



Introduction

Indian Institute of Technology Mandi

Graphics for Design



Syllabus

1. Importance of engineering drawing; Drawing techniques
2. Manual drawing instruments and their uses – Drawing board; Mini-drafter; Set squares; Drawing instrument box; Scales; Protractor; French curves; Drawing papers; Drawing pencils; Eraser; Drawing pins/clips; Sand paper block; Duster.
3. Conventions - ISO and BIS; Layout of drawing sheets; Border lines; Title block; Folding of drawing sheets; Lines, lettering and dimensioning.
4. Scales – Plane, diagonal and vernier
5. Curves used in engineering practice:
6. Orthographic projection – Theory of projection

7. Projection of points

8. Projection of straight lines

9. Projection of planes

10. Projection of solids

11. Auxiliary projections

12. Sections of solids

13. Development of surfaces

14. Intersections of solids

15. Isometric projections

Books/References

Dhananjay A Jolhe, Engineering drawing, TMH,

**M.B. Shah and B.C. Rana, Engineering Drawing, Pearsonson,
2009.**

**N D Bhatt and V M Panchal, Engineering Drawing, Charator Publishing
House,**

ENGINEERING DRAWING

Graphical means of expression of technical details without the barrier of a language.

Universal language for Engineers

What will you learn from this course?

How to communicate technical information.

- **Visualization** – the ability to mentally understand visual information.
- **Graphics theory** – geometry and projection techniques used for preparation of drawings.
- **Standards** – set of rules for preparation of technical drawings. **Conventions** – commonly accepted practices in technical drawings.
- **Tools** – devices used to create technical drawings and models.
- **Applications** – the various uses for technical drawings.

Graphic language: mode of communication through SKETCHES

Drawing: graphical representation of an OBJECT

Engineering Drawing

Drawing of an object contains all the necessary information, required for the construction/fabrication of the object, like

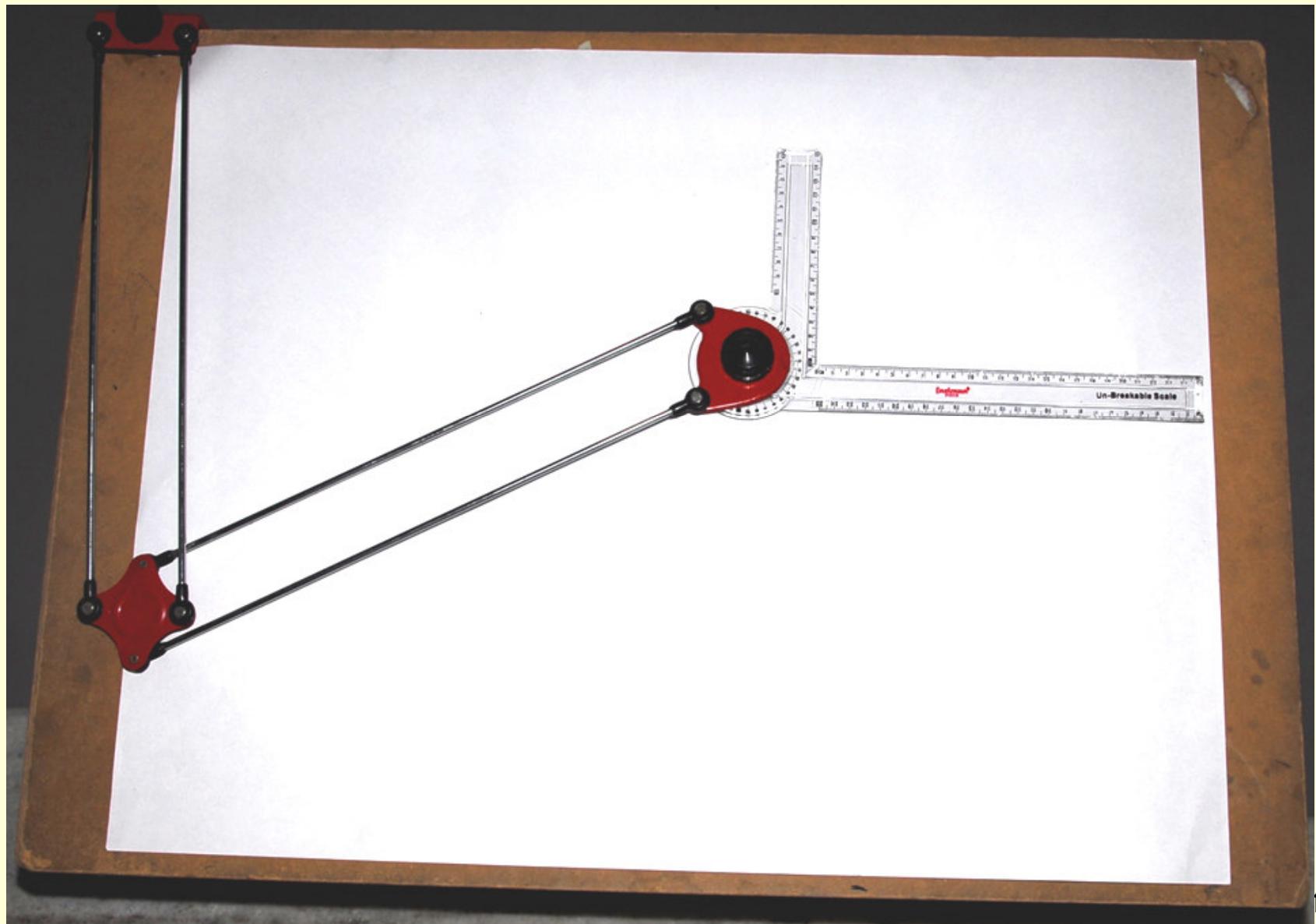
- actual shape,
- accurate sizes,
- manufacturing methods,
- materials to be used etc.,

List of tools required for the drawing practice session

Sl. No.	Item	Quantity
1	Mini-drafter (or T-Square)	1
2	Engineering Drawing Box	1
3	French curves	1 set
4	Set-square	1 set
5	Protractor	1
6	Drawing Clip	1 set
7	Lead pencil/clutch pencil	2-3
8	Lead (HB, H & 2H)	1 each set
9	Eraser	1
10	Sand paper/cello tape	1
11	Blade / pencil sharpener	1
12	Drawing Sheet	1 per session

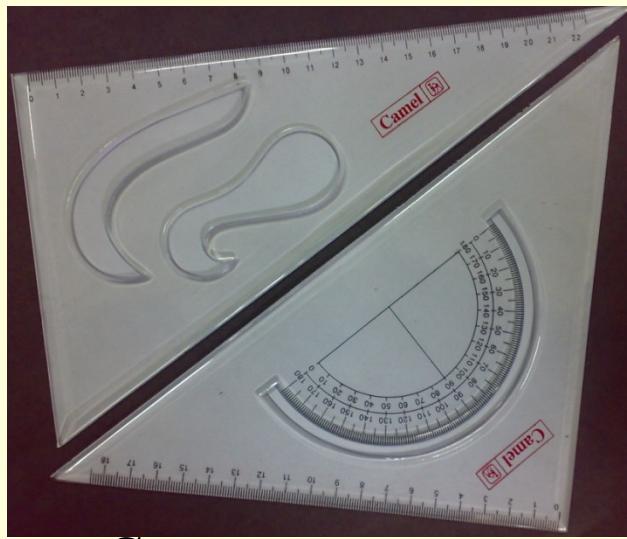
- Students without Engineering Drawing Box will not be allowed to attend the practical session.
- School Instrument box is not allowed.

