

Engineering drawing practice

Part 1. Recommendations for general principles

Pratique du dessin industriel
Partie 1. Principes généraux

Technische Zeichnungen
Teil 1. Allgemeine Grundsätze

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- British Railways Board
- British Standards Society
- Drawing Office Material Manufacturers' and Dealers' Association
- EEA (The Association of Electronics, Telecommunications and Business Equipment Industries)
- Electricity Association
- Gauge and Tool Makers' Association
- Institution of Chemical Engineers
- Institution of Engineering Designers
- Society of British Aerospace Companies Limited

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Engineering drawing practice
Part 1. Recommendations for general principles

Additional text

Foreword

Insert the following text at the end of the Foreword.

This Part of BS 308 is being superseded by the adoption of European implementations of international standards.

The following standards have been published as British Standards.

European standard	Subject	Deleting action on BS 308 : Part 1
BS EN ISO 5455	Scales	Clause 5
BS EN ISO 6413	Splines and serrations	Clause 13.6
BS EN ISO 6433	Item references	Clause 11
BS EN ISO 10209-1†	Drawing terms	Clause 3
BS EN ISO 8826-1	Bearings	Clause 14.4
BS EN ISO 9222-1	Seals - general	Clause 14.5
BS EN ISO 9222-2	Seals - detailed	—
†Delayed		

The adoption procedures have been commenced for the following standards.

European standard	Subject	Deleting action on BS 308 : Part 1
EN ISO 2162-1	Springs	Clause 14.7
EN ISO 6410-1	Threads	Clause 13.7
EN ISO 6410-2	Threaded inserts	Clause 14.3
EN ISO 6410-3	Threaded fasteners	Clause 14.6
EN ISO 10209-2	Projection terms	—

Further ISO standards expected to be adopted include the following.

ISO standard	Subject	Deleting action on BS 308 : Part 1
ISO 128	General principles	Clauses 6, 8, 9, 10
ISO 2203	Gears	Clause 14.6
ISO 3098-1	Lettering	Clause 7
ISO 5457	Drawing sheets	Clause 4
ISO 6411	Centre holes	Annex B

Because BS 308 does not conflict in its technical recommendations the withdrawal of this Part of the standard is delayed until all the relevant ISO standards have been adopted.

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Foreword

This Part of BS 308 has been prepared under the direction of the General Mechanical Engineering Standards Policy Committee and continues to reflect the established conventions and to take account of both national and international developments since the 1984 revision, which is now withdrawn.

Britain continues to participate in International Organization for Standardization (ISO) technical committees on technical drawing for the establishment of international standards with worldwide recognition. Virtually all the contents of this standard reflect those agreements reached internationally with which Britain has concurred. The responsible committee's policy of drawing attention to differences of practice or application between British and ISO or foreign standards by way of footnotes is continued and developed. Some contrasting draughting practices common to the ISO standards may not be actually specified in those standards but appear in their drawing examples due purely to developed continental practice taken as being normal. The footnotes relating to projection lines and dimension lines in Part 2 of this standard are a case in point.

This revision includes reorganized clauses on conventional and simplified representation which now include more items featured in the ISO standards. Particular attention is drawn to the changed indication for rolling bearings and the inclusion of seals to align with ISO and their differences should be noted. Also the text has been re-examined and amended in some areas where experience has shown a need for better clarity to reduce potential for confusion and misinterpretation.

This Part of BS 308 deals with general principles; it leads through from the choice of paper sizes and scales to a complete drawing of views and sections awaiting the application of dimensions, tolerances and related information.

Part 2 of this standard deals with dimensioning, tolerancing and interpretations and the application of surface roughness symbols. Part 3 of this standard deals specifically with geometrical tolerancing.

The reader hardly needs reminding that by the very nature of this subject, which impinges on the personal skills, practices and preferences of individual practitioners (e.g. draughtsmen), BS 308 differs in essence, use and perception by the users at large from the majority of technical standards. It will be observed that BS 308 has developed along its particular path in content, style and publication policy since its inception in 1927 as the world's presumed first engineering drawing standard and thus enjoys a certain reputation. Hence, whereas virtual technical equivalence can be claimed with the ISO standards in pursuance of the committee's declared policy of alignment wherever possible in relation to established British practice, there is no physical equivalence. It should also be noted that, whereas BS 308 has always been presented as recommendations founded on accepted good practice, in contrast the ISO standards are often presented in a more specific and instructional manner.

It is the declared policy of the ISO technical committee responsible for technical drawing standards to identify each individual detail subject of draughting by an individual separate standard. Hence the compass of this Part alone of BS 308 covers the following separate ISO standards.

ISO 128 : 1982	<i>Technical drawings – General principles of presentation</i>
ISO 2162 : 1973	<i>Technical drawings – Representation of springs</i>
ISO 2203 : 1973	<i>Technical drawings – Conventional representation of gears</i>
ISO 3098-1 : 1974	<i>Technical drawings – Lettering – Part 1. Currently used characters</i>
ISO 5455 : 1979	<i>Technical drawings – Scales</i>
ISO 5457 : 1980	<i>Technical drawings – Sizes and layout of drawing sheets</i>
ISO 6410 : 1981	<i>Technical drawings – Conventional representation of threaded parts</i>
ISO 6411 : 1982	<i>Technical drawings – Simplified representation of centre holes</i>

ISO 6413 : 1988	<i>Technical drawings – Representation of splines and serrations</i>
ISO 6433 : 1981	<i>Technical drawings – Item references</i>
ISO 7200 : 1984	<i>Technical drawings – Title blocks</i>
ISO 8826-1 : 1989	<i>Technical drawings – Rolling bearings – Part 1. General simplified representation</i>
ISO 9222-1 : 1989	<i>Technical drawings – Seals for dynamic application – Part 1. General simplified representation</i>
ISO 10209-1 : 1992	<i>Technical product documentation – Vocabulary – Part 1. Terms relating to technical drawings: general and types of drawings</i>

It may be worthy of note that in ISO the generic term 'technical drawing' is used to embrace all drawings that can be so described and the term 'engineering drawing', which is a form particular to engineering and as such is in common parlance in the UK, is not used.

