

Chapter - I

Engineering Drawing

Introduction

A picture is worth saying a thousand words; hence drawings are used to visually communicate ideas, thoughts, and designs. Drawings drawn by an engineer for engineering purposes is Engineering Drawing.

Drawing is the Universal Graphical Language of Engineers, spoken, read and written in its own way. Engineers must have perfect drawing skills and excellent working knowledge of engineering concepts. An inaccurate drawing may misguide the workman and ultimately affect the production.

Objectives

In this, the first session, you'll be looking at drawing instruments and the typical accessories used in drawing. On completion of the session, you should be able to:

- Identify various types of drawing instruments and their uses.
- Classify drawing sheets and the different grades of drawing pencils.
- Draw the layout and title block on a drawing sheet.
- Use the lettering and dimensioning techniques in common practice.

Drawing Instruments

The Drawing Board

The D2 or D3 drawing boards are usually used in polytechnics and engineering colleges. Drawing boards are made of well-seasoned softwood such as Oak or Pine. The standard sizes of drawing boards as per **BIS** (1444-1977) are given in the table.

Designation	Dimensions (mm)		
	Length	Width	Thickness
D0	1500	1000	25
D1	1000	700	25
D2	700	500	15
D3	500	350	15

The Drawing Sheet

The standard sizes of drawing sheets as per **BIS** (10711-1983) are given in the table. The ratio of the width of a drawing sheet to its length is $1: \sqrt{2}$.

The drawing sheet should be tough and strong and its fibers should not disintegrate when an eraser is used on its surface.

Designation	Dimensions (mm)	
	Length	Width
A0	1189	841
A1	841	594
A2	594	420
A3	420	297
A4	297	210

Minidrafter:

A minidrafter is a device with two scales set at right angles to each other. It combines the functions of a T-square, setsquares, scales and a protractor. It can be easily and quickly moved to any location on the drawing sheet without altering the scales.

The T-Square

A T-square is mainly used together with setsquares for drawing horizontal lines, angles and perpendicular lines. There are two essential parts of a T-square, namely the stock and the blade. The blade is fitted with ebony or a plastic piece to form the working edge of the T-square. The stock and the blade of a T-square are held together at right angles to each other. T-squares are made of hard quality wood such as teak or mahogany, etc.

Instrument Box

The instrument box contains the following instruments and accessories.

- Compasses-Large compasses and Bow compasses
- Dividers-Plain Dividers and Bow Dividers
- An Inking pen
- A lead case
- A Small Screwdriver

The instruments in an instrument box are made of nickel coated steel or brass.

The Compasses

A pair of compasses are used to draw circles and arcs. Compasses are used in conjunction with scales (rulers).

Large compasses

Large compasses are used to draw circles up to 100 mm diameter. For drawing circles of more than 100 mm diameter, a lengthening bar is used.

Bow compasses

Bow compasses are used for drawing small circles up to 25 mm diameter.

The Dividers

Dividers are used in conjunction with scales.

Plain Dividers

Plain dividers are used to divide straight or curved lines into a prescribed number of equal parts, for transferring dimensions and for setting of distances from a scale to drawings.

Bow Dividers

Bow dividers are used to hold precise distances for dividing or transferring.

Inking Pen

An inking pen is used to draw straight or curved lines in tracing ink.

Lead Case

A lead case is used to store pencil leads.

Small screwdriver

A screwdriver is used to tune the screws in the instruments.

The Setsquares

Setsquares are used to draw parallel and perpendicular lines. Setsquares are made of transparent celluloid or acrylic and may also contain French curves.

The Procircle

A procircle is circular in shape. Its periphery is divided into 0.5° graduations that are used to mark and measure angles. It also has circular holes of different sizes that may be used to draw circles of specific diameter.

The Scales

Scales or rulers are devices with precise graduations marked on their straight edges for precise measurements.

Scales are made of celluloid or cardboard. Eight types of scales are used (M1, M2,...,M8) as per **BIS 10713 - 1983**.

Scale of a Drawing

The drawing of an object is usually produced to a definite proportion with respect to the actual size of the object. This ratio is called the "scale of drawing".

Drawing to Full scale: When a drawing is produced to a size equal to that of the object, the drawing is said to be drawn to "full scale".

Drawing to a reduced scale: When a drawing is produced to a size smaller than that of the object, the drawing is said to be drawn to a "reduced scale".

Drawing to an enlarged scale: When a drawing is produced to a size greater than that of the object, the drawing is said to be drawn to an "enlarged scale".

DESIGNATION OF SCALE	SCALES			
	FRONT SIDE		REAR SIDE	
M1	FULL SIZE	1:1	50 cm to 1 metre	1:2
M2	40 cm to 1 metre	1:2.5	20 cm to 1 metre	1:5
M3	10 cm to 1 metre	1:10	5 cm to 1 metre	1:20
M4	2 cm to 1 metre	1:50	1 cm to 1 metre	1:100
M5	5 mm to 1 metre	1:200	2 mm to 1 metre	1:500
M6	0.33 cm to 1 metre	1:300	0.66 cm to 1 metre	1:600
M7	0.25 mm to 1 metre	1:400	0.125 mm to 1 metre	1:800
M8	1 mm to 1 metre	1:1000	0.5 mm to 1 metre	1:2000

Drawing Pencils

Drawing pencils are of different grades.

The HB pencil is a soft grade used for drawing thick lines, borderlines, lettering and arrowheads.

The H pencil is used to draw finishing lines, visible lines and hidden lines.

The 2H pencil is a hard grade pencil used for drawing construction lines, dimension lines, centre lines and section lines.

Other grades are used for artistic application.

Eraser

An eraser is a good quality rubber that is used to erase unwanted lines, arcs etc., from a drawing.

Clips

Drawing clips are used to fix the drawing sheet on the drawing board. They are made of nickel-coated steel.

Cello tape (Adhesive tape) may also be used in place of clips to fix the drawing sheet on the board.

Sharpener and Emery Paper

A pencil sharpener is used to give pencils with good drawing tips. Emery paper (120 grade) is used to obtain a conical or chisel tipped pencil.

French curves

French curves are used for drawing irregular curves that cannot be drawn by compasses.

BIS & ISO Drawing Conventions

The International Standards Organization (ISO) Geneva has formulated International standards for Engineering Drawing. The Bureau of Indian Standards (BIS) previously known as Indian Standards Institution (ISI) has adopted the ISO standards. The ISO standards are applicable to the following topics:

- Layout of Drawing sheet
- Line Types
- Lettering in Drawing
- Dimensioning Methods
- Arrows

Layout of Drawing Sheet

Engineering students generally use A2 or A3 size drawing sheets. After fixing the drawing sheet on to the drawing board, the "Border lines" and the "Title block" are first drawn.

The Borderlines:

An ideal working space for drawing is obtained by drawing the borderlines. The following steps are involved in drawing the borderlines:

Draw a filing margin of 30 mm width at the left-hand edge of the drawing sheet.

Provide margins of a minimum of 10 mm each at the top, bottom and right side of the drawing sheet. Use an HB pencil for drawing the borderlines.