Mini-drafter

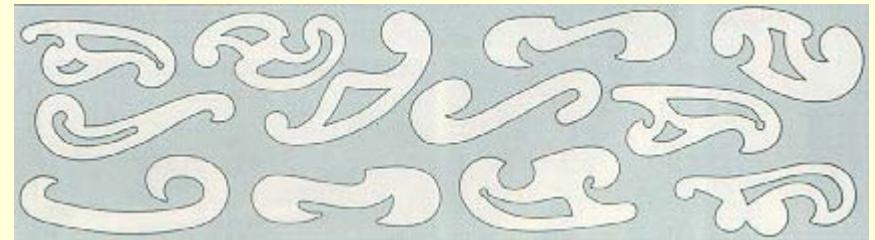




Mini-drafter fixed on a drawing table



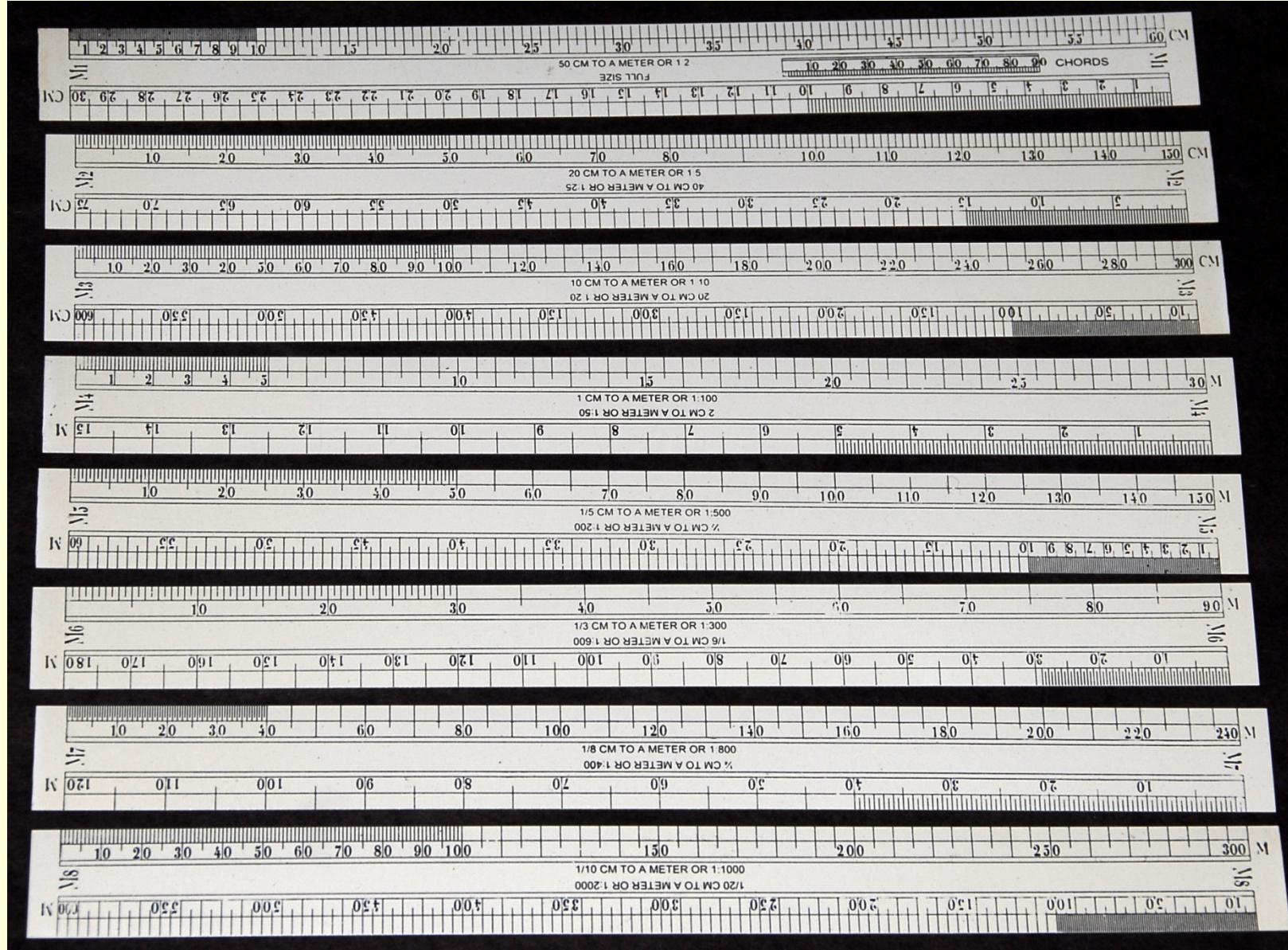
Set-square



Drawing Clips



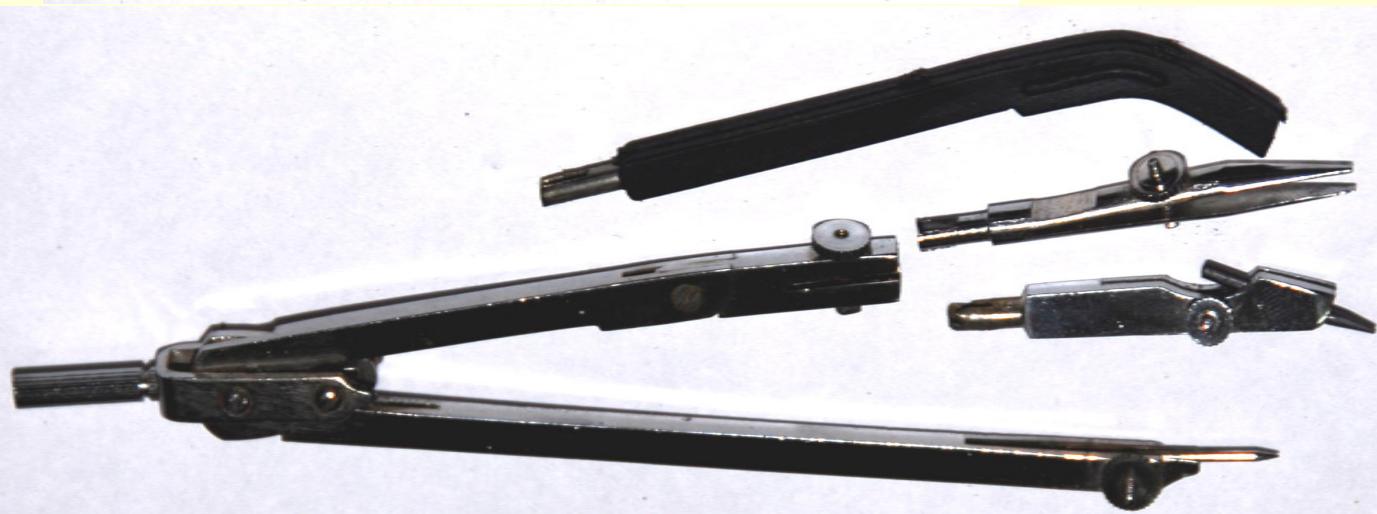
French Curves



Scale set



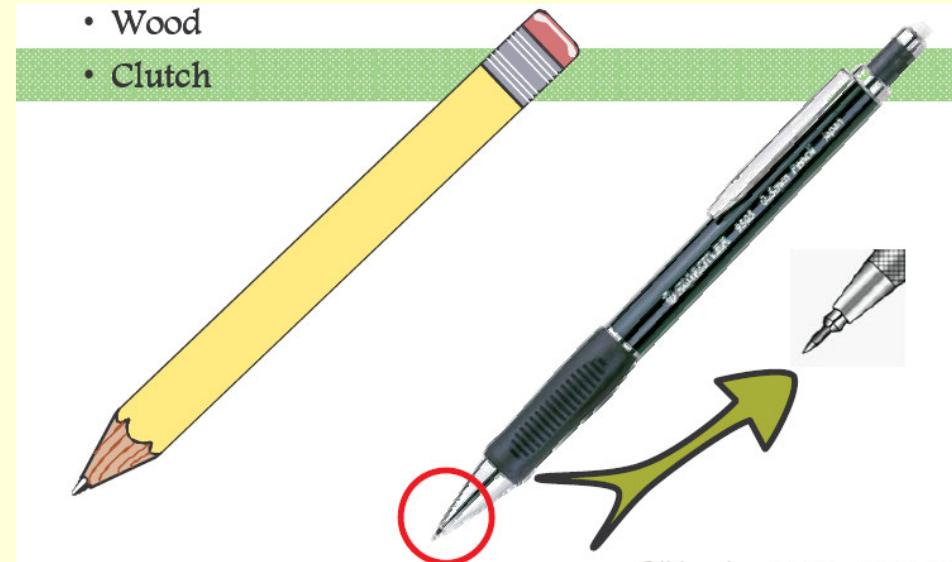
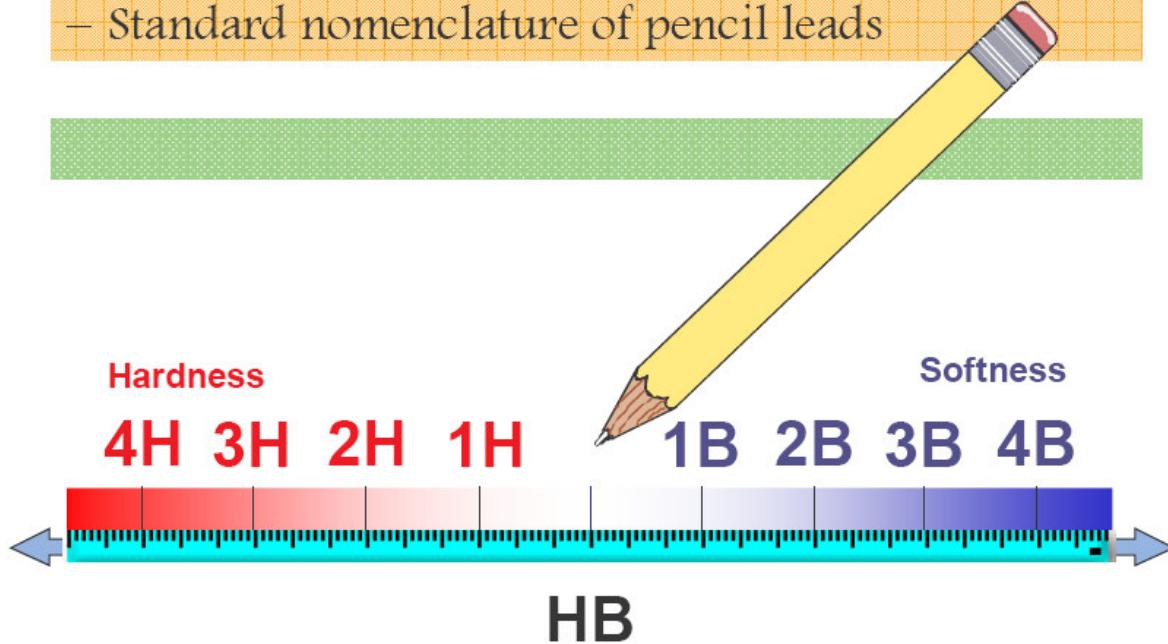
Engineering Drawing Box



