

*Textbook of*  
**ENGINEERING  
DRAWING**

**K Venkata Reddy**

# **Textbook of Engineering Drawing**

**Second Edition**

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## CHAPTER 1

# Drawing Instruments and Accessories

### 1.1 Introduction

Engineering drawing is a two dimensional representation of three dimensional objects. In general, it provides necessary information about the shape, size, surface quality, material, manufacturing process, etc., of the object. It is the graphic language from which a trained person can visualise objects.

Drawings prepared in one country may be utilised in any other country irrespective of the language spoken. Hence, engineering drawing is called the universal language of engineers. Any language to be communicative, should follow certain rules so that it conveys the same meaning to every one. Similarly, drawing practice must follow certain rules, if it is to serve as a means of communication. For this purpose, Bureau of Indian Standards (BIS) adapted the International Standards on code of practice for drawing. The other foreign standards are : DIN of Germany, BS of Britain and ANSI of America.

### 1.2 Role of Engineering Drawing

The ability to read drawing is the most important requirement of all technical people in any profession. As compared to verbal or written description, this method is brief and more clear. Some of the applications are : building drawing for civil engineers, machine drawing for mechanical engineers, circuit diagrams for electrical and electronics engineers, computer graphics for one and all.

The subject in general is designed to impart the following skills.

1. Ability to read and prepare engineering drawings.
2. Ability to make free – hand sketching of objects.
3. Power to imagine, analyse and communicate, and
4. Capacity to understand other subjects.

### 1.3 Drawing Instrument and Aids

The Instruments and other aids used in draughting work are listed below :

- |                  |                   |                   |
|------------------|-------------------|-------------------|
| 1. Drawing board | 2. Mini draughter | 3. Instrument box |
| 4. Set squares   | 5. Protractor     | 6. Set of scales  |
| 7. French curves | 8. Drawing sheets | 9. Pencils        |
| 10. Templates    |                   |                   |

## 1.2 Textbook of Engineering Drawing

### 1.3.1 Drawing Board

Until recently drawing boards used are made of well seasoned softwood of about 25 mm thick with a working edge for T-square. Now a days mini-draughters are used instead of T-squares which can be fixed on any board. The standard size of board depends on the size of drawing sheet size required.

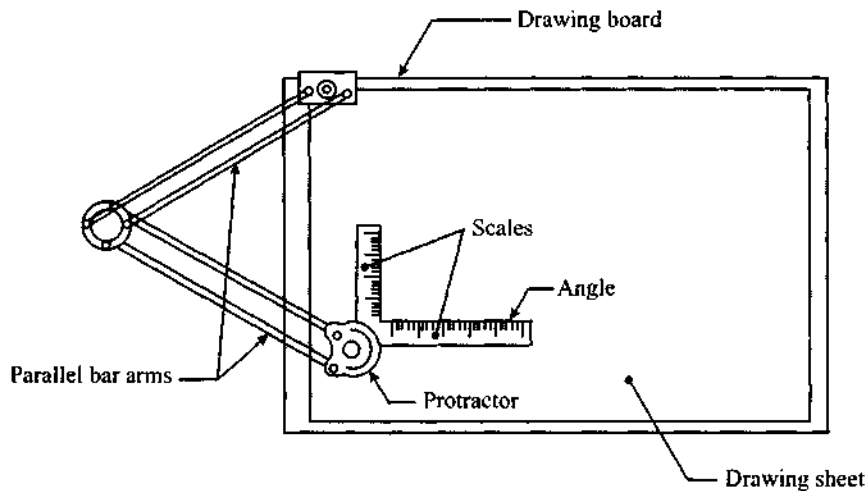


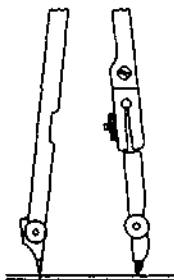
Fig. 1.1 Mini-draughter

### 1.3.2 Mini-Draughter

Mini-draughter consists of an angle formed by two arms with scales marked and rigidly hinged to each other (Fig. 1.1). It combines the functions of T-square, set-squares, scales and protractor. It is used for drawing horizontal, vertical and inclined lines, parallel and perpendicular lines and for measuring lines and angles.