In the ISO technical committee for technical drawing it is still the apparent long term intention to unify, in one set of standards, as many of the practices and conventions of all disciplines using technical drawings as possible. In Britain the traditional separations are maintained and it should be carefully noted that BS 308 continues to provide recommendations for engineering drawings in the manufacturing industries associated with mechanical, electrical, electronics, hydraulics, pneumatics and nuclear engineering disciplines.

The needs of the building, architectural, civil and structural engineering and construction services industries continue to be covered by BS 1192. BS 308 does not cover special disciplines such as in naval architecture and aeronautical lofting. There are standards published for some industries using BS 308 as a basis but requiring additional recommendations and conventions particular to the discipline. BS 4301, which gives recommendations for the preparation of drawings for optical elements and systems, and BS 2774, which gives drawing conventions for laboratory glassware, are examples.

BS 5070, dealing with engineering diagram drawing practice, is a companion standard to BS 308 and caters for the same industries providing recommendations on a wide variety of engineering diagrams. Commonly, as a diagram can be called a 'drawing' and a drawing can be called a 'diagram', it is useful to summarize the difference in the scopes of these standards. BS 308 covers what are commonly accepted to be drawings that define shape, size and form. BS 5070 covers the drawing of diagrams that are normally associated with flow of one sort or another and which relate components (usually indicated by symbols) functionally one to another by the use of lines, but do not depict their shape, size or form; neither do they in general indicate actual connections or locations.

The recommendations of this standard have been established having regard to the requirements of microfilming. Drawings prepared in accordance with this standard should be suitable for microfilming and reduced-size reproduction techniques.

Computer aided draughting machines are capable of producing drawings in accordance with this standard. Any minor exceptions found in practice due to the limitations of a particular bought system would not be expected to prejudice the understanding of a drawing otherwise claimed to be in accordance with this standard.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Notes on the presentation of this standard

NOTE 1. The figures in this standard are independent and each is selected solely for its simplicity and clarity to illustrate only the text to which it relates. They are not the only possible examples and they are not intended as design examples or to be fully dimensioned working drawings, but otherwise are drawn according to the basic recommendations of this standard.

NOTE 2. Linear dimensions shown in the figures are in millimetres.

NOTE 3. In the illustrations to this standard, a convention is adopted of using capital letters for notes that would appear as part of the drawing and lower case letters are used for notes explaining the point under consideration in relation to the text.

NOTE 4. This standard recognizes both the first and third angle projection methods as having equal status, see clause 8, as does ISO 128 : 1982. The first angle projection method is that normally used for British Standards and is thus used in this publication in the interests of uniformity of presentation. The third angle method is only shown where it illustrates the relevant clause. However, it should be understood that the alternative projection method, i.e. third angle projection, could equally well have been used without prejudice to the principles established.

NOTE 5. It is recognized in 10.3.1 that it is common for hatching to be omitted where the time and expense involved is not justified and the understanding of the drawings will not be impaired. Hatching is used throughout this publication as normal practice in British Standards.

NOTE 6. Due to the limitations of size of the figures in this standard, the sizes of arrowheads may not conform to 6.4.

Recommendations

1 Scope

This Part of BS 308 gives recommendations for the general principles of presentation and practice to be applied to all engineering drawings draughted to scale in orthographic projection¹⁾. Recommendations are given for drawing layout, scale, types of lines, lettering, methods of orthographic projection, sections and conventional representation.

Drawings prepared in accordance with this standard will generally be suitable for the majority of reprographic processes and conform to the recommendations of BS 5536.

Annex A lists British and international standards which cover different aspects of engineering drawing practice.

Centre holes may be represented in the simplified form given in ISO 6411 as extracted in annex B.

2 References

2.1 Normative reference

This Part of BS 308 incorporates, by reference, provisions from a specific edition of another publication. This normative reference is cited at the appropriate point in the text and the publication is given on page 60. Subsequent amendments to, or revisions of, this publication apply to this Part of BS 308 only when incorporated in it by updating or revision.

2.2 Informative references

This Part of BS 308 refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on page 60, but reference should be made to the latest editions.

3 Types of engineering drawings in common use

3.1 General

A drawing is either of the following:

- a) in general, any form of graphical representation;
- b) in particular, a graphical representation of an object which depicts the form and/or position of the object.

A drawing may consist of more than one sheet.

A sketch is a casual drawing, usually free-hand and unlikely to be to scale.

3.2 Design layout drawing

A design layout drawing represents in broad principles the feasible solutions meeting the design requirements. A design scheme may fulfil a similar function.

3.3 Detail drawing

A detail drawing depicts a single object and includes all the necessary information required (e.g. the form, dimensions, tolerances, material, finishes, treatment, etc.) to define completely that object. A single part drawing fulfils a similar function.

An object will normally be referred to as a component (hence the synonymous component drawing), a part, or an item (as contained in an item list, see 3.9)²⁾.

3.4 Tabular drawing

A tabular drawing depicts an object (see 3.3) typical of a series of similar such objects having their variable characteristics presented in tabular form. (This could equally relate to a series of similar assemblies)³⁾.

