CHAPTER

2

ENGINEERING DRAWING

LEARNING OBJECTIVES

1. To know about the engineering drawing and there importance.
2. To know and able to use of instruments and materials use in engineering drawing.
3. To know about the dimensioning, lettering and numbering the drawing.
4. To know about view and projections of engineering drawing.
5. Able to draw the basic mechanical drawings.

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6.1 INTRODUCTION

- Engineering drawing is an effective method of communication between engineers belonging to various disciplines of engineering. All necessary features of an objects are mentioned on the drawing with proper dimensioning and important remarks. The entire community of engineers can analyse the object for its correctness, accuracy of the object's design and modifications. As all the production related remarks and instructions are graphically expressed in the drawing, it is easy for the production process to be carried out.
- Engineering drawing is the language of engineers. This language is spoken, read and written in their own way. It is used as a means of communicating ideas, concepts and designs to all the others involved in the process of production.

2.1.1. Importance of Engineering Drawing

It is not possible to explain all the details of objects orally irrespective of the size of the object (very small to large). Some of the details may be left out, misrepresented or misunderstood.

There may be some difficulty in understanding oral communication because of the languages spoken by the individuals. Considering such difficulties, drawings are used to communicate with people from different levels in the field of engineering (from engineers to workers). They can understand the drawing and help manufacture new components. Another distinct advantage is that the details are protected for further reference.

As there is a define grammar for a language and rules and regulations for games and sports, there is definition for a drawing.

Each and every symbol, line, letter and numbers has its unique meaning. Drawing should be made with these definitions in mind. Same methods are to be followed in making drawings for them to be accepted and understood all over the world.

2.2. DRAWING INSTRUMENTS

Proper equipments and instruments must be used for making drawings. Following are the instruments required for preparing drawings.

1. Drawing board
2. T - square
3. Drafter
4. Pencils and pencil leads
5. Scales
6. Set squares
7. Protractor
8. French curves
9. Instrument Box
10. Drawing sheets

2.2.1. Drawing board

A drawing board is a well-seasoned soft wooden board of an approximate thickness of 20mm. A straight ebony strip is fitted on the left edge of the board to support the movement of the T-square.

The top surface of the drawing board should be flat and smooth and the thickness uniform B.I.S (Bureau of Indian Standards) has standardized the sizes of drawing board as follows.

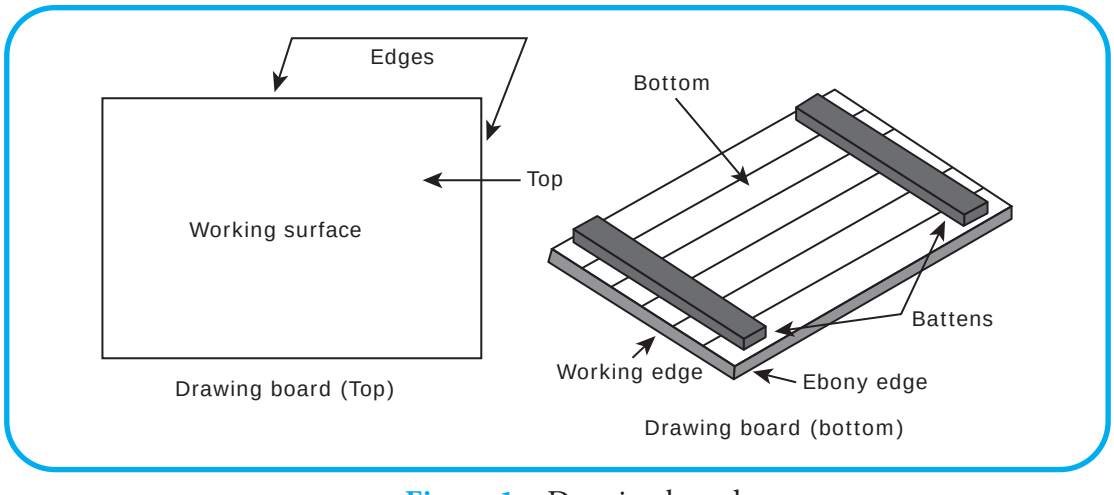


Figure 1 Drawing board

SI. NO	Desig-nation	Size in mm L x W x T	Size of sheet
1	D0	1500 X 1000 X 25	A0
2	D1	1000 X 700 X 25	A1
3	D2	700 X 500 X 15	A2
4	D3	500 X 350 X 15	A3

2.2.2. T-Square

T -square is an instrument used to draw horizontal lines parallel to each other. When used along with set- square, it is used as a base to draw various angles.

There are two parts of a T-square namely stock and blade. These two parts are connected at right angle to each other. Stock is the piece that supports the blade by attaching it to the ebony of the drawing board.

The working length of the T -square is approximately equal to the length of the drawing board. T-square is illustrate in figure

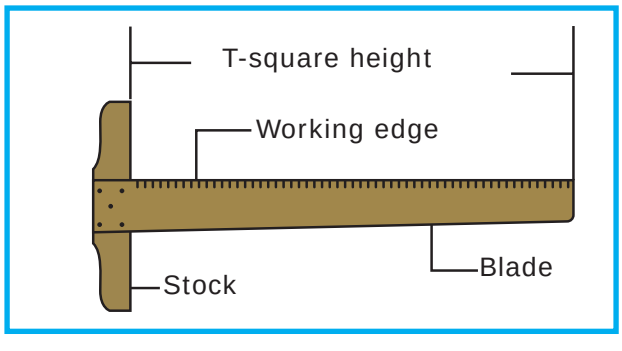


Figure 2 T-Square

SI. No	Designation	Length of the working edge of the blade in mm
1	T0	1500 x 10
2	T1	1000 x 10
3	T2	700 x 5
4	T3	500 x 5

2.2.3. Drafter

It comprises of a pair of steel strips hinged at the center .At one end, a clamp is provided. This clamp is useful in clamping the drafter at the left side top corner of the drawing board .The other end is known as working end which consists of the two perpendicular scales and circular base. The perpendicular scales are graduated in millimetres whereas circular scale is graduated in degrees up to 360°.The working end can be oriented to any angle and fixed at the position with help of knob.

When the clamping end is fitted to the drawing board, the working end can be made to slide over the board. After the perpendicular scales are set at the desired angle, parallel or perpendicular lines can be drawn. Taking reference from the circular scale, line at any desired can also be drawn. Mni Drafter is illustrated in figure.

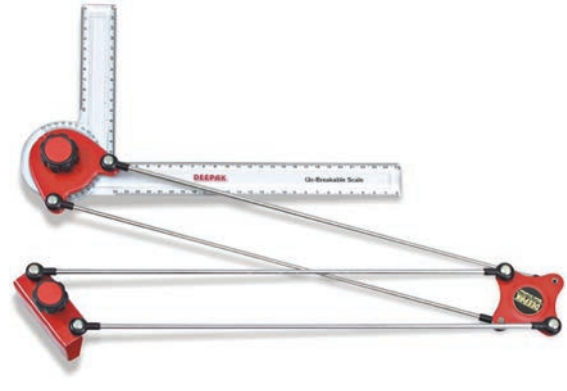


Figure 3 Mini Drafter

2.2.4 Pencils and Pencil leads

Pencils are used for making drawings on drawing sheets. The quality of the pencil determines the accuracy and appearance of the drawing. The grades of pencil are designated by marking made on each of them. The grade of pencil describes the hardness of the graphite lead used. The grades of pencil range from 9H to 9B, where 9H is the hardest

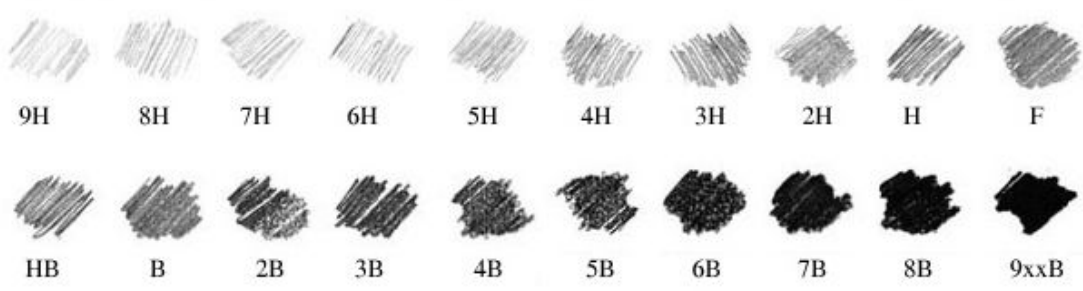


Figure 4 Grade of Pencil

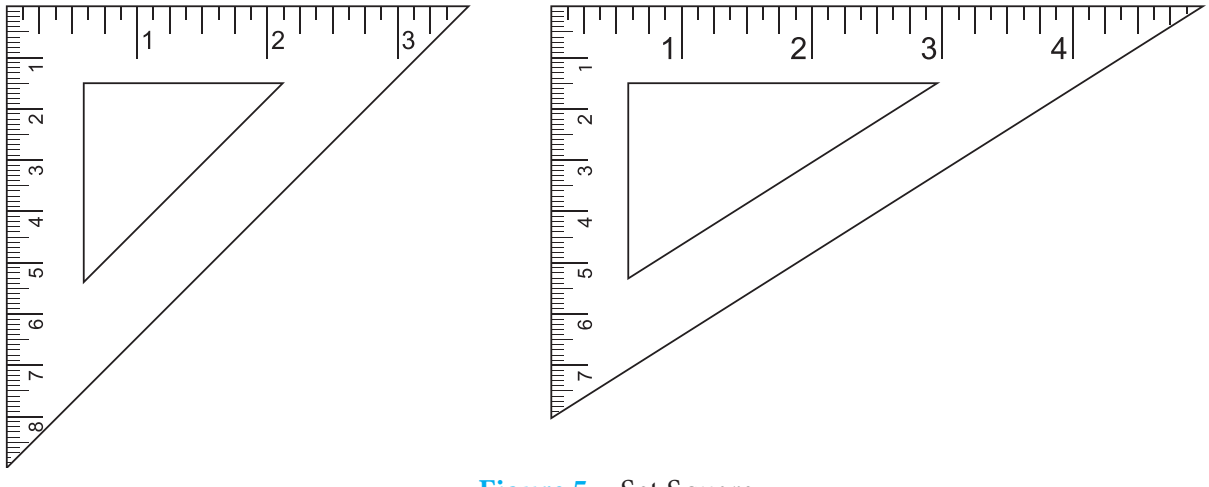


Figure 5 Set Square

and 9B is the softest. Hard pencils such as 2H, H are used for making engineering drawing and for lettering and dimensioning, softer pencils like HB pencils are used, also used for making freehand sketches.

