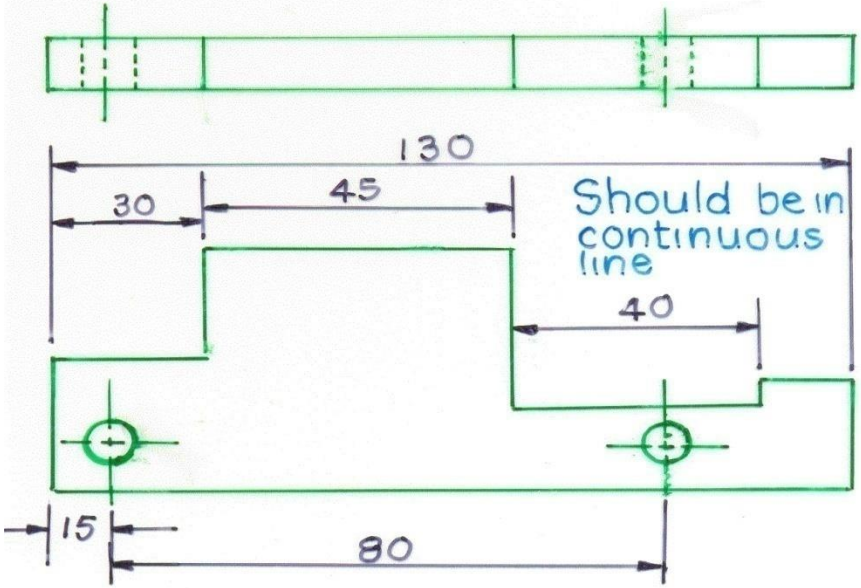


Consecutive Dimensions p. 335

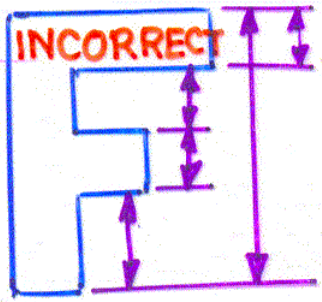


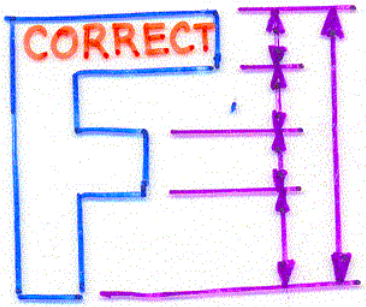
(a) Correct

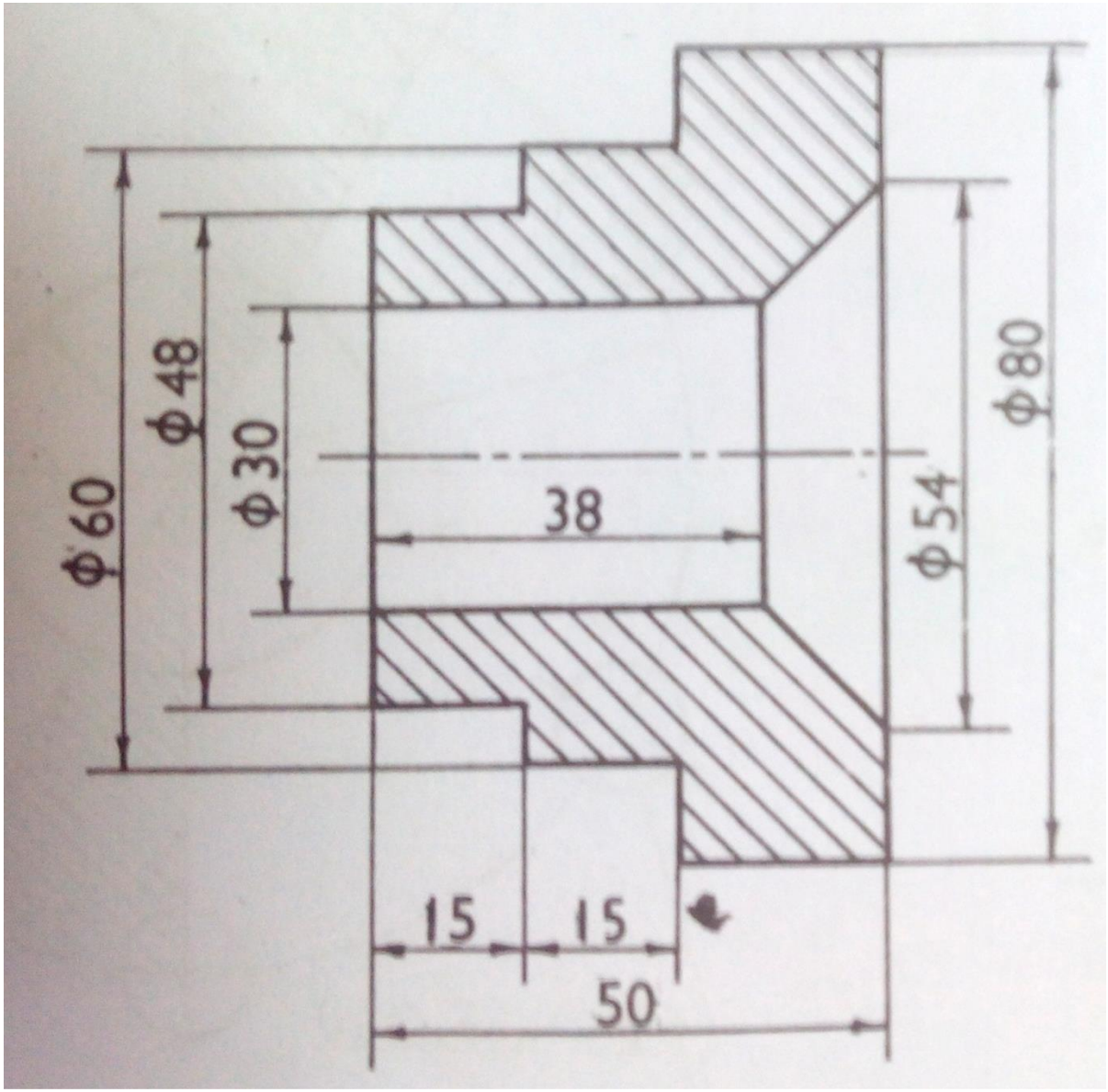
In line
Good
practic



(b) Incorrect






φ60
φ48
φ30
38
φ54
φ80
15
15
50

•The following indications are used with dimensions to show applicable shape identification and to improve drawing interpretation. The diameter and square symbols may be omitted where the shape is clearly indicated. The applicable indication (symbol) shall precede the value for dimension

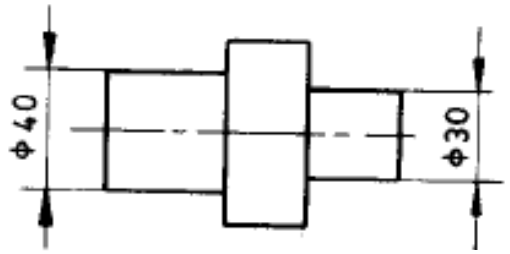
ϕ : Diameter

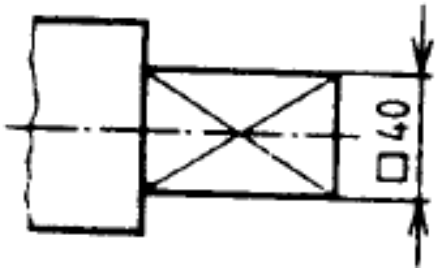
Sϕ : Spherical diameter

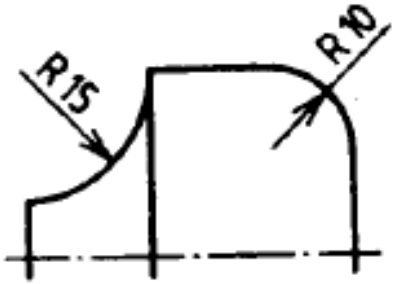
R: Radius

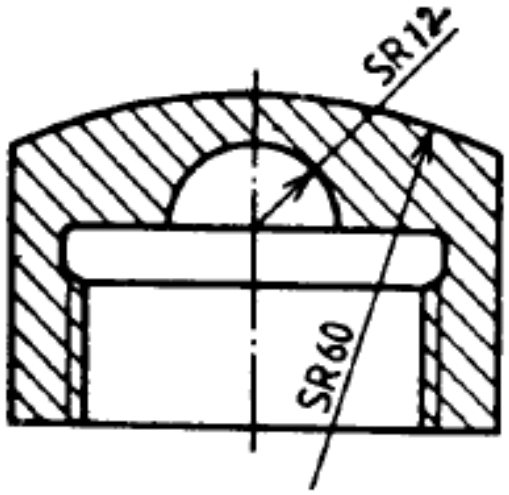
SR : Spherical radius

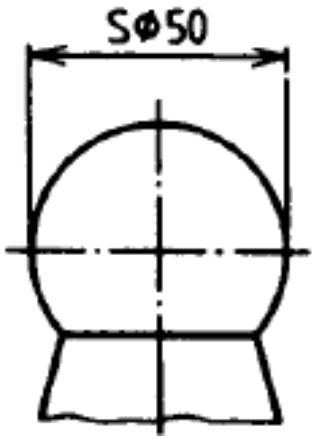
□: Square





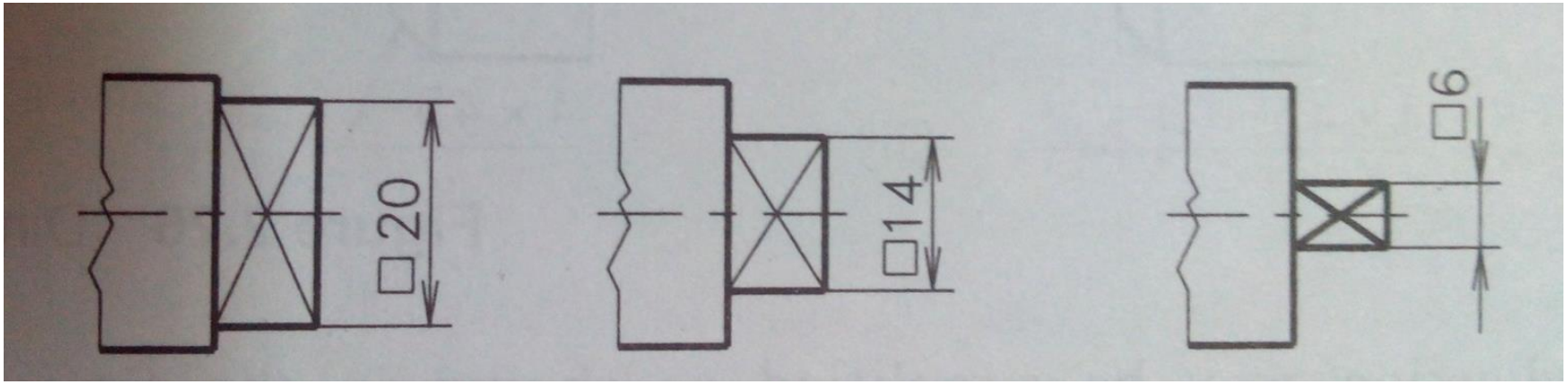


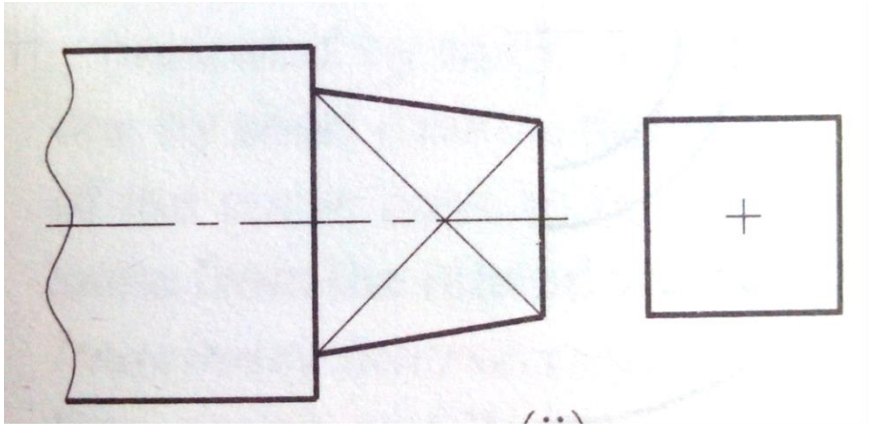




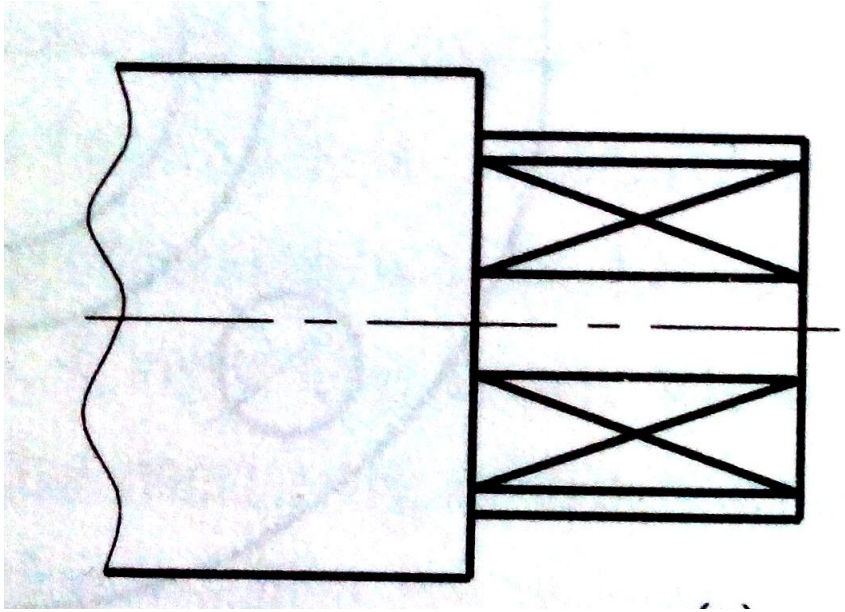
Dimensioning of a square cross-section

A square symbol along with the indication of diagonals drawn as continuous thin line is used to show a square section. **The square symbol can be omitted in some of the cases.**





Guess the side view of the following component !!!



Round/cylindrical Features

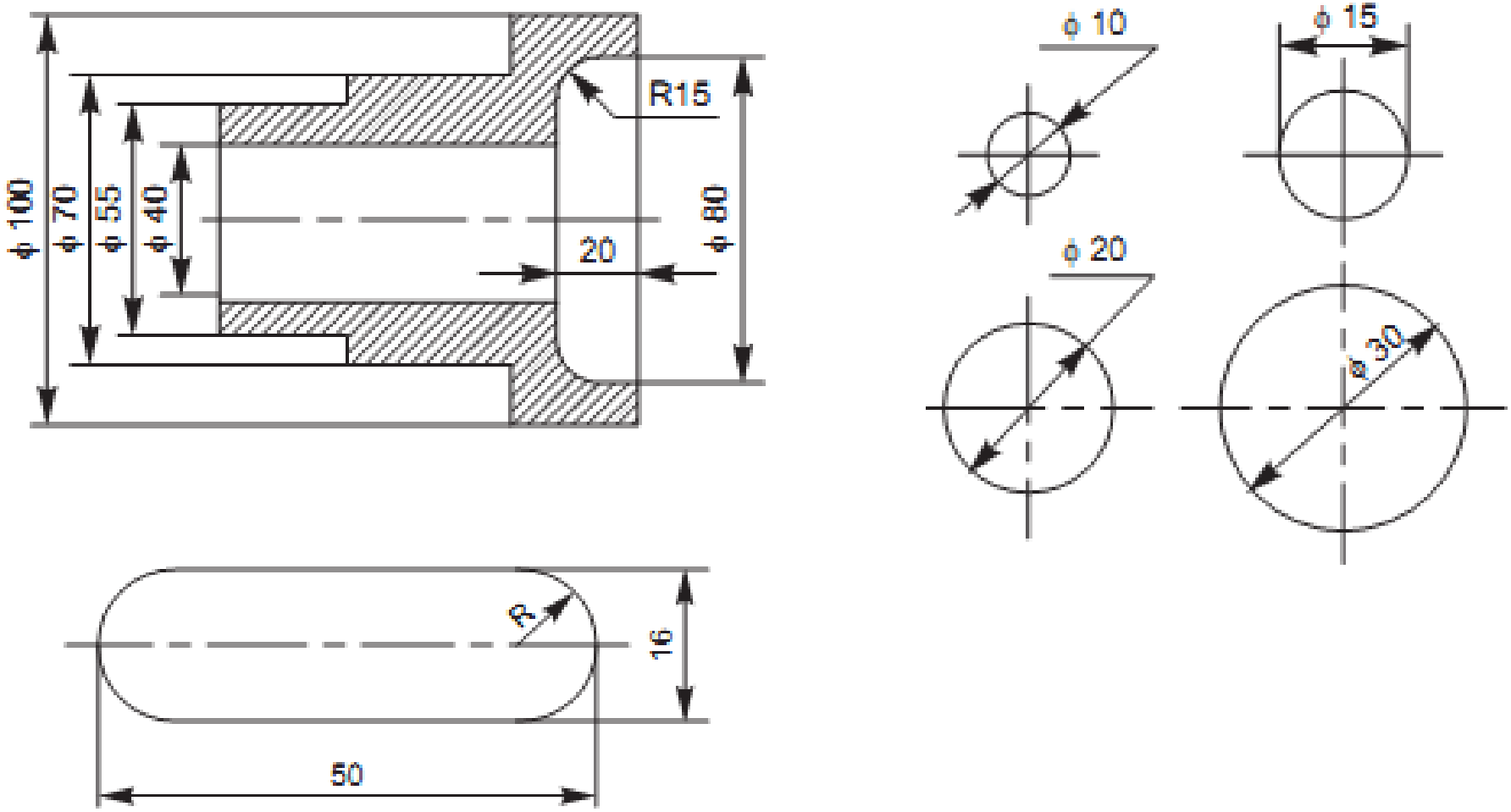
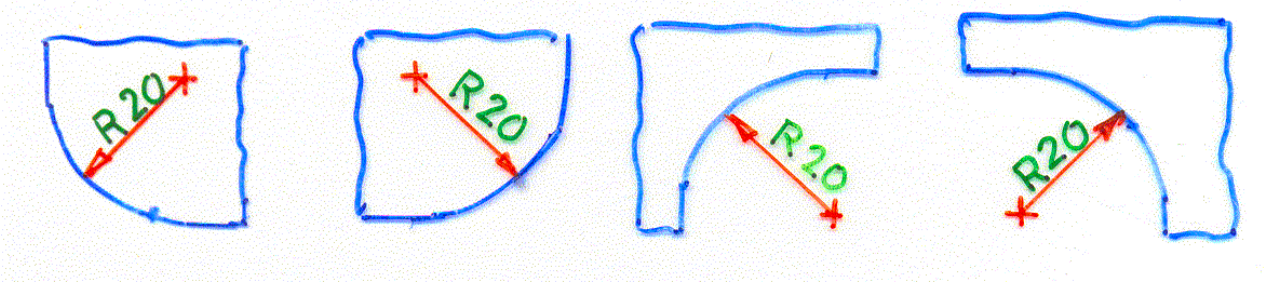
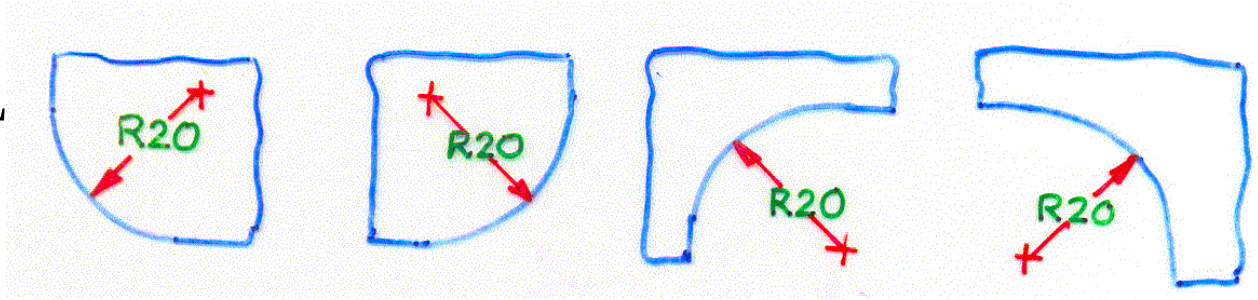


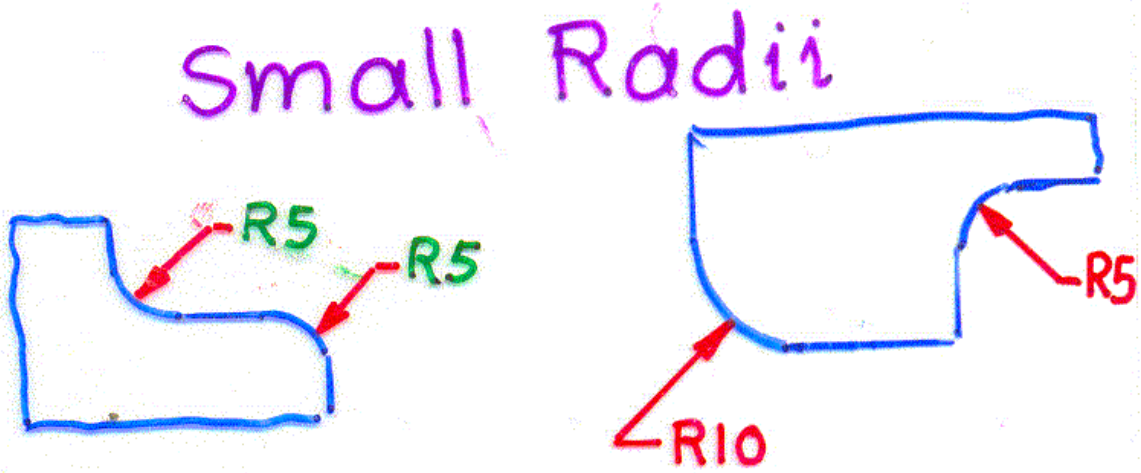
Fig. 2.49 Dimensioning of radius

ALIGNED

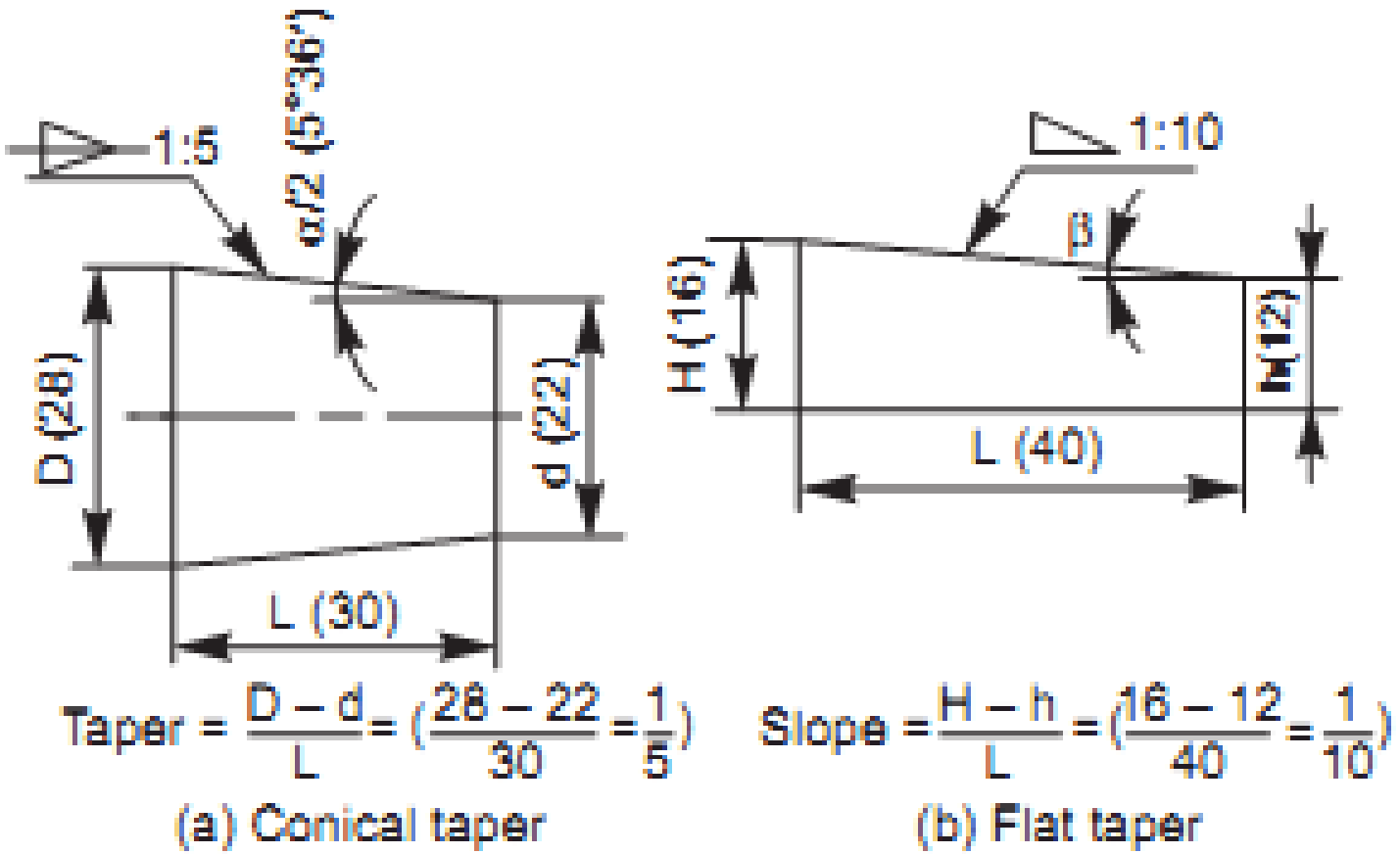


UNIDIRECTIONAL





Taper Features



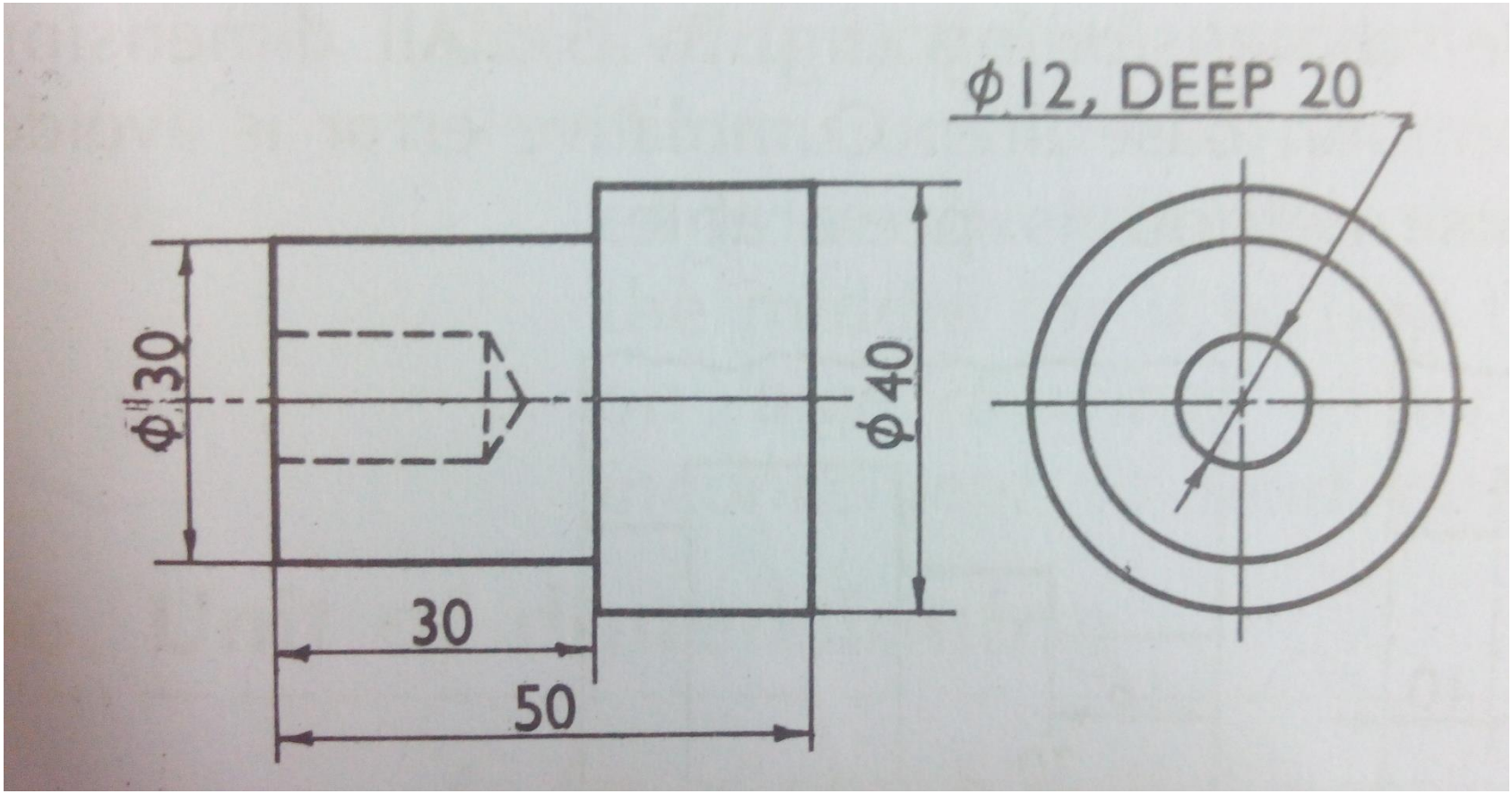
$$\text{Taper} = \frac{D-d}{L} = \left(\frac{28-22}{30} = \frac{1}{5}\right)$$

(a) Conical taper

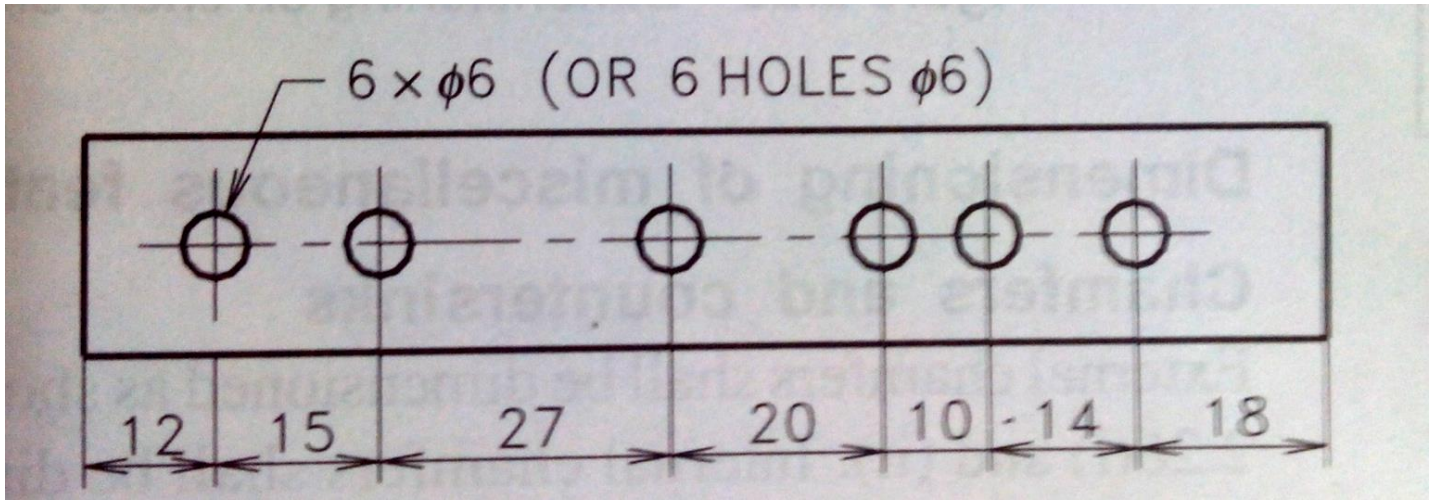
$$\text{Slope} = \frac{H-h}{L} = \left(\frac{16-12}{40} = \frac{1}{10}\right)$$

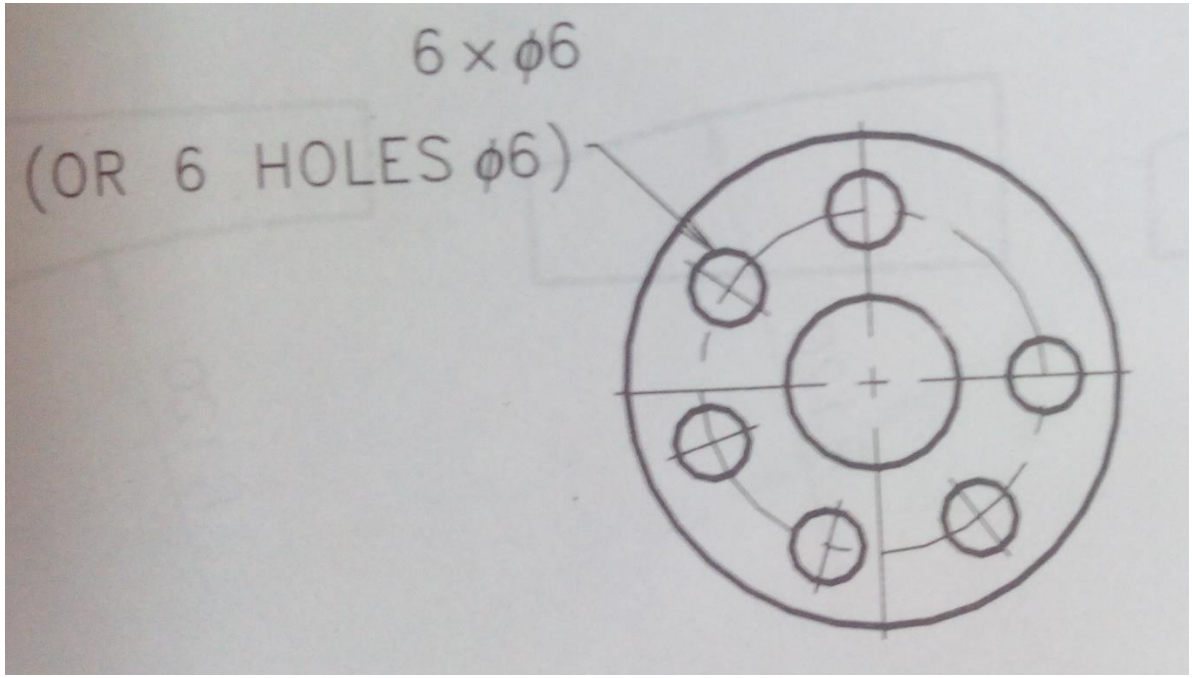
(b) Flat taper

Dimension of Hole - Diameter, Depth

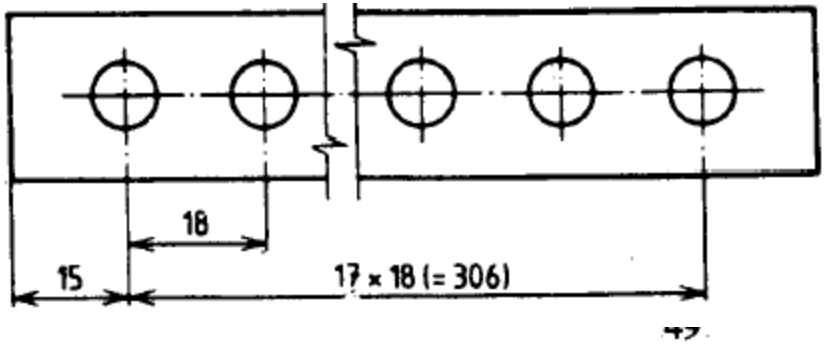


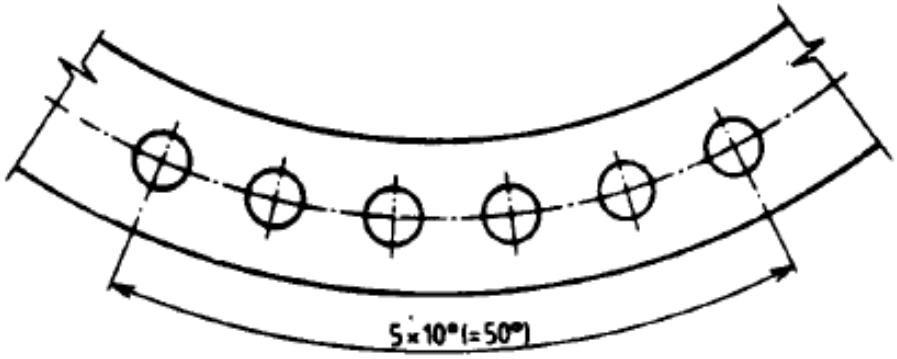
Repeated features

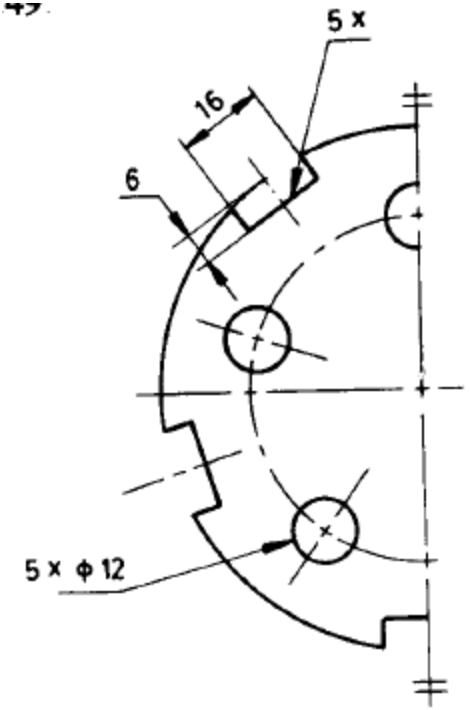




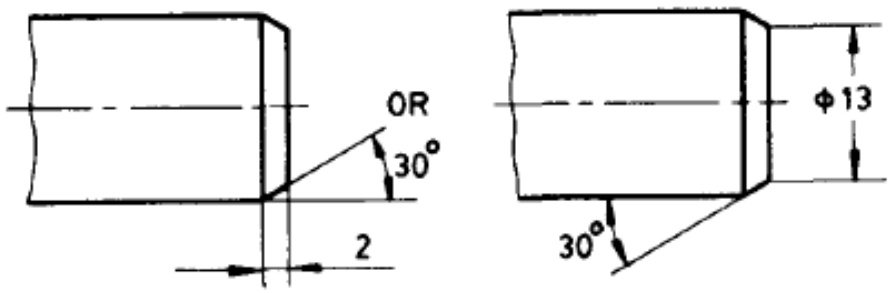
Equidistant Features - Where equidistant features or uniformly arranged elements are part of drawing specifications, the dimensioning may be simplifies as follows-



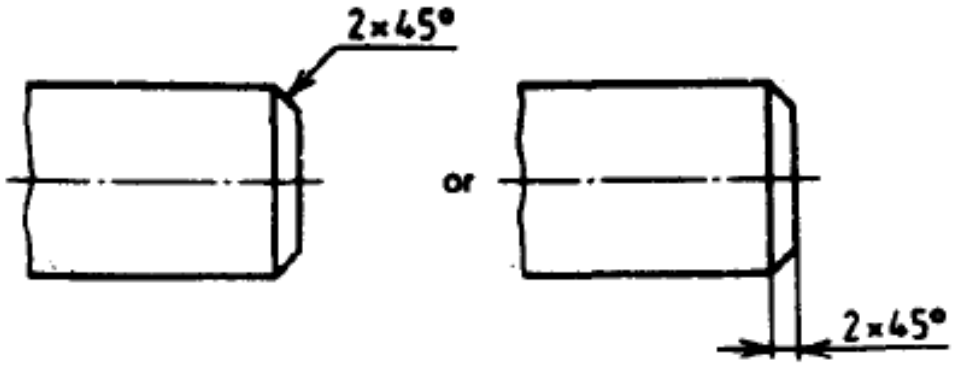




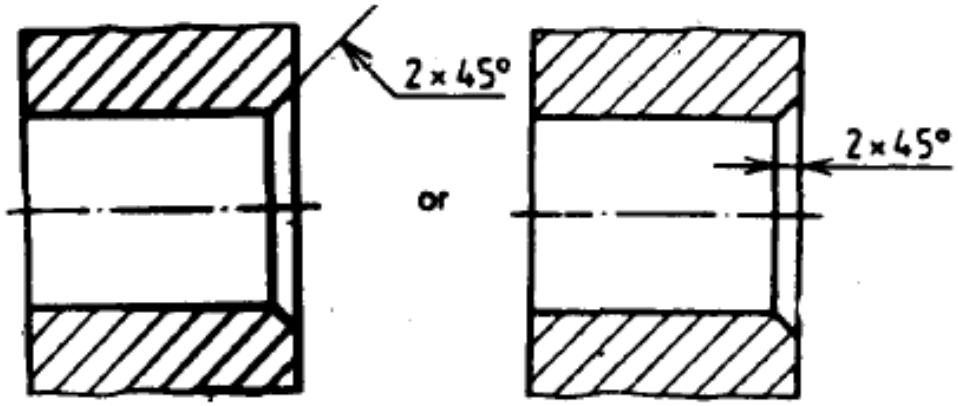
Chamfers shall be dimensioned as shown in figure

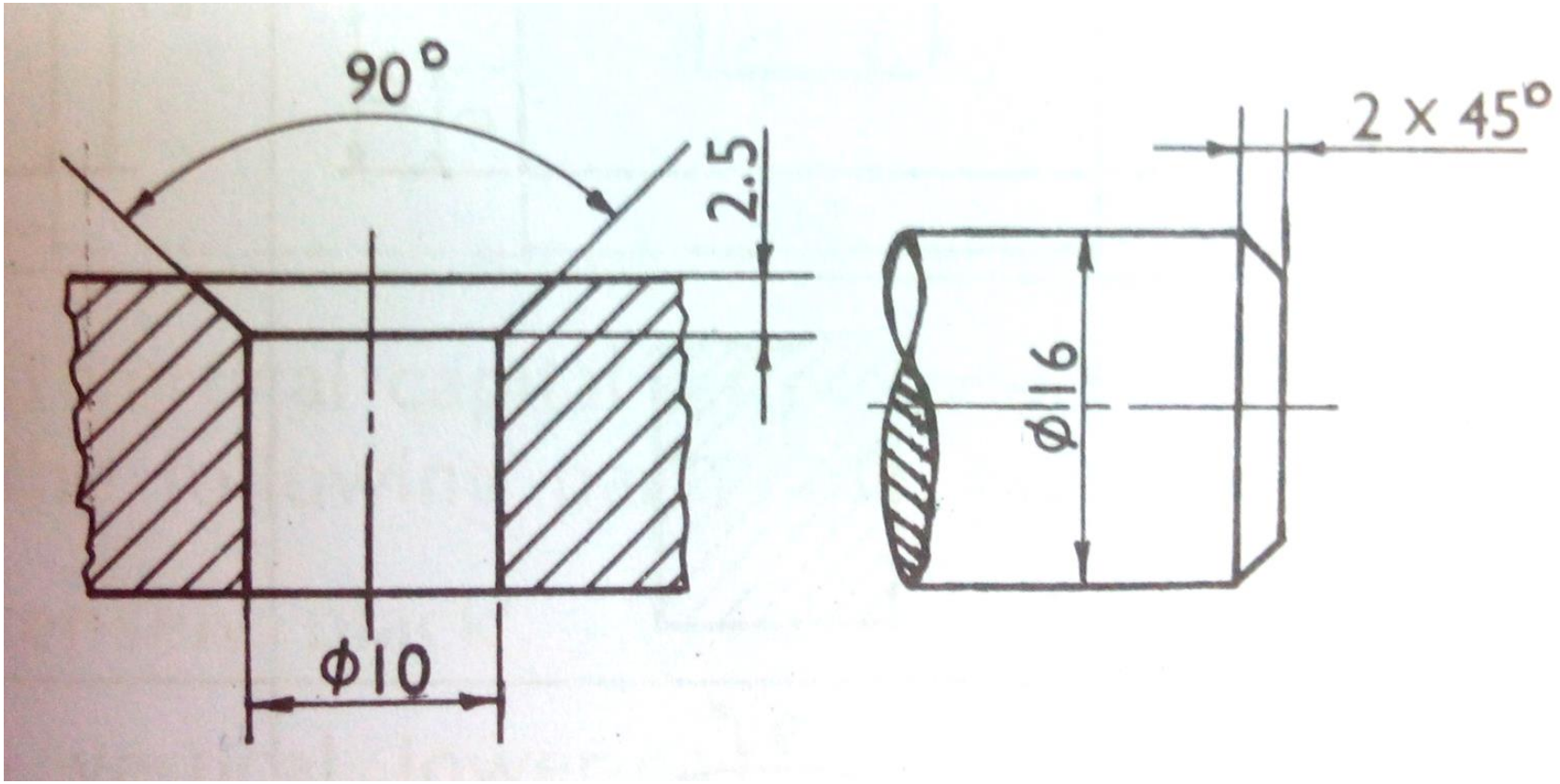


45 degree chamfers



Internal chamfers




90°
2.5
2 x 45°
ϕ16
ϕ10

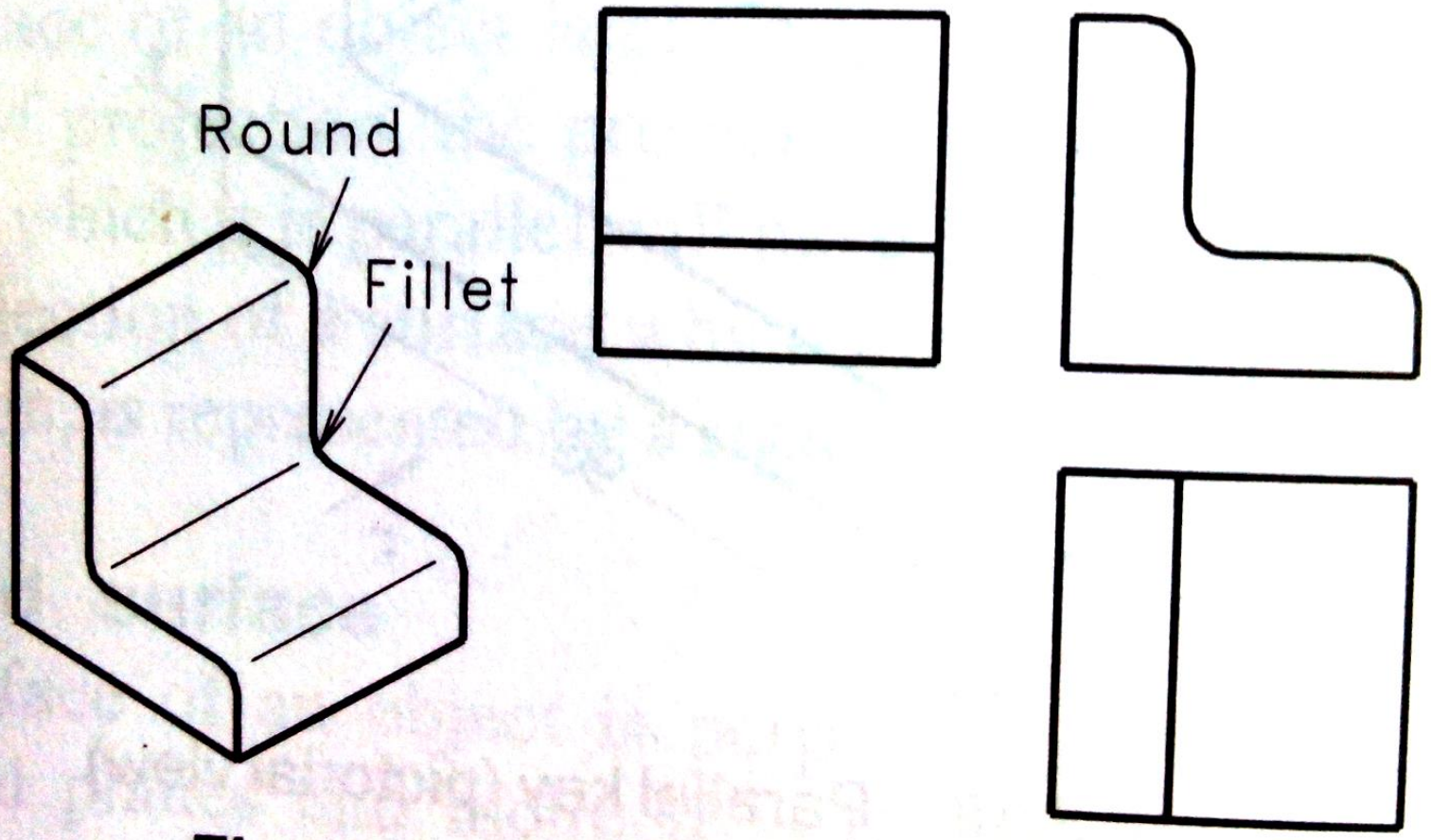
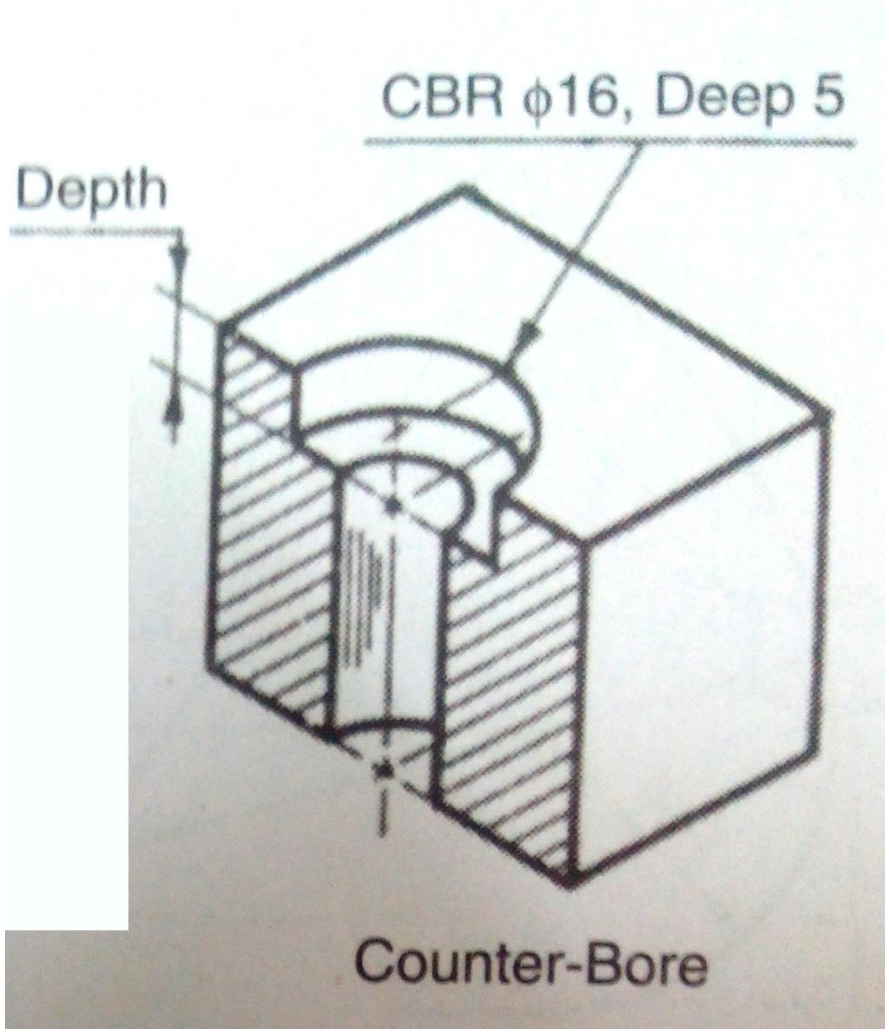
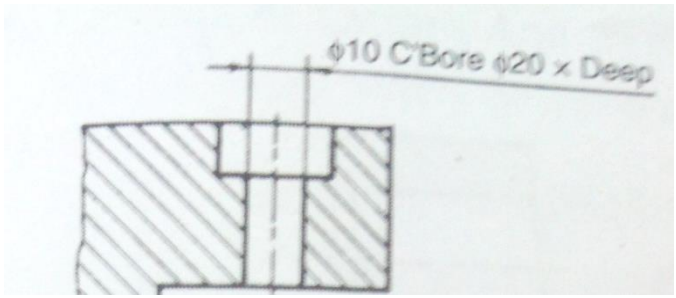
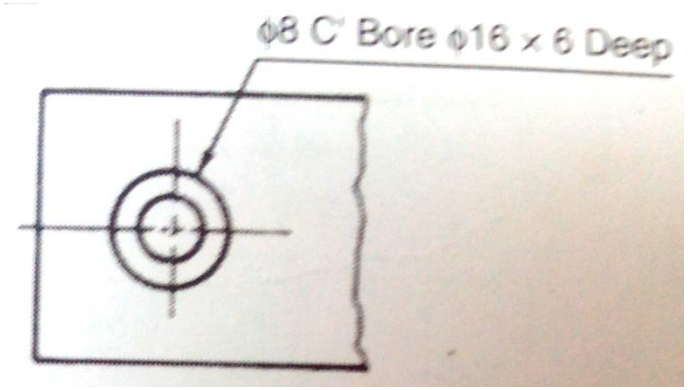
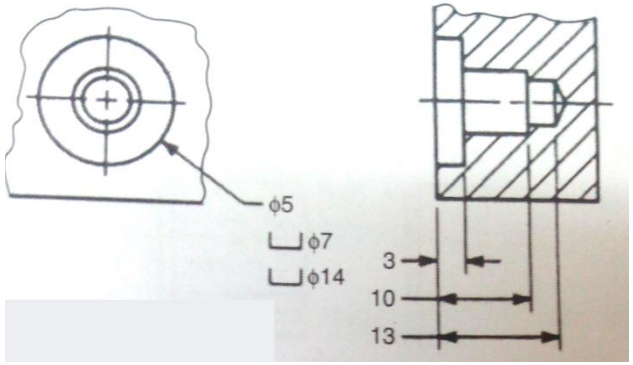


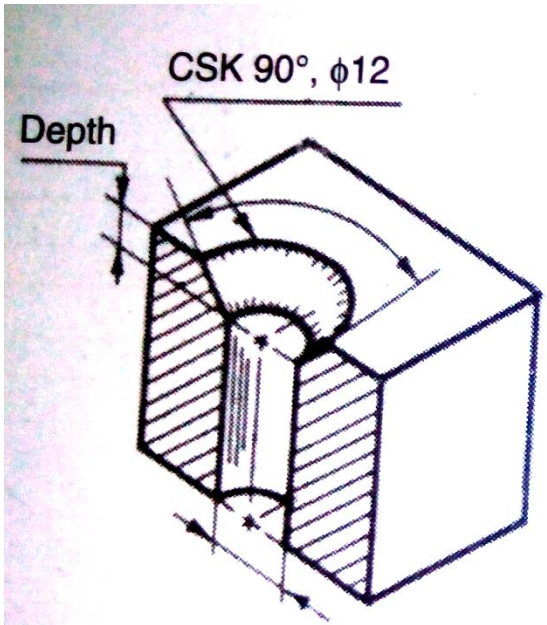
Figure 3.23 Fillets and rounds.