3.5 Assembly drawing

An assembly drawing shows two or more parts, or sub-assemblies, in their assembled form, including any dimensions and instructions necessary to effect assembly. An item list should be included or referred to. The term 'general assembly drawing' implies the complete product. A sub-assembly drawing implies a low level constituent assembly.

3.6 Combined drawing

A combined drawing shows an assembly, item list and constituent details drawn separately but all on the same drawing.

3.7 Arrangement drawing

An arrangement drawing of the complete finished product or equipment shows the arrangement of assemblies (and may be termed general arrangement drawing). It includes important functional and/or performance features. An installation drawing is a particular variation which provides the necessary information to effect proper installation on site or in further equipment.

NOTE. A simple version may be described as an outline drawing.

3.8 Diagram

A diagram is a drawing depicting, by the use of simplified representation, the function of a system or the relationship between component parts, see BS 5070.

¹⁾ An engineering drawing is therefore a particular form of the generic technical drawing, which latter term is used in ISO standards. Civil and structural engineering and construction services are excluded (see BS 1192). The special discipline aspects of naval architecture and aeronautical lofting are not included.

²⁾ The equivalent definition in ISO 10209-1 is for part drawing, and the definition for detail drawing relates to building and construction practice.

³⁾ The equivalent definition in ISO 10209-1 is 'component range drawing'.

3.9 Item list

An item list is a list of all component parts required for an assembly, shown either on the drawing or on a separate list. A parts list may fulfil a similar function.

3.10 Drawing list

A drawing list is a list of drawings associated with an assembly.

4 Drawing sheets

4.1 Sizes

ISO A series drawing sheet sizes as specified in BS 3429 : 1984 should be used. Sizes of sheets recommended for engineering drawing are given in table 1. Sizes larger than A0 should be exceptional.

Table 1. Recommended drawing sheet sizes (trimmed)

Designation	Size mm	Minimum border width from drawing frame to edge of sheet mm
A0	841 × 1189	20
A1	594 × 841	20
A2	420 × 594	10
A3	297 × 420	10
A4	210 × 297	10

4.2 Formats

4.2.1 General

Drawing sheets have two formats:

- landscape*: intended to be viewed with the longest side of the drawing sheet horizontal, see figure 1(a)⁴;
- portrait*: intended to be viewed with the longest side of the drawing sheet vertical, see figure 1(b)⁴.

4.2.2 Trimming marks

Trimming marks may be provided in the borders at the four corners of the sheet in order to facilitate trimming of prints. These marks can be in the form of right-angled isosceles triangles or alternatively two short strokes at each corner⁵) (see figure 1).

4.2.3 Borders and frames

4.2.3.1 General

It is recommended that all sheets should include a frame to enclose the drawing area together with the title block and other standard information. The frame should be symmetrical with the edges of the sheet.

The minimum widths of the borders are shown in table 1. In the majority of cases the values shown for borders are sufficiently large to allow for gripping during printing. The frame should accommodate such marks as are necessary for microfilming procedures as recommended in BS 5536 and other reduced-size reproduction techniques.

4.2.3.2 Frame lining

Lines forming the frame should be continuous and of a minimum thickness of 0.5 mm.

4.2.3.3 Grid system or zoning

The provision of a grid reference system for all sizes of drawing sheets, will facilitate location on the drawing of details, changes, etc.

The number of divisions should be divisible by two and be chosen in relation to the complexity of the drawing. It is recommended that the length of any side of the rectangles comprising the grid should not be less than 25 mm and not more than 75 mm.

The grid reference system lines should be drawn as short lines of 0.5 mm minimum thickness located in the border and touching the frame (see figure 1).

The rectangles of the grid should be referenced by means of capital letters down the vertical edges beginning at the top and numerals along the horizontal edges beginning at the left-hand side of the sheet. The references may be repeated on the opposite sides.

The letters and numerals should be placed in the borders, close to the frame at a minimum distance of 5 mm from the edges of the trimmed sheet, and should be in upright characters (see figure 1).

4.2.3.4 Centring marks

Centring marks should be provided to facilitate positioning of the drawing for reproduction processes including microfilming. They should extend from the edges of the sheet to the frame and beyond by approximately 5 mm (see figure 1 and also BS 5536).

4.2.3.5 Orientation marks

An orientation mark may be provided in the form of a triangular arrowhead located on that centring mark adjacent to and pointing toward the intended position of the drawing user⁶) (see figure 1).

4.2.3.6 Print folding marks

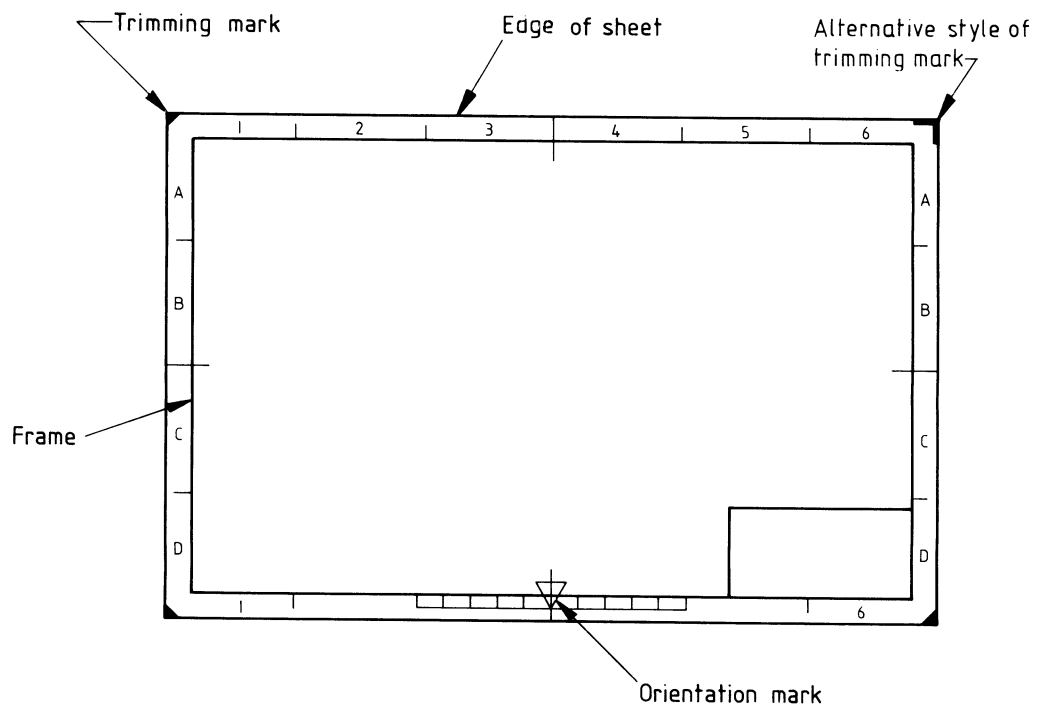
Folding marks, where required, may be indicated according to the method of folding employed.