### 1.3.3 Instrument Box

Instrument box contains 1. Compasses, 2. Dividers and 3. Inking pens. What is important is the position of the pencil lead with respect to the tip of the compass. It should be at least 1 mm above as shown in Fig. 1.2 because the tip goes into the board for grip by 1 mm.



(a) Sharpening and position of compass lead



(b) Position of the lead leg to draw larger circles

Fig. 1.2

### 1.3.4 Set of Scales

Scales are used to make drawing of the objects to proportionate size desired. These are made of wood, steel or plastic (Fig.1.3). BIS recommends eight set-scales in plastic/cardboard with designations M1, M2 and so on as shown in Table 1.1 Set of scales

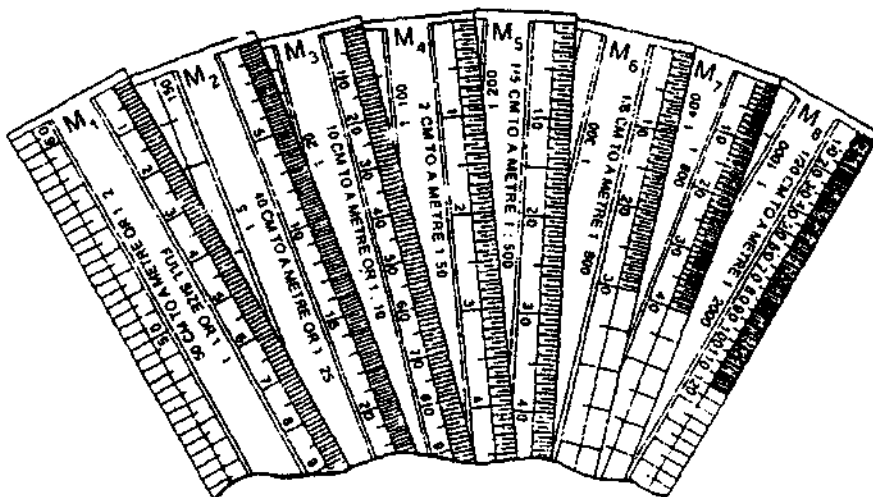


Fig. 1.3 Set of scales

Table 1.1 Set of Scales

	M1	M2	M3	M4	M5	M6	M7	M8
Scale on one edge	1:1	1:2.5	1:10	1:50	1:200	1:300	1:400	1:1000
Scale on other edge	1:2	1:5	1:20	1:100	1:500	1:600	1:800	1:2000

**Note :** Do not use the scales as a straight edge for drawing straight lines.

These are used for drawing irregular curved lines, other than circles or arcs of circles.

Table 1.2

Scales for use on technical drawings (IS : 46-1988)			
Category	Recommended scales		
Enlargement scales	50 : 1	20 : 1	10 : 1
	5 : 1	2 : 1	
Full size	1 : 1		
Reduction scales	1 : 2	1 : 5	1 : 10
	1 : 20	1 : 50	1 : 100
	1 : 200	1 : 500	1 : 1000
	1 : 2000	1 : 5000	1 : 10000

### 1.3.5 French Curves

French curves are available in different shapes (Fig.1.4). First a series of points are plotted along the desired path and then the most suitable curve is made along the edge of the curve. A flexible curve consists of a lead bar inside rubber which bends conveniently to draw a smooth curve through any set of points.