Pencils

- Pencil Lead

- Standard nomenclature of pencil leads



Dimensions of Engineer's Drawing Boards

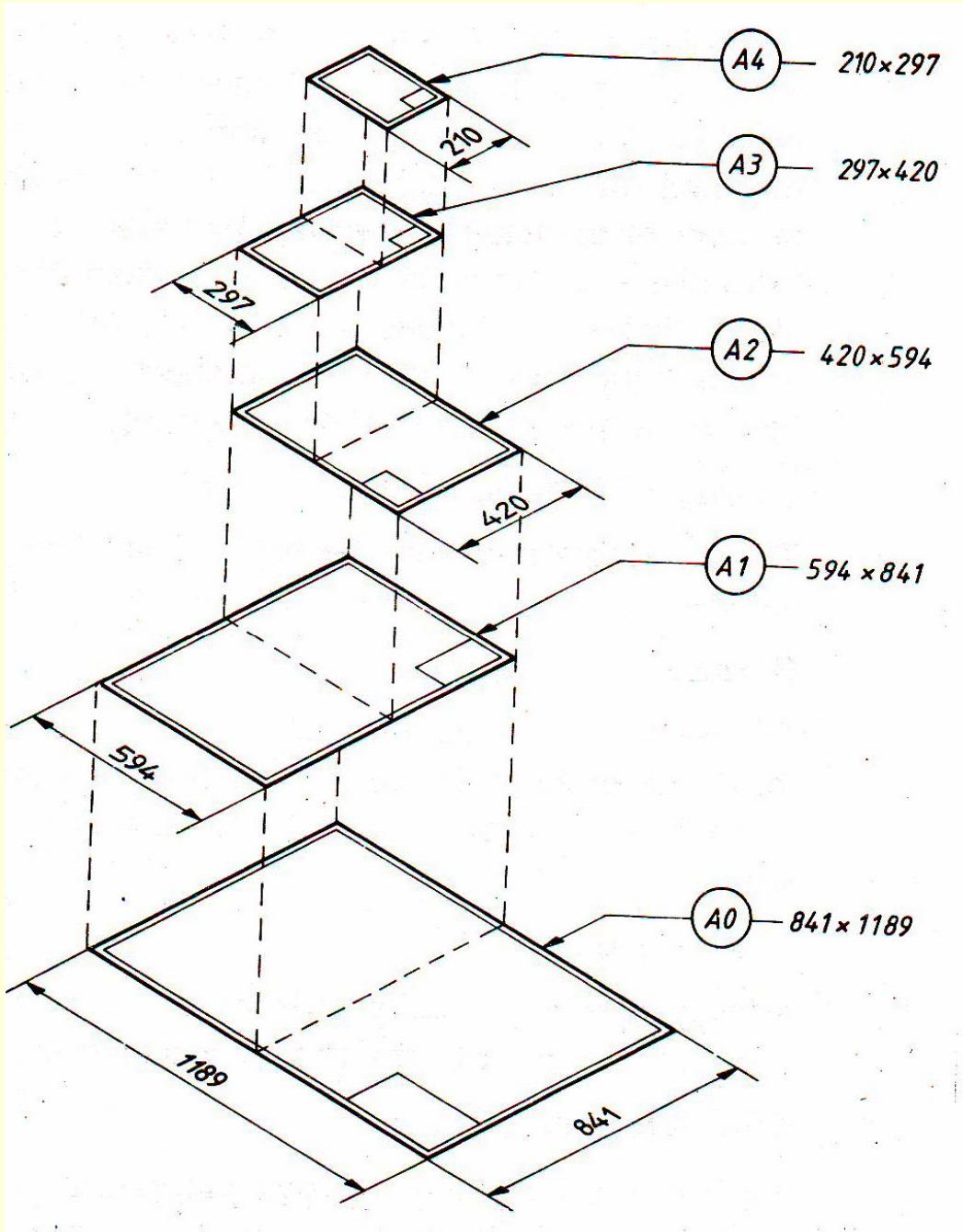
Designation	Length x Width (mm)	Recommended for use with sheet sizes
D0	1500 x 1000	A0
D1	1000 x 700	A1
D2	700 x 500	A2
D3	500 x 500	A3

D0 and D1 for drawing offices, for students use – D2

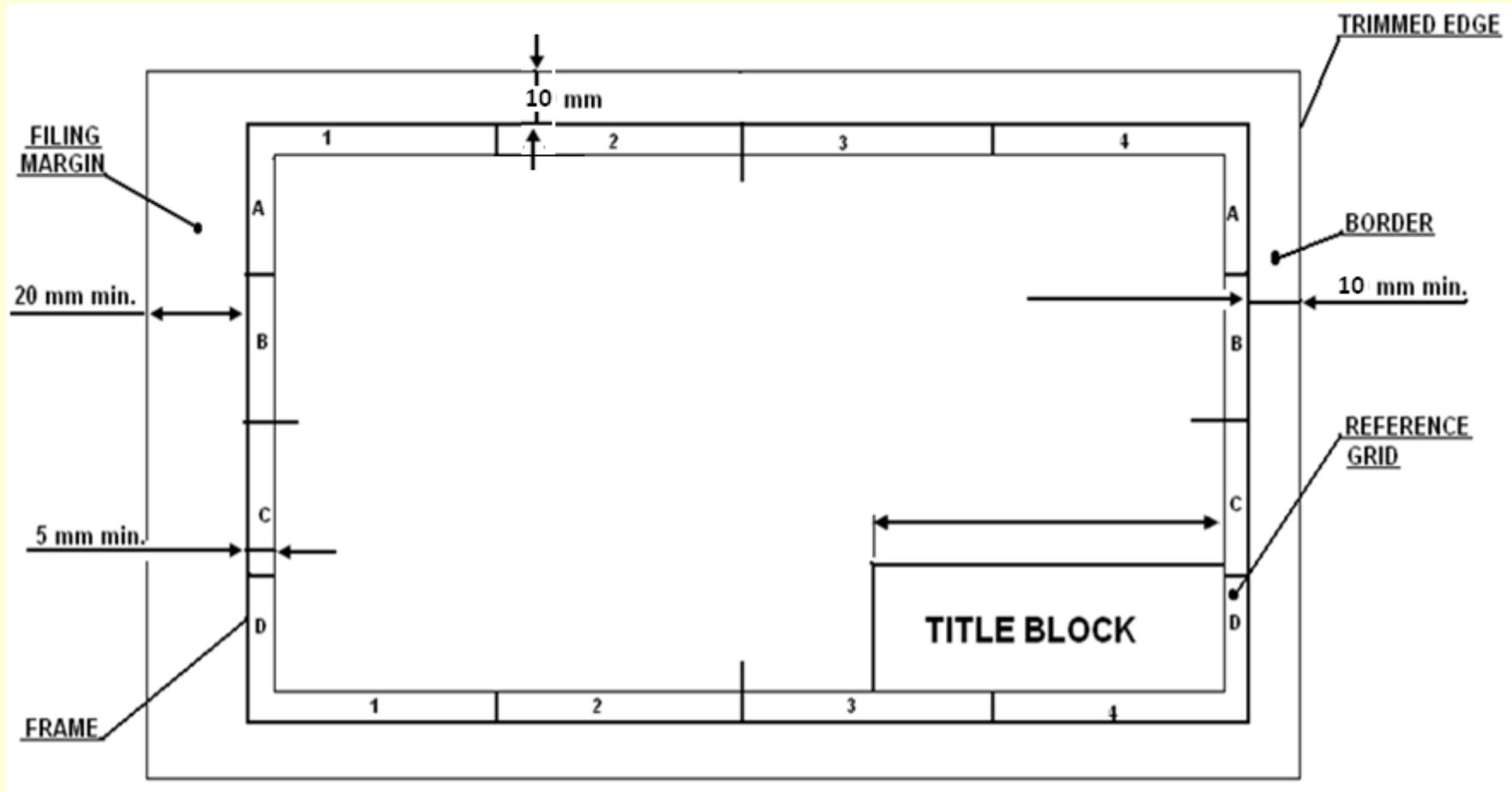
Standard sizes of drawing sheets as per BIS

Designation	Size (mm)
A0	841 x 1189
A1	594 x 841
A2	420 x 594
A3	297 x 420
A4	210 x 297