NOTE. BS 1192 : Part 1 gives recommendations on the methods of folding prints.

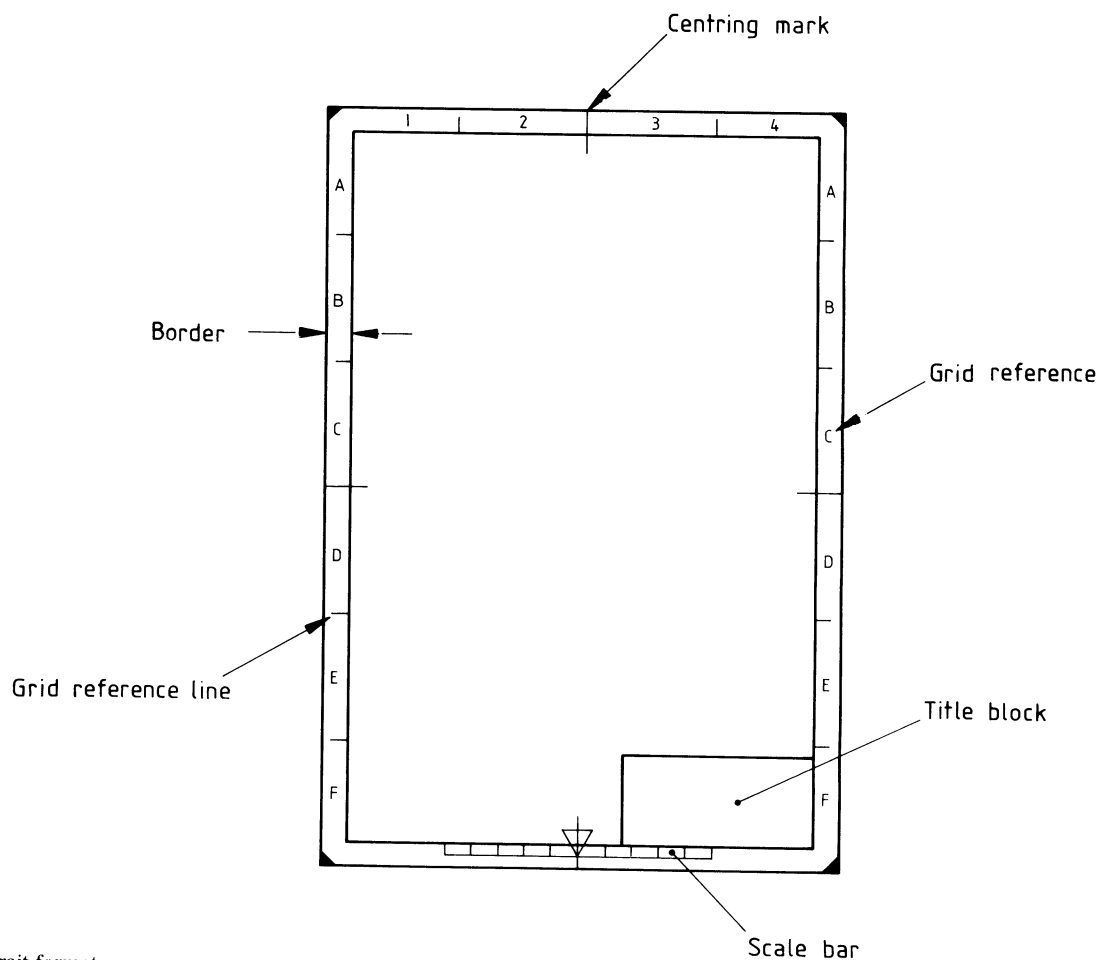
⁴) In ISO 5457 'landscape' is designated as 'type X' and 'portrait' is designated as 'type Y'.

⁵) ISO 5457 : 1980 originates this option.

⁶) ISO 5457 : 1980 calls for two orientation marks, the second mark being placed either on the left-hand or the right-hand vertical frame according to whether the sheet is an X (horizontal format) or a Y (vertical format) type respectively.



(a) Landscape format



(b) Portrait format

Figure 1. Drawing sheets showing frame, title block and other markings

4.2.3.7 Scale bar

The scale bar should be figure-less, have a minimum length of 100 mm and be divided into 10 mm intervals. It should preferably be located symmetrically about a centring mark, near the frame and within the border. It should have a maximum width of 5 mm and the continuous strokes should be of 0.5 mm maximum thickness.

