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BRITISH STANDARD 308:1943

ENGINEERING
DRAWING OFFICE
PRACTICE

BRITISH STANDARD INSTITUTION

RECOMMENDATIONS FOR BRITISH STANDARD

Engineering
DRAWING OFFICE
PRACTICE

B.S. 308 : 1943

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BRITISH STANDARDS INSTITUTION

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CONTENTS

Co-operating Organisations	Page 3
RECOMMENDATIONS FOR BRITISH STANDARD ENGINEERING DRAWING OFFICE PRACTICE	
Foreword	5
Typical Drawing	5
1. Sizes of Drawings and Tracings	6
2. Sizes of Drawing Boards	7
3. Layout of Drawing Sheets	7
4. Planning the Drawings	9
5. Numbering and Referencing	10
6. Scales	11
7. Types of Lines	12
8. Methods of Projection and Arrangement of Views	14
9. Lettering	18
×10. Conventional Representation of Materials	19
11. Sectioning and Sectional Views	19
×12. Dimensioning	23
13. Limits and Fits	28
14. Machining Symbols and Surface Finish	28
15. Screw Threads, Bolts, Nuts, etc.	30
16. Rivets	32
17. Welding	32
18. Structural Steelwork	33
19. Abbreviations for Drawings	36
20. Graphs	38
APPENDICES	
I. Reproduction of Drawings	40
II. Preparation and Care of Drawings	42
III. British Standards for Material Specifications and General Engineering	43
IV. Symbols	45
V. Engineering Survey Plans (Lines and Topographical Symbols)	46
PLATES	
1. Typical Layout of Drawing Sheet for Detail Parts	
2. Typical Layout of Drawing Sheet for Structural and General Engineering and Assembly Drawings	
3. Typical Layout of Drawing Sheet for Jig and Tool, Machine and Gauge Drawings	
4. Typical Drawing	

CO-OPERATING ORGANISATIONS

The Mechanical Industry Committee under whose supervision this British Standard was prepared consists of representatives from the following Government Departments and Scientific and Industrial Organisations :

- *Admiralty
 - Crown Agents for the Colonies
 - Department of Scientific and Industrial Research
 - High Commissioner for India
 - Home Office
 - Ministry of Health
 - *Ministry of Supply
 - Ministry of Transport
 - Ministry of Works
 - *War Office
 - Agricultural and Road Machinery Manufacturers' Association
 - Association of Consulting Engineers
 - British Chemical Plant Manufacturers' Association
 - British Compressed Air Society
 - *British Electrical and Allied Manufacturers' Association
 - British Engineers' Association
 - British Iron and Steel Federation
 - British Marine Oil Engine Manufacturers' Association
 - Engineering Insurance Companies
 - Institute of Marine Engineers
 - Institute of Petroleum
 - Institution of Automobile Engineers
 - *Institution of Civil Engineers
 - Institution of Gas Engineers
 - Institution of Heating and Ventilating Engineers
 - *Institution of Mechanical Engineers
 - *Institution of Production Engineers
 - Locomotive Manufacturers' Association
 - Machine Tool Trades Association
 - Railway Companies of Great Britain
- The Government Departments and Scientific and Industrial Organisations marked with an asterisk in the above list, together with the following, were directly represented on the Committee entrusted with the preparation of this British Standard.
- Ministry of Aircraft Production
 - Board of Education
 - H.M. Stationery Office
 - Imperial College of Science and Technology
 - Drawing Office Material Manufacturers and Dealers' Association
 - Society of Motor Manufacturers and Traders
 - Society of British Aircraft Constructors
 - Association of Engineering and Shipbuilding Draughtsmen

THIS BRITISH STANDARD having been approved by the Mechanical Industry Committee and endorsed by the Engineering Divisional Council was published under the authority of the General Council on 13th December, 1943.

These recommendations are based on the use of British units, but are generally applicable also to the metric system.

They are intended to apply to new drawings made in connection with a contract when placed, and should not preclude the submission, by the manufacturer or contractor, of drawings previously prepared in accordance with the conventions which he has been accustomed to employ hitherto.

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the Committees charged with the revision of the standards to which they refer.

A complete list of British Standards indexed and cross-indexed for reference will be found in the Institution's Handbook.

British Standards to which references are made in these recommendations are listed on pages 31 & 32 and 43 to 46. Reference is also made to B.S. 164, Limits and Fits for Engineering, and to B.S. 1134, Surface Finish.

British Standards are revised, when necessary, either by the issue of amendment slips or by the issue of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or edition. If users wish to be kept informed of any alteration to this standard notification should be made to Publications Department of the Institution, giving the number and title of the Standard.

RECOMMENDATIONS FOR BRITISH STANDARD

ENGINEERING
DRAWING OFFICE PRACTICE

FOREWORD

This Specification, which has been prepared under the authority of the Mechanical Industry Committee, supersedes B.S. 308 : 1927, Engineering Drawing Office Practice. The Technical Committee constituted to draft proposals for this revised and amplified edition had before them the two-fold purpose of establishing a Standard and providing a useful guide which will enable young engineers and draughtsmen to proceed with much of their work without too frequent reference to their seniors, following the lead of the American and Australian Standards in these respects.