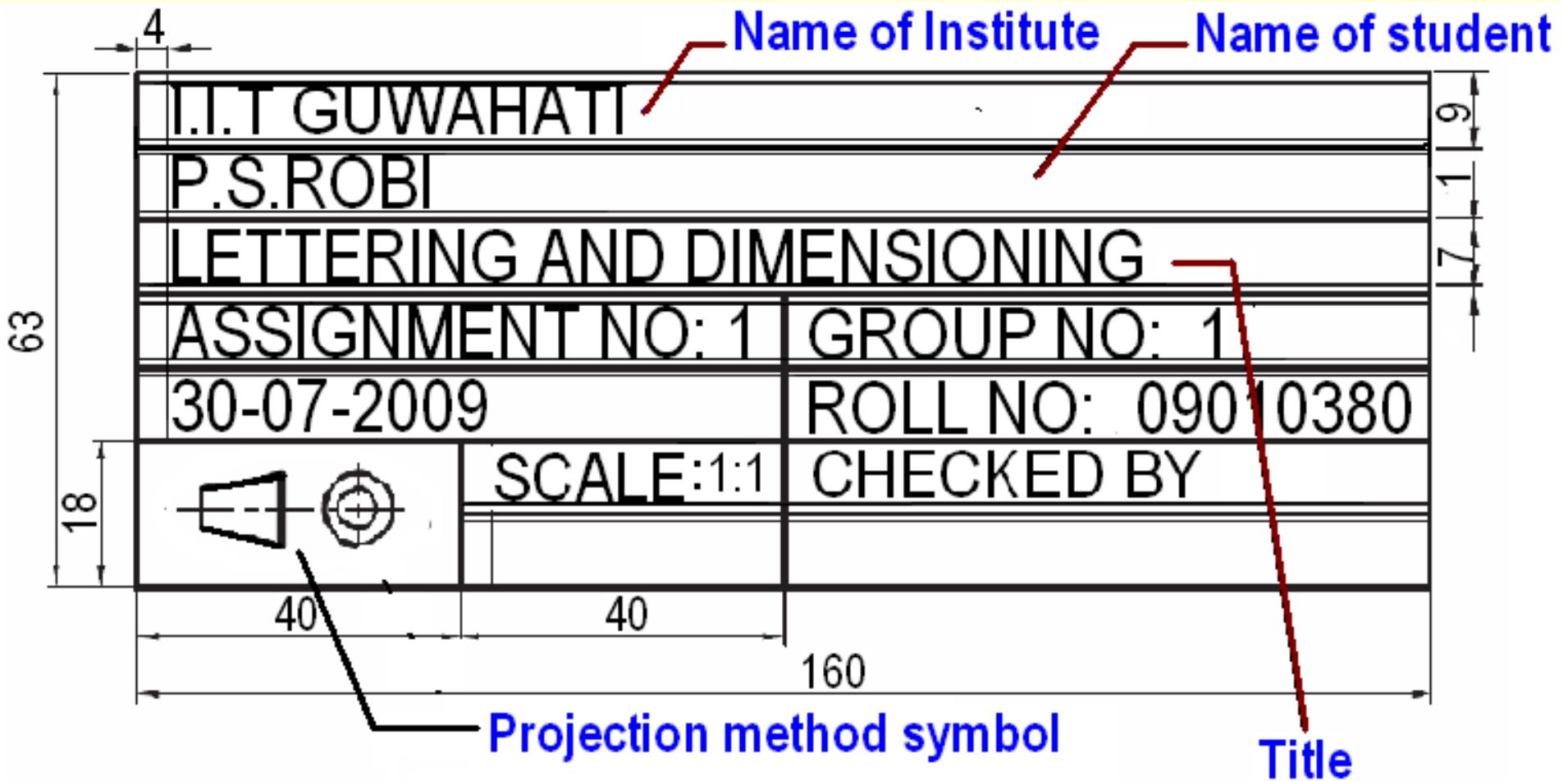
Drawing Sheet Sizes



Drawing sheet Layout



Title Block



LINES AND LETTERING*

LINES

Lines are the basic feature of a drawing. A line may be straight, curved, continuous, segmented, thin, thick, etc., each having its own specific sense.

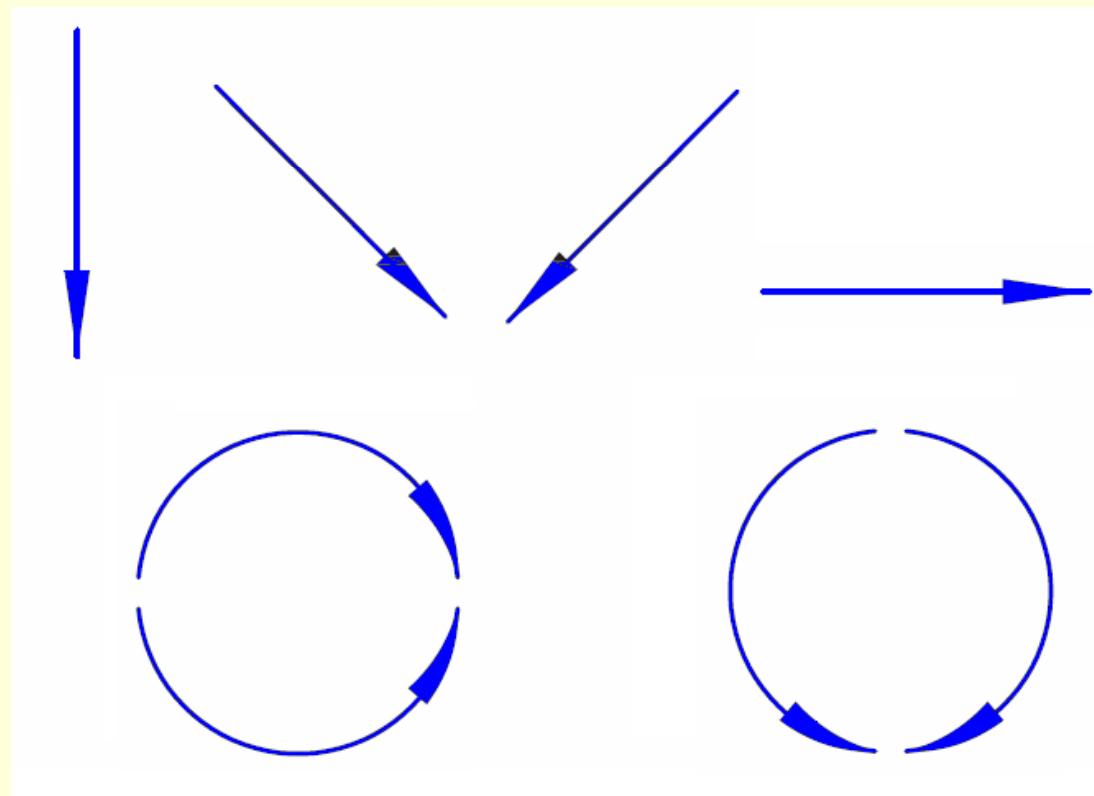
Line strokes refer to the directions of drawing straight and curved lines

***standard given in BIS : SP-46, 2003**

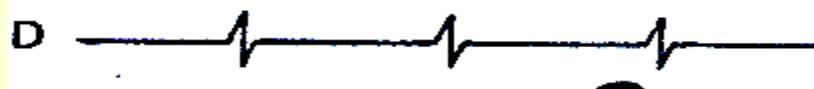
Available in //intranet.iitg.ernet.in/bis.asp/start.shtml

Line Strokes

Vertical and inclined lines are drawn from top to bottom, horizontal lines are drawn from left to right. Curved lines are drawn from left to right or top to bottom.



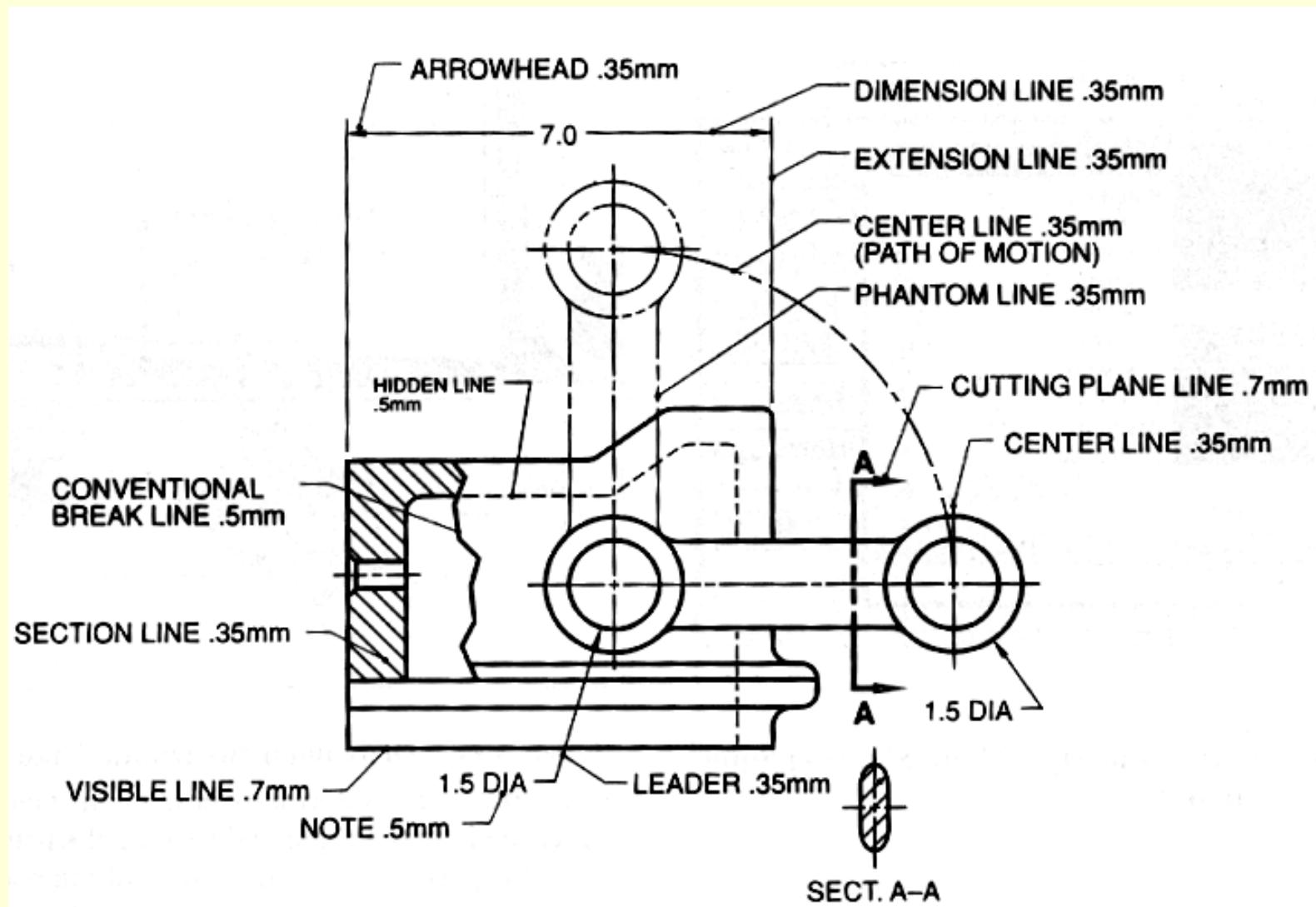
Line types

Illustration	Application
Thick 	Outlines, visible edges, surface boundaries of objects, margin lines
Continuous thin 	Dimension lines, extension lines, section lines leader or pointer lines, construction lines, boarder lines
Continuous thin wavy 	Short break lines or irregular boundary lines – drawn freehand
Continuous thin with zig-zag 	Long break lines
Short dashes, gap 1, length 3 mm 	Invisible or interior surfaces

Line types

Illustration	Application
Short dashes 	Center lines, locus lines Alternate long and short dashes in a proportion of 6:1,
Long chain thick at end and thin elsewhere 	Cutting plane lines
Continuous thick border line 	Border

