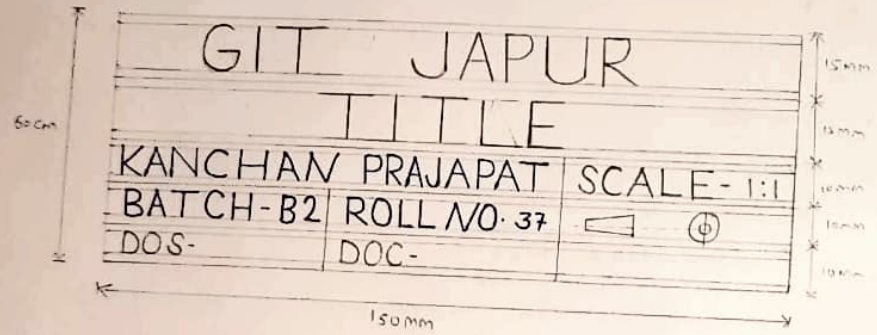
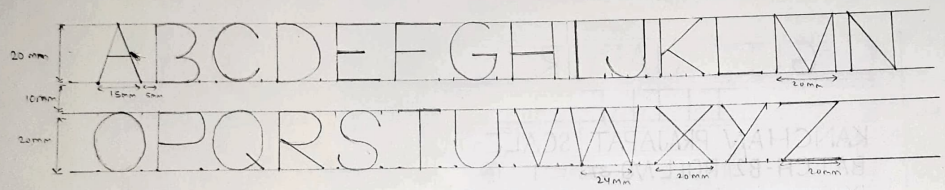
Outside margin -> 1H
Inside margin -> 2H
details -> HB

Title Block



Lettering



For all
w : h = 5 : 6
w = 15mm
h = 20mm

For M, X and Z
w : h = 1 : 1

For W
w : h = 6 : 5
h = 20mm, w = 24mm

For I
width = 0

Table

Lines	
Initial work and construction lines Outline, dotted lines, section-plane line, dimension lines, arrowheads centre lines, section lines	H 2H 3H or 4H

Line	Description	General Applications.
A.	Continuous thick or Continuous wide	Visible outline, visible edges; crests of screw threads; limits of length of full depth thread, lines of cuts and section arrows; parting lines of moulds in views; main representations in diagrams, maps, flow charts; system lines (structural metal engg.)
B.	Continuous thin (Narrow) (Straight or curved)	Imaginary lines of intersection; grid dimension, extension, projection, short centre, leader, refrence lines; hatching; outlines of revolved sections; roots of screw threads; interpretation lines of tapered features; framing of details; indication of repetitive details;
C.	Continuous thin (narrow) freehand	Limits of partial or interrupted views and sections, if the limit is not a chain thin line.
D.	Continuous thin (Narrow) with zigzags (Straight)	Long-break line.
E.	Dashed thick (wide).	Line showing permissible of surface treatment.
F.	Dashed thin (Narrow)	Hidden outlines, Hidden edges.
G.	Chain thin long-dashed dotted (Narrow)	Centre line; lines of symmetry; trajectories; pitch circle of gears, pitch circle of Holes.

	Line	Description	General Applications
H.	—·—·—·—·—	Chain thin (Narrow) with thick (wide) at the ends and at changing of position.	Cutting planes.
J.	—·—·—·—	Chain thick or long-dashed dotted (wide)	Indication of lines or surfaces to which a special requirement applies.
K.	—··—··—··—	Chain thin double-dashed or long-dashed double-dotted (narrow)	Outlines of adjacent parts Alternative and extreme positions of movable parts Centroidal lines initial outlines prior to forming Parts situated in front of the cutting plane.

(Fig. 3-1)

Types of lines

(1) Outlines (A): Lines drawn to represent visible edges and surface boundaries of objects are called outlines or principal lines. They are continuous thick or wide lines [Fig. 3-2].

(2) Margin lines (A): They are continuous thick or wide lines along which the prints are trimmed. [Fig. 2-1(a)].

(3) Dimension lines (B): These lines are continuous thin lines. They are terminated at the outer ends by pointed arrowhead touchings the outlines, extension lines or centre lines (fig 3-2).