The urgent need of providing the trimming allowance necessary for economical printing has been solved by retaining the former standard sizes of drawings and tracings and specifying, for each of these sizes, maximum frame or border line sizes. Three additional sizes and one minor alteration of size have been included, two of these conforming to drawing sheets in common use and the other two to commercial stationery.

Having thus increased the list of standard sizes to include all those in most common use, it is confidently hoped that orders for sizes outside this extended range will be reduced to a minimum.

It has been considered preferable to include references to other British Standards which are helpful to the designer and draughtsman rather than reprint extracts from them. By adopting this course the subsequent revision of subject matter to which reference is made will not necessarily entail revision of this British Standard on engineering drawing office practice.

The Committee have confirmed the recommendation, contained in B.S. 308 : 1927, that conventions of cross hatching to represent materials should be limited to those habitually used for wood and concrete. They have included a few of the firmly established existing conventions with regard to colours when these are required to be used.

The difficult subjects of tolerancing, the application of limits and fits, and grades of surface finish have merited the attention of special Technical Committees and separate publications will be issued in due course relating to these matters.

The Committee wish to express their indebtedness to the helpful comments received from many firms and associations and to the American and Australian Standards for engineering drawing practice.

TYPICAL DRAWING

A typical manufacturing drawing for a machined part embodying many of the drawing office practices recommended in this British Standard is illustrated in Plate 4.

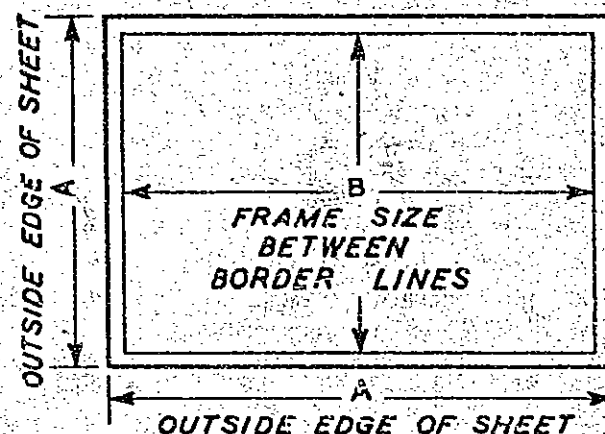
SIZES OF DRAWINGS AND TRACINGS

1. The list of recommended standard sizes is based on the following considerations :

a. The economical use of standard rolls of drawing and tracing paper, tracing cloth and sensitised paper and cloth, all of which are manufactured in 30 in. and 40 in. widths. When cut or printed sheets are used, these in the first place, have to be cut from 30 in. and 40 in. rolls.

b. The provision of a blank border which will enable prints to be trimmed if necessary without incurring the use of uneconomical sizes of sensitised material to allow for trimming. Finished prints which have been trimmed will then be slightly less in size than the original drawings but not less than the frame or border line size of the drawings.

c. The inclusion of such sizes as 40 in. $\times$ 27 in., 30 in. $\times$ 22 in. and 27 in. $\times$ 20 in. which are in common use, and for which drawing boards, plan cabinets and filing receptacles exist. Also the inclusion of the sizes 13 in. $\times$ 8 in. and 10 in. $\times$ 8 in. in order to conform with commercial stationery.



Sizes of drawings and tracings. Overall dimensions in inches across edges of sheet.	Maximum frame size. Dimensions in inches between border lines.
A	B
72 $\times$ 40	70 $\times$ 38
60 $\times$ 40	58 $\times$ 38
53 $\times$ 30	52 $\times$ 29
40 $\times$ 30	39 $\times$ 29
40 $\times$ 27	39 $\times$ 26
40 $\times$ 15	39 $\times$ 14
30 $\times$ 22	29 $\times$ 21
30 $\times$ 20	29 $\times$ 19
27 $\times$ 20	26 $\times$ 19
20 $\times$ 15	19 $\times$ 14
15 $\times$ 10	14 $\frac{1}{4}$ $\times$ 9 $\frac{1}{4}$

Additional sizes to conform with commercial stationery :

Sizes of drawings and tracings. Overall dimensions in inches across edges of sheet.	Maximum frame size. Dimensions in inches between border lines.
A	B
13 $\times$ 8	12 $\frac{1}{4}$ $\times$ 7 $\frac{1}{4}$ } See note
10 $\times$ 8	9 $\frac{1}{4}$ $\times$ 7 $\frac{1}{4}$ } below.

NOTES. 1. B sizes are the recommended *maximum* border line sizes; these border lines may be drawn further in from the edge of the sheet if desired.

2. Drawing, tracing and sensitised sheets should be cut to sizes A. After printing, the sensitised sheets may be trimmed if necessary but it is recommended that the prints be left as large as possible. The border lines which appear on the drawings and tracings should not be trimmed off the prints.

