ICS 01.100.30

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1980
(As amended 1994)

SOUTH AFRICAN STANDARD

Code of practice

Building drawing practice

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SOUTH AFRICAN BUREAU OF STANDARDS

CODE OF PRACTICE

BUILDING DRAWING PRACTICE

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NOTICE

This standard was approved in accordance with SABS procedures on 27 February 1980.

NOTE 1 In terms of the Standards Act, 1993 (Act 29 of 1993), no person shall claim or declare that he or any other person complied with an SABS standard unless

a) such claim or declaration is true and accurate in all material respects, and

b) the identity of the person on whose authority such claim or declaration is made, is clear.

NOTE 2 It is recommended that authorities who wish to incorporate any part of this standard into any legislation in the manner intended by section 31 of the Act consult the SABS regarding the implications.

This standard will be revised when necessary in order to keep abreast of progress. Comment will be welcome and will be considered when the standard is revised.

PREFACE

This standard covers the production of building construction drawings in which information is communicated accurately and clearly, and with economy of means. For this purpose the selection of a co-ordinated drawing system rather than the continued use of traditional methods is most important.

The standard is intended as a basis for the instruction of architectural, engineering, and building students, and it is suggested that educational and technical centres make extensive use of the standard.

To ensure correlation and co-ordination, all drawings relating to a building should be prepared in accordance with this standard. Drawings so prepared will include the work of the architectural, structural, electrical, and mechanical engineering professions and of the industries associated with building. The procedures should not, however, be considered mandatory, but more as a guide to normal practice.

Particular attention is drawn to the "Plan of Work" given in Appendix B. This is in the form of a flow diagram showing the recommended sequence of events in the design process and documentation for a building project.

Reprint incorporating Amendment No. 1: 28 March 1994

Attention is drawn to the applicable standards given in appendix A of this standard. These references are indispensable for the application of this standard.

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SOUTH AFRICAN BUREAU OF STANDARDS

CODE OF PRACTICE

BUILDING DRAWING PRACTICE

1. SCOPE

1.1 This code of practice covers information required for the production of drawings related to buildings and their services.

NOTE: The titles of publications referred to by number in the code are given in Appendix A.

2. GENERAL

2.1 Drawings are prepared so that designers can communicate their requirements to all concerned in a clear, concise, and unambiguous manner.

For co-ordination of working drawings, the architect should use the elemental drawing technique, i.e. basic framework drawings should be produced as "masters". The principal agent (when other than the architect) should be responsible for ensuring that such a master set of drawings is produced. Copy-negatives can then be taken from these masters and information specific to only the trade for which the drawing is produced can be added by the various consultants.

Actual conditions on a building site are very different from those prevailing in a drawing office, and drawings should be prepared in a manner that takes account of this fact. Details that appear easy to read in an office may be obscured on a site by dirt, oil, or clay from a workman's hands. Also the drawings may get wet or be folded and unfolded many times so that they become illegible. Therefore, for site use, drawings should be printed on durable material.

Rules alone will not produce a systematically arranged set of drawings. A positive attitude is required of the draughtsman, and observance of the following points by him should help to produce a systematic approach:

a) Remember that a working drawing is an instruction from the designer to the builder, who needs to know not only what the building is to look like but also the parts of which it will consist and how they will fit together.
b) At the beginning of the working drawing stage, prepare a list of the drawings likely to be required and their titles. Before starting each drawing, consider the title and ask:

What is the purpose of this drawing?
What information will the user expect to find here?
What type of information (layout, assembly components) is it intended to convey?
What part(s) (element(s)) of the project is it about?

c) Provide only information on a drawing that will enable it to fulfil its purpose (a cluttered drawing should prompt the question "Have I lost sight of the purpose of this drawing?", or "Should I be producing two drawings instead of one?"). On drawings use written descriptions that are as brief as is consistent with completeness, lines that are clear and not too thin, and lettering that is clear and not too small (see Sections 7 and 8). Ensure that instructions on drawings are positive and written in the imperative mood.
d) On completing a drawing, check that it contains explicit information about the shape, size, location, and fixing of all components and materials. Ensure that each drawing gives all the information (together with references to associated drawings) necessary for the construction of the portion of work shown, and omits irrelevant detail.
e) Show two or more details on one drawing only if they are of one information type and relate to the same subject except for small projects where all the information may be on one drawing. Title and code the drawing specifically.
f) Do not repeat drawings of the same part of a building to several different scales. A small-scale layout drawing identifies parts, shows their location in the building, and gives references to detailed information. Details of materials to be used will normally be given in separate specifications, and references to types of material on drawings can be in an abbreviated form (see Section 16). Produce a minimum number of component drawings to a scale large enough to show the detailed information adequately.
g) Remember that the user seeks information from the set of drawings as a whole; he starts from the working drawings, so put references on them which will lead to the relevant details. Make reference to any special items concerned with construction details on the drawings themselves, and not in a separate letter or document. Use the same sheet size for all the drawings within one discipline.