Uses of different types of lines in a given drawing



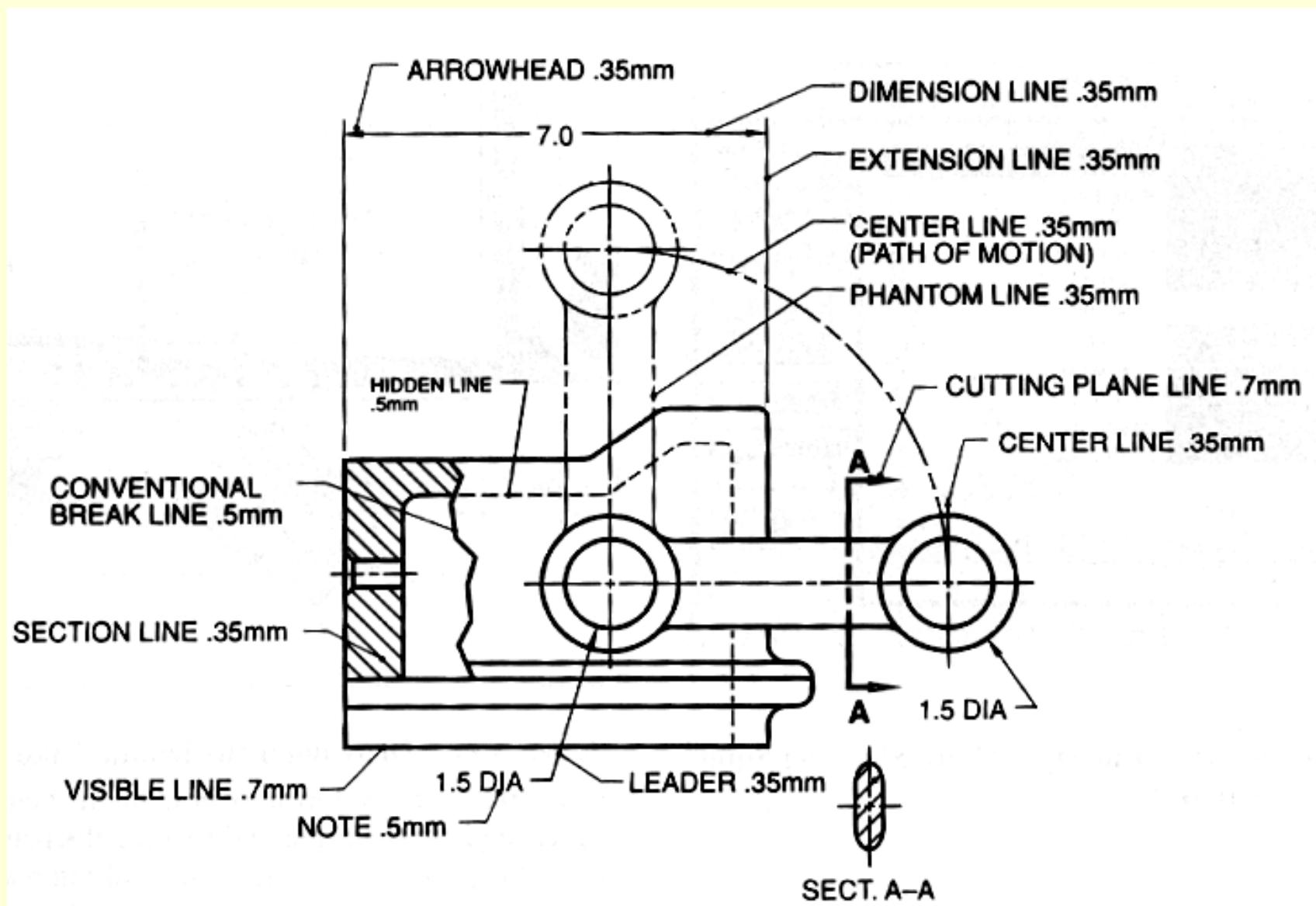
Units of Measurement

- **International systems of units (SI) – which is based on the meter.**
- **Millimeter (mm) - The common SI unit of measure on engineering drawing.**
- **Individual identification of linear units is not required if all dimensions on a drawing are in the same unit (mm).**
- **The drawing shall however contain a note: ALL DIMENSIONS ARE IN MM. (Bottom left corner outside the title box)**

Dimensioning

- Indicating on a drawing, the size of the object and other details essential for its construction and function, using lines, numerals, symbols, notes, etc.
- Dimensions indicated on a drawing should be those that are essential for the production, inspection and functioning of the object.
- Dimensions indicated should not be mistaken as those that are required to make the drawing of an object.

An example



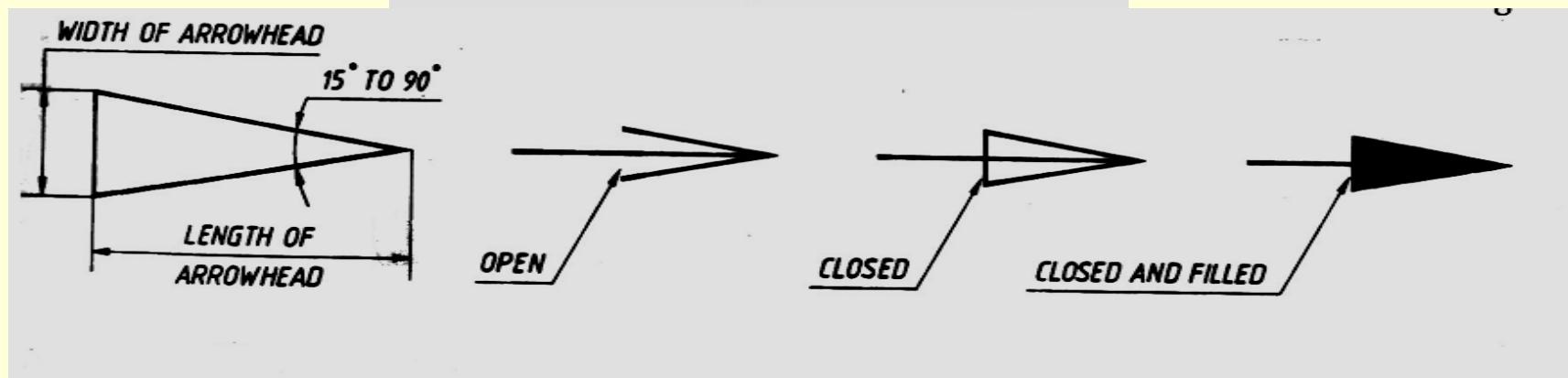
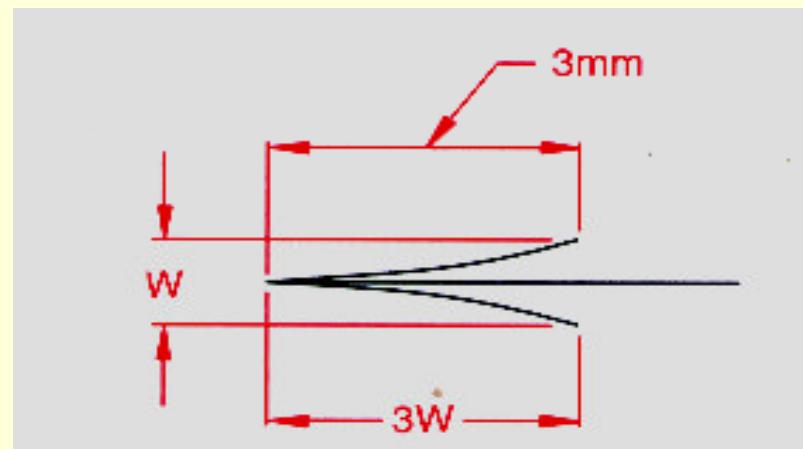
- **Extension line** – a thin, solid line perpendicular to a dimension line, indicating which feature is associated with the dimension.
- **Visible gap** – there should be a visible gap of **1.5 mm** between the feature's corners and the end of the extension line.