3. No notes or figures which are required to be reproduced on the print should appear outside the border lines.

4. On the commercial stationery size sheets border lines may be omitted if desired, but it is recommended that the drawing space utilised should not exceed that determined by the B dimensions.

5. It is recommended that all drawings and tracings should be marked with the standard sheet size (A size) in inches in a convenient place immediately inside the border lines.

SIZES OF DRAWING BOARDS

2. The sizes of drawing boards in common use are :

Antiquarian	54 in. $\times$ 32 in.
Double Elephant	42 in. $\times$ 29 in. See note.
Imperial	31 in. $\times$ 23 in.
Half Imperial	23 in. $\times$ 16 in.

NOTE. Manufacturers can provide drawing boards 42 in. $\times$ 32 in. to take 40 in. $\times$ 30 in. drawings and it is recommended that this size should be used in future in place of the Double Elephant size, 42 in. $\times$ 29 in.

LAYOUT OF DRAWING SHEETS

3. a. *Title Blocks.* In many drawing offices it is considered preferable for Standard Size sheets to be bought already cut to size and printed. This is productive of neatness and uniformity, facilitates the reading of drawings, and makes it possible for items, such as Drawing No., Name of Firm, Description or Title of Drawing, etc., to be easily found, especially when using drawings prepared by outside sources.

The *title block* is therefore an important printed feature and should be placed at the *bottom right hand corner* of the sheet. It is recommended that spaces should be provided for the following information on all title blocks.

Drawing No.
Name of Firm.
Description or Title of Drawing.
Date and Signatures.
Scale.

b. *Repetition of Drawing No. or Part No.* This should be placed in the *top left hand corner*, so as to be readily visible when vertical filing is adopted.

c. *Additional Information.* Where appropriate, additional information and notes may be included as follows :

(i) *Material List.* This should be placed immediately *above* the title block and may include such items as, Part No., description of part, material, quantity required.

The raw material from which parts are to be made should be clearly specified to be in accordance with a British Standard or other accepted specification ; where necessary the grade of that particular material should also be indicated.

(ii) *Job or Order No.*

(iii) *Treatment, finish, etc.*

(iv) *Key to machining and other symbols.*

(v) *Tolerance of dimensions without specified limits.*

(vi) *Tool and Gauge references.*

(vii) *General Notes.* These should be placed immediately *below* the top border line near the centre of the sheet.

(viii) *Other information.* In addition to the foregoing, individual Drawing Offices will naturally add to their standard sheets other information suited to their manufacturing procedure.

d. *Typical Title Blocks.* Typical title blocks incorporating these recommendations, where necessary, are illustrated in Plates 1, 2 and 3.

Plate 1. *For detail parts.* In general only one part is shown on a given sheet, the size of which will vary to suit the actual detail. For quantity manufacture, it is preferable not to have to refer to any other data sheet, and consequently the drawing should be as complete as possible. This can be achieved by including in the Title Block : Drawing or Part No. ; Part Name ; Scale ; Material Specification ; Material Form and Treatment ; Finish ; Machining Symbols ; Standard Tolerance for *unlimited* machine dimensions ; Signature and Date Columns ; Name of Firm. This information can be accommodated on the smallest sheet, namely 10 in. $\times$ 8 in.

NOTE. When a separate drawing is made for each detail part, some organisations identify the drawing by a part number reference ; others find it convenient to use the drawing number as the identification number of the article.

Plate 2. *For structural and general engineering and assembly drawings.* In this case more than one part will generally be shown and the Title Block may include : Drawing No. ; Description or Title ; Scale ; Finish ; Signature and Date Columns ; Name of Firm.

Plate 3. *For jig and tool, machine and gauge drawings.* Here, quantities are not usually involved, and it is useful for Jig and Tool drawings to include details and assembly on one sheet. The Title Block may include : Drawing No. ; Job No. ; Description ; Scale ; Standard Fits ; Machining Symbols ; Signature and Date Columns ; Name of Firm.

e. *Revisions.* It is most important that drawings should record all alterations which are made. A convenient form is a table giving Revision No. (or Letter), Date, Signature and brief record of change.

Where interchangeability of a part is not affected, either in the dimensional sense or for other reasons, the drawing number or part number should not be changed. If interchangeability is affected, a new drawing number or a new part number should be given to the detail or details concerned.

In order that the position of a revision can be found readily on the drawing it is recommended that the revision No. or letter be repeated in proximity to the modified dimension or other detail, and the number or letter enclosed by an easily recognisable geometrical figure such as a circle or square.

In conjunction with revisions to drawings it is usual to issue a form or note to record the change, to ensure the replacement of existing prints made obsolete by the change, and to give the disposition of any existing parts or work in progress, and other details which may be needed by the manufacturing departments.

PLANNING THE DRAWINGS

4. a. Where a number of drawings are required to detail a complete design, a key drawing or a layout or assembly drawing is necessary. Such drawings will show the project to a convenient scale, and the drawing numbers, which deal with each part or section in detail, may be recorded in suitable tabular form on the drawing or on a separate sheet usually known as a 'drawing list.'

b. An alternative method, particularly applicable to structural work, is to include on each individual sheet of a series of drawings a small key plan, elevation or both, conveniently placed preferably near to the Title Block, indicating in bold lines to which part of the whole work the particular sheet refers. An example is given in Fig. 1.