4.2.4 Title block

4.2.4.1 General

The title block is that area of the drawing sheet which contains the information required for the identification, administration and interpretation of the drawing and should preferably be placed in the lower right-hand corner of the drawing frame (see figure 1). The title block may need to be extended leftwards depending on the amount of information to be included. The drawing number may also appear elsewhere on the drawing sheet for convenience⁷⁾.

4.2.4.2 Basic information

It is recommended that provision be made for basic information such as the following:

- a) name of company or organization;
- b) drawing number;
- c) descriptive title of depicted part or assembly;
- d) date of drawing;
- e) signature(s), e.g. drawn by, authorized by;
- f) original scale;
- g) copyright clause;
- h) projection symbol;
- i) unit of measurement;
- j) reference to standards and/or related specifications;
- k) sheet number;
- l) number of sheets;
- m) issue information.

4.2.4.3 Supplementary information

The following additional or supplementary information should be considered for inclusion in the drawing format according to need:

- a) material and specification;
- b) treatment/hardness;
- c) finish;
- d) surface texture;
- e) general tolerances;
- f) key to geometrical tolerances;
- g) screw thread forms;

- h) sheet size;
- i) first used on;
- j) similar to;
- k) equivalent part;
- l) supersedes;
- m) superseded by;
- n) tool references;
- o) gauge references;
- p) warning notes, e.g. 'Do not scale'.

NOTE. The list is not necessarily comprehensive.

5 Scales

5.1 General

The scale is determined as the ratio of the linear dimension of an element of an object, as represented in the original drawing, to the real linear dimension of the same element of the object itself.

5.2 Indication of scale

Full size should be indicated by '1:1', the ratio of an enlargement scale by 'X:1' and the ratio of a reduction scale by '1: X'.

5.3 Enlargement scale

An enlargement scale is a scale where the ratio is larger than 1:1. It is said to be larger as its ratio increases.

5.4 Reduction scale

A reduction scale is a scale where the ratio is smaller than 1:1. It is said to be smaller as its ratio decreases.

5.5 Designation of scale

The complete designation of a scale on a drawing consists of its ratio preceded by the words, 'ORIGINAL SCALE..' ⁸⁾.

5.6 Designation of multiple scale

Where it is necessary to use more than one scale on a drawing, each scale should be clearly identified.

Where a drawing is drawn substantially to one main scale and only subsidiary views are drawn to other scales then that main scale only is entered against 'ORIGINAL SCALE'.

5.7 Recommended scales

Recommended scales are given in table 2 ⁹⁾.

If, for special applications, a larger or smaller scale is needed than those recommended, the range may be extended in either direction, provided that the new scale is derived from a recommended scale by multiplying the numerator or denominator by an integral power of 10.

⁷⁾ ISO 7200 is more specific in its presentation and imposes a dimensional limit on width.

⁸⁾ The word 'original' is not included in ISO 5455.

⁹⁾ The recommended scales are identical with ISO 5455.

Table 2. Recommended scales

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

5.8 Choice of scales

The scale to be chosen for the drawing depends on the size of the drawing sheet and the size of the object to be depicted. The scale should be large enough to permit easy and clear interpretation of the information. Details that are too small for clear dimensioning in the main representation should be shown in a separate view to a larger scale (see 9.7).

6 Lines

6.1 Presentation

6.1.1 All lines should be black and dense. It is important that all the lines on a drawing, including those added in any revision, should be of consistent density and reflectance. The lines on any one drawing sheet should preferably be entirely in pencil or entirely in ink. If a mixture of pencil and ink is used, every effort should be made to ensure that uniform density and reflectance are maintained.

6.1.2 To assist clarity of reduced scale reproductions the clear space between lines should be not less than 0.7 mm. It is accepted that in some cases the scale of the drawing will be violated.

6.2 Thickness

Two thicknesses of line are recommended: thick and thin, which should be in the ratio of 2:1. Thickness should be selected from the range 0.25 mm, 0.35 mm, 0.5 mm, 0.7 mm, 1.0 mm, 1.4 mm and 2.0 mm.

6.3 Types of line and their application

6.3.1 General

Only those types of line shown in table 3 should be used. Examples of their application are shown in figure 2.

6.3.2 Dashed lines

Dashed lines should comprise dashes of consistent length and spacing, approximately to the proportion

shown in table 3. They should start and end with dashes in contact with the hidden or visible lines from which they originate, except when the hidden line continues a visible line (as clearly shown in figure 9). Dashed lines should also meet with dashes at corners (as clearly shown in figure 9) and at points of tangency.

6.3.3 Chain lines

Chain lines should comprise alternate long and short dashes of consistent length and spacing. They should start and end with a long dash. At points of change of direction the corners should be formed by long dashes. Where a chain line meets an arc it should join with a long dash at the point of tangency.

Centre lines should extend only a short distance beyond the feature unless required for dimensioning or other purposes. In general they should not extend through the spaces between views, except when clarity would be enhanced. They should not terminate at another line of the drawing.

Where centre lines define points or angles the intersections should be formed by long dashes.

6.3.4 Coinciding lines

When two or more lines of different type coincide, the following order of priority should be observed (see figure 3 and table 3):

- visible outlines and edges (type A);
- hidden outlines and edges (types E or F);
- cutting planes (type H1);
- centre lines, etc. (types G and B7);
- outlines and edges of adjacent parts, etc. (type K);
- projection lines (type B3).

Adjacent outlines of assembled parts should coincide, thin material in section excepted (see figure 27).

6.3.5 Leader lines

A leader line is straight, of type B, and shows where dimensions, notes, etc. are intended to apply.