(4) Extension or projection lines (B): These lines also are continuous thin lines. They extend by about 3 mm beyond the dimension lines (fig. 3-2).

(5) Construction lines (B): These lines are drawn for constructing figures. They are shown in geometrical drawings only. They are continuous thin light lines.

(6) Hatching or section lines (B): These lines are drawn to make the section evident. They are continuous thin lines and are drawn generally at an angle of 45° to the main outlines of the section. They are uniformly spaced about 1mm to 2mm apart (fig. 3-2).

(7) Leader or pointer lines (B): Leader line is drawn to connect a note with the feature to which it applies. It is a continuous thin line (fig. 3-2).

(8) Border line (B): Perfectly rectangular working space is determined by drawing the border line [fig. 2-12(a)]. They are continuous thin lines.

(9) Short-break lines (C): These lines are continuous, thin and wavy. The are drawn freehand and are used to show a short break, or irregular boundaries (fig. 3-3).

(10) Long-break lines (D): These lines are thin ruled lines with short zigzags within them. They are drawn to show long break (fig. 3-3).

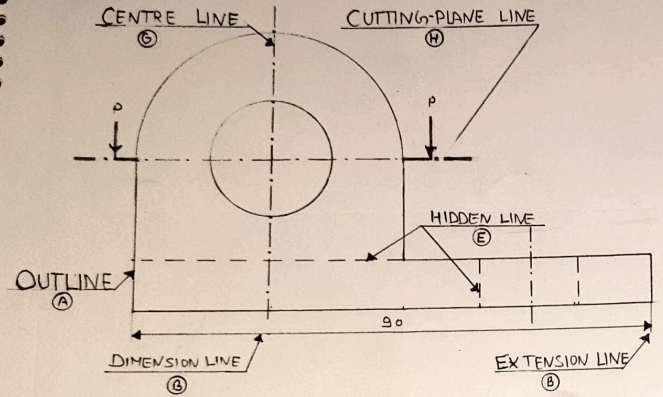
(11) Hidden or dotted lines (E or F): Interior or hidden edges and surfaces are shown by hidden lines. They are also called dotted lines. They are of medium thickness and made up of short dashes of approximately equal lengths of about 2 mm spaced at equal distances of about 1 mm, when a hidden line meets or intersects another hidden line or an outline, their point of intersection or meeting should be clearly shown (fig. 3-2)

(12) Centre lines (G): Centre lines are drawn to indicate the axes of cylindrical, conical or spherical objects or details, and also to show the centres of circles and arcs. They are thin, long, chain line composed of alternately long and dot spaced approximately 1 mm apart. The long dashes are about 9 to 12 mm. Centre lines should extend for a short distance beyond the outlines to which they refer. For the purpose of dimensioning or to correlate the views they may be extended as required. The point of intersection between two centre lines must always be indicated. Locus lines, extreme positions of movable parts and pitch circles are also shown by this type of line (fig. 3-2 and fig 3-3).

(13) Cutting-plane lines (H): The location of a cutting plane is shown by this line. It is a long, thin, chain line, thick at ends only (fig 3-2).

(14) Chain thick (J): These lines are used to indicate special treatment on the surface.

(15) Chain thick double-dots (K): This is a chain thin double-dot line.