CBR ϕ16, Deep 5
Depth
Counter-Bore

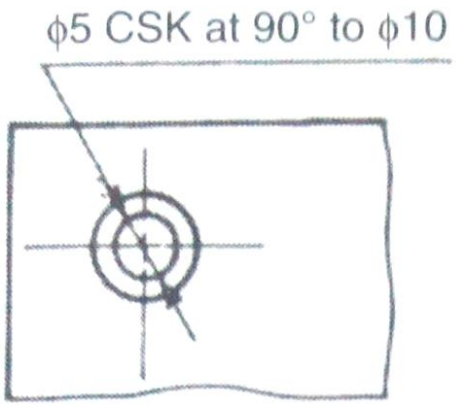

ϕ10 C'Bore ϕ20 x Deep

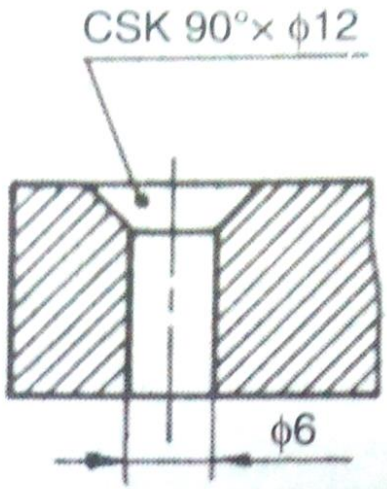

ϕ8 C' Bore ϕ16 x 6 Deep

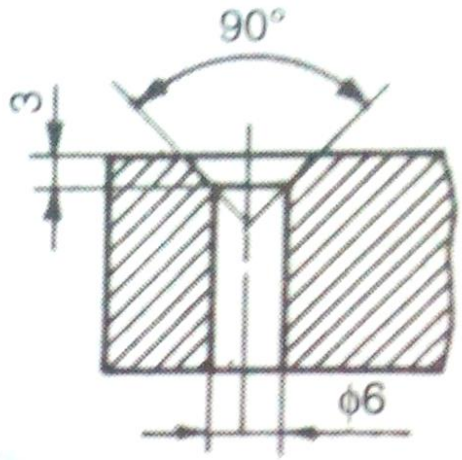

ϕ5
ϕ7
ϕ14
3
10
13



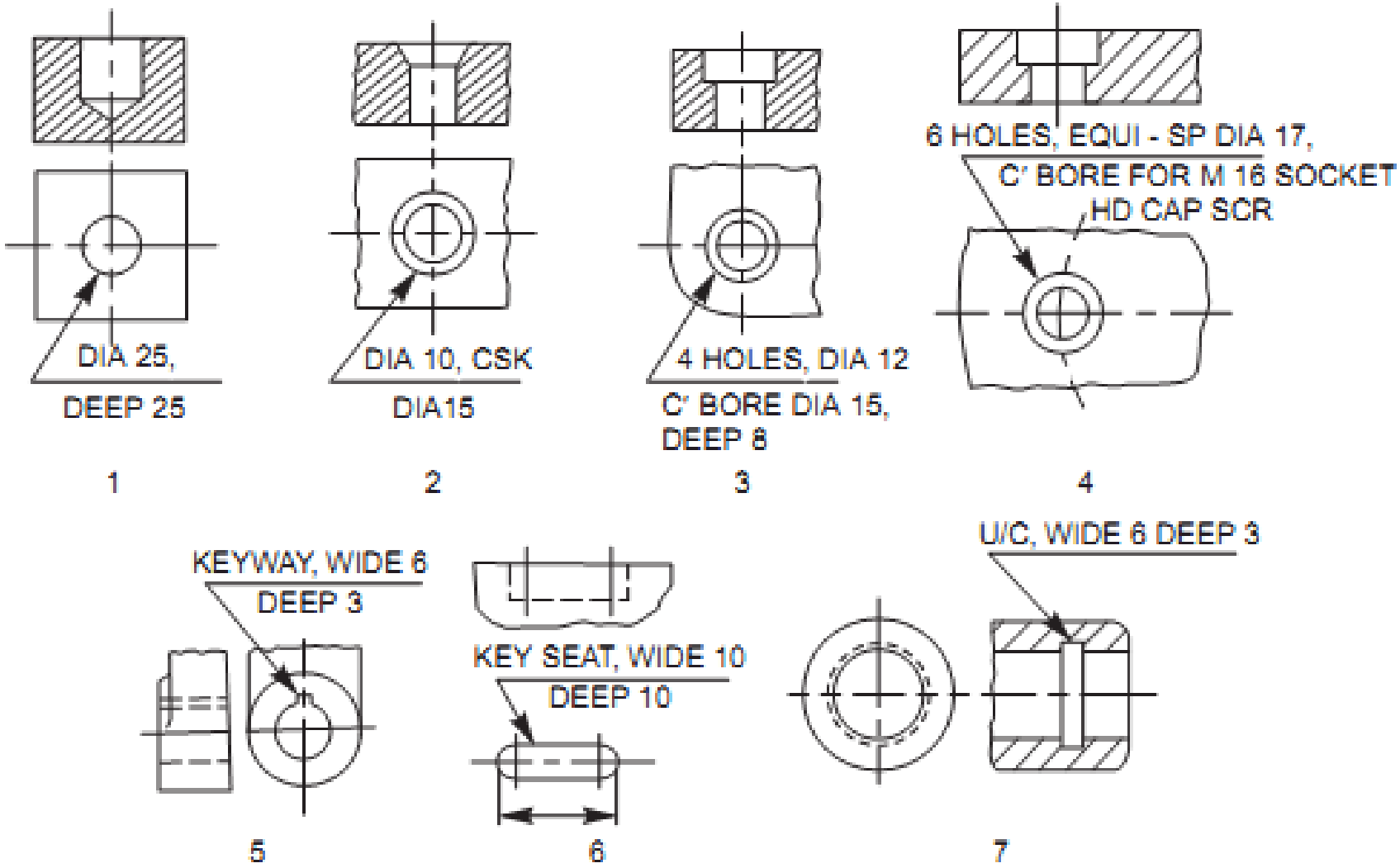
Counter-Sink

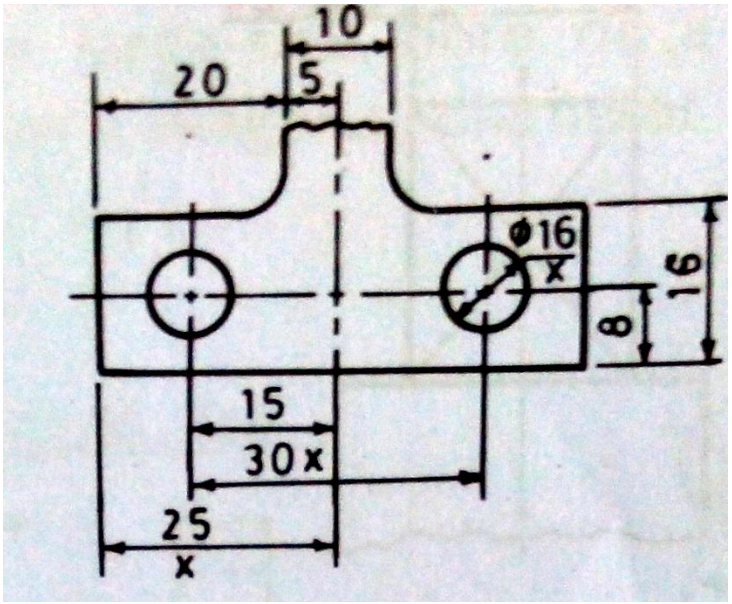


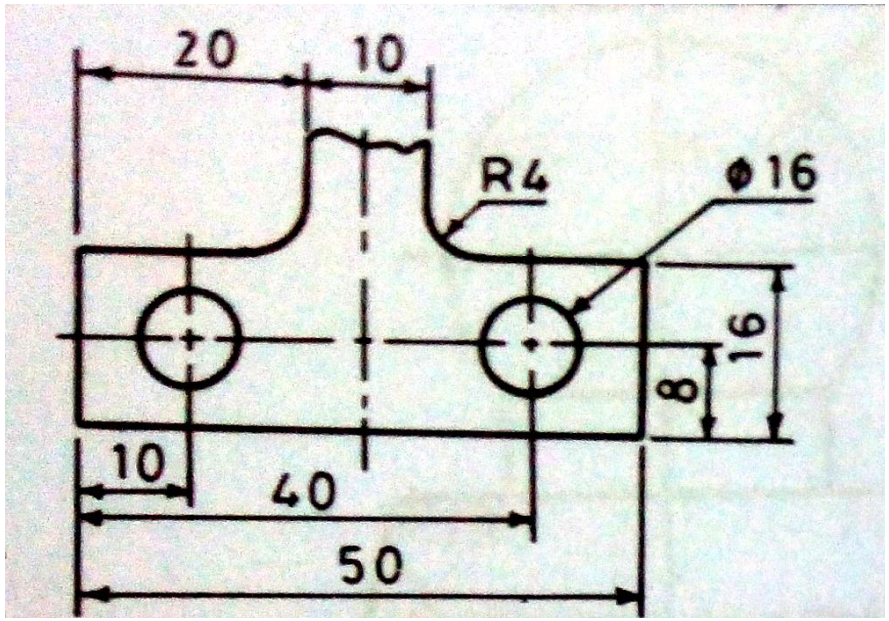


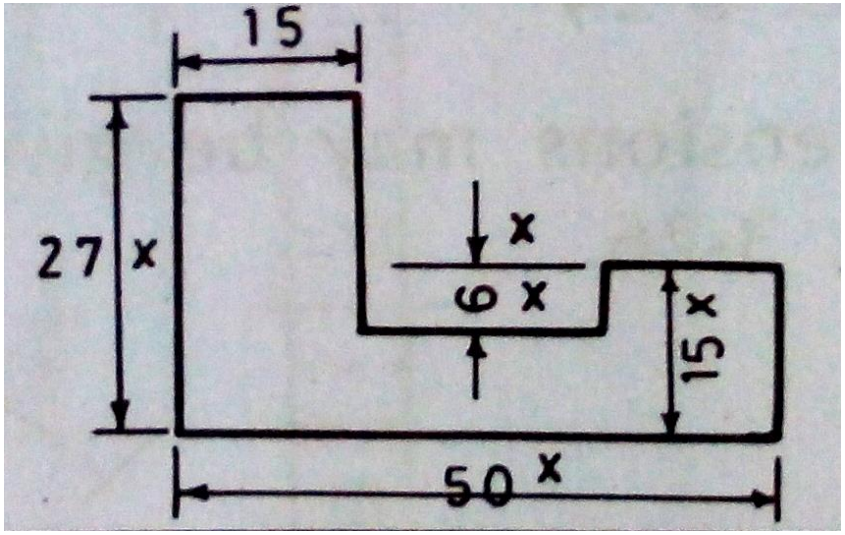


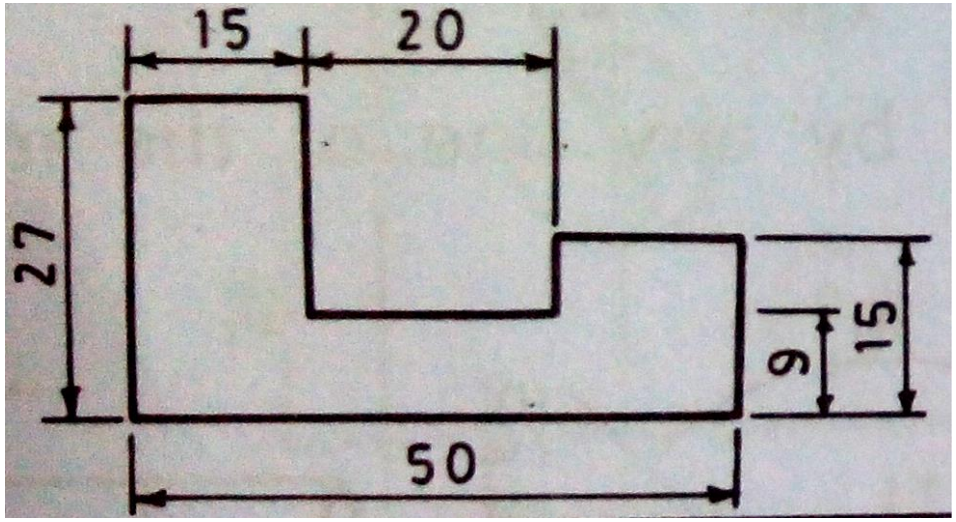
Method of indicating Notes

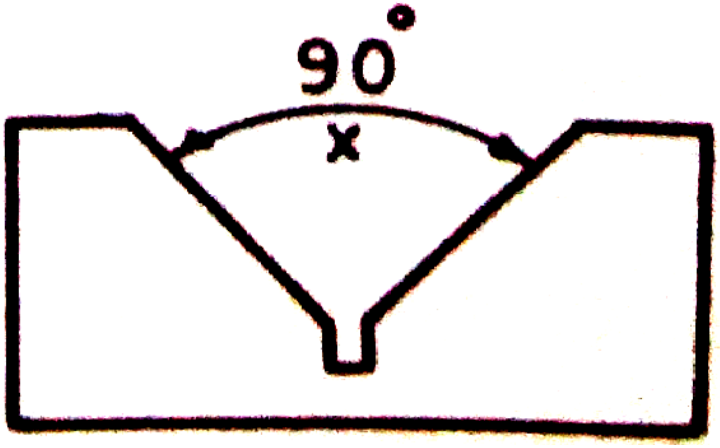


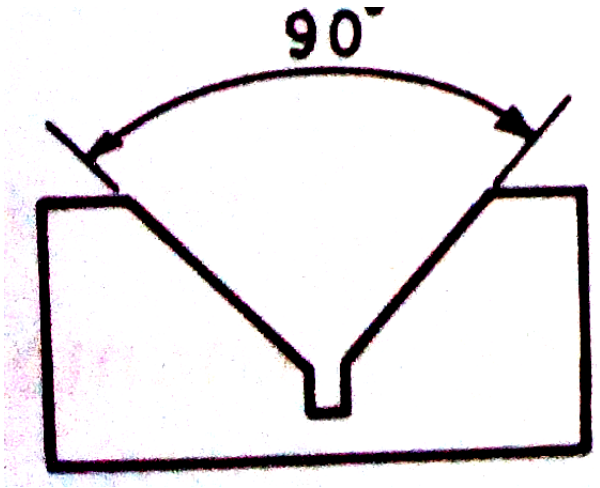

10
20
5
ϕ16
x
16
8
15
30x
25
x

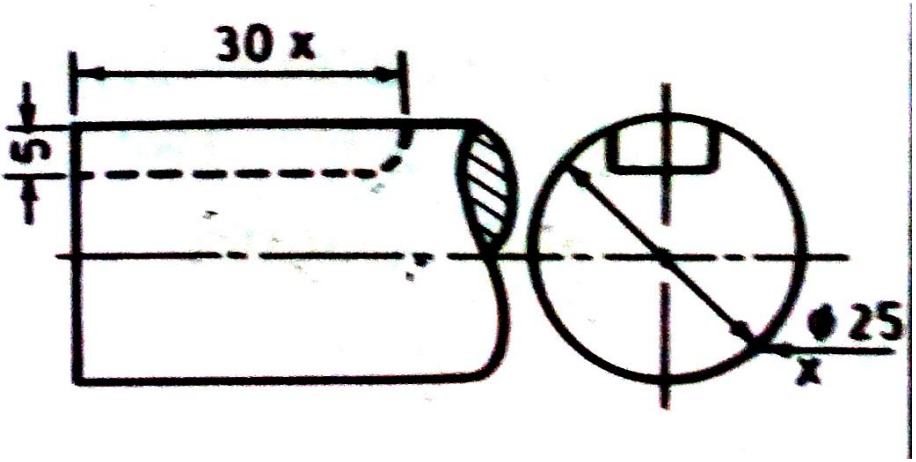

20
10
R4
ϕ16
16
8
10
40
50

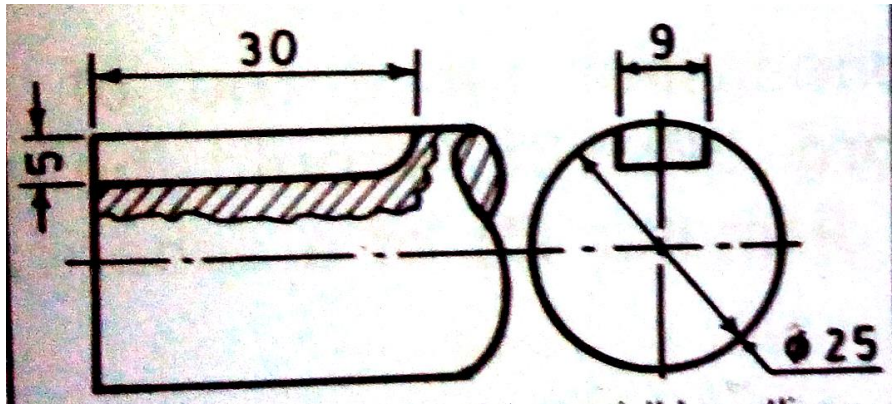

15
27
x
x
6
x
15x
50
x


15
20
27
9
15
50

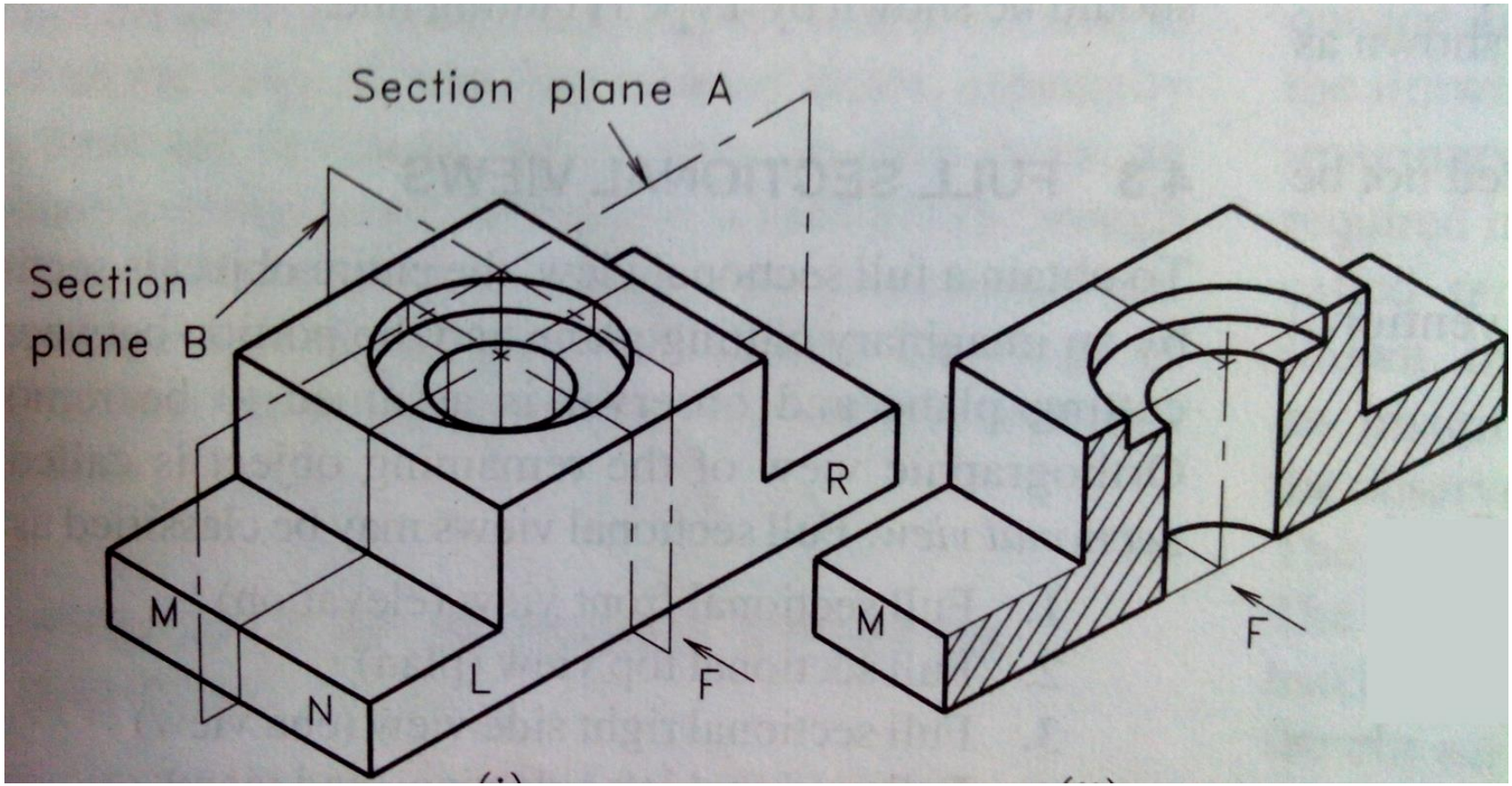

90°
x


90°

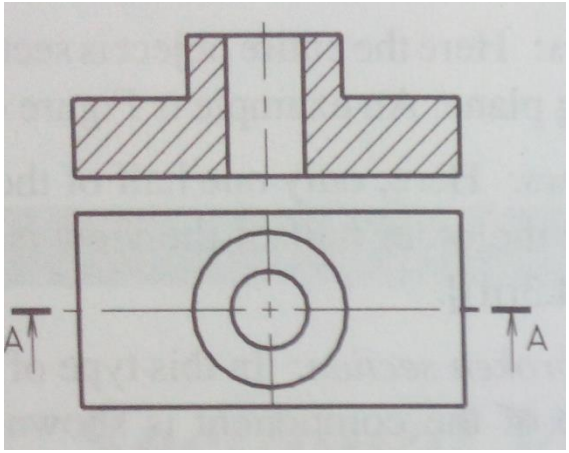

30 x
5
ϕ25
x


30
9
5
ϕ25

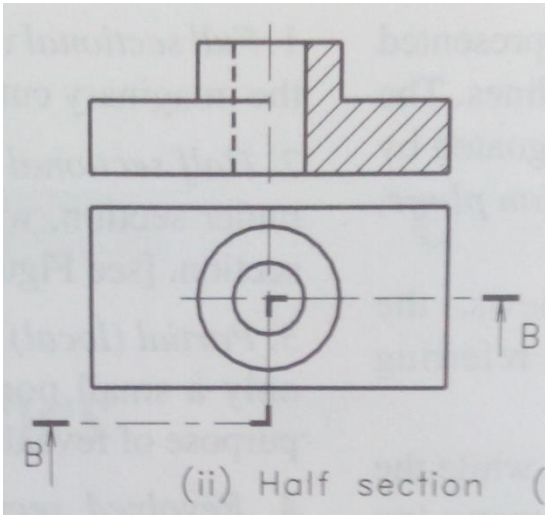
Sectioning

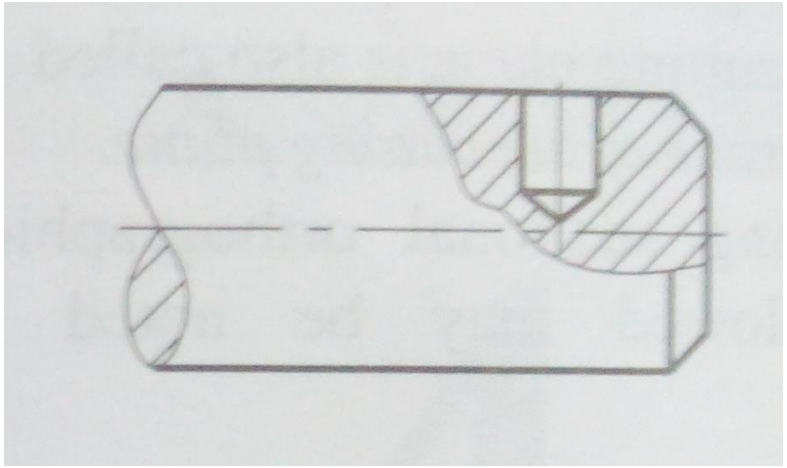


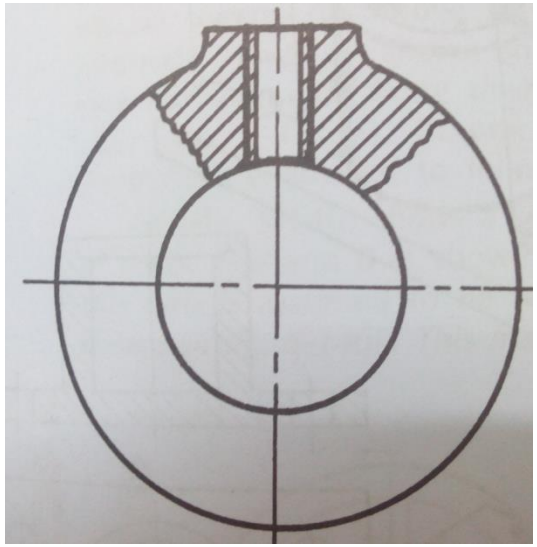
Full section



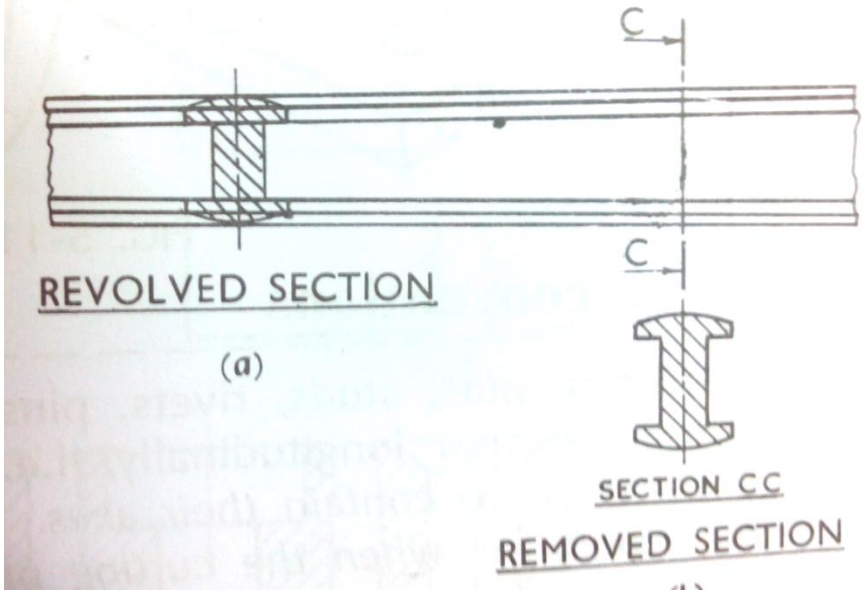
Half section

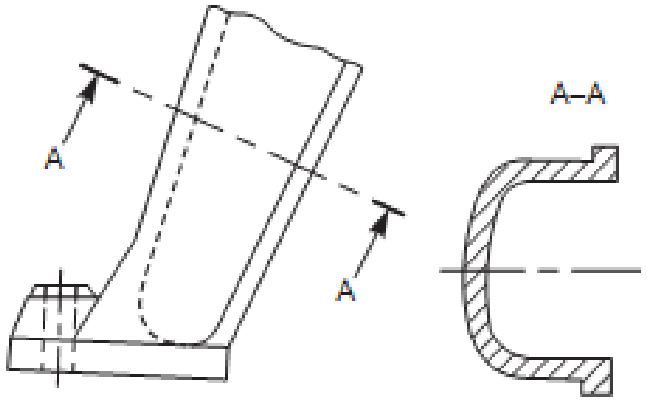






Partial/Local/Broken section





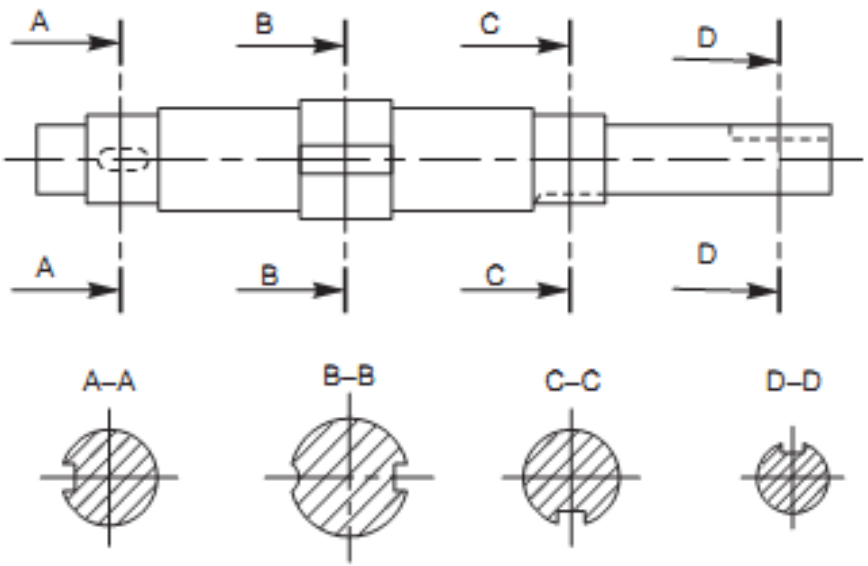


Fig. 2.25 Successive sections

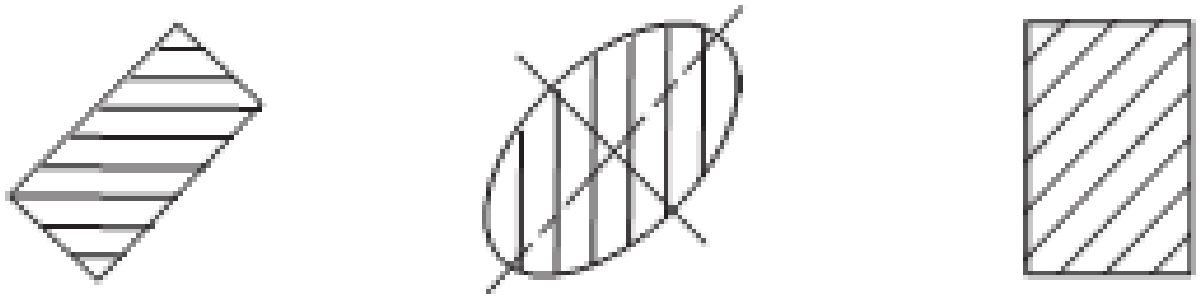
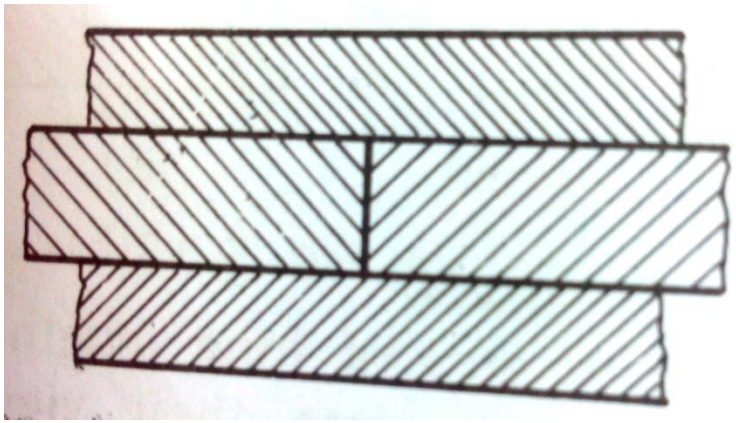
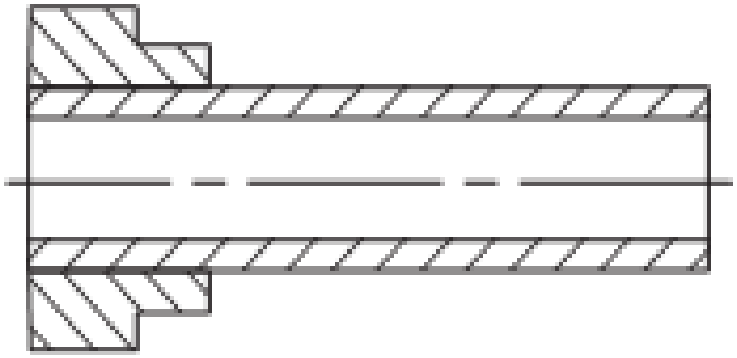


Fig. 2.11 Preferred hatching angles





Recap

- Every dimension is necessary for complete dimension of a finished part.
- Gap between extension line and outline (1 mm)
- The dimension should be quoted once only.
- Adequate spacing between component and dimension and also between two rows of dimensions (10-12 mm).
- Dimension should be taken from solid outline. Not from the hidden features.
- Dimension line should not reference the solid surface of the component, it should be refer to extension line.
- Crossing of dimension line should be avoided.


END!!

Machine Drawing

Credit 2 - 0L-4P

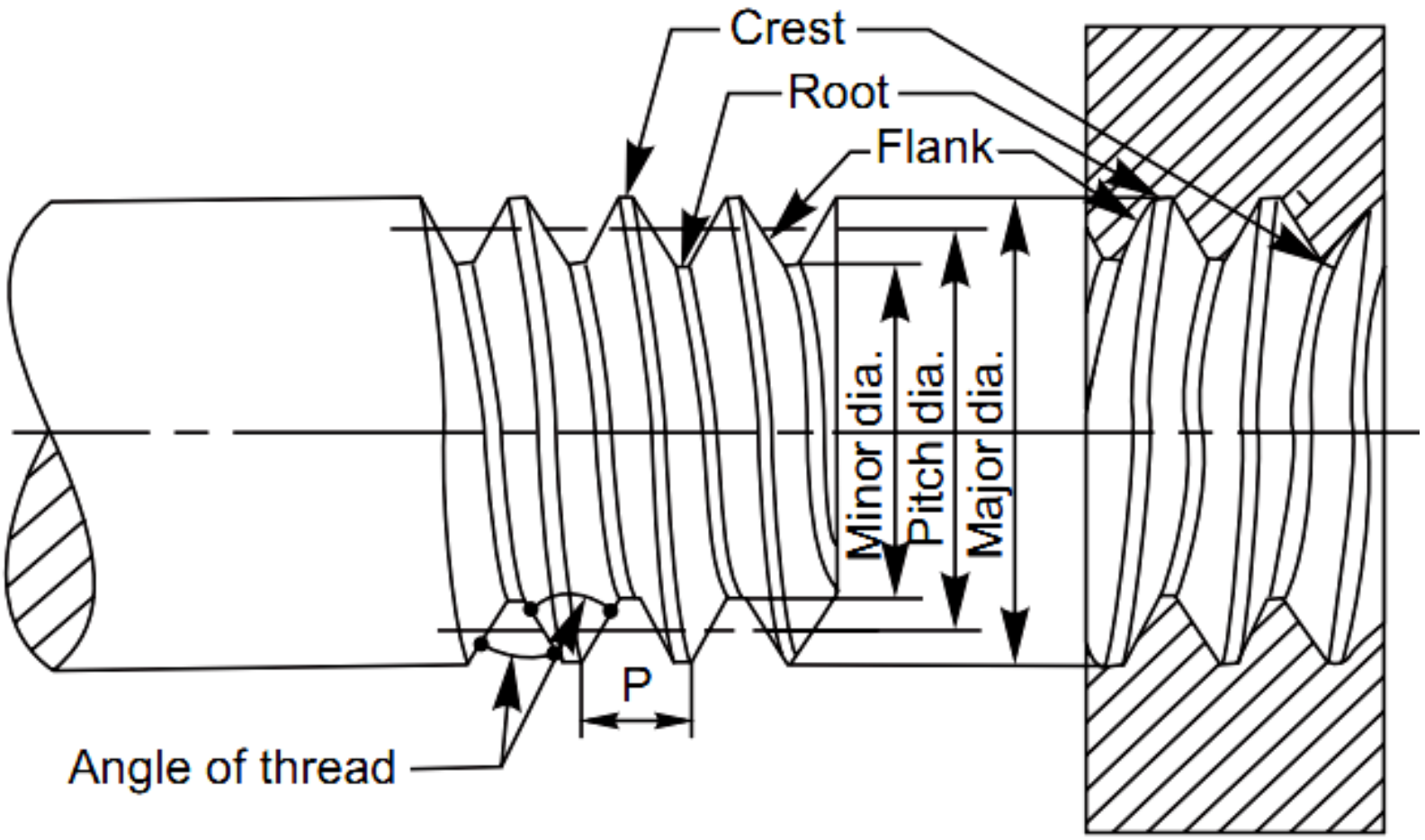
Screw Fasteners

Md Asjad Mokhtar
Assistant Professor, ME
DCE, Darbhanga
drasjadmokhtar@gmail.com
9999914381

Screw Threaded Joints

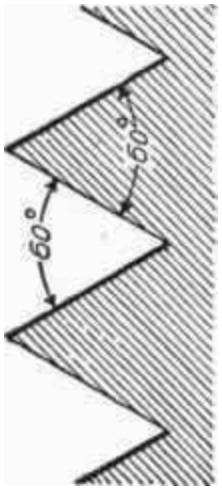
External Thread
(Male)

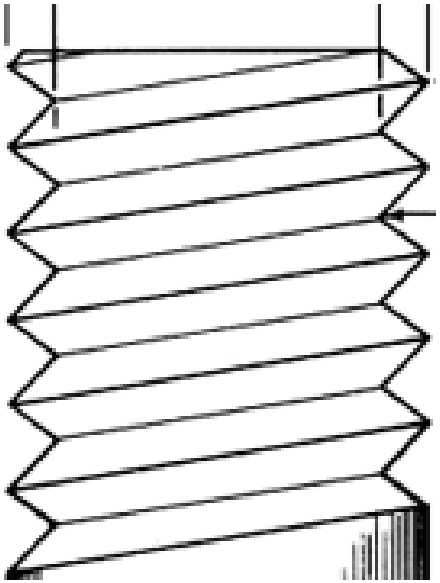
Internal Thread
(Female)

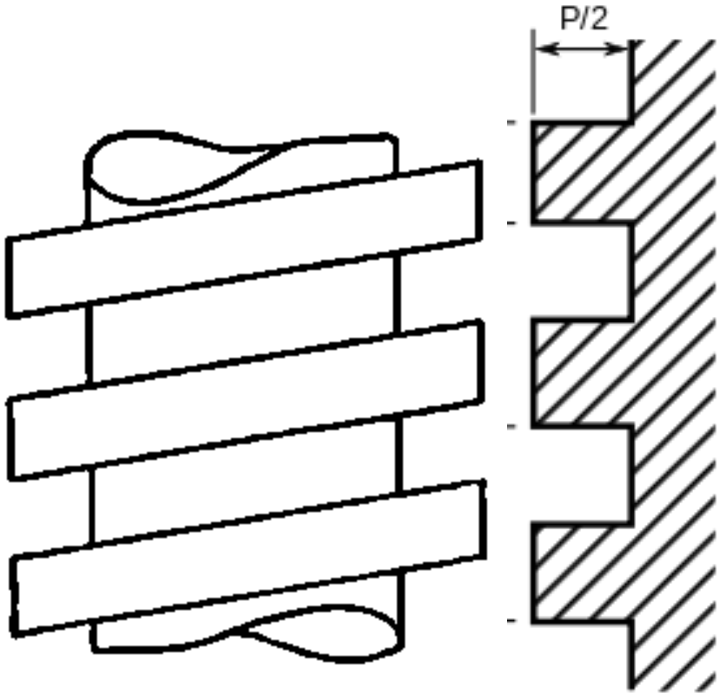


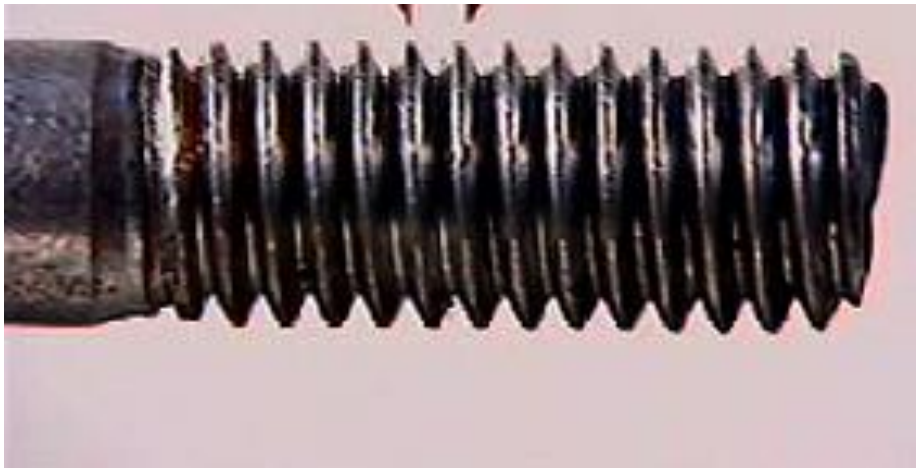
1. **Major (Nominal) Diameter**
2. **Minor (Core) Diameter**
3. **Pitch Diameter**
4. **Pitch**
5. **Lead**
6. **Flank**
7. **Crest**
8. **Root**

- Form of thread-
  - **Triangular threads or V threads**
  - **Square threads**



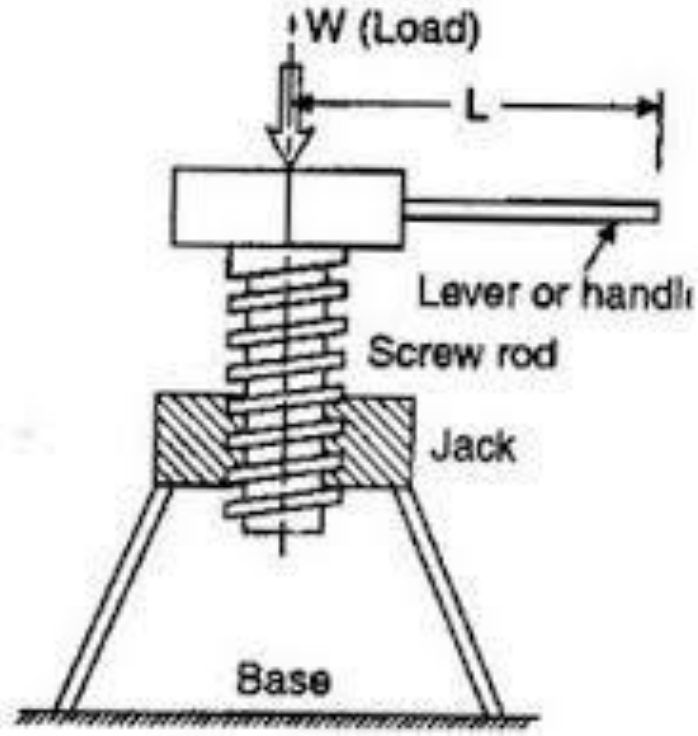




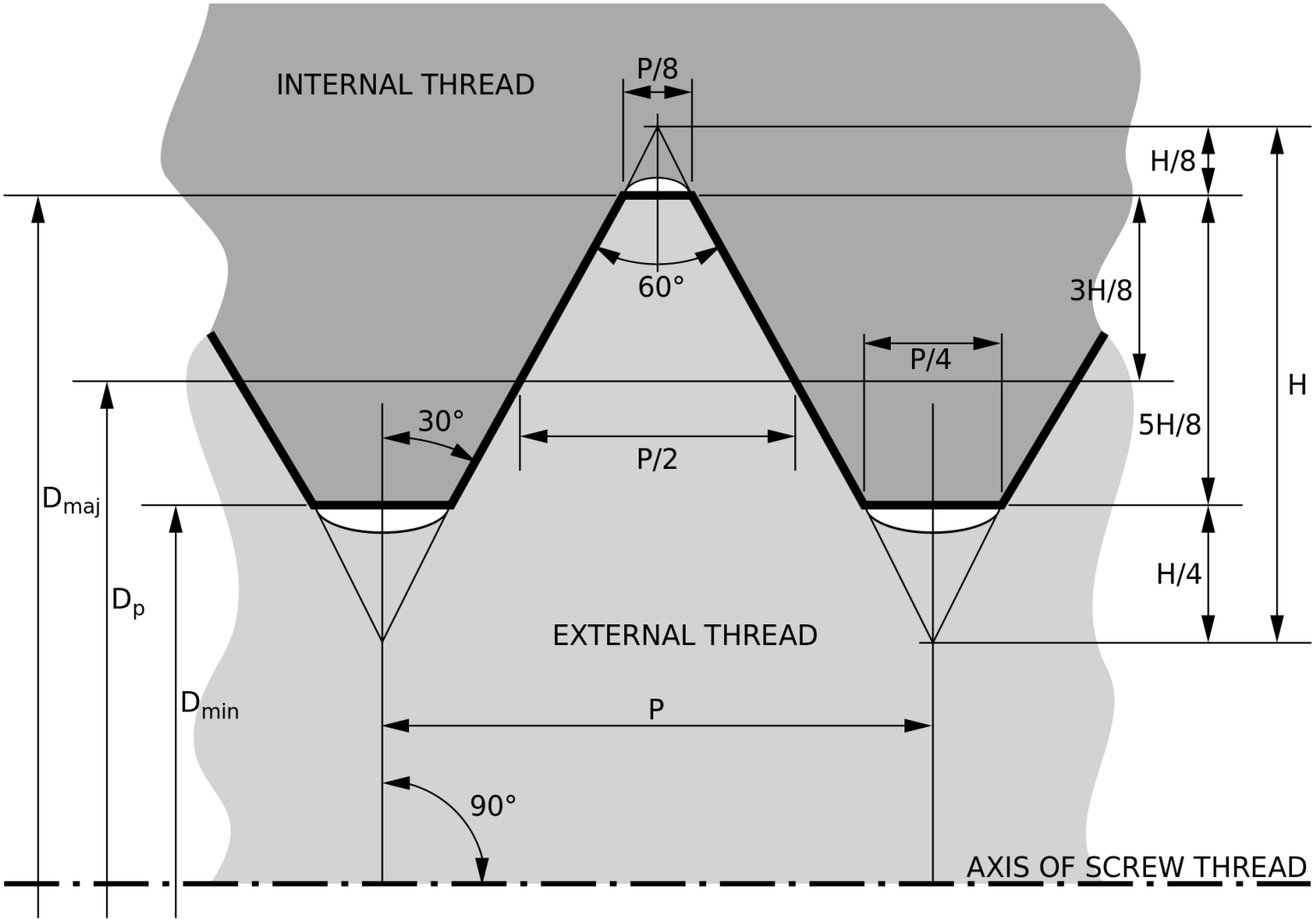


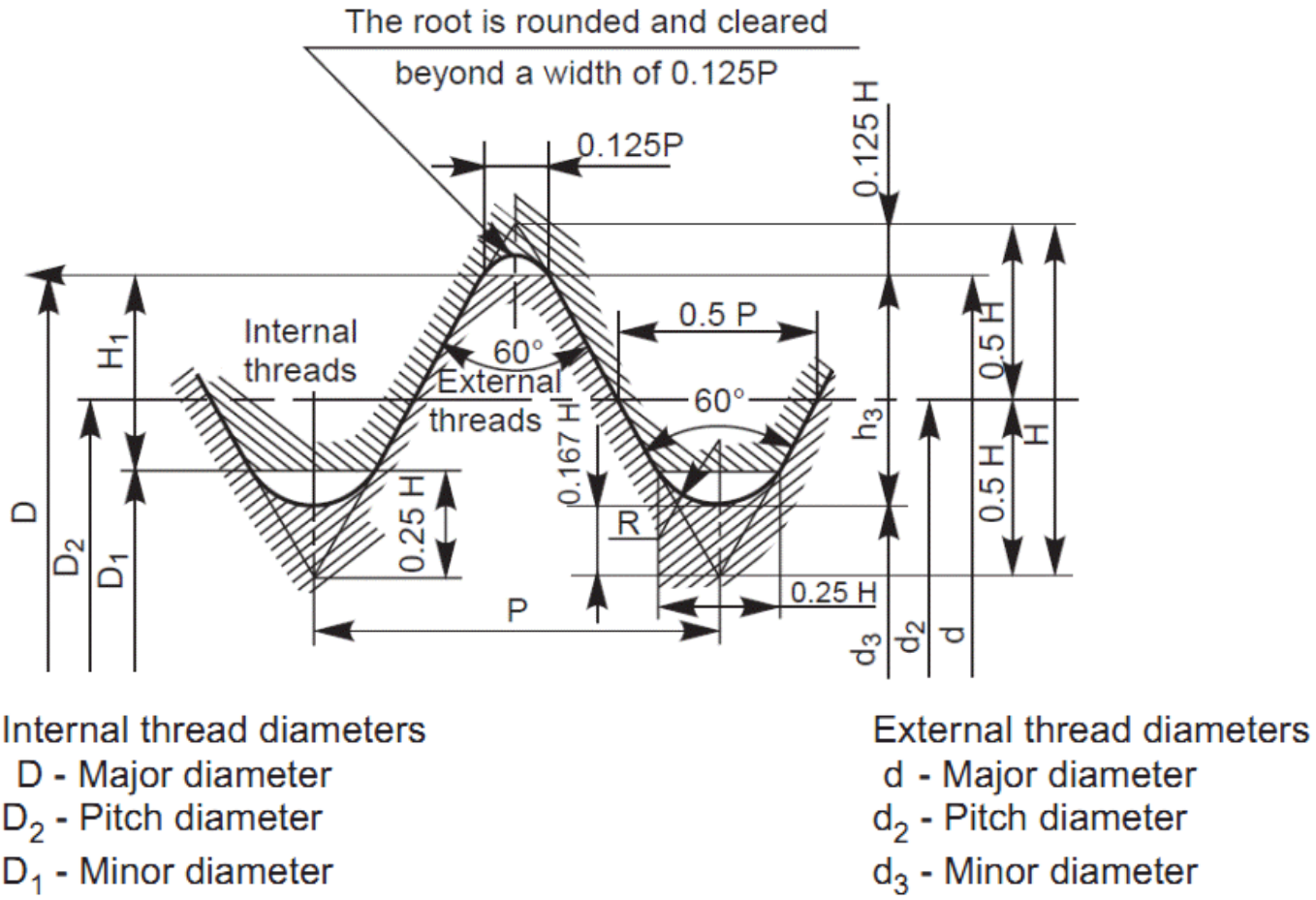
- V thread
  - More root area- strong
  - Easy to manufacture
  - More friction grip
  - Use in fastening

- Square thread
  - Difficult to Produce
  - Use in power transmission
  - Screw Jack, Vice etc.



Metric thread





Internal thread diameters
D - Major diameter
D_2 - Pitch diameter
D_1 - Minor diameter

External thread diameters
d - Major diameter
d_2 - Pitch diameter
d_3 - Minor diameter

Fig. 5.2 Metric screw thread

P = Pitch

H = 0.86 P

D = d = Major diameter

$D_2 = d_2 = d - 0.75H$

$D_1 = d_2 - 2(H/2 - H/4) = d - 2H_1$

$d_3 = d_2 - 2\,(H/2 - H/6)$

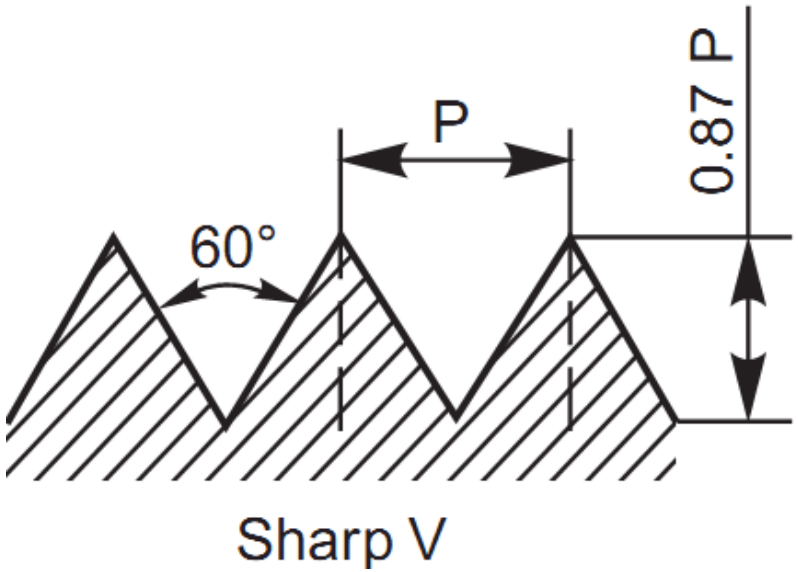
$= d - 1.22P$

$H_1 = (D - D_1)/2 = 5H/8 = 0.54P$

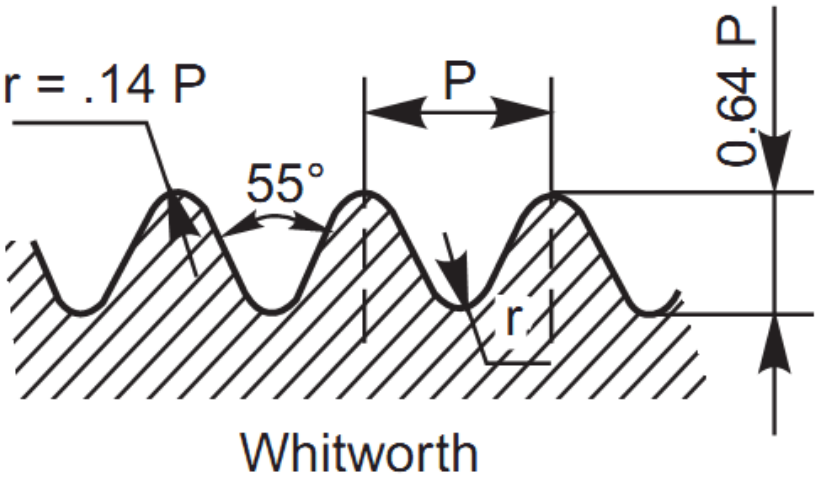
$h_3 = (d - d_3)/2 = 17/24H = 0.61P$

$R = H/6 = 0.14P$

Different forms of threads



Sharp V



Whitworth

Larger contact area

More frictional resistance

Used for accurate positioning

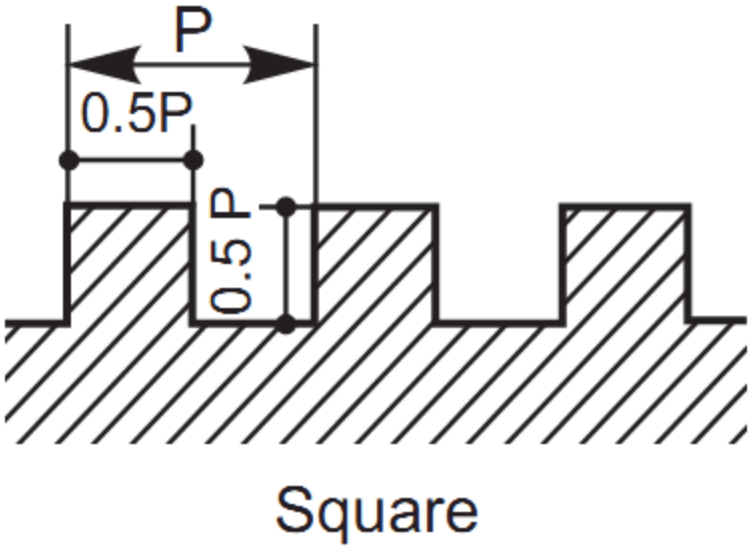
Used in fastening

British Withworth thread

Rounded ends

Less chance of damage

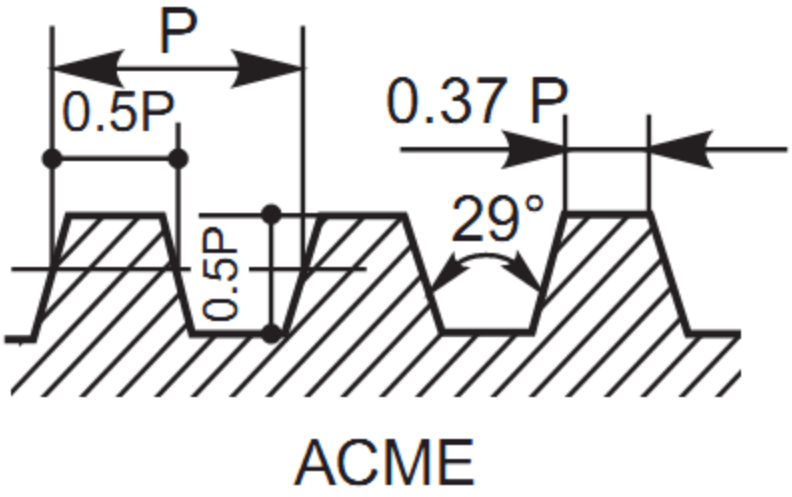
Different forms of threads



Square

Difficult to produce

Used in power transmission



ACME

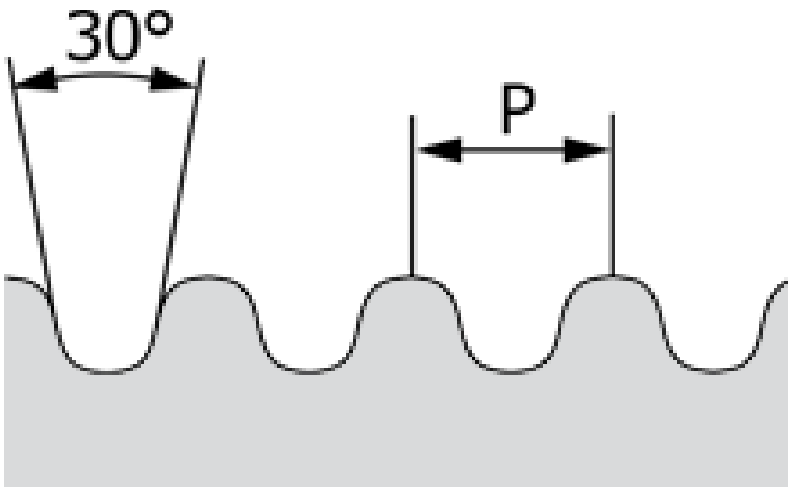
Modified form of square thread

Easy to produce than Sq thread

Used with split Nut

Lead screw in Lathe m/c

Different forms of threads



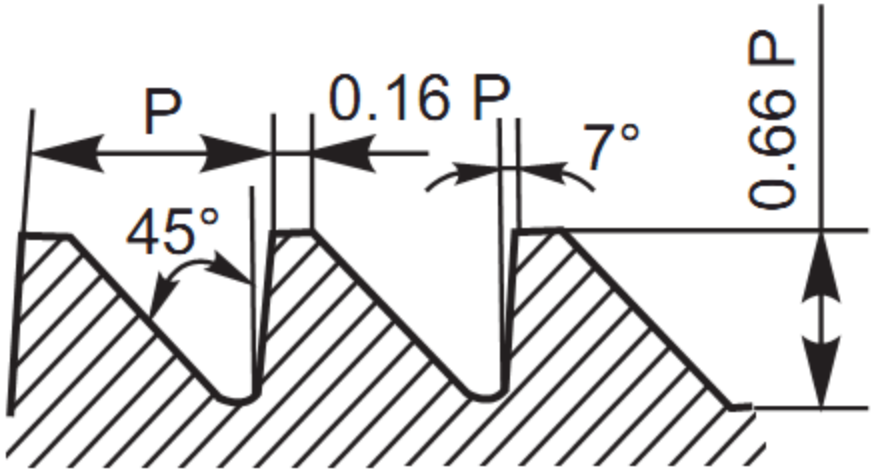
Knuckle Thread

Rounded form of sq. thread

Withstand heavy wear

Rough handling

Railway carriages, Electric bulb



Buttress

Combination of Sq. and V thread

Have quality of both threads

Able to take load in one direction

Bench Vice

Designation of threads

- Coarse pitch or Fine Pitch
- 10 mm Nominal diameter – 1.5 mm or (1.25 – 1- 0.75 mm)

M10 M10 x 1.5 M10 x 1.25

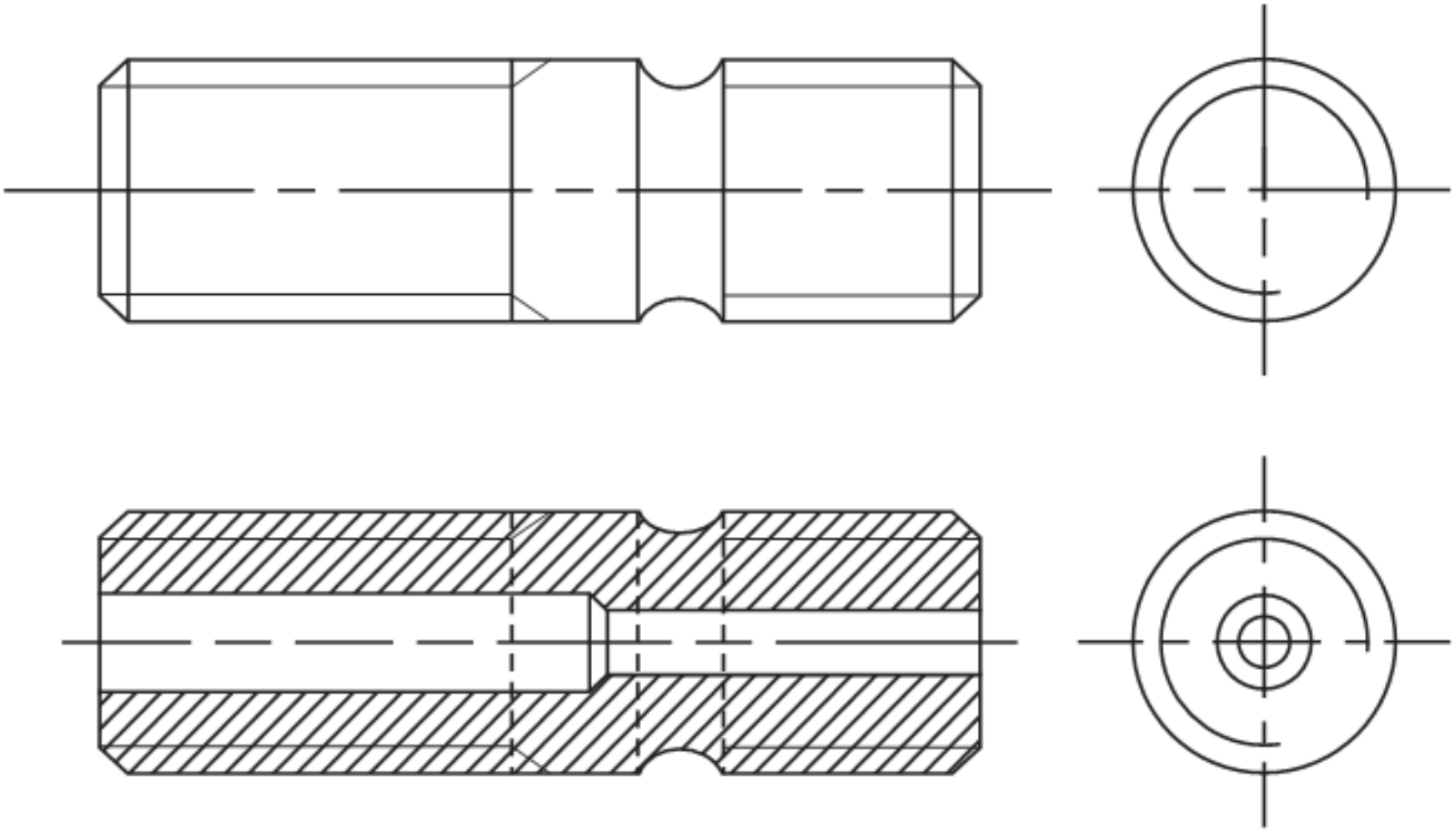
M – Matric thread, 10 – Nominal diameter , 1.5 pitch

SQ 10 x 1.5

ACME 10 x 1.5

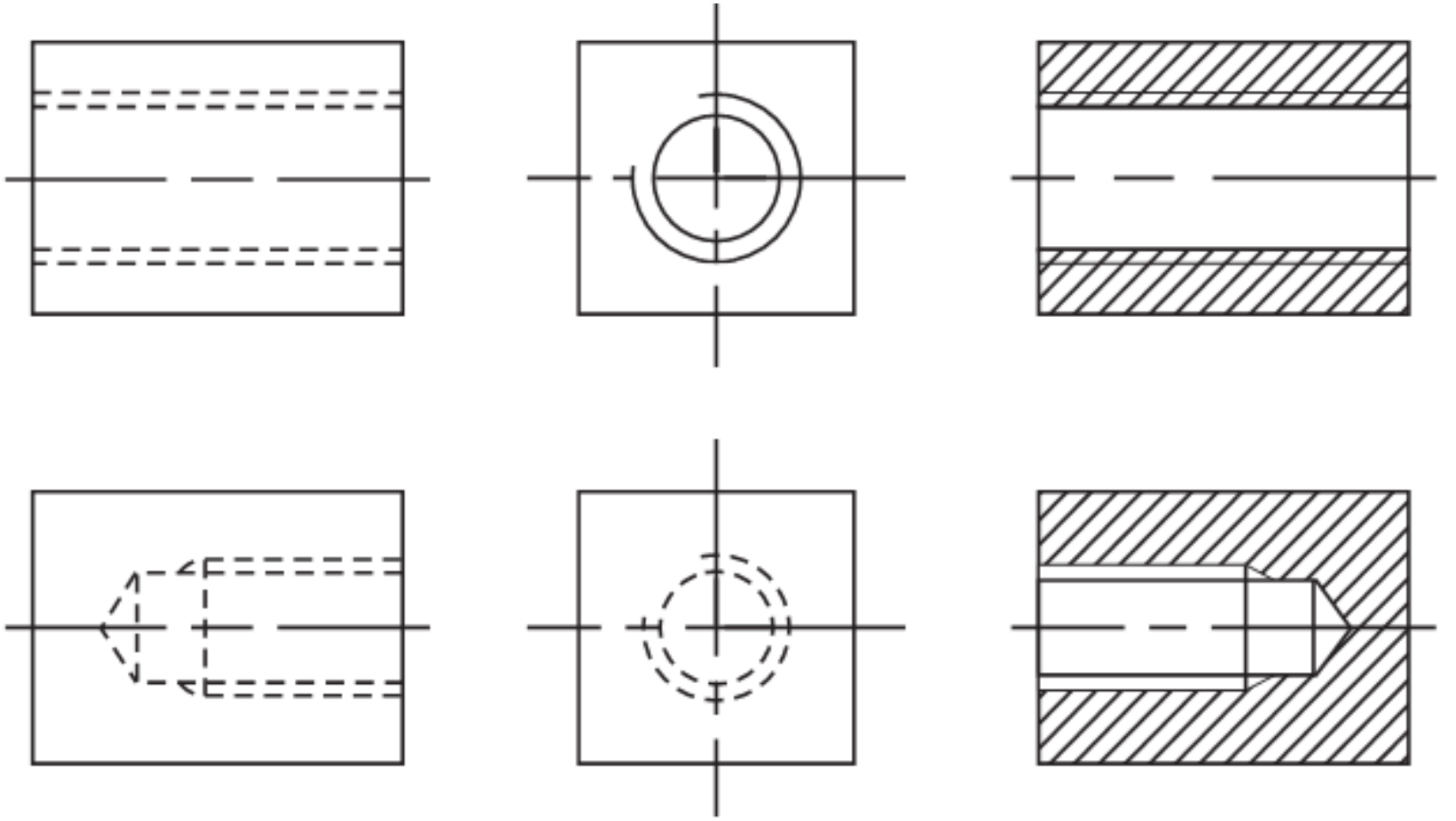
Presentation of threads

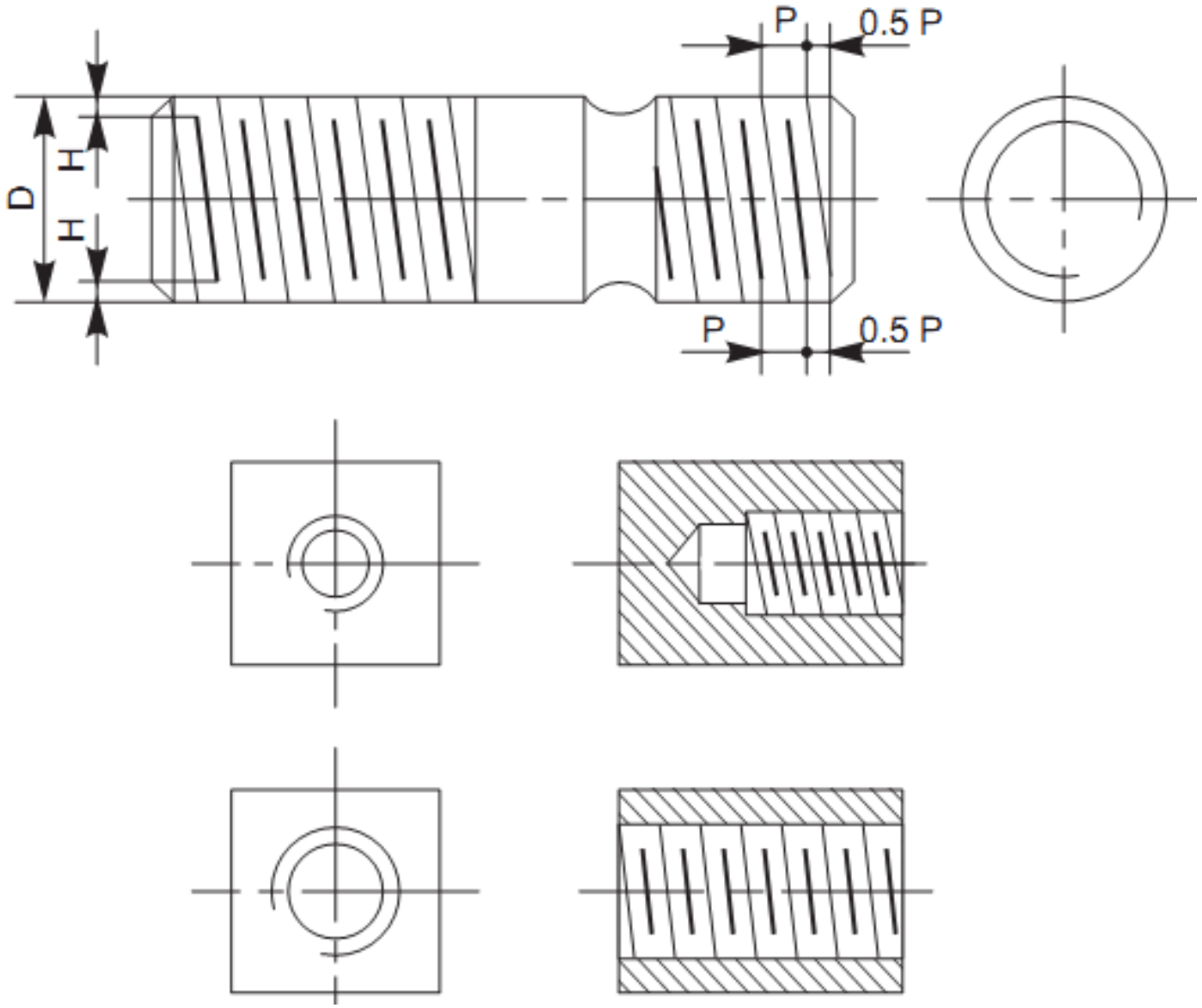
- External threads



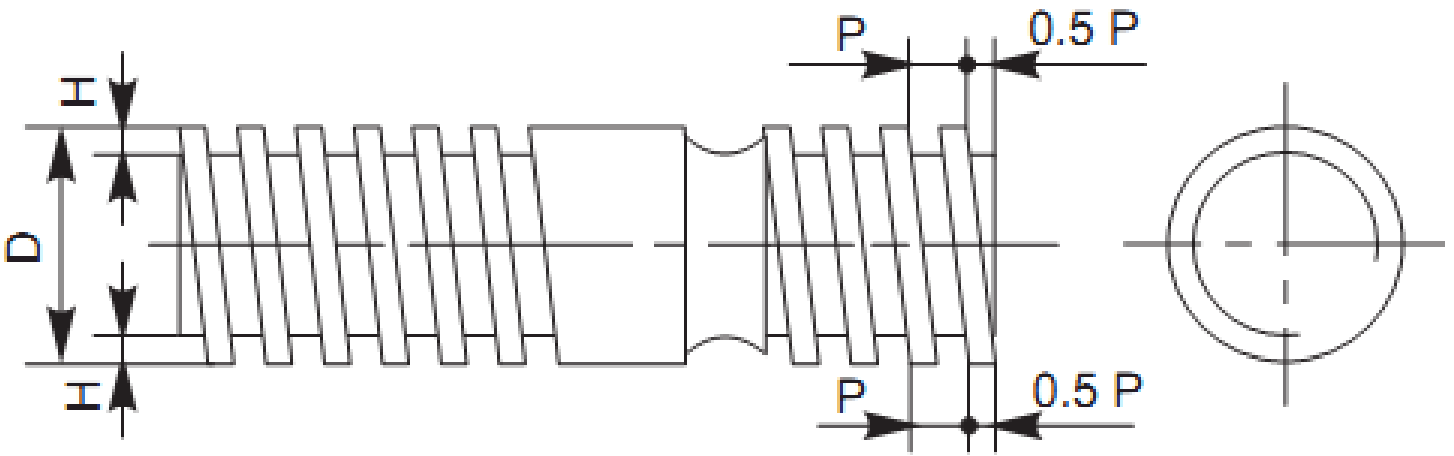
Presentation of threads

- Internal threads

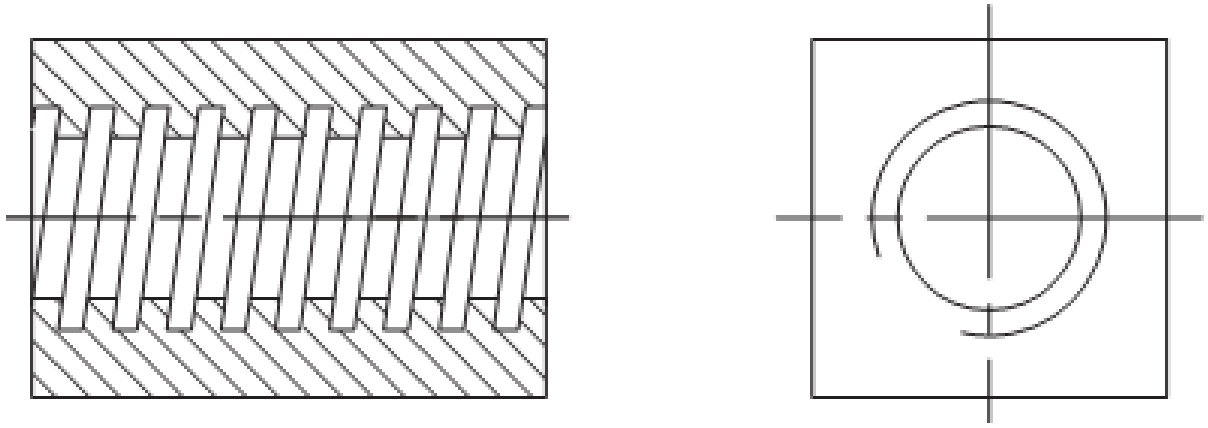




Another method to present V-threads

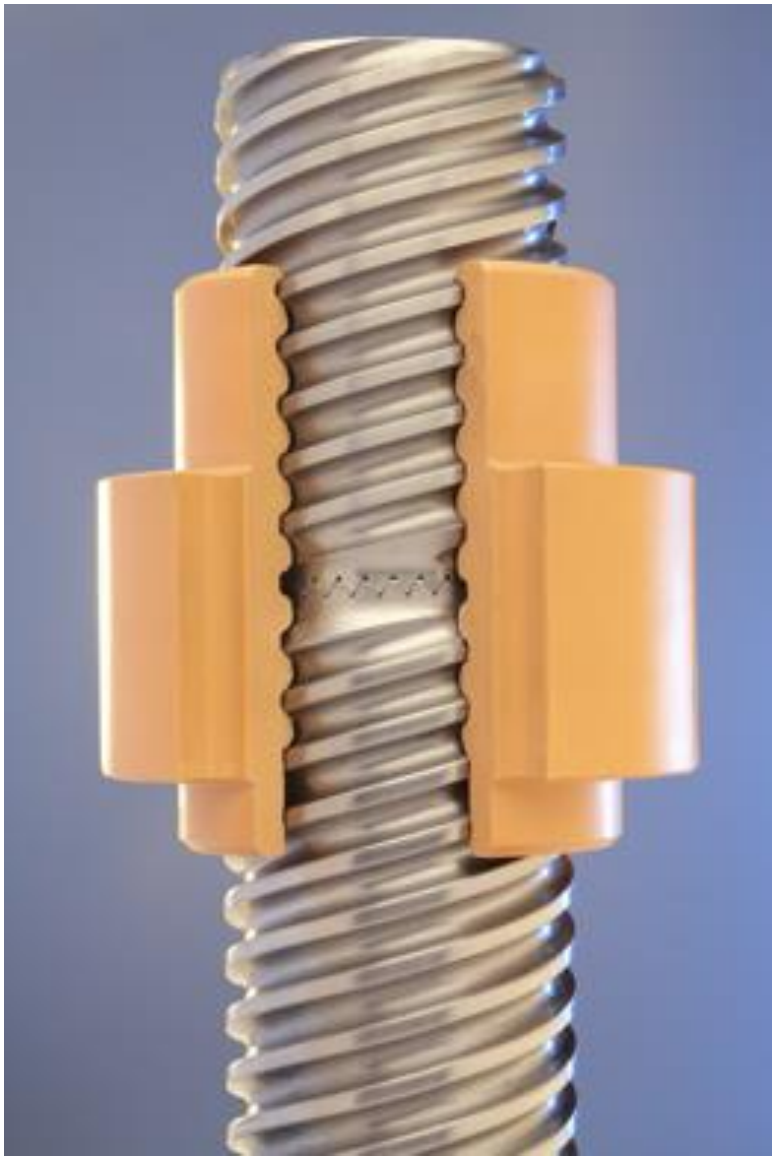


(a)