The grades of the pencil may be categorized as

- Soft - 9B to 2B
- Medium - B to 3H
- Hard - 4H to 9H

2.2.5. Set-Square

Set-square are useful in drawing perpendicular lines and lines at 30°, 45°, 60° and 90° to the horizontal lines drawn with T-square. By the combined use of two Set-square, we can also draw lines at 15°, 75° and 105° to the horizontal line.

There are two types of Set-square

1. Thirty -Sixty (30°-60°)
2. Forty five (45°)

2.2.6. Protractor

Protractor are used to measure or construct angles which cannot be done by Set-square. The shape of the protractor may be circular or semi- circular. They are made of celluloid, wood or ivory.

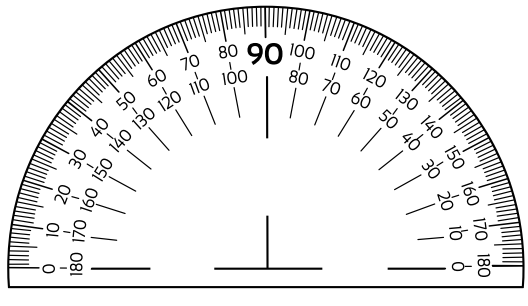


Figure 6 Protractor

2.2.7. French curves

French curves are the templates, profiles and contours of different shapes and sizes are cut on the edges of French curves. Curve lines and circular arcs which cannot be drawn with a compass can quickly be drawn with French curve. Figure illustrate French curves

Figure 7 French Curves

2.2.8. Instrument box

The instrument box contains different drawing instruments for drawing different types of drawings. The instruments are

1. Large Size Compass
2. Small Bow Compass
3. Small Ink Bow Compass
4. Large Size Divider
5. Small Bow Divider
6. Lengthening Bar
7. Inking Pen
8. Pin Point
9. Ink Pot
10. Lead Case

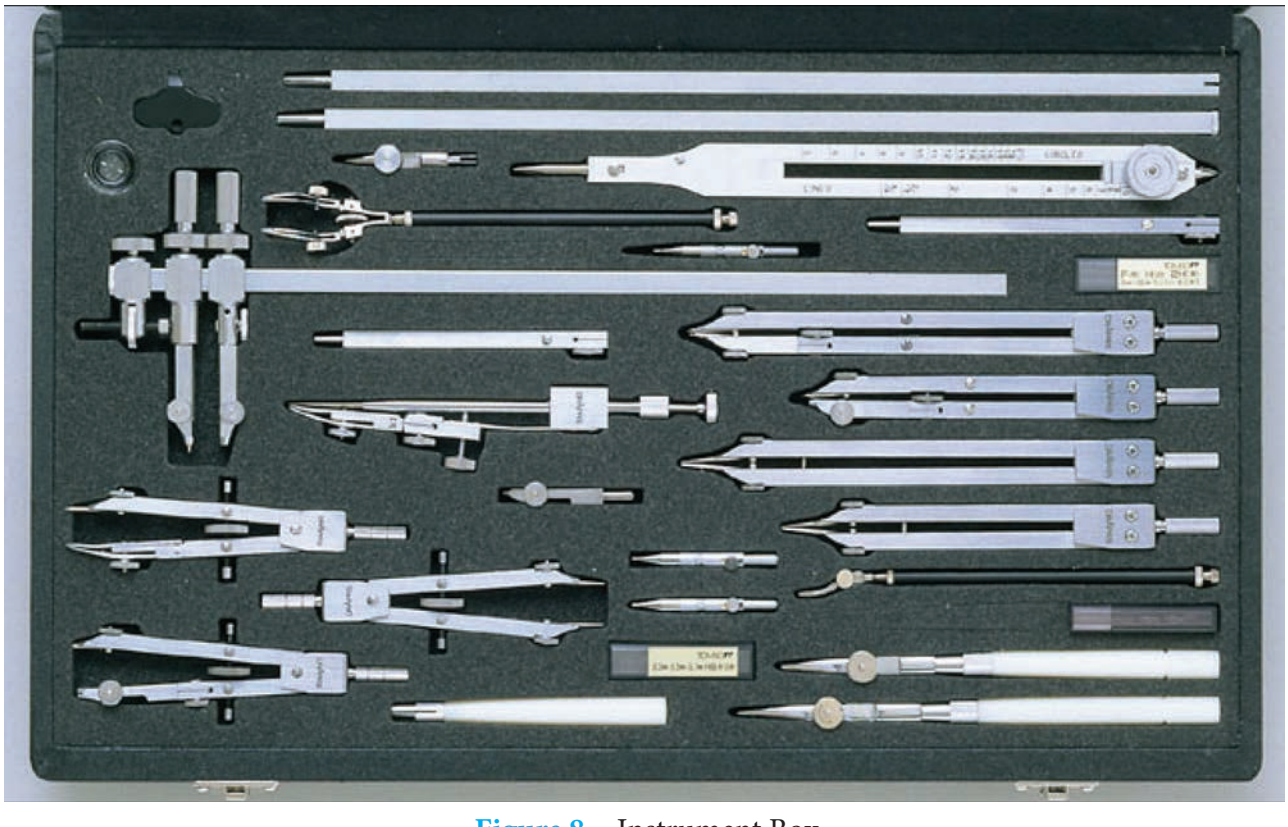


Figure 8 Instrument Box

2.2.9. Compass

Compass are used for the drawing circles and arcs of required sizes. It has two metals legs joined at the top with help of a knee joint. One of the two legs is fitted with an adjustable needle. The other leg has an attachment which can hold an inking device (or) a pencil lead tip.

Figure 9 Compass

2.2.10. Divider

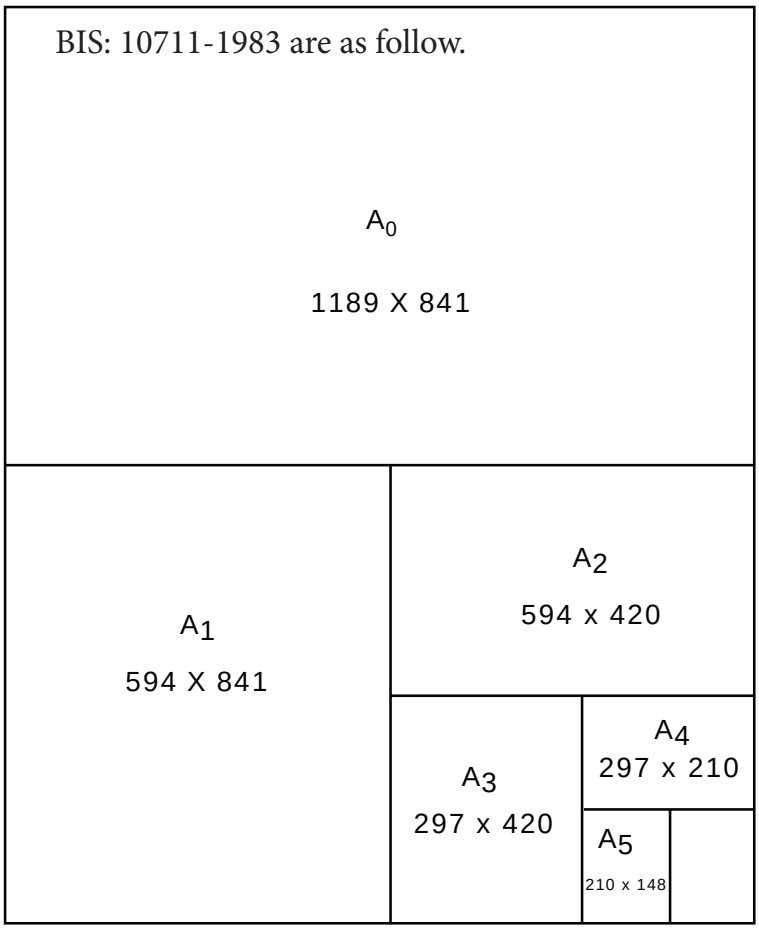
Straight lines or curved lines are divided into required number of equal parts with help of dividers.

Figure 10 Divider

2.2.11. Drawing Sheet

Different qualities of drawing sheets used for making drawings. The quality of the sheet depends upon the nature of drawing. It should be tough, strong and uniform thickness. The effect of erasing should not be felt and ink should not spread out. The smooth side of the sheet should always be used for drawing.

The standards sizes of trimmed drawing sheets recommended by International Organisation for Standardization (ISO) and adopted by Bureau of Indian Standards (BIS).



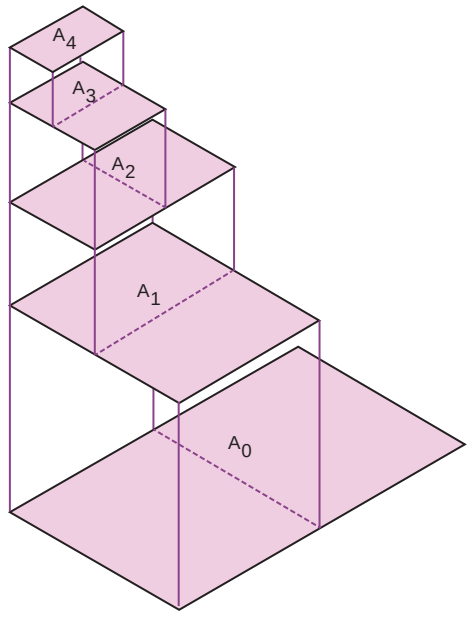


Figure 10 Drawing Sheet

2.3. BUREAU OF INDIAN STANDARDS

The field of engineering and Technology is fast evolving day by day to set newer trends in the world community. The arrival of foreign technologies, technical tie –ups between different countries, and exchange of new technologies have made it mandatory to set specific international standards in the field. This need is most felt in preparing and understanding of engineering drawing. Indian Standards Institution (ISI) established in the year 1947, formulated the code of practice for general engineering drawing in the year 1955. ISI was taken over and renamed as Bureau of Indian Standards (B.I.S.) in the year 1987 by an Act in the Indian Parliament. In the year 1987, B.I.S. has adopted the standards of ISO (Indian Organization for Standardization).