A leader line should terminate:

- with a bold dot, if it ends within the outline of an object (see figure 4(a));
- with an arrowhead, if it ends on the outline of an object (see figure 4(b)) and 6.4);
- without dot or arrowhead if it ends on a dimension line (see figure 4(c)).

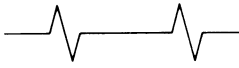
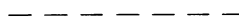
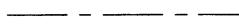
The slope of leader lines for notes, item references, etc. should contrast with that of adjacent lines.

Horizontal and vertical leader lines should be avoided.

Long leader lines should be avoided. Leader lines should not pass through the intersection of other lines.

Separate leader lines should never intersect.

Table 3. Types of line

Line	Description	Application
A 	Continuous thick	A1 Visible outlines A2 Visible edges
B 	Continuous thin	B1 Imaginary lines of intersection B2 Dimension lines B3 Projection lines B4 Leader lines B5 Hatching B6 Outlines of revolved sections B7 Short centre lines
C 	Continuous thin irregular	¹⁾ C1 Limits of partial or interrupted views and sections, if the limit is not an axis
D 	Continuous thin straight with zigzags	²⁾ D1 Limits of partial or interrupted views and sections, if the limit is not an axis
E 	Dashed thick	E1 Hidden outlines E2 Hidden edges
F 	Dashed thin ³⁾	F1 Hidden outlines F2 Hidden edges
G 	Chain thin	G1 Centre lines G2 Lines of symmetry G3 Trajectories and loci G4 Pitch lines (including circles)
H 	Chain thin, thick at ends and changes of direction	H1 Cutting planes
J 	Chain thick	J1 Indication of lines or surfaces to which a special requirement applies (drawn adjacent to surface)
K 	Chain thin double dashed	K1 Outlines and edges to adjacent parts K2 Outlines and edges of alternative and extreme positions of movable parts K3 Centroidal lines K4 Initial outlines prior to forming ⁴⁾ K5 Parts situated in front of a cutting plane K6 Bend lines on developed blanks or patterns

NOTE. The lengths of the long dashes shown for lines G, H, J and K are not necessarily typical due to the confines of the space available.

¹⁾ See also 9.5.4 and 10.7.

²⁾ This type of line is suited for production of drawing by machines. Note that in use it extends a short distance beyond the outline.

³⁾ The thin F type line is more common in the UK, but on any one drawing or set of drawings only one type of dashed line should be used.

⁴⁾ Included in ISO 128 : 1982 and used mainly in the building industry.