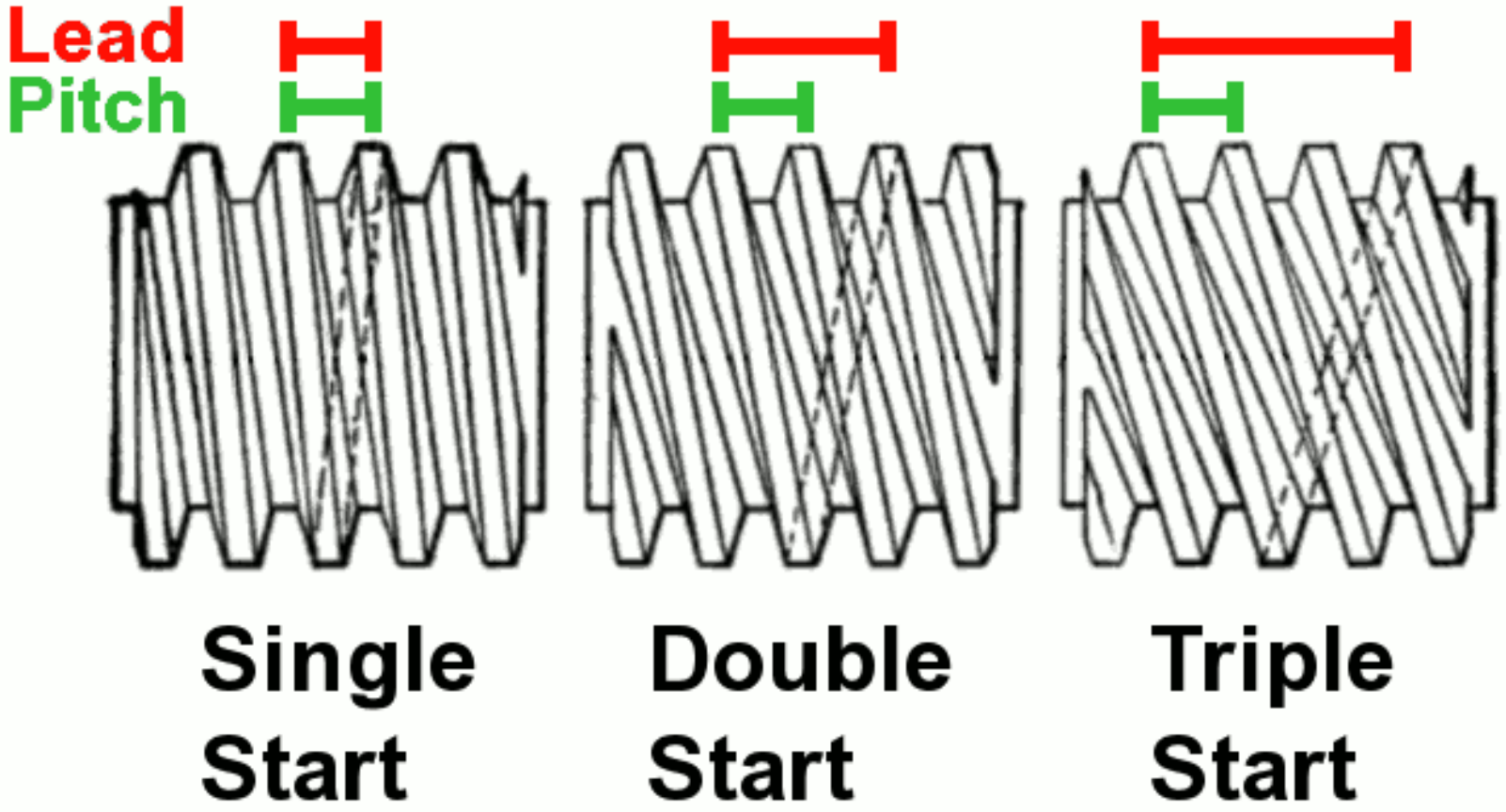


Another method to present SQ-threads

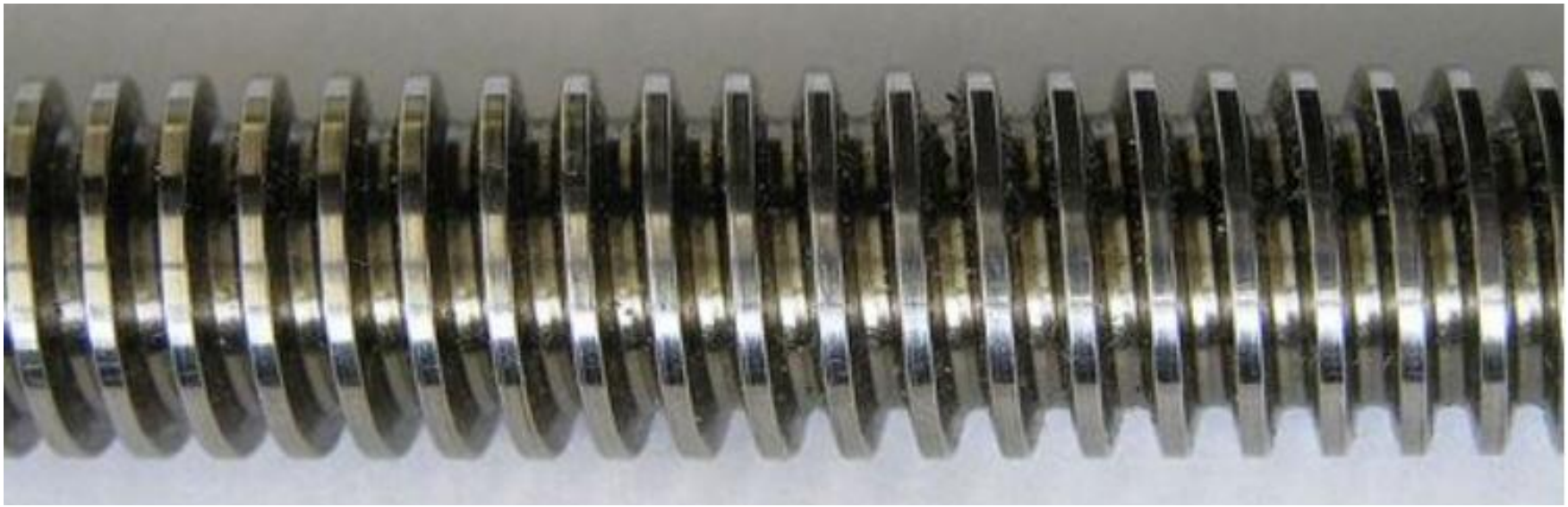
- Multi start threads



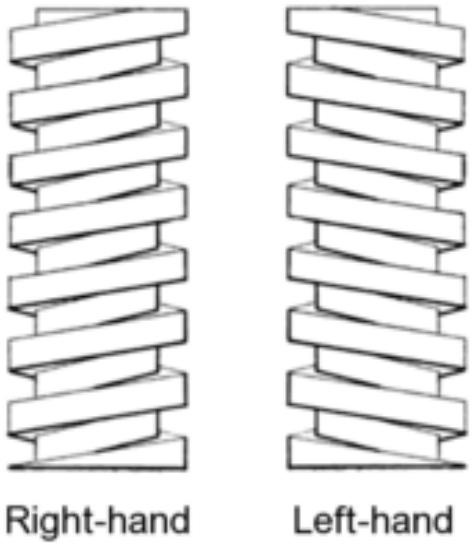
- Multi start threads

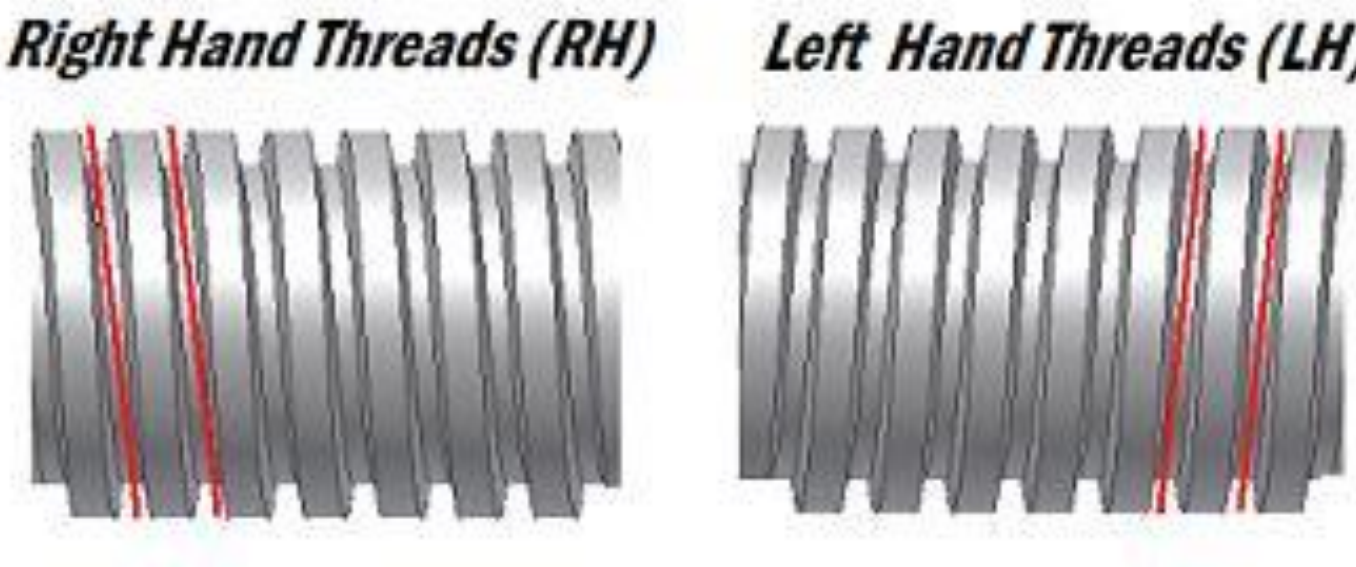


- Multi start threads

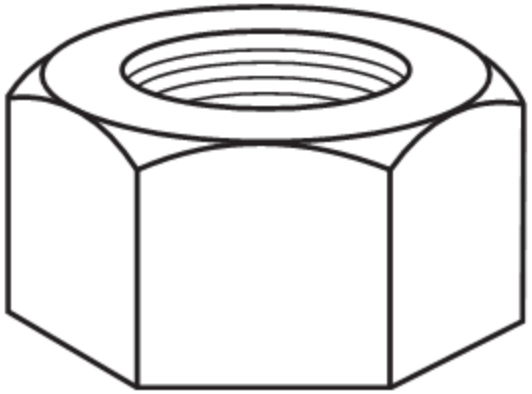


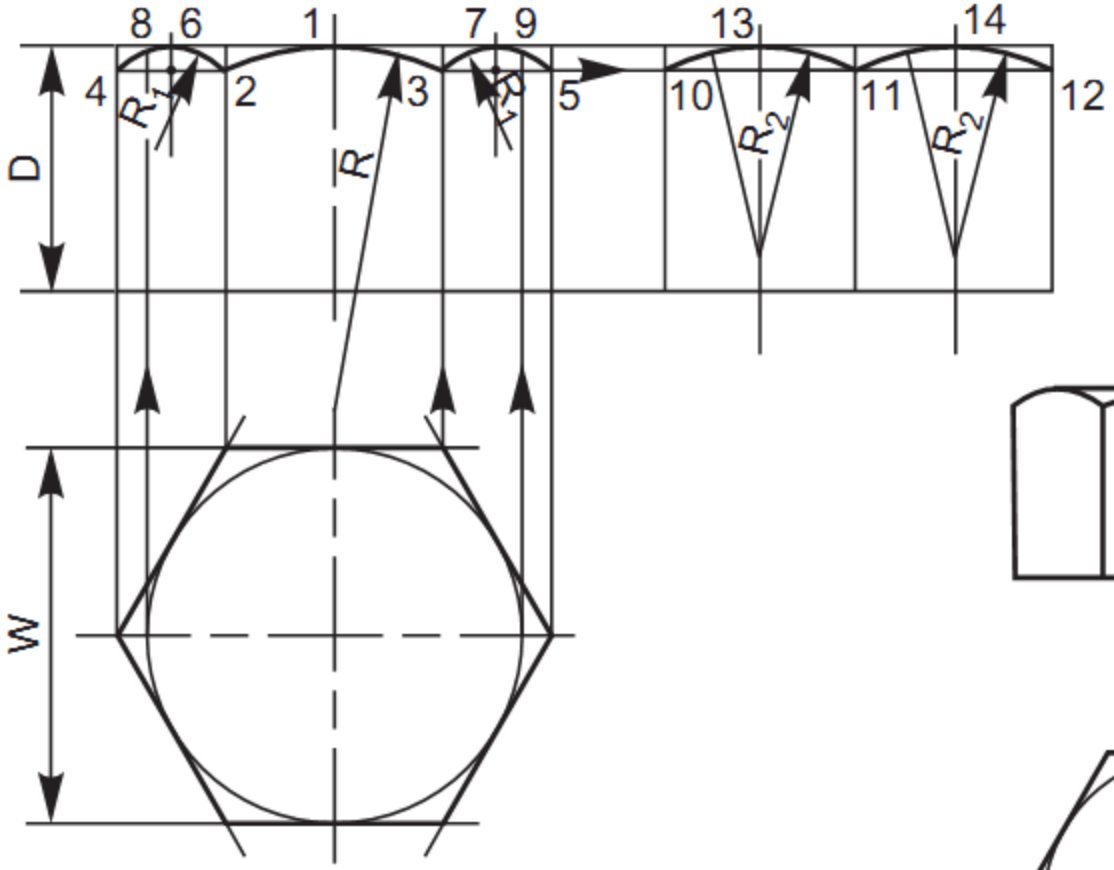
Left hand and Right hand threads

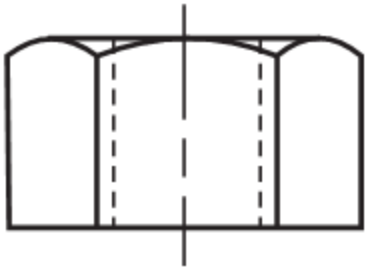


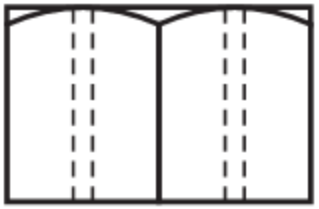


Hexagonal Nut

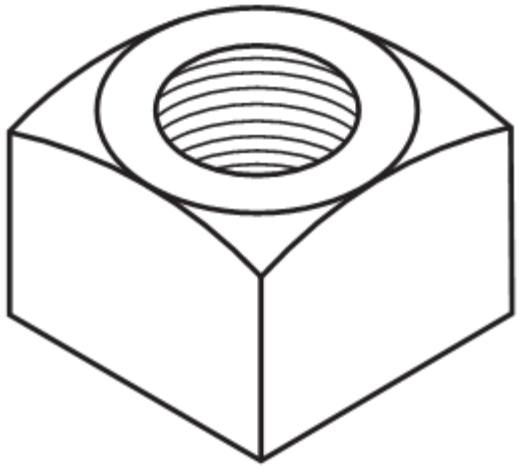








Square Nut



Machine Drawing

Credit 2 - 0L-4P

Riveted Joints

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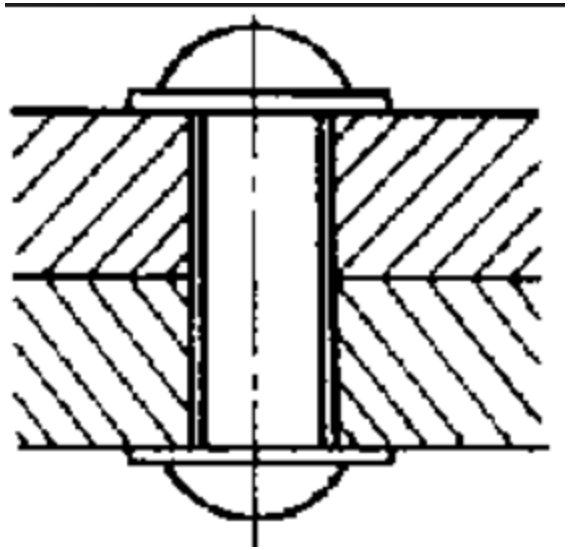


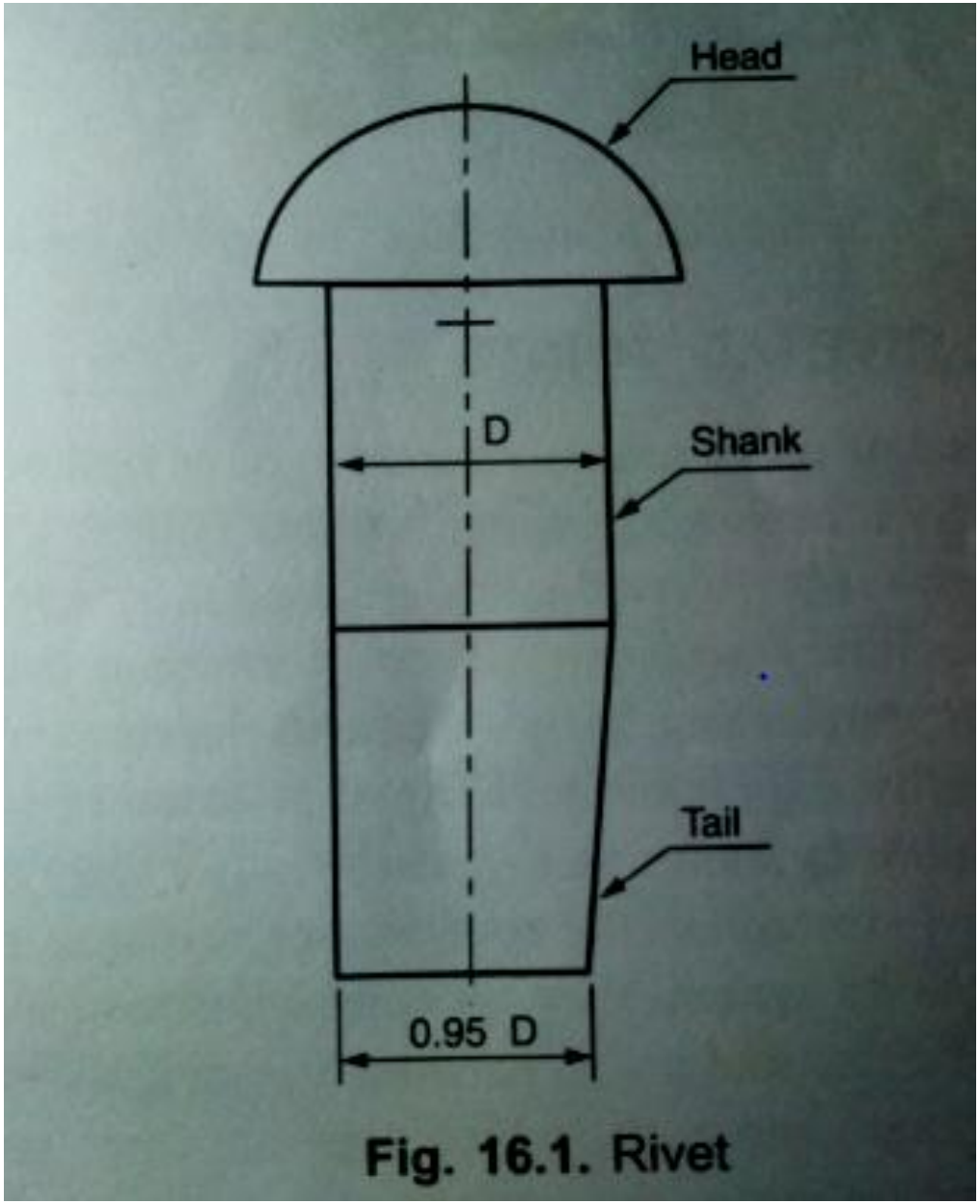
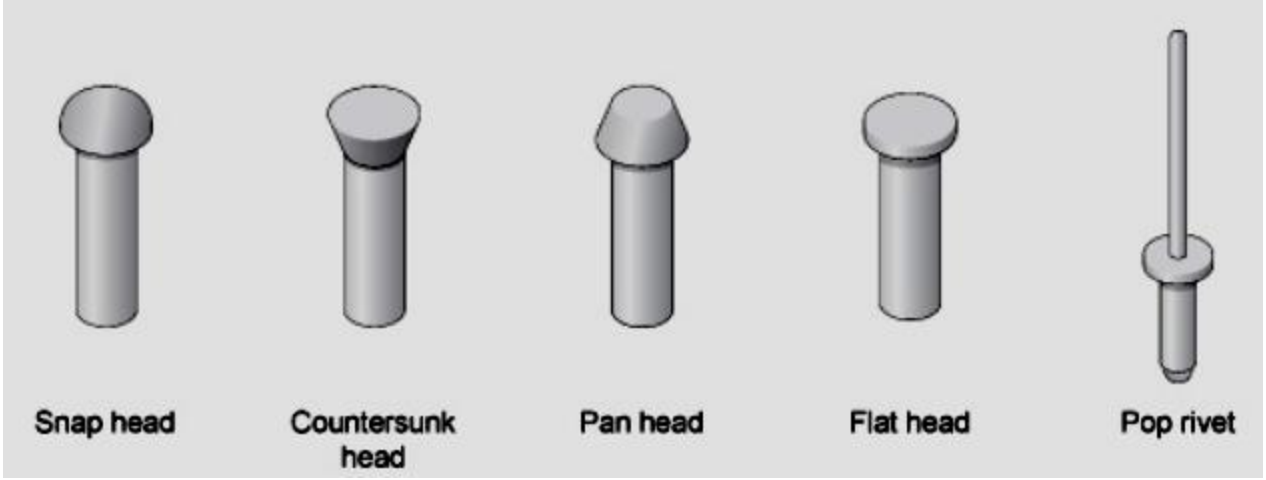
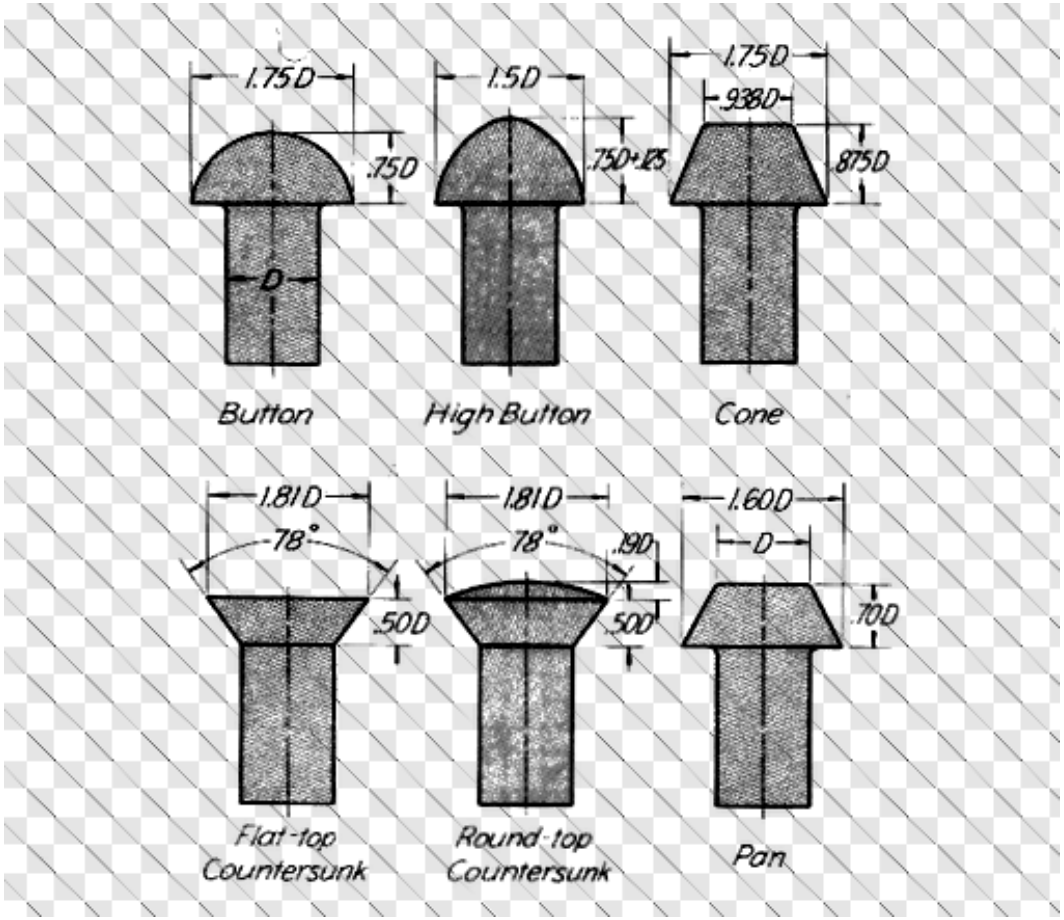
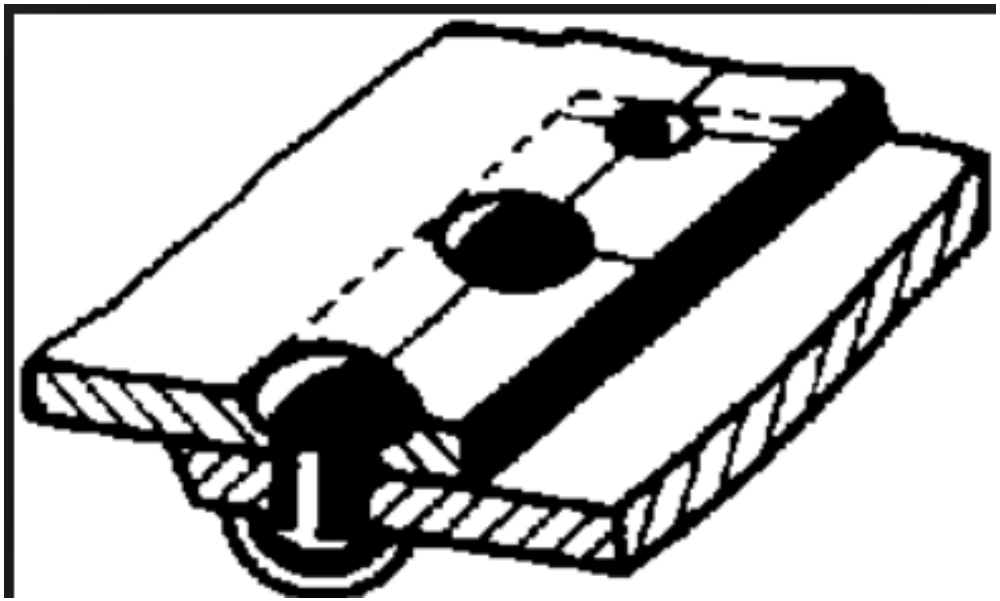


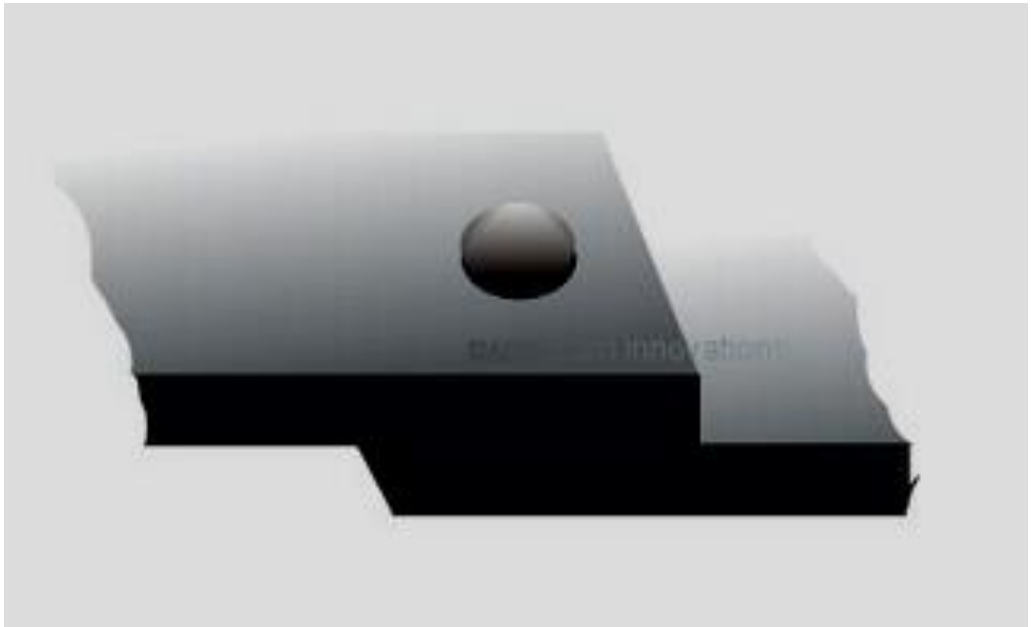
Fig. 16.1. Rivet

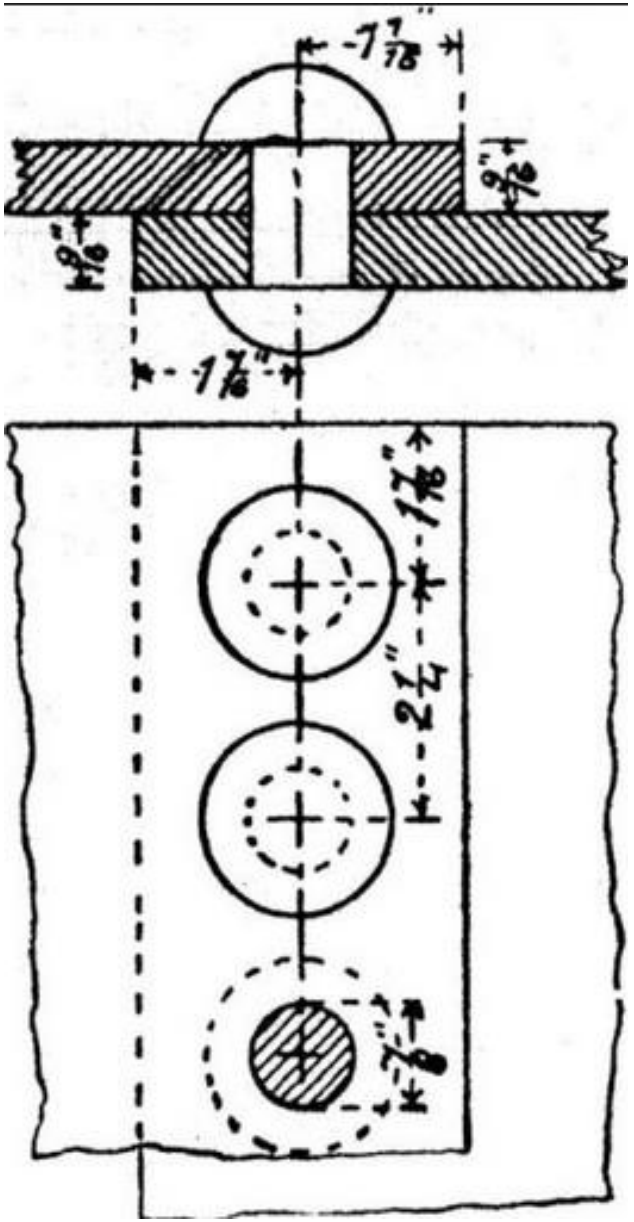

Snap head
Countersunk head
Pan head
Flat head
Pop rivet


1.75D
.75D
D
Button
1.5D
.750+.125
High Button
1.75D
.938D
.875D
Cone
1.81D
78°
.50D
Flat-top Countersunk
1.81D
78°
.190
.500
Round-top Countersunk
1.60D
D
.70D
Pan

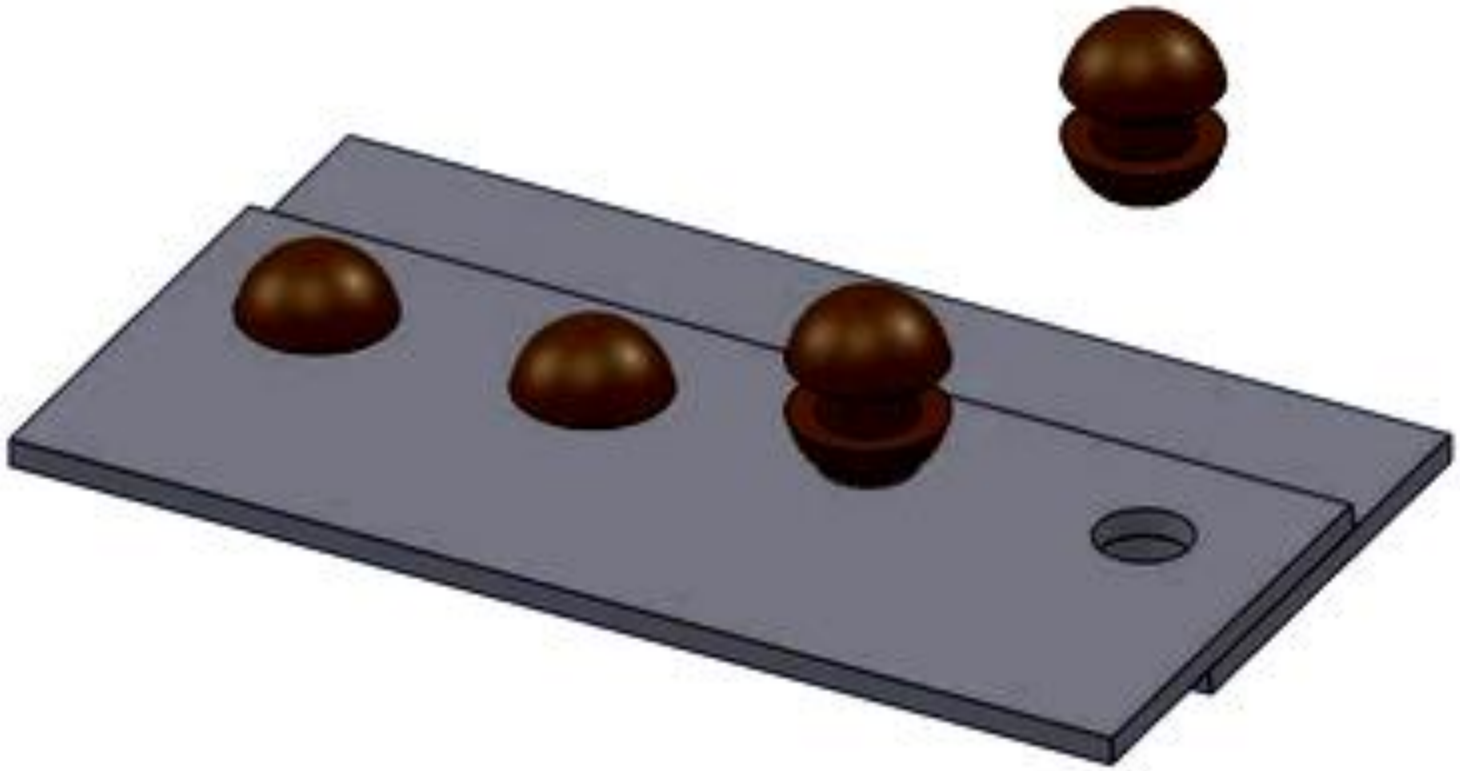
Lap joint



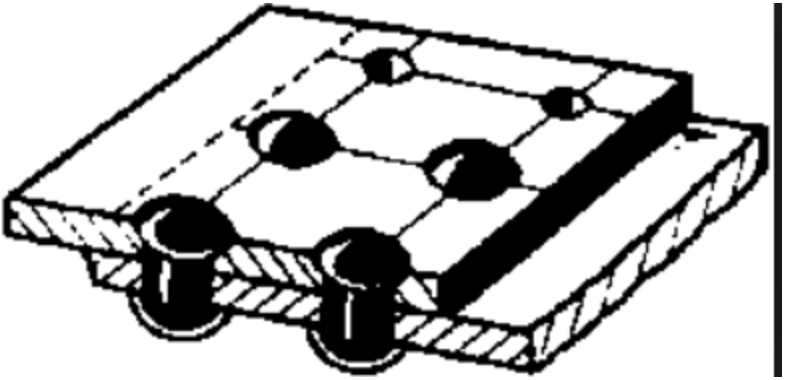


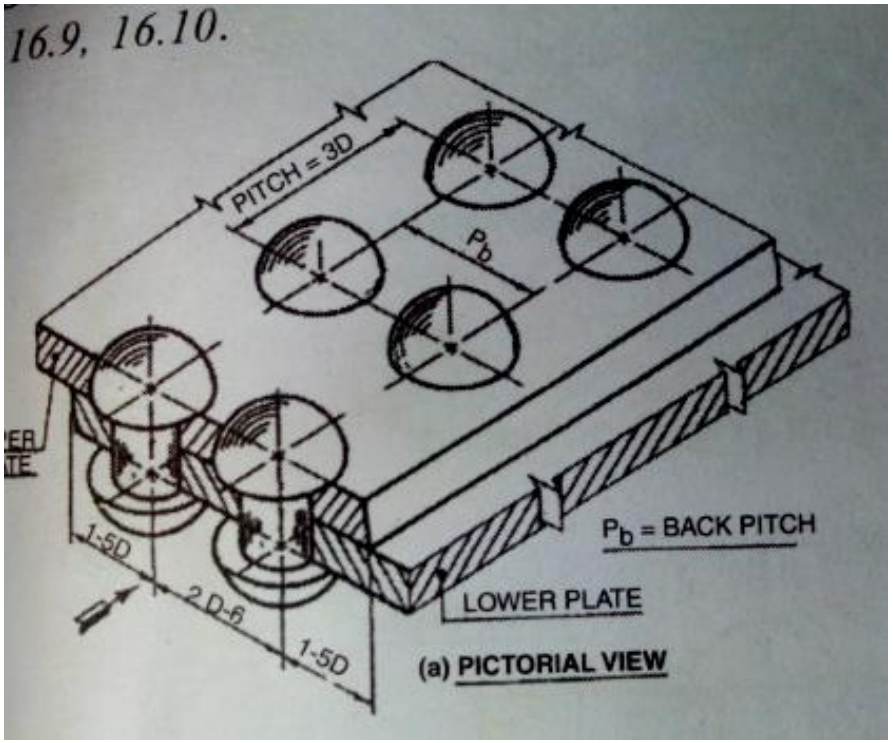


Lap joint



Lap joint





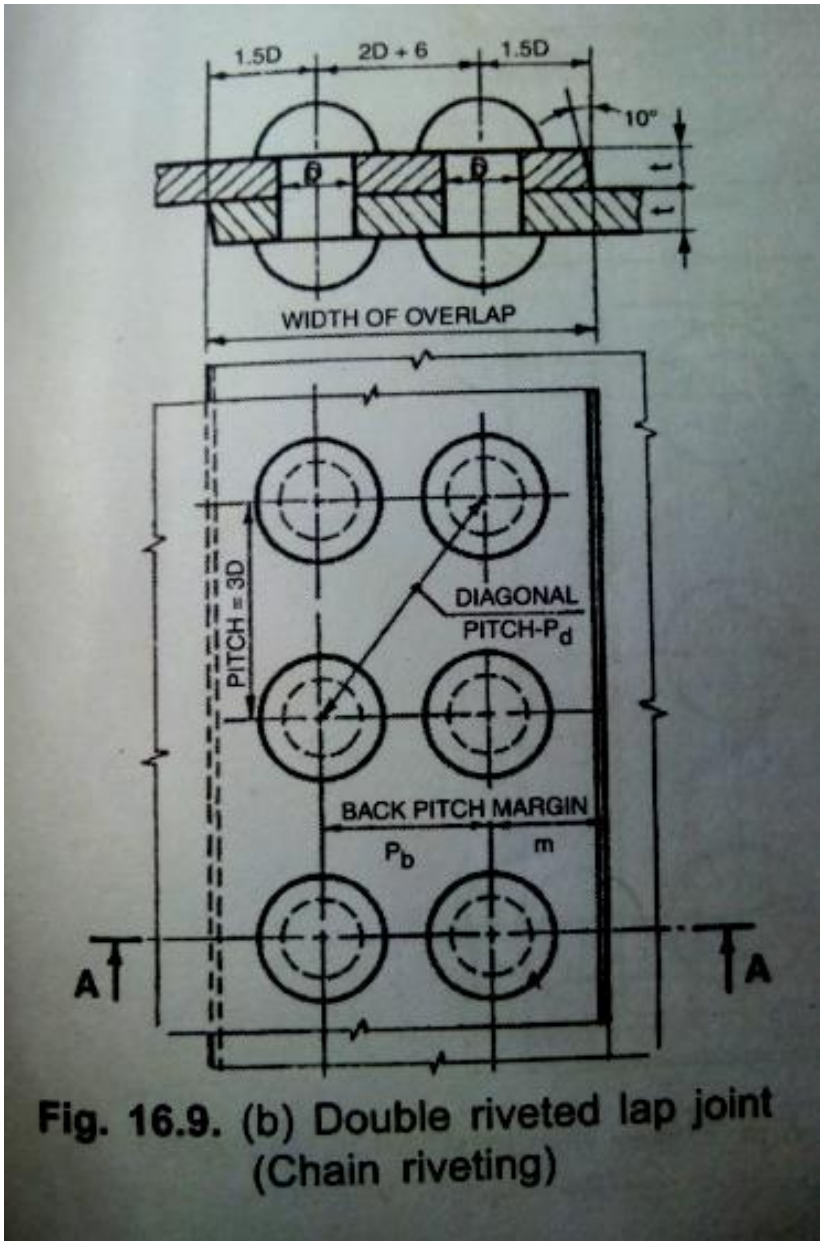


Fig. 16.9. (b) Double riveted lap joint (Chain riveting)

Lap joint

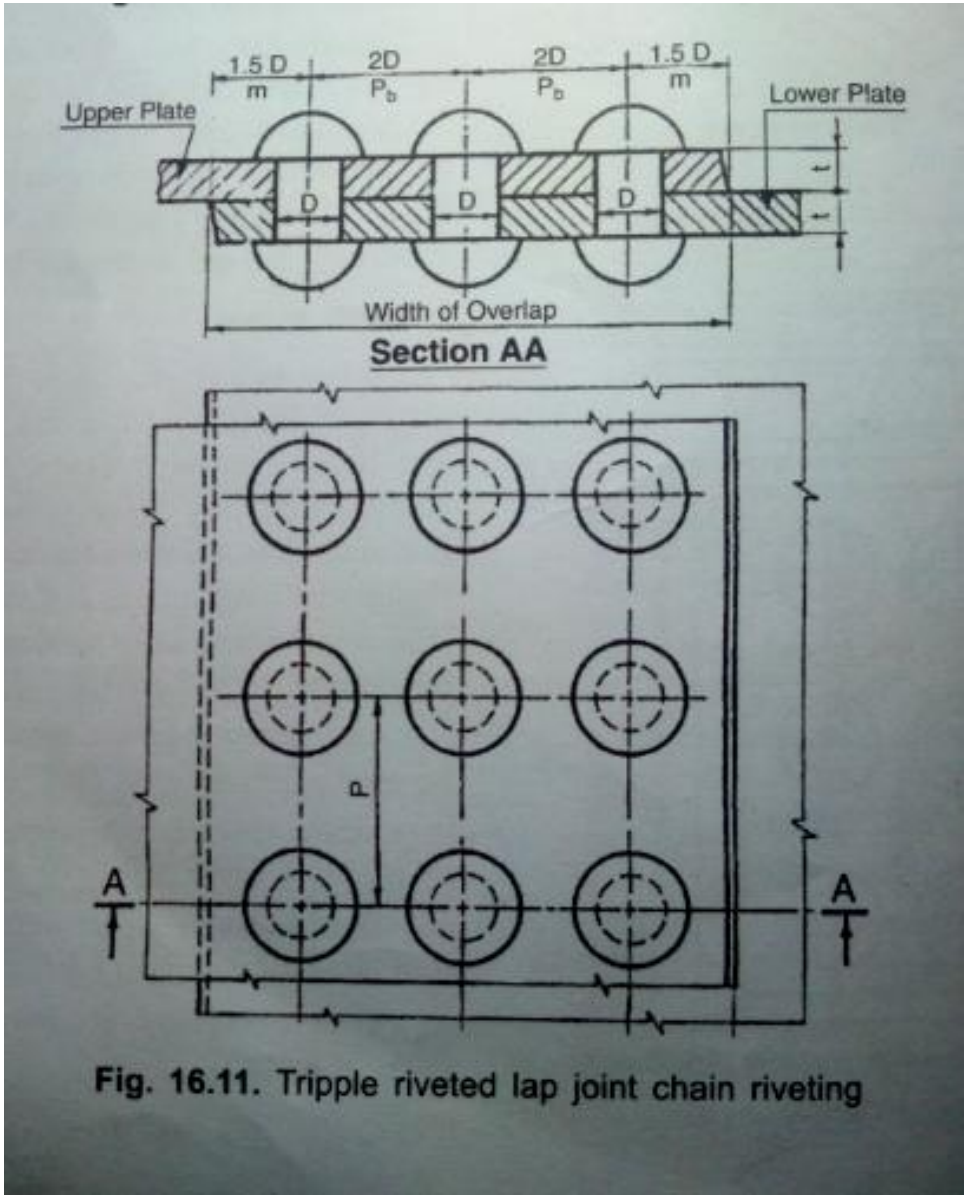


Fig. 16.11. Tripple riveted lap joint chain riveting

Lap joint

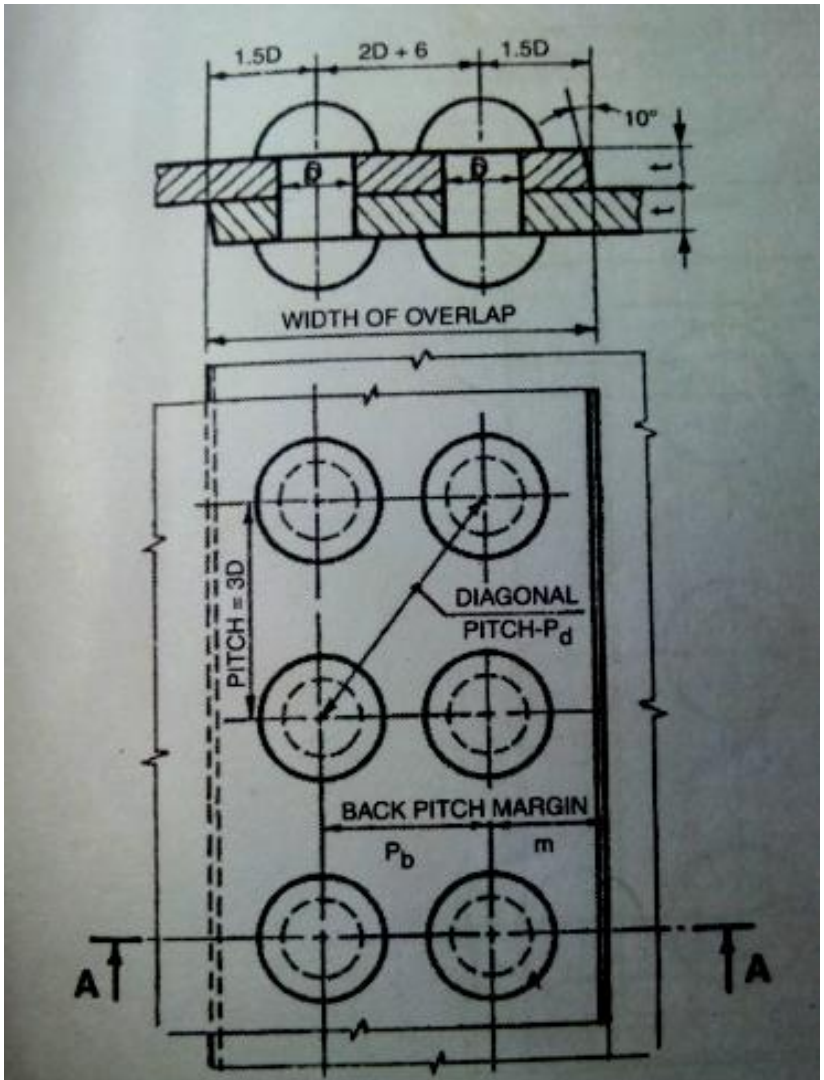
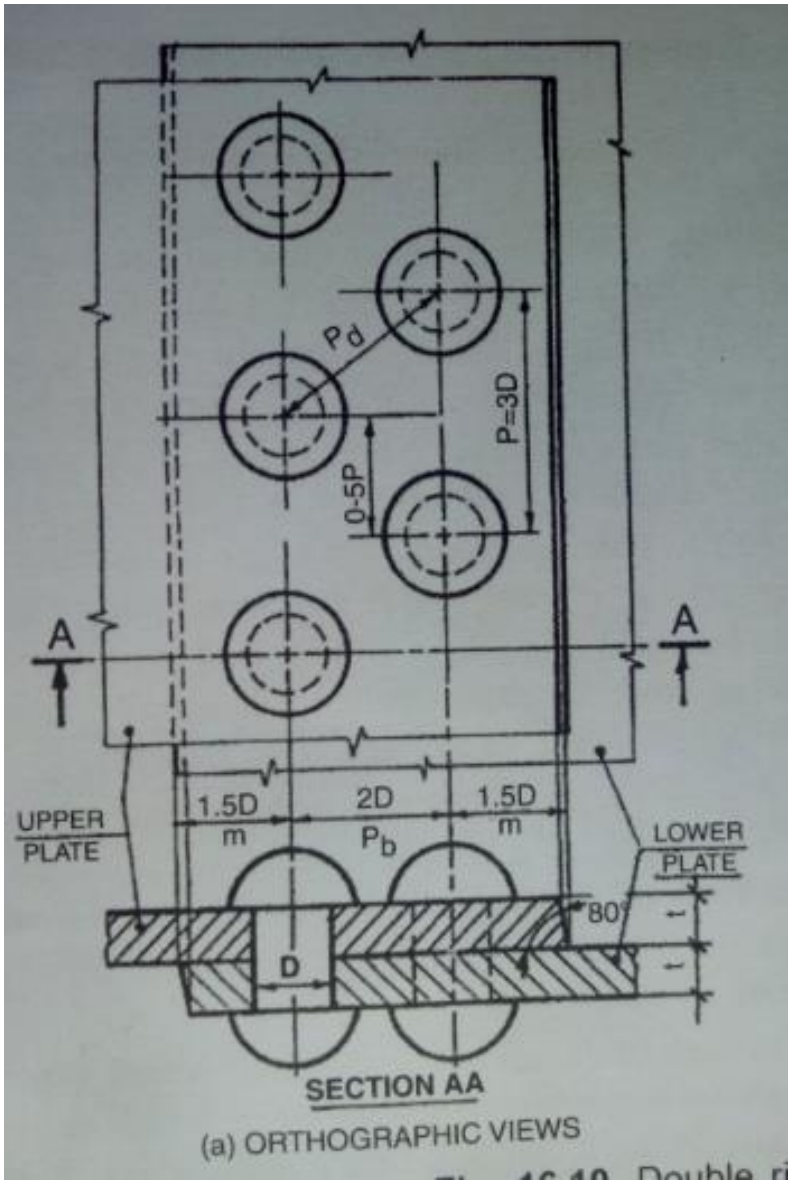
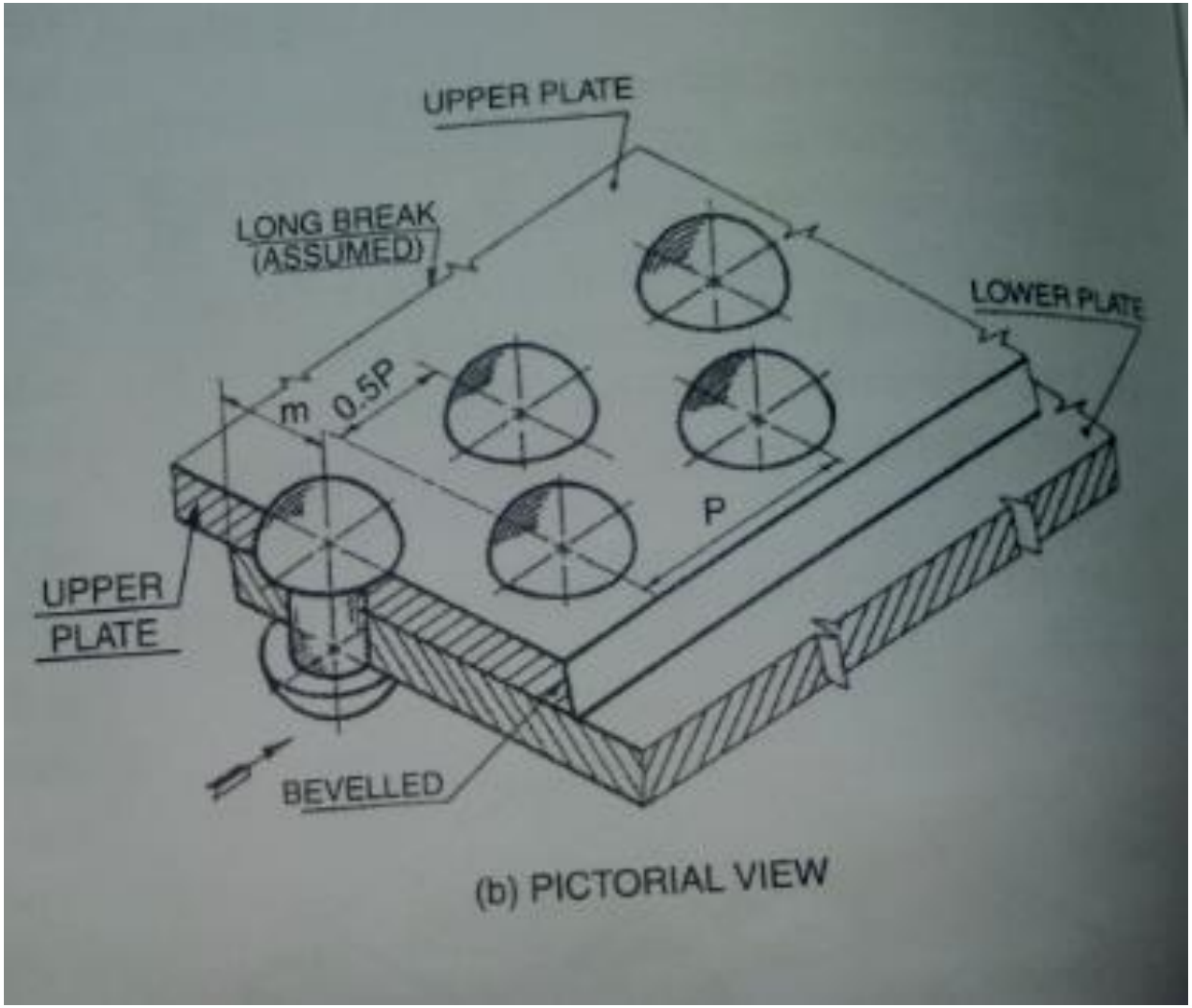


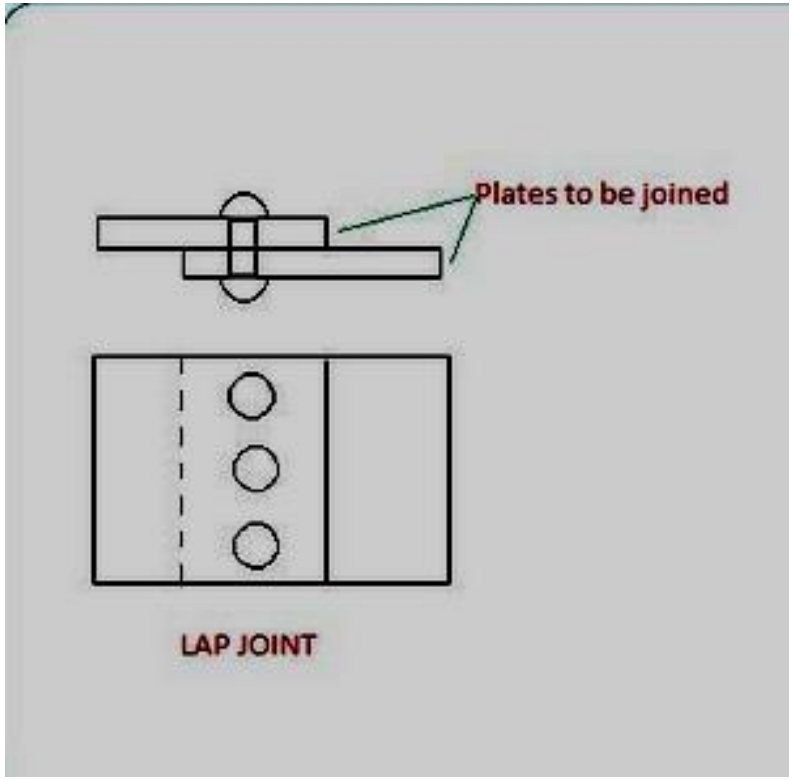
Fig. 16.9. (b) Double riveted lap joint (Chain riveting)



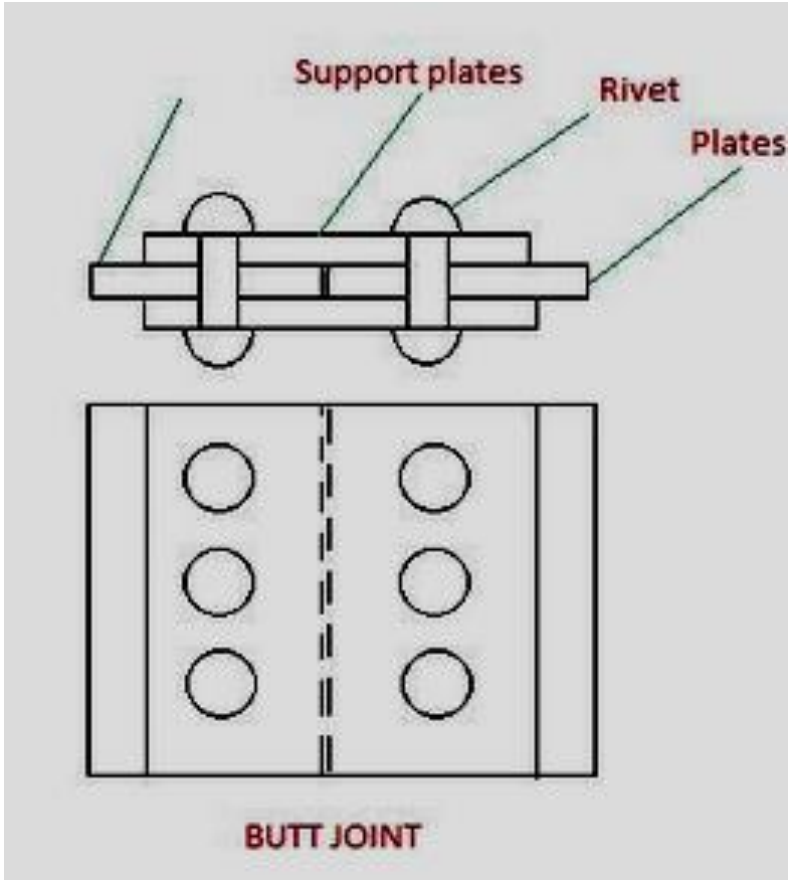
Lap joint


UPPER PLATE
LONG BREAK (ASSUMED)
LOWER PLATE
m
0.5P
P
UPPER PLATE
BEVELLED
(b) PICTORIAL VIEW

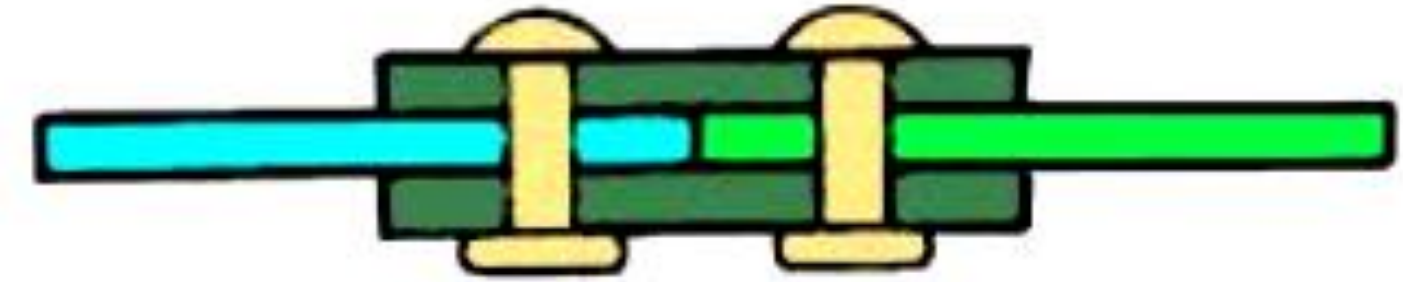
Lap joint

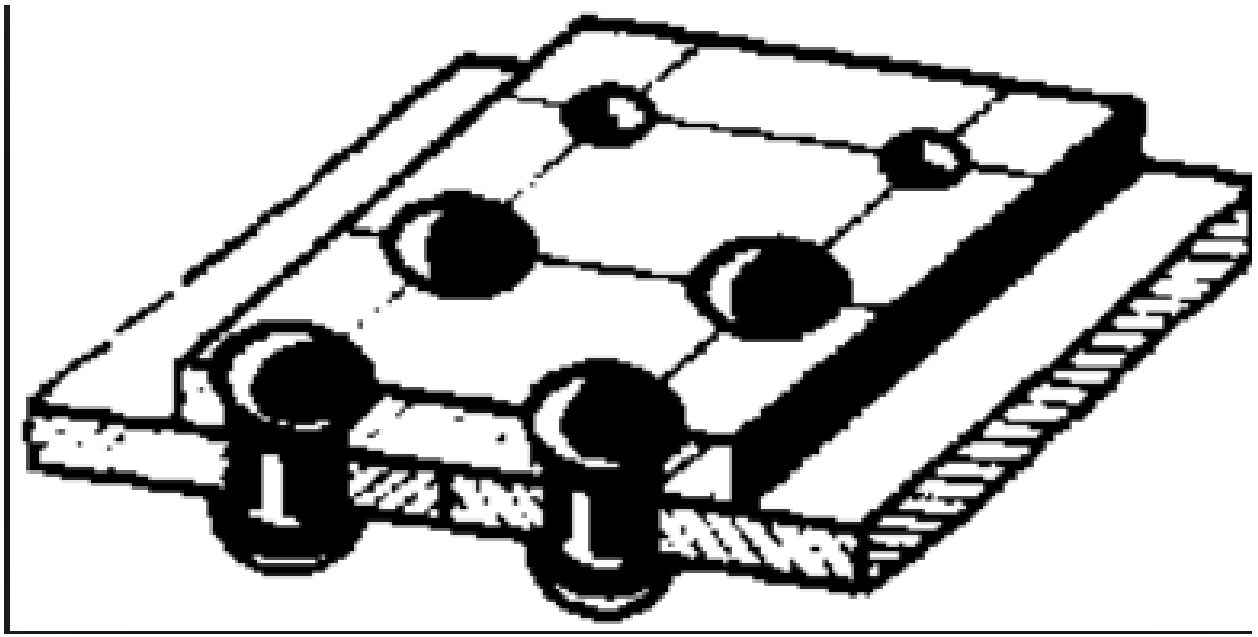


Butt joint



Butt joint





Butt joint

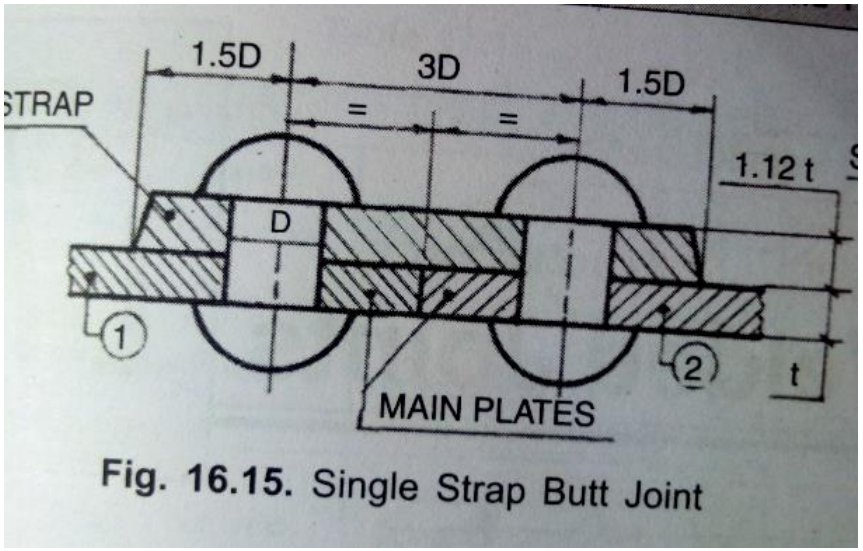


Fig. 16.15. Single Strap Butt Joint

Single strap Butt joint

Double strap Butt joint

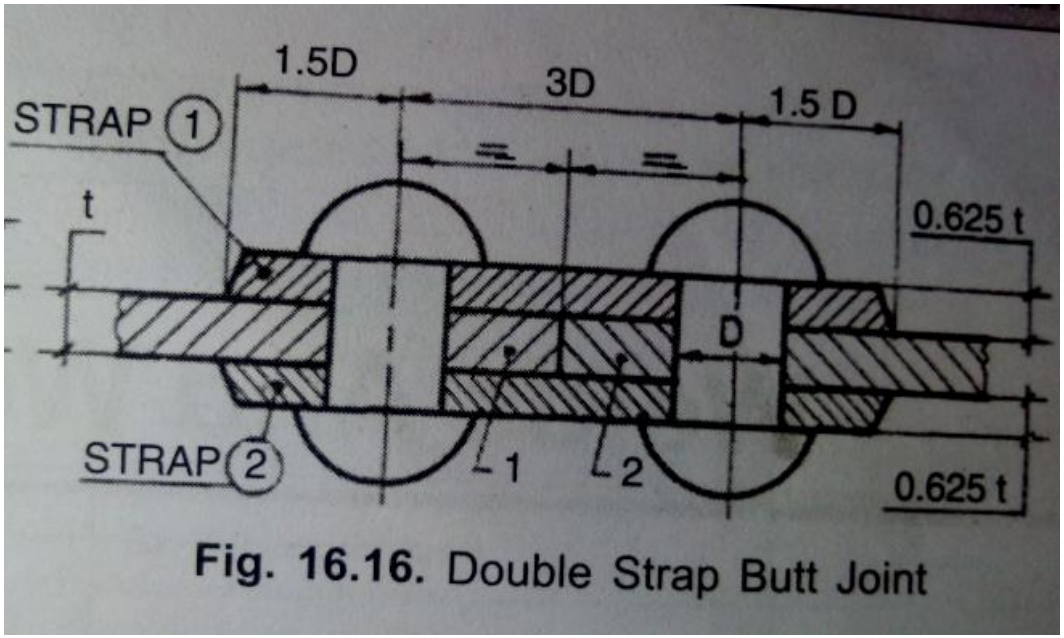
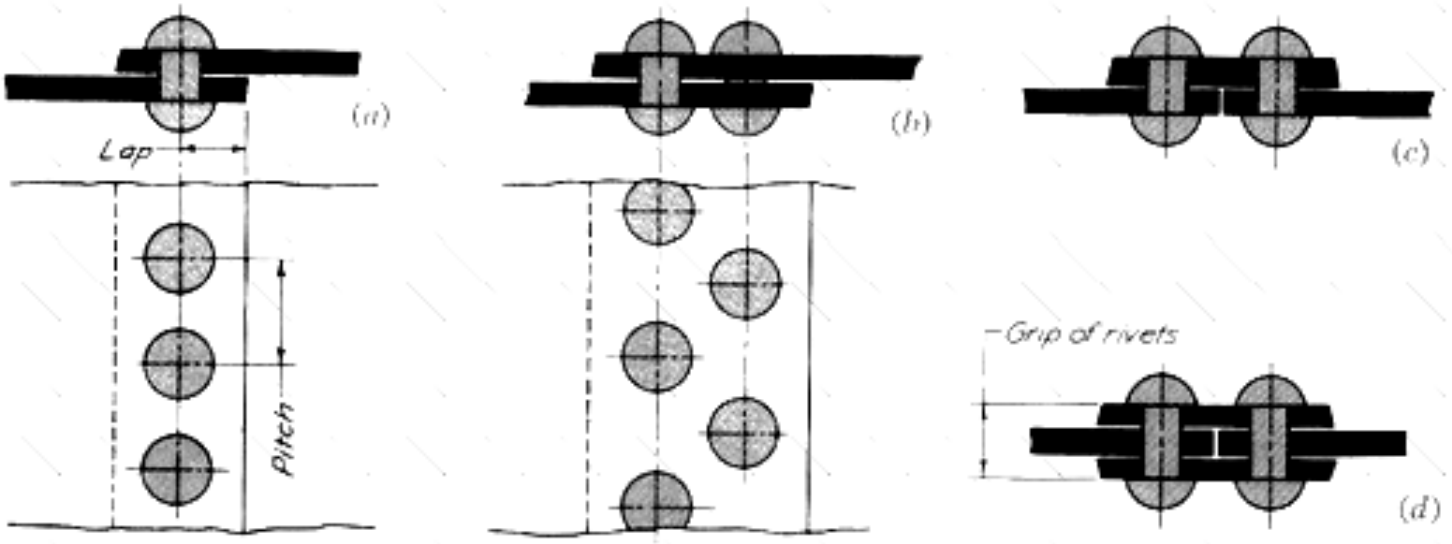
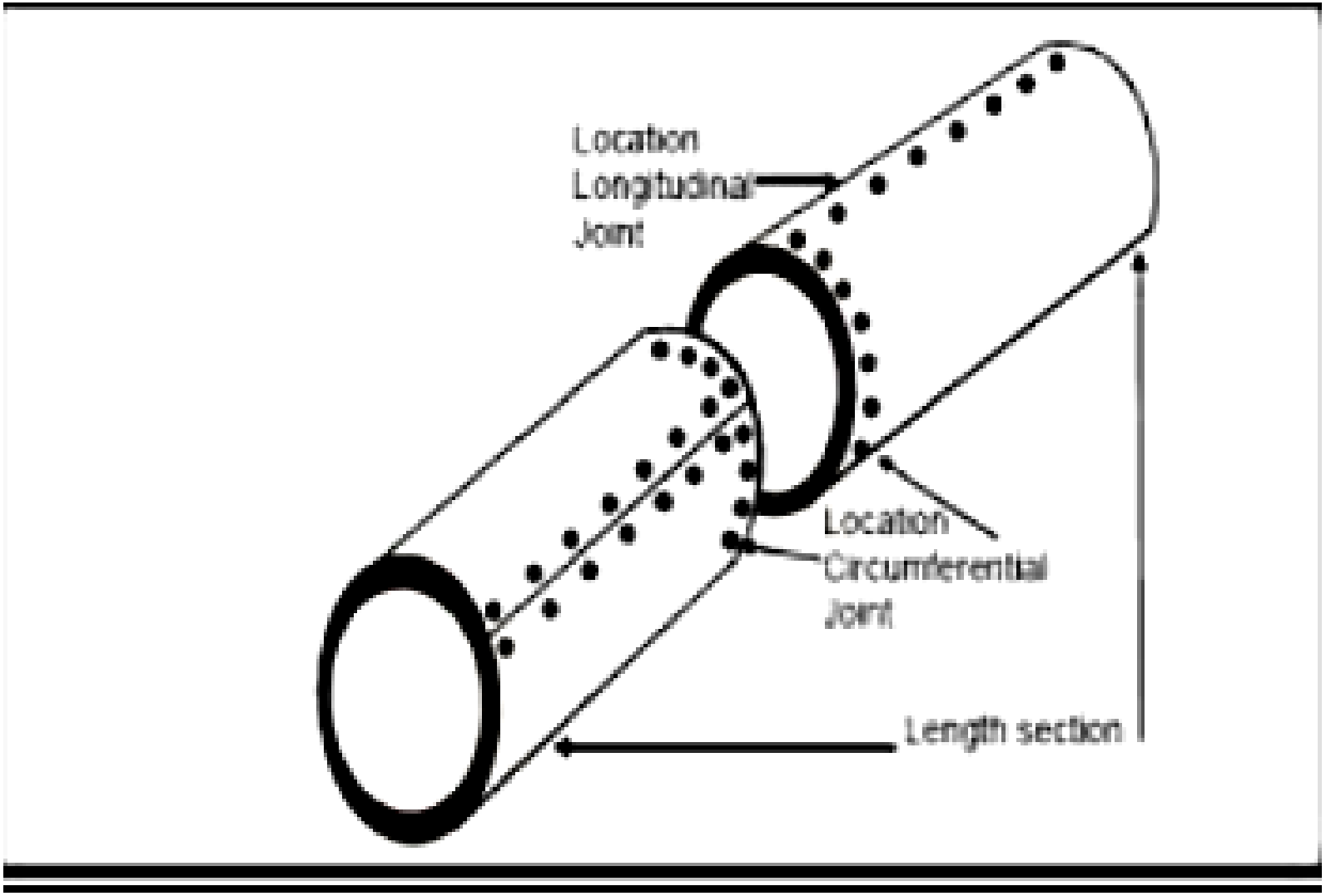
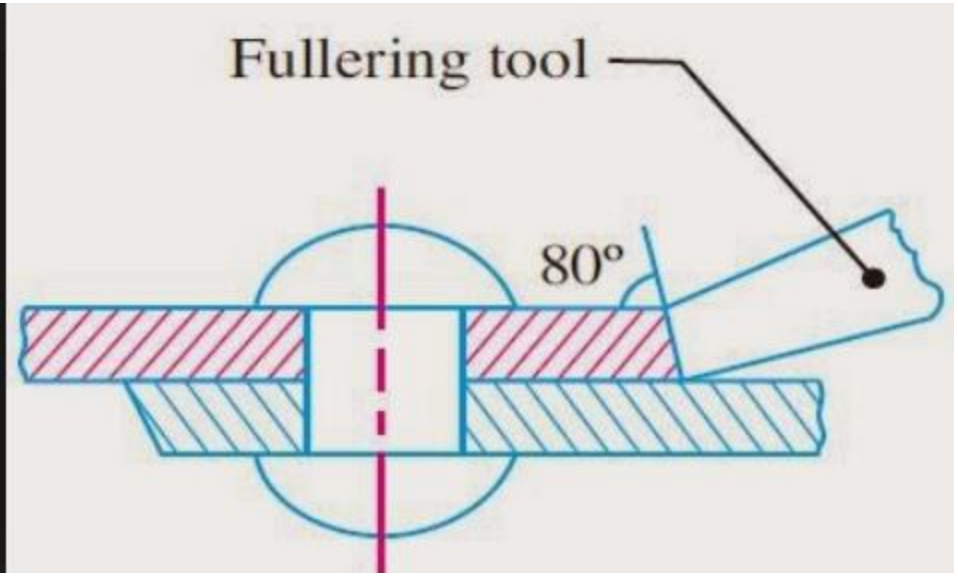