The drawings illustrating this code of practice are for reference only and may not necessarily be to the scales shown (in cases where a scale is shown on the drawing) on account of variations that have occurred during the reduction for printing.

Dimensions of components quoted in the code are given for reference only, and do not necessarily represent standard sizes. An illustration of a site plan (Fig. 2) is given; it does not necessarily cover the requirements of local authorities.

Drawings will be suitable for microfilming if the recommendations made in this code are followed. For further information on microfilming see SABS 048.

3. CLASSIFICATION OF DRAWINGS

3.1 GENERAL. Information concerning a project is normally given on drawings and on written or printed sheets. To facilitate the presentation and to enable information to be found quickly, a drawing is classified according to the particular type of information to be communicated and generally contains only that information which is appropriate to its category. Do not give information in a drawing that could be better included in a schedule, specification, or information sheet.

3.2 TYPES OF DRAWINGS

3.2.1 Sketch Drawings. These are preliminary drawings, sketches, or diagrams that show the general intentions of the designer. These drawings may be done freehand.

3.2.2 Design Drawings. These are amplified sketch drawings by the designer that are sufficiently dimensioned and co-ordinated to enable contract documents to be prepared if required, and to enable other members of the professional team concerned to complete their similar drawings. These drawings may be done freehand.

3.2.3 Working Drawings. These are made up of locality plans, site plans, and layout drawings (which are unique), and component ranges, component details, and assembly drawings (which could be standardized).

a) Locality plans (see Fig. 1). A locality plan is a plan that identifies the site and locates the outline of a building in relation to a town plan or other wider context.
b) Site plans (see Fig. 2). A site plan is a plan that indicates the size and features of a site and locates the positions of buildings in relation to them. It also contains other information required by the authority concerned, e.g. building lines, etc.
c) Layout drawings (see Fig. 3). A layout drawing is a drawing (including plans, elevation, and sections) that shows the positions in a building occupied by the various spaces; the general construction of the building; the location of principal elements; the components.

d) Component drawings
1) Component range (see Fig. 4). This is a drawing that shows the basic sizes and the system of reference for a set of components, e.g. windows, doors, etc.
2) Component detail (see Fig. 5). This is a drawing that shows all the information necessary for the manufacture of a component.
3) Assembly drawings (see Fig. 6). These are drawings that show in detail the construction of a building: junctions in and between elements, between elements and components, and between components.