Leader line

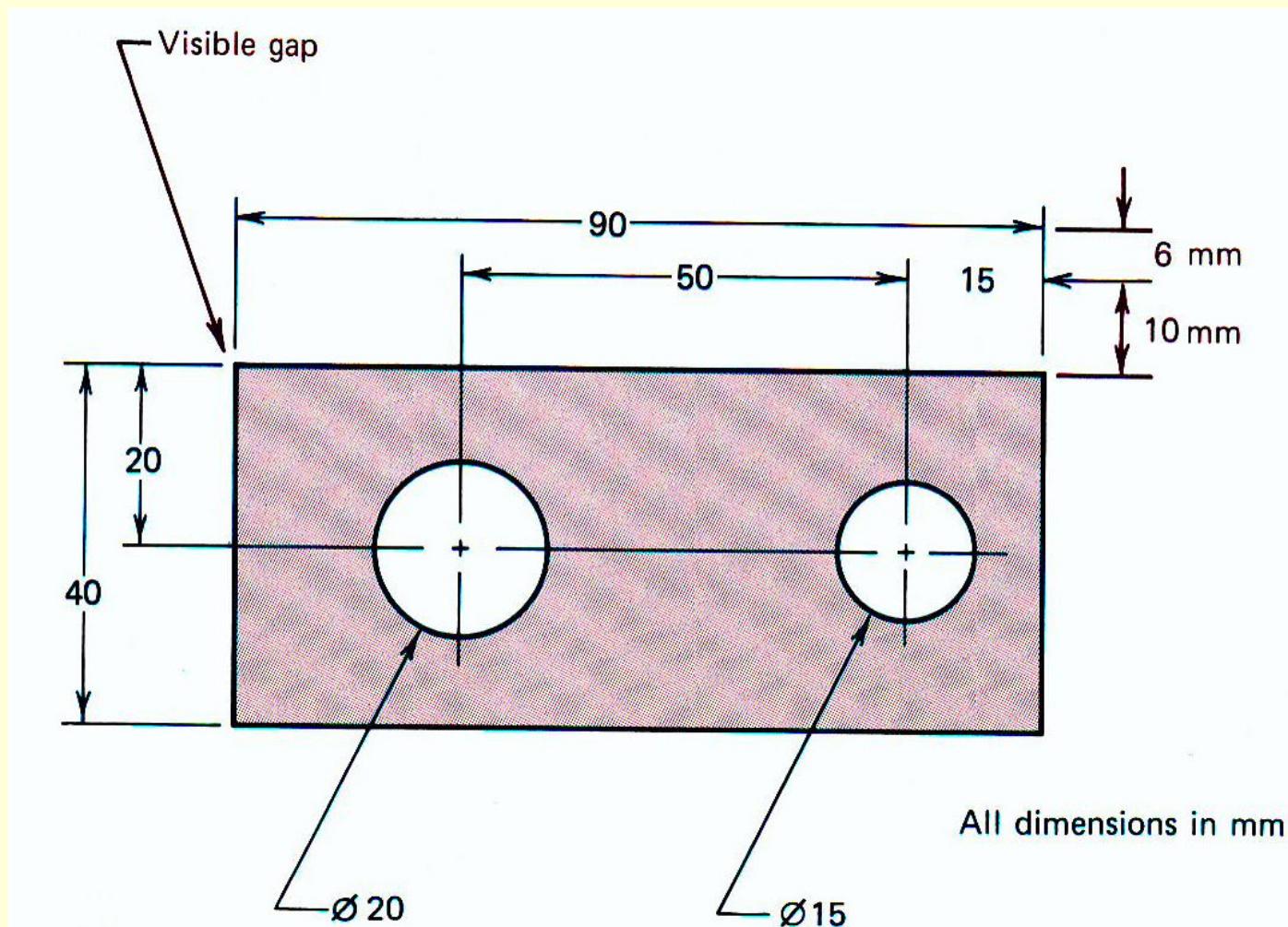
- A thin, solid line used to indicate the feature with which a dimension, note, or symbol is associated.
- Generally a straight line drawn at an angle that is neither horizontal nor vertical.
- Terminated with an arrow touching the part or detail.
- On the end opposite the arrow, the leader line will have a short, horizontal shoulder. Text is extended from this shoulder such that the text height is centered with the shoulder line

Arrows

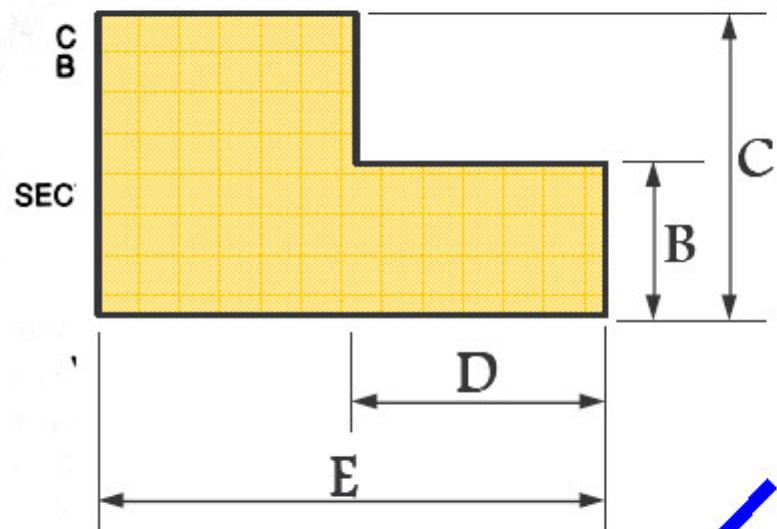
3 mm wide and should be 1/3rd as wide as they are long - symbols placed at the end of dimension lines to show the limits of the dimension. Arrows are uniform in size and style, regardless of the size of the drawing.



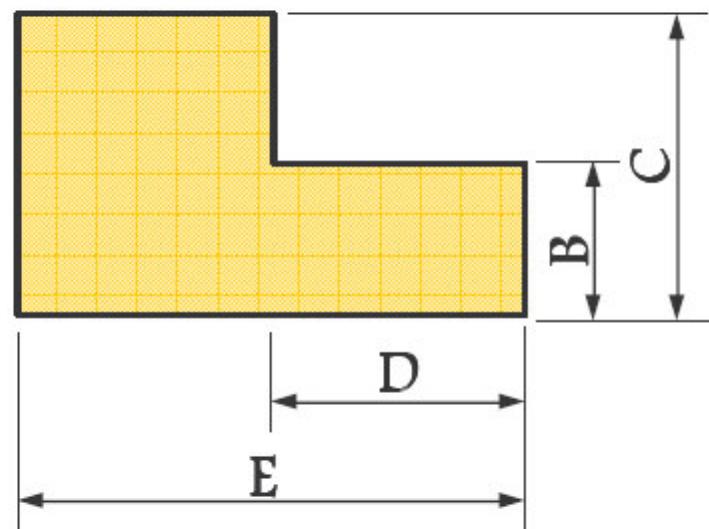
Spacing of Dimensions



Placing of Dimensions

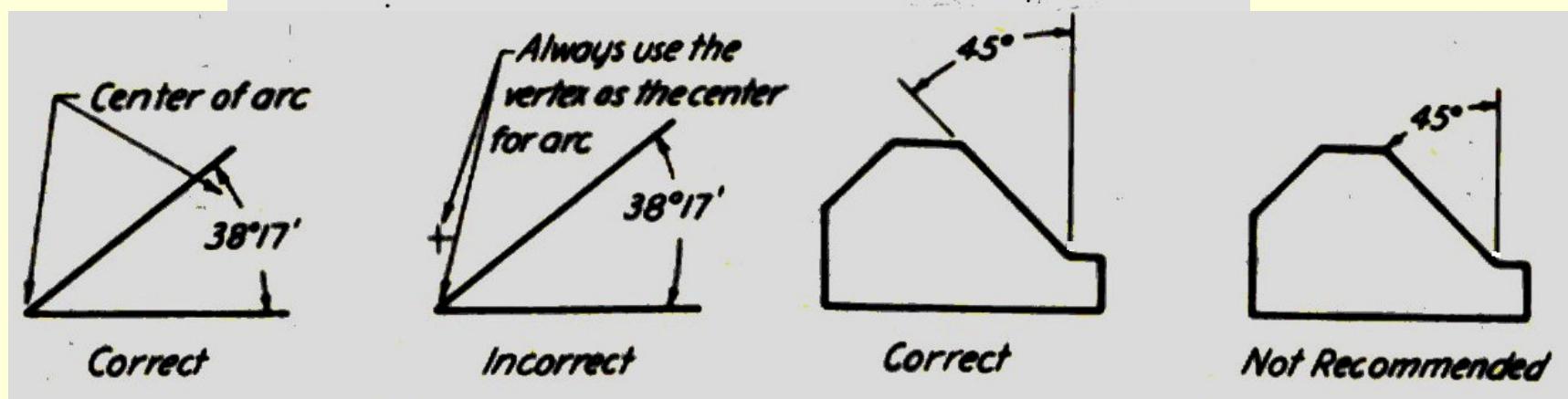
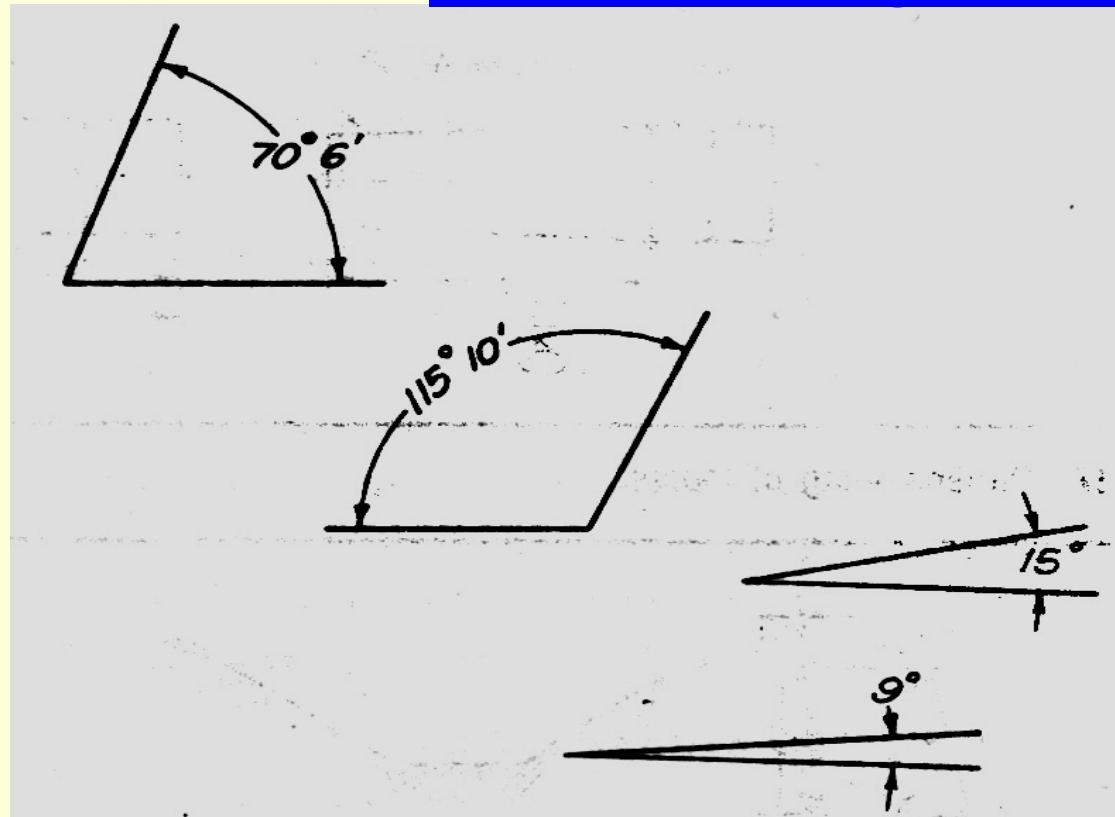