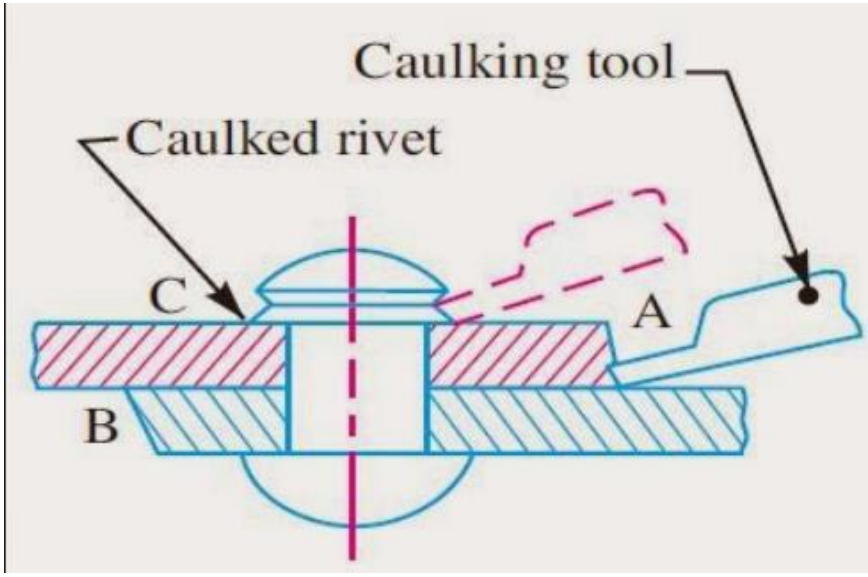
Fig. 16.16. Double Strap Butt Joint

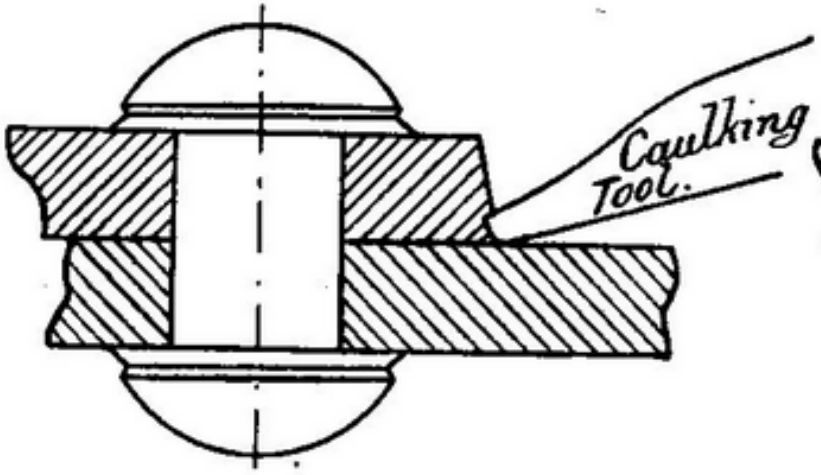

(a)
Lap
Pitch
(b)
(c)
Grip of rivets
(d)

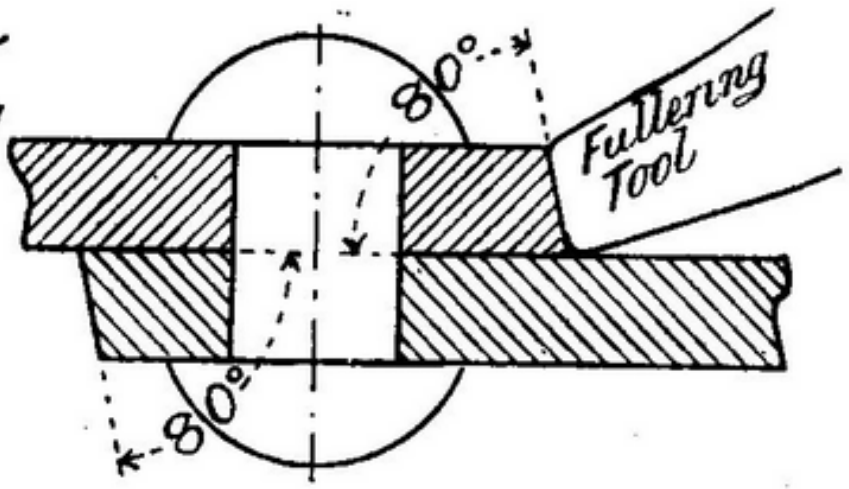
Boiler joint


Location
Longitudinal
Joint
Location
Circumferential
Joint
Length section


Fullering tool
80°


Caulking tool
Caulked rivet
C
A
B


Caulking Tool


80°
Fullering Tool
80°

Machine Drawing

Credit 2 - 0L-4P

Nut, Bolts, Washers

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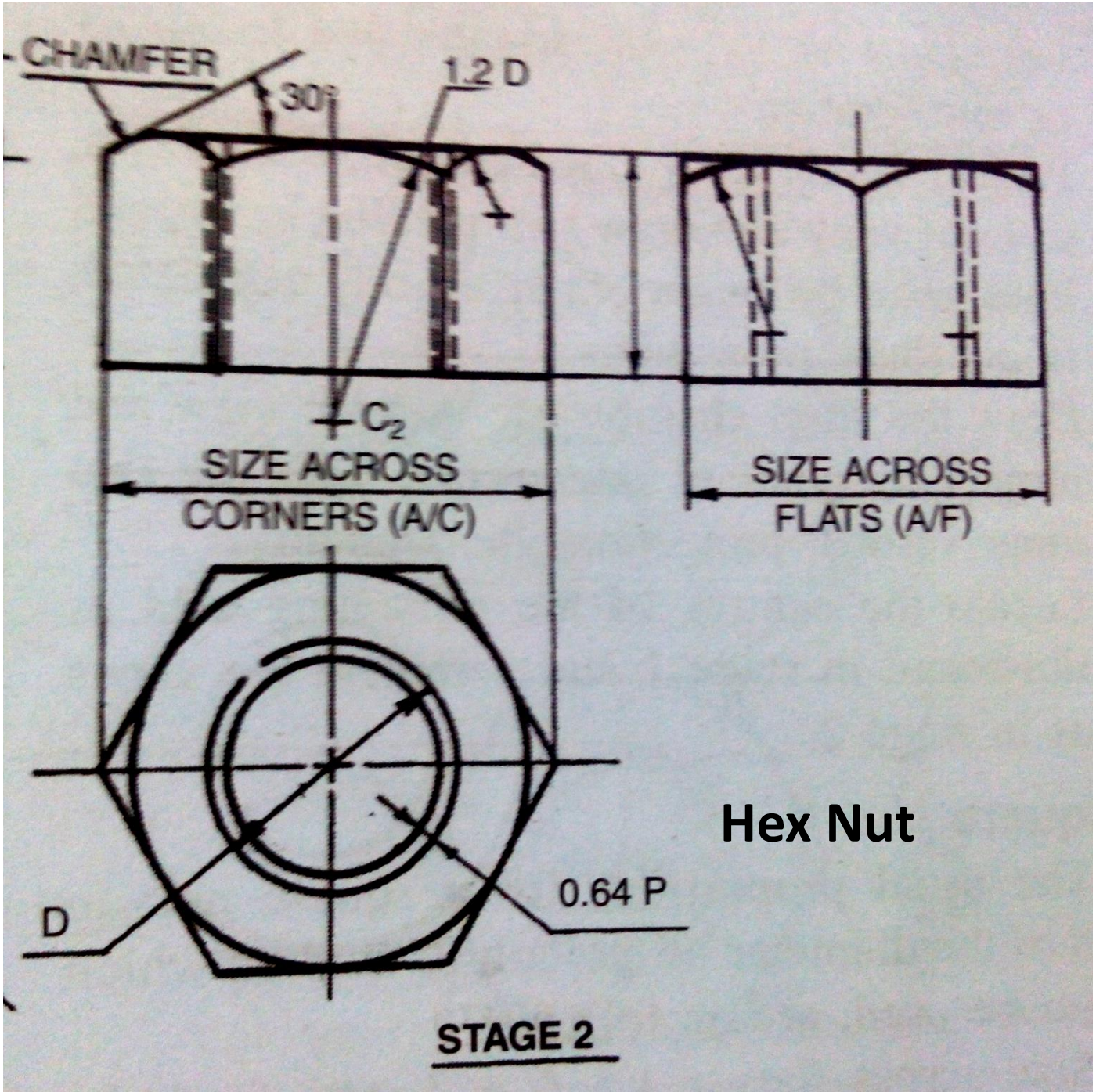
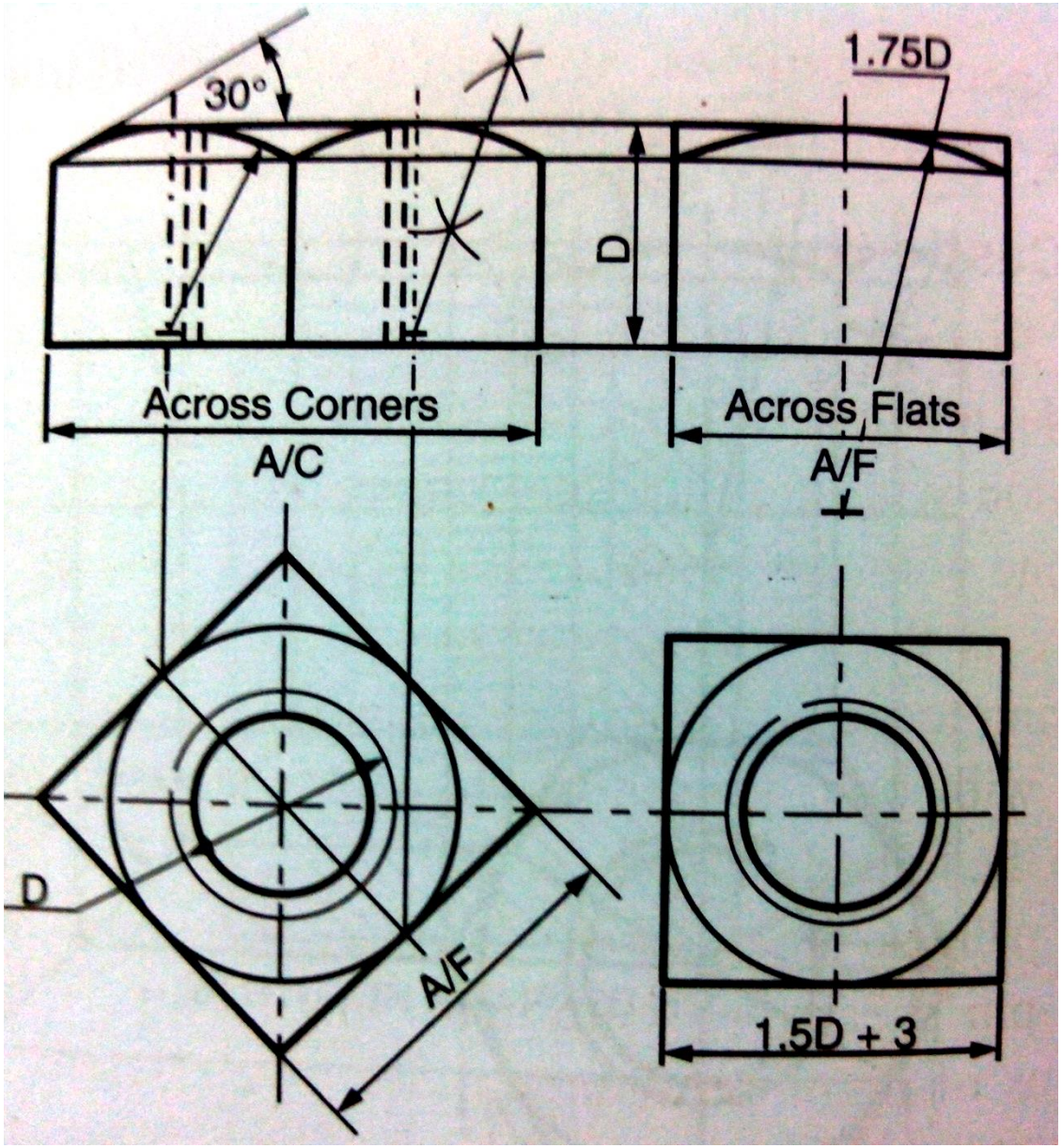
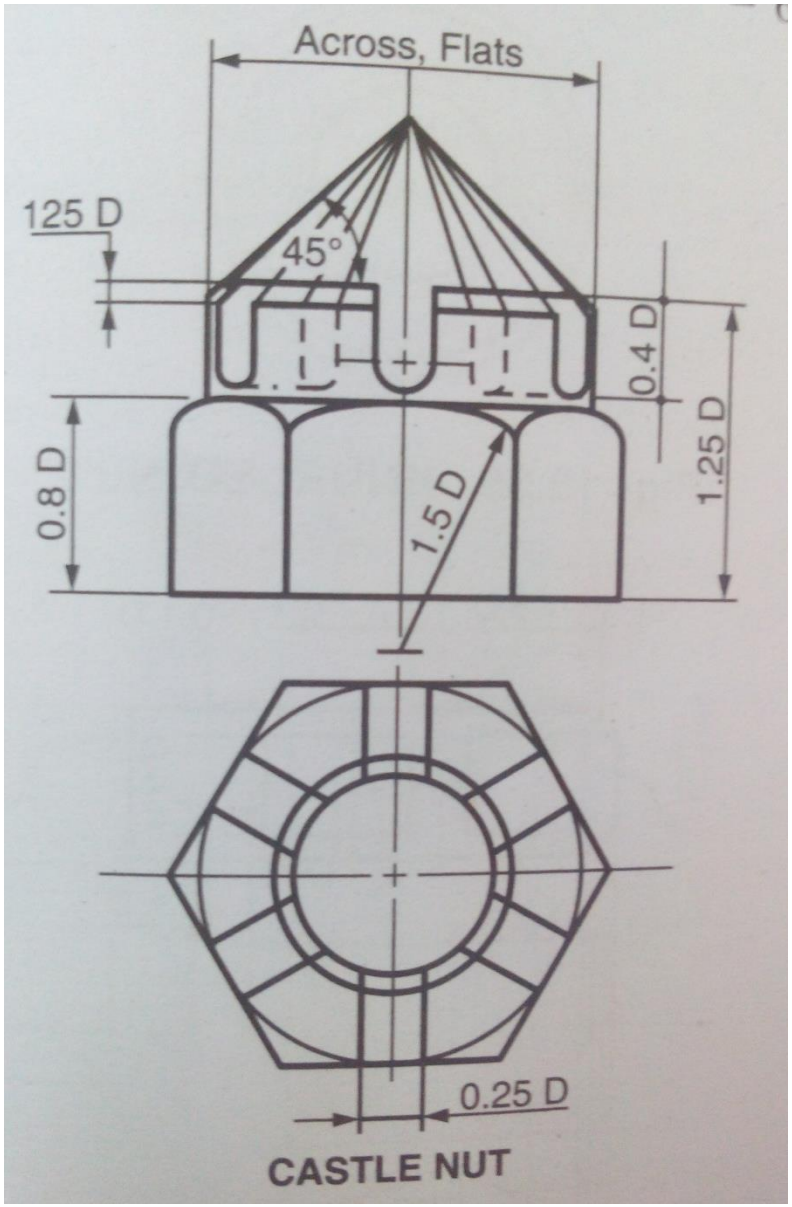

CHAMFER
30°
1.2 D
C_2
SIZE ACROSS
CORNERS (A/C)
SIZE ACROSS
FLATS (A/F)
D
0.64 P
STAGE 2

Hex Nut

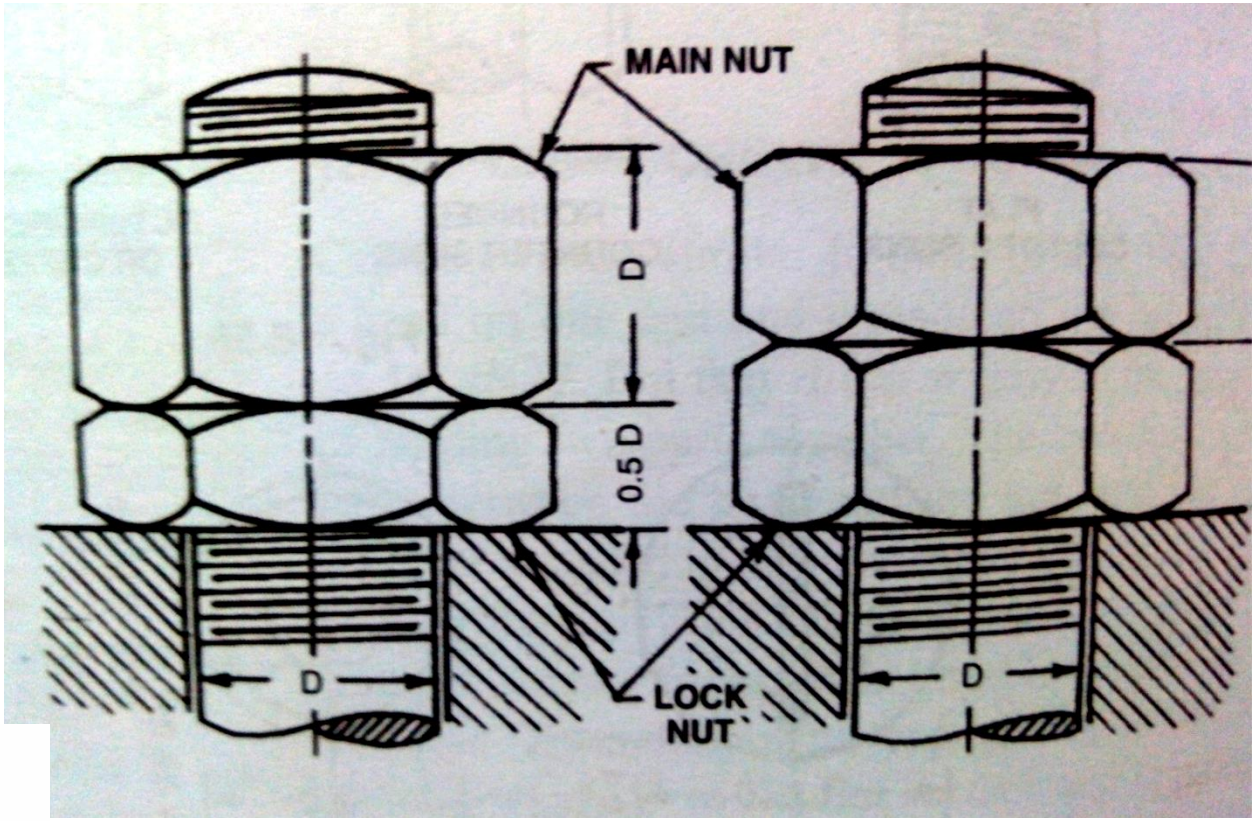
SQUARE NUT



CASTLE NUT

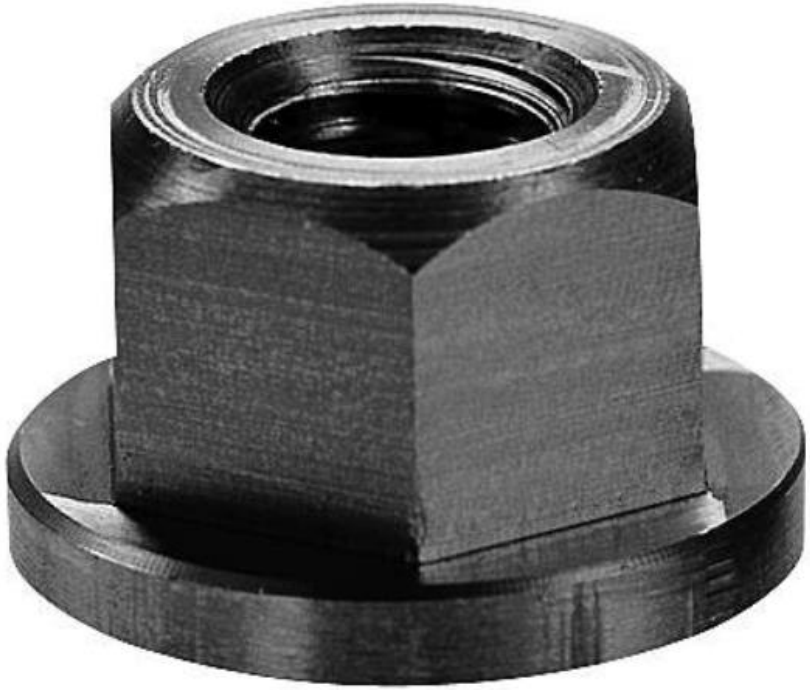


Hex Lock/Jam NUT

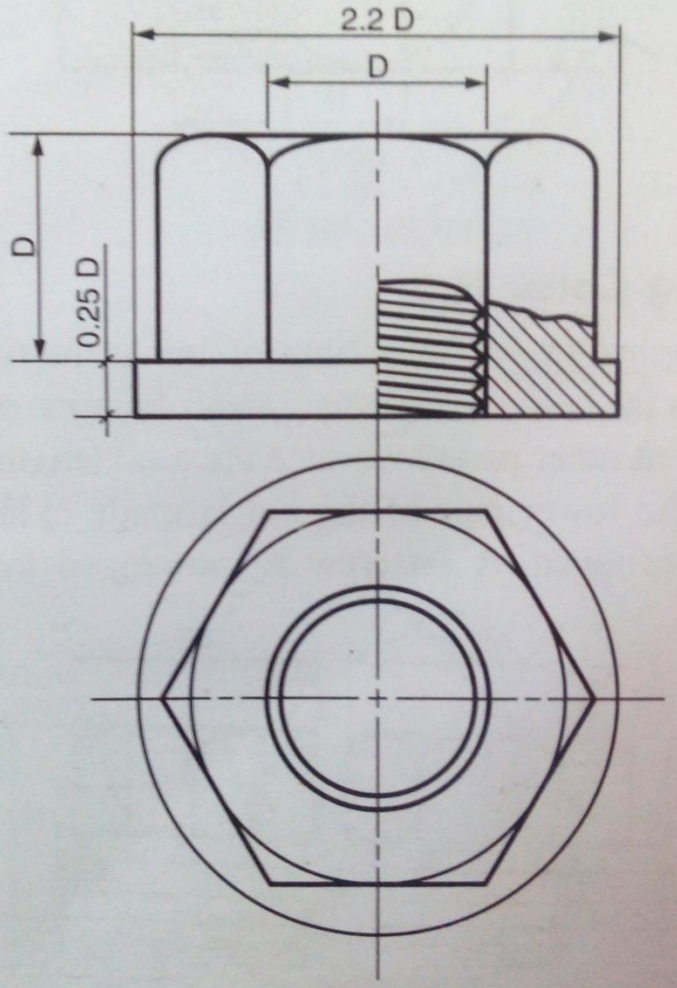


Hex Nylon Lock NUT

Flanged NUT

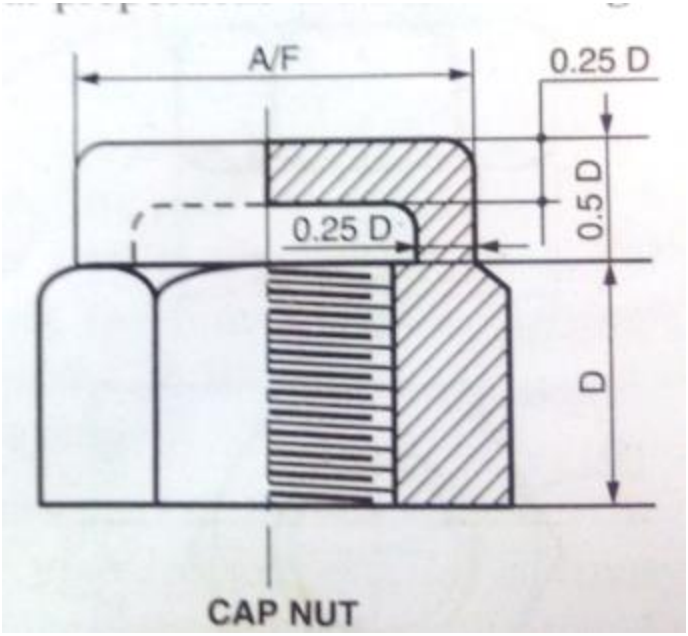


Thus flanged nut, too, is a hexagonal nut with an integral washer. The flange increases the bearing area of the nut, and the bolt can be used in comparatively large sized hole due to the flange.

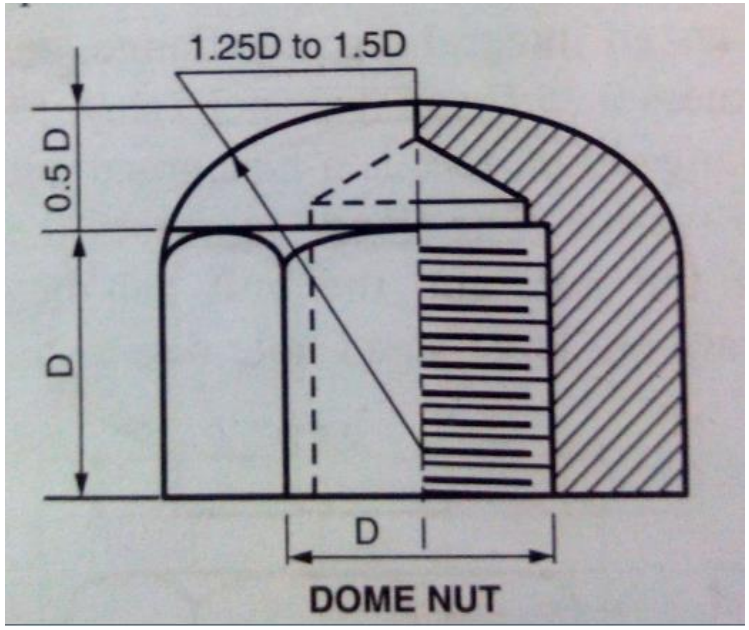


FLANGED NUT

CAP NUT



DOM NUT



Wing NUT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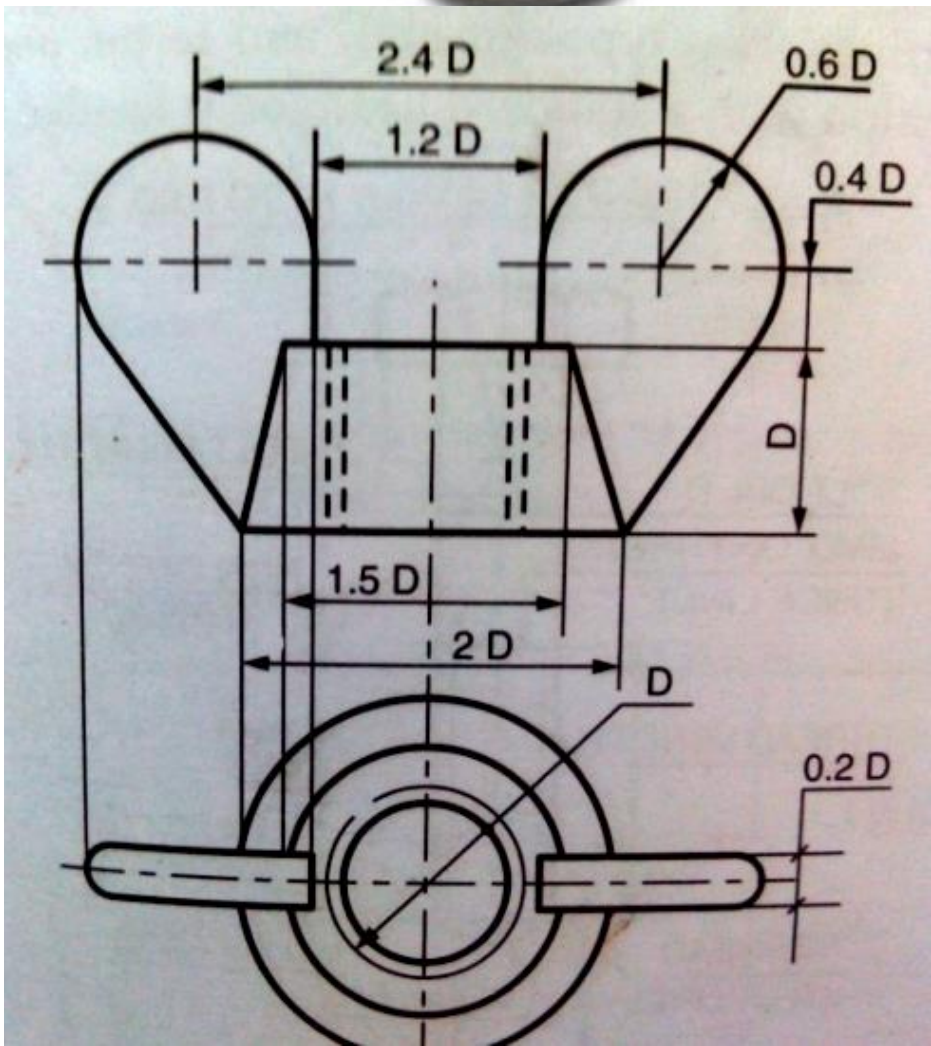
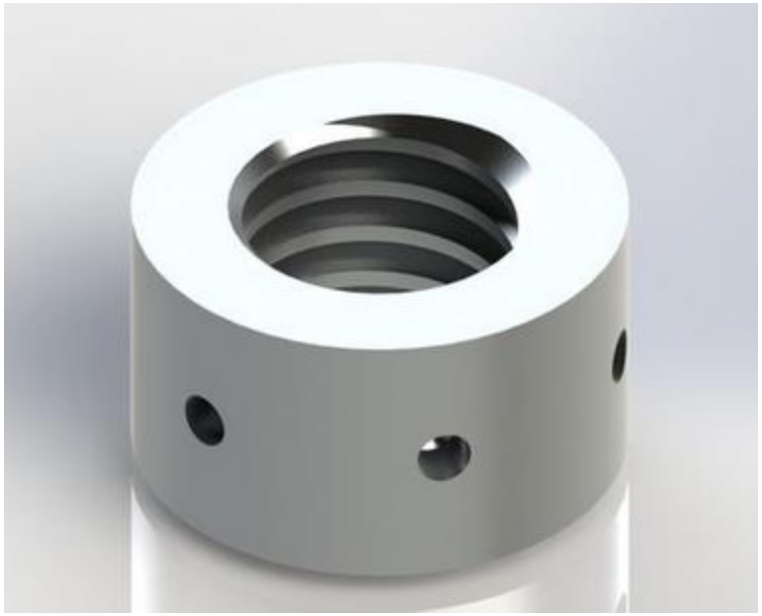
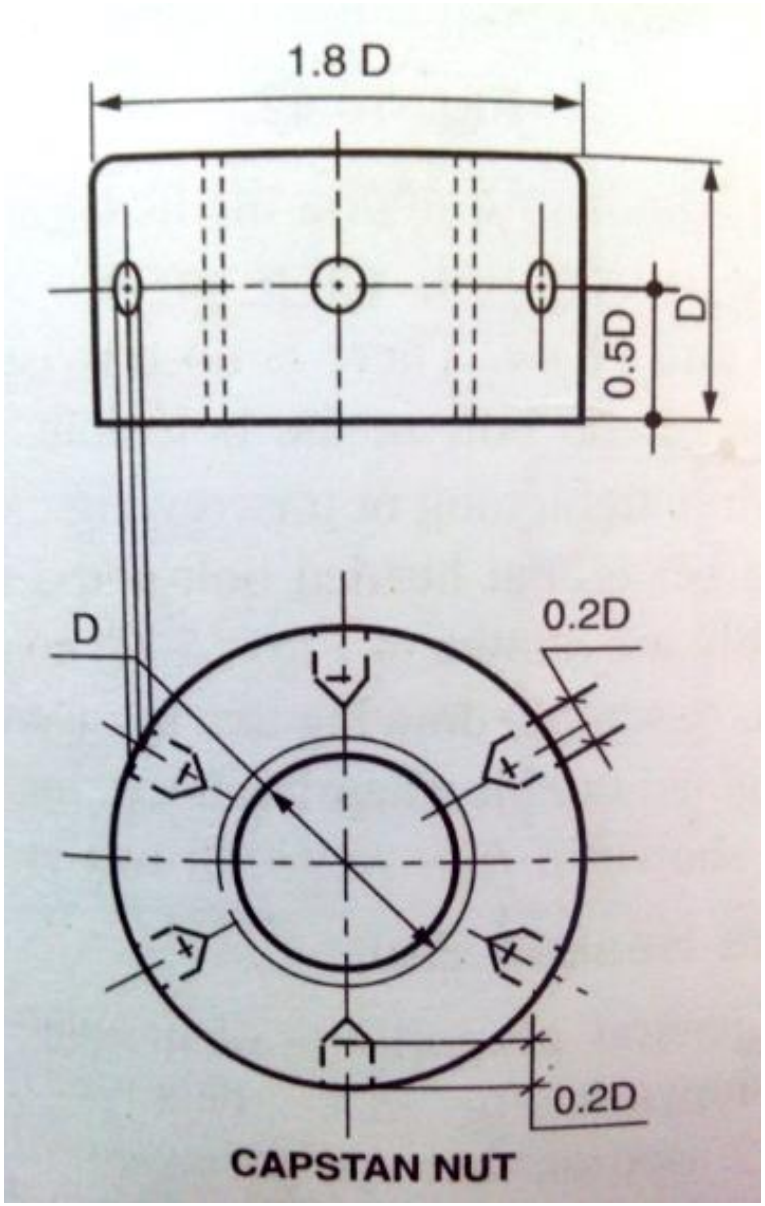
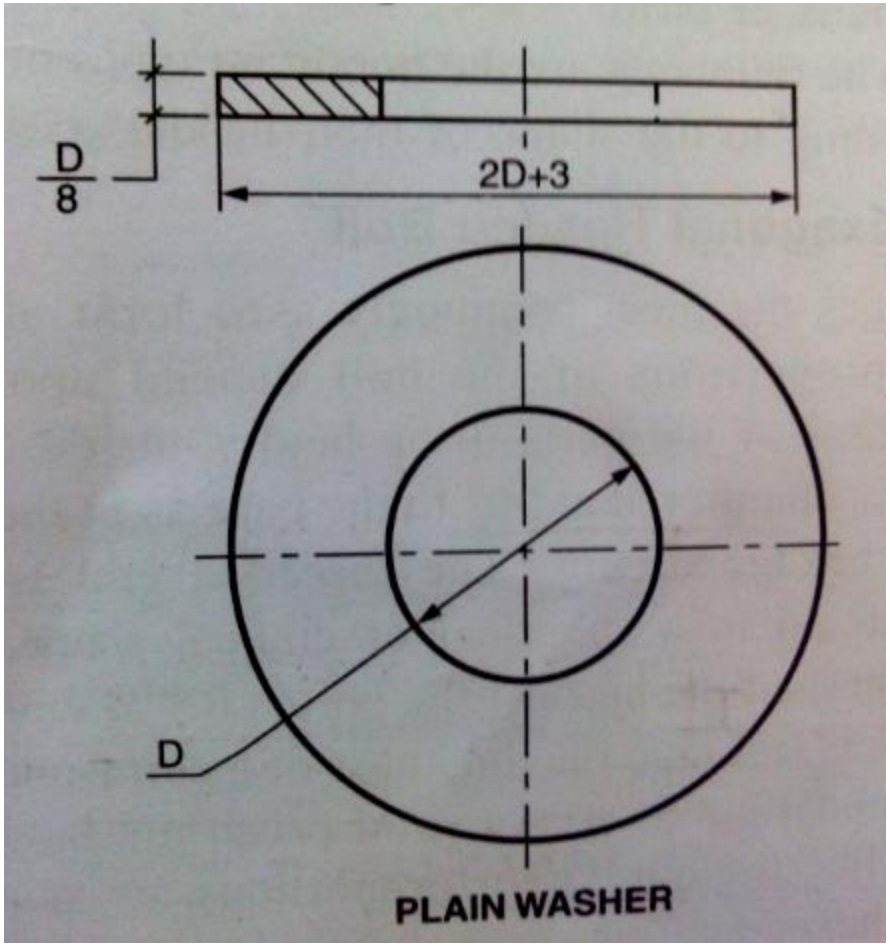

2.4 D
0.6 D
1.2 D
0.4 D
D
1.5 D
2 D
D
0.2 D

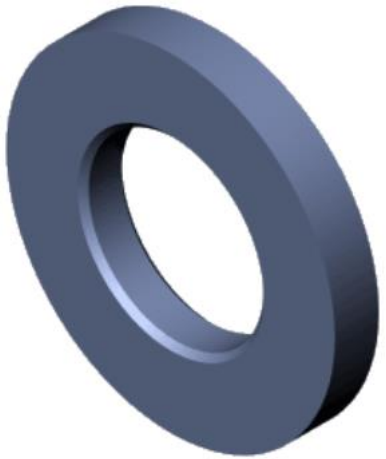
Capstan NUT



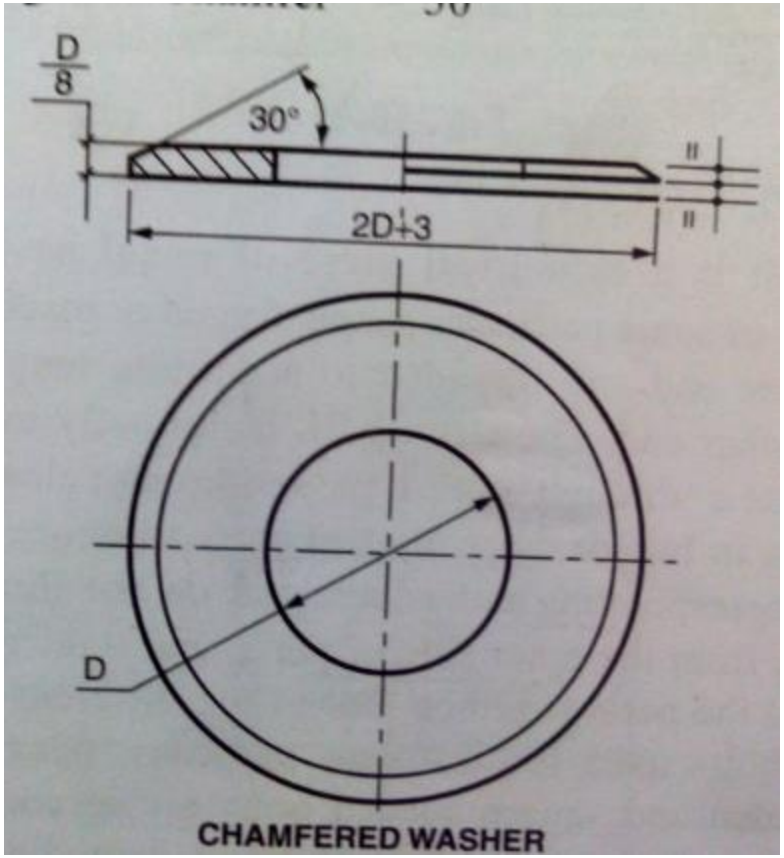


Washer



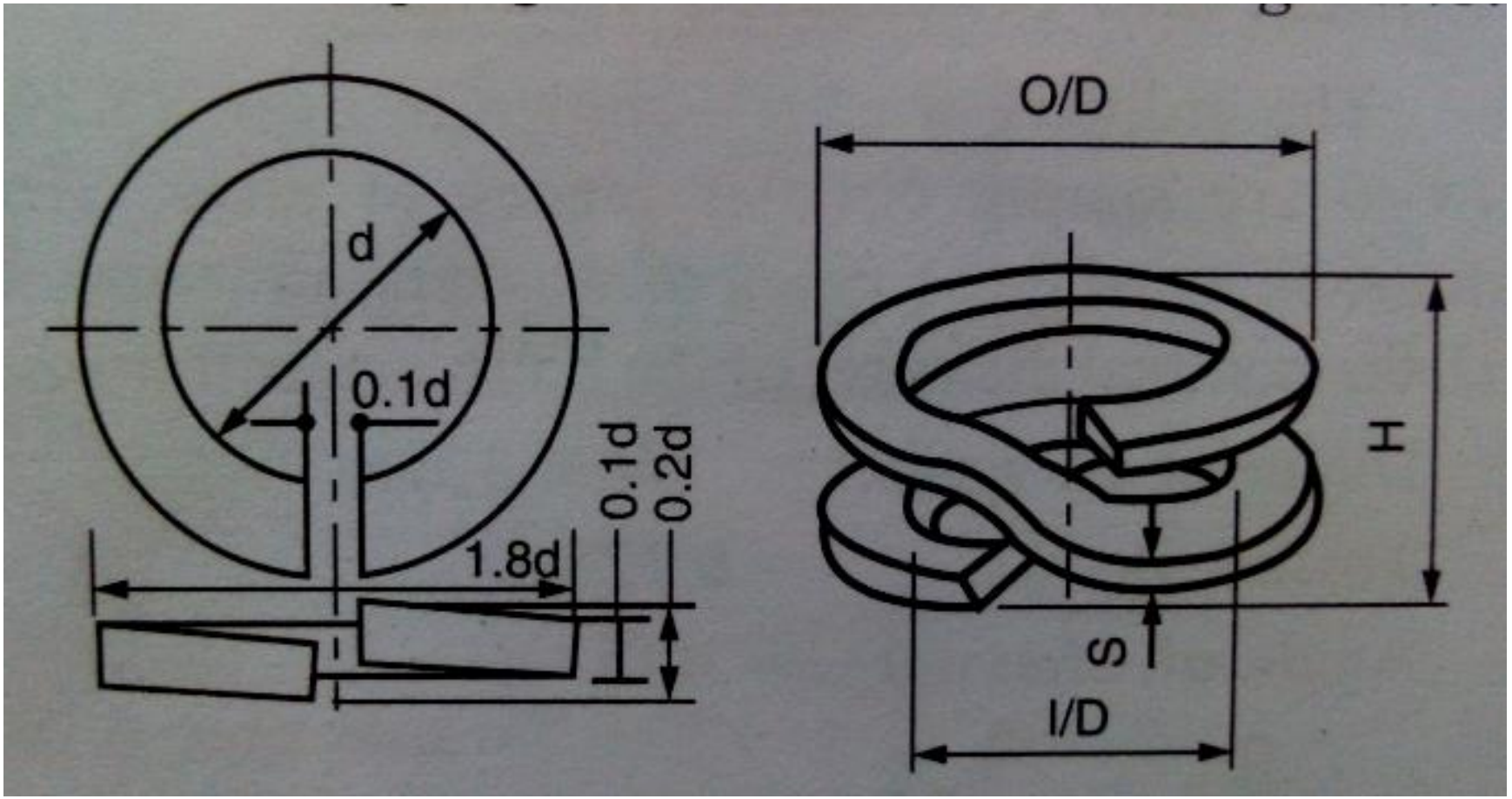


Chamfered Washer



Spring Washer

Spring Washer



Nut Types

Hex
A six sided nut. Also referred to as a Finished Hex Nut.

Heavy Hex
A heavier pattern version of a standard hex nut.

Nylon Insert Lock
A nut with a nylon insert to prevent backing off. Also referred to as a Nylock.

Jam
A hex nut with a reduced height.

Nylon Insert Jam Lock
A nylock nut with a reduced height.

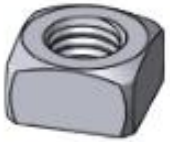
Wing
A nut with 'wings' for hand tightening.

Cap
A nut with a domed top over the end of the fastener.

Acorn
Acorn nuts are a high crown type of cap nut, used for appearance.

Flange
A nut with a built in washer like flange.

Tee
A nut designed to be driven into wood to create a threaded hole.



Square
A four sided nut.

Prevailing Torque Lock
A non-reversible lock nut used for high temperature applications.

K-Lock or Kep
A nut with an attached free-spinning external tooth lock washer.

Coupling
Coupling nuts are long nuts used to connect pieces of threaded rod or other male fasteners.

Slotted
Slotted nuts are used in conjunction with a cotter pin on drilled shank fasteners to prevent loosening.

Castle
Castle nuts are used in conjunction with a cotter pin on drilled shank fasteners to prevent loosening.

Fastener Categories

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.

Socket Screws
Socket screws, also known as Allen Head, are fastened with a hex Allen wrench.

Set Screws
Machine screws with no head for screwing all the way into threaded holes.

Eye Bolts
A bolt with a circular ring on the head end. Used for attaching a rope or chain.

Eye Lags
Similar to an eye bolt but with wood threads instead of machine thread.

J-Bolts
J shaped bolts are used for tie-downs or as an open eye bolt.

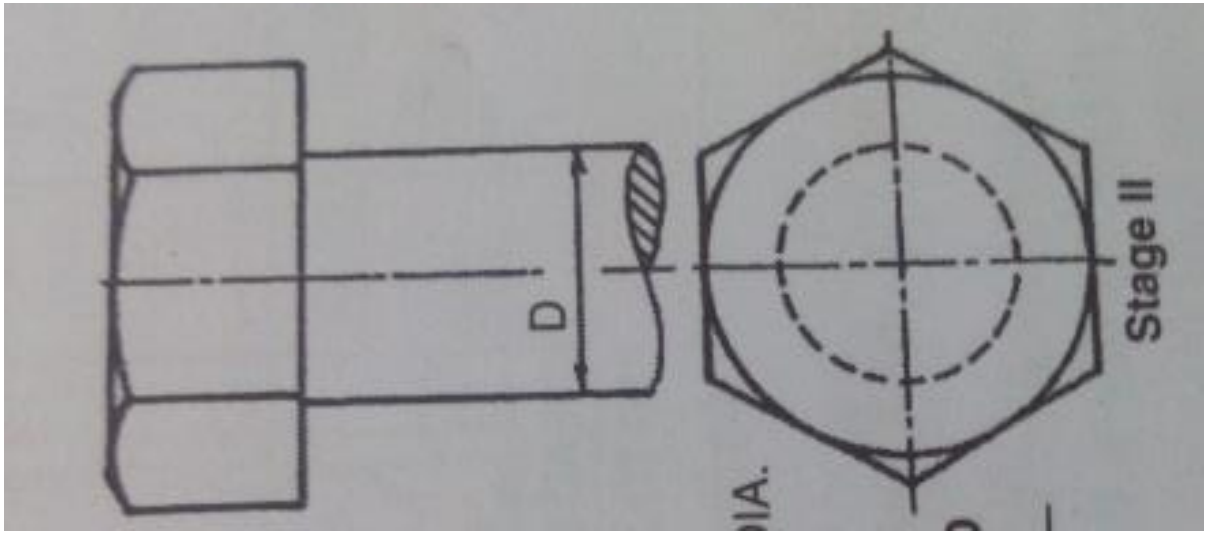
U-Bolts
Bolts in U shape for attaching to pipe or other round surfaces. Also available with a square bend.

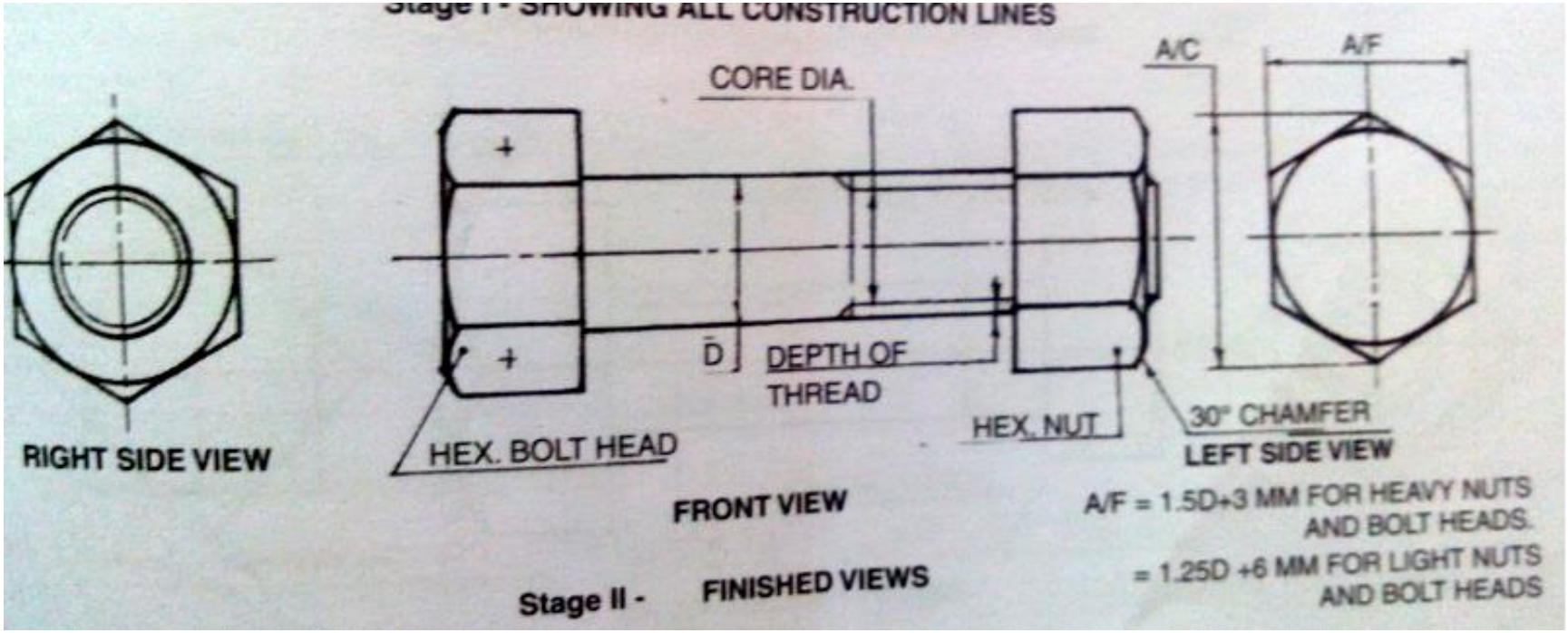
Shoulder Bolts
Shoulder bolts (also known as stripper bolts) are used to create a pivot point.

Elevator Bolts
Elevator bolts are often used in conveyor systems. They have a large, flat head.

Bolts

Washer Faced Bolt

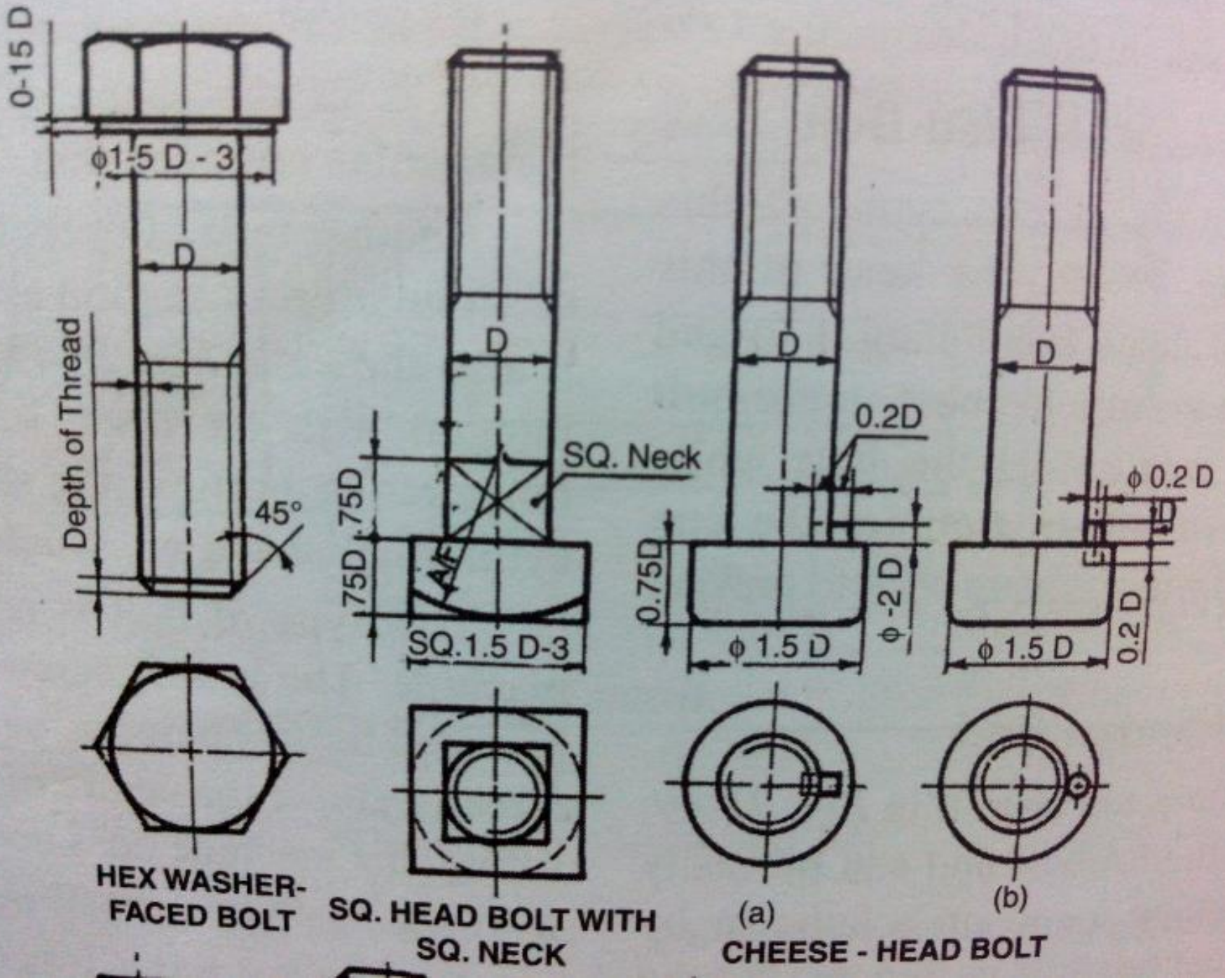

D
Stage II


Stage I - SHOWING ALL CONSTRUCTION LINES
CORE DIA.
A/C
A/F
D
DEPTH OF THREAD
HEX. BOLT HEAD
HEX. NUT
30° CHAMFER
RIGHT SIDE VIEW
FRONT VIEW
LEFT SIDE VIEW
A/F = 1.5D+3 MM FOR HEAVY NUTS AND BOLT HEADS.
= 1.25D +6 MM FOR LIGHT NUTS AND BOLT HEADS
Stage II - FINISHED VIEWS

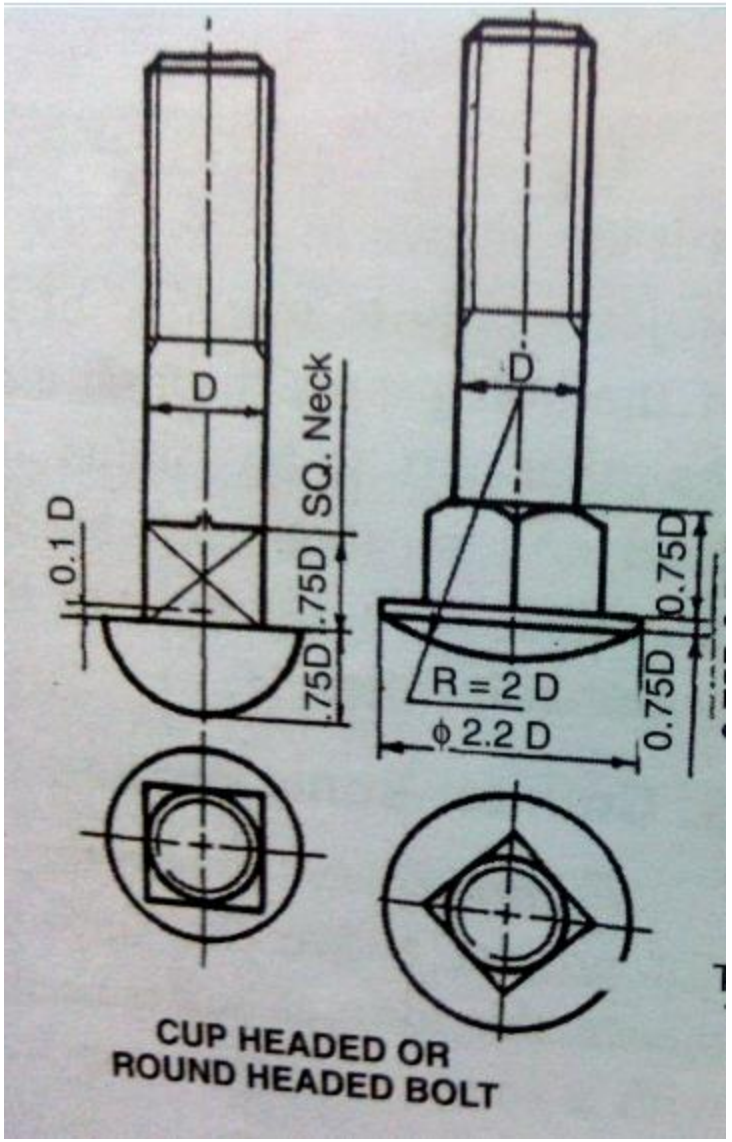
Square Headed Bolt

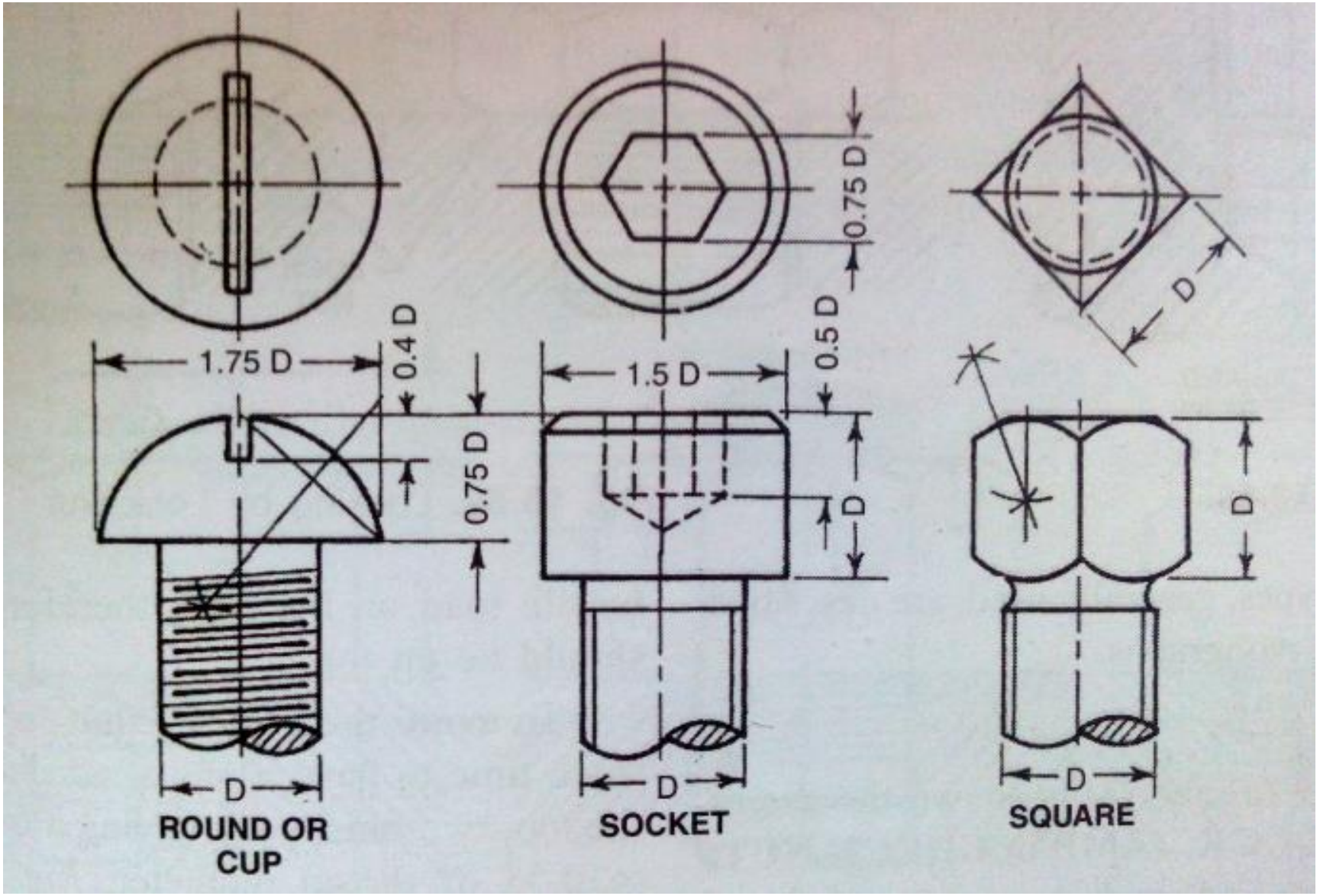
Square Headed Bolt with round Neck

Cheese Headed Bolt

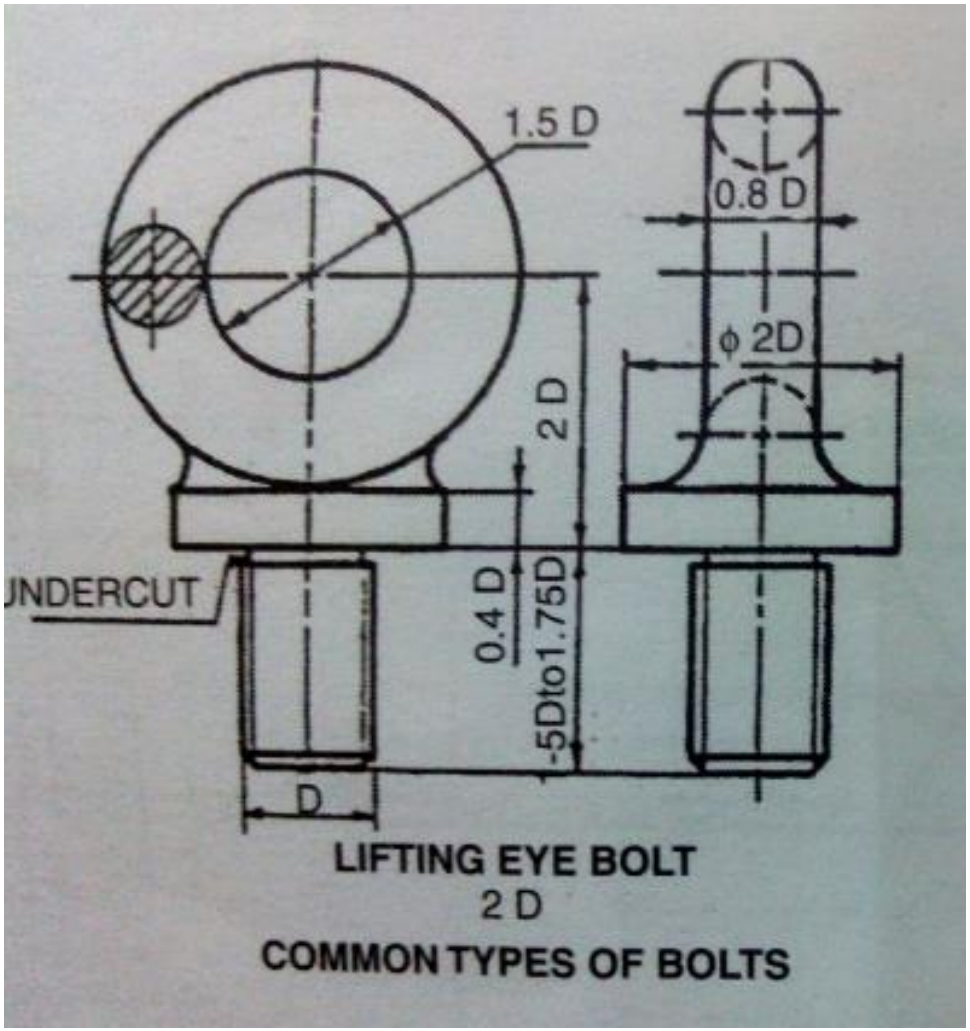

0-15 D
φ1.5 D - 3
D
Depth of Thread
45°
HEX WASHER-FACED BOLT
D
SQ. Neck
.75D
.75D
AF
SQ.1.5 D-3
SQ. HEAD BOLT WITH SQ. NECK
D
0.2D
0.75D
φ -2 D
φ 1.5 D
(a)
D
φ 0.2 D
0.2 D
φ 1.5 D
(b)
CHEESE - HEAD BOLT