2.3.1. Layout of drawing sheet

The Layout of drawing sheets make it easy for the readers to locate all important references of the drawing. For this a standard arrangement should be followed in which all the information are included. The Layout of drawing sheet should have the following features.

1. Margin
2. Title block
3. Parts list
4. Revision panel
5. Zone system
6. Folding marks

Margin: Margin is provided in a drawing sheet to enable it to be trimmed. After trimming, the sizes of the standard drawing

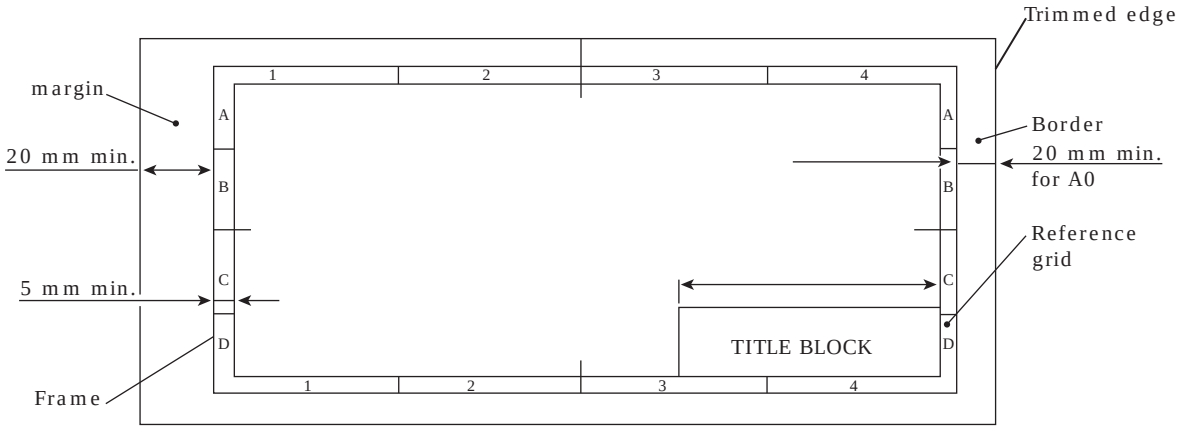


Figure 11 Layout of drawing sheet

sheets should be equal to the sizes of trimmed sheets recommended by B.I.S.

Apart from margins, border lines are drawn to get a complete working space. Drawing of border lines should also facilitate easy filing or binding.

Title Block: Provision of title block in a drawing in necessary as it gives all information regarding the drawing. It is placed at the bottom right hard corner of the drawing sheet. B.I.S has recommended the size of the title block to be 185mm x 65mm. The size is the same for all designated sizes of the sheet (i.e. from A0-A5). The title block should contain the following information. A0-A5 a sample title block is given below:

Title of Drawing

1. Drawing Number
2. Title of the Drawing
3. Projection
4. Material Details
5. Scale of Drawing
6. Surface Finish
7. Tolerance

2.4. LETTERING AND DIMENSIONING

2.4.1. Lettering

Lettering is an important feature in engineering drawings. Writing of titles and subtitles of drawings, dimensioning the

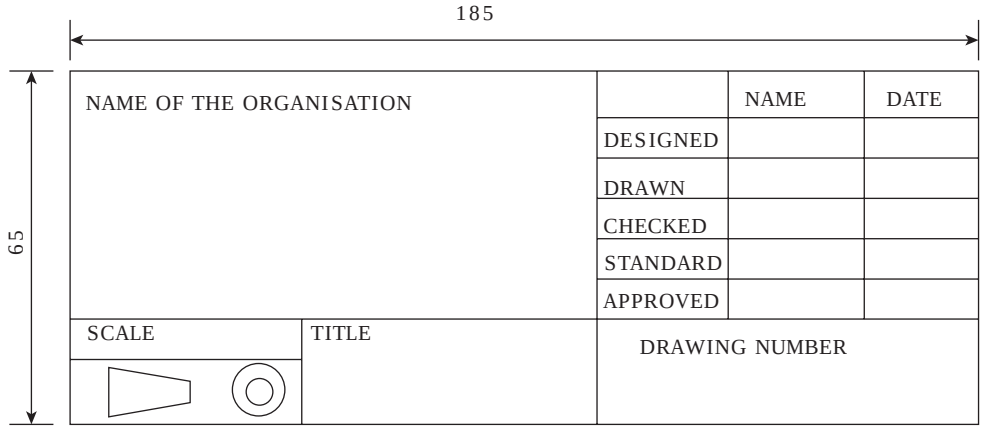


Figure 12 Title Block

parts of the objects drawn, writing the scale and other details is called dimensioning.

Importance of Lettering

Neatness, legibility, uniformity, suitability for microfilming and photocopying are the main feature of lettering. Poor lettering will spoil the appearance of a drawing and lead to wrong results. So, it very important that it is done correctly to finish the drawing completely.

Proportion of Lettering

There is no specified proportions for each letter of alphabets lettering. Considering uniformity, a proportions between the height and the width is to be followed. There are three proportions by which lettering can be done best. They are

1. NORMAL LETTERING
2. CONDENSED LETTERING
3. EXTENDED LETTERING

Normal lettering: It will have normal height and width and finds application in general use.

Condensed lettering: It has shortened width with respect to its height and is used where space available is limited.

Extended lettering: It will have more width and normal height.

Spacing of Letters

The distance left between two adjacent letters while lettering is known as spacing of letters.

A distance equal to the 3/5th of the height of the letters has to be left between two successive words. The space between two lines should be equal to 1 ½ times the height of the letters.

Size of Letters

The size of letters in engineering drawing is the height of the letters. B.I.S recommends standard sizes of lettering for various features and they are listed below

SI No	Features	Size (Height in mm)
1	Drawing Numbers, Letters indicating cutting plane section	10, 12
2	Title of the drawing	6, 8
3	Sub-titles and headings	3, 4, 5 & 6
4	Material List, Dimensioning, Schedules , notes	3, 4 & 5
5	Tolerances Alteration entries	2 & 3

Types of Letters

The lettering in which the alphabets are written with uniform thickness is known as Gothic lettering. Gothic lettering may be done on single stroke and double stroke. Double stroke letters are thicker than single stroke letters.

ITALIC PRINTING IS

free hand gothic

OR ROMAN LETTERING

1. Vertical letters
   a) Upper case letters (capital)
   b) Lower case letters

2. Inclined letters
   a) Upper case letters (capital)
   b) Lower case letters

Vertical Letters: If the direction of alphabets and numerals is vertical, the letters are known as vertical letters, both upper case and lower case letters are written in this fashion.

Inclined Letters: When the letters are written inclined to the horizontal line, they are called inclined letters. The angle of inclination is approximately 75° from right to left.

Vertical Upper Case Letters

A B C D E F G H I J K L M N

O P Q R S T U V W X Y Z

I II III IV V VIVII VIII XI X

Vertical Lower case Letters

a b c d e f g h i j k l m n

o p q r s t u v w x y z

1 2 3 4 5 6 7 8 9 0

Inclined Upper case letters

A B C D E F G H I J K L M N

O P Q R S T U V W X Y Z

I II III IV V VIVII VIII XI X

Inclined lower case letters

a b c d e f g h i j k l m n

o p q r s t u v w x y z

1 2 3 4 5 6 7 8 9 0

2.4.2. Dimensioning

Drawings are made to represent the actual shape and size of the objects to be produced. So it is necessary to place proper dimensions and related information regarding different parts of the object. In case the dimensioning is not done properly, there will be great loss in materials, labour and time.

Dimensioning is known as the method of writing various sizes (or) measurements of an object and other important information such as tolerances on a finished drawing. It should be done with great care that no information is left out in describing the object completely.

Types of Dimensions

System of Dimensions

According to B.I.S., there are two system of placing dimensions on drawing and they are

1. Aligned system
2. Unidirectional system

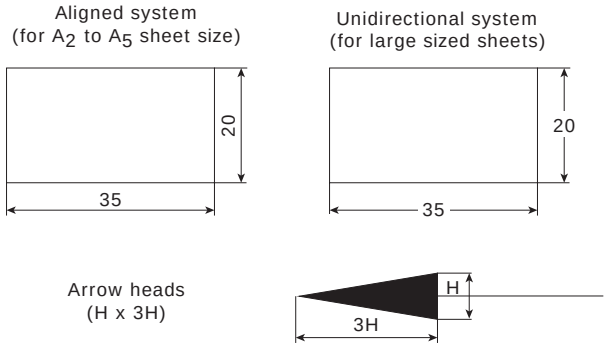


Figure 13 Types of Dimensions

Aligned system: The dimensions are placed in a manner to read them from the bottom or from the right side of the drawing. All the dimensions are placed above the dimension lines. Aligned system dimensioning is commonly used in engineering drawing.

Unidirectional system: The dimensions are placed so that they may be read from the bottom of the drawing only. The dimensions are placed approximately at the middle of the dimension line by breaking it .There is no restriction in controlling the direction of the dimension lines.

Notation of dimensioning

The dimension lines, extension lines, leader lines, arrow head, dimension figures, notes and symbols make up the notation of dimensioning.

Dimension line: Dimension lines are used to indicate the measurement in numbers at a space above them or at a space created by breaking them approximately at their center. Dimension line is drawn as thin continuous line.

Extension line: It is the line that extends from the outline of the object on a drawing. It is a continuous thin line extending atleast about 2mm beyond the dimension line.

Leader line: When some notes are to be made regarding a specific feature of a drawing, leader lines are used. They extended from where the notes have to be applied to a point where the notes are actually written. Leader line has an arrow at one end which touches the particular feature. It is drawn at any convenient angle between 30° to 60°.

Arrow Head: Arrow head are placed at both ends of a dimension line. They touch the extension lines drawn from the outline of the part and indicates the extend of a dimension. The length and width of the arrow should be in the ratio 3:1.