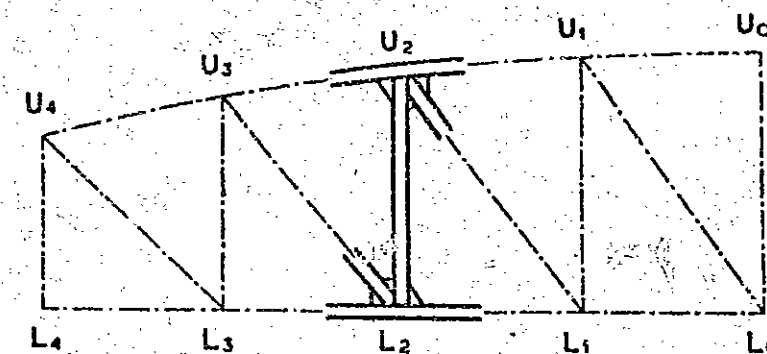


Fig. 1. Key diagram

c. When several parts are shown on one drawing they should preferably be grouped according to the process involved ; i.e. parts machined from bar material, castings, welded structures, sheet metal work, etc., should be grouped respectively on the same sheet.

d. Wherever appropriate, the main view of a detail should have the same orientation as that of the same part as given on the assembly drawing.

e. As a rule, ship and marine engineering drawings are made forward to the right, aft to the left.

NUMBERING AND REFERENCING

5. a. *Numbering.* The system of numbering drawings will be a matter for individual firms or departments but, in general, the following rules should be observed.

(i) A Register, Book or Master File should be used for the systematic allocation of Drawing Nos.

(ii) When a given part is changed so as to be no longer interchangeable with the previous design, either in the dimensional sense or for any other reason, a new Drawing or Part No. should be given, as indicated in Clause 3 e.

(iii) Any given part, although it may be used in various models, types or sizes of mechanism, should always retain the original Drawing or Part No. and should be detailed on one drawing only.

(iv) Wherever possible, right and left hand parts or assemblies should have consecutive Drawing or Part Nos.

b. *Referencing.* Where assembly drawings comprise a large number of parts it is recommended that part reference numbers should be arranged as far as possible in vertical columns or horizontal rows in the most convenient groupings outside the drawn views, with pointer lines indicating the respective parts by means of arrow heads or dots.

These part reference numbers should be ringed with a circle, or other geometrical figure to facilitate the location of the numbers when reading the drawing.

SCALES

6. The following scales are recommended :

General Engineering.

Full size (1/1)	$\frac{3}{4}$ in. = 1 ft. (1/16)
Half size (1/2) (see note below)	$\frac{1}{2}$ in. = 1 ft. (1/24)
	$\frac{3}{8}$ in. = 1 ft. (1/32)
3 in. = 1 ft. (1/4)	$\frac{1}{4}$ in. = 1 ft. (1/48)
$1\frac{1}{2}$ in. = 1 ft. (1/8)	$\frac{1}{8}$ in. = 1 ft. (1/96)
1 in. = 1 ft. (1/12)	$\frac{1}{16}$ in. = 1 ft. (1/192)

Where scales greater than full size are required scale multipliers of 2, 4, 8 and 10 are recommended.

For indicating the scale in the appropriate division of the Title Block a simple abbreviation is :

Scale 1/1 (for full size).

Scale 1/4 (for quarter size).

Scale 2/1 (for twice full size) and so on.

NOTE. Original details should be drawn to scale. Full size is recommended wherever possible, rather than half size.

Surveys.

6 in. to the mile.

$$\frac{1}{2500}$$

88 ft. to the inch.

$$\frac{1}{500}$$

40 ft. to the inch.

Earthworks.

20 ft. to the inch. Longitudinal sections are often drawn to distorted scales, such as $\frac{1}{2500}$ horizontally and 20 ft. to the inch or 40 ft. to the inch vertically.

Metric Scales.

Where metric scales are used these should normally be selected from 1/1, 1/2, 1/5 and 1/10 and decimal multiples or sub-multiples of these fractions.

TYPES OF LINES

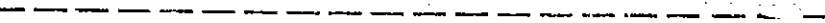
7. For general engineering drawings the types of lines shown in Fig. 2 should be used.

a.  Continuous (thick)

Use for : Visible outlines ; border lines of sheets.

b.  Continuous (thin)

Use for : Dimension lines ; projection or extension lines for dimensions ; hatching or sectioning ; pointer lines for notes and for adjacent parts.

c.  Short dashes (thin)

Use for : Hidden details ; existing installations or portions to be removed.

d.  Long chain (thin)

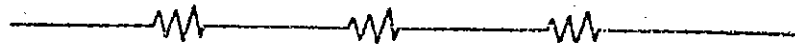
Use for : Centre lines ; path lines (indicating movement) ; cutting planes or section lines (i.e. traces of cutting planes).

e.  Short chain (thin)

Use for : Developed or false views ; adjacent parts.

f.  Continuous wavy (thick)

Use for : Irregular boundary lines ; short break lines.

g.  Ruled line and short zig zags

Use for : Long break lines.