Unidirectional



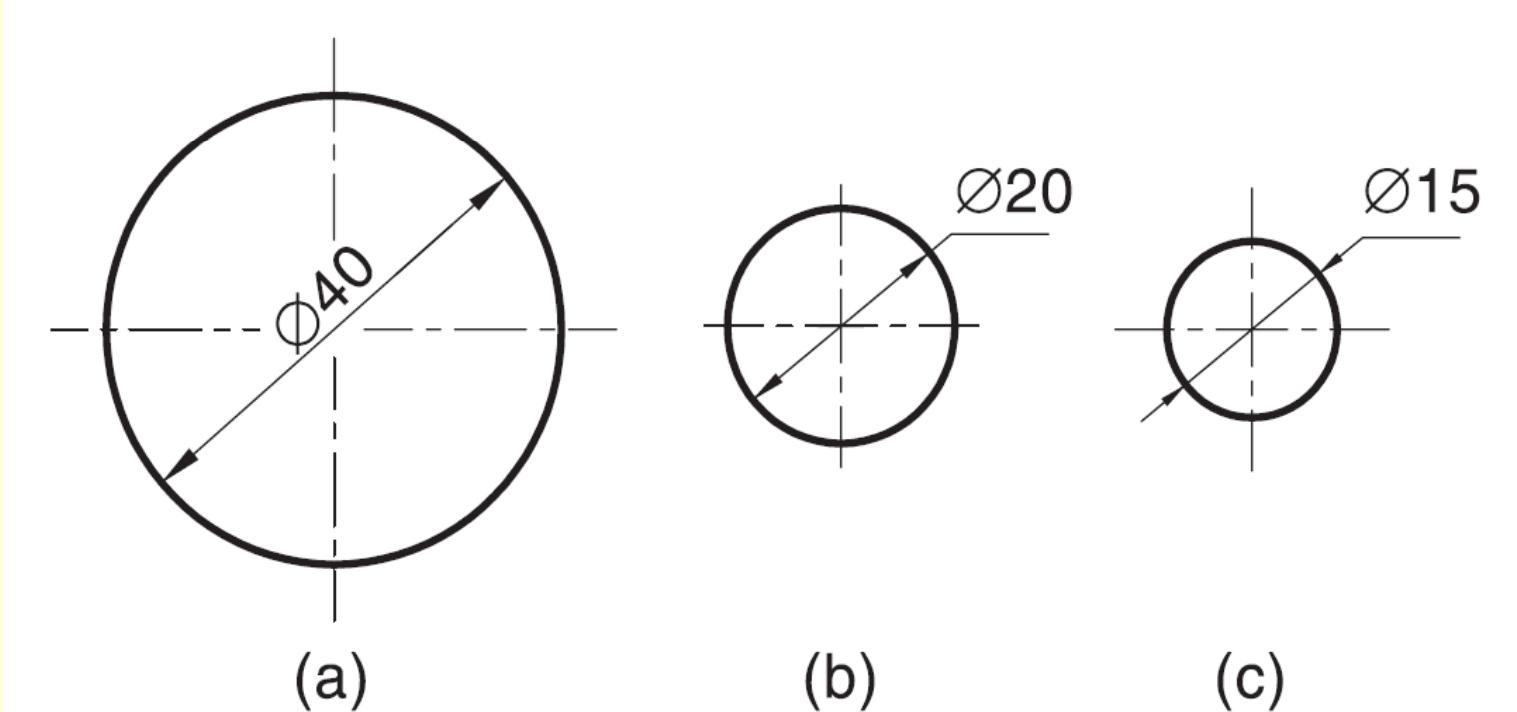
Aligned

Dimensioning of angles



Dimensioning of Circular Features

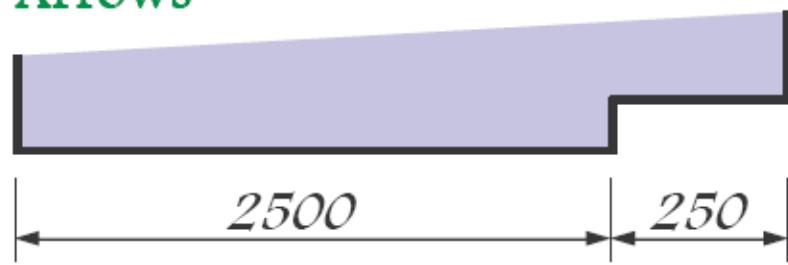
A circle should be dimensioned by giving its diameter instead of radius. The dimension indicating a diameter should always be preceded by the symbol \emptyset ,



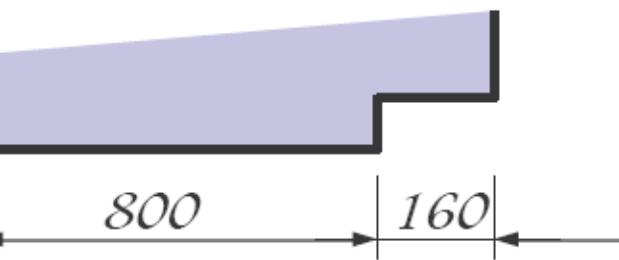
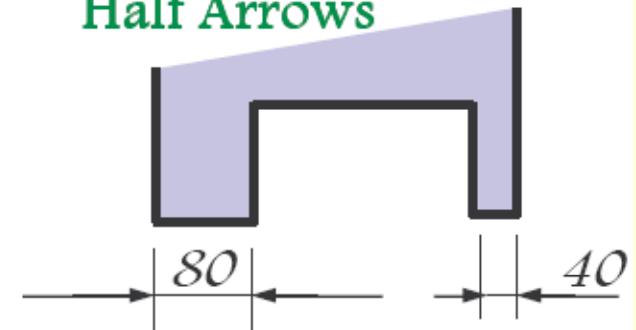
Dimensioning a Length