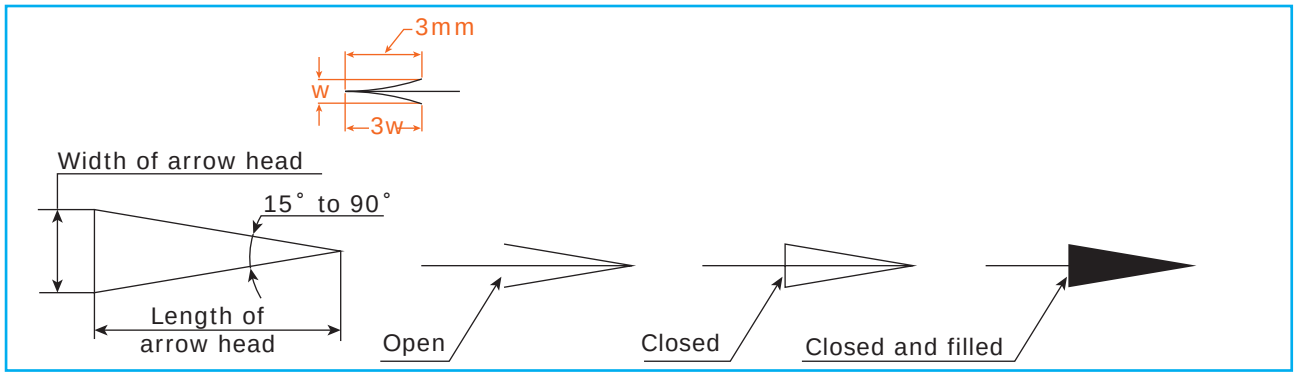


Figure 14 Arrow Head

Drawing Figure: The size of a specific feature is indicated by the dimension figure either as a numerical or as symbols like Ø, R followed by numerals.

Types of Line

Engineering drawing is made by the combination of different types of lines. Each line shown in the drawing is meant to represent a separate meaning. So it necessary to understand the types of lines and their meaning to make or read a drawing successfully.

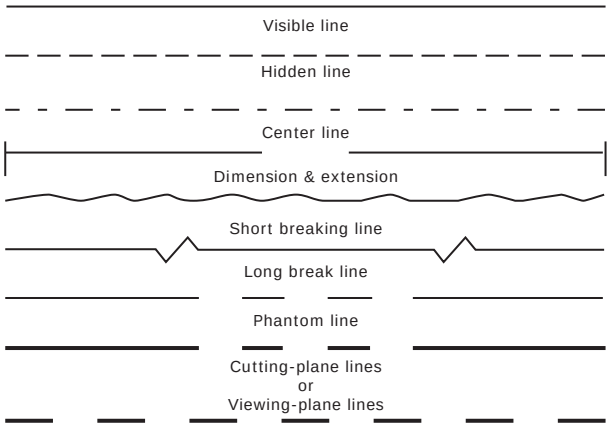


Figure 15 Types of Line

Continuous thick line: A continuous thick line in a drawing represents a visible edge or outline. It is drawn with a H or HB grade pencil.

Continuous thin line: Continuous thin lines are used for construction of a drawing. These lines are also used for drawing dimension lines, extension lines, leader lines, and sectional lines (hatching line). When used as construction lines, they do not appear on the finished drawing. But in geometrical drawings, they are removed. Continuous thin lines are drawn with 2H pencils.

Short dashes: Short dashes represent hidden features or outlines in a drawing. The dashes should be of uniform length and the spacing equal. They are drawn with H pencils.

Long chain (thin): Long chain lines are drawn as an alternative combination of a long dash and a short dash. The lengths of both long dashes, short dashes are to be maintained uniform and they are equispaced. They represent centre lines, extreme positions movable parts and pitch circles in drawings. This types of line is drawn with a 2H pencil.

Long chain (Thick at ends): It is very similar to a long chain line expect that the terminal long dashes are drawn thick. Cutting plane lines are represented by this type of line. The terminal dashes are drawn with H pencil and others with 2H pencils.

Long chain (Thick): A long chain line is drawn thick completely for this type of line. The surfaces which are to receive additional treatment are represented by a long chain (thick) line. It is drawn with a HB pencil.

Continuous thin (Wavy): Irregular boundary lines and short break lines are drawn as wavy continuous thin lines. They are with 2H pencils.

Ruled line and short zigzag (thin): These lines indicate long break lines. When a long structure of uniform shape is to be shown on a drawing, its view is intercepted by this line and it is drawn with 2H pencil.

Continuous thick line

Continuous thin line

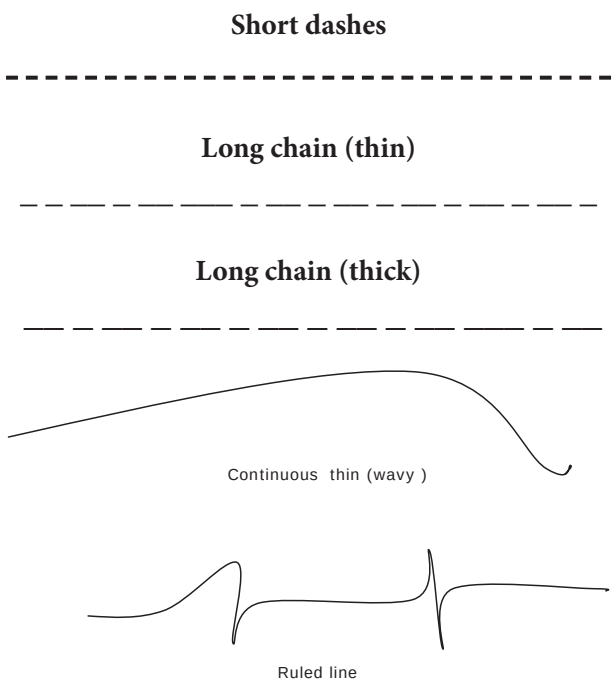
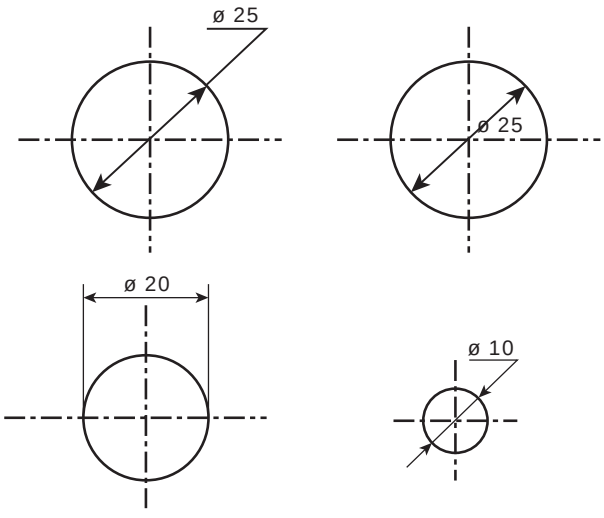


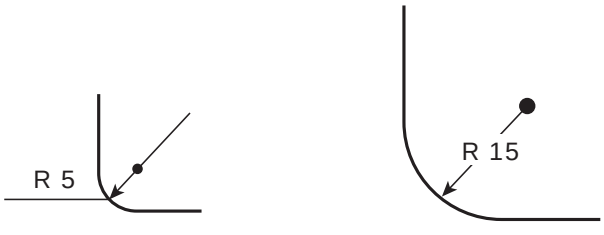
Figure 16 Types of Line

General rules for dimensioning

1. Dimension should be placed outside the view as far as possible.
2. Dimension lines should not intersect each other.
3. Dimension lines should not be placed cutting an extension line.
4. Dimension lines should be given on the view which shows the relevant feature most clearly.
5. Dimension should never be crowded. If the spaces is not sufficient, arrow heads may be replaced by dots or inclined lines.
6. The distance between the outline of the object and first dimension line should be at least 10mm.
7. A distance of atleast 8mm should be kept between two adjacent dimension lines.
8. The extension line should not project beyond 2mm from the dimension line.
9. Leader lines should be constructed at an angle to the horizontal(30°, 45° and 60°)
10. Center lines should not be used as dimension line.
11. Dimensions with smaller sizes should be placed near the drawing than those with bigger sizes.
12. Dimensions marked in one view, need not be repeated in other views.
13. While dimensioning angles, their values are placed outside the view.
14. Remarks, instructions and foot notes should be written horizontally.
15. Dimensions of part which are not drawn to scale should be underlined. If the whole drawing is not drawn to scale, a note should be made in the drawings as 'NOT TO SCALE'.
16. When all the dimensions are in same unit, there is no need to mention the unit. Instead a foot note should be written as 'ALL DIMENSIONS ARE IN mm'.
17. The size of the datum plane should be written within brackets.
18. While dimensioning external threads, the type, size and length should be marked.
19. The size of the arcs should be indicated by its radius.
20. The diameter of the circle is always specified as follows;

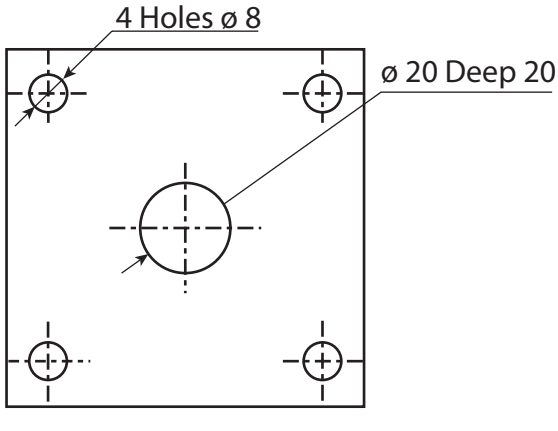


21. While marking the dimension of an arc, the dimension should be proceeded by a mark 'R'.

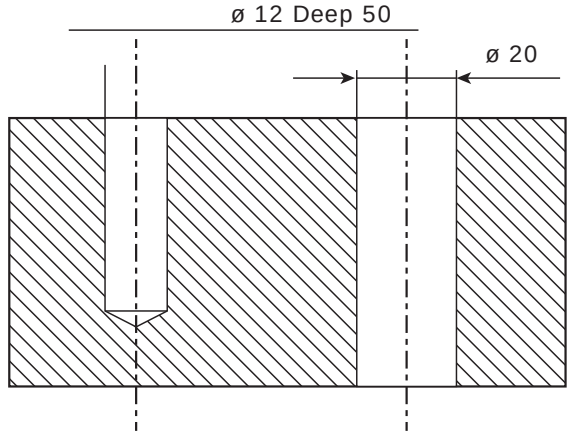


22. The dimensions of holes may be made in the following methods

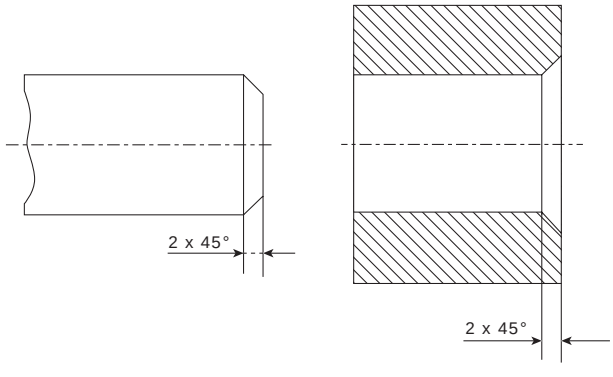
(i) It should be understood that the four holes are of 8mm diameter. The hole at the centre is 20 mm deep and the diameter is 20 mm.