Fig. 2. Types of lines

The outline, type *a* line, should be outstanding in appearance on the drawing and those lines specified as thick in Fig. 2 should be from two to three times thicker than those specified as thin. The actual thickness of the line should be governed by the size and character of the drawing. Lines should be dense to produce good prints.

Centre lines should project for a short distance beyond the outline to which they refer, but where necessary to aid dimensioning or to co-relate views, they should be extended accordingly.

Short break lines, type *f* should be used to shorten the view of long uniform parts. See Fig. 3.

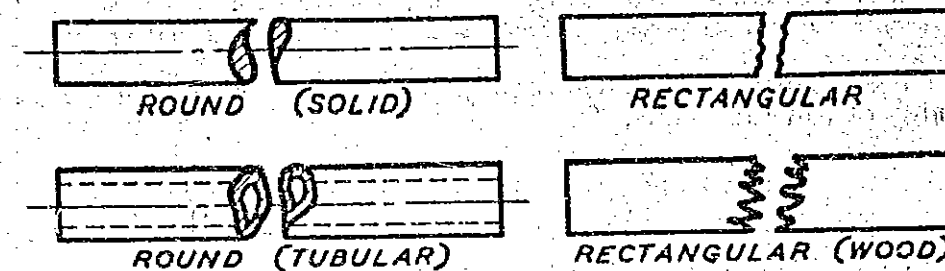


Fig. 3. Conventional breaks

An alternative position, or the limiting position, of a moving part, should be identified by type *e* line. The path line of a moving part should be identified by type *d* line. See Fig. 4.

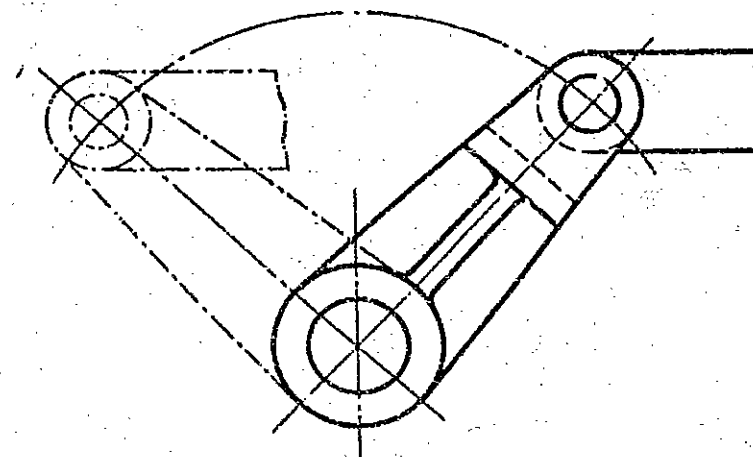


Fig. 4. Indication of alternative position

The lines recommended for boundaries on Engineering Survey Plans are shown in Appendix V: 'Engineering Survey Plans: Lines and Topographical Symbols.'

METHODS OF PROJECTION AND ARRANGEMENT OF VIEWS

8. *a.* First angle projection. The British Standard method of projection is first angle projection, namely, that in which each view is so placed that it represents the side of the object remote from it in the adjacent view. See Fig. 5.

When the first angle method of projection is used, it is not necessary to identify or name the views.