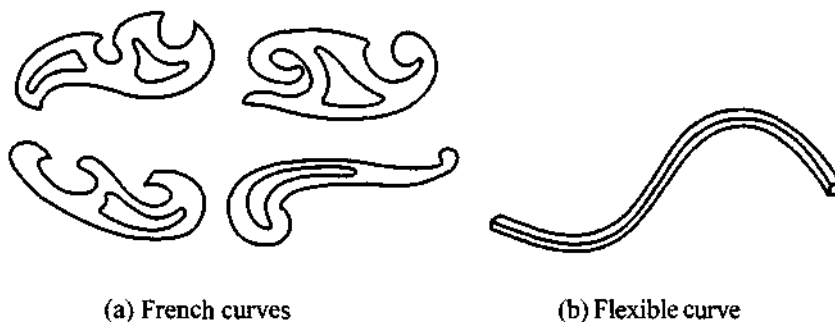


Fig. 1.4

### 1.3.6 Templates

These are aids used for drawing small features such as circles, arcs, triangular, square and other shapes and symbols used in various science and engineering fields (Fig.1.5).

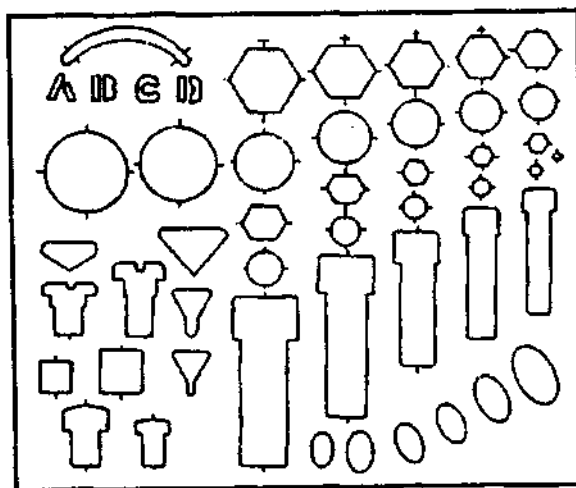


Fig. 1.5 Template

### 1.3.7 Pencils

Pencils with leads of different degrees of hardness or grades are available in the market. The hardness or softness of the lead is indicated by 3H, 2H, H, HB, B, 2B, 3B, etc. The grade HB denotes medium hardness of lead used for general purpose. The hardness increases as the value of

the numeral before the letter H increases. The lead becomes softer, as the value of the numeral before B increases (Fig.1.6).

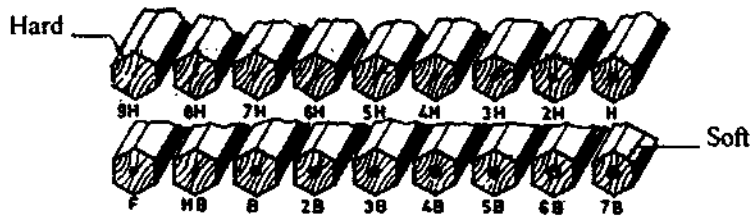


Fig. 1.6 Pencil Leads

The selection of the grade depends on the line quality desired for the drawing. Pencils of grades H or 2H may be used for finishing a pencil drawing as these give a sharp black line. Softer grade pencils are used for sketching work. HB grade is recommended for lettering and dimensioning.

Now a days mechanical pencils are widely used in place of wooden pencils. When these are used, much of the sharpening time can be saved. The number 0.5, 0.70 of the pen indicates the thickness of the line obtained with the lead and the size of the lead diameter.

Micro-tip pencils with 0.5 mm thick leads with the following grades are recommended.

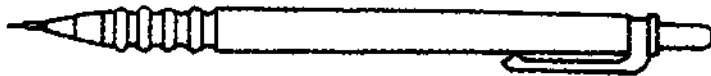


Fig. 1.7 Mechanical Pencil

**HB** Soft grade for Border lines, lettering and free sketching

**H** Medium grade for Visible outlines, visible edges and boundary lines

**2H** Hard grade for construction lines, Dimension lines, Leader lines, Extension lines, Centre lines, Hatching lines and Hidden lines.