(ii) The hole on the left is 50 mm deep and is of diameter 12 mm. The other hole is a through hole of diameter 20 mm



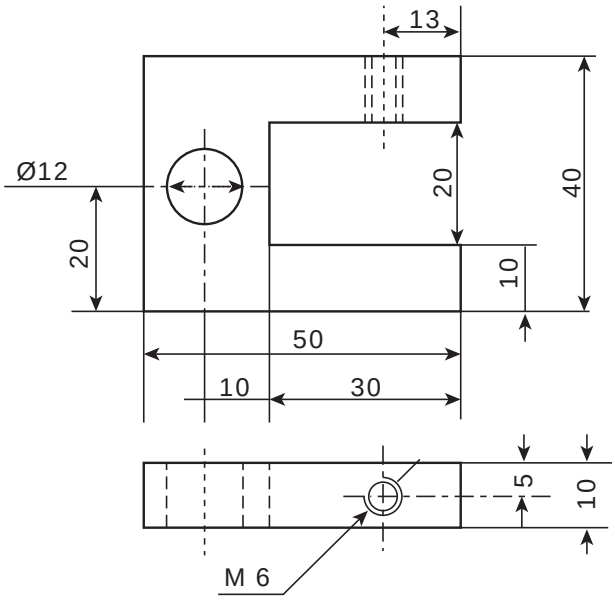
23. Chamfering is done at the ends of cylindrical parts and parts having cylindrical holes chamfering is dimensioned as shown following diagrams.



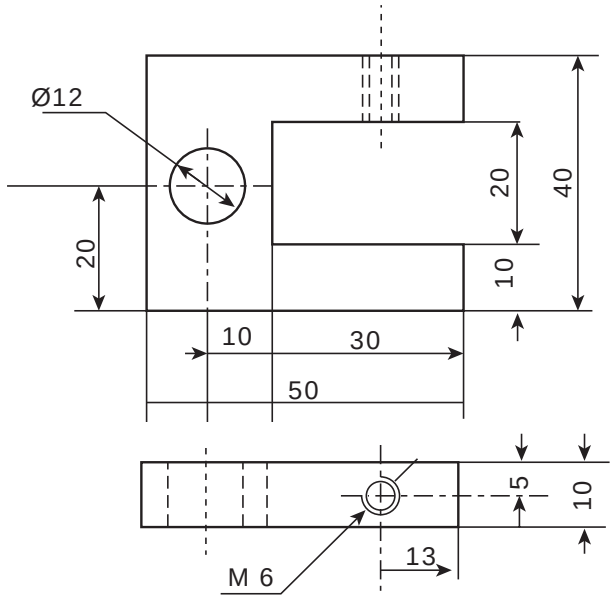
Incorrect and Correct Methods of Dimensioning

In the previous section, guidelines are given regarding proper dimensioning of some important profiles. However, there are chances that dimensions may not be represented in a correct way. Some examples are given in the next few pages to highlight the situations where dimensions are misrepresented frequently and to correct them.

Incorrect



Correct



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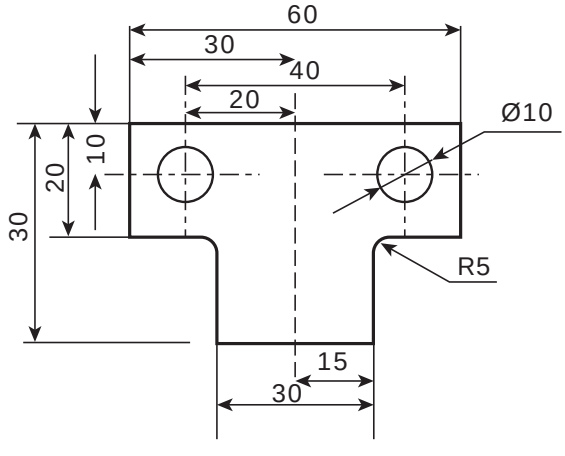
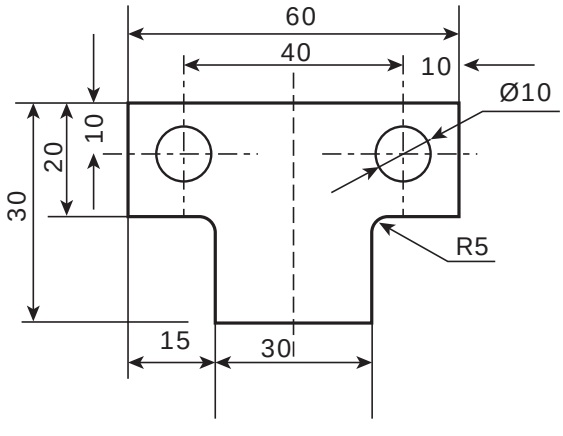


Correct



2.5. SCALE OF DRAWING

A proportion is used either to reduce or increases the dimensions of the object. So the proportion by which the actual size of the object is reduced or increased on a drawing is known as Scale of a drawing.

2.5.1. Uses of Scales

The important uses of scales are

1. Scales are useful in making reduced size and enlarged size drawings.
2. The dimensions of various parts can be measured directly.

2..5.2. Types of scales

There are three types of scales according to the proportions made on them.

1. Full size scale
2. Reducing scale
3. Enlarging scale

Full size scale: When the dimensions of objects are shown on a drawings in its actual sizes, the scale used in the drawings is full size scale. Full size scale is indicated as 1:1

Reducing scale: When the size of the object is too large to be accommodated on a drawing sheet, the dimensions of the object are reduced in a particular proportion and represented in the drawing. This scale is known as reducing scale.

Eg: 1:2, 1:5, & 1:10

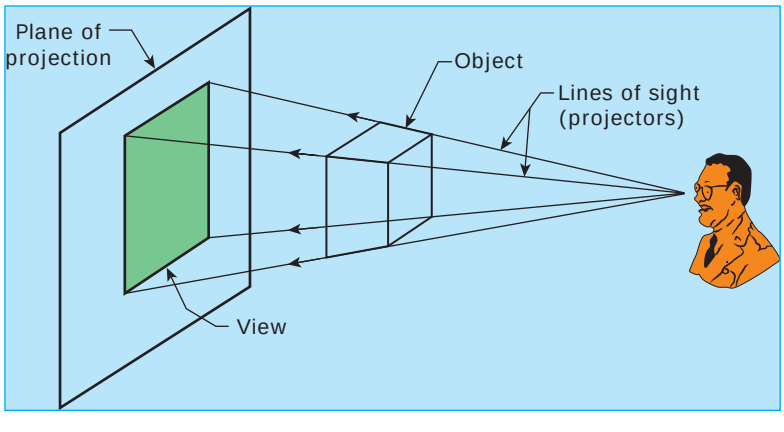
Enlarging scale: When the size of the object to be shown on the drawing sheet is very small to give clear description about the object, the dimensions of the object are enlarged in a particular proportion. This scale is called enlarging scale.

Eg: 2:1, 5:1, and 10:1.

Full size scale	Reducing scale	Enlarging scale
1:1	1:2 1:5 1:10 1:20 1:50 1:100 1:200	10:1 5:1 2:1

2.6. PROJECTION

In the engineering drawing, the exact shape and size of an object should be shown on a two dimensional plane and paper. For doing so, the object is imagined to be located between the observer and the plane on which the view is going to be obtained. Straight lines are drawn from different points on the contour of the object to meet the plane of paper. The points obtained on the sheet of paper are joined in proper sequence to form the image or view of the object.

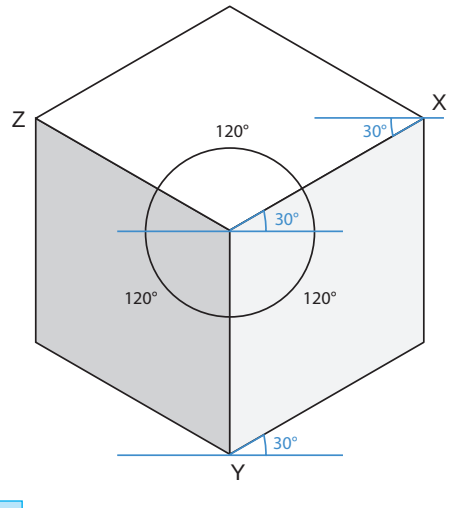


2.6.1. Isometric View

If the length, breadth and height of an object are drawn and shown in a single view which is called Isometric view.

Method of drawing of Isometric View

Isometric projection is the representation of an object in pictorial form. In isometric projection, there are three pictorial axes namely X, Y and Z which are 1200 apart. The length, breadth and height of the object are drawn on these axes.



2.6.2. Orthographic View

It is the projection in which different views of an object are obtained on planes of projection when the projectors are parallel to each other and perpendicular to the plane on which the view is projected.

There are some assumptions to be made for obtaining orthographic projection:

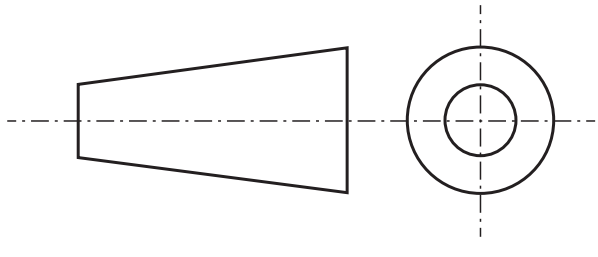
1. The observer looks at the object from an infinite distance.
2. The lines drawn from various points on the contour of the object (projectors) are parallel to each other.
3. On projection from the object, these lines meet the plane (of projection) at right angles (the Projectors are perpendicular to the plane of projection)
4. The plane of projection is transparent.