BRITISH STANDARD METHOD OF PROJECTION

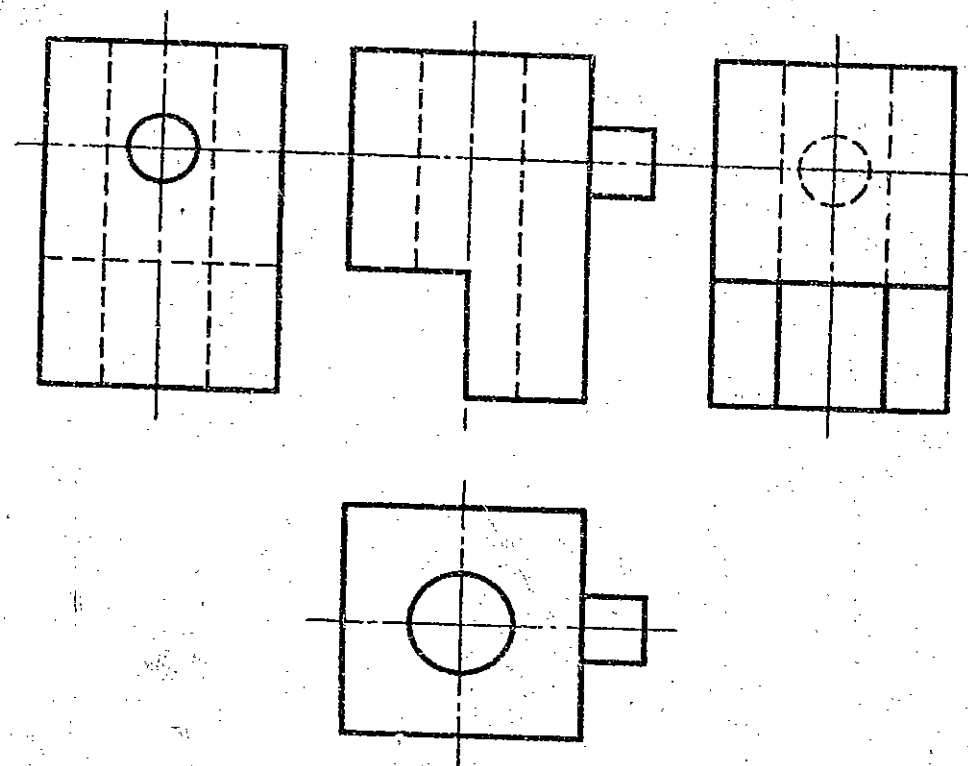


Fig. 5. First angle projection

If, for special reasons, it is desired to use any method other than first angle, the drawing should clearly indicate the method by a note, by arrows showing the direction of aspect of the various views in relation to each other, or by some other suitable means.

b. Third angle projection. In the third angle method of projection each view is so placed that it presents the side of the object near to it in the adjacent view, thereby bringing the features of adjacent views in juxtaposition. See Fig. 6. When the third angle projection is employed, it is recommended that a prominent note should be printed on the drawing 'Third Angle Projection.'

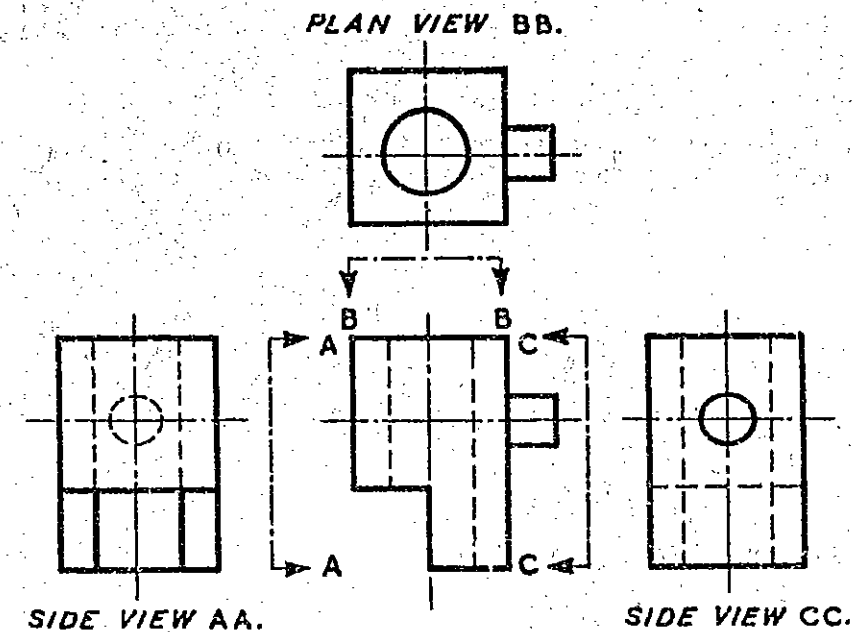


Fig. 6. Third angle projection

c. Combination of first and third angle projections. An example of a combination of first and third angle projections is shown in Fig. 7, where, in relation to the elevation, side views are so placed that they are in third angle projection and plan view in first angle projection. When using a combination of projections, it is important that the aspect of the views in relation to the elevation should be clearly indicated.

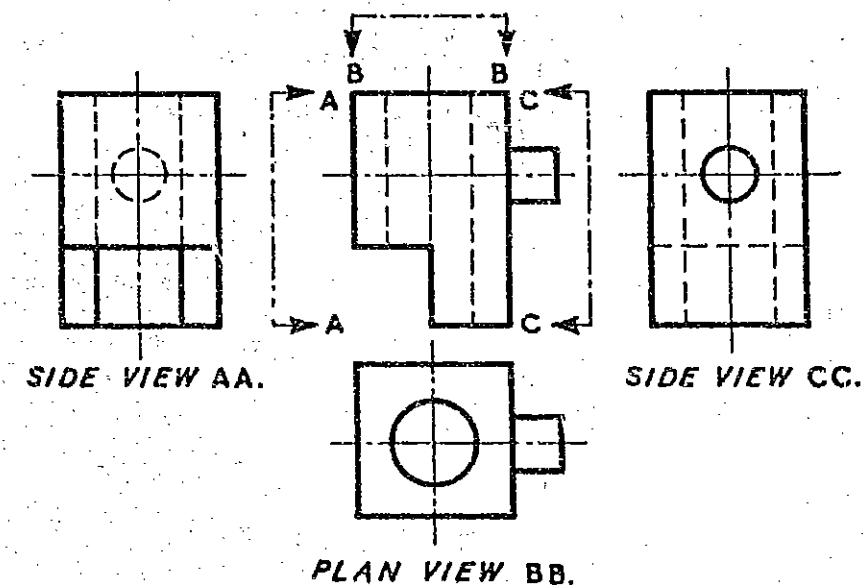


Fig. 7. Combination of first and third angle projection

d. Choice of views. The number of views should be sufficient to ensure that there will be no misunderstanding.