CENTRE LINE
G
CUTTING-PLANE LINE
H
P
P
HIDDEN LINE
E
OUTLINE
A
90
DIMENSION LINE
B
EXTENSION LINE
B

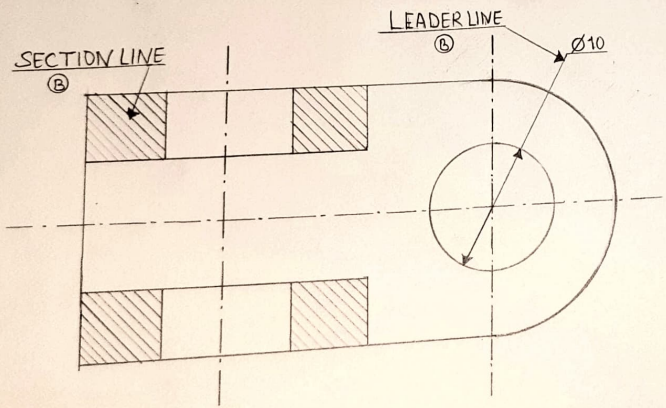

LEADER LINE
B
Ø10
SECTION LINE
B

FIG. 3-2

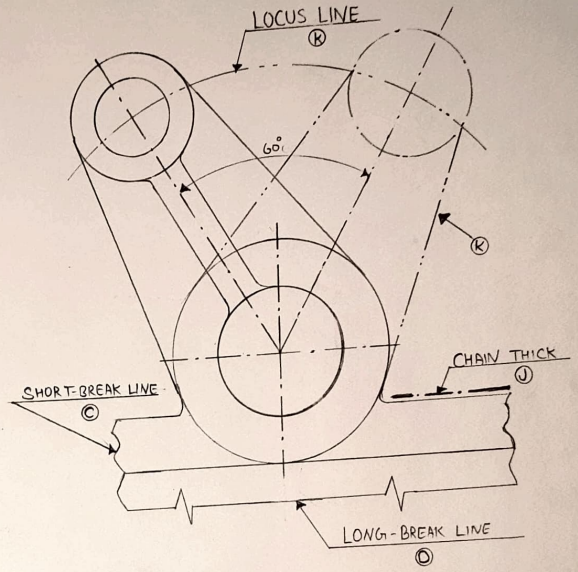

LOCUS LINE
K
60°
K
CHAIN THICK
J
SHORT-BREAK LINE
C
LONG-BREAK LINE
D

FIG. 3-3

SCALES

A scales is defined as the ratio of the linear dimensions of element of object as represented in a drawing to the actual dimensions of the same element of the object itself.

4-2. SCALES

The scales generally used for general engineering drawings are shown in table 4-1 [SP:46]

TABLE - 4.1

(i)	Reducing Scales	1:2 1:20 1:200 1:2000	1:5 1:50 1:500 1:5000	1:10 1:100 1:1000 1:10000
(ii)	Enlarging Scales	50:1 5:1	20:1 2:1	10:1
(iii)	Full size scales			1:1

All these scales are usually 300 mm long and sub-divided throughout their lengths. The scale is indicated on the drawing at a suitable place near the title. The complete designation of a scale consists of word scale followed by the ratio, i.e. scale 1:1 or scale, full size.

It may not be always possible to prepare full size drawings. They are, therefore, drawn proportionately smaller or larger. When drawing are drawn smaller than actual size of the object (as in case of building, bridges, large machines etc.) the scale used is said to be a reducing scale. (1:5). Drawings of small machine parts, mathematical instruments, watches etc. are made larger than their real size. These are said to be drawn on an enlarging scale (5:1).

The scales can be expressed in the following three ways:

(1) Engineer's Scale: In this case, the relation between the dimension on the drawing and the actual dimension of the object is mentioned numerically in the style as 10mm = 5 m etc.

(2) Graphical scale: The scale is drawn on the drawing itself. As the drawing becomes old, the engineer's scale may shrink and may not give accurate results.

However, such is not the case with graphical scale because if the drawing shrinks, the scale will also shrink. Hence the graphical scale is commonly used in surrey maps.

(3) Representative fraction: The ratio of the length of object represented on drawing to the actual length of the object represented is called the Representative Fraction. (R.F.).

$$R.F. = \frac{\text{Length of the drawing}}{\text{Actual length of object}}$$

When a 1 cm long line in a drawing represents 1 meter length of object, the R.F. is equal to $\frac{1\text{cm}}{1\text{m}} = \frac{1\text{cm}}{1\times100\text{cm}} = \frac{1}{100}$ and the scale of the drawing will be 1:100 or $\frac{1}{100}$ full size. The R.F. of a drawing is greater than unity when it is drawn on an enlarging scale. For example, when a 2mm long edge of an object is shown in a drawing by a line 10mm long, the R.F. is $\frac{1\text{cm}}{2\text{mm}} = \frac{10\text{mm}}{2\text{mm}} = 5$. Such a drawing is said to be drawn on scale 5:1 or five times full-size.