Types of orthographic projection

The object can be placed in any of the four quadrants to obtain the projections (or) views. In convention. The practice of getting views by placing the object either in the first or in the third quadrant is followed. So, the types of orthographic projections are

1. First angle projection
2. Third angle projection

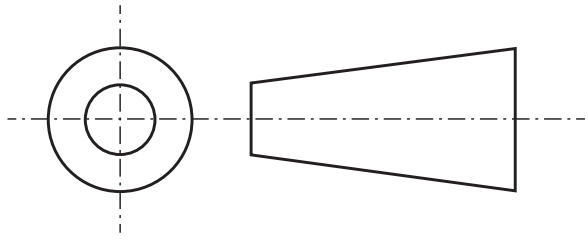
First Angle Projection: When the object is placed in the first quadrant in front of the vertical plane and above the horizontal plane, the method of obtaining the projections on these planes is called First Angle Projection.



In this method of projection, the object lies between the observer and the planes of projection. The front view is obtained above the ground line (or) reference line and the top view is obtained below the ground line. When the horizontal plane and auxiliary vertical plane are rotated after obtaining the projections, the views will be arranged as follows:

1. The top view is placed below the front view
2. The left side view is placed at the right side of the front view
3. The right side view is positional at the left side of the front view.

Third Angle Projection: The method of obtaining projections on vertical plane and above the horizontal planes by placing the object in the third quadrant is known as Third Angle Projection. Here, the object is placed behind the vertical plane and below the horizontal plane.



In this method of projection, the planes of projection lie between the observer and the object. The front view is obtained below the ground line and the top view is obtained above the ground line.

When the horizontal plane and auxiliary vertical plane are rotated after obtaining the projections, the views will be arranged as follows:

1. The top view is placed above the front view
2. The left side view is placed at the left side of the front view
3. The right side view is placed at the right side of the front view.

Views obtained in orthographic projection

Different views are obtained on different planes in orthographic projection. They are

1. Front View (or) Elevation
2. Top view (or) Plan
3. Right Side View
4. Left side View
5. View from Below
6. View from the Rear
7. Cut Section View
8. Auxiliary view

Front view: when the object is viewed from its front, the projection (or) view of the object obtained on the vertical plane, is known as front view. It is also known as Elevation. The details of length and height are found in this view.

Top view: when the object is viewed from its top, the projection (or) view of the object obtained on the horizontal plane, is known as top view. It is also known as Plan. Length and width details of the object are found in this view.

Side view: When the object is viewed from its side, the projection (or) view of the object obtained on the auxiliary vertical plane is known as side view. It can also be called as side elevation.

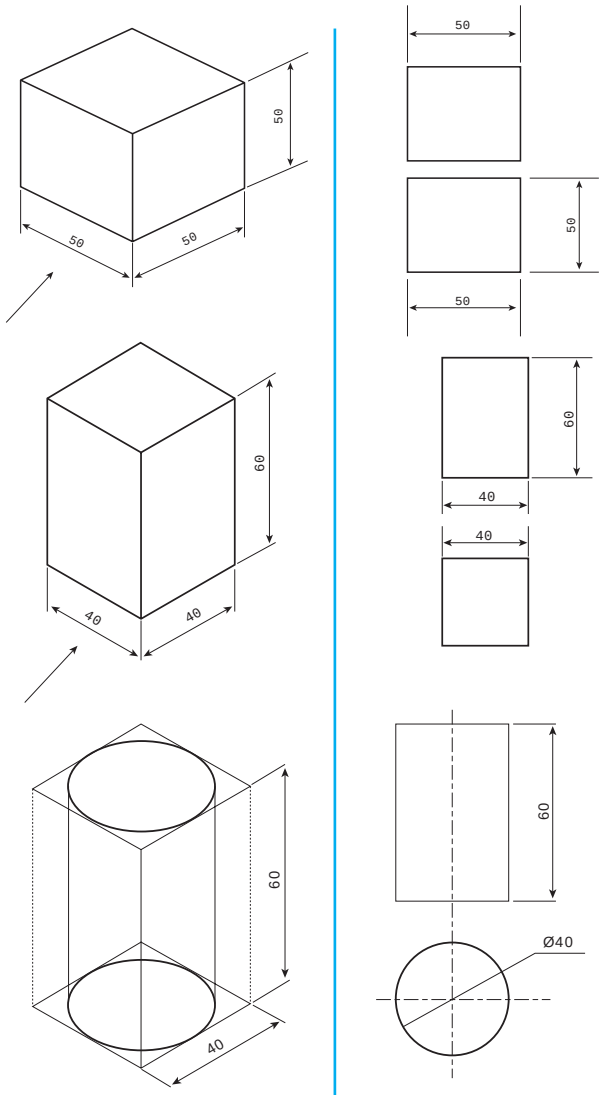
Auxiliary view: when the object is viewed from a direction which is not parallel to any of the three major axes, the projection (or) view obtained on a auxiliary plane is known as auxiliary view. When a specific detail which cannot be shown in any of the above three views is necessary to be shown, it is done so on auxiliary view.

Making orthographic projection from isometric view

The isometric view helps us in understanding the shape of the object but does not give the dimensional and inner details of the object. But these details are necessary for designing and manufacturing purposes. So, the need of orthographic projection becomes essential.

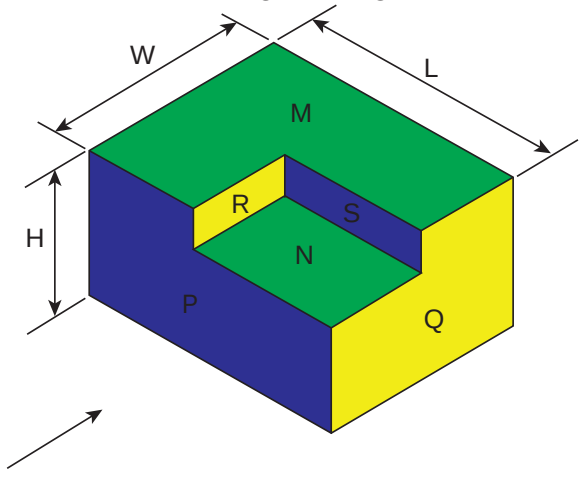
The object is viewed from the direction of arrow to obtain the front view. If the arrow is not given, the most prominent views is taken as front view. The other views are obtained by viewing the object in direction that are perpendicular to the one utilized for front view.

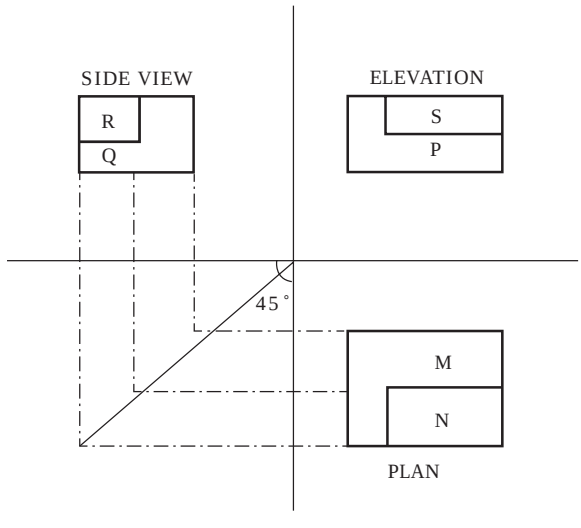
Isometric views **Orthographic Projections**



The following illustrations are given to make orthographic projections from the given isometric views.

Method of Drawing Orthographic View

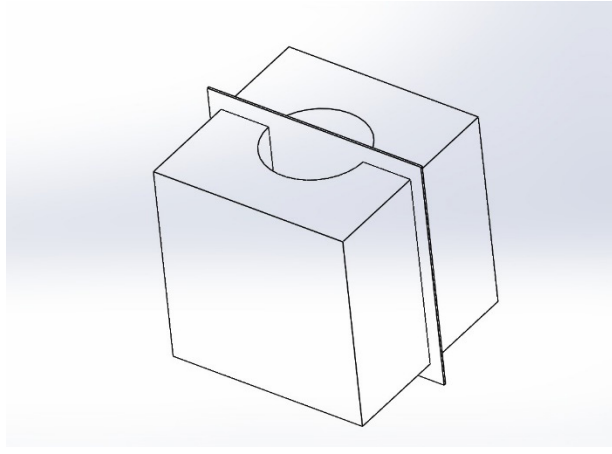


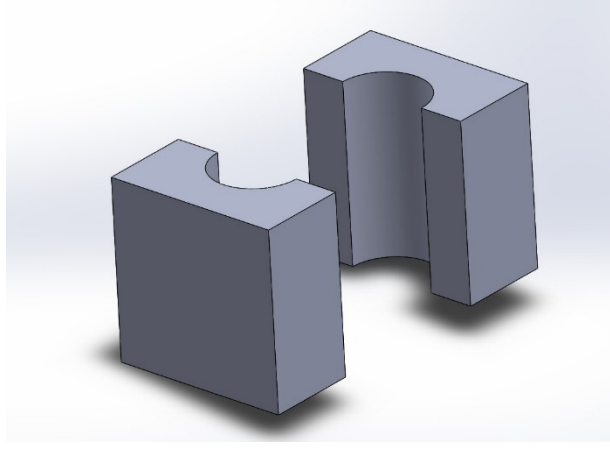


2.6.3. Sectional View

A sectional view is a view used on a drawing to show an area or a hidden part of an object by cutting away or removing some of that object.

The plane used to cut the object is called as cutting plane.