Views should be selected to give as few hidden lines as possible.

e. Auxiliary views. Objects having inclined faces may have such faces projected to show the true shape of the inclined surface. See Fig. 8.

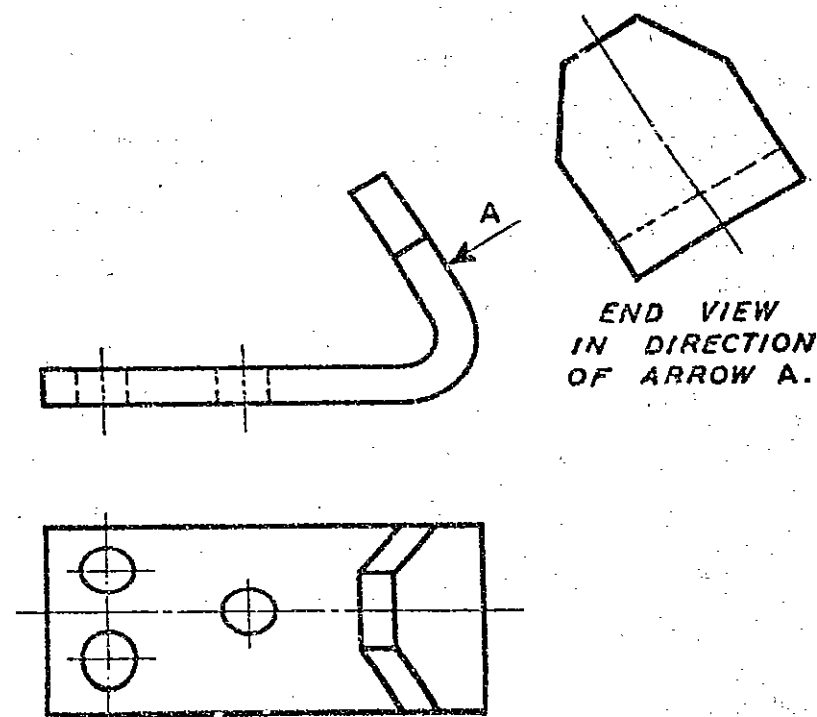
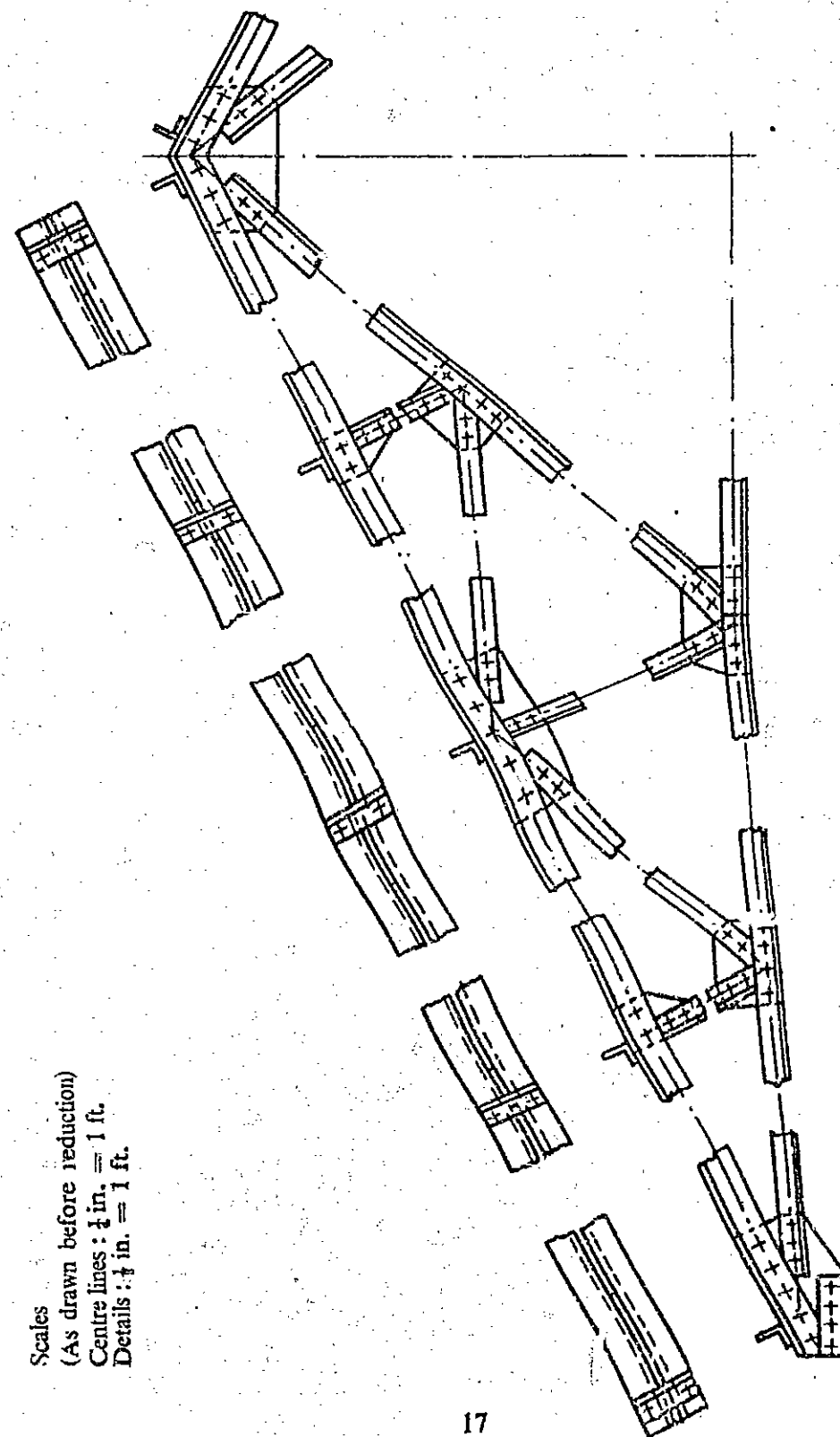