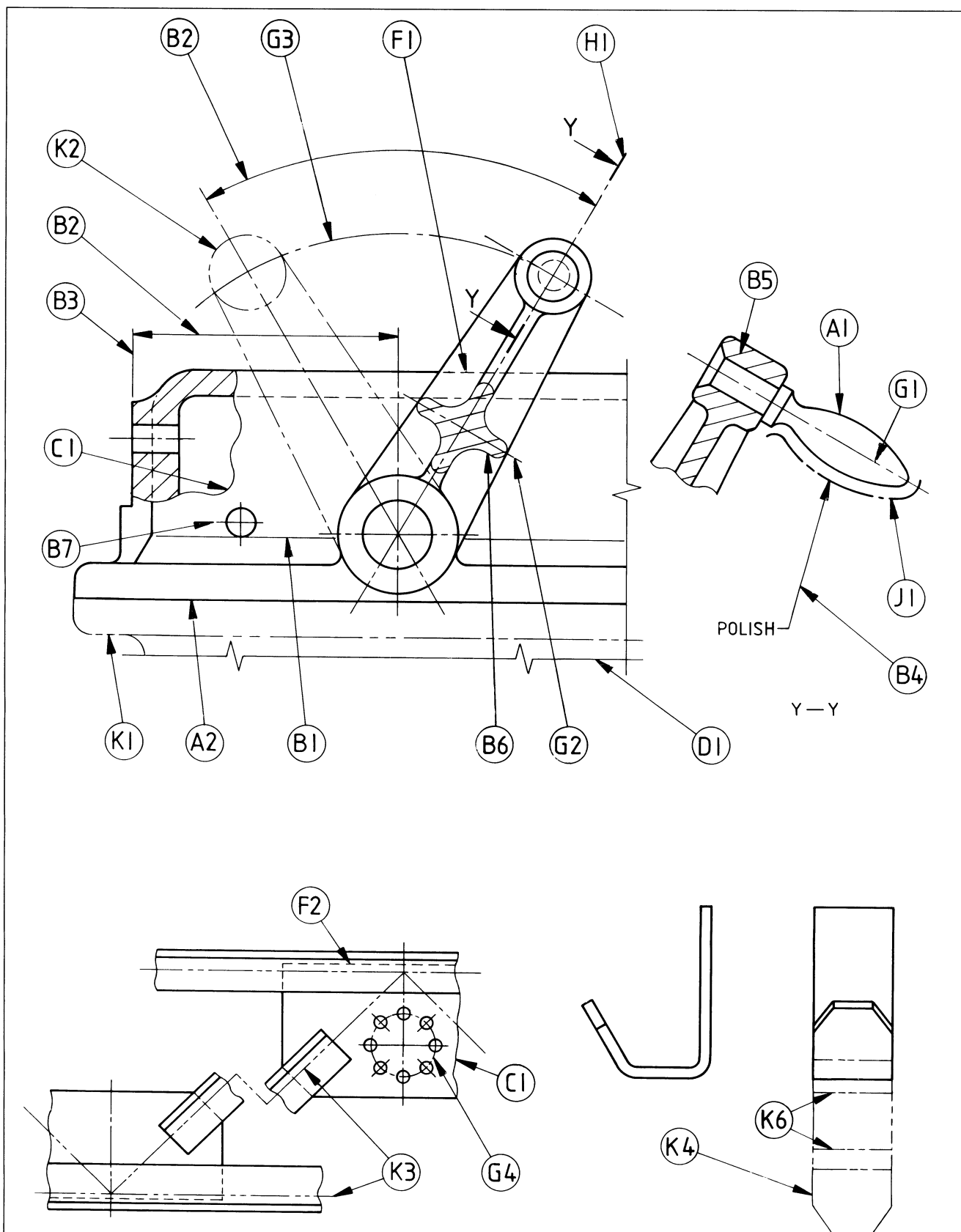


Figure 2. Applications of the various types of line

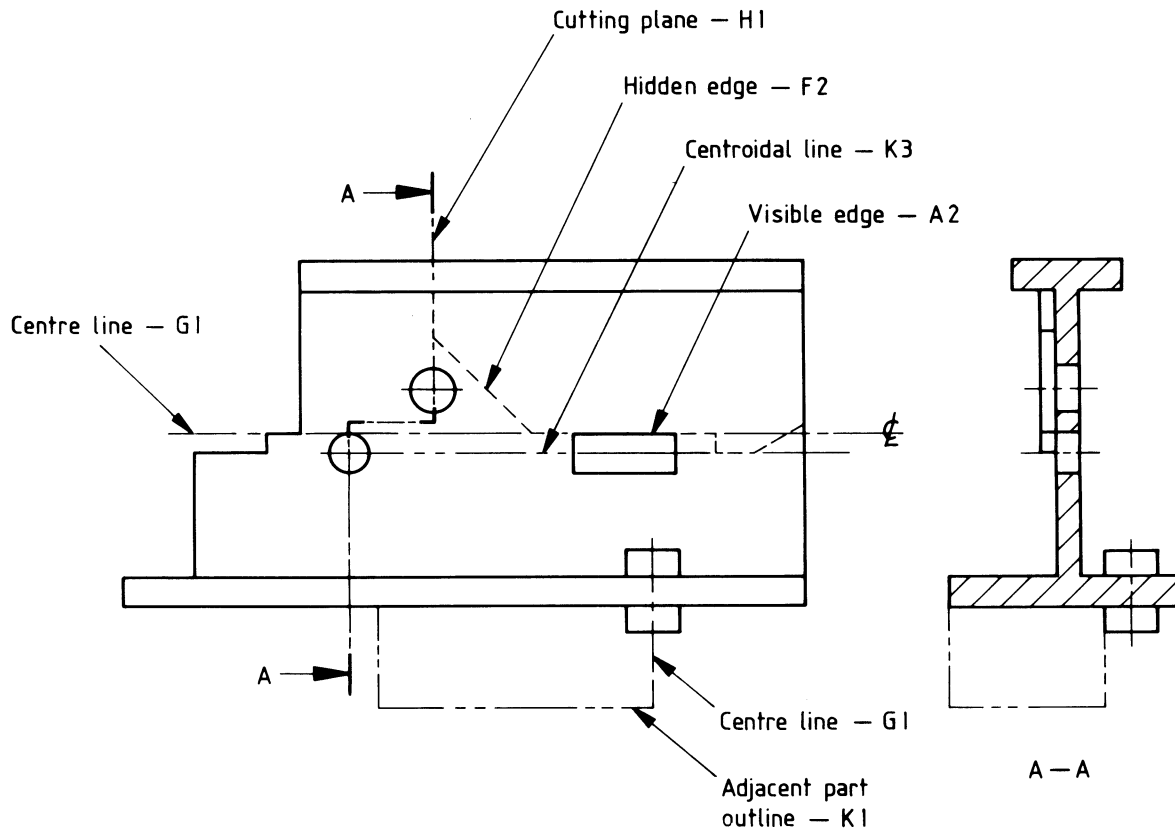


Figure 3. Priorities of coinciding lines

6.4 Arrowheads and arrows

6.4.1 General

Arrowheads should be approximately triangular, formed with straight lines and symmetric about the dimension line, leader line, or stem. Arrowheads drawn manually should be filled in¹⁰⁾.

NOTE. Arrowheads drawn by machine need not be filled in, in which case they should be drawn with type B lines.

The point of the arrowhead should touch the projection line, outline, cutting plane line or other limiting line (see figure 4(b) and 4(c)).

6.4.2 Sizes and proportions

6.4.2.1 Arrowheads on dimension and leader lines should be 3 mm to 5 mm long.

6.4.2.2 Arrowheads on arrows showing direction of viewing should be 7 mm to 10 mm long. The stem of the arrow should be approximately the same as, but not less than, the length of the arrowhead.