## CHAPTER 2

# Lettering and Dimensioning Practices

(As per BIS : SP : 46 : 2003)

### 2.1 Introduction

Engineering drawings are prepared on standard size drawing sheets. The correct shape and size of the object can be visualised from the understanding of not only its views but also from the various types of lines used, dimensions, notes, scale etc. For uniformity, the drawings must be drawn as per certain standard practice. This chapter deals with the drawing practices as recommended by Bureau of Indian Standards (BIS) SP: 46:2003. These are adapted from what is followed by International Standards Organisation (ISO).

### 2.2 Drawing Sheet

The standard drawing sheet sizes are arrived at on the basic Principal of  $x : y = 1 : \sqrt{2}$  and  $xy = 1$  where  $x$  and  $y$  are the sides of the sheet. For example A0, having a surface area of 1 Sq.m;  $x = 841$  mm and  $y = 1189$  mm. The successive sizes are obtained by either by halving along the length or doubling the width, the area being in the ratio 1 : 2. Designation of sizes is given in Fig.2.1 and their sizes are given in Table 2.1. For class work use of A2 size drawing sheet is preferred.

Table 2.1

Designation	Dimension, mm Trimmed size
A0	841 × 1189
A1	594 × 841
A2	420 × 594
A3	297 × 420
A4	210 × 297

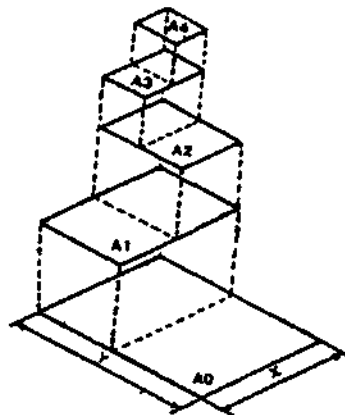


Fig. 2.1 Drawing Sheet Formats

## 2.2 Textbook of Engineering Drawing

### 2.2.1 Title Block

The title block should lie within the drawing space at the bottom right hand corner of the sheet. The title block can have a maximum length of 170 mm providing the following information.

1. Title of the drawing.
2. Drawing number.
3. Scale.
4. Symbol denoting the method of projection.
5. Name of the firm, and
6. Initials of staff who have designed, checked and approved.

The title block used on shop floor and one suggested for students class work are shown in Fig.2.2.

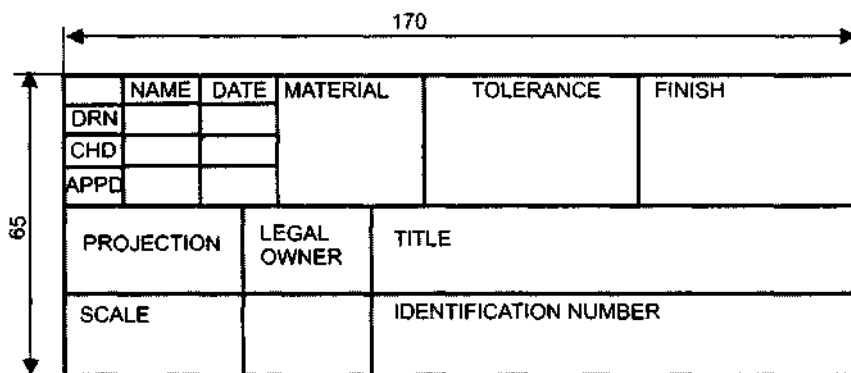


Fig. 2.2(a)