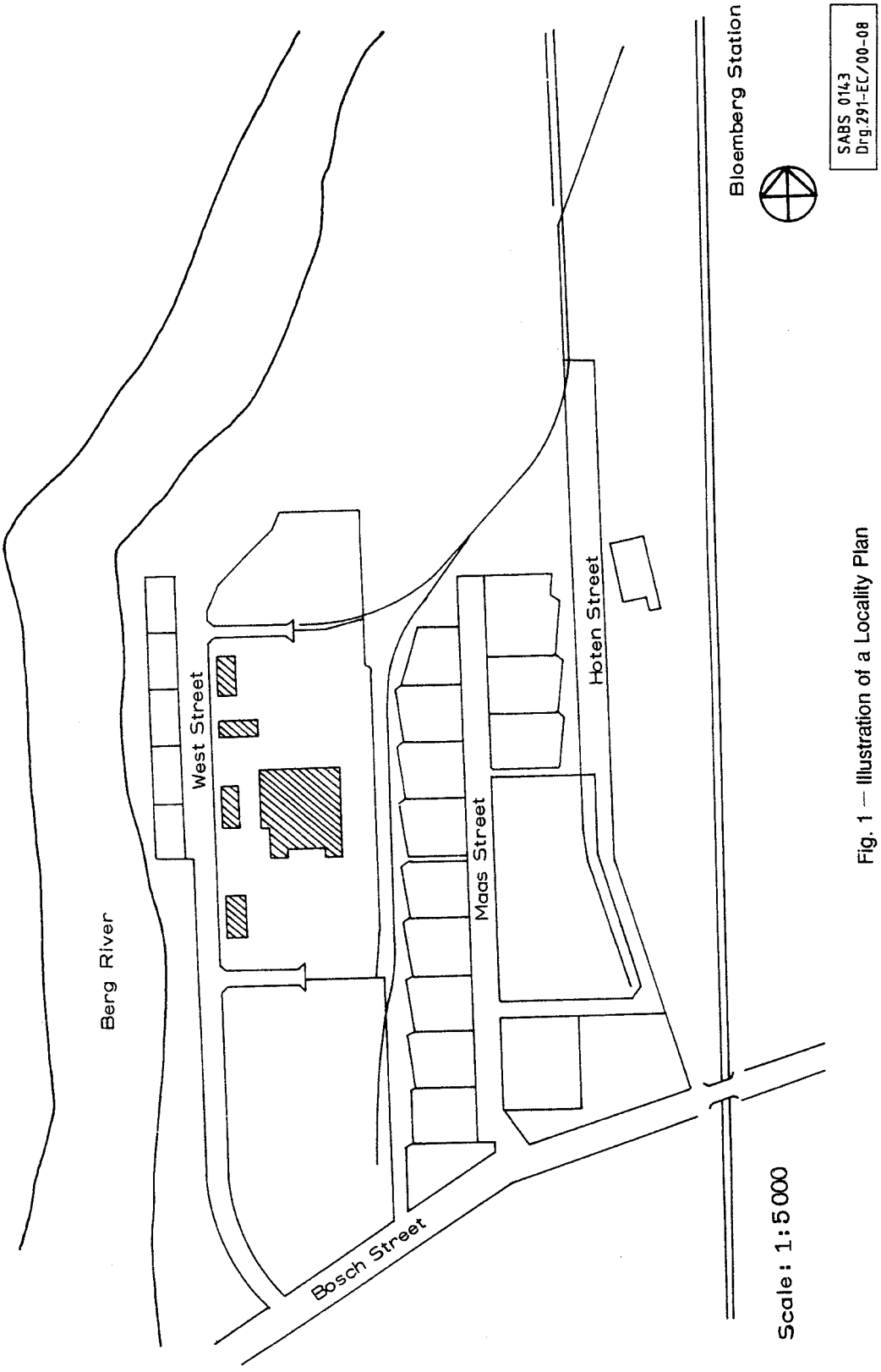
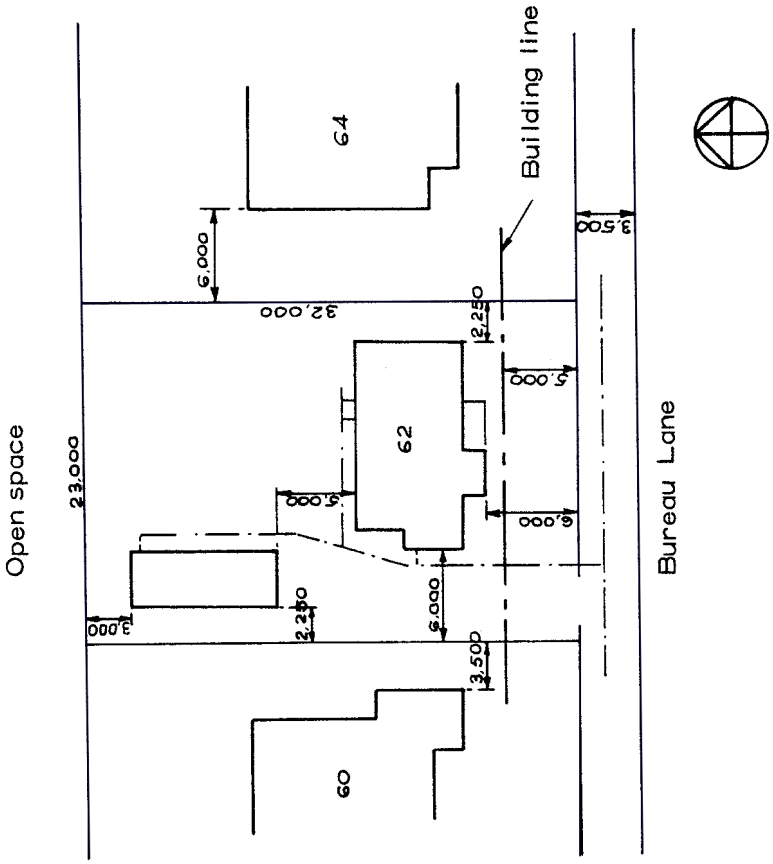