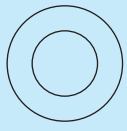
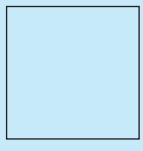
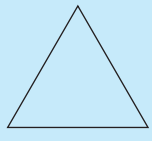
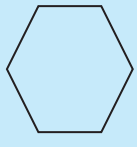
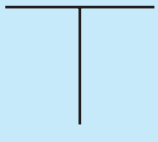
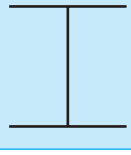


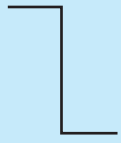
Types of Sectional view

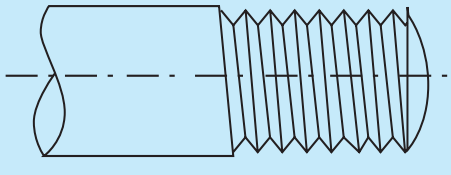
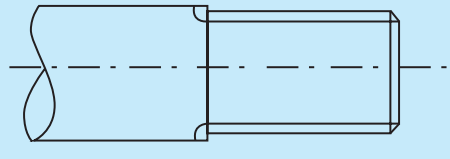
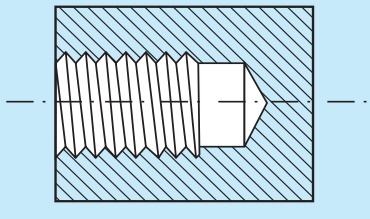
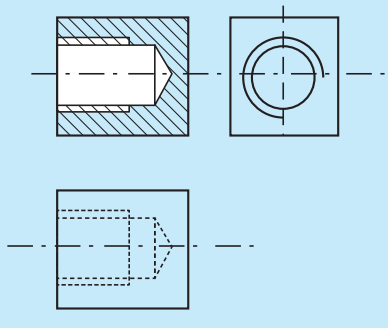
The following are the types of sectional views used in engineering drawing.

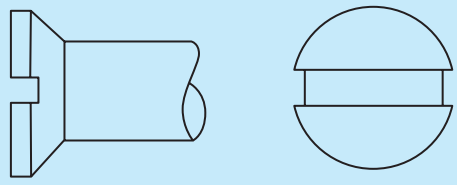
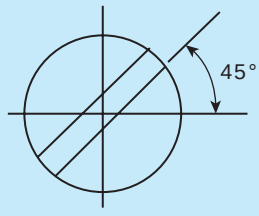
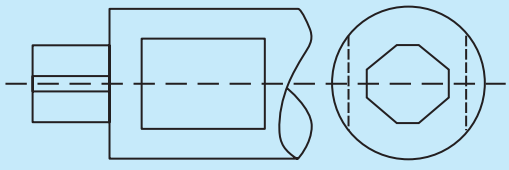
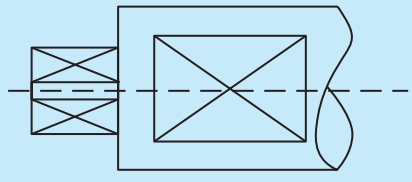
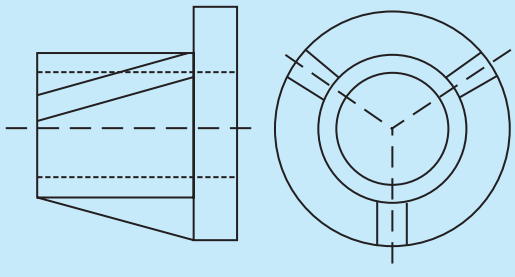
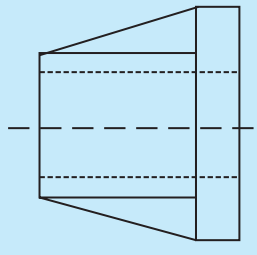
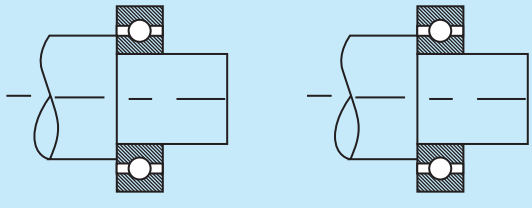
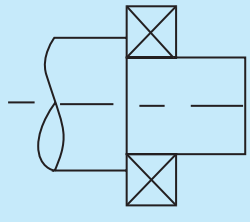
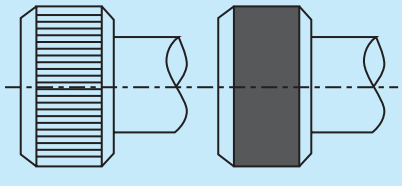
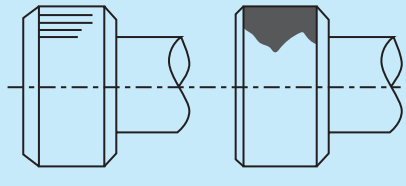
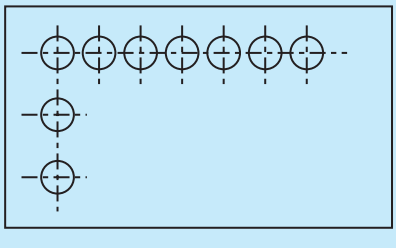
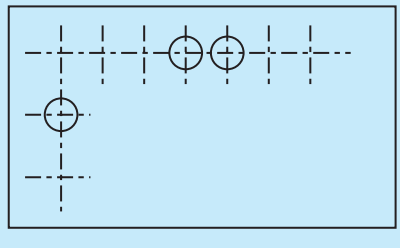
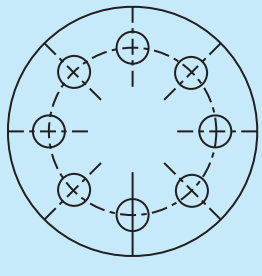
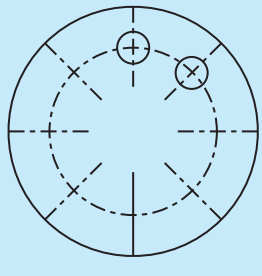
1. Full sectional view
2. Half sectional view
3. Offset sectional view
4. Broken sectional view
5. Revolving sectional view
6. Removed sectional view

2.7. BLUE PRINT READING

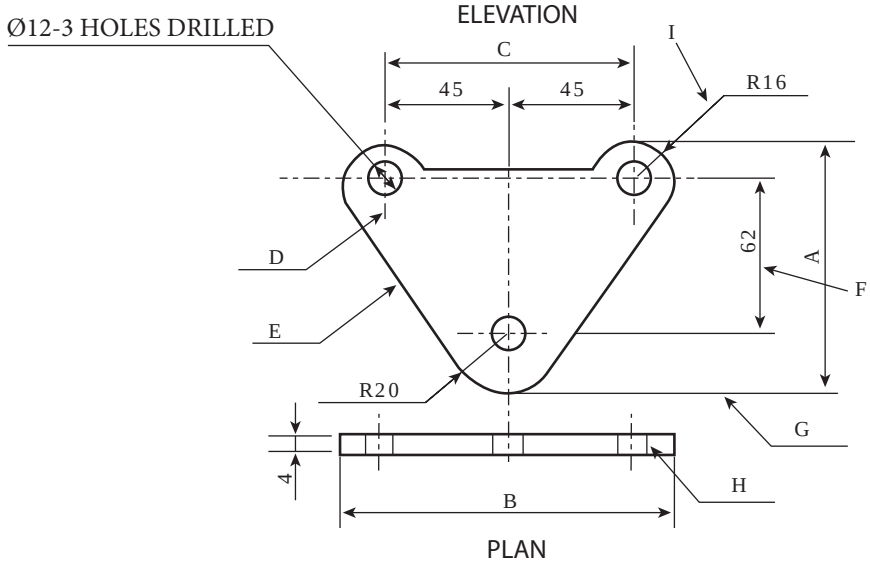
SI.No.	Description	Symbol	Specified Dimensions
01.	Round section		**d**
02.	Tube		**d x t**
03.	Square section		**s**
04.	Triangular section		**a**
05.	Hexagonal section		**s**
06.	Half round section		
07.	Rectangular section		**w x t**
08.	Angle section	 	**A x B** **A x B**
09.	T section		**h x b** **h x b**
10.	I – beam section		**h**

SI.No.	Description	Symbol	Specified Dimensions
11.	Channel section		h
12.	Z section		
13.	Rail section		
14.	Bulb Angle section		h
15.	Bulb plate section		h

Title	Actual Projection/Section	Convention
External Threads		
Internal Threads		

Title	Actual Projection/Section	Convention
Slotted Head		
Square End and Flat		
Redial Ribs		
Bearing		
Knurling		
Holes on Linear Pitch		
Holes on Circular Pitch		

Details in Drawing



1. The two views drawn in this drawing are Plan and Elevation
2. The lines used in the drawing are
   a. D- Center Line
   b. E- Visible Outline
   c. F- Dimension Line
   d. G- Extension Line
   e. H- Dotted Line
   f. I - Leader Line
3. The value of B is 122mm

   Where,
   i. In elevation view two radius are given as R5 and R16, which means it is 5mm & 16mm.
   ii. The distance between the centre of the holes are 45, 45
   iii. So B= 16+16+45+45= 122mm
4. There are three holes in the part

   Where,

   3 Holes with the Diameter of 12mm- mentioned as

   D12 Drilled Hole 3 Nos
5. Thickness of the plate is 4mm mentioned in plan view of the drawing

Activities

1. Collect different grade of pencils.
2. Collect different size of paper.

QUESTIONS

I Choose the best answer

1. The method of drawing length, breadth, and height of an object on planes 120° a part is known as
   a. Orthographic projection
   b. Isometric projection
   c. First angle projection
   d. Third angle projection

2. The lines drawn from the contour of an object to the plane of projection are called
   a. Imaginary lines
   b. Straight lines
   c. Projectors
   d. Projection

3. Top view is obtained on
   a. Vertical plane
   b. Horizontal plane
   c. Profile plane
   d. Auxiliary plane

4. In first angle projection the top view is placed
   a. Above the front view
   b. Left side of the front view
   c. Right side of the front view
   d. Below the front view

5. BIS refers to
   a. Bharath industrial society
   b. Bureau of Indian standards
   c. British institute of standards
   d. Bureau of international standards

6. ISI was taken over and renamed as BIS in the year
   a. 1947 b. 1983
   c. 1987 d. 1999

7. The size of letters in the title of the drawing is
   a. 10mm b. 6mm
   c. 3mm d. 2mm

8. Gothic lettering
   a. Is done by writing alphabets with uniform thickness
   b. Is done with calligraphic nibs
   c. Has shortened width with respect to its height
   d. Has more width and normal height

9. The method of placing dimensions parallel and about the dimension lines is
   a. Aligned system
   b. Leader line method
   c. Extension line method
   d. Unidirectional system