Round Headed Bolt

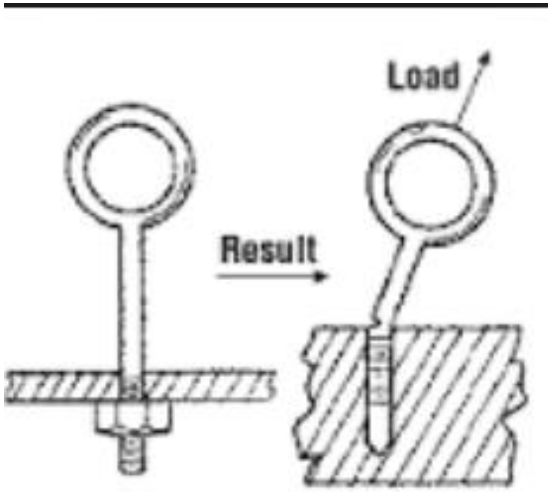



1.75 D
0.4 D
0.75 D
D
ROUND OR
CUP
0.75 D
1.5 D
0.5 D
D
D
SOCKET
D
D
SQUARE

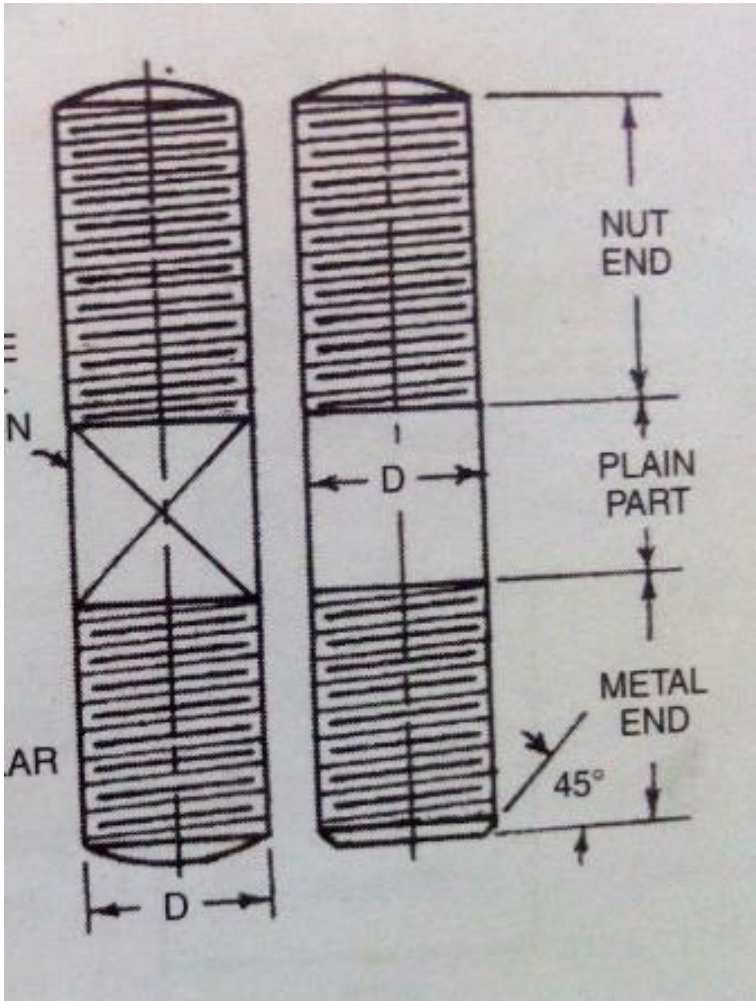

AUSTRALIA
ENMOM

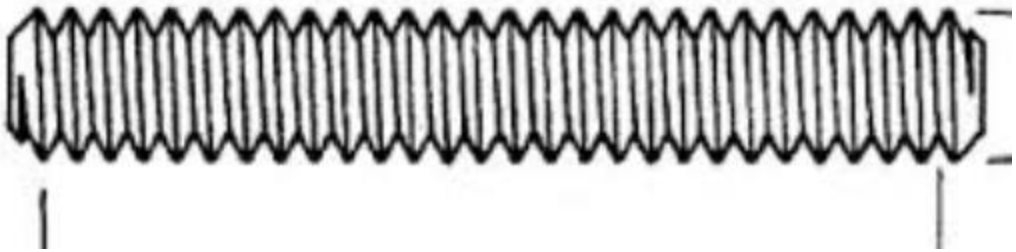

1.5 D
0.8 D
ϕ 2D
2 D
UNDERCUT
0.4 D
-5Dto1.75D
D
LIFTING EYE BOLT
2 D
COMMON TYPES OF BOLTS

Eye Bolt

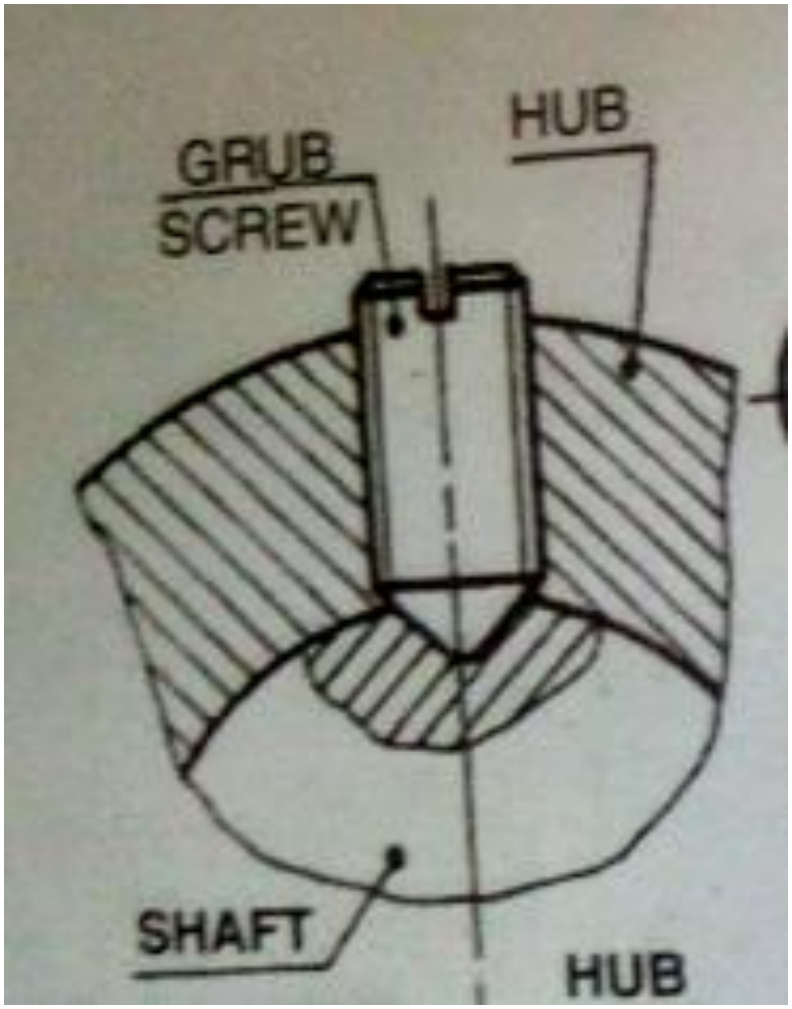

Load
Result

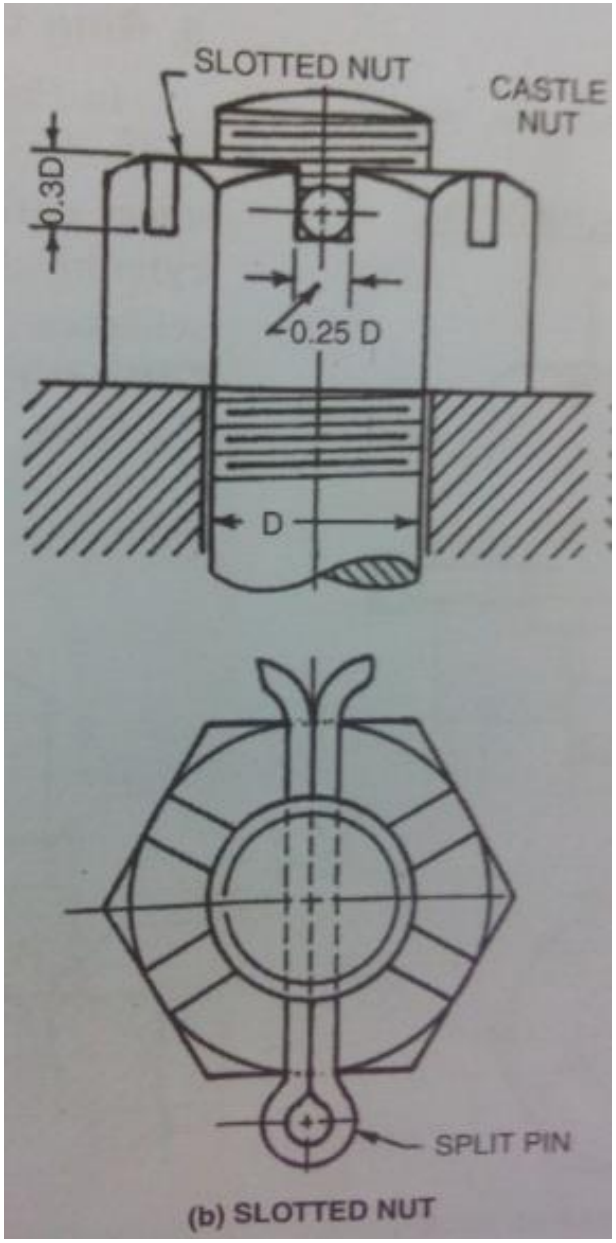
STUD Bolt



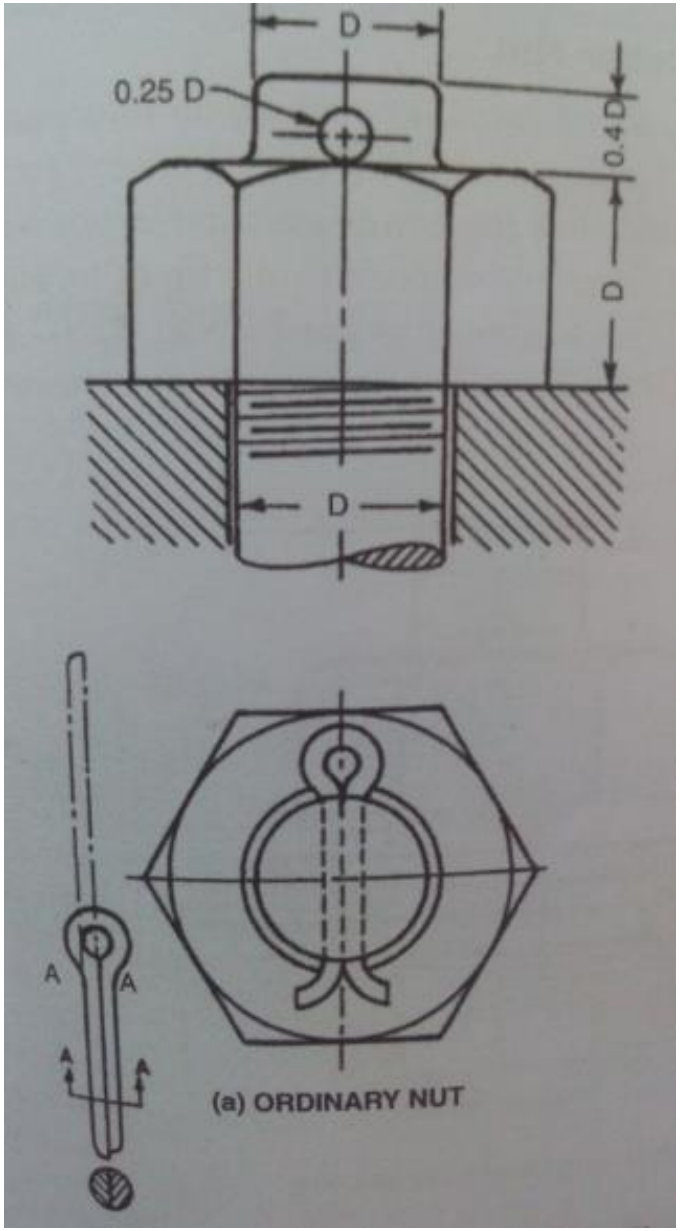


GRUB SCREW


HUB
GRUB
SCREW
SHAFT
HUB

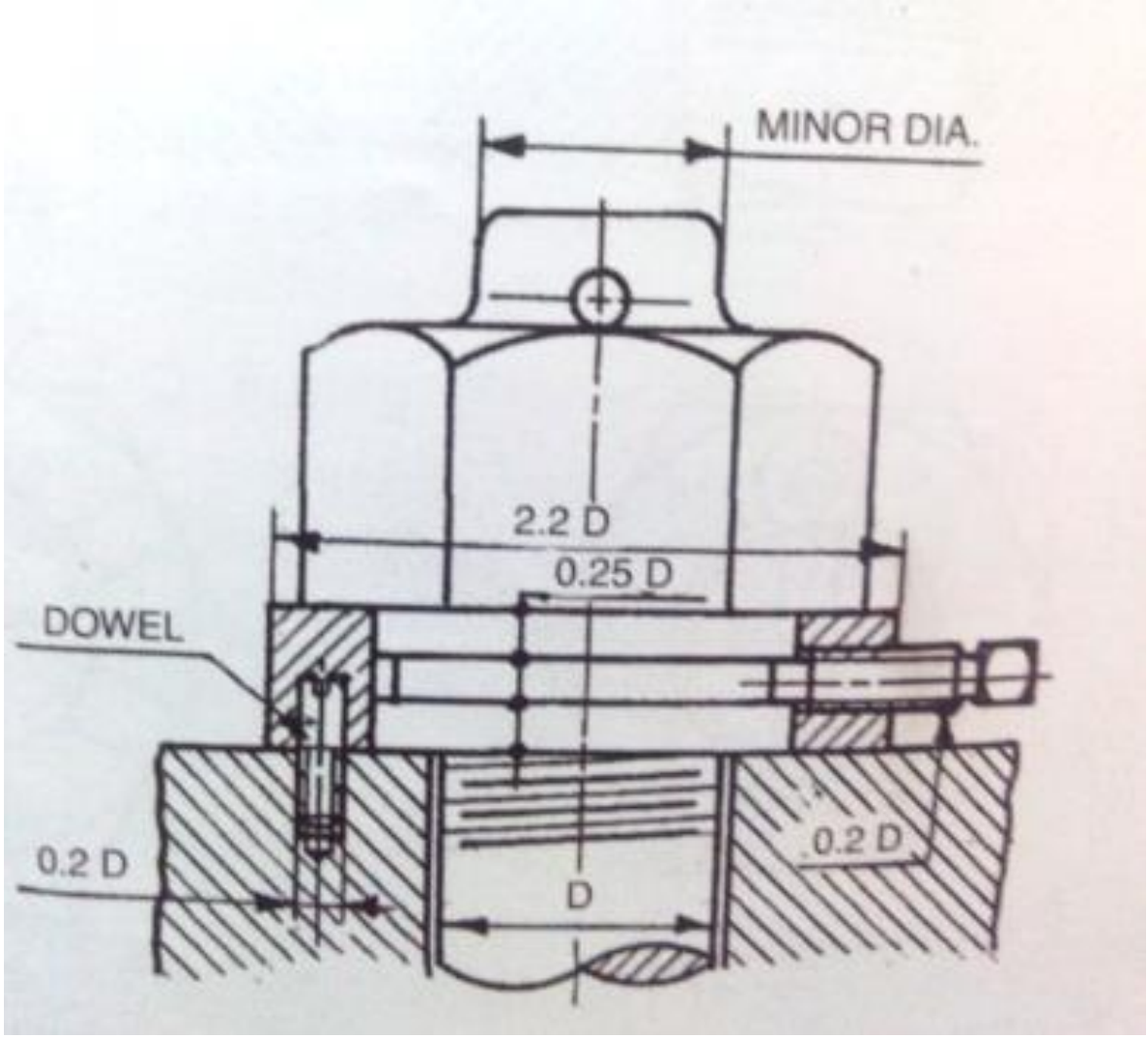


(b) SLOTTED NUT



(a) ORDINARY NUT

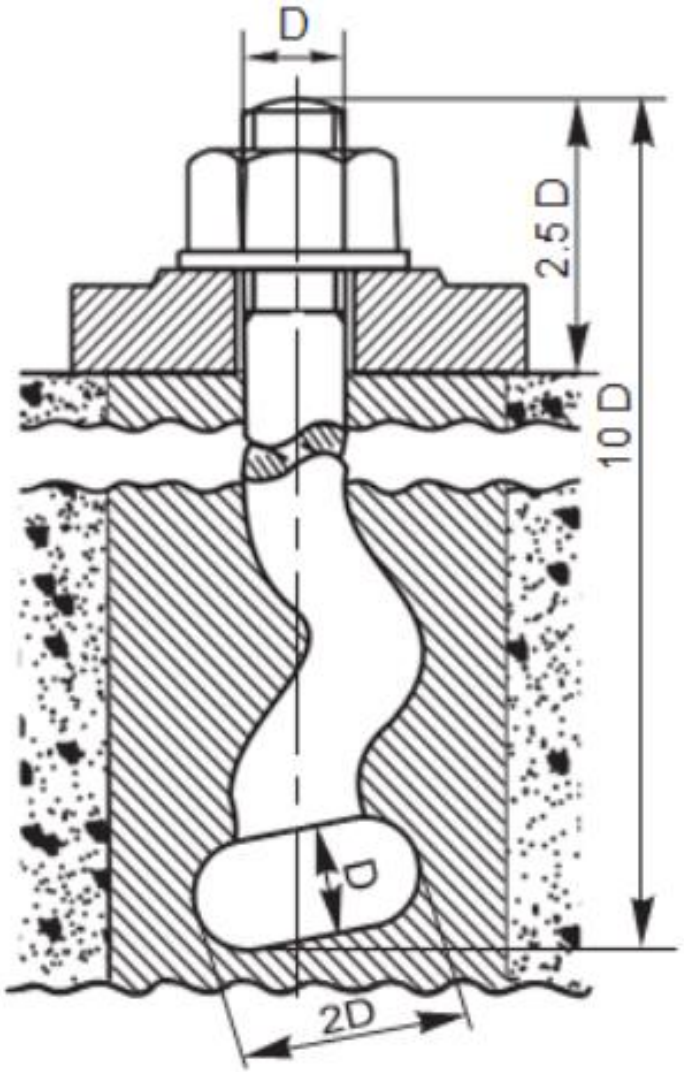
Ring Collar Nut/Ring Nut



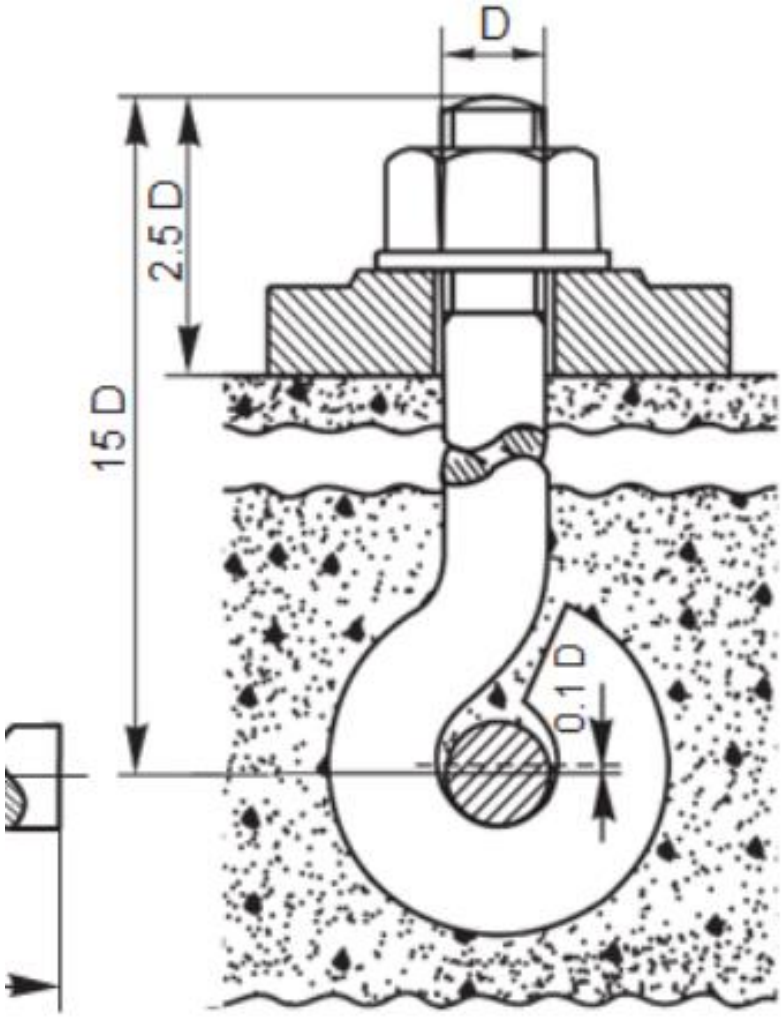
Foundation Bolt

Foundation Bolt

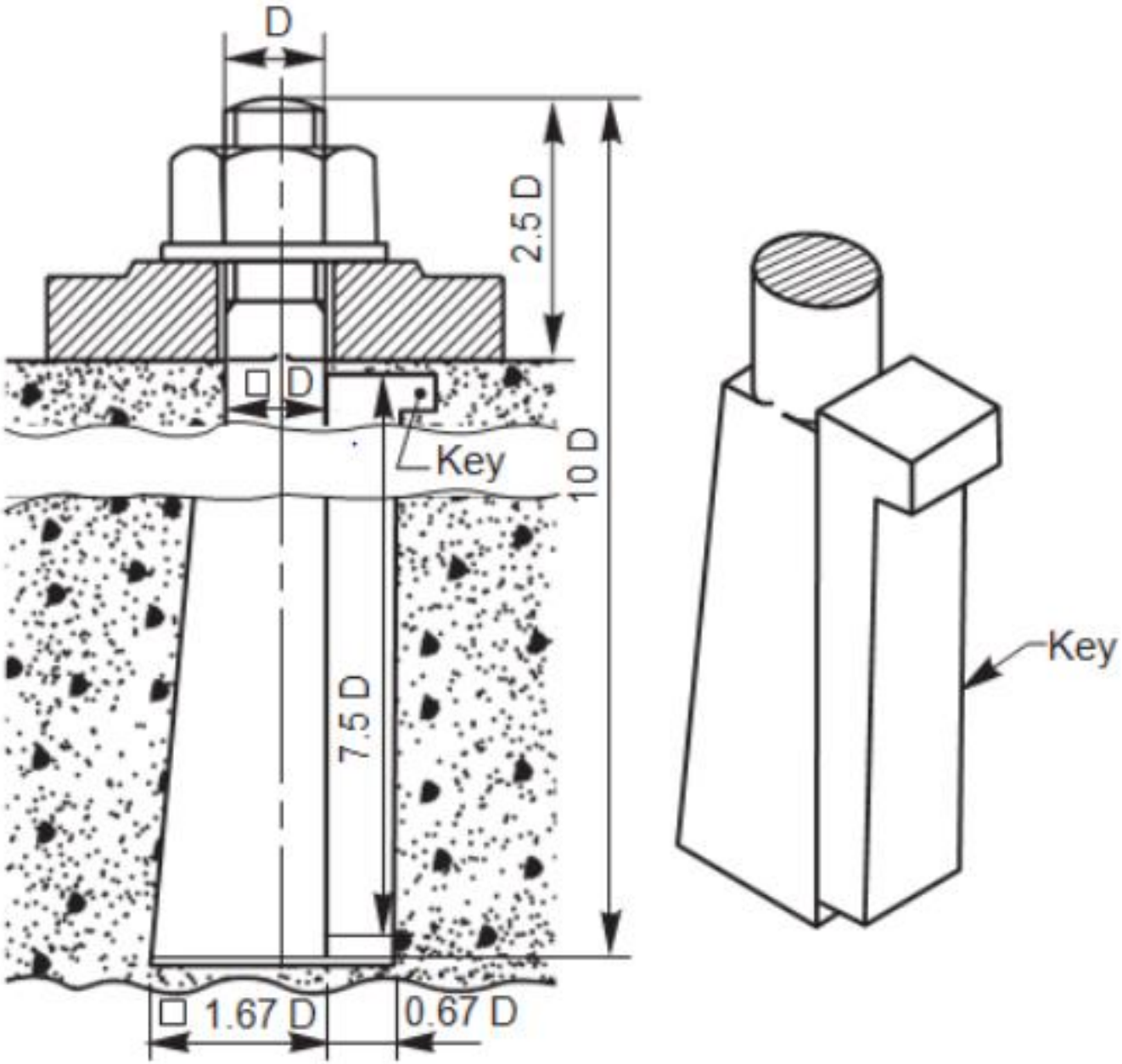
Foundation Bolt



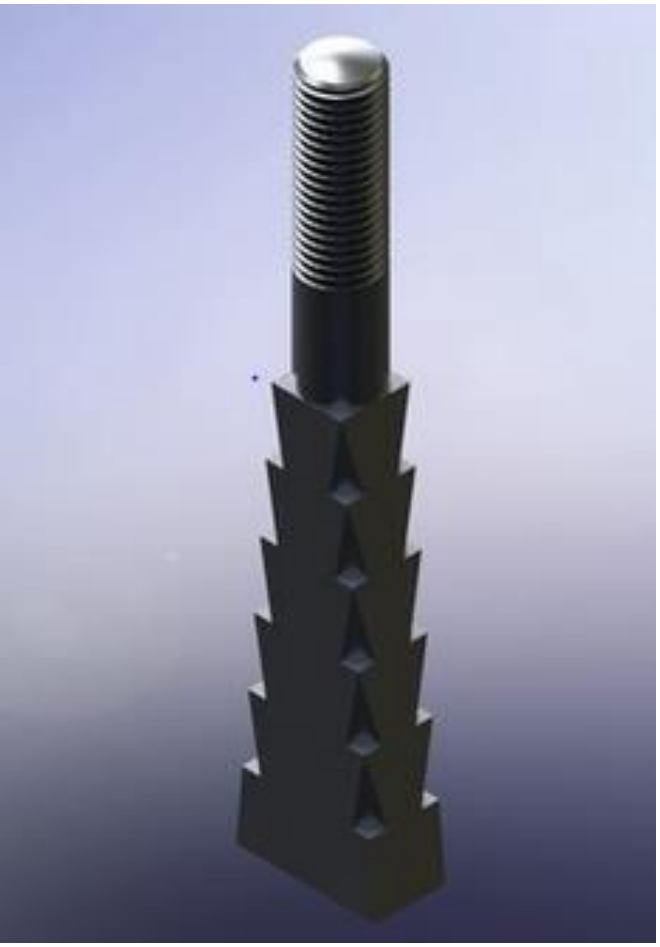
Bent foundation bolt

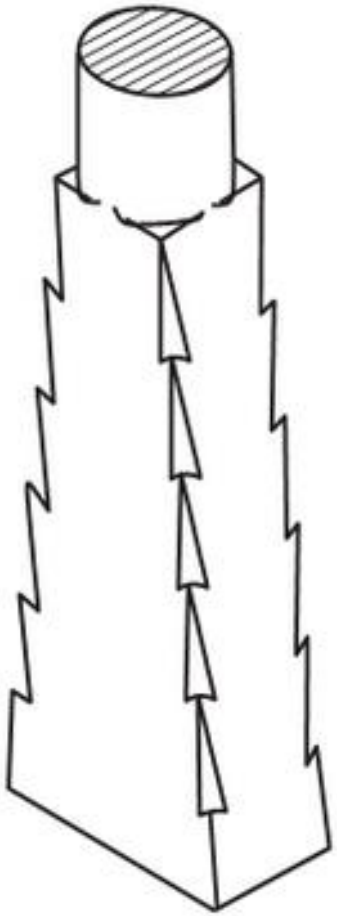


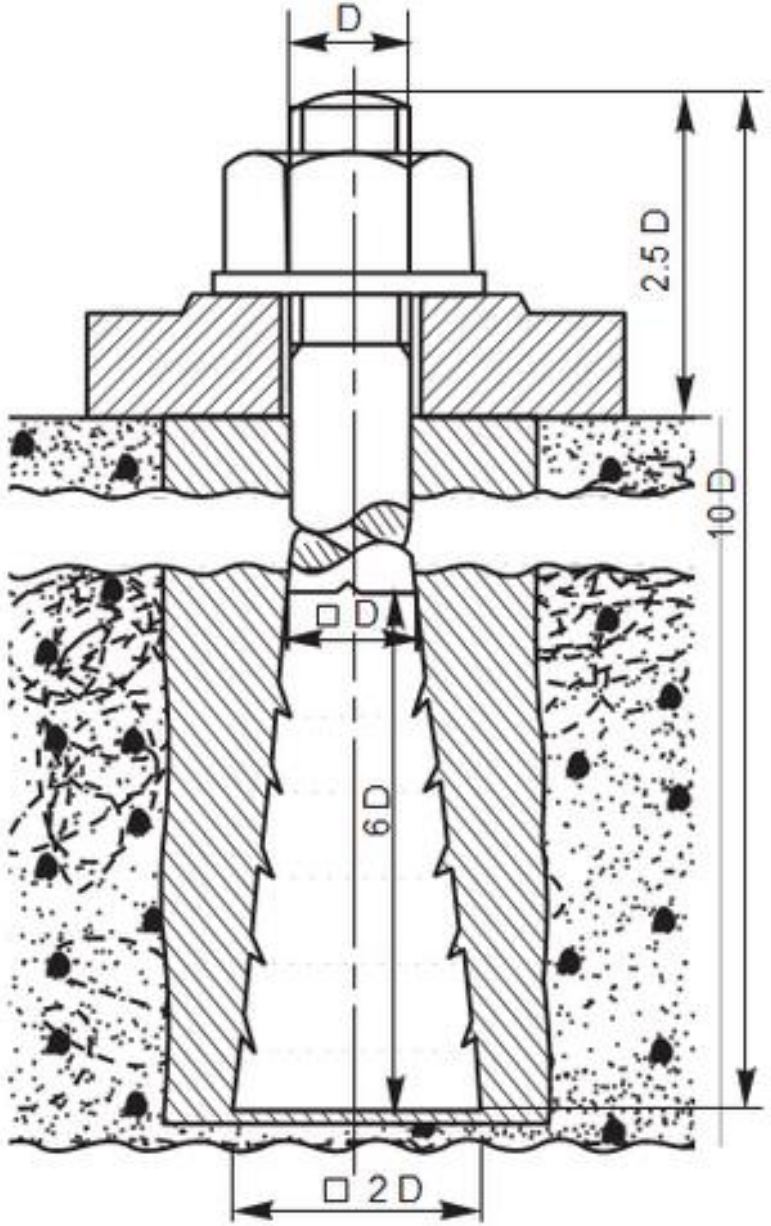
Eye foundation bolt



Lewis foundation bolt







Rag foundation bolt

Machine Drawing

Credit 2 - 0L-4P

Keys, Cotters and coupling

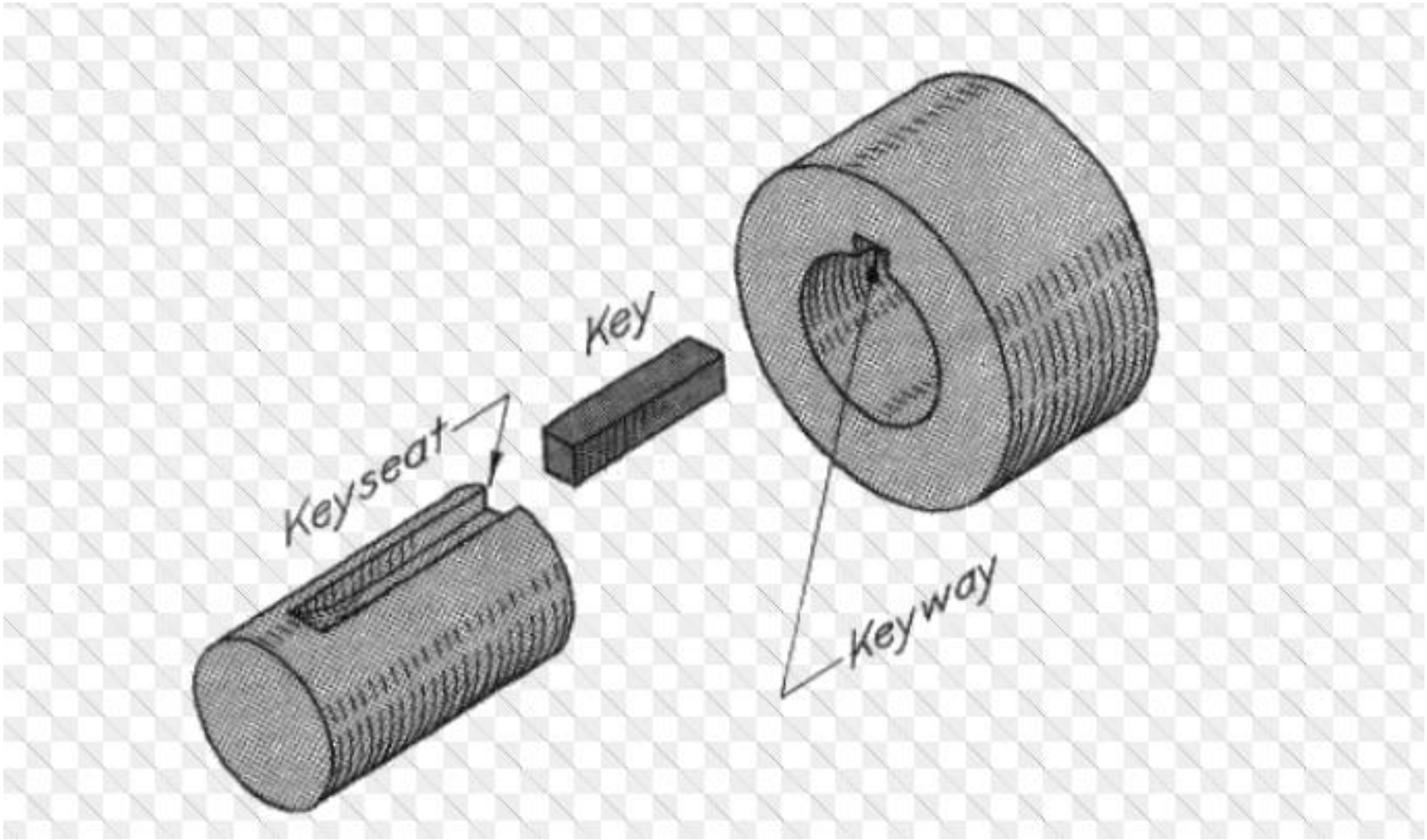
Md Asjad Mokhtar

Assistant Professor, ME

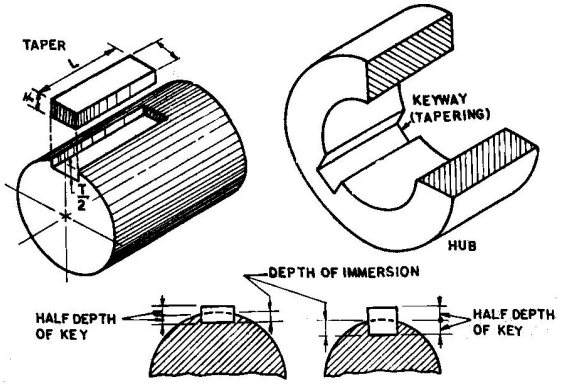
DCE, Darbhanga

drasjadmokhtar@gmail.com

9999914381


Key
Keyseat
Keyway

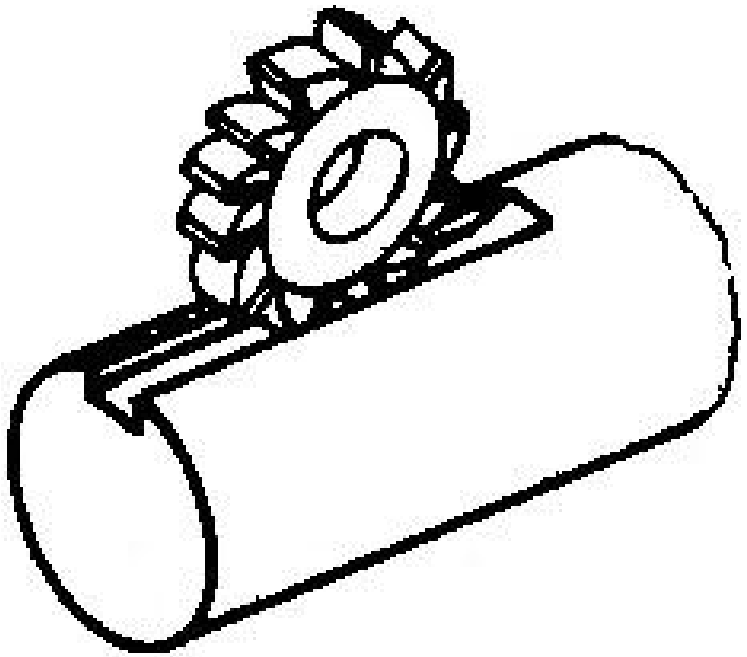
Keys



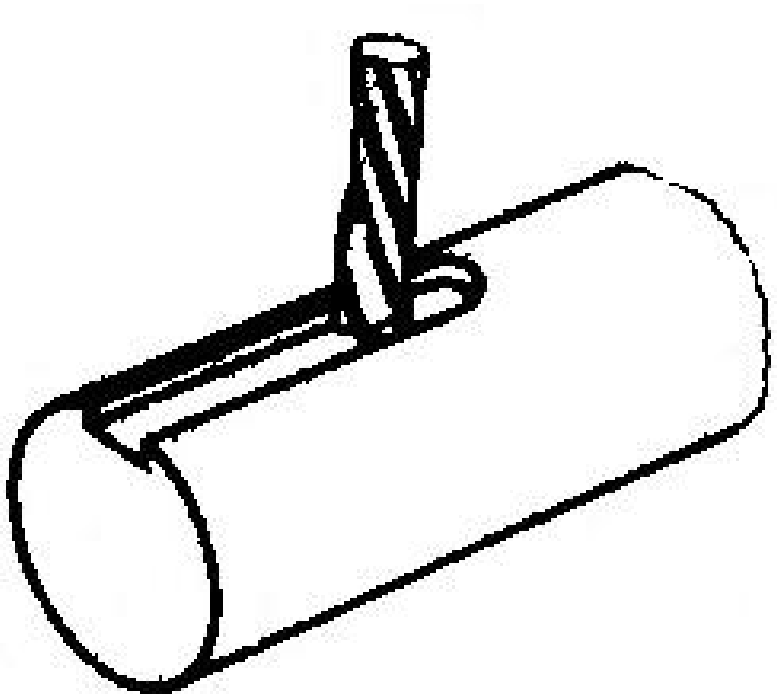
- A key is the piece inserted in an axial direction between a shaft and hub of the mounted machine element such as pulley or gear etc.,
- to prevent relative rotation….

  may allow sliding movement along the shaft if required.
- Keys are temporary fastening and are always made of mild steel because they are subjected to shearing and compressive stresses caused by the torque they transmit.
- a keyway is the groove cut in the shaft or hub to accommodate a key. Key ways can be milled horizontally or vertically .

Keyways milled



horizontally



vertically

Classification of keys

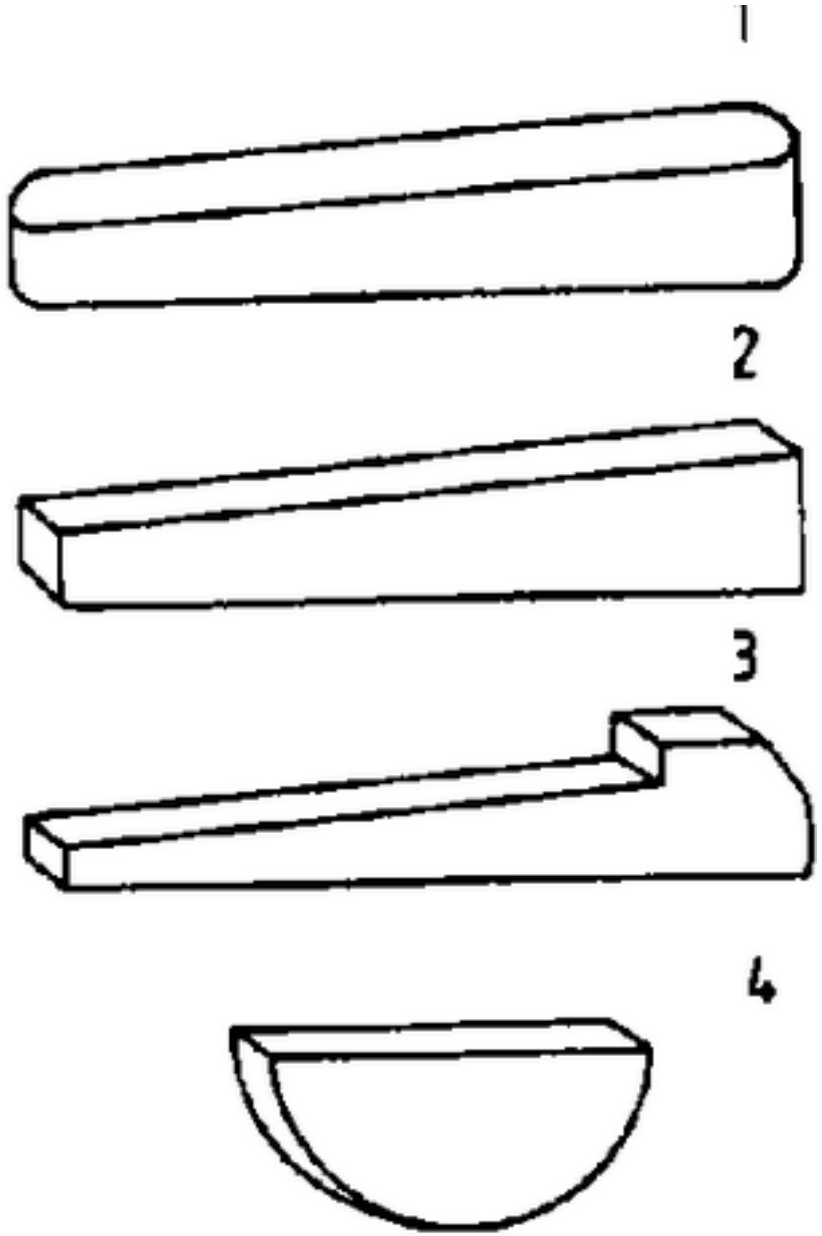
- Saddle keys
  - » Hollow saddle key
  - » Flat saddle key
- Round keys
  - » Parallel pin
  - » Taper pin
- Sunk keys
  - » Taper sunk keys
  - » Parallel sunk keys
  - » Feather keys
  - – Woodruff key (adjustable key)

1. Sunk Key

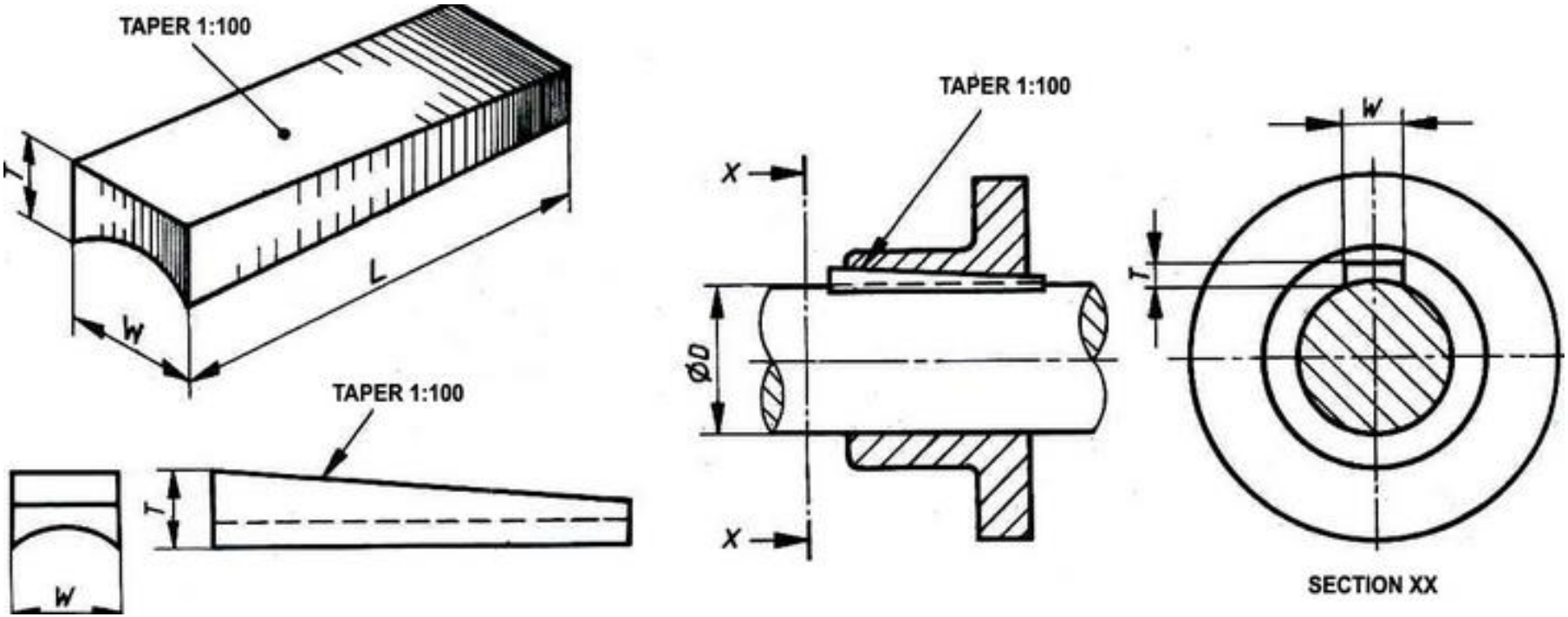
2. Sunk Key {Tapered - Rectangular / SQ Key}

3. Sunk - Gib Head

4. Woodruff



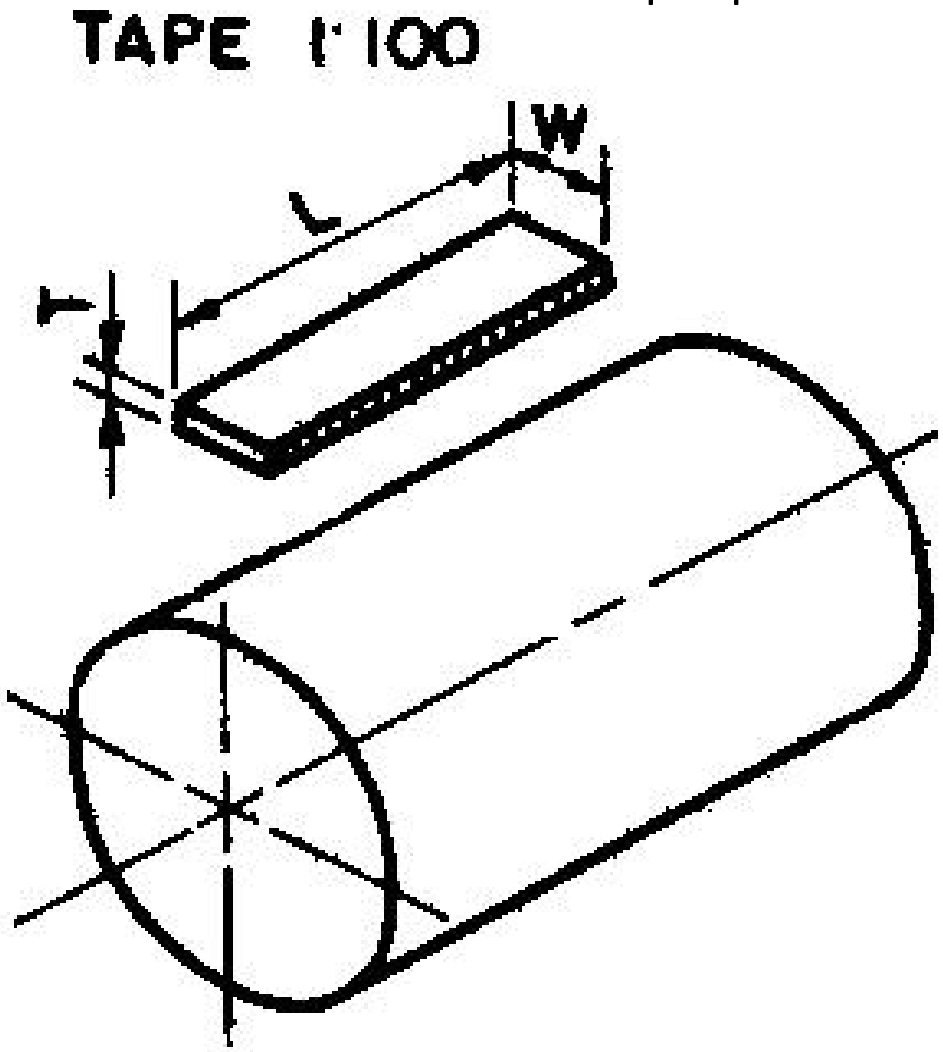
Saddle key

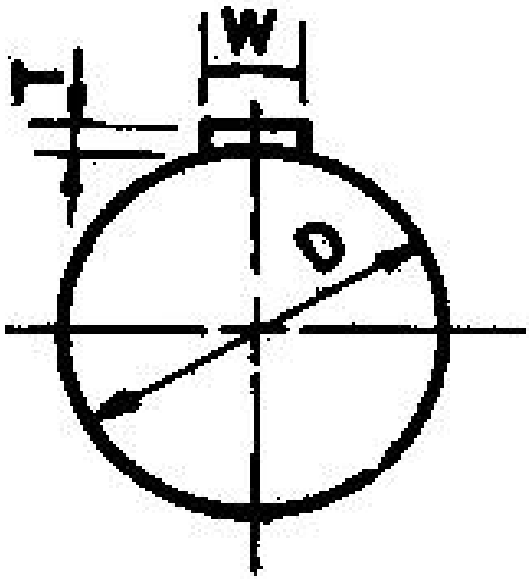


Hollow saddle key

–this key has curved underside so that it can be placed on the curved surface of the shaft. The keyway is cut in the mating piece (hub) only.

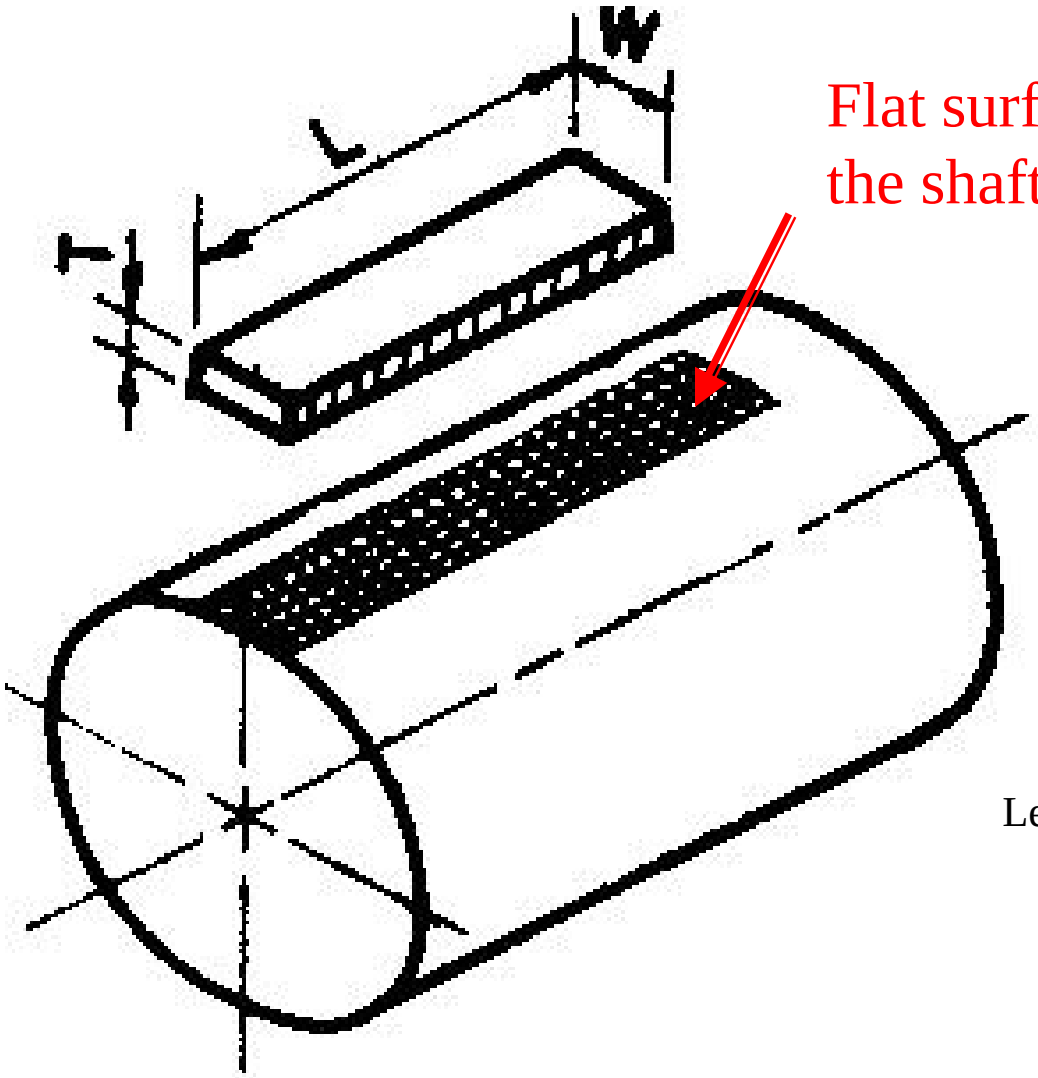
Saddle key are taper keys and are sunk into the hub only
Taper prevents axial movement along the shaft



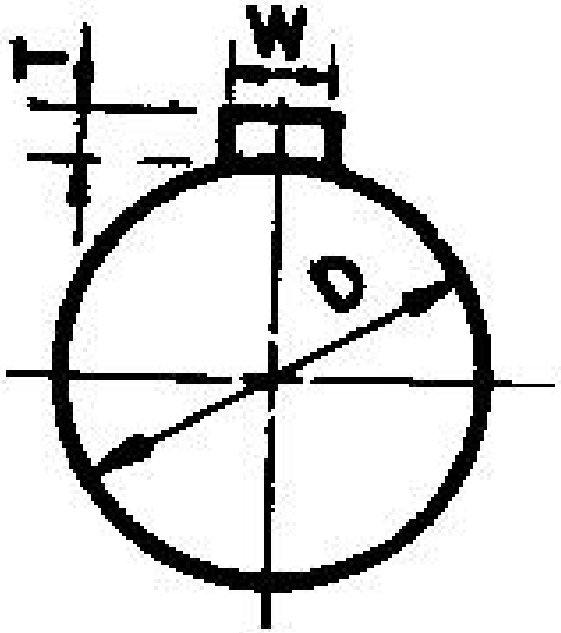


Saddle key is suitable for light duty, since they rely on a friction drive alone and are liable to slip on the shaft under load

Flat saddle key



Flat surface on the shaft



holding force is comparative large than the hollow saddle key

Let D = diameter of the shaft

Width of the key, W = D/4

Nominal thickness at large end , T = W/3 = D/12

Length of the key , L = D to 1.5D

Taper on the top surface = 1:100

Sunk keys

- Sunk keys are sunk in the shaft and the hub. These keys are suitable for heavy duty since they rely on positive drive.
  - Taper sunk keys:
    - This is the standard form of the key and may be either of rectangular or square cross-section. The key is sunk in the shaft to a depth of half its nominal thickness when measured at the side.
      - » Rectangular cross-section

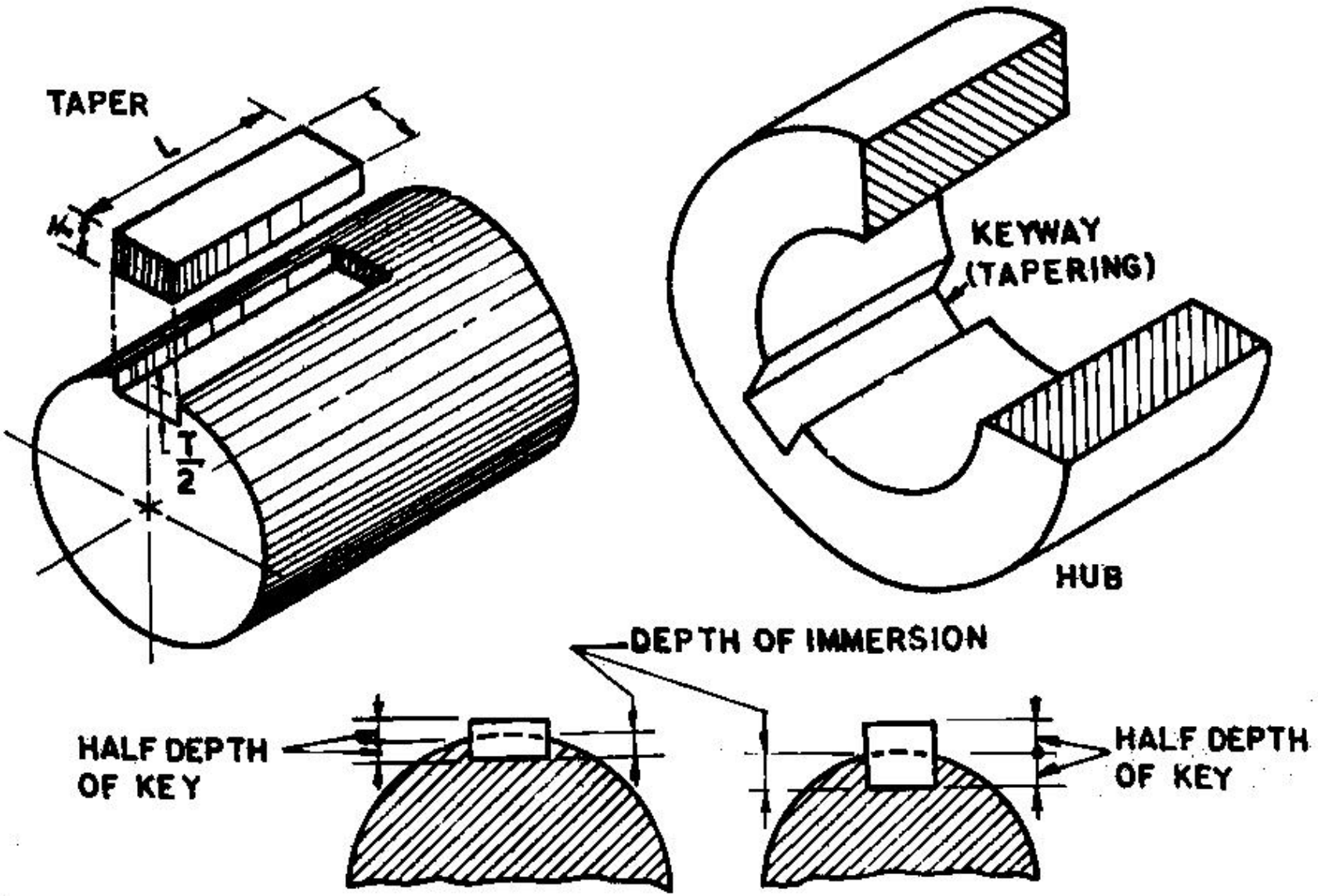
        let D = diameter of the shaft

        width of the key W = D/4

        nominal thickness T = (2/3)W = (1/6)D
      - » Square cross-section:

        T = W

Sunk taper key

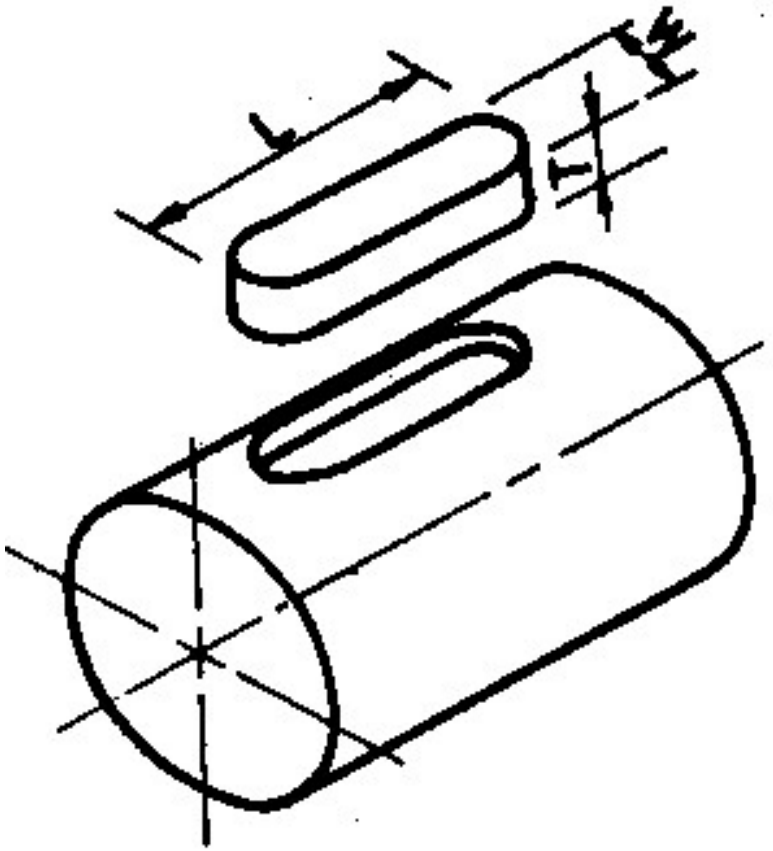


Parallel sunk key

It is uniform in width and thickness throughout.

It is thus taper less and is used where the pulley or other mating piece is required to slide along the shaft.

It may be rectangular or square cross-section and their ends may be squared or rounded.

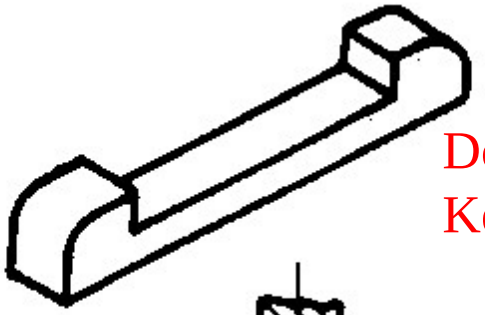


Feather keys

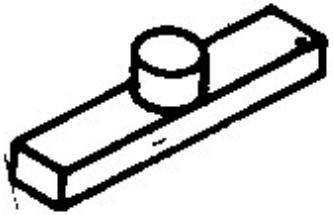
It is a key attached to one member of a pair

It is a particular kind of parallel key that permits axial moment

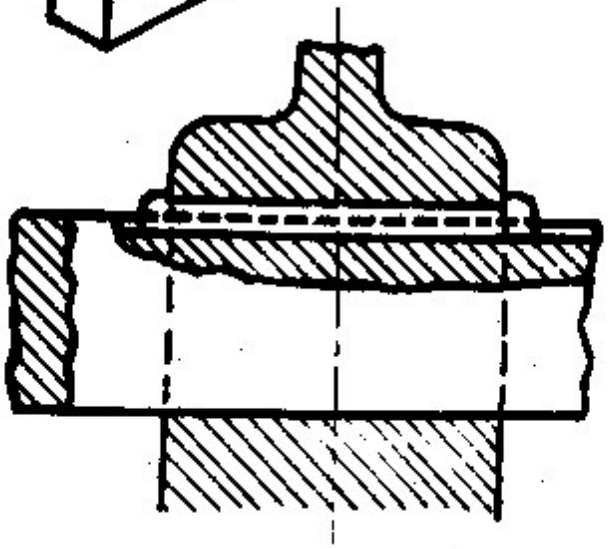
A feather key is secured either to the shaft or to the hub, the key being a sliding fit in the keyway of the machine element on which it moves.

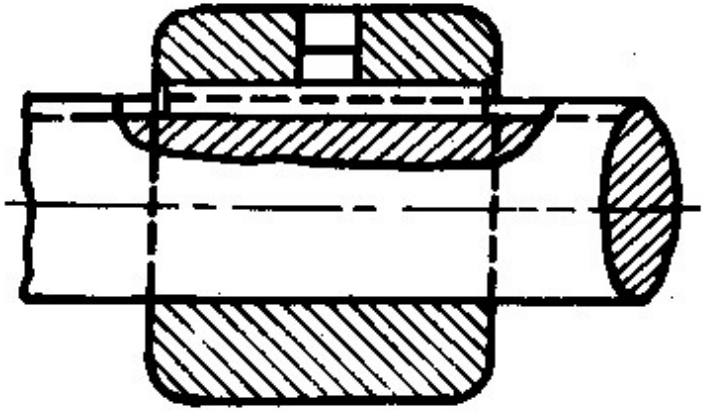


Double Headed Key



Peg Key





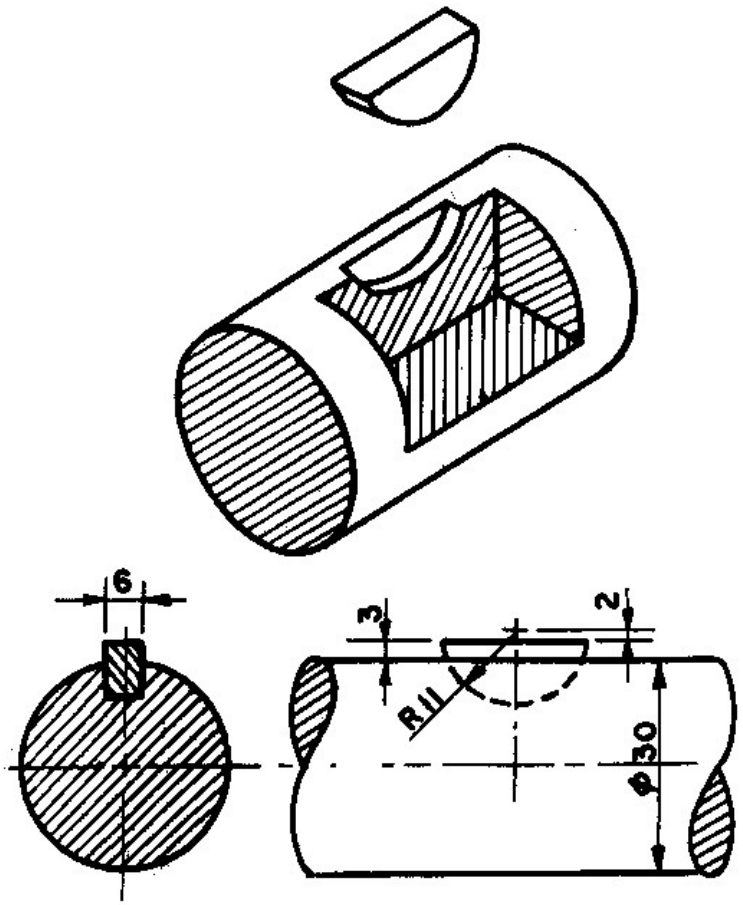
Woodruff keys

It is an adjustable sunk key in the form of a semi-circular disc of uniform thickness.

The key fits into a semi-circular keyway in the shaft and the top of the key fits into a plain rectangular key way in the hub of the wheel.

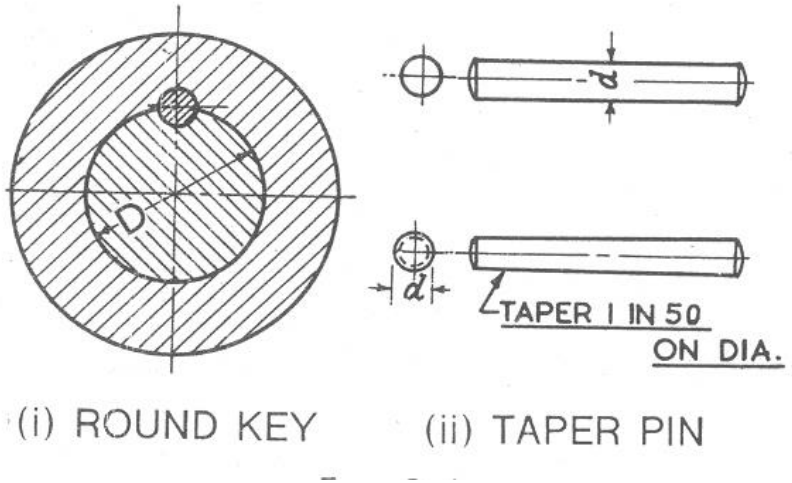
Since the key and the key seat bear the same radius , it has the advantage of adjusting itself to any taper of the slot of the hub or boss of wheel

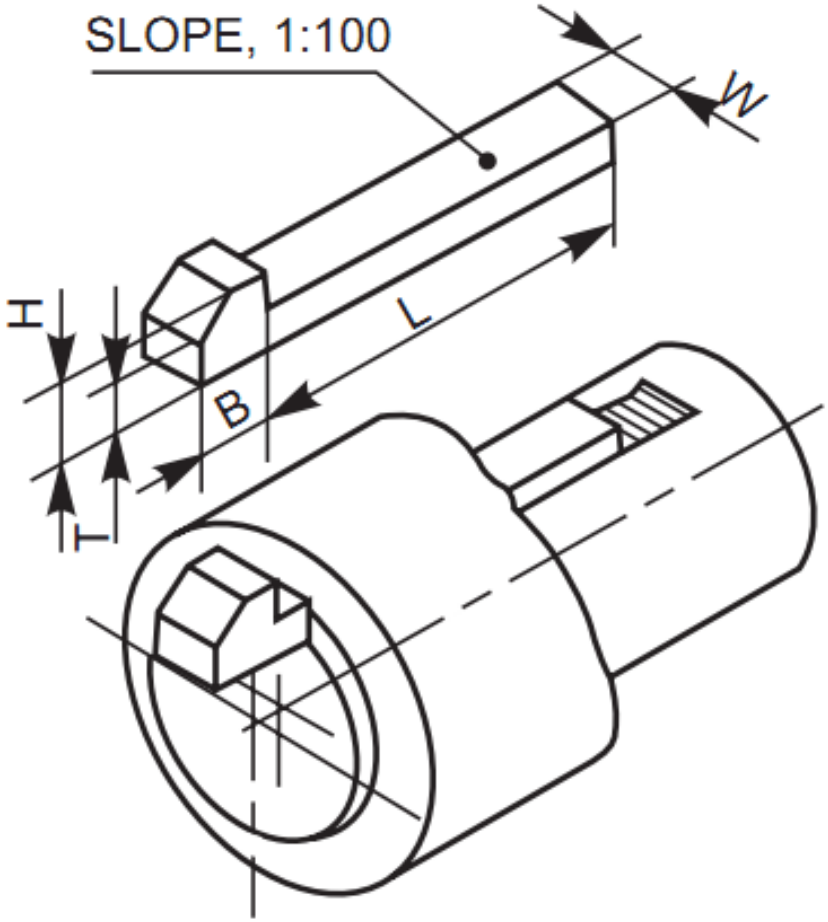
Used in feed gear box of lathe, other machine tools and in automobiles



Woodruff Key

Round key or Pin Key:

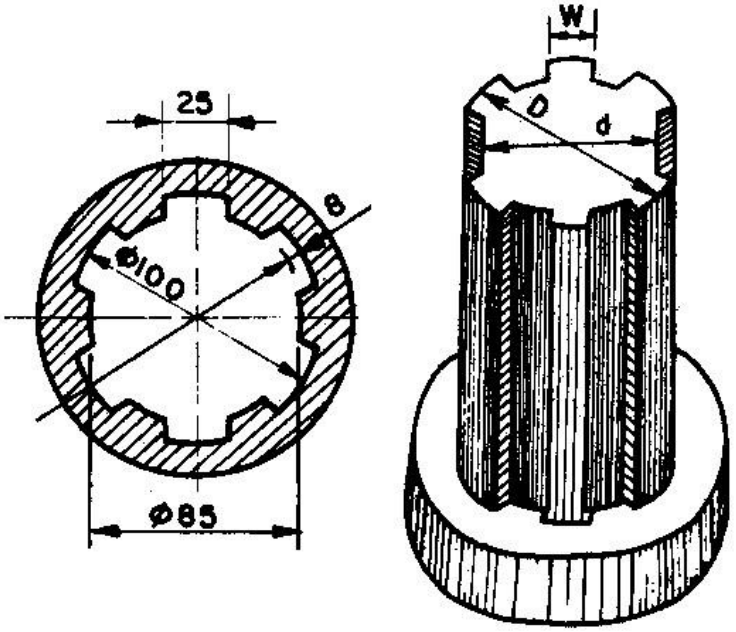




Gib Head key

Spline shaft and hub

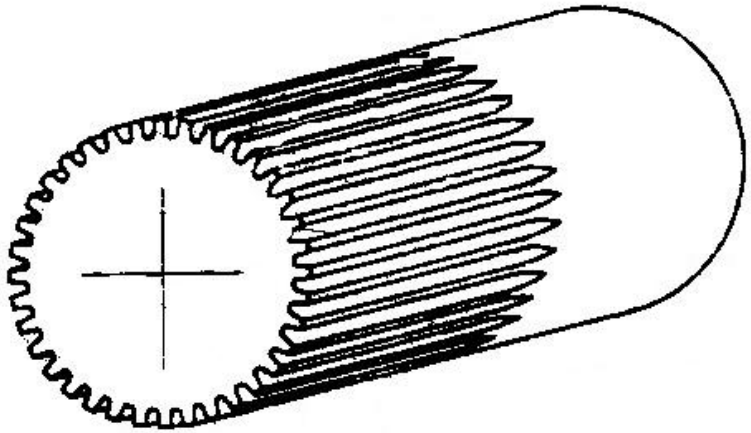
- A spline shaft is used when the hub is required to slide along the shaft. These shafts are used mostly for sliding gear application as in automotive gear box and propeller shaft of aircraft.
- A spline shaft in which are cut equiangular longitudinal groove, the metal between these groove forming splines or feathers of uniform depth.
- By this means the power transmitted is equally divided amongst the number of keys giving great strength and security against total failure than by using a single key.