4.3. SCALES ON DRAWINGS

When an unusual scale is used, it is constructed on the drawing sheet. To construct a scale the following information is essential:

(1.) The R.F. of the scale.
(2.) The units which it must represent, for example, millimetres and centimetres, or feet and inches etc.
(3.) The maximum length which it must show.

The length of the scale is determined by the formula:

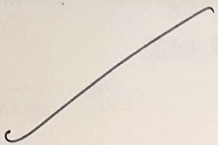
Length of the scale = R.F. × [maximum length required to be measured.]

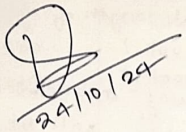
It may not be always possible to draw as long a scale as to measure the longest length in the drawing. The scale is therefore drawn 15 cm to 30 cm long, longer lengths being measured by marking them off in parts.

4.4. TYPES OF SCALES

The scales used in practice are classified as under:

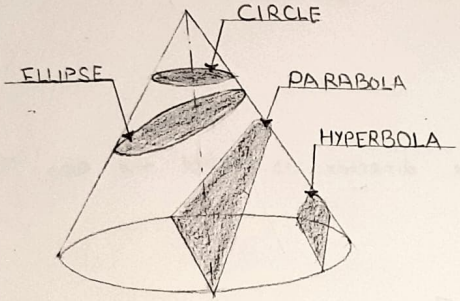
(1.) Plain scales
(2.) Diagonal scales
(3) Comparative scales
(4.) Vernier Scales
(5) Scale of chords.

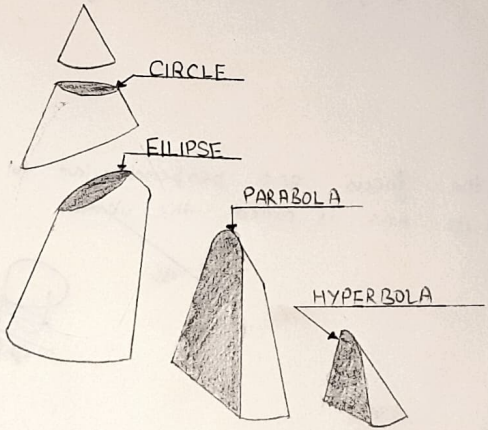




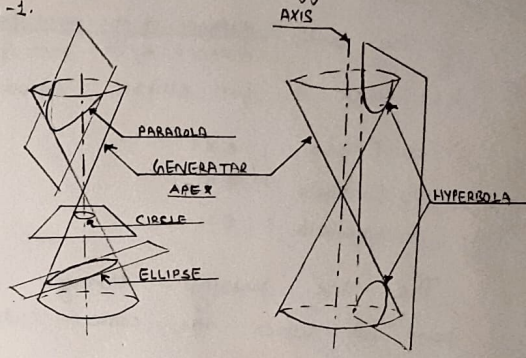
CONIC-SECTIONS

The sections obtained by the intersection of a right circular cone by a plane in different positions relative to the axis of the cone are called conics. Refer to fig. 6-1.





Conic sections



(i) When the section plane is inclined to the axis and cuts all the generators on one side of the apex, the section is an ellipse. (fig. 6-1)

(ii) When the section plane is inclined to the axis and is parallel to one of the generator, the section is a parabola. (fig. 6-1).

(iii) A hyperbola is a plane curve having two separate parts or branches, formed when two cones that point towards one another are intersected by a plane that is parallel to the axis of the cones.

The conic may be defined as the locus of a point moving in a plane in such a way that the ratio of its distances from a fixed point and a fixed straight line is always constant. The fixed point is called the focus and the fixed line, the directrix.

The ratio $\frac{\text{distance of the point from the focus}}{\text{distance of the point from the directrix}}$ is called eccentricity. and is denoted by e. It is always less than 1 for ellipse, equal to 1 for parabola & greater than 1 for hyperbola, i.e.

(i) Ellipse : $e < 1$
(ii) Parabola : $e = 1$
(iii) Hyperbola : $e > 1$

The line passing through the focus and perpendicular to the directrix is called the axis. The point at which the conic cuts its axis is called the vertex.

24/10/24