10. The length and width of the arrowhead should be in the ratio

a. 2:1 b. 1:2
c. 3:1 d. 5:2

11. Drawing boards with dimensions of 1000 X 700 X 25 is designated as

a. D0 b. D1
c. D2 d. D3

12. Drawing sheets with dimensions of 297 X 210 is designated as

a. A0 b. A1
c. A2 d. A4

13. Horizontal parallel lines are drawn with

a. T-square
b. Protractor
c. French curves
d. Drawing board

14. Freehand sketches are made with

a. 2B Pencils
b. 4B pencils
c. HB pencils
d. 2H pencils

15. Angular lines are drawn and measured with

a. Divider
b. Protractor
c. Compasses
d. Tee square

16. Straight and curved lines may be divided equally with

a. Divider
b. Protractor
c. Compasses
d. Inking pen

17. The lines used to show the hidden details of a drawing are known as

a. Centre lines
b. Sectional lines
c. Dotted lines
d. Hatching

18. The sectional portion of the object is indicated by

a. Dimension lines
b. Hatching
c. Hidden lines
d. Centre lines

19. The cutting plane angle of the full section is

a. 180° b. 90°
c. 60° d. 45°

20. The section of a connecting rod is generally shown in

a. Half section
b. Revolved section
c. Local section
d. Offset section

21. The method showing the section of an object adjacent to its view is

a. Half section
b. Revolved section
c. Local section
d. Offset section

II. ANSWER THE FOLLOWING QUESTIONS (3 MARK)

1. What are the types of orthographic projection?
2. What is isometric projection?
3. What is orthographic projection?

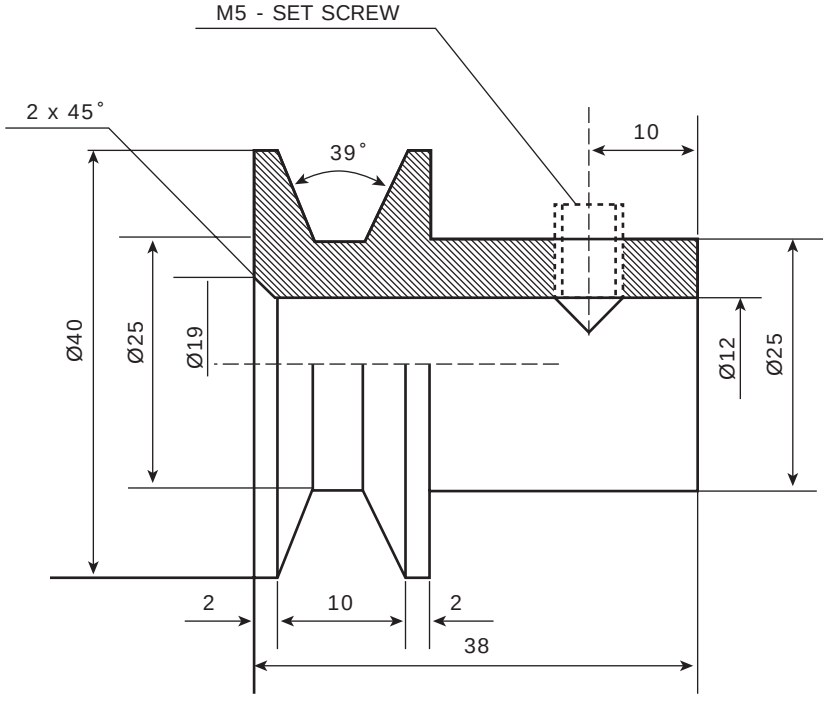
4. What is third angle projection?
5. What are the views obtained in orthographic projection?
6. Draw the symbol of first angle projection and third angle projection?
7. When was BIS established?
8. What does ISO refer to?
9. What is a title block?
10. What are the main features of lettering?
11. What are the types of letters?
12. What is dimensioning?
13. What are the two types of dimensioning and explain?
14. Mention the two types of set-square?
15. What are the grades of drawing pencils?
16. What is the use of French curves?
17. What are the instruments found in the instrument box?
18. What are the objectives of a sectional view?
19. What is cutting plane?
20. What is a sectional view?
21. What are the types of sectional views?
22. What is a scale of a drawing?
23. What are the important uses of scales?
24. What are the types of scales?
25. How scales are classified?

III. ANSWER THE FOLLOWING QUESTIONS (5 MARK)

1. What are the informations to be furnished in a title block
2. Draw different types of lines and specify their applications.

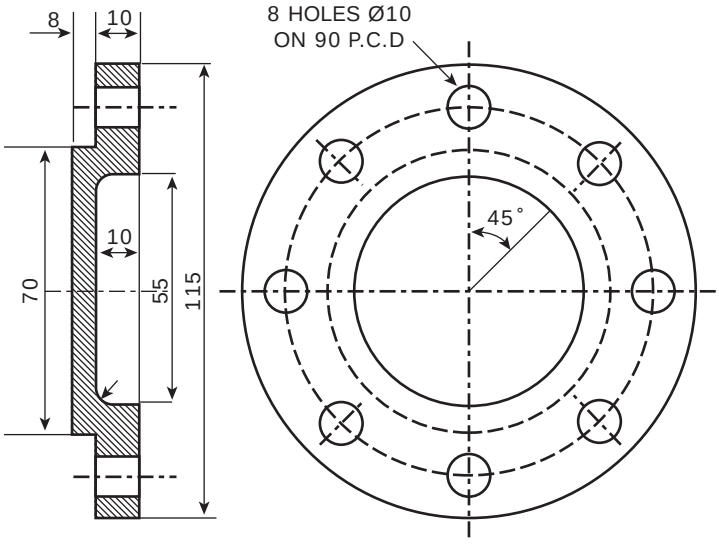
IV. ANSWER THE FOLLOWING QUESTIONS (10 MARK)

1. Answer the following questions by using the diagram



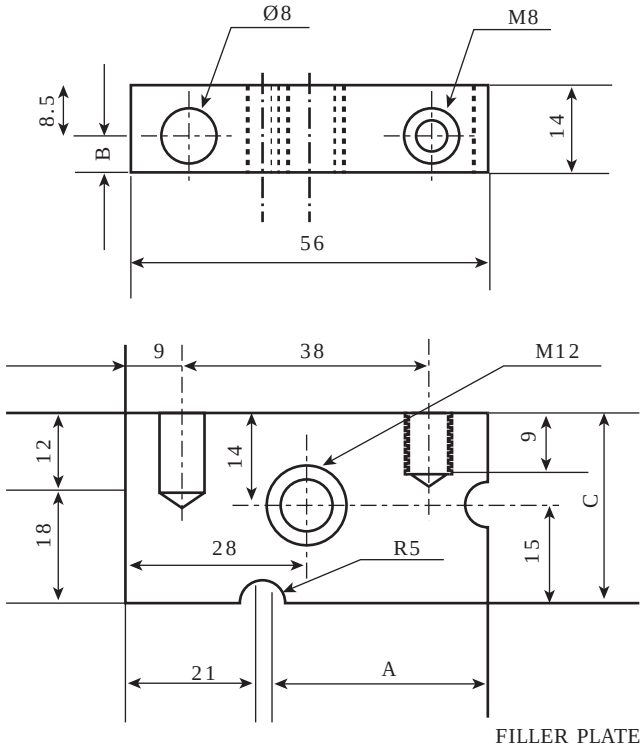
a. Mention the use of the part
b. What is the outer diameter of the part?
c. What is the length of the part?
d. What is the size of the thread?
e. What is the angle of the V – groove?
f. What is the diameter of the central hole?
g. What is the depth of the V – groove?

2. Answer the following questions by using the diagram



a. What is the pitch circle diameter?
b. How many holes are there in the part?
c. What is the outer diameter of the part?
d. What is the thickness of the part?
e. What is the angle between two adjacent holes?

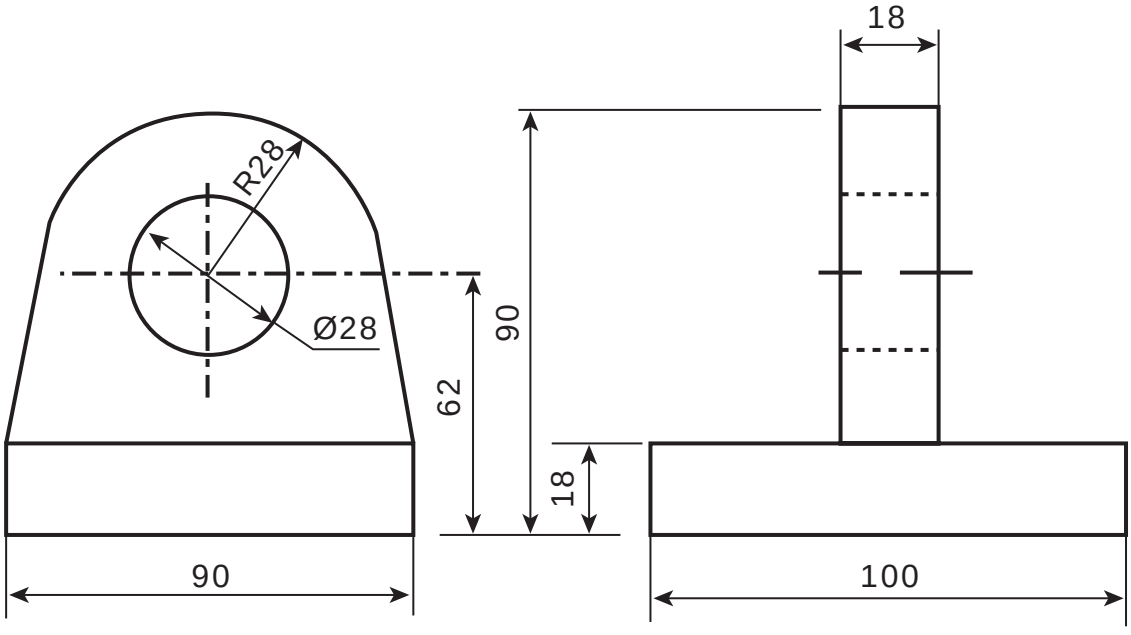
3. Answer the following questions by using the diagram



FILLER PLATE

a. How many holes are tapped?
b. What is the radius of the groove?
c. What is the length of the part?
d. What is the width of the part?
e. What is the height of the part?
f. What are the dimensions represented by A, B & C?

4. Answer the following questions by using the diagram



a. What are the overall dimensions of the bracket shown?

b. What is the shape and size of the base of the bracket?

c. What is the size of the hole in the bracket?

d. What is the radius of the curved top?