Spline

Serrated shafts

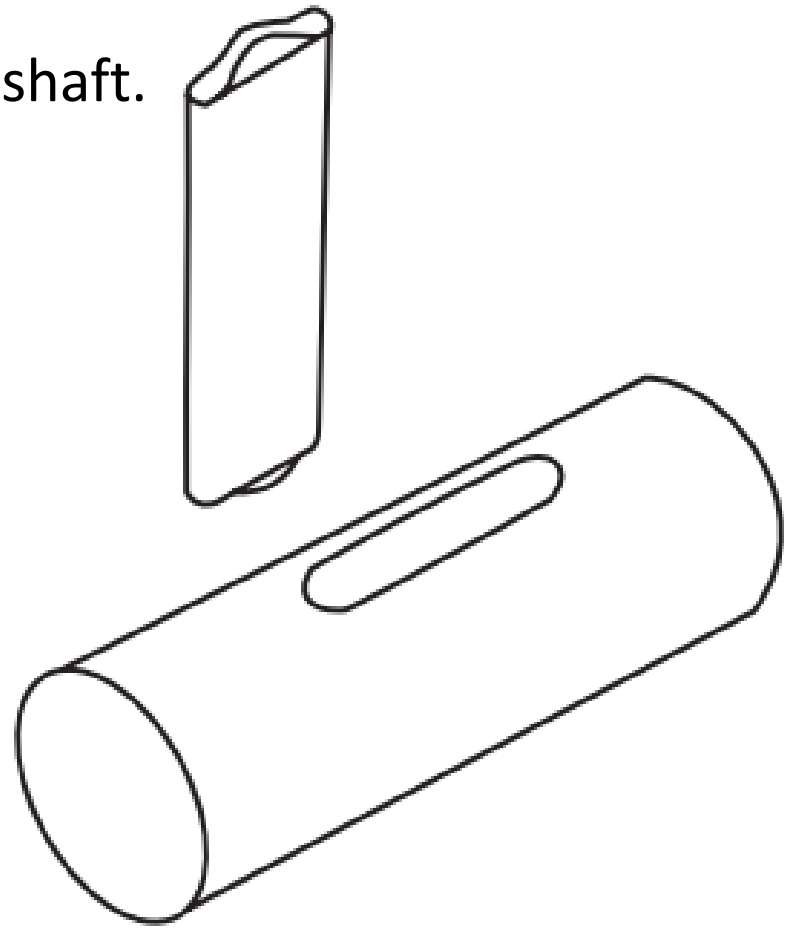
- A spine shaft - disadvantage of reduced strength
- A serrated shaft gives maximum strength for a given weight of material.
- number of corresponding grooves are cut in the shaft and mating piece, the two being tightly pressed, one over the other
- the bottom of the serrations and the crests of the teeth are flat.
- these are used in aircraft assemblies



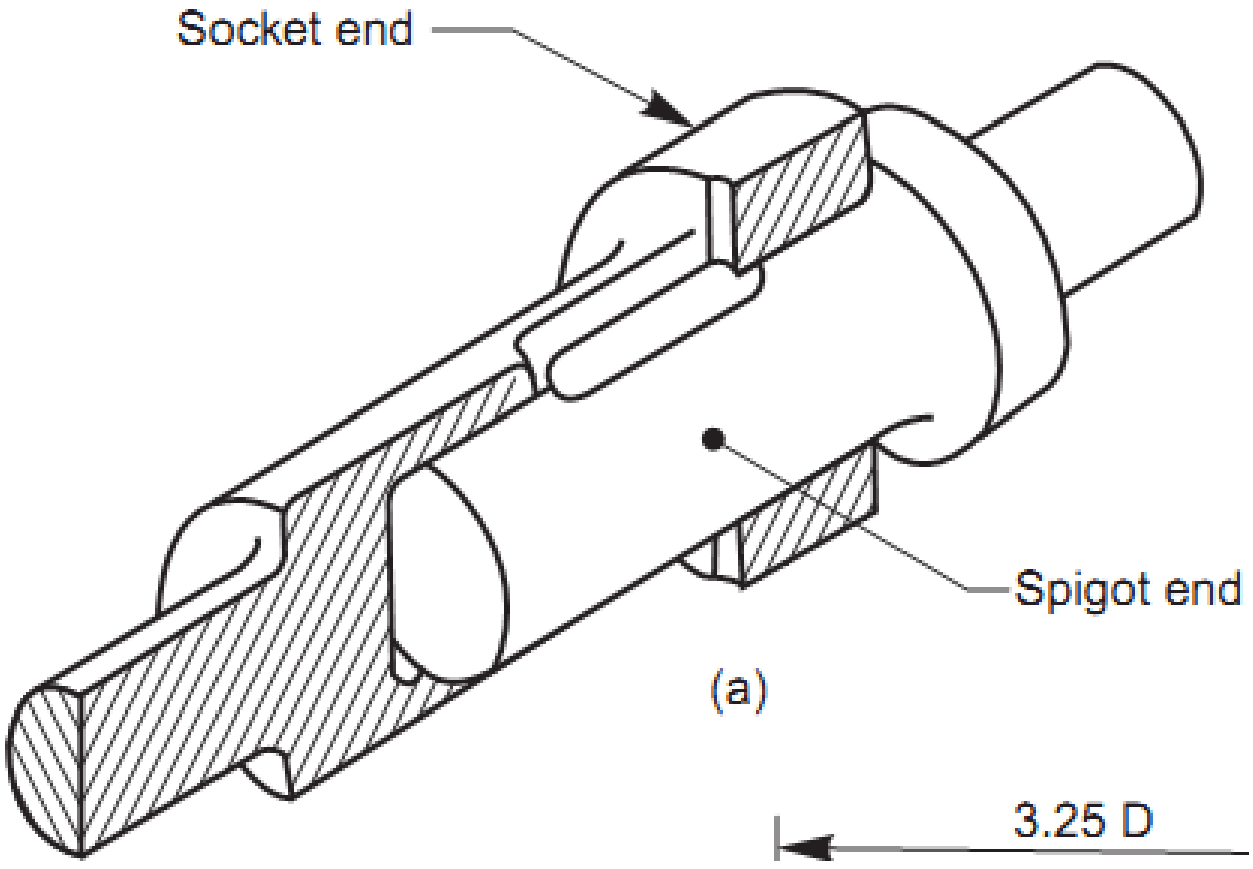
Cotter Joint

- Cotter is a flat wedge shaped piece
- Uniform in thickness
- Tapered (1:30) at one side
- Use to join two square or rectangular shaft.
- Force fit of cotter in the joint

- Types
- Cotter joint with sleeve
- Cotter joint with socket and spigot
- Cotter joint with Gib head

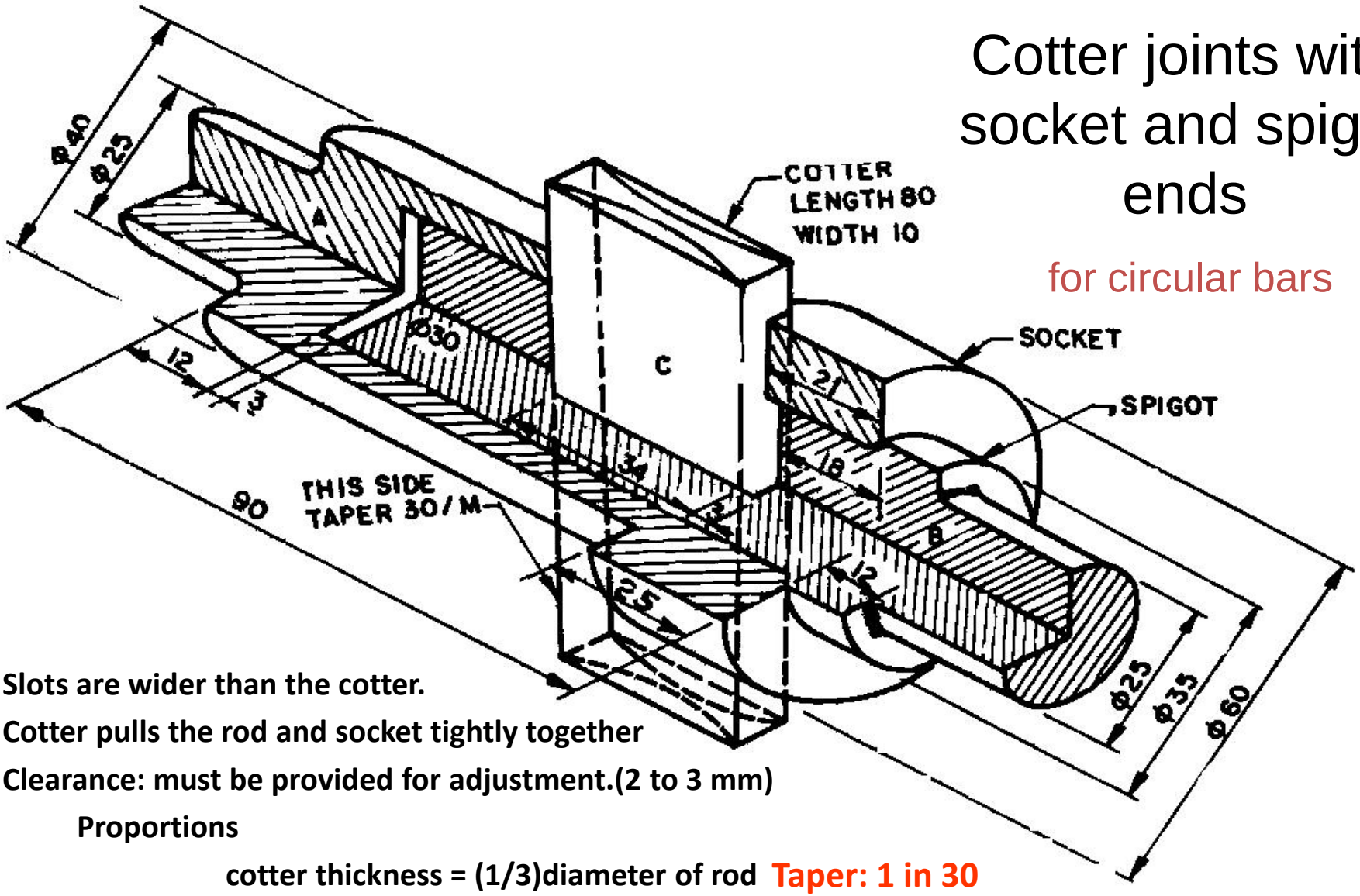


Socket-spigot joint



Cotter joints with socket and spigot ends

for circular bars



Slots are wider than the cotter.

Cotter pulls the rod and socket tightly together

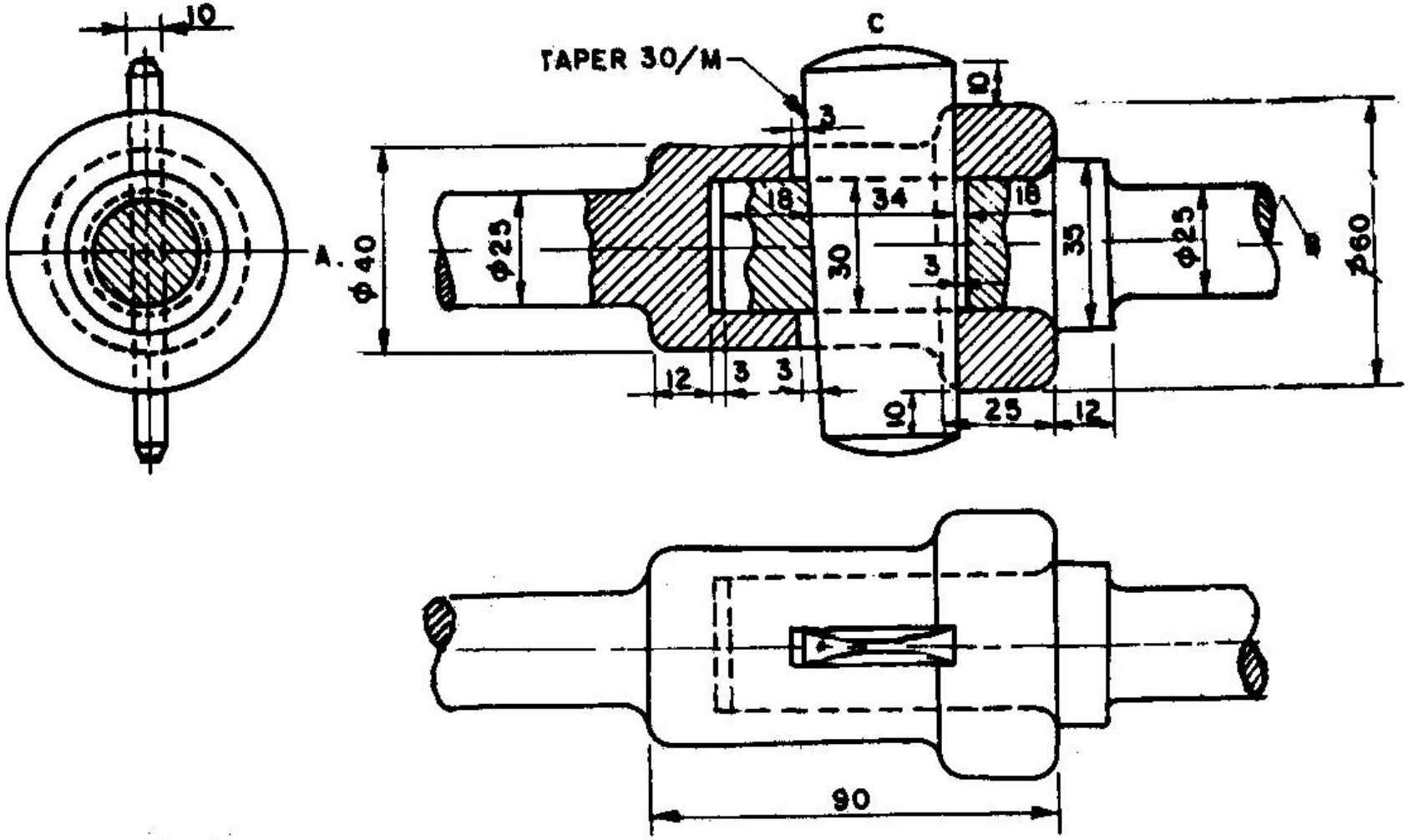
Clearance: must be provided for adjustment.(2 to 3 mm)

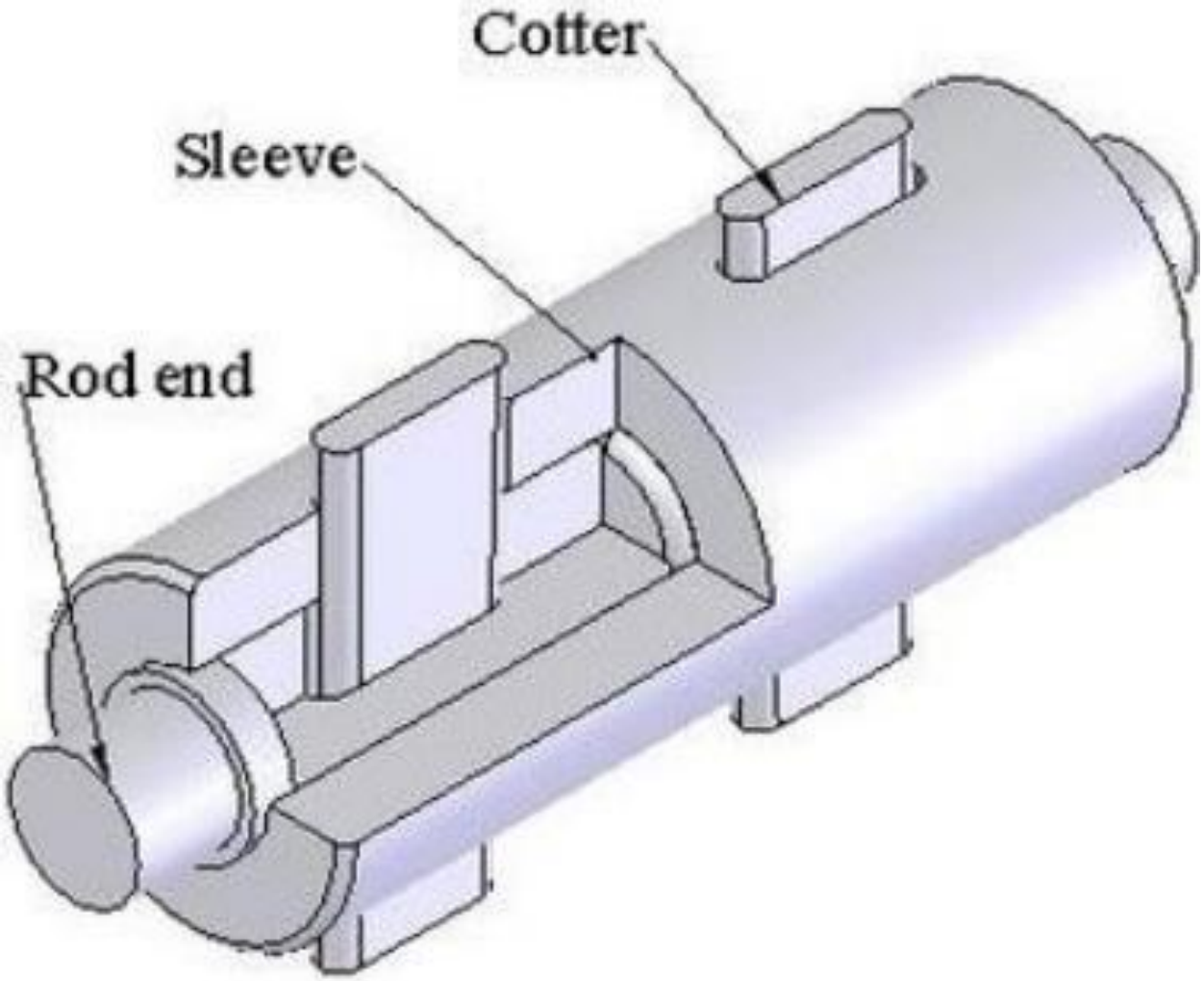
Proportions

cotter thickness = (1/3)diameter of rod **Taper: 1 in 30**

cotter width = rod diameter

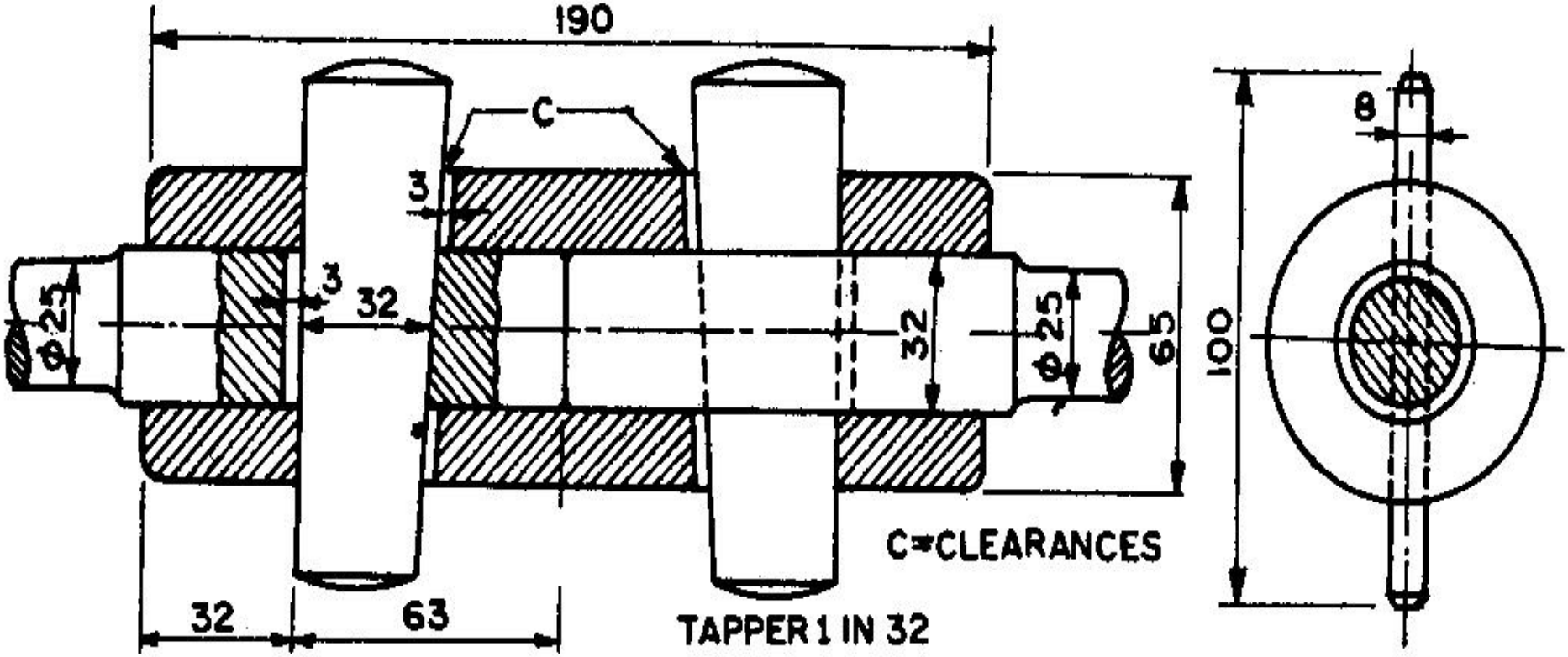
Cotter joint




Cotter
Sleeve
Rod end

Sleeve and cotter joint

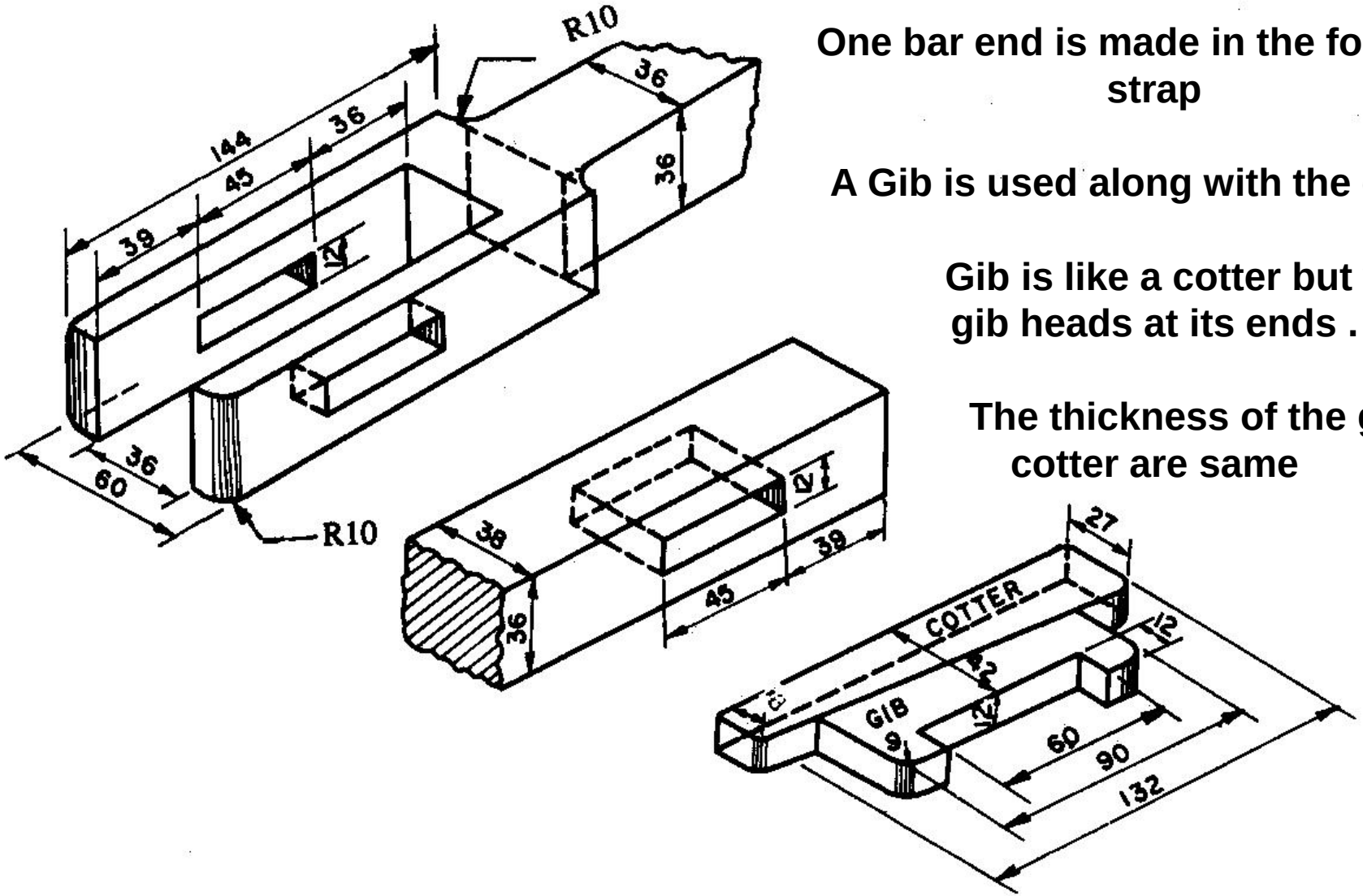
For circular rods



The enlarged ends of the rods butt against each other with a common sleeve over them

- The rod ends are enlarged to take care of the weakening effect caused by slots

Gib and cotter joint for rectangular rods



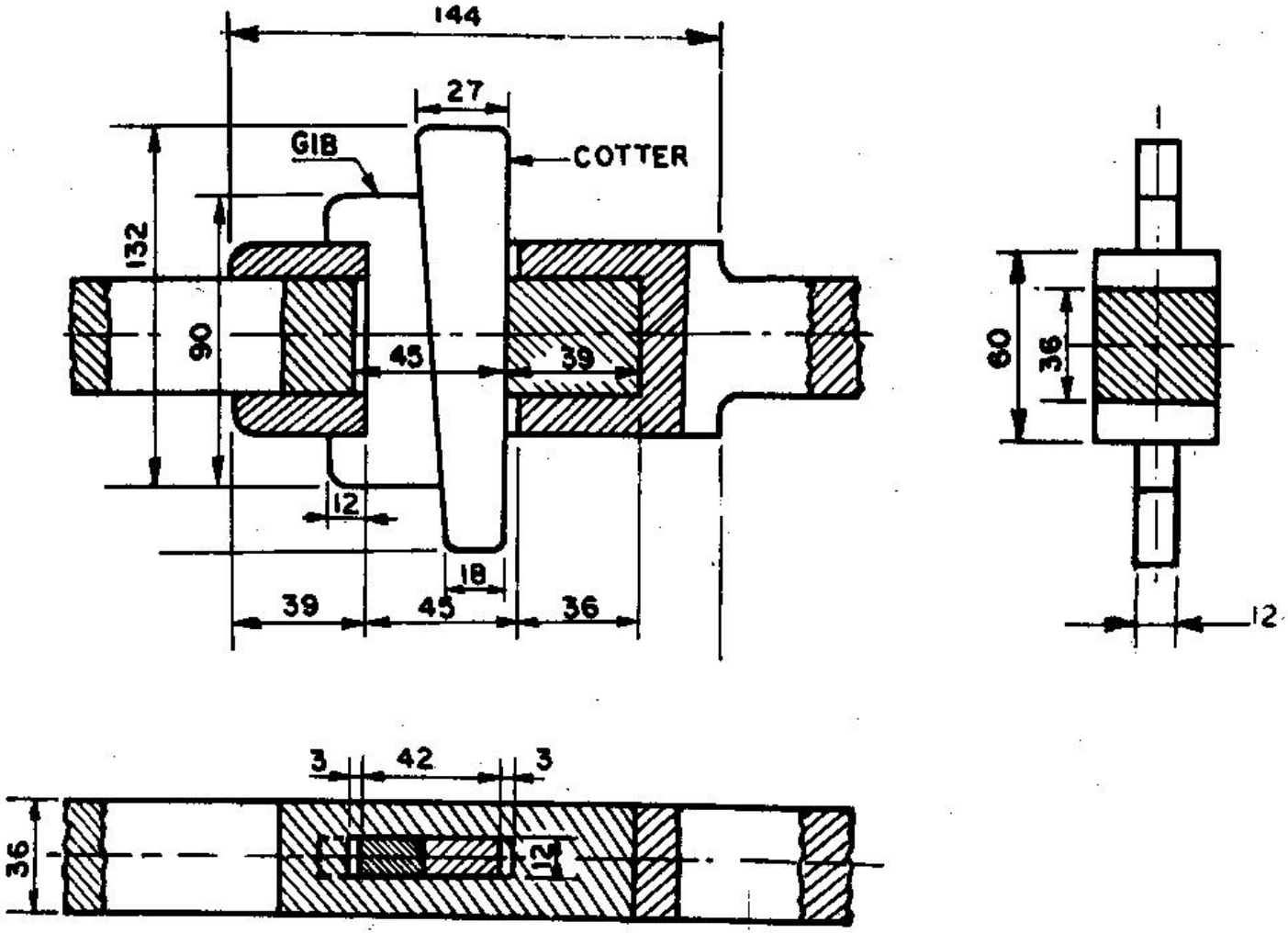
One bar end is made in the form of a strap

A Gib is used along with the cotter.

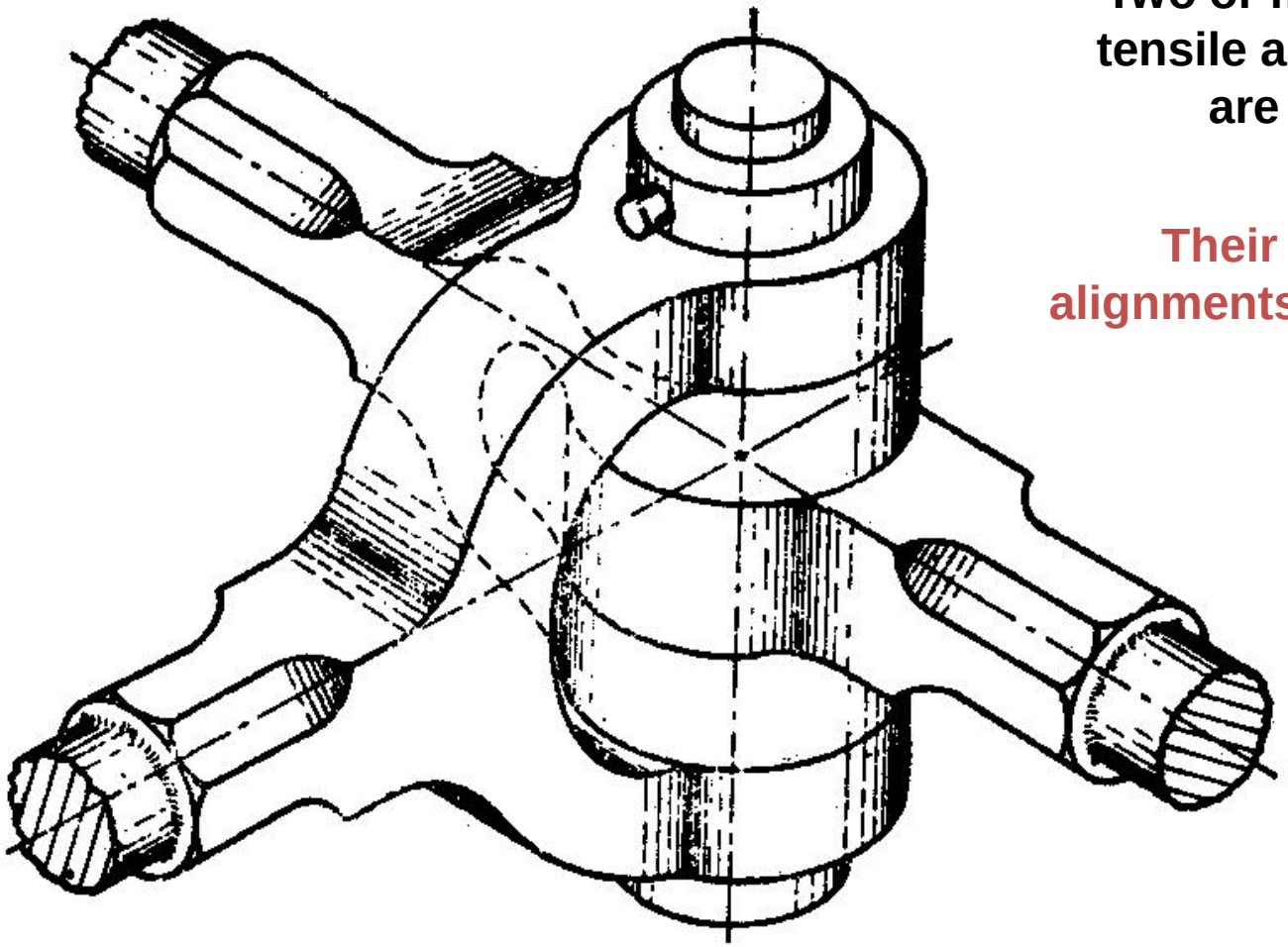
Gib is like a cotter but with two gib heads at its ends .

The thickness of the gib and cotter are same

Gib and cotter joint or rectangular rods



Joints::: Knuckle joint



Two or more rods subjected to tensile and compressive forces are fastened together

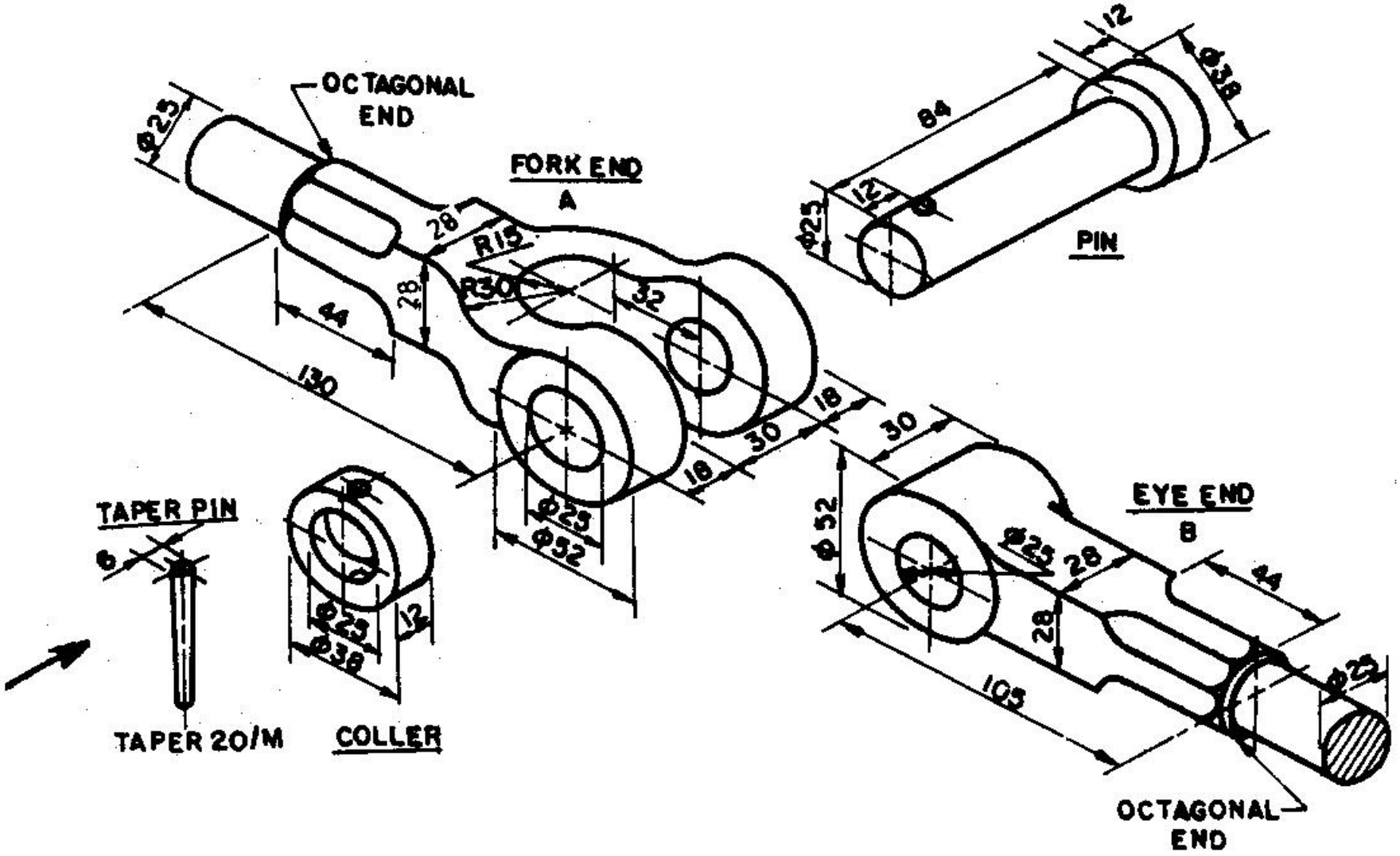
Their axes are not in alignments but meet in a point

The joint allows a small angular moment of one rod relative to another

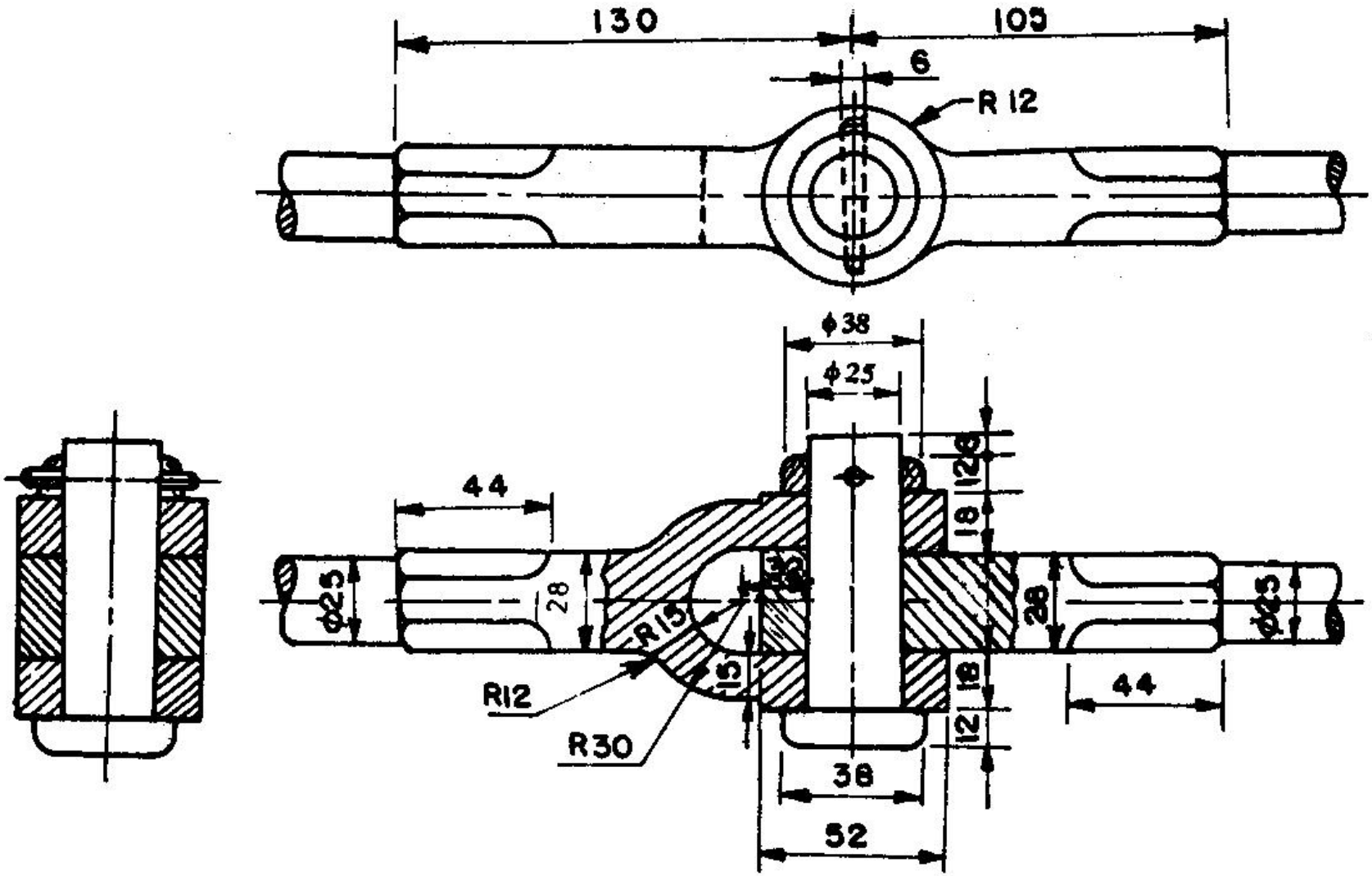
It can be easily connected and disconnected

Applications: Elevator chains, valve rods, etc

Knuckle joint



Knuckle joint



Machine Drawing

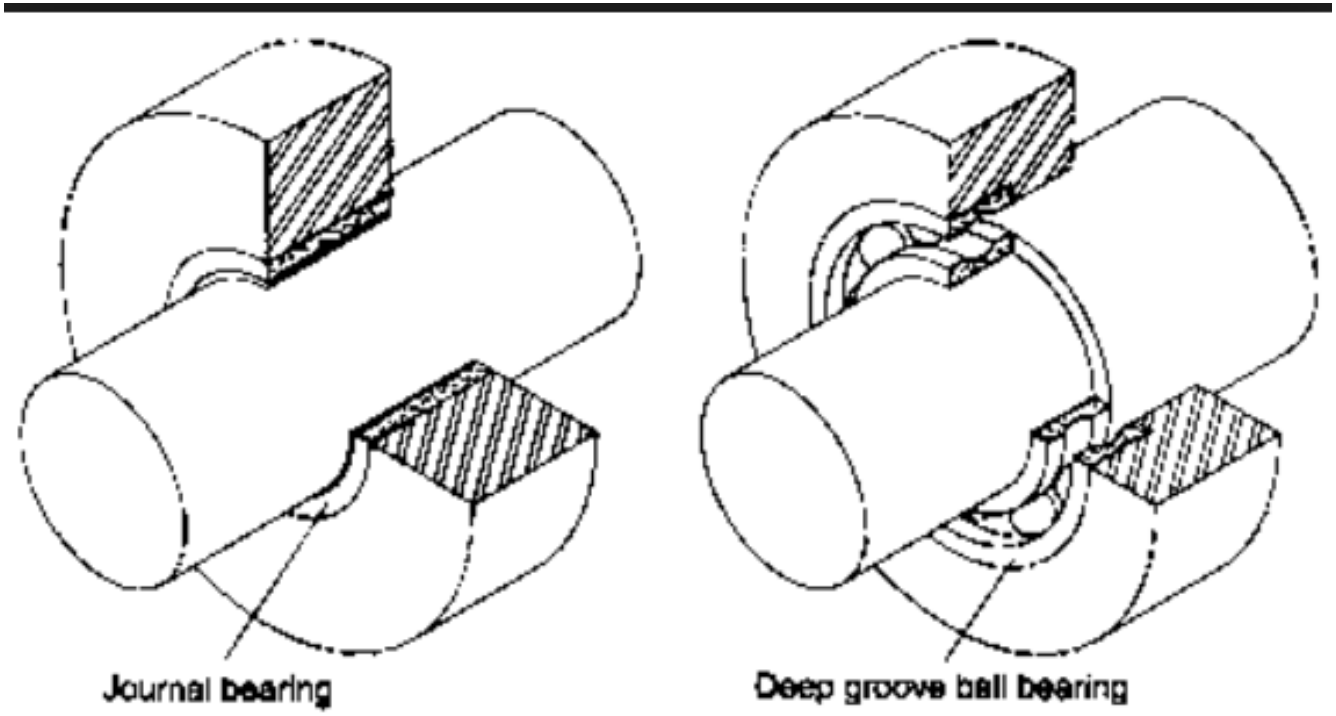
Credit 2 - 0L-4P

Bearings and Assembly drawings

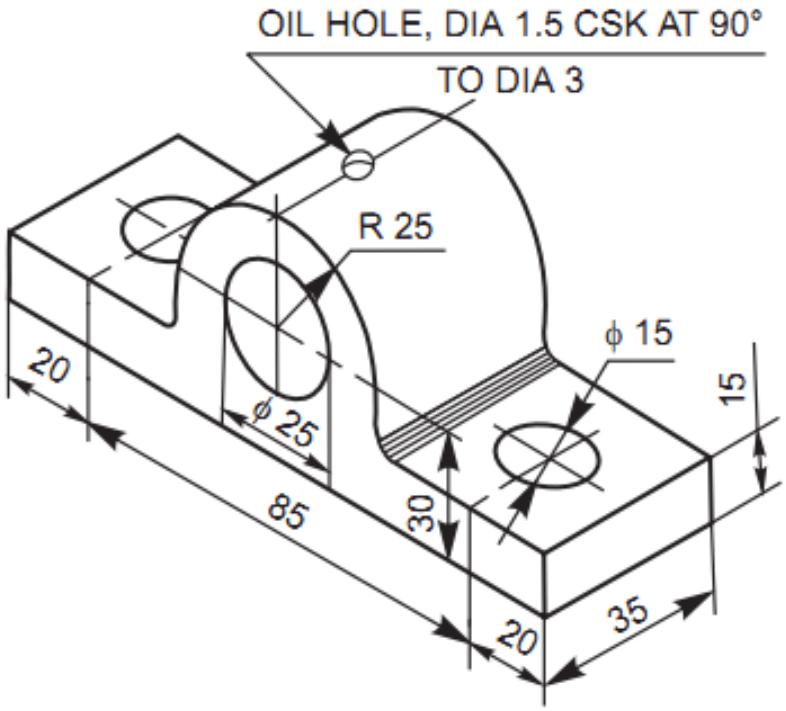
Md Asjad Mokhtar
Assistant Professor, ME
DCE, Darbhanga
drasjadmokhtar@gmail.com
9999914381

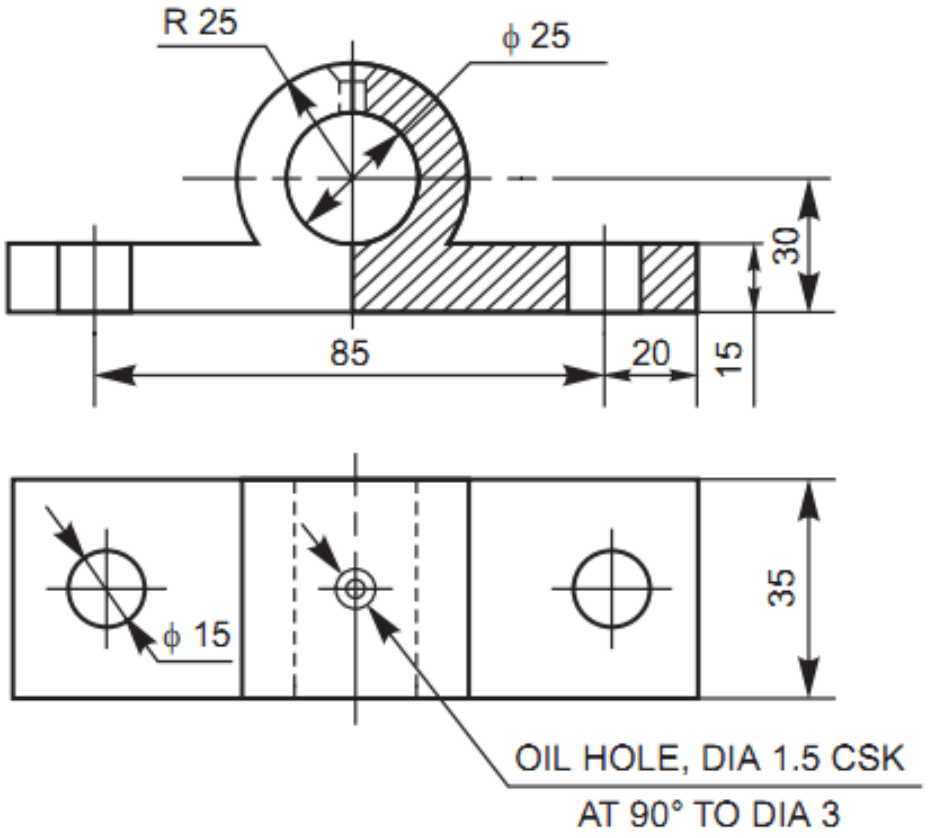
BEARING

- **Rotating shafts are supported by bearings**
- Sliding contact bearings (Hydrodynamic/Hydrostatic bearing)
- Rolling contact Bearings

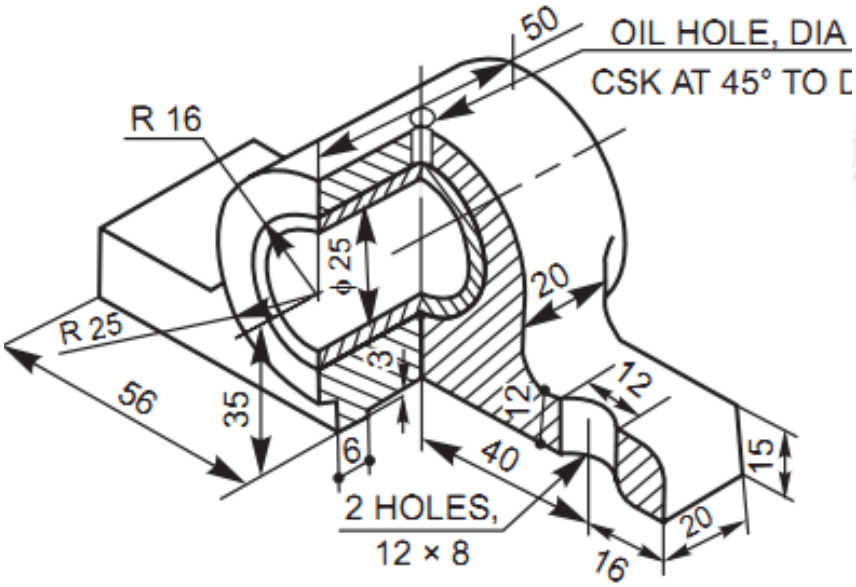


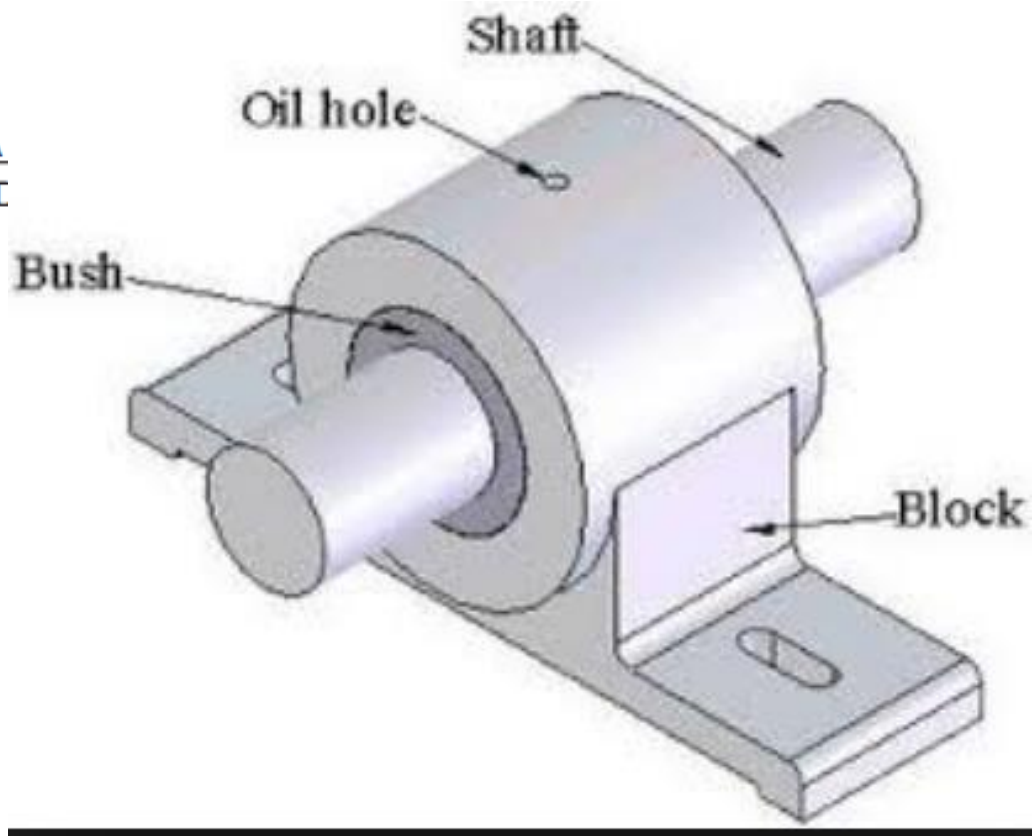
- **SOLID BEARING**
  - This is the simplest among the journal bearings, and usually made of cast iron. This consists of a cylindrical block with a rectangular base. The hole in the cylindrical block supports the shaft and the holes in the base are used for bolting down the bearing.
  - **No provision for wear**



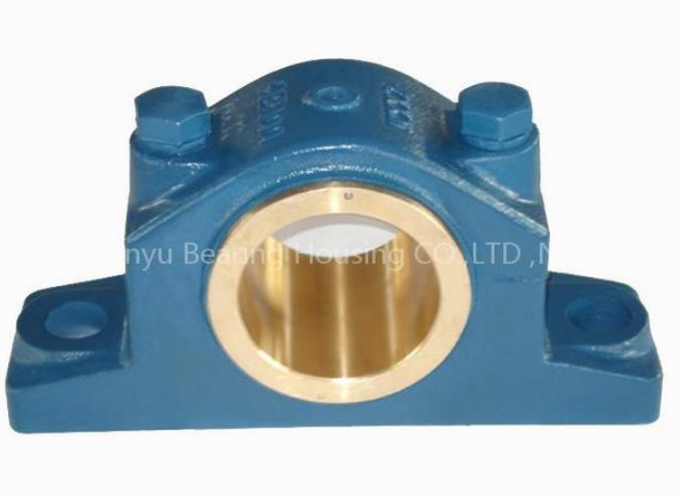


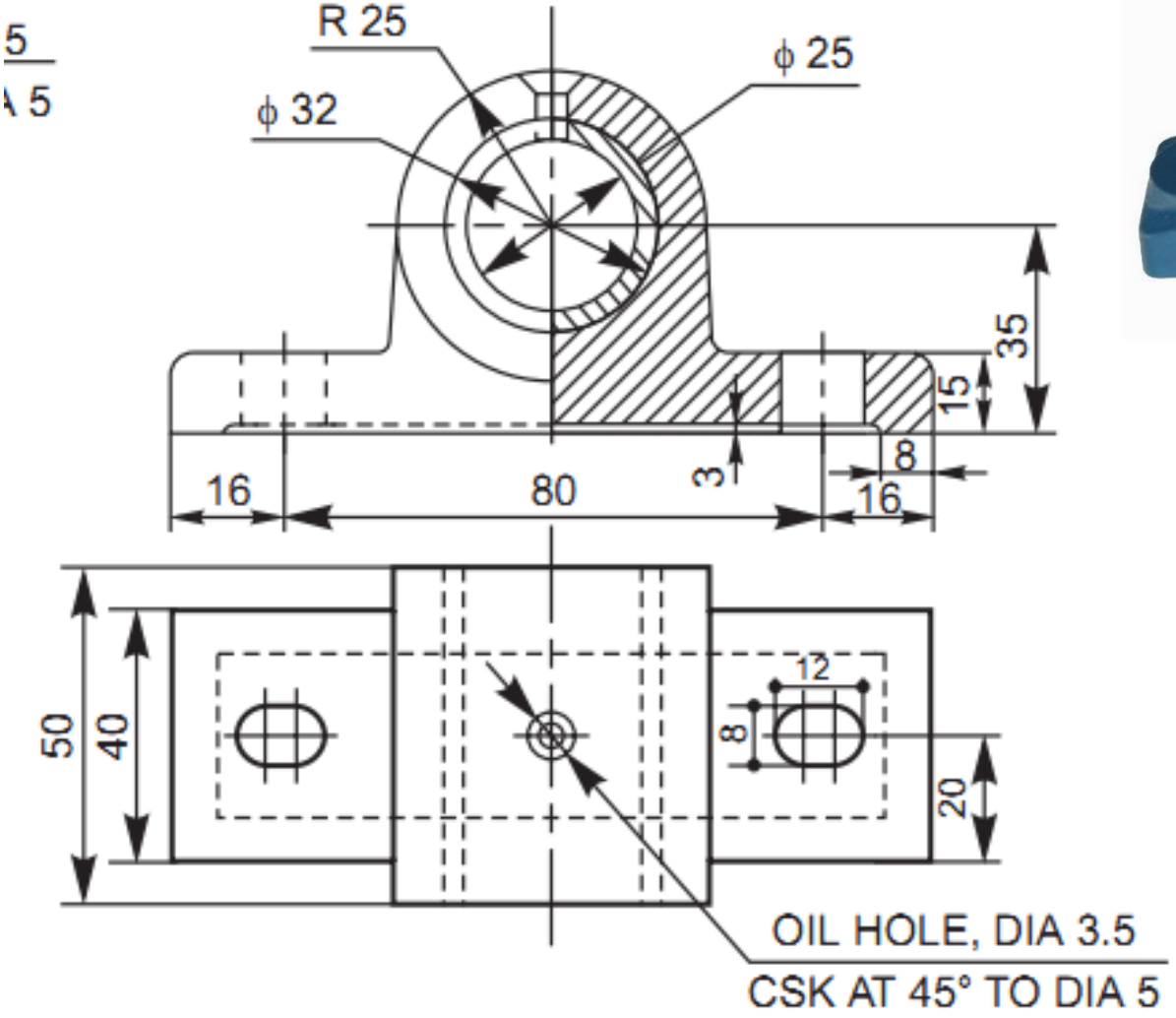
- BUSH BEARING
  - This bearing consists of mainly two parts, the body and the bush. The body is usually made of cast iron and the bush of soft materials such as brass, bronze or gunmetal.
  - Bush is tight fitted
  - Oil hole for lubrication



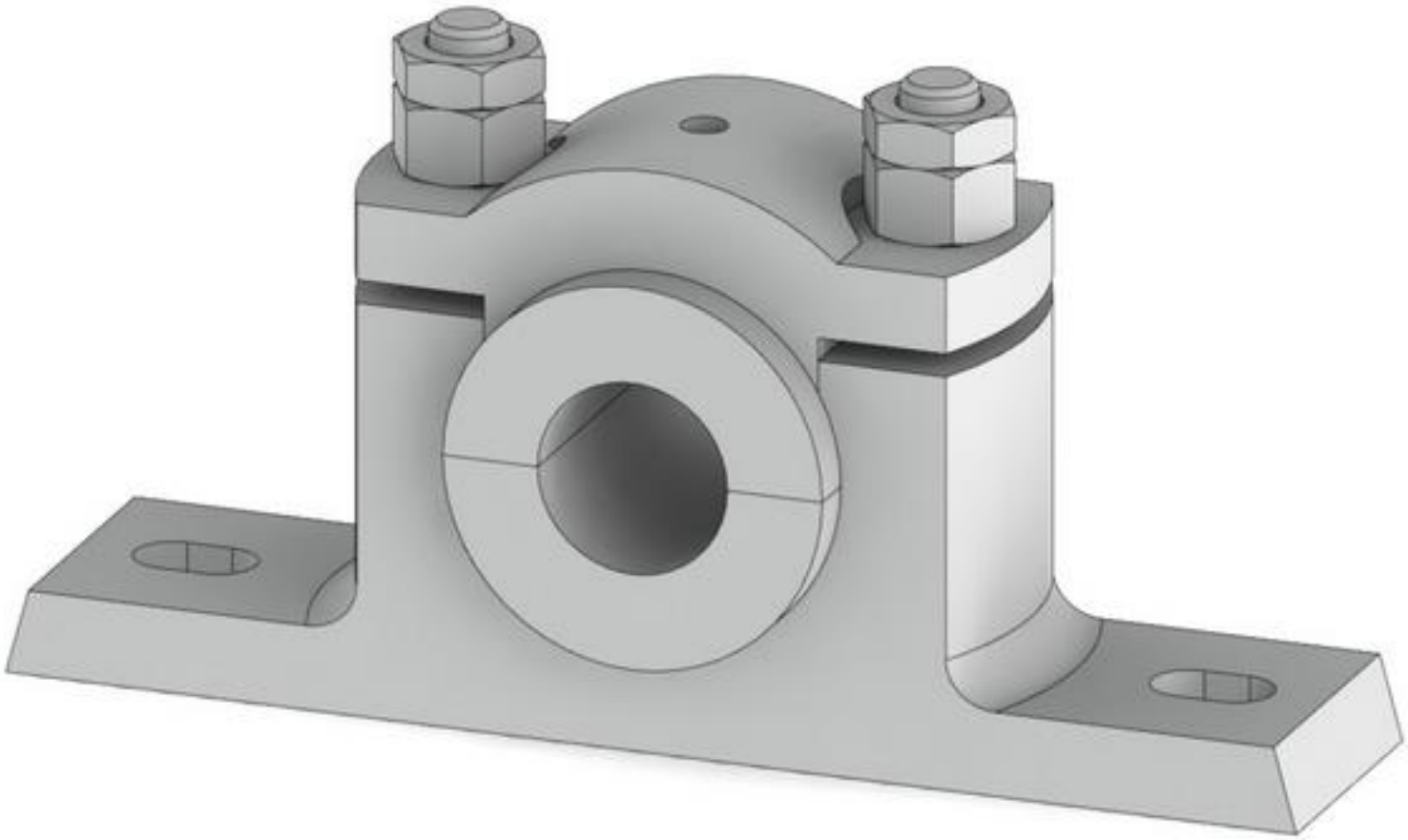


- Bush Bearing



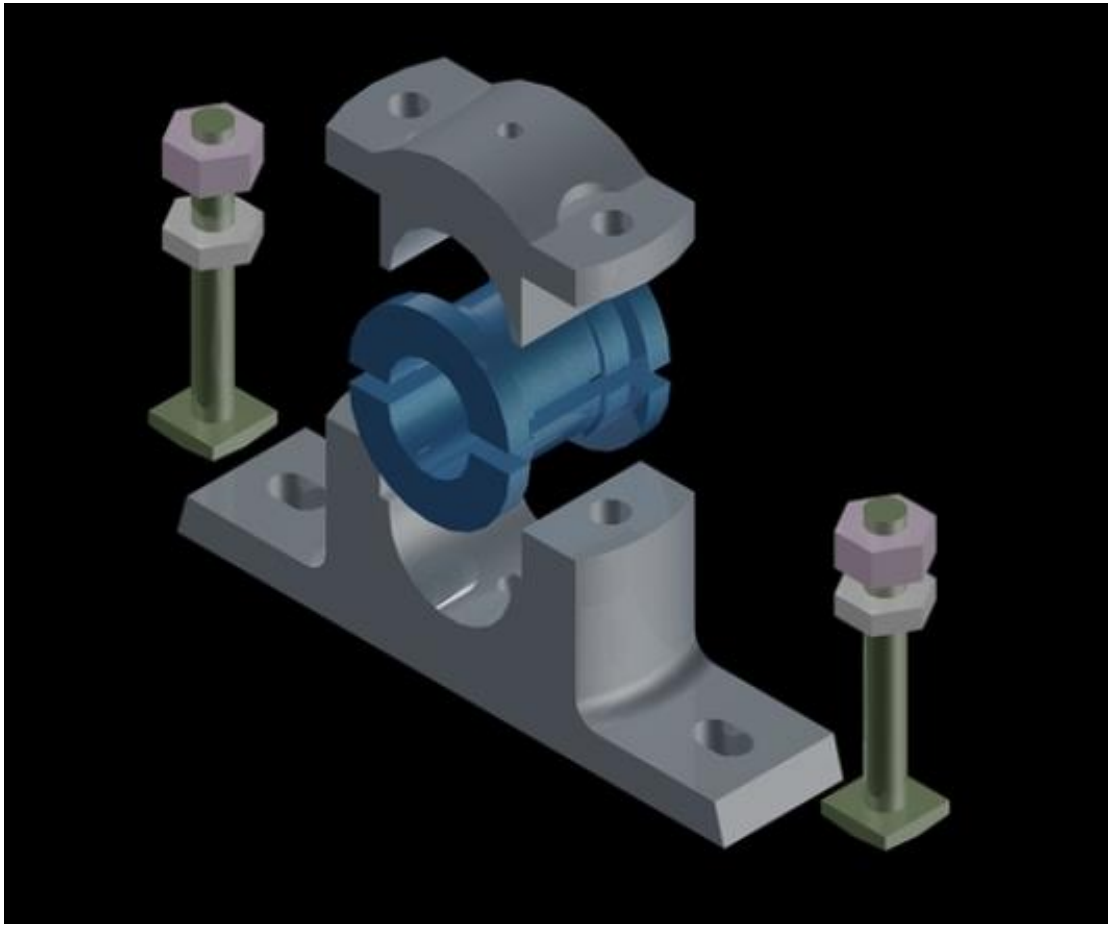


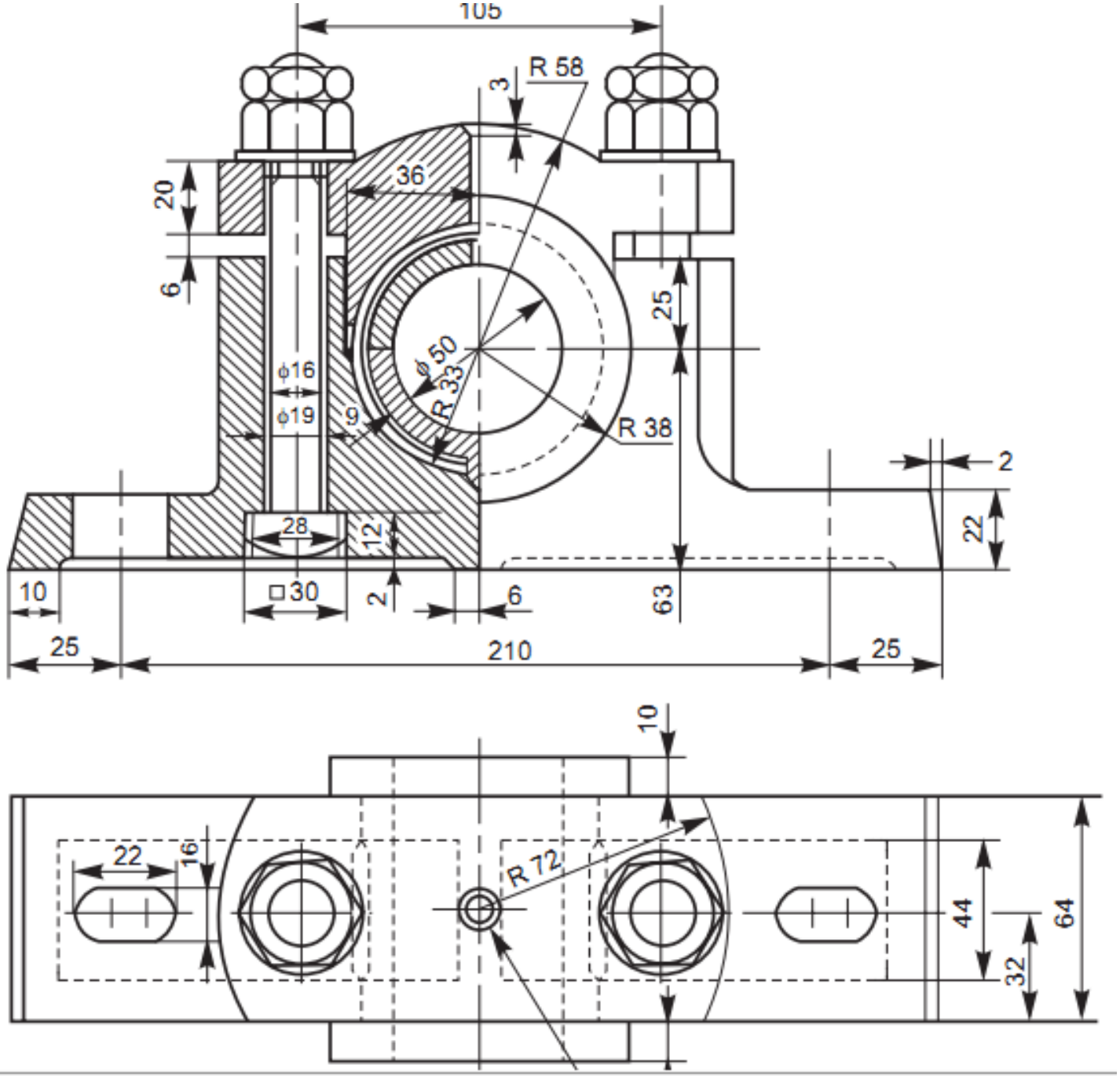
- Plummer block (Pedastal Bearing)



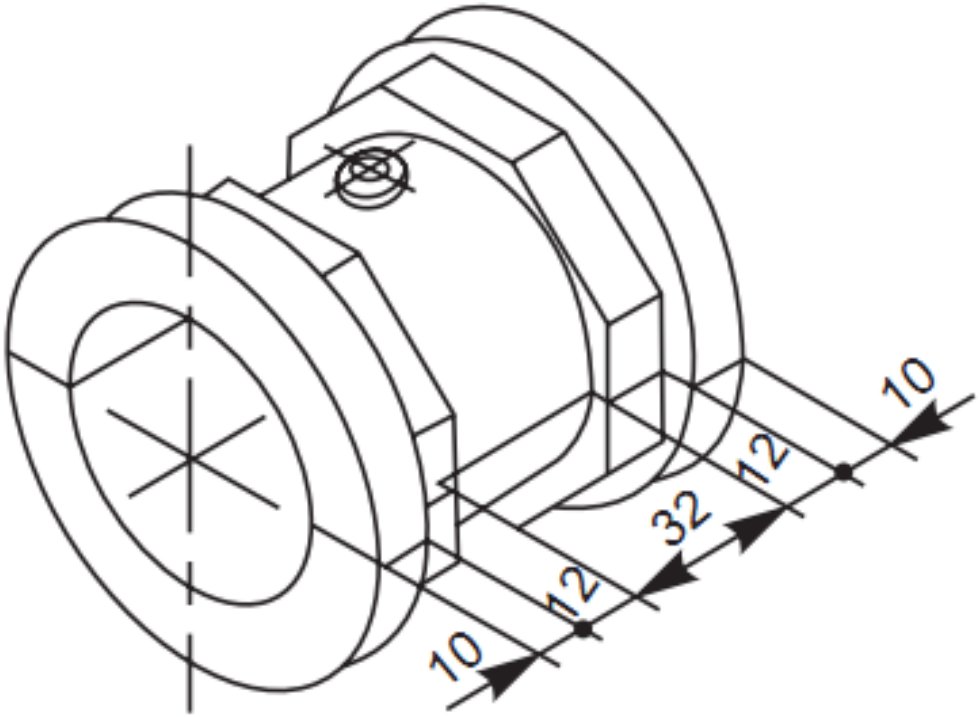
- This bearing is used for long shafts, requiring intermediate support, especially when the shaft cannot be introduced in the bearing end-wise.
- It consists of a pedastal or base, a cap and a bush, split into two halves, called '**bearing brasses**'.