Depends on Available Space

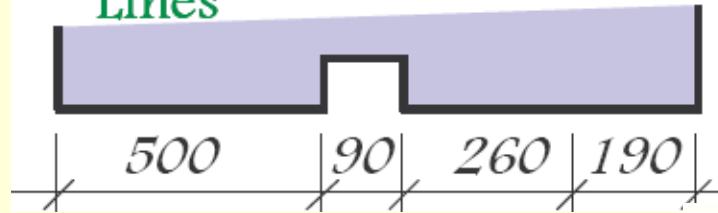
Arrows



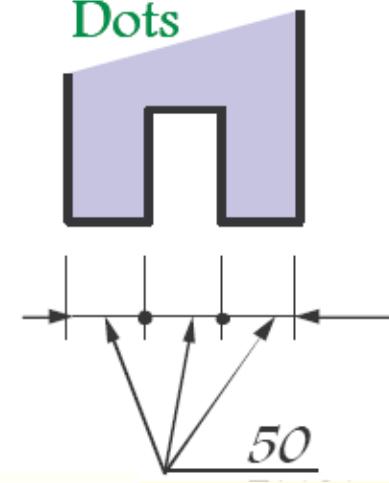
Half Arrows



Lines

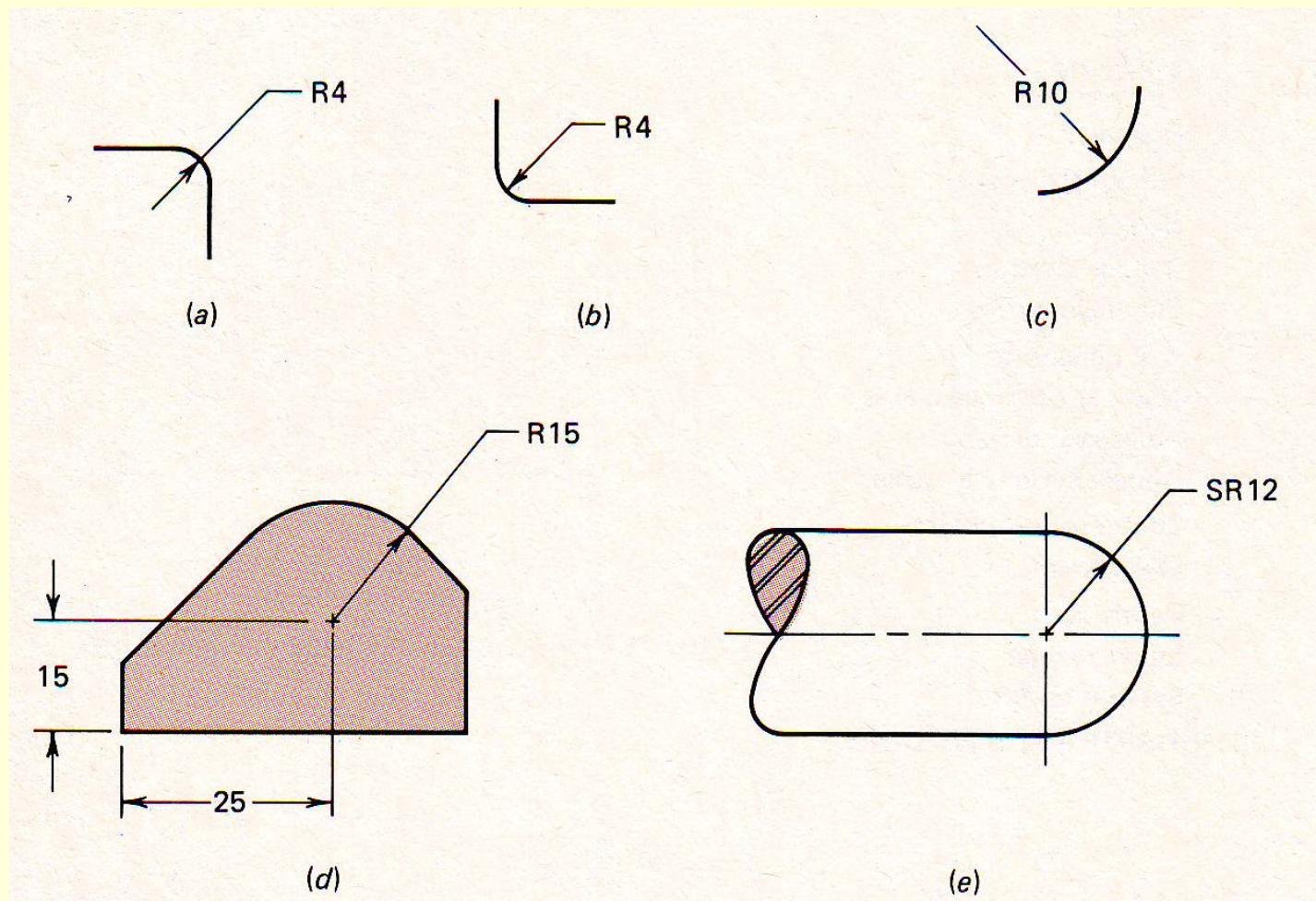


Dots



Dimensioning Radii

Arcs of Circle Precede with 'R' to distinguish from length



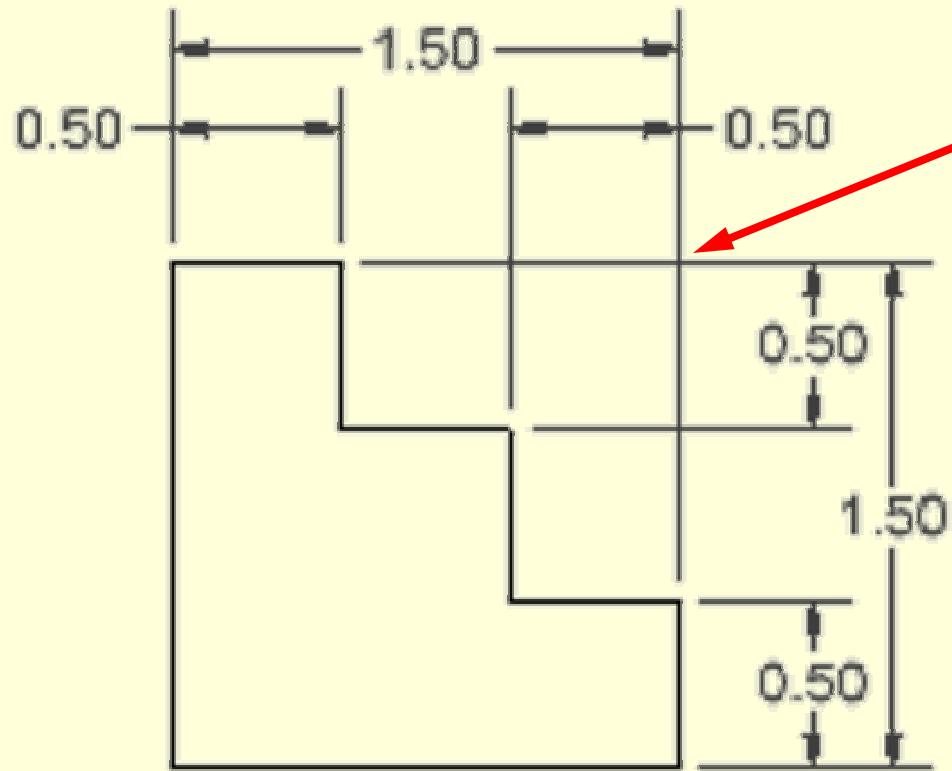
RULES OF DIMENSIONING

1. Between any two extension lines, there must be one and only one dimension line bearing one dimension.
2. As far as possible, all the dimensions should be placed outside the views. Inside dimensions are preferred only if they are clearer and more easily readable.
3. All the dimensions on a drawing must be shown using either Aligned System or **Unidirectional System**. In no case should, the two systems be mixed on the same drawing.
4. The same unit of length should be used for all the dimensions on a drawing. The unit should not be written after each dimension, but a note mentioning the unit should be placed below the drawing.
5. Dimension lines should not cross each other. Dimension lines should also not cross any other lines of the object.
6. All dimensions must be given.
7. Each dimension should be given only once. No dimension should be redundant.

8. Do not use an outline or a centre line as a dimension line. A centre line may be extended to serve as an extension line.
9. Avoid dimensioning hidden lines.
10. For dimensions in series, adopt any one of the following ways.
 - i. Chain dimensioning (Continuous dimensioning) All the dimensions are aligned in such a way that an arrowhead of one dimension touches tip-to-tip the arrowhead of the adjacent dimension. The overall dimension is placed outside the other smaller dimensions.
 - ii. Parallel dimensioning (Progressive dimensioning) All the dimensions are shown from a common reference line. Obviously, all these dimensions share a common extension line. This method is adopted when dimensions have to be established from a particular datum surface
 - iii. Combined dimensioning When both the methods, i.e., chain dimensioning and parallel dimensioning are used on the same drawing, the method of dimensioning is called combined dimensioning.

Dimensioning Guidelines

Avoid crossing extension lines

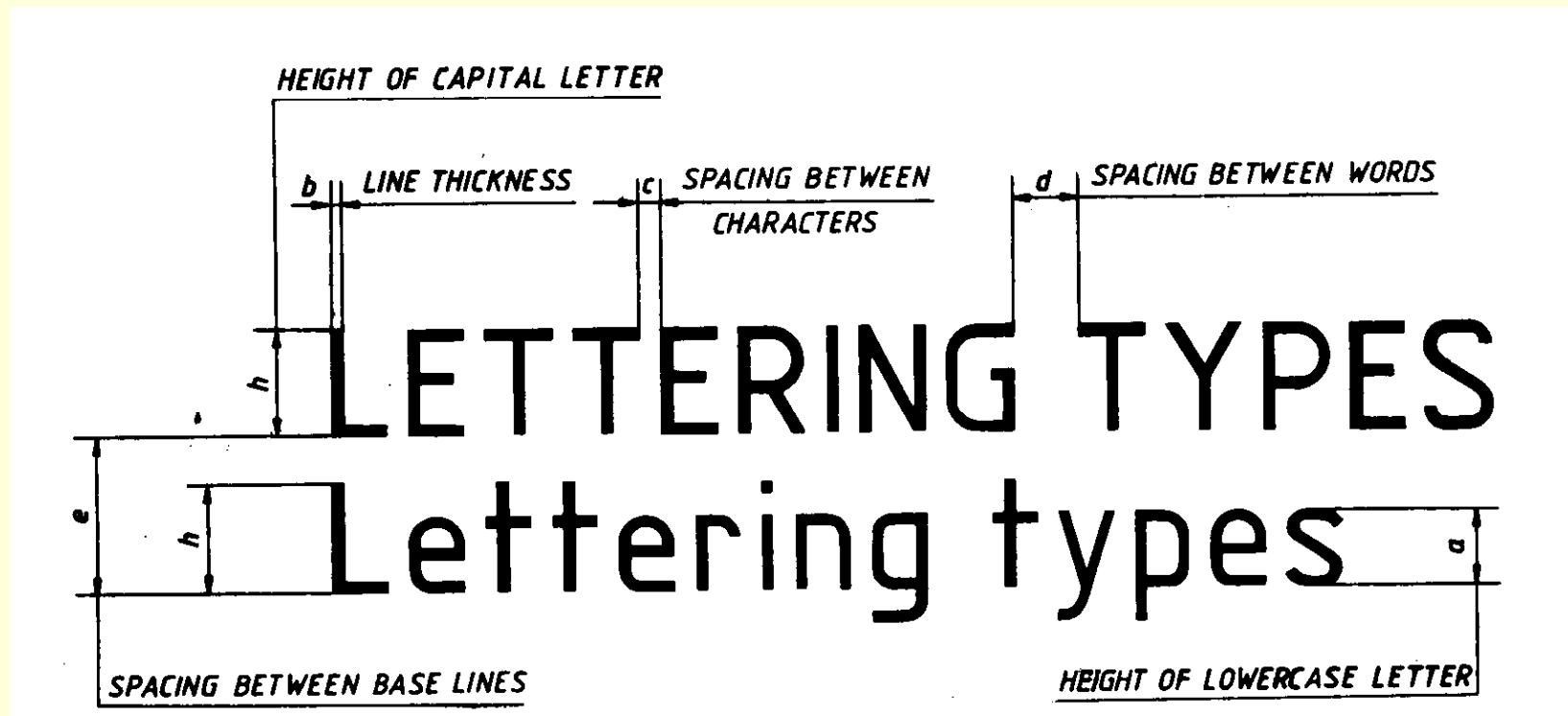


Multiple extension line crossings may be confused for the outside corner of the part.

- Single stroke refers to the thickness obtained in one stroke of a pencil or ink pen .
- It does not mean that the pencil or pen should not be lifted while completing a particular letter.

Lettering types

- Lettering A – Height of the capital letter is divided into 14 equal parts
- Lettering B – Height of the capital letter is divided into 10 equal parts



Specifications of A -Type Lettering

Specifications	Value	Size (mm)							
Capital letter height	h	2.5	3.5	5	7	10	14	20	
Lowercase letter height	$a = (5/7)h$	-	2.5	3.5	5	7	10	14	
Thickness of lines	$b = (1/14)h$	0.18	0.25	0.35	0.5	0.7	1	1.4	
Spacing between characters	$c = (1/7)h$	0.35	0.5	0.7	1	1.4	2	2.8	
Min. spacing b/n words	$d = (3/7)h$	1.05	1.5	2.1	3	4.2	6	8.4	
Min. spacing b/n baselines	$e = (10/7)h$	3.5	5	7	10	14	20	28	

Ratio of height to width varies, but in most cases is 6:5



Thank you