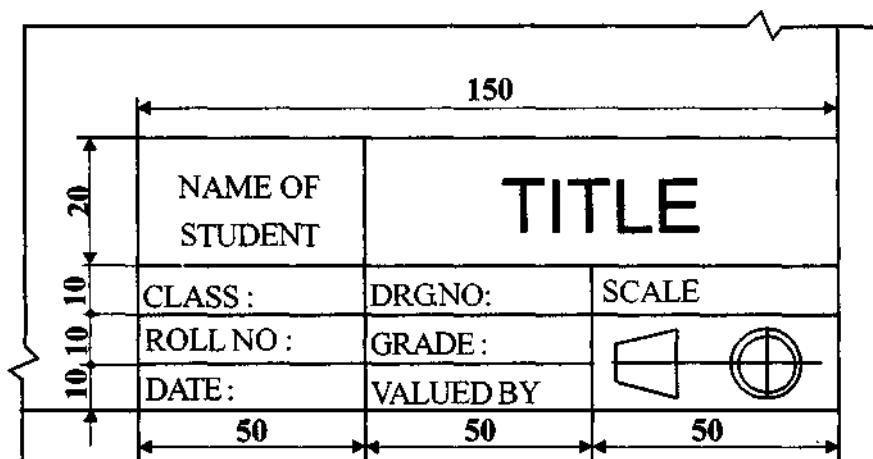


Fig. 2.2(b)

### 2.2.2 Drawing Sheet Layout (Is 10711 : 2001)

The layout of a drawing sheet used on the shop floor is shown in Fig.2.3a, The layout suggested to students is shown in Fig.2.3b.

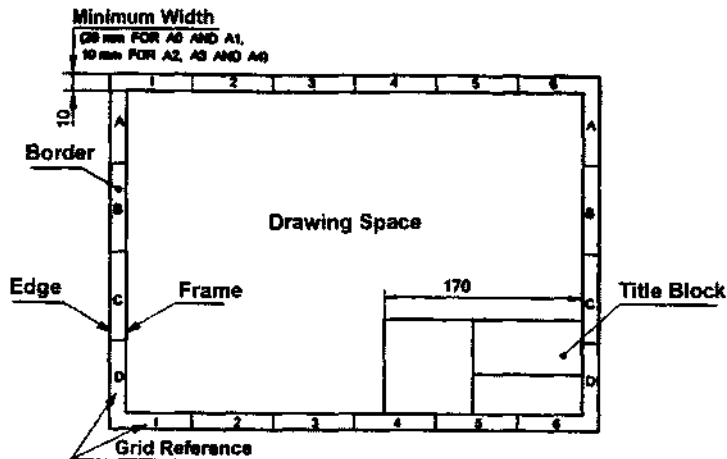


Fig. 2.2 (a) General features of a drawing sheet

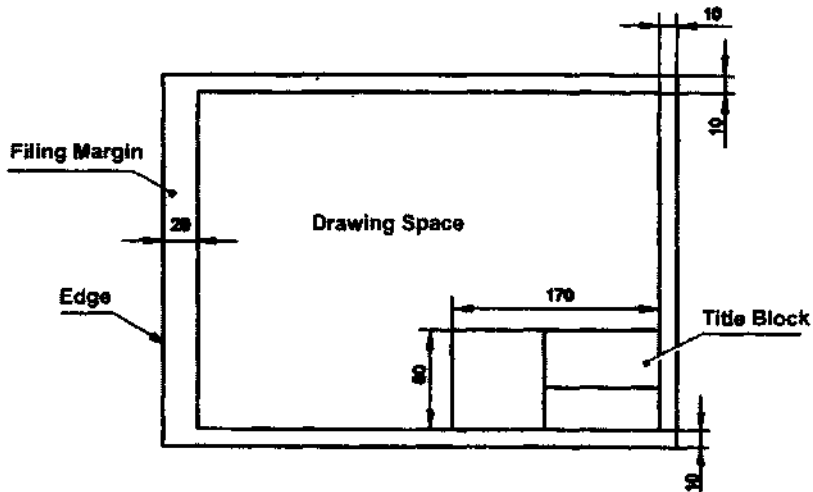


Fig. 2.3 (b) Layout of sheet for class work

### 2.2.3 Folding of Drawing Sheets

IS : 11664 – 1999 specifies the method of folding drawing sheets. Two methods of folding of drawing sheets, one suitable for filing or binding and the other method for keeping in filing cabinets are specified by BIS. In both the methods of folding, the Title Block is always visible.

2.4. Shows the method in which drawing sheets may be unfolded and refolded, without the necessity of removal from the file.



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