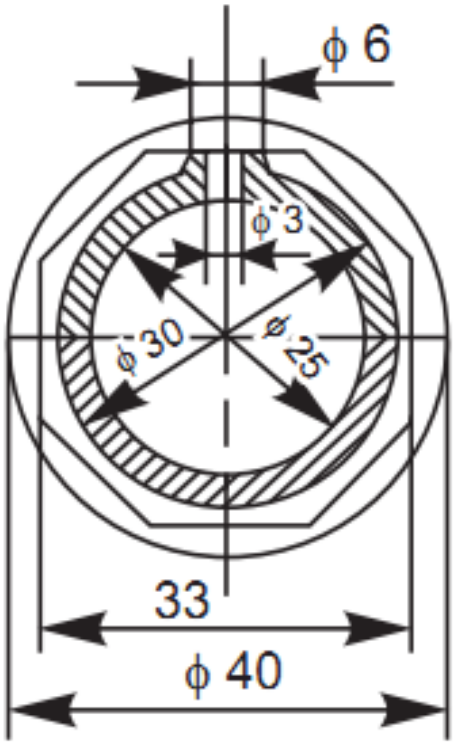
Flanges are provided at either end of the bush, to prevent its axial motion

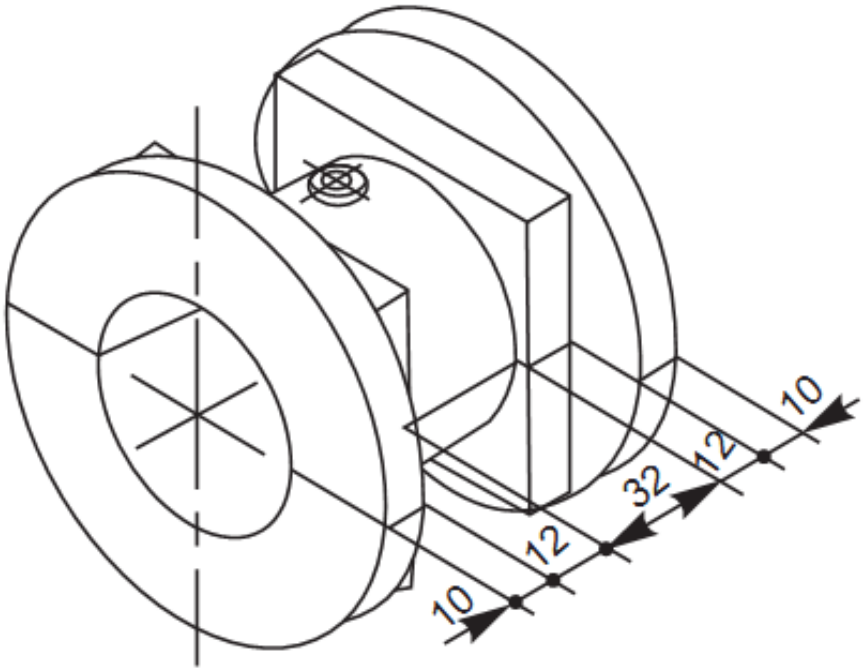


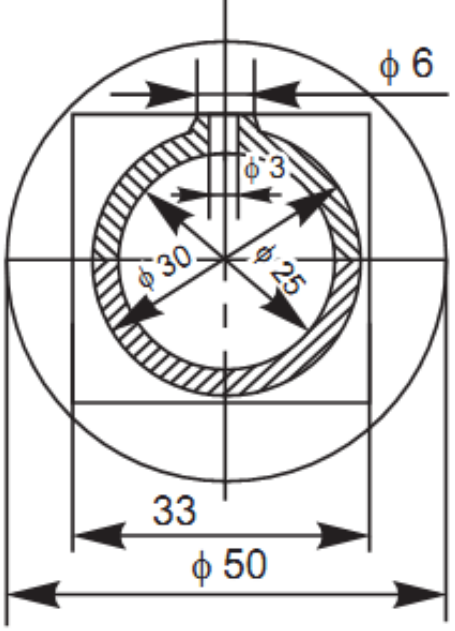

105
R 58
3
36
20
6
25
ϕ16
ϕ19
9
ϕ50
R 33
R 38
2
22
28
12
10
□30
2
6
63
25
210
25
10
22
16
R 72
44
64
32

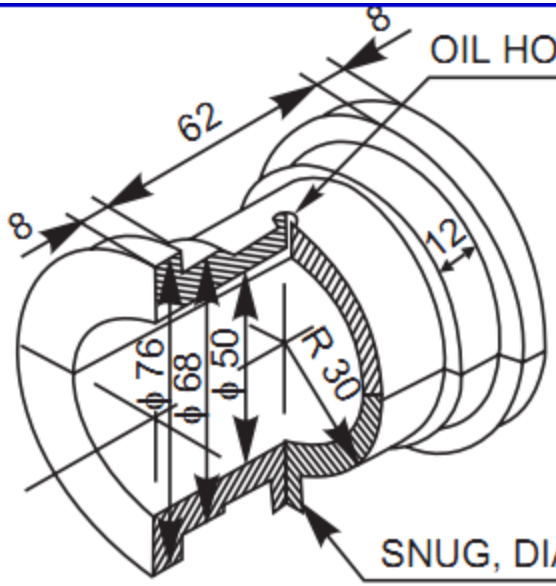
- Different shapes of Bush in Plummer block

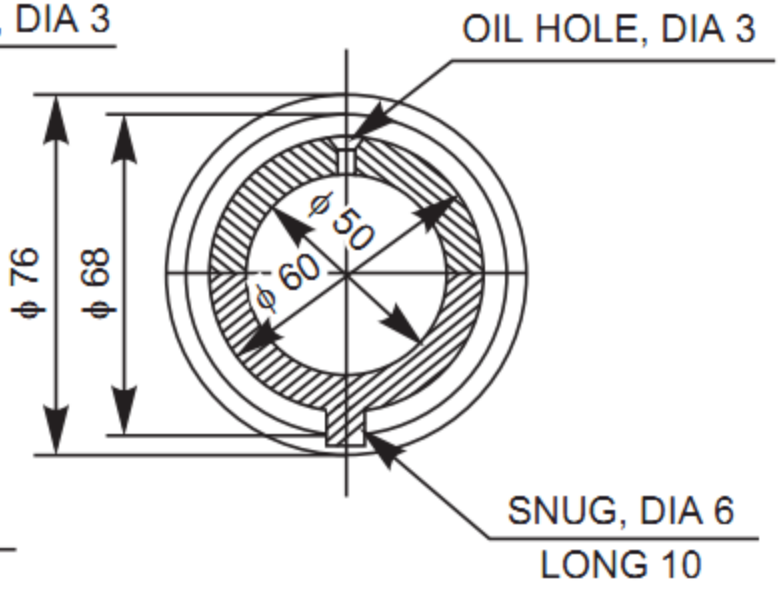




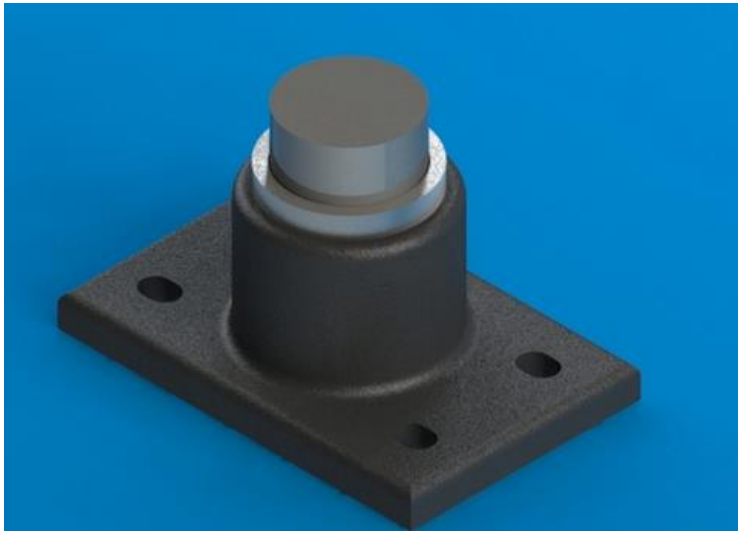

10
12
32
12
10

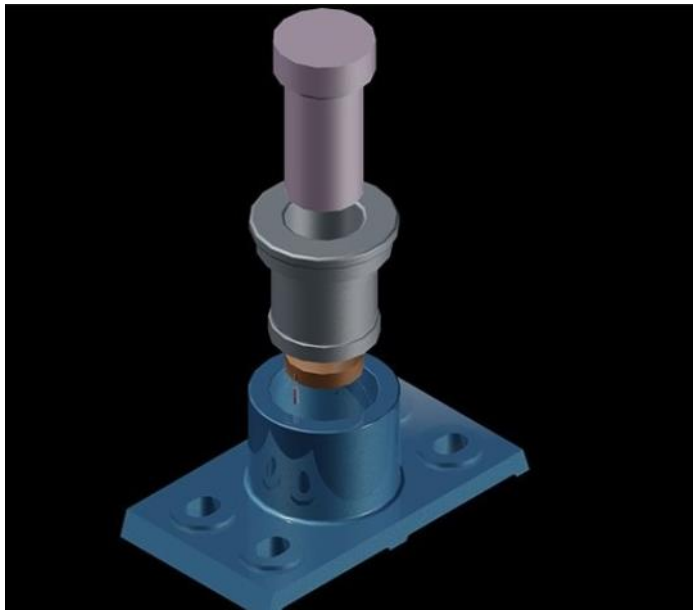

ϕ 6
ϕ 3
ϕ 30
ϕ 25
33
ϕ 50


8
OIL HOLE, DIA 3
62
8
12
ϕ 76
ϕ 68
ϕ 50
R 30
SNUG, DIA 6
LONG 10


OIL HOLE, DIA 3
ϕ 76
ϕ 68
ϕ 50
ϕ 60
SNUG, DIA 6
LONG 10

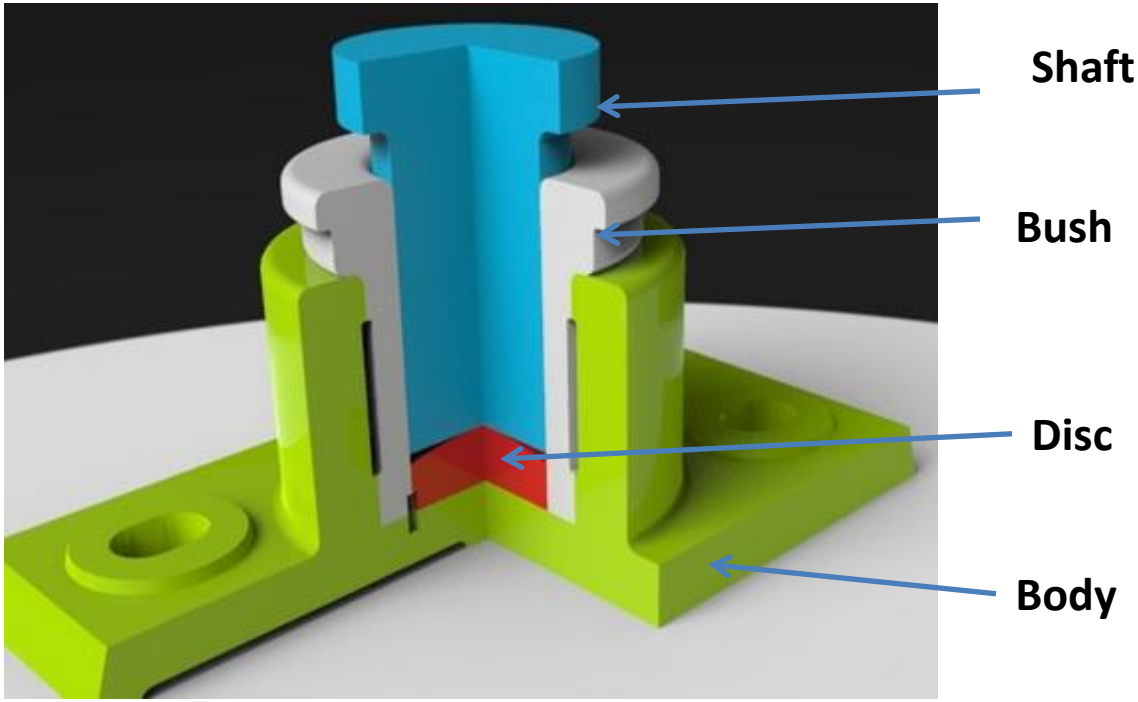
- **Thrust Bearing**
  - Thrust bearings are used to support shafts subjected to axial loads
  - 1. Pivot or Foot-step Bearing
  - Collar bearing

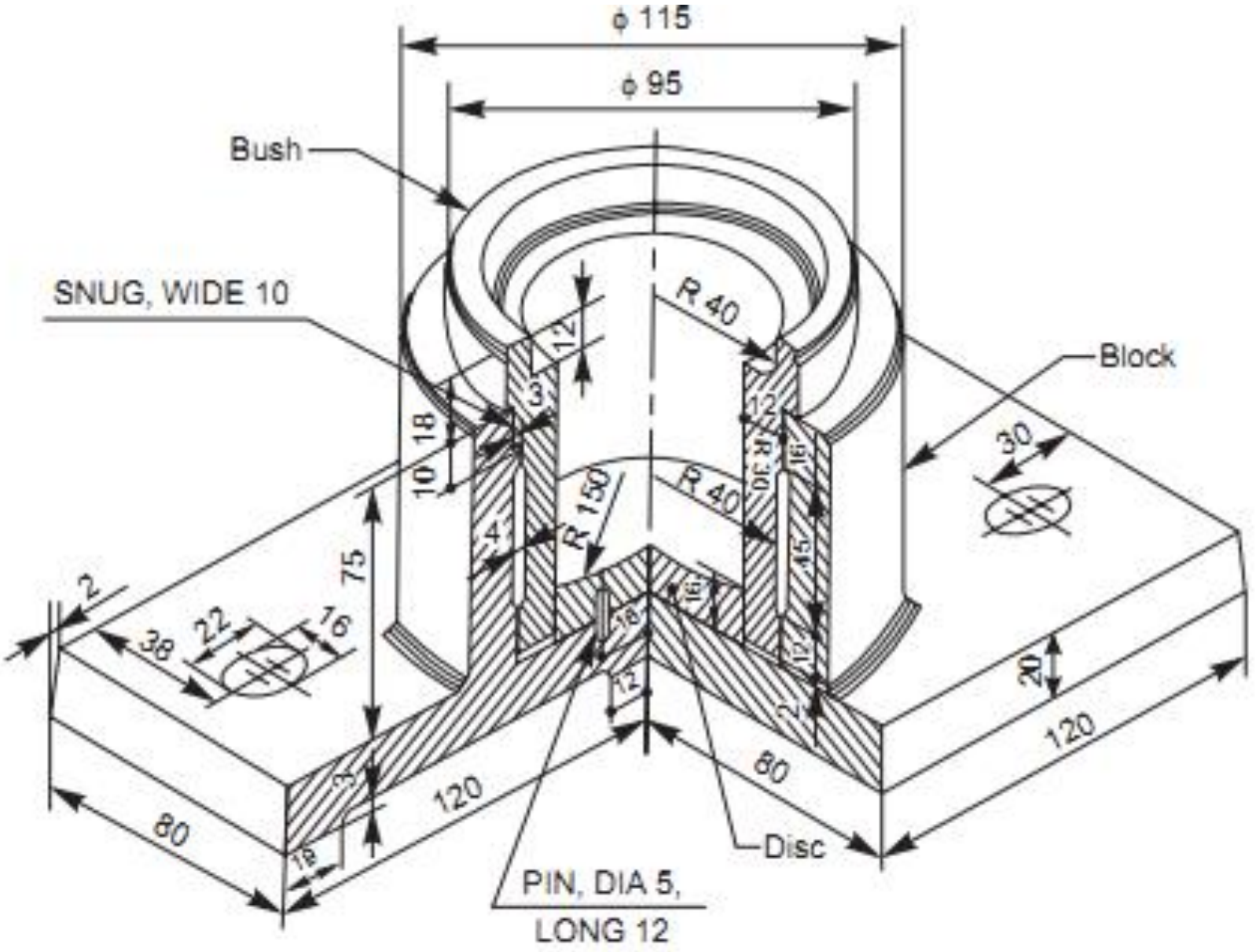


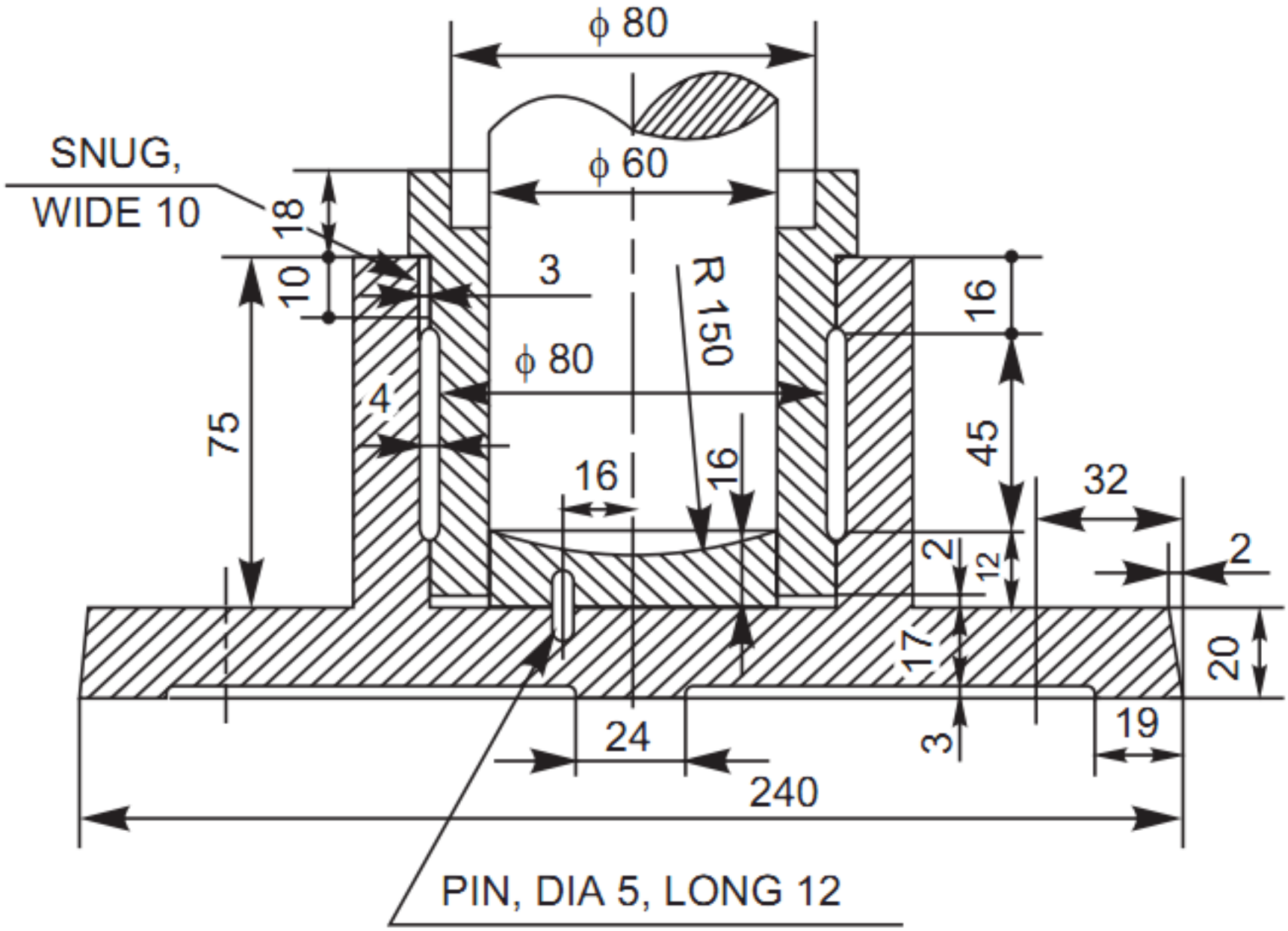


- **Foot-step bearing**
- This bearing is used to support a vertical shaft under axial load. the shaft is terminated at the bearing.
- The bottom surface of the shaft rests on the surface of the bearing
- which is in the form of a disc
- The bush fitted in the main body supports the shaft in position and takes care of possible radial loads coming on the shaft.

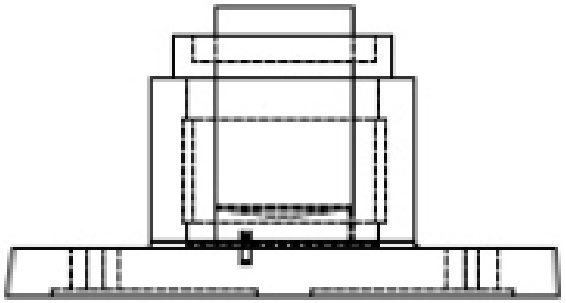
The disc is prevented from rotation by a pin inserted through the body and away from the centre



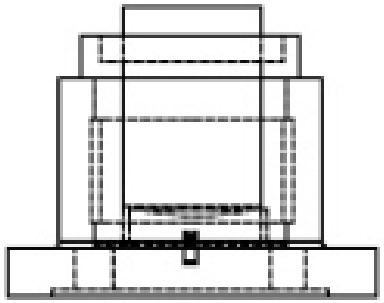

ϕ 115
ϕ 95
Bush
SNUG, WIDE 10
R 40
12
3
18
10
4
R 150
R 30
16
45
30
Block
75
2
38
22
16
3
120
80
18
12
20
Disc
PIN, DIA 5,
LONG 12


ϕ 80
ϕ 60
SNUG,
WIDE 10
18
10
3
R 150
16
ϕ 80
4
75
45
16
16
32
2
2
12
17
20
3
19
24
240
PIN, DIA 5, LONG 12

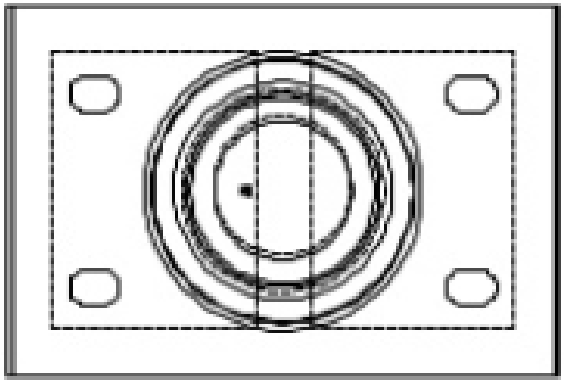
Foot Step Bearing



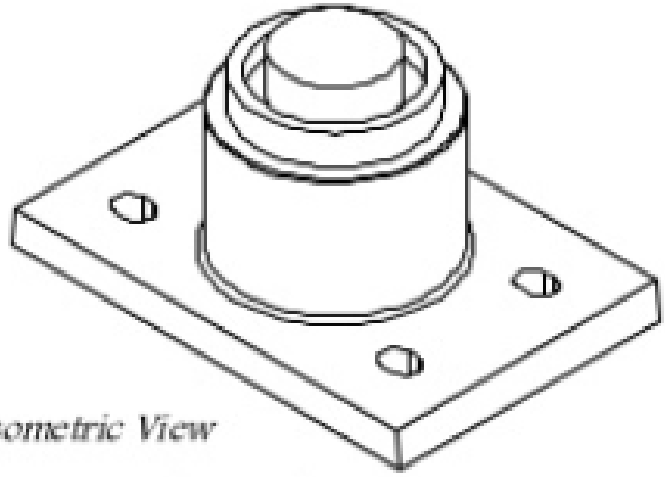
Front View



Side View



Top View



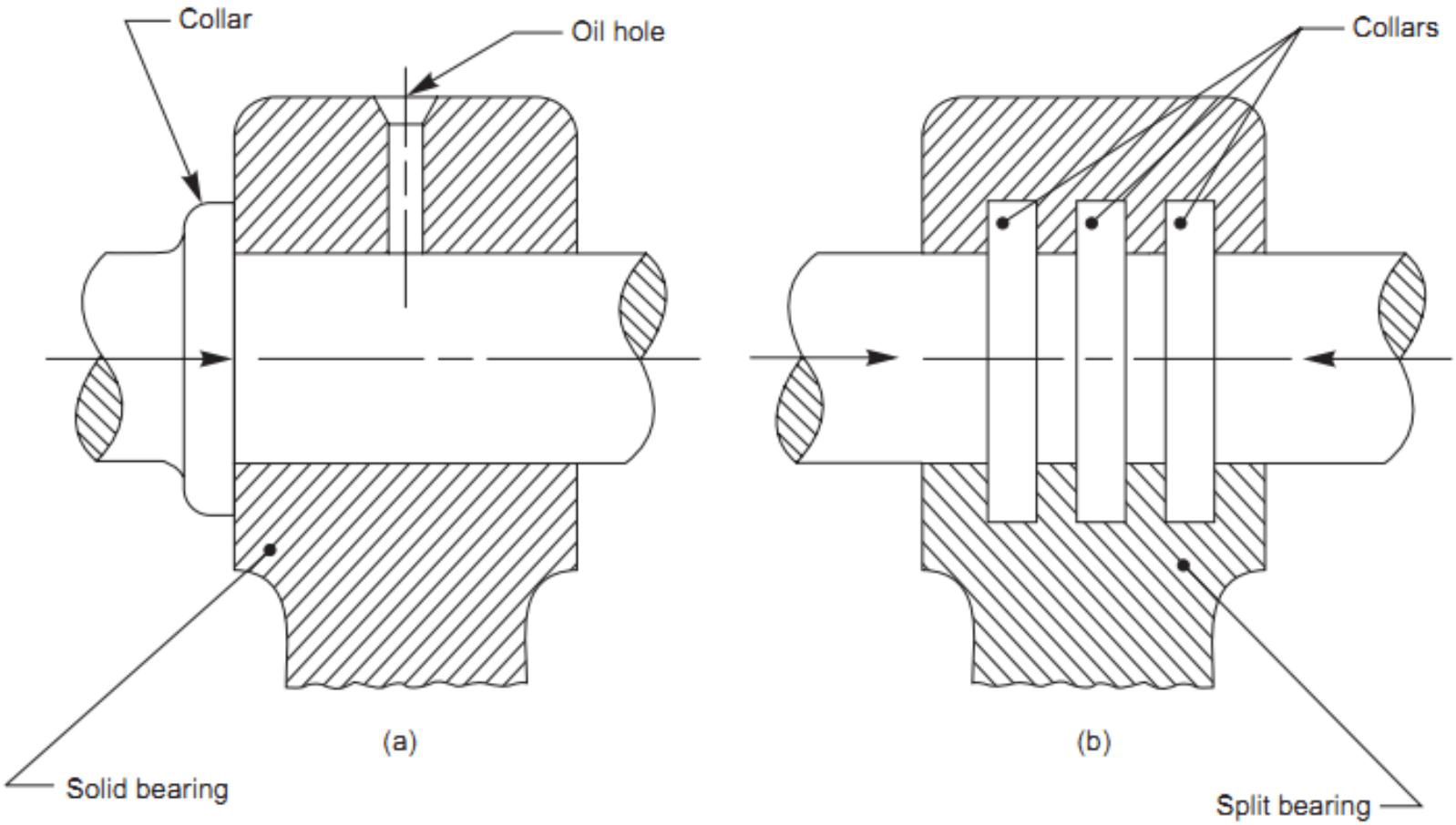
Isometric View

Item number	Title	Quantity
1	Block	1
2	Bush	1
3	Pin	1
4	Pad	1
5	Shaft	1

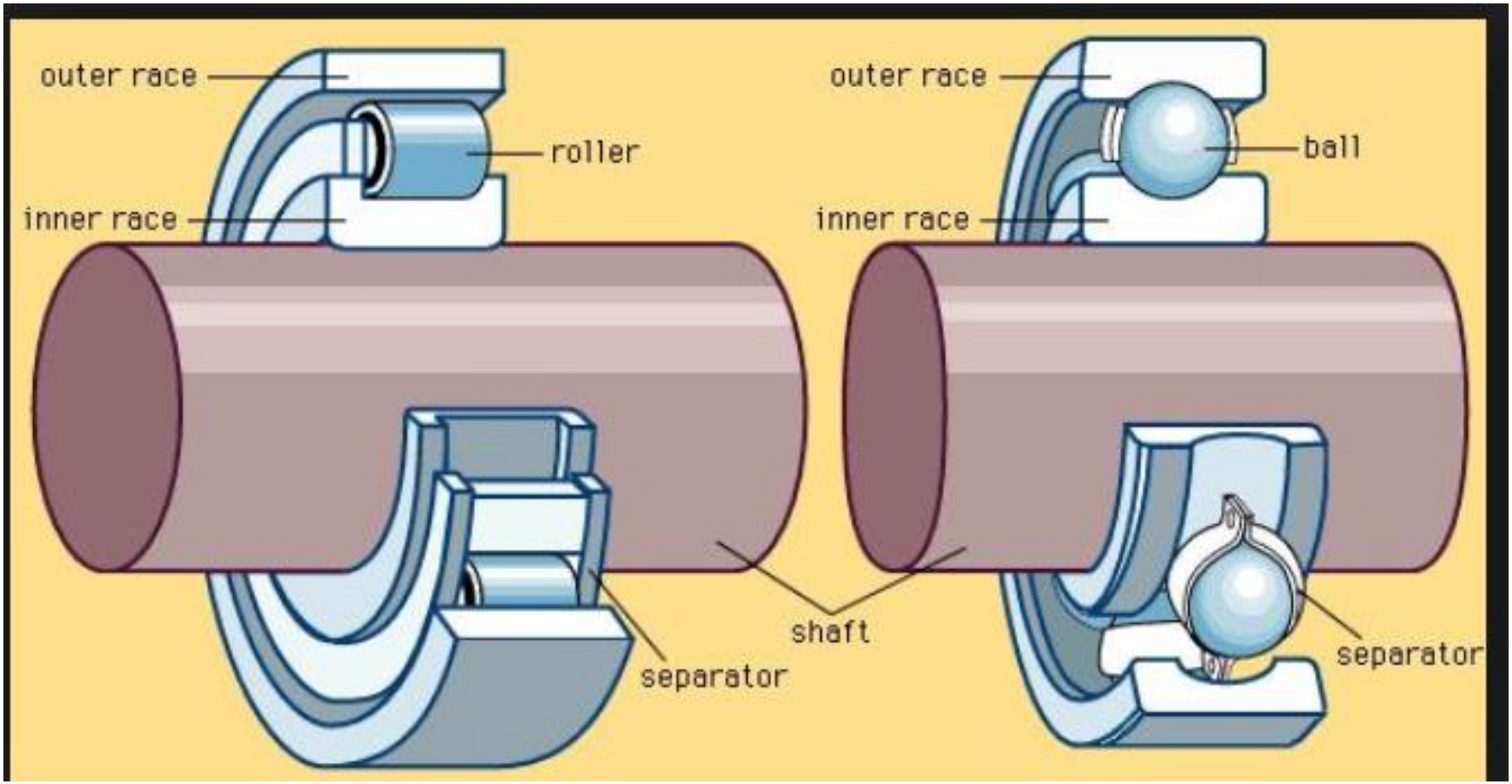
HARISH.V

476ME12021

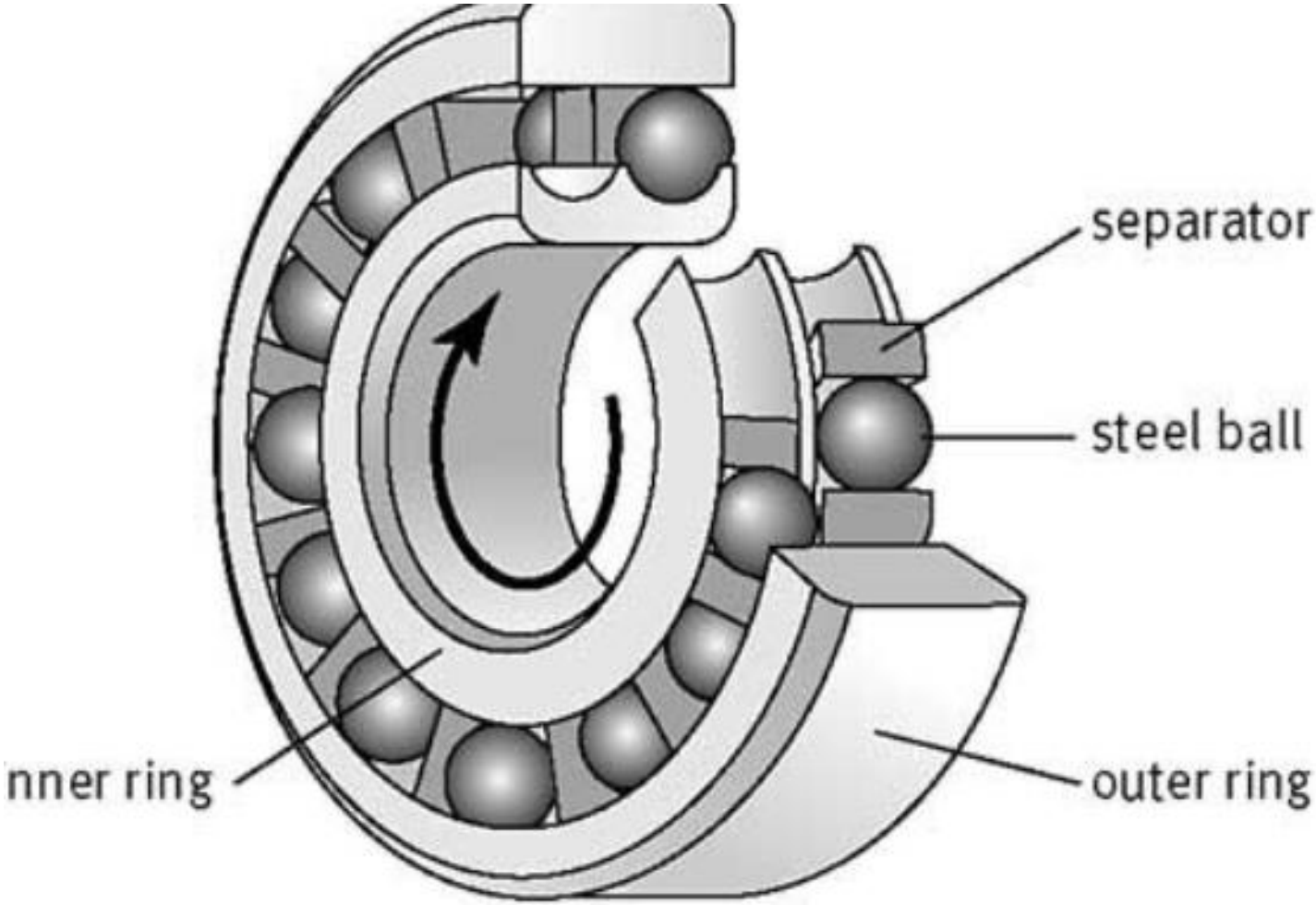
- **Collar thrust bearing**
  - This is generally used for supporting a horizontal shaft under axial load
  - The shaft extends through and beyond the bearing.

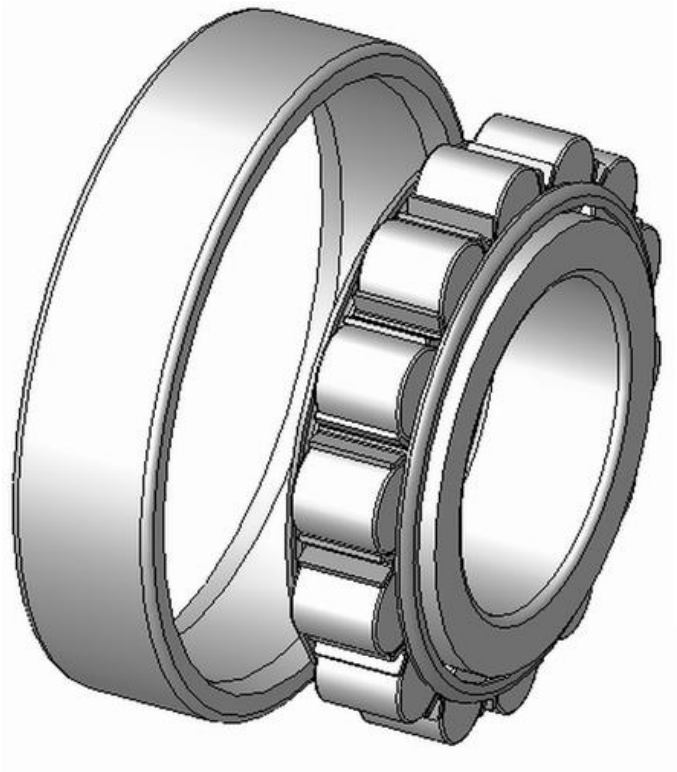


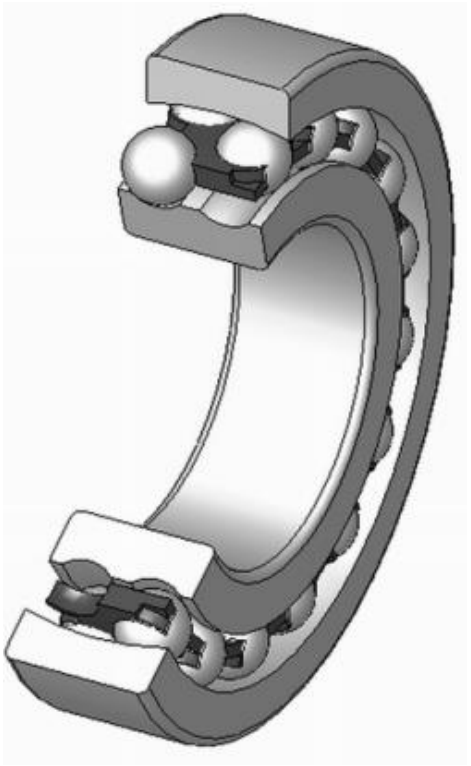
Rolling Bearing (Ball/Roller Bearing)

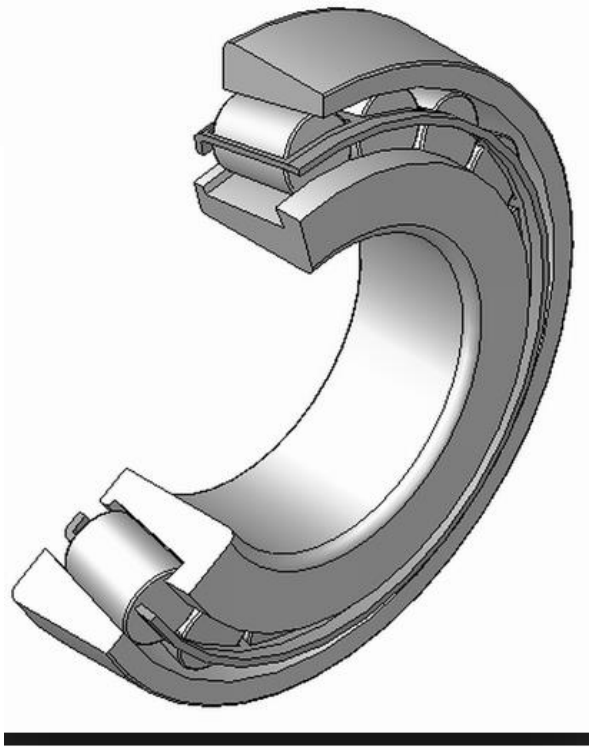


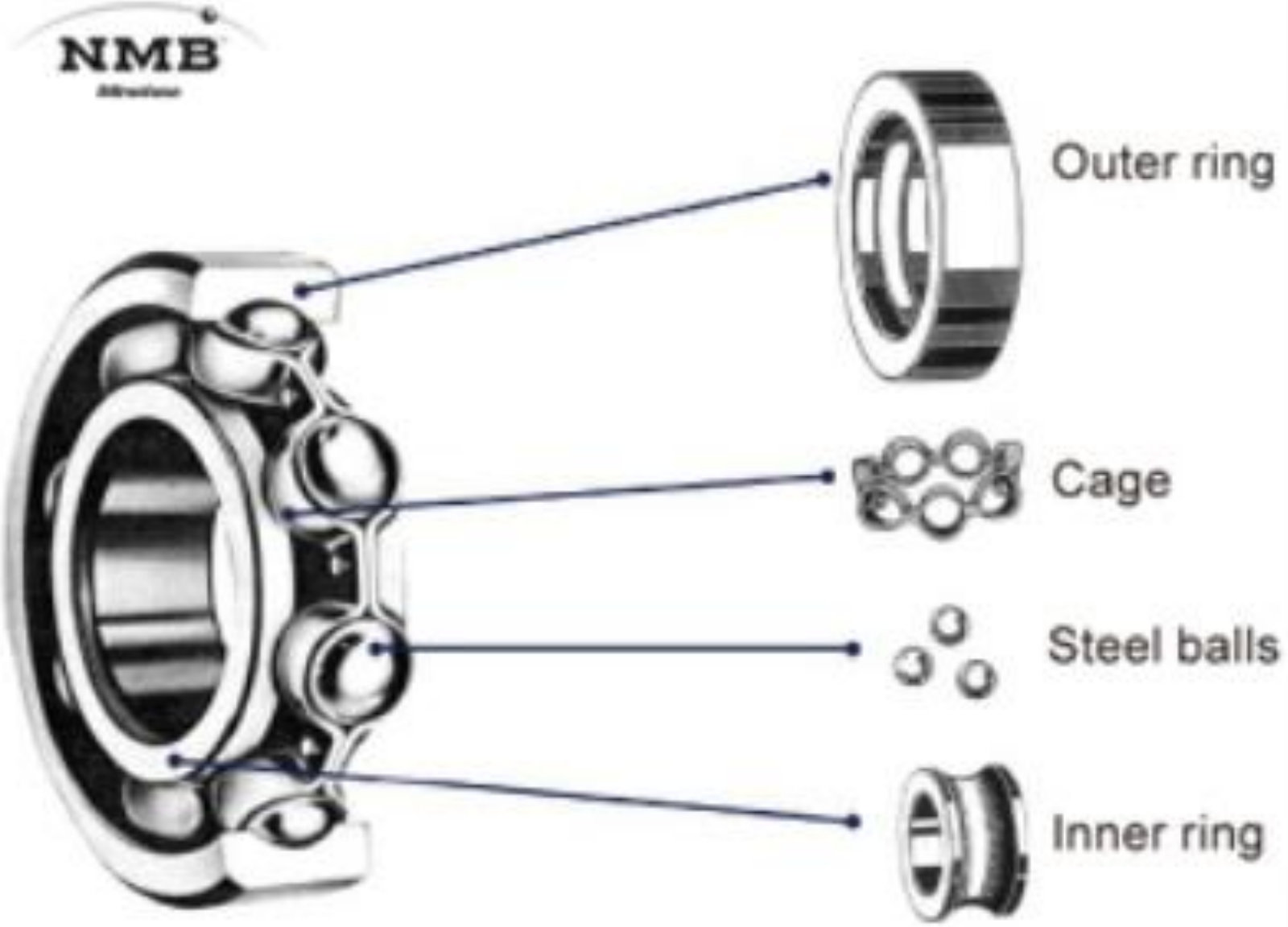
Rolling Bearing (Ball/Roller Bearing)







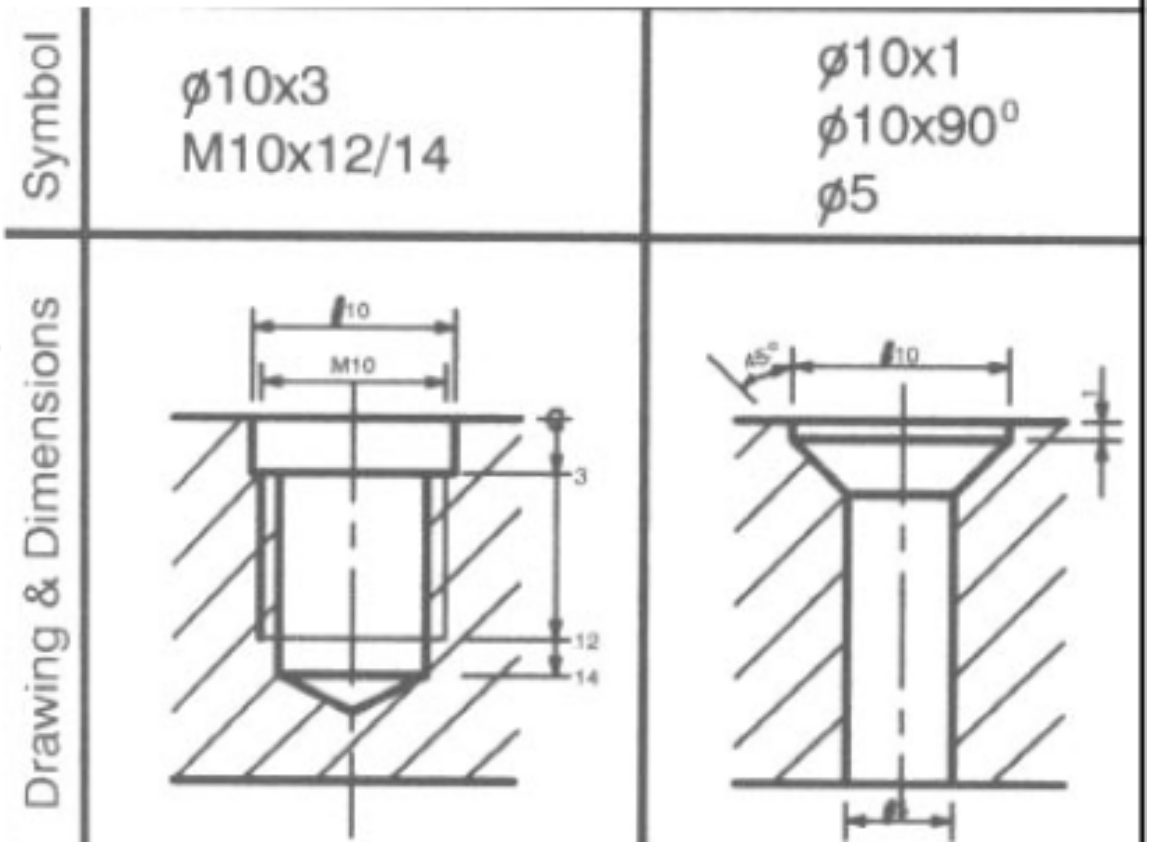


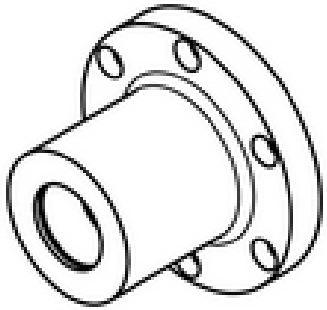

NMB
Outer ring
Cage
Steel balls
Inner ring

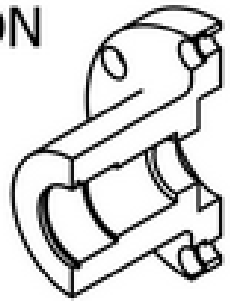
Assembly drawings

Symbology

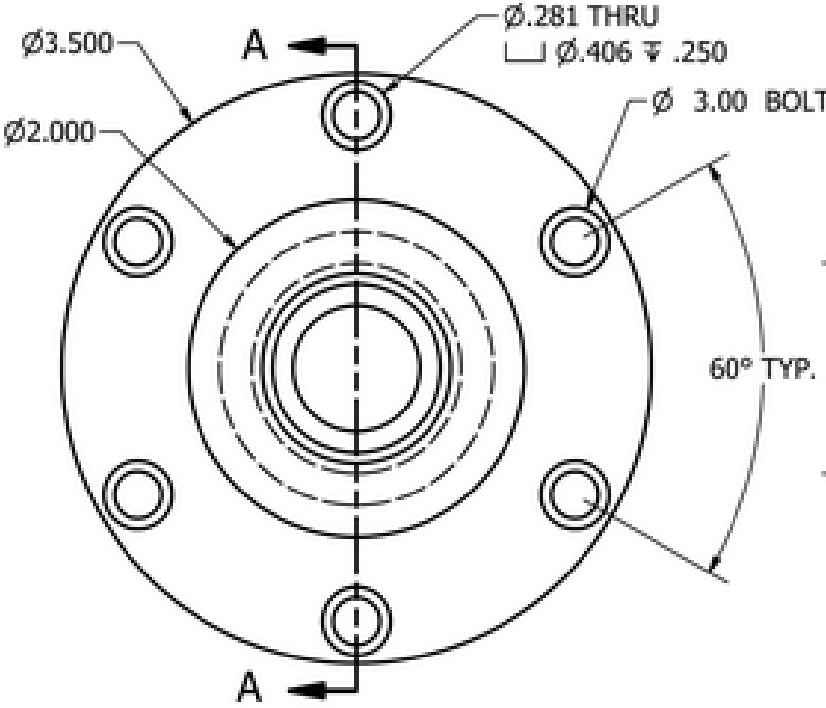
- ISO standards recommend that abbreviations and symbols are used wherever possible to avoid a link to any particular language
  - φ or DIA = diameter
  - CL = centerline
  - CRS = centers
  - CSK = countersunk
  - PCD = pitch circle dia.
  - R or RAD = radius
  - THD = thread
  - TOL = tolerance

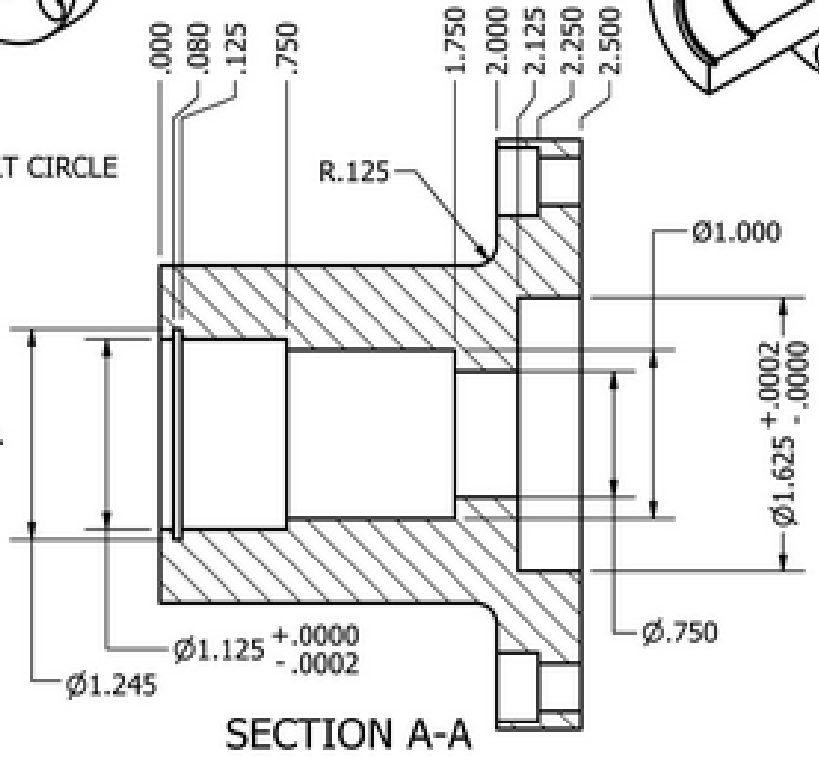






CROSS SECTION

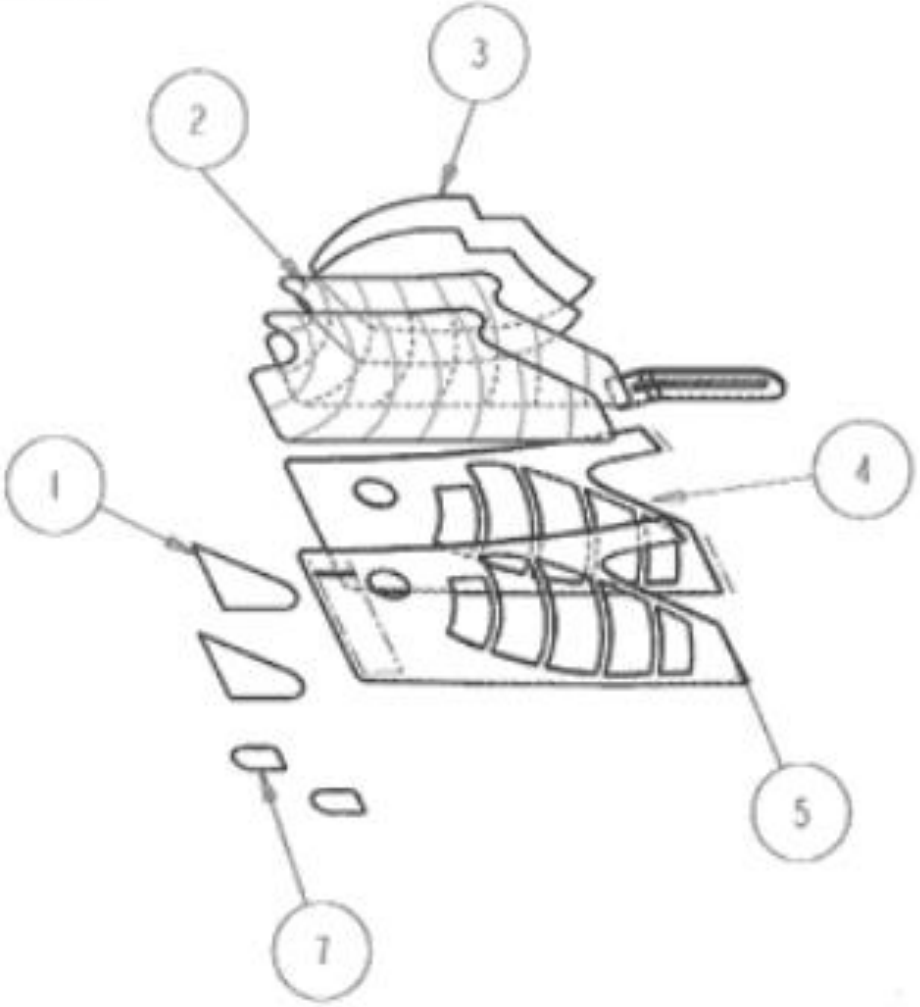




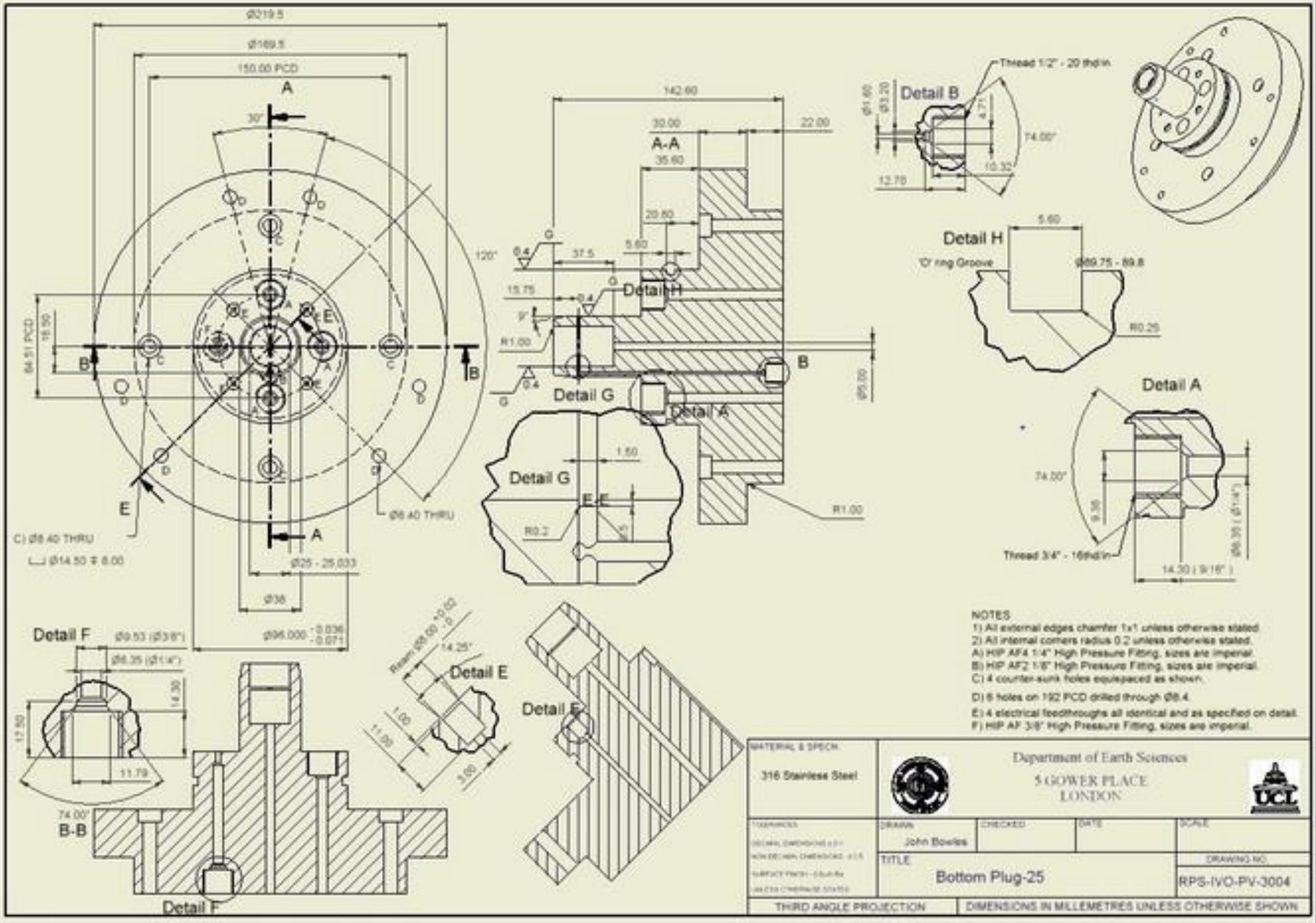
SECTION A-A

TOLERANCES: ∠ ± .1° .X ± .1 .XX ± .01 .XXX ± .001 UNLESS NOTED OTHERWISE	DRAWN BY: C. WETZEL	DATE: 5-11-09	CAD Solutions L.L.C.
	CHECKED BY: CNG	DATE: 5-11-09	
	APPROVED BY: CMW	DATE: 5-11-09	PART NO. 051109 SPINDLE HUB
	MATERIAL: CLASS 30 GREY IRON		SIZE A · DWG NO · REV 0
	FINISH:		SCALE · SHEET 1 OF 1

FOR QUOTATION ONLY
Pro/ENGINEER

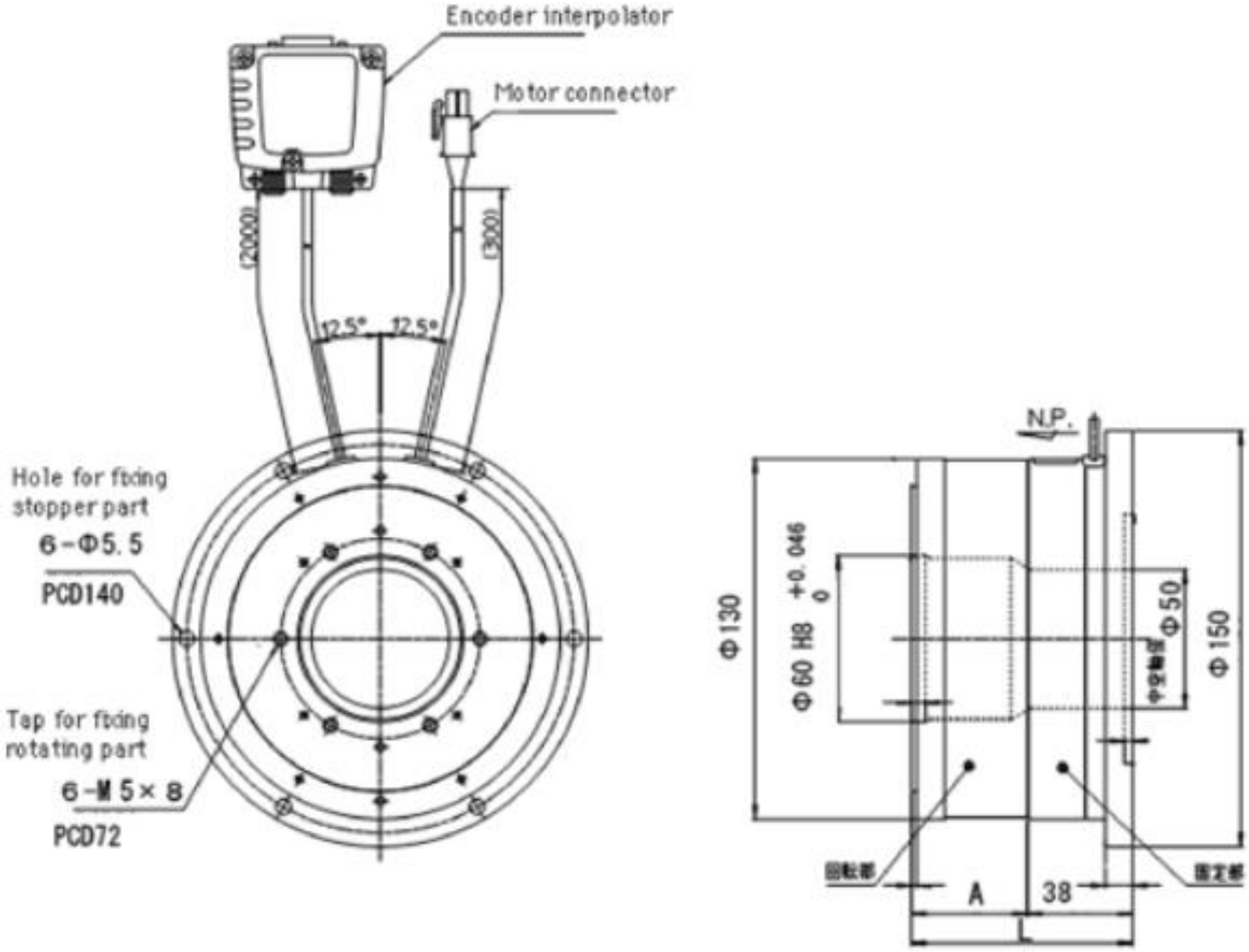


INDEX	PART NAME	QTY
1	[illegible]	2
2	[illegible]	2
3	[illegible]	2
4	[illegible]	1
5	[illegible]	1
6	[illegible]	1
7	[illegible]	2



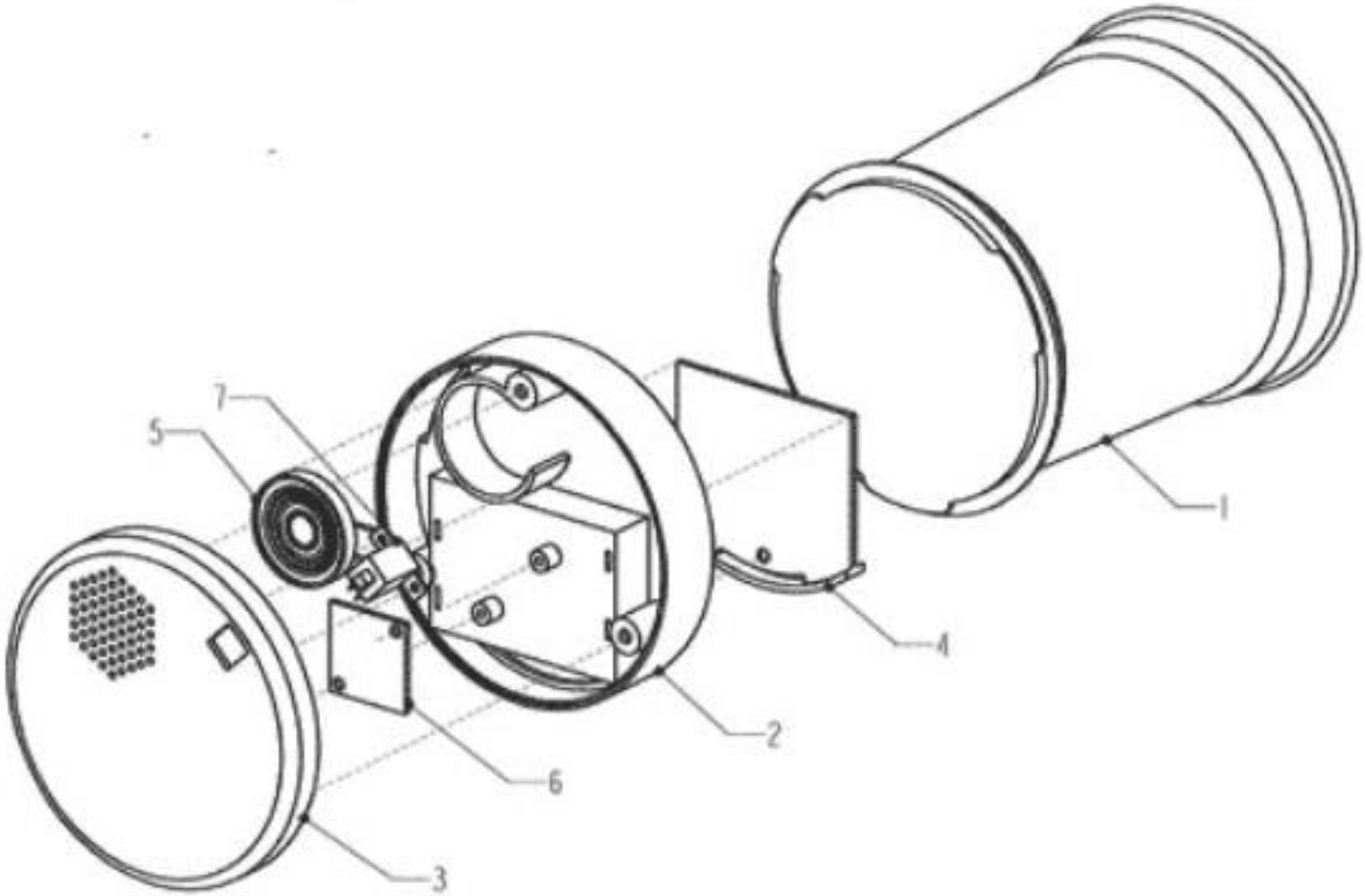
NOTES
1) All external edges chamfer 1x1 unless otherwise stated.
2) All internal corners radius 0.2 unless otherwise stated.
A) HIP AF4 1/4" High Pressure Fitting, sizes are imperial.
B) HIP AF2 1/8" High Pressure Fitting, sizes are imperial.
C) 4 counter-sunk holes equispaced as shown.
D) 6 holes on 192 PCD drilled through Ø8.4.
E) 4 electrical feedthroughs all identical and as specified on detail.
F) HIP AF 3/8" High Pressure Fitting, sizes are imperial.