Fig. 8. Projection of inclined faces

f. Space between views. Ample space should be provided between views to permit of placing dimensions without crowding, and to preclude the possibility of notes pertaining to one view over-lapping or crowding the other views.

g. Framed structures. In the case of framed structures, a convenient and much used method of projection consists in drawing the layout of the centre lines of members to one scale and superimposing drawings of the details to a larger scale on the intersection points of these centre lines. Other views of the parts detailed are drawn in convenient positions alongside. A case of this kind is illustrated in Fig. 9. The two scales used should be clearly indicated.



Scales
(As drawn before reduction)
Centre lines : $\frac{1}{4}$ in. = 1 ft.
Details : $\frac{1}{2}$ in. = 1 ft.

Fig. 9. Framed structure

LETTERING

9. The objective should be to provide distinct uniform letters and figures with reasonable rapidity which will ensure the production of good and legible prints. The specimens reproduced in Fig. 10 are given as a guide; the sizes used may be varied to suit the applications.

Although sloping letters and figures are recommended for general use, vertical letters and figures of the same general proportions may be used where preferred. Vertical characters are recommended for drawing Nos. titles and reference Nos.

ABCDEFGHIJKLMNOPQRSTUVWXYZ

1234567890

ABCDEFGHIJKLMNOPQRSTUVWXYZ

1234567890

abcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUVWXYZ

UVWXYZ&

1234567890

ABCDEFGHIJKLMNOPQRSTUVWXYZ

UVWXYZ&

1234567890

ABCDEFGHIJKLMNOPQRSTUVWXYZ

RSTUVWXYZ&

1234567890

ABCDEFGHIJKLMNOPQRSTUVWXYZ

PQRSTUVWXYZ&

1234567890

Fig. 10. Examples of lettering

CONVENTIONAL REPRESENTATION OF MATERIALS

10. In view of the large variety of materials used, it is undesirable to rely on the various conventions of cross hatching except in the cases of wood and concrete, which it is recommended should be as shown in Figs. 11, 12 and 13, where a convention is required.



Fig. 11. Section of wood with grain

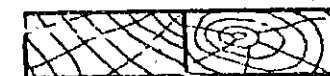


Fig. 12. Section of wood across grain



Fig. 13. Section of concrete

It is, therefore, recommended that in every case different materials should be indicated by notes on drawings and tracings. Any special means (e.g. hatching or colours) used to indicate different materials should be shown by a note or in a key diagram on the drawing or tracing.

Colours, when used, should be in accordance with existing conventions, such as:

Cast iron	Payne's G.	Brass and gun metal	Light Yellow.
Wrought iron	Prussian B.ue.	Brickwork	Light Crimson Lake.
Steel	Purple.	Timber	Burnt Sienna.

Colouring and coloured lines should not be used on tracings from which reproductions may be required.

SECTIONING AND SECTIONAL VIEWS

11. a. Sectioning lines (hatching). As specified in Clause 7 sectioning lines should be thin and should be suitably spaced in relation to the area to be covered. Wide hatching should be used for large area sectioning and large surfaces.

Sloping sectioning lines should normally be drawn at 45° with the edge of the drawing sheet, and at right angles to each other to distinguish between adjacent parts in section. See Fig. 14.

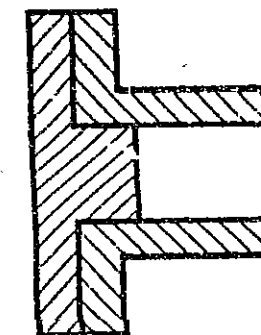


Fig. 14. Sectioning lines for adjacent parts