6.4.2.3 The width of the arrowheads should be approximately a third of their length.

7 Lettering

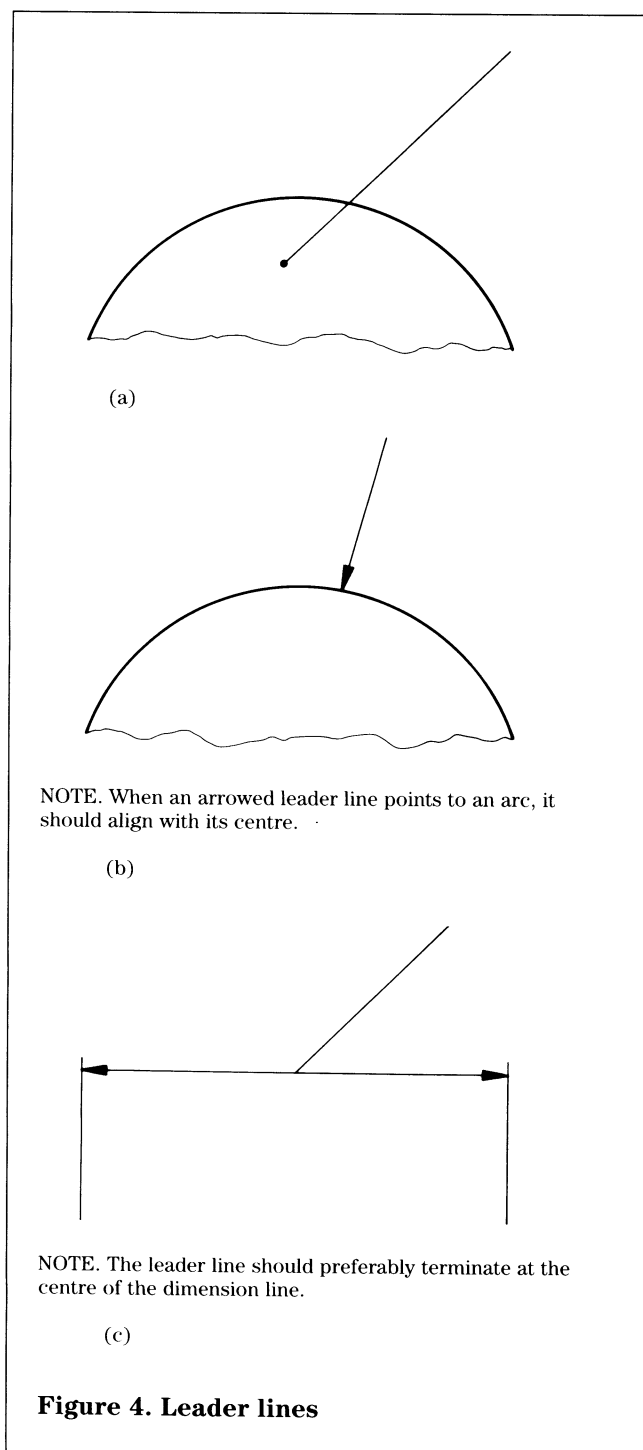
7.1 General

It is important that characters should be uniform and equally capable of being produced by hand, stencil, machine or other means. The characters on the drawing should remain legible not only in a full size copy but in the form of a reduced copy or as an image on a microfilm viewing screen.

Clarity, style, size and spacing are important, particularly for figures, as unlike letters they rarely fall into identifiable patterns and have to be read individually.

All strokes should be black and of consistent density compatible with the line work. Care should be taken that sufficient space exists between characters and parts of characters to ensure that 'filling in' will not take place during reproduction.

¹⁰⁾ ISO 129 : 1985 provides also for open barbed arrowheads with point angles up to 90° as used by the building and construction industries.



7.2 Style

No particular style of lettering is recommended, the aim should be to produce legible and unambiguous characters. Characters should be open form and devoid of embellishments.

NOTE 1. Where the figure one could be confused with the lower case form of the letter L, or the capital I, a 'top hook'/slanting serif may be used.

Vertical and sloping characters are both suitable for general use but the presentation should be consistent on any one drawing sheet, i.e. vertical and sloping letters should not be mixed.

NOTE 2. The examples in figure 5 are provided as a guide only and have been produced by the use of stencils.

Capital letters are preferred to lower case as they are less congested and are less likely to be misread when reduced in size. It is recommended that lower case letters be restricted to instances where they form part of a standard symbol, code or abbreviation. '

7.3 Character height and proportions

7.3.1 Character height

Table 4 lists the minimum recommended heights for upper case characters.

7.3.2 Character proportions

It is stressed that the dimensions given in table 4 are the minimum heights for upper case characters. When lower case characters are used they should be proportioned so that the body height is approximately 0.6 times the upper case height.

The stroke thickness of the character should be approximately 0.1 times the character height and the clear space between characters and parts of characters should be approximately 0.7 mm for 2.5 mm upper case characters, other sizes being in proportion.

The space between lines of lettering should be not less than half the character height but, in the case of titles, closer spacing may sometimes be unavoidable.

Table 4. Character height

Application	Drawing sheet size	Minimum character height mm
Drawing numbers, etc.	A0, A1, A2 and A3	7
	A4	5
Dimensions and notes	A0	3.5
	A1, A2, A3 and A4	2.5

ABCDEFGHIJKLMNOPQRSTUVWXYZ
 abcdefghijklmnopqrstuvwxyz
 1234567890

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890

ABCDEFGHIJKLMNOPQRSTUVWXYZ
 aabcdefghijklmnopqrstuvwxyz
 1234567890

ABCDEFGHIJKLMNOPQRSTUVWXYZ
aabcdefghijklmnopqrstuvwxyz
1234567890

Figure 5. Examples of letters and numerals (see note 2 to 7.2)

7.4 Orientation of lettering

When a landscape format drawing sheet is used with the title block at the bottom right-hand corner (see figure 1(a)) notes should be lettered parallel to the long side of the sheet. When a landscape format drawing sheet is used in portrait position, the title block should appear at the left-hand side and notes should be lettered perpendicular to the long side of the sheet.

7.5 Location of notes

7.5.1 Notes of a general character should be grouped together and not spread over the drawing.

7.5.2 Notes relating to specific details should appear near the relevant feature, but not so near as to crowd the view.

7.6 Underlining

Underlining of notes is not recommended. Where emphasis is required, larger characters should be used.

8 Projection

8.1 Multi-view orthographic projection is predominantly used in engineering drawings. There are two systems, known as First Angle and Third Angle, each providing six views both based on a framework of planes at right angles. Both are approved internationally and they have equal status. The system of projection used on a drawing should be indicated by the appropriate symbol (see figure 6).