MATERIAL & SPECN.: 316 Stainless Steel	Department of Earth Sciences, 5 GOWER PLACE, LONDON			
TOLERANCES: DECIMAL DIMENSIONS ±0.1 / NON DECIMAL DIMENSIONS ±1/8 / SURFACE FINISH 3.2µm Ra / UNLESS OTHERWISE STATED	DRAWN: John Bowles	CHECKED	DATE	SCALE
	TITLE: Bottom Plug-25			DRAWING NO.: RPS-IVO-PV-3004
THIRD ANGLE PROJECTION	DIMENSIONS IN MILLEMETRES UNLESS OTHERWISE SHOWN			


Encoder interpolator
Motor connector
(2000)
(300)
12.5°
12.5°
Hole for fixing
stopper part
6-Φ5.5
PCD140
Tap for fixing
rotating part
6-M5×8
PCD72
N.P.
Φ130
Φ60 H8 +0.046 0
Φ50
Φ150
A
38

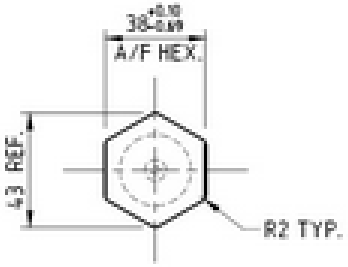
FOR QUOTATION ONLY
Pro/ENGINEER

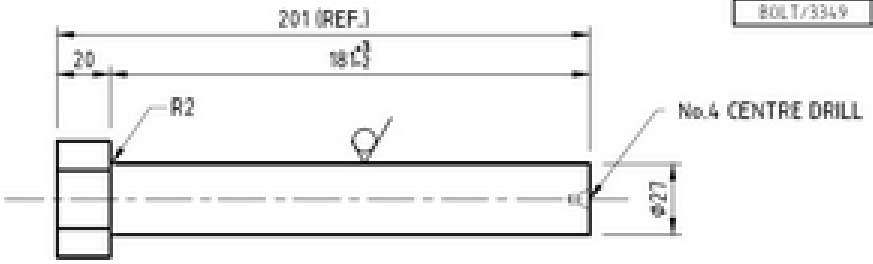
0



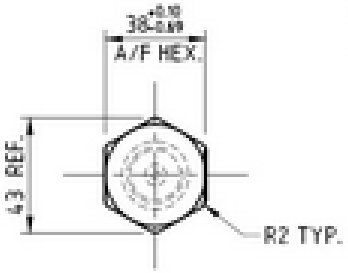
TITLE:	MFG. PROCESS:	MAX. THICKNESS (i.e.):	COLOR:	DRAWN BY:
SHEET SIZE: REVISION:	MATERIAL:	APPROX. WEIGHT (kg):	QUANTITY: 1	SCALE:

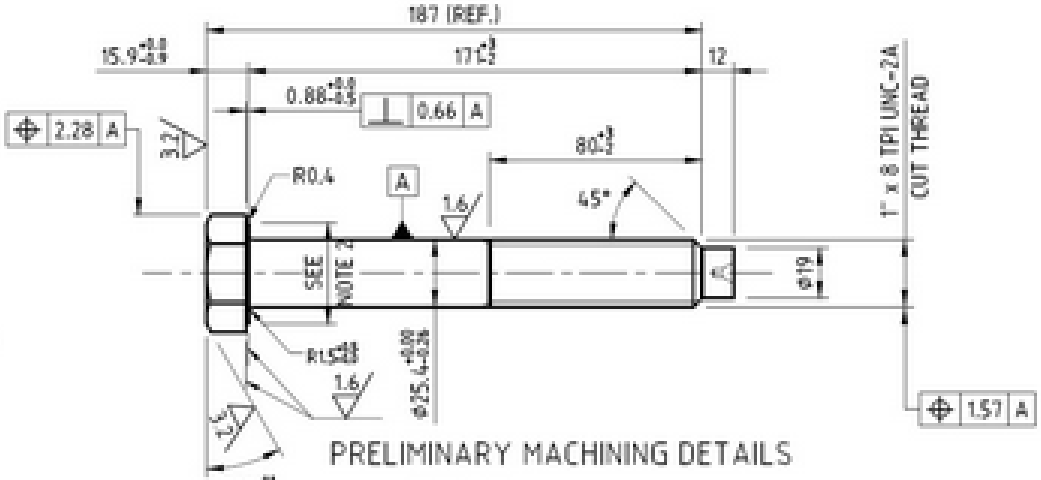
PRODUCT CODE	HEAD USER LENGTH	CUT USER LENGTH
BOLT/3349	46 – CALCULATED	225 – CALCULATED



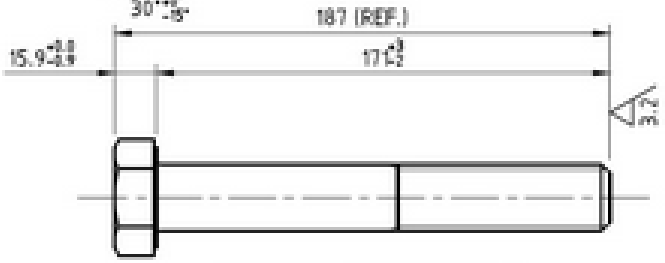


FORGE DETAIL





PRELIMINARY MACHINING DETAILS



FINISHED BOLT DETAIL

NOTE:

1. REMOVE ALL SHARP EDGES AND BURRS.
2. DIMENSION INDICATED TO BE:
   WIDTH ACROSS FLATS – MAX.
   – ø34.29 MIN.

DONHAD

DONHAD PTY. LTD.
18-22 Jackson St.
Bayswaterdean Perth
Western
Australia 6054
Tel: (08) 9279 7611

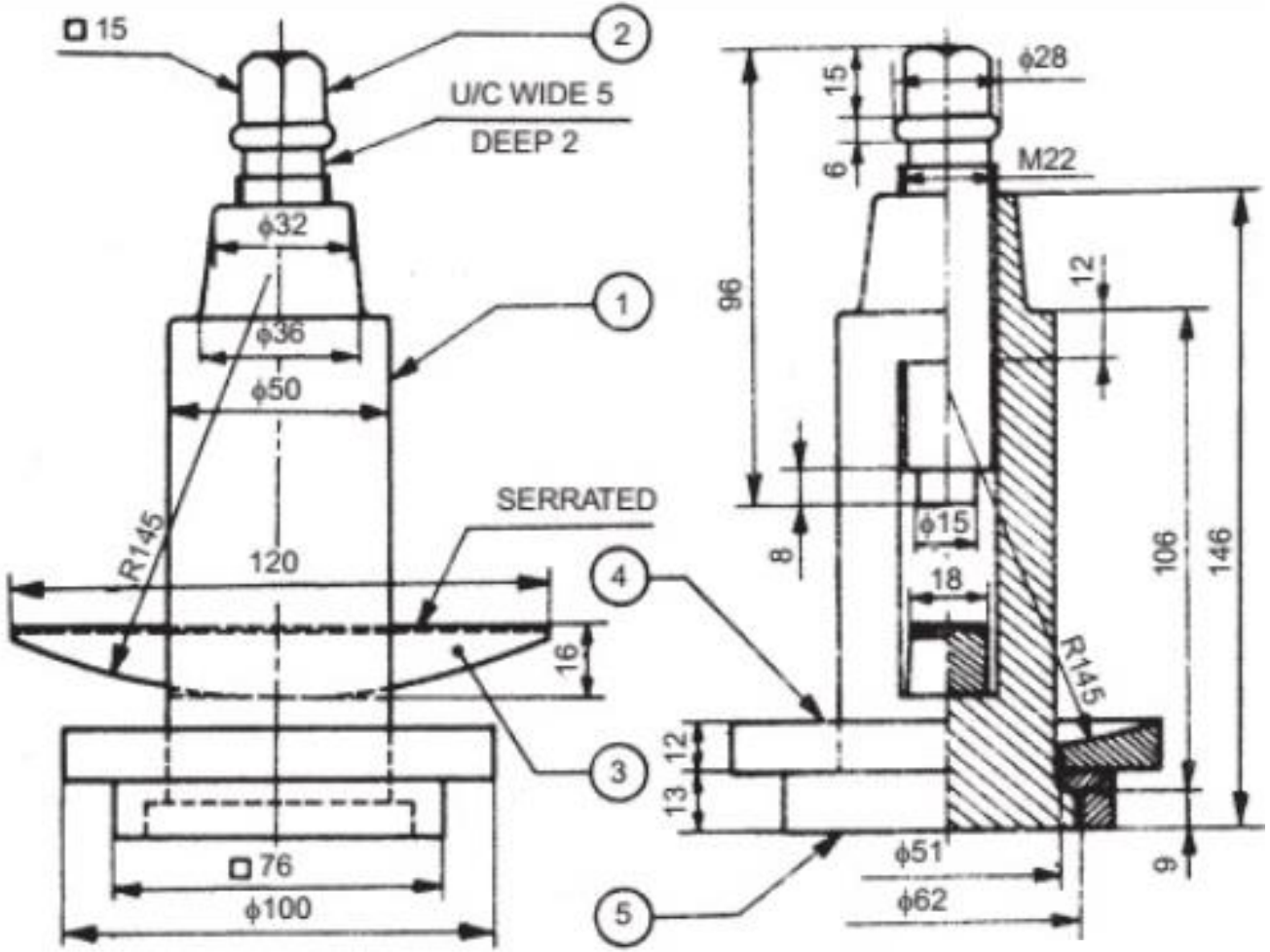
1" x 8 TPI UNC HEX. HEAD BOLT
USE INSERT 14918 WITH PUNCHES 14567
& 38 A/F HEX.
FOR 1" & 2" UPSETTERS

X=0 TOLERANCES TO BE:	
DECIMAL PLACES	TOLERANCE
0	± 1
0.0	± 0.5
0.00	± 0.1

IF IN DOUBT – ASK

THIRD ANGLE PROJECTION
ALL DIMENSIONS IN mm
DO NOT SCALE THIS DRAWING

CHECKED BY		DRAWN	JEFF DB
DATE CHKD		DATE 24/11/04	SCALE 1:2.5
LAST EDIT	ORIGINAL CREATION	APP'D	DATE
Last E.DATE	24/11/2004	DRAWING NUMBER	
MATERIAL	REFER TO W.O.	14961	
TREATMENT	REFER TO W.O.		



Parts list

Part No.	Name	Matl.	Qty.
1	Body	MS	1
2	Clamp screw	MCS	1
3	Wedge	CI	1
4	Ring	MS	1
5	Square block	MS	1

Machine Drawing

Credit 2 - 0L-4P

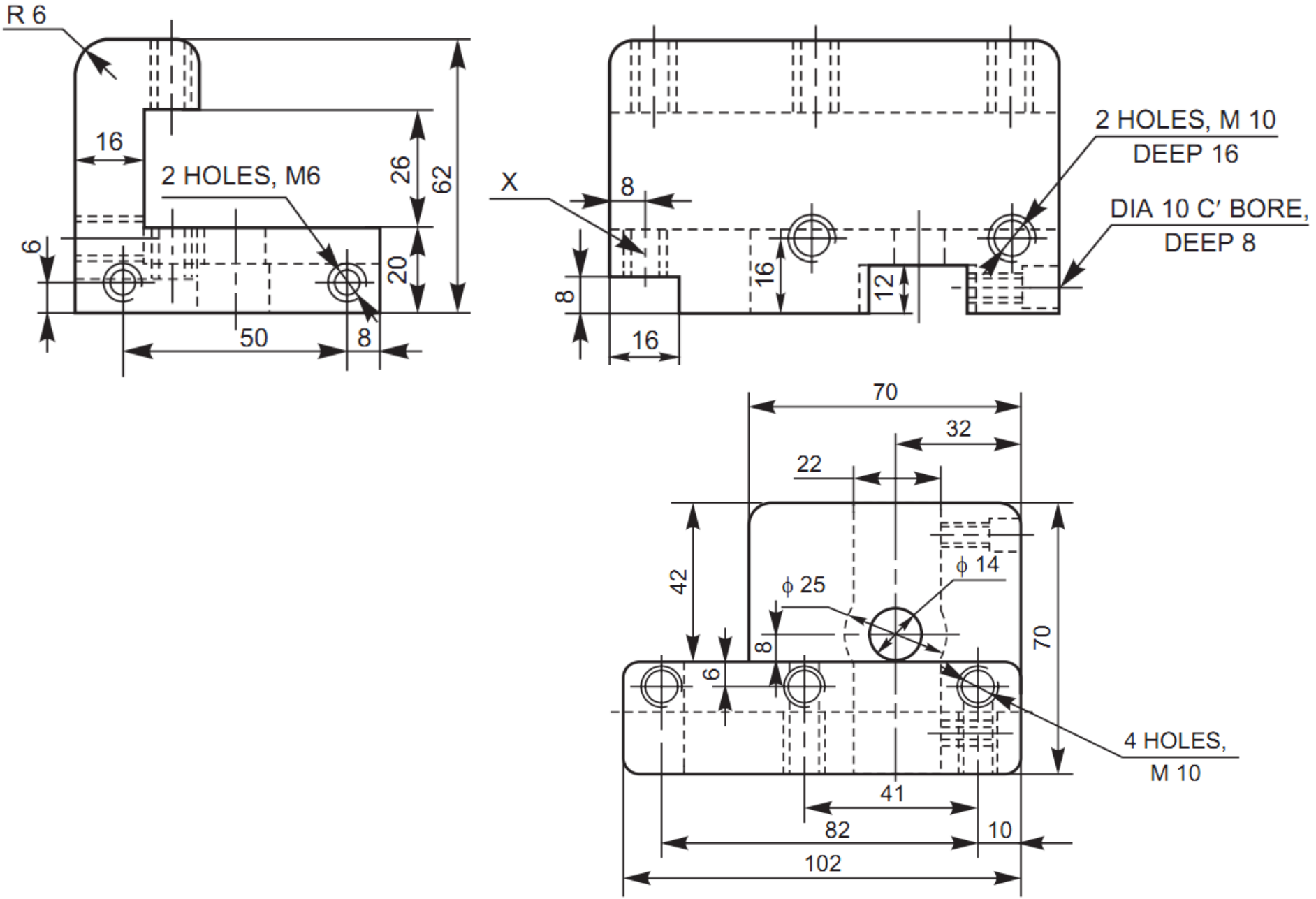
Assembly drawings II

Md Asjad Mokhtar
Assistant Professor, ME
DCE, Darbhanga
drasjadmokhtar@gmail.com
9999914381

BLUEPRINT

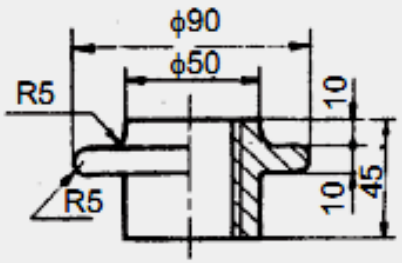
- Blueprint is the common name of the copies taken from an original drawing
- Usually drawn on a tracing paper
- The copies may be obtained by way of **Xerox copying**, copy of a photo film etc.
- Color of the print has nothing to do with the name “blueprint”

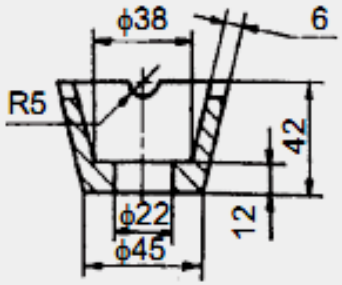
Tool post

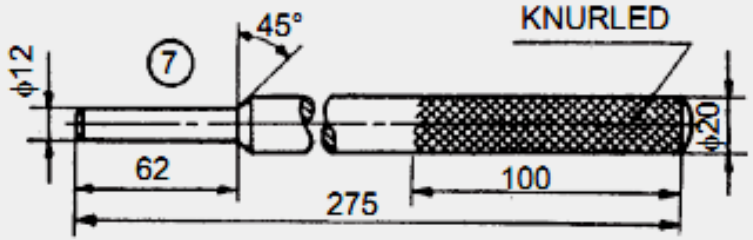

R 6
16
2 HOLES, M6
26
62
6
20
50
8
X
8
2 HOLES, M 10
DEEP 16
DIA 10 C′ BORE,
DEEP 8
16
8
16
12
70
32
22
42
ϕ 25
ϕ 14
8
6
70
4 HOLES,
M 10
41
82
10
102

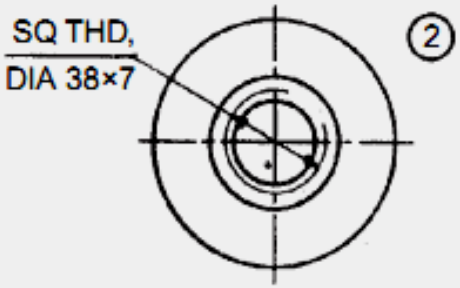
Assembly Drawing

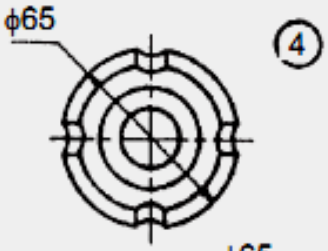
- An assembly drawing is one which represents various parts of a machine in their working Position
- **Design Assembly Drawing:** An assembly drawing made at the design stage while developing a machine is known as design assembly drawing.

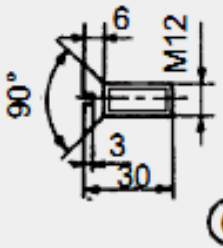


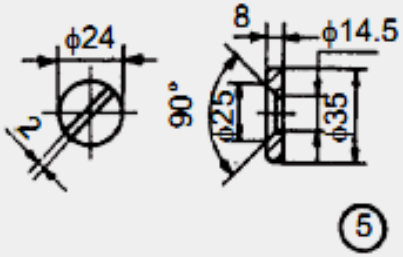


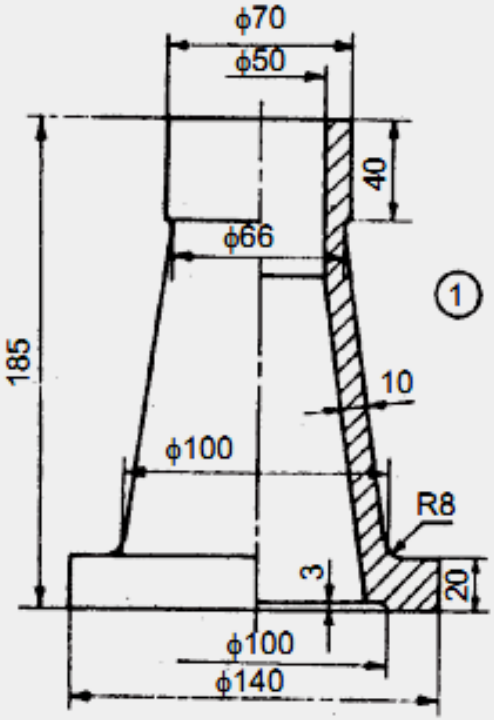


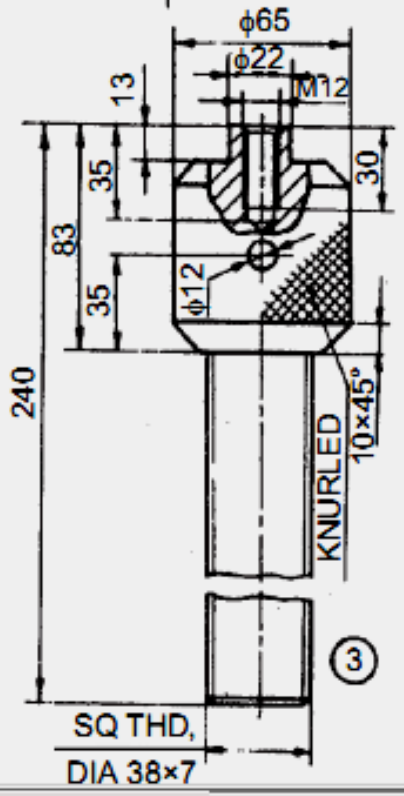








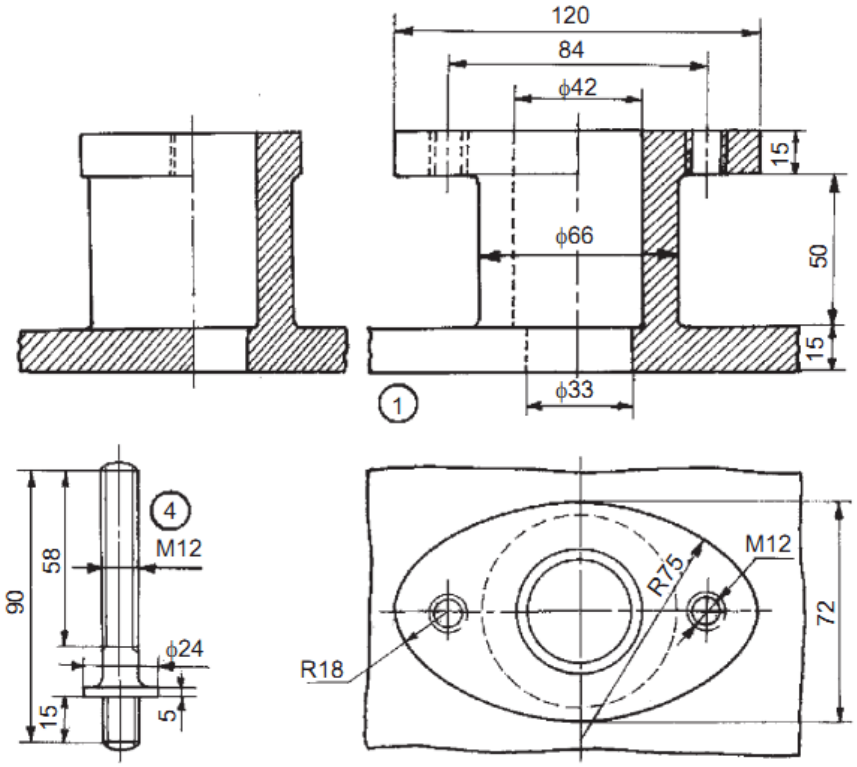


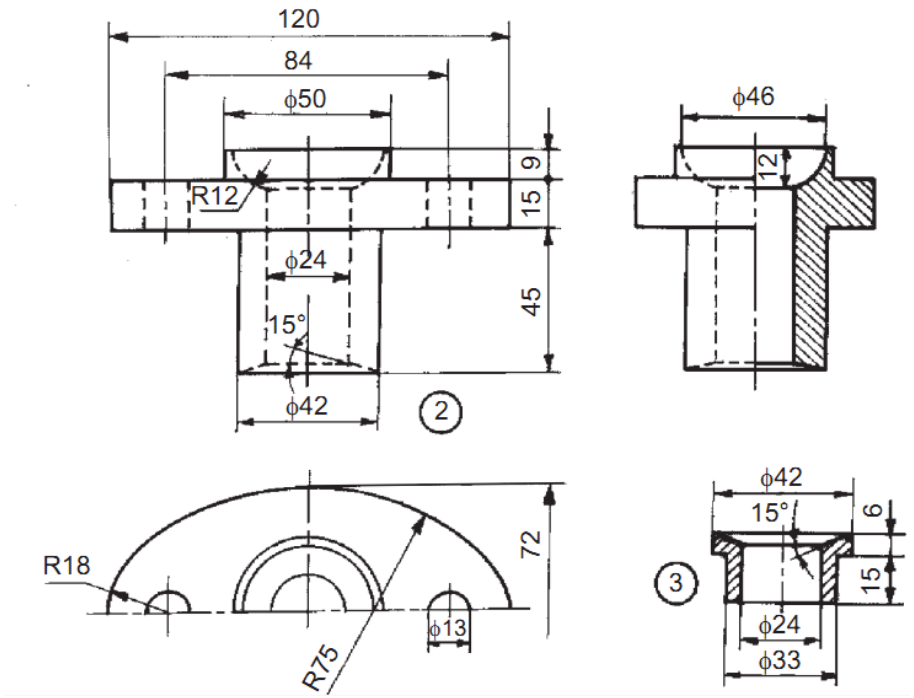


Parts list

Part No.	Name	Matl	Qty
1	Body	CI	1
2	Nut	GM	1
3	Screw	MS	1
4	Cup	CS	1
5	Washer	MS	1
6	Screw	MS	1
7	Tommy bar	MS	1

Screw Jack

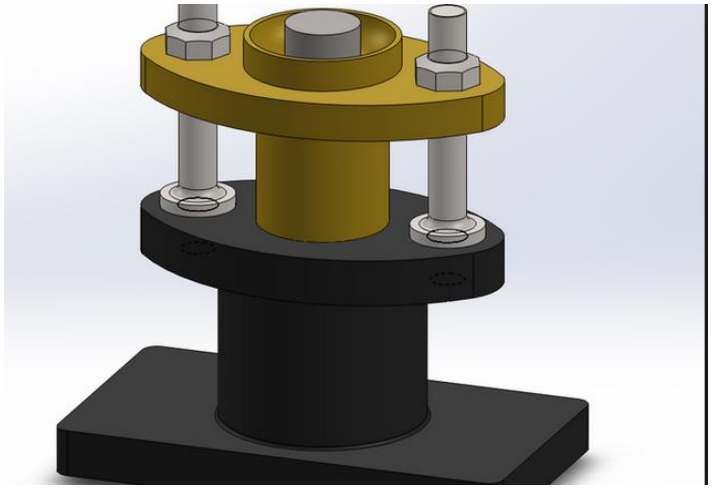


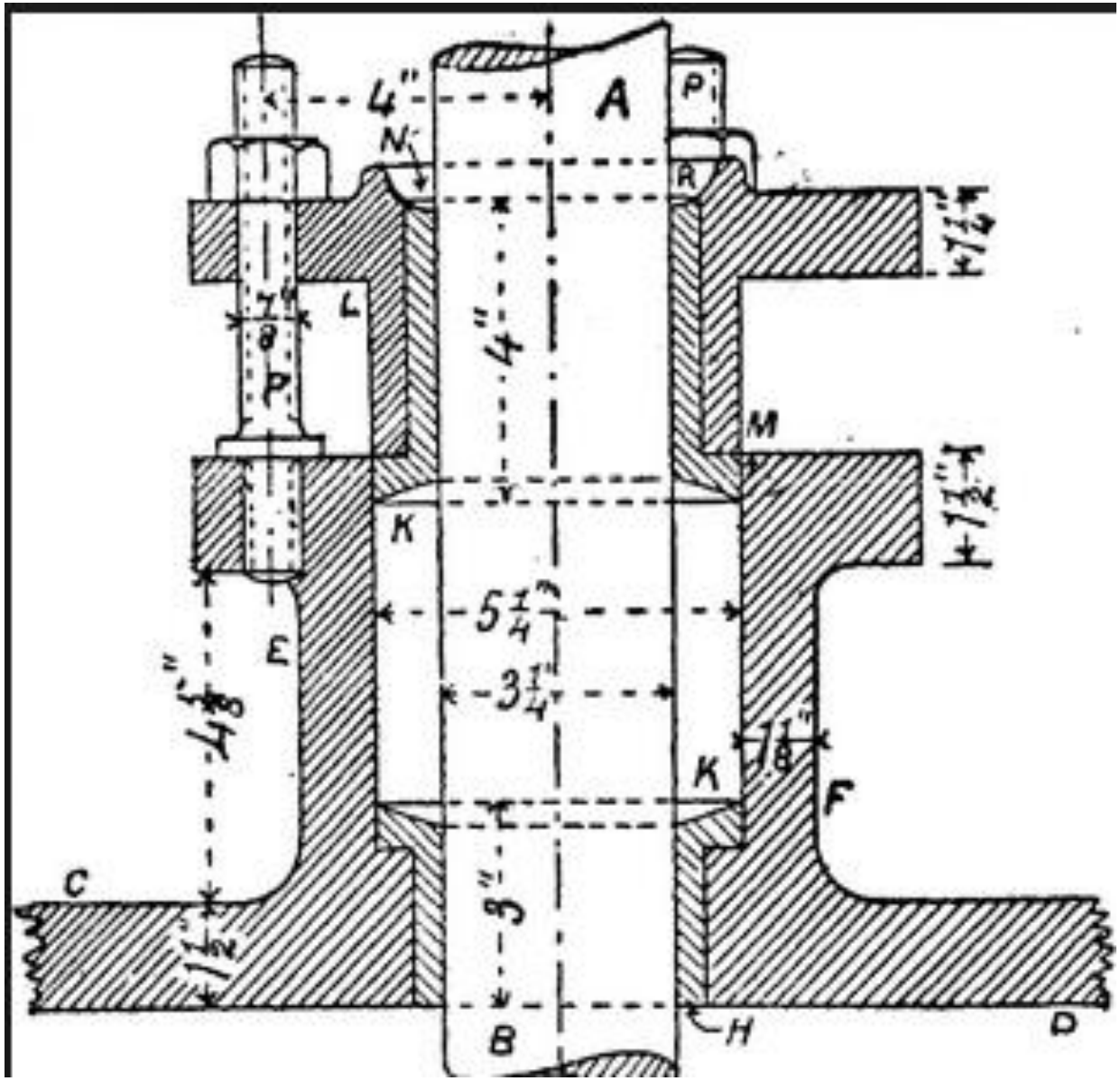


Stuffing Box

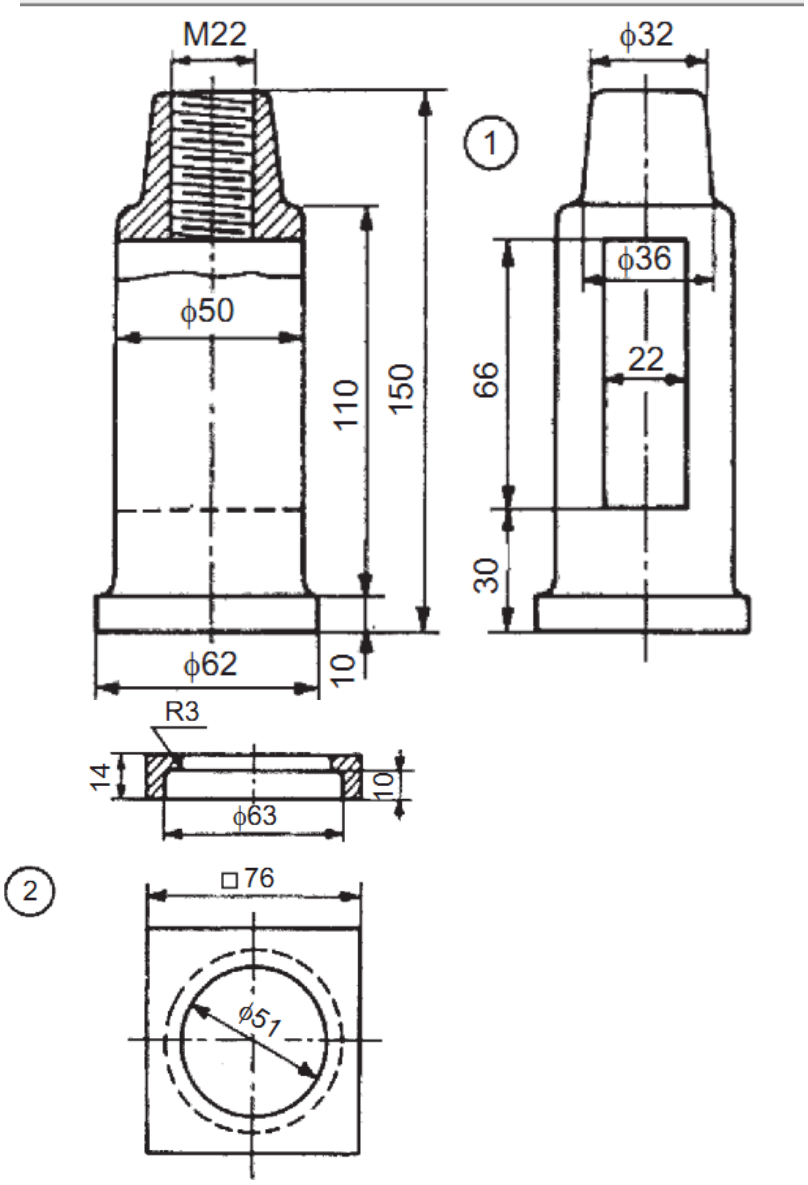
Parts list

Part No.	Name	Matl	Qty
1	Body	CI	1
2	Gland	Brass	1
3	Bush	Brass	1
4	Stud	MS	2
5	Nut, M12	MS	2



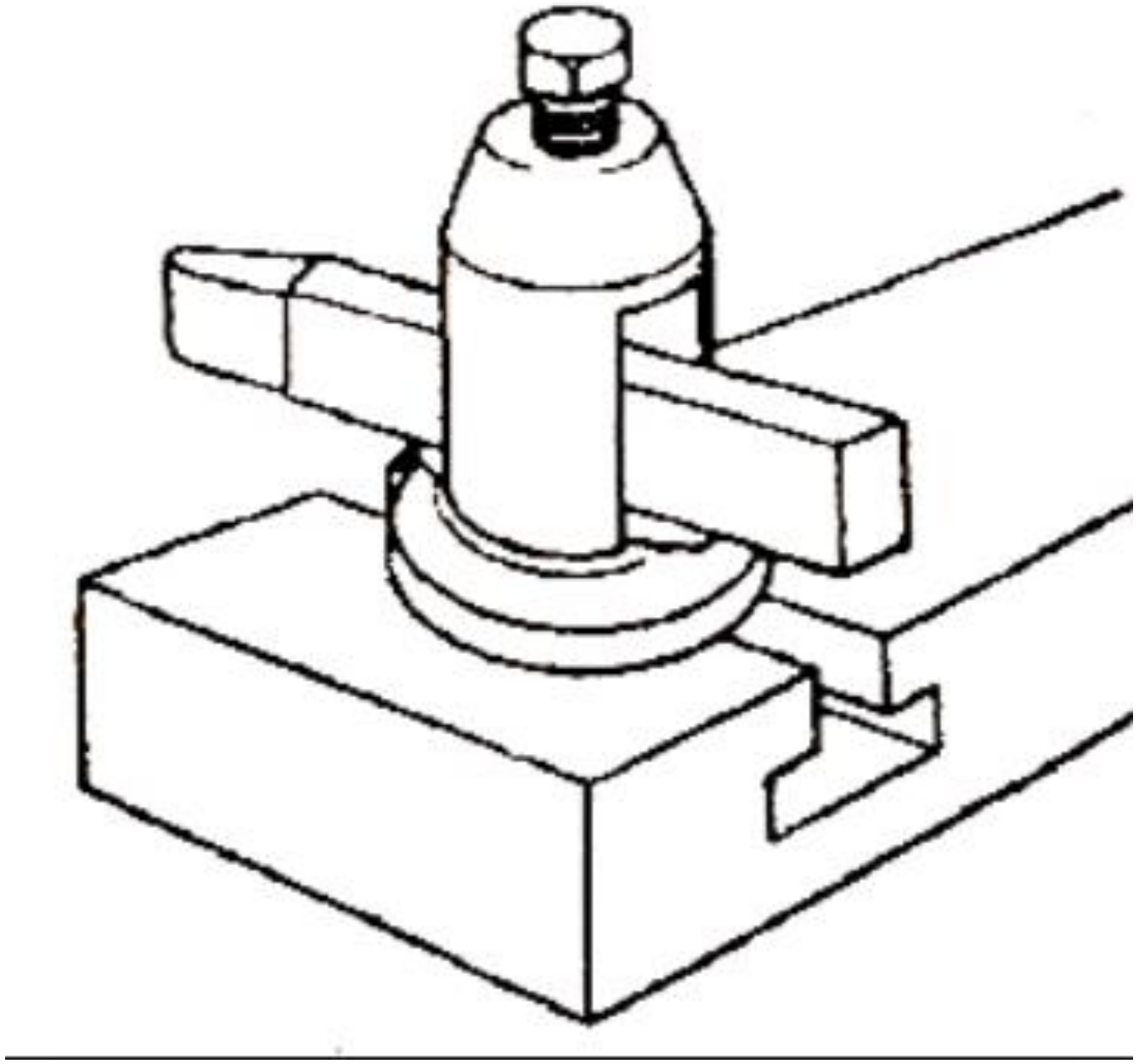

4"
A
P
N
R
L
P
4"
M
K
5 1/4"
E
3 1/4"
K
F
C
3"
B
H
D

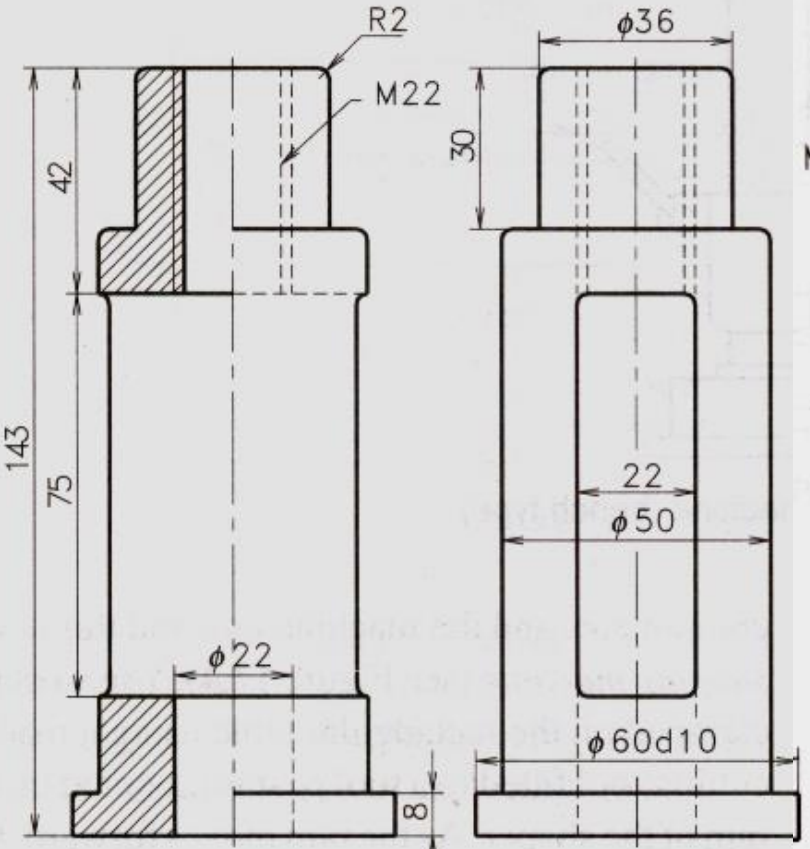
Lathe tool post



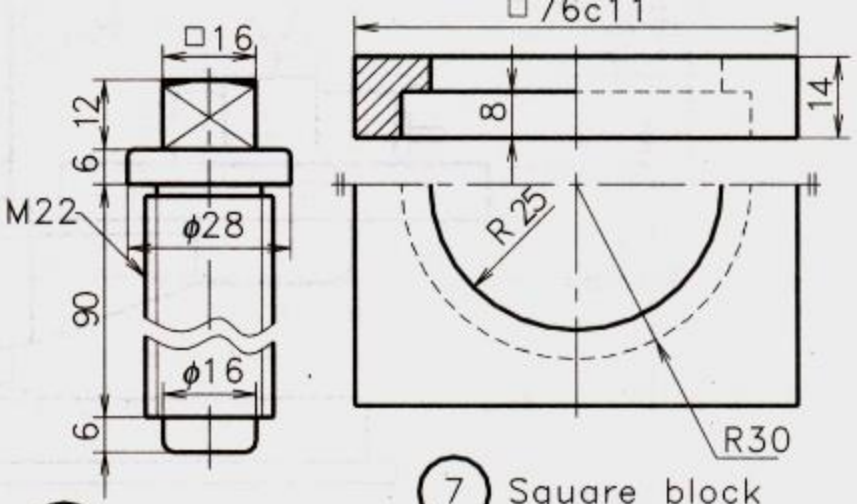
Parts list

No.	Name	Matl	Qty
1	Piller	MCS	1
2	Block	MCS	1
3	Ring	MS	1
4	Wedge	MCS	1
5	Screw	TS	1



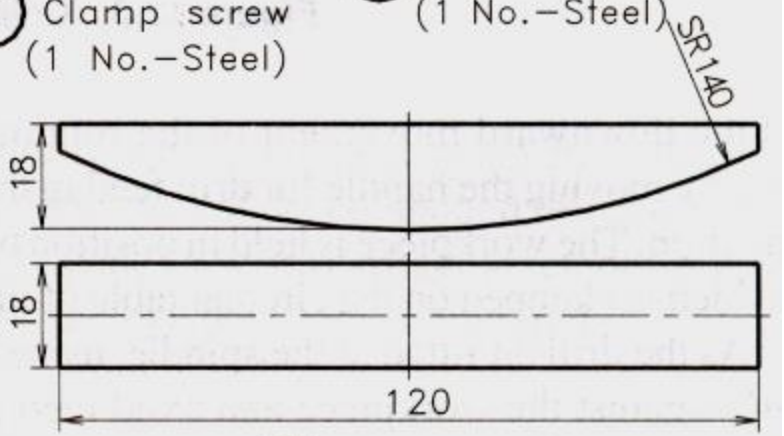


(1) Tool post (1 No.–Steel)

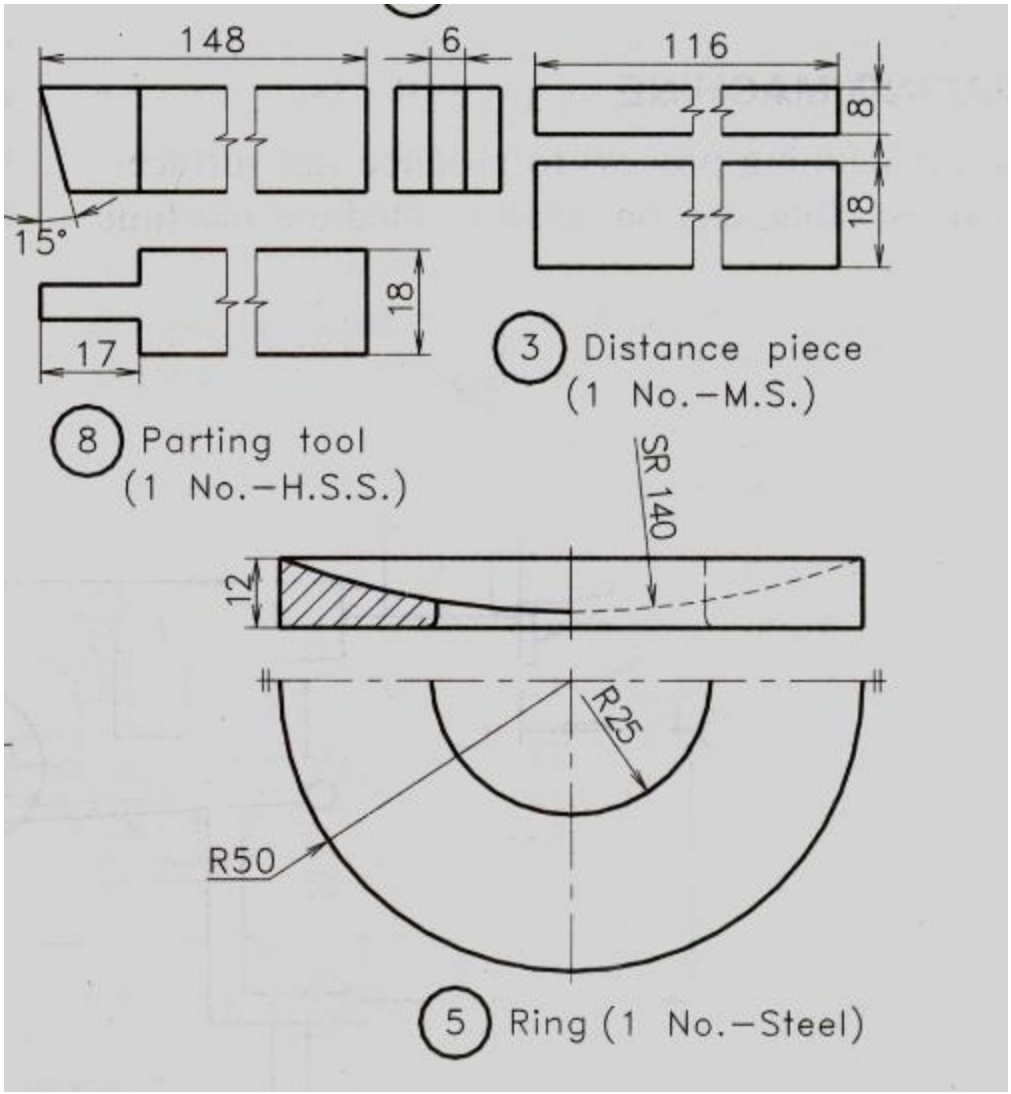


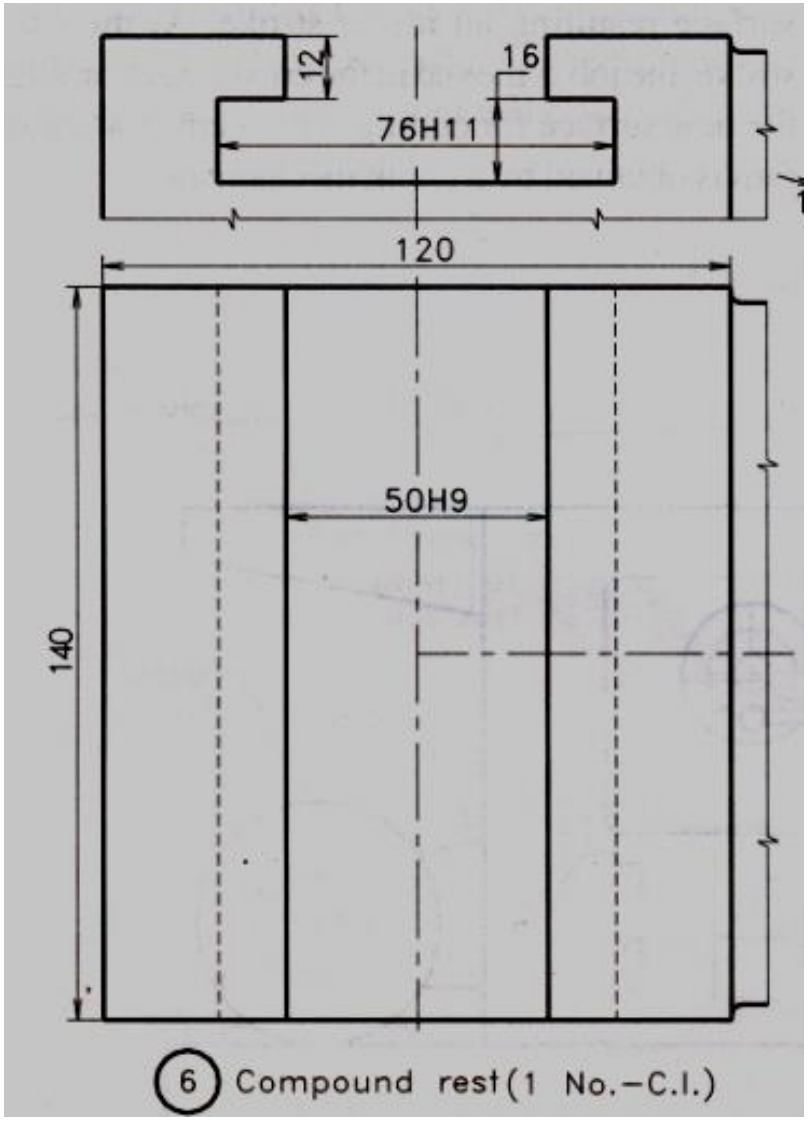
(2) Clamp screw (1 No.–Steel)

(7) Square block (1 No.–Steel)



(4) Wedge (1 No.–Steel)


148
6
116
8
18
15°
18
17
3 Distance piece
(1 No.–M.S.)
8 Parting tool
(1 No.–H.S.S.)
SR 140
12
R25
R50
5 Ring (1 No.–Steel)


12
16
76H11
120
50H9
140
6 Compound rest (1 No.–C.I.)

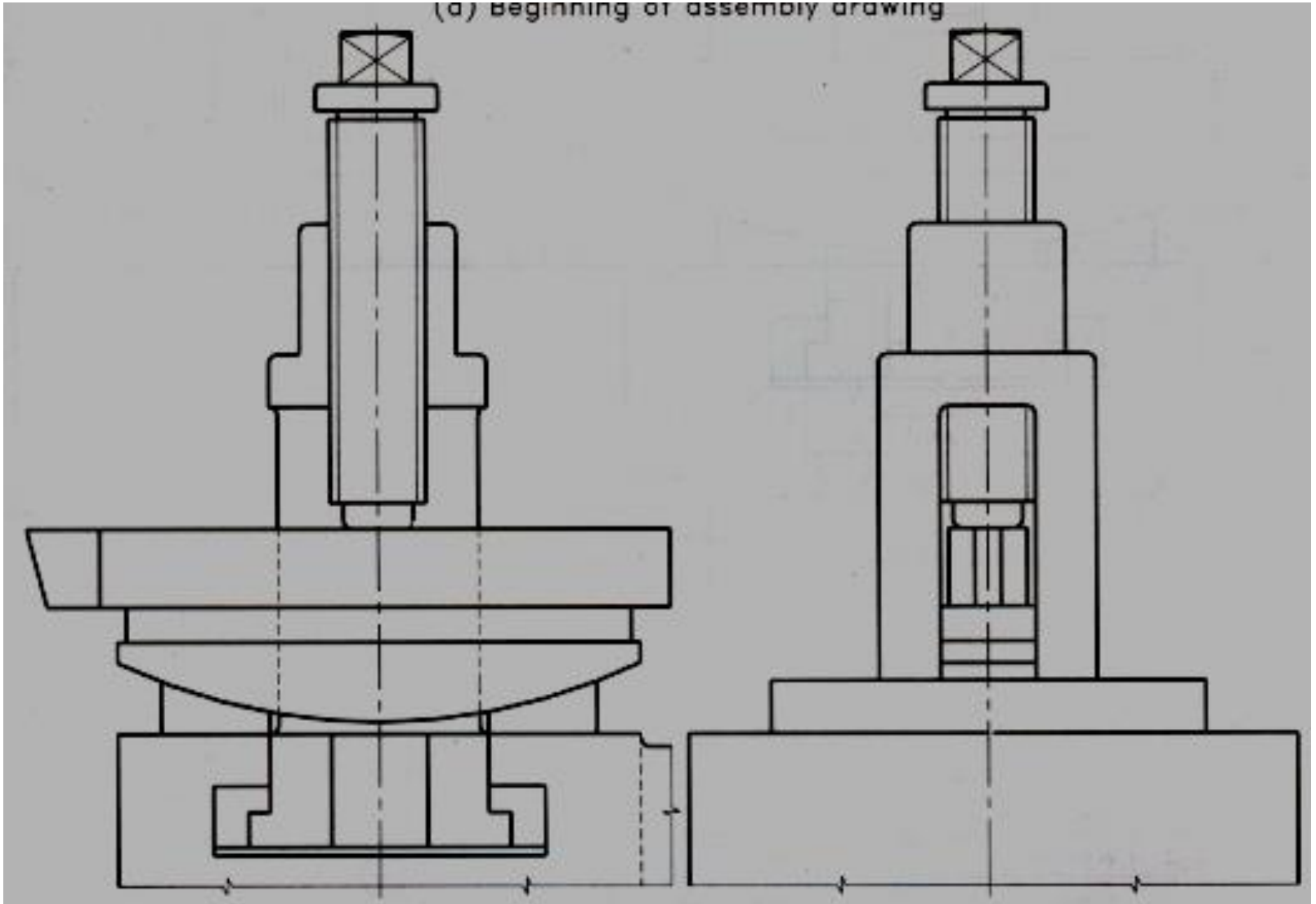
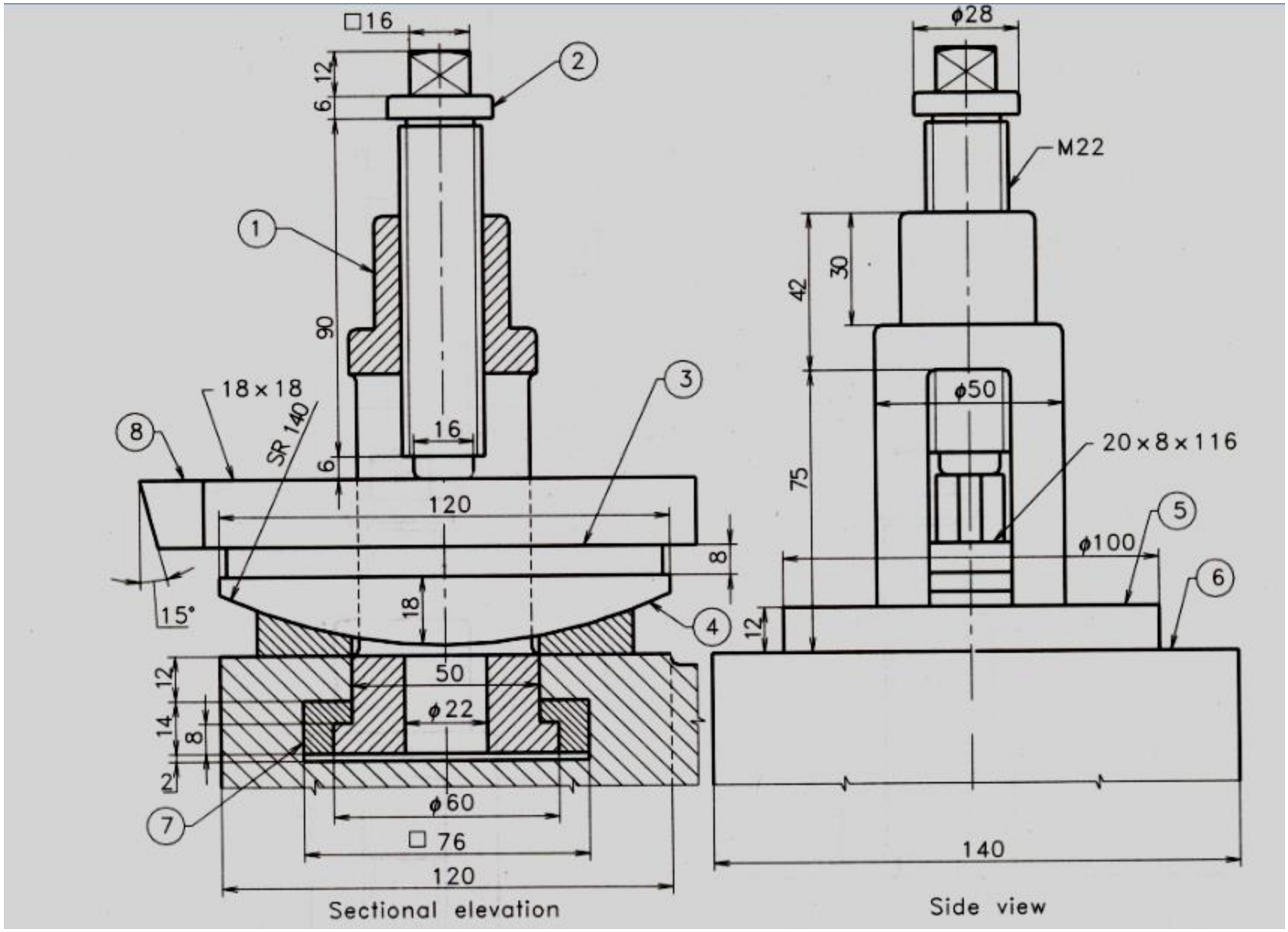
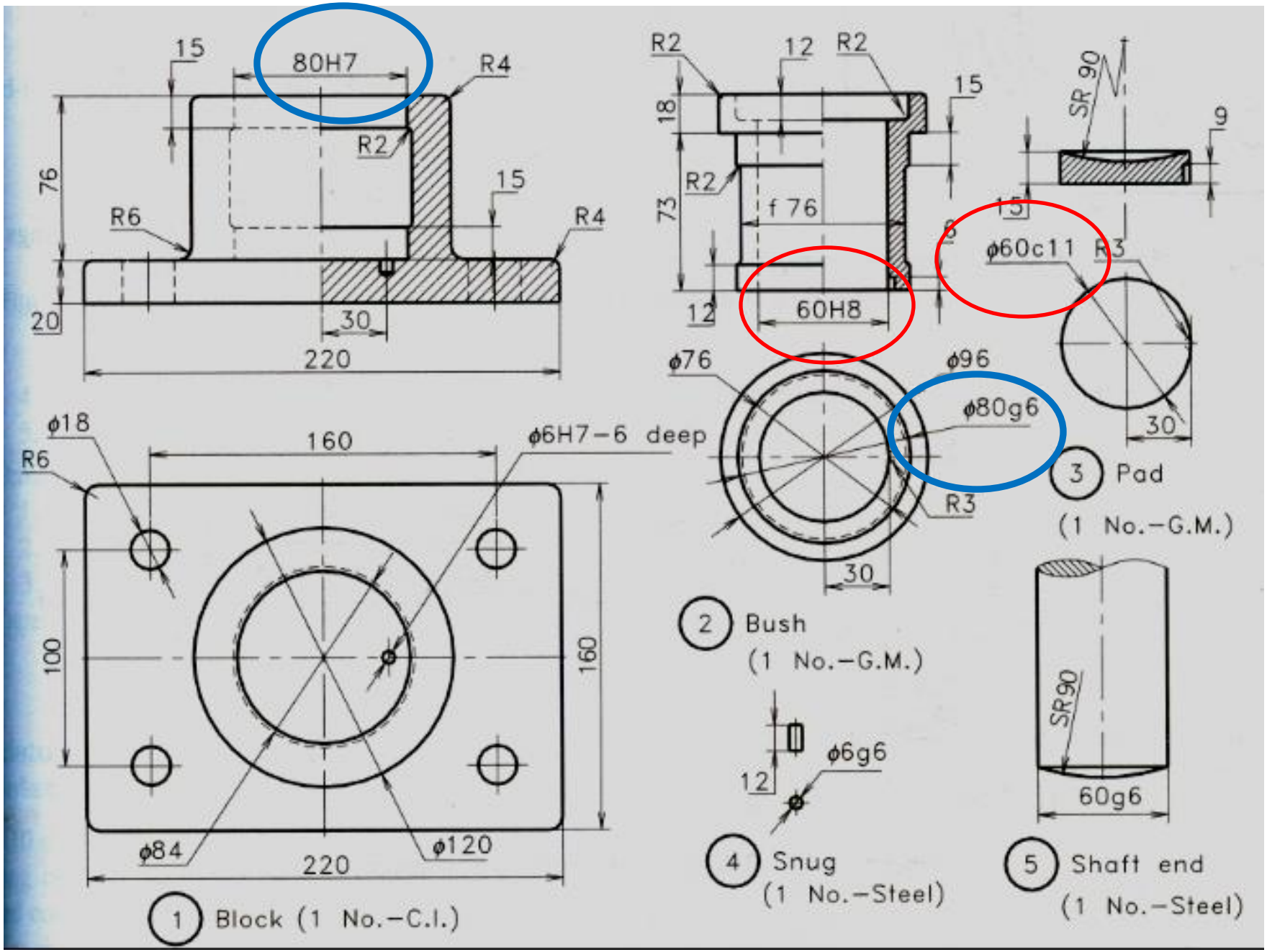


Figure 17.6 Lathe tool post (assembly steps).


□16
12
6
2
1
90
18×18
SR 140
8
3
16
6
120
8
15°
18
4
12
50
14
φ22
8
2
7
φ60
□76
120
Sectional elevation
φ28
M22
42
30
φ50
20×8×116
75
5
φ100
6
12
140
Side view



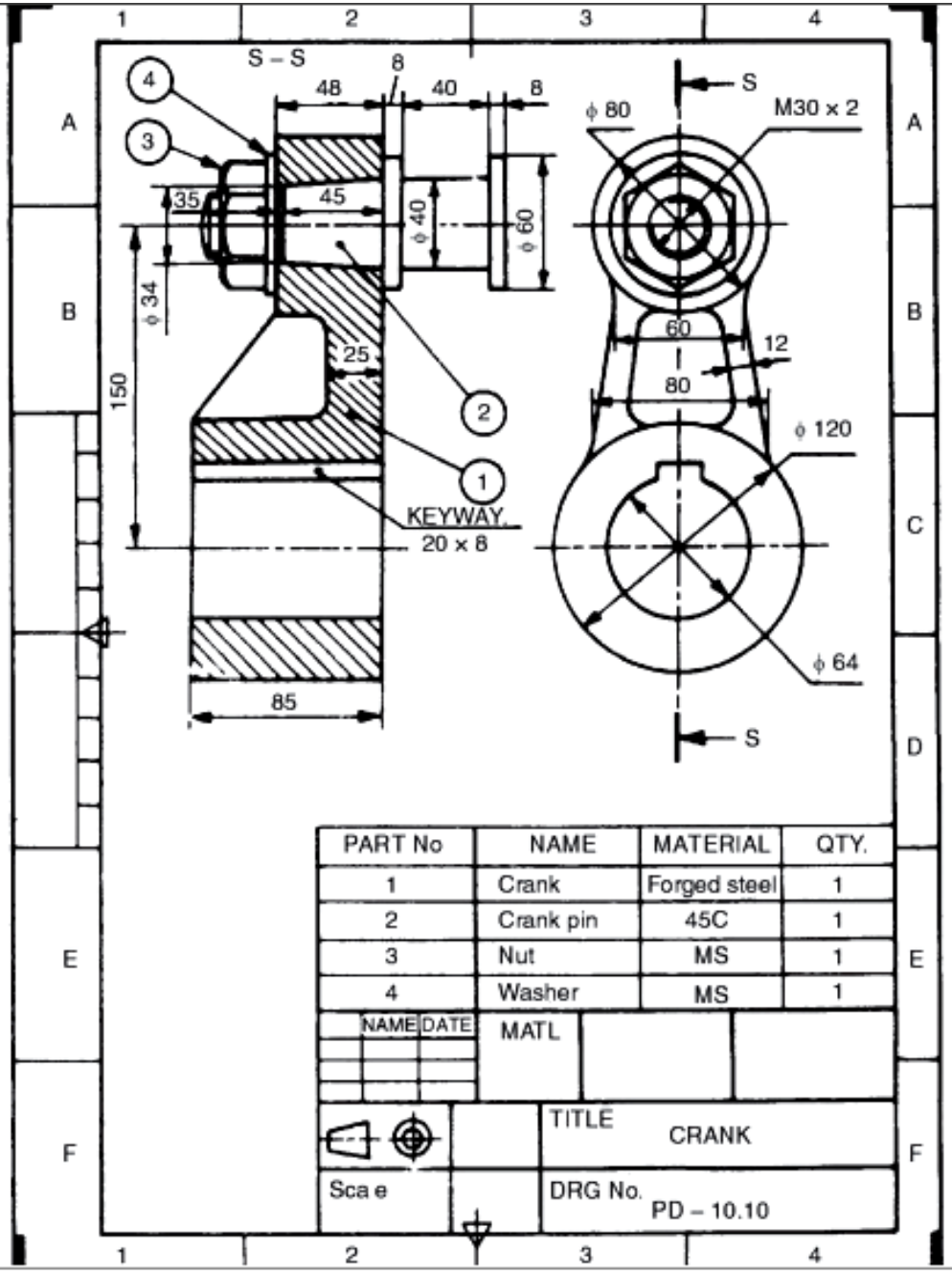
Foot-Step Bearing

Other Important assembly

- Plummer block
- Bench Vice
- Screw Jack
- Lathe Tail-Stock
- Engine Connecting Rod
- Cross Head
- Steam engine Connecting rod end
- Feed-check valve
- Stuffing box
- Tool post
- Cross head
- Foot-step bearing

Assembly Drawing cont…

- **Working assembly drawings** are normally made for simple machines, comprising small number of parts. Each part is completely dimensioned to facilitate easy fabrication.



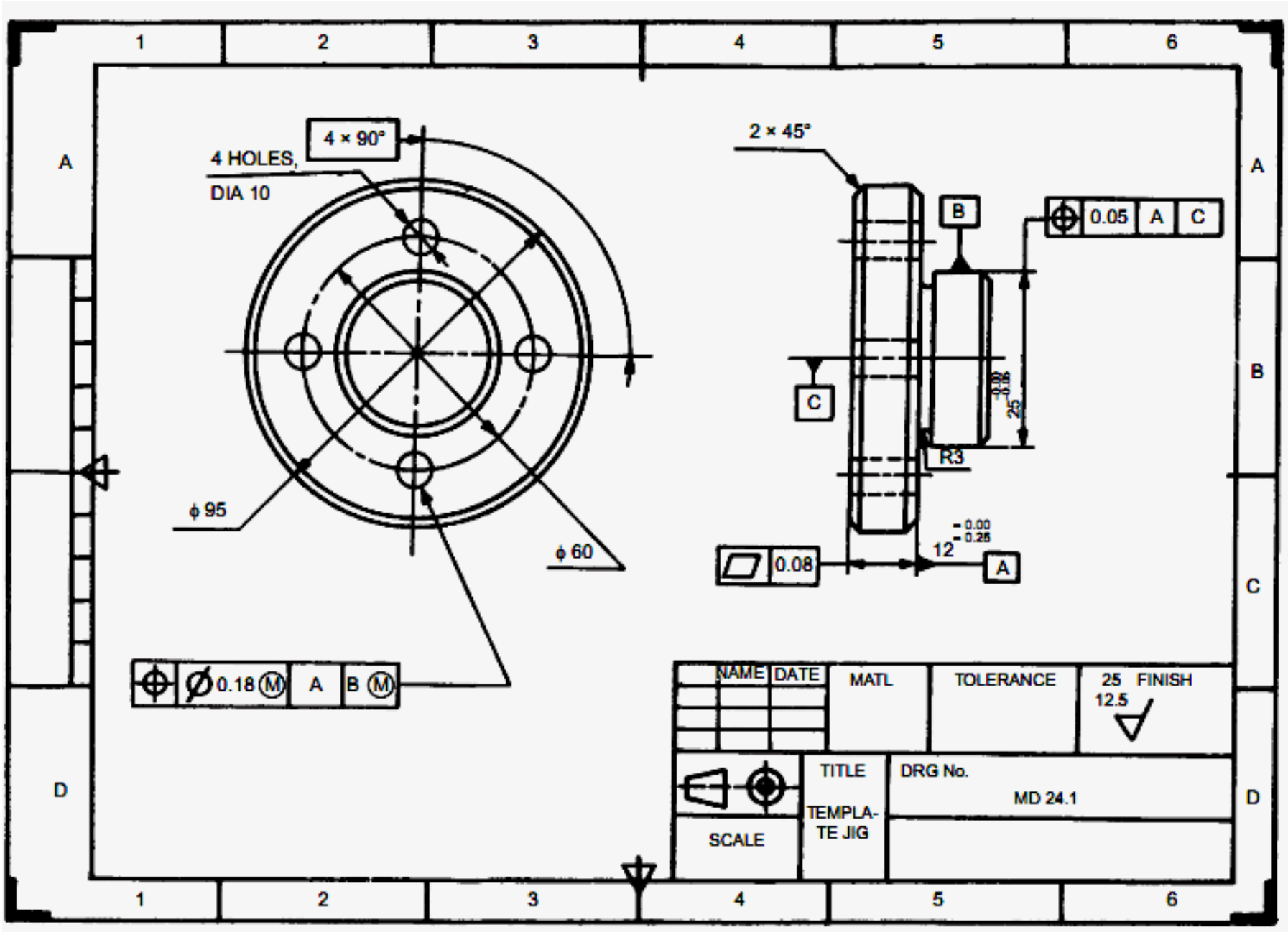
PART No	NAME	MATERIAL	QTY.
1	Crank	Forged steel	1
2	Crank pin	45C	1
3	Nut	MS	1
4	Washer	MS	1

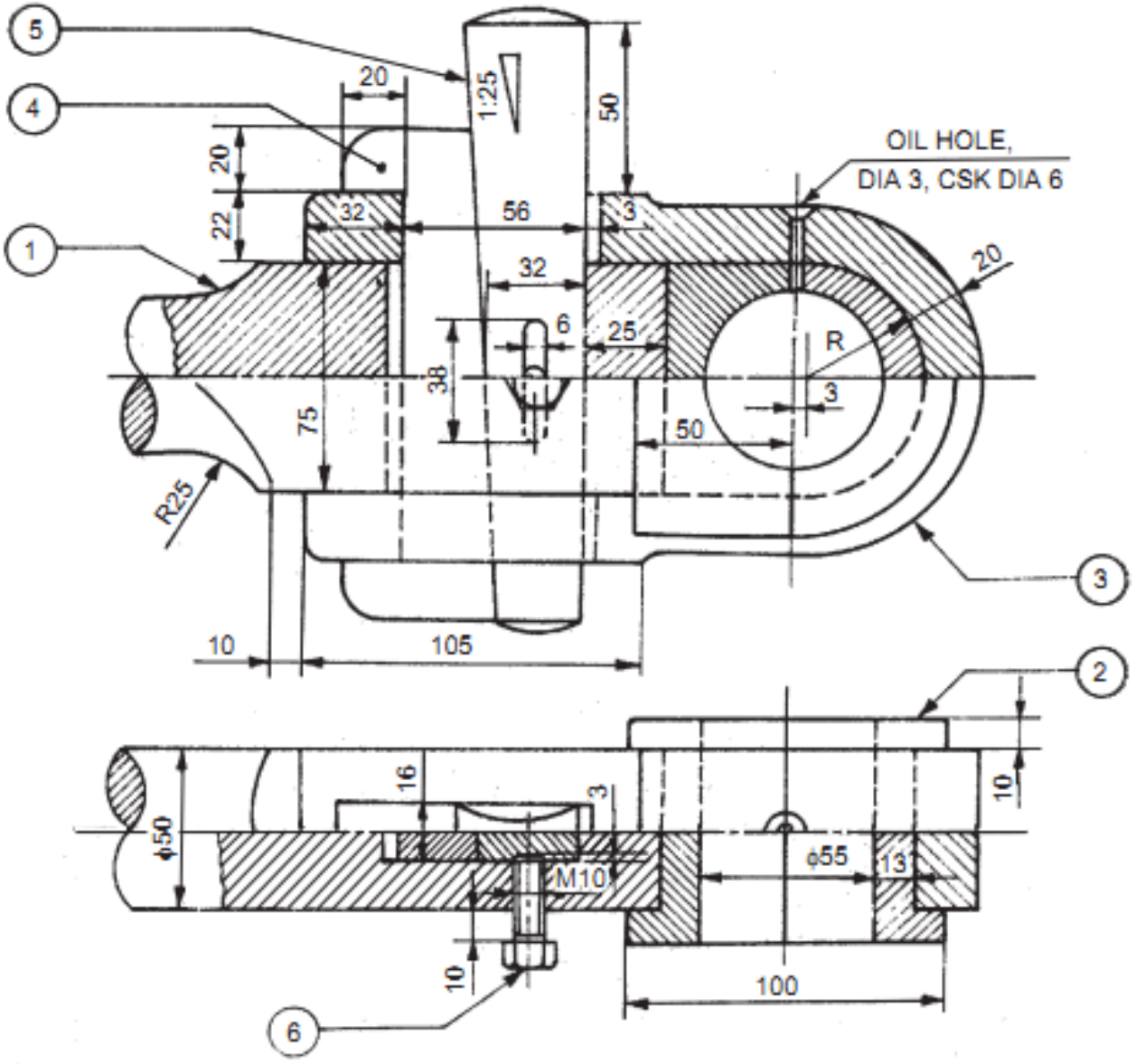
NAME	DATE	MATL		

	TITLE CRANK
Sca e	DRG No. PD – 10.10

Production Drawing

- A **production drawing**, also known as working drawing, supplies information and instructions for the manufacture or construction of machines or structures.
- It should provide all the **dimensions, limits, special finishing processes**, **surface quality**, etc.
- The particulars of material, etc., are given in the title block


1
2
3
4
5
6
A
B
C
D
4 × 90°
4 HOLES,
DIA 10
ϕ 95
ϕ 60
Ø 0.18 M A B M
2 × 45°
B
0.05 A C
C
25 -0.00 -0.28
R3
0.08
12 -0.00 -0.28
A
NAME
DATE
MATL
TOLERANCE
25 FINISH
12.5
TITLE
TEMPLA-
TE JIG
DRG No.
MD 24.1
SCALE


5
4
1
20
1:25
50
20
22
32
56
3
OIL HOLE,
DIA 3, CSK DIA 6
32
6
25
20
R
38
3
75
50
R25
3
10
105
2
16
3
10
ϕ50
M10
ϕ55
13
10
100
6