Fig. 1 — Illustration of a Locality Plan



Scale: 1:200

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Fig. 2 — Illustration of a Site Plan

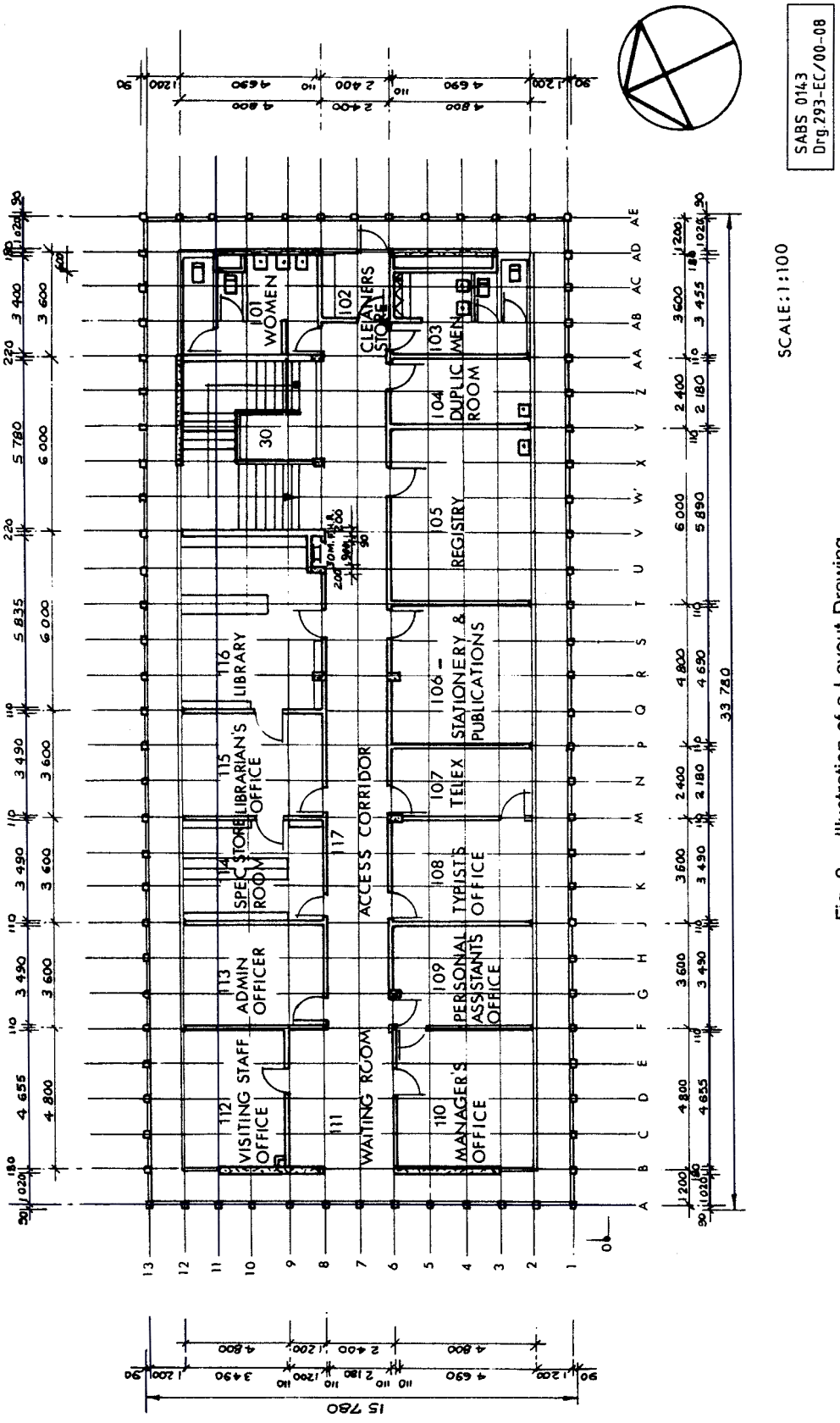


Fig. 3 — Illustration of a Layout Drawing

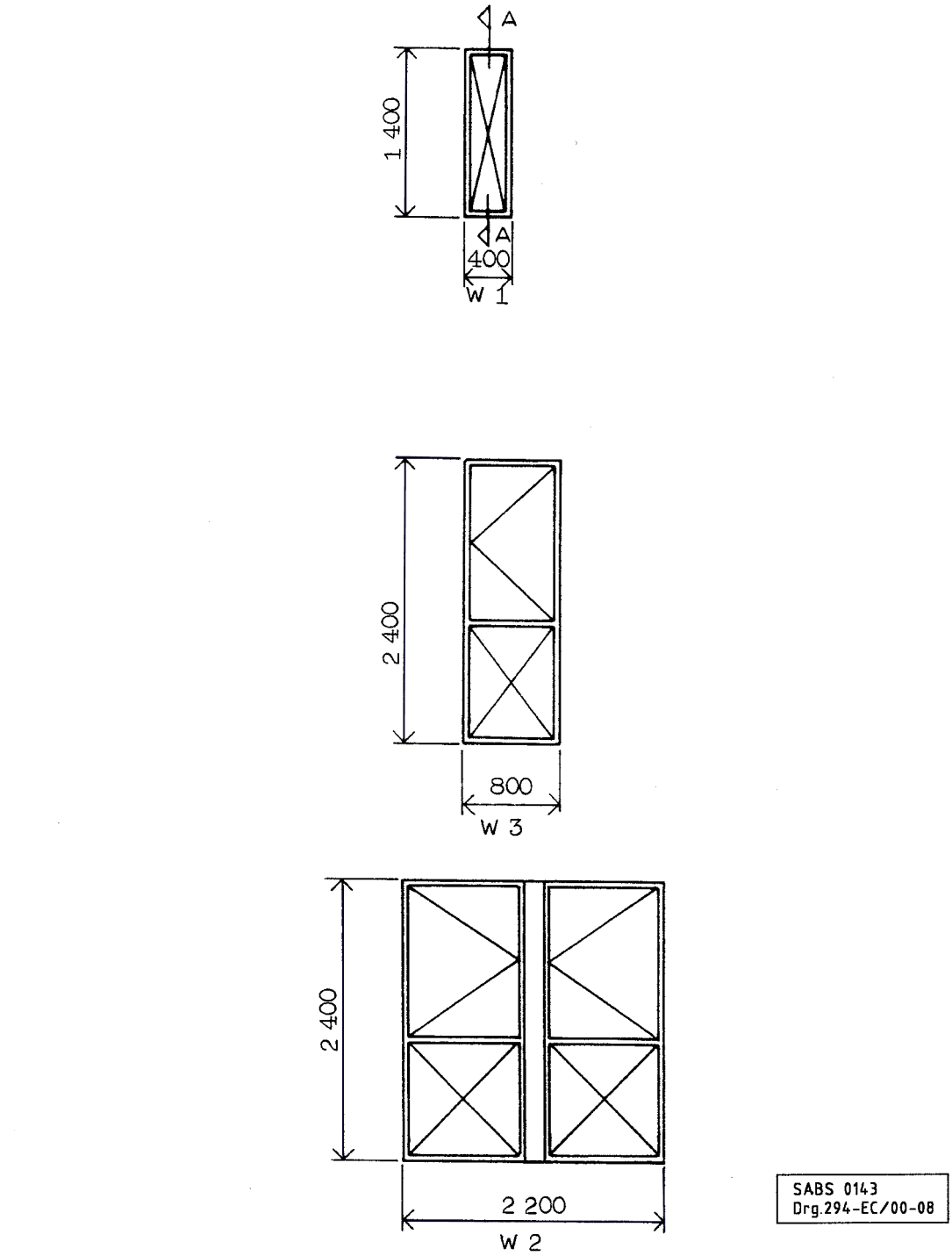


Fig. 4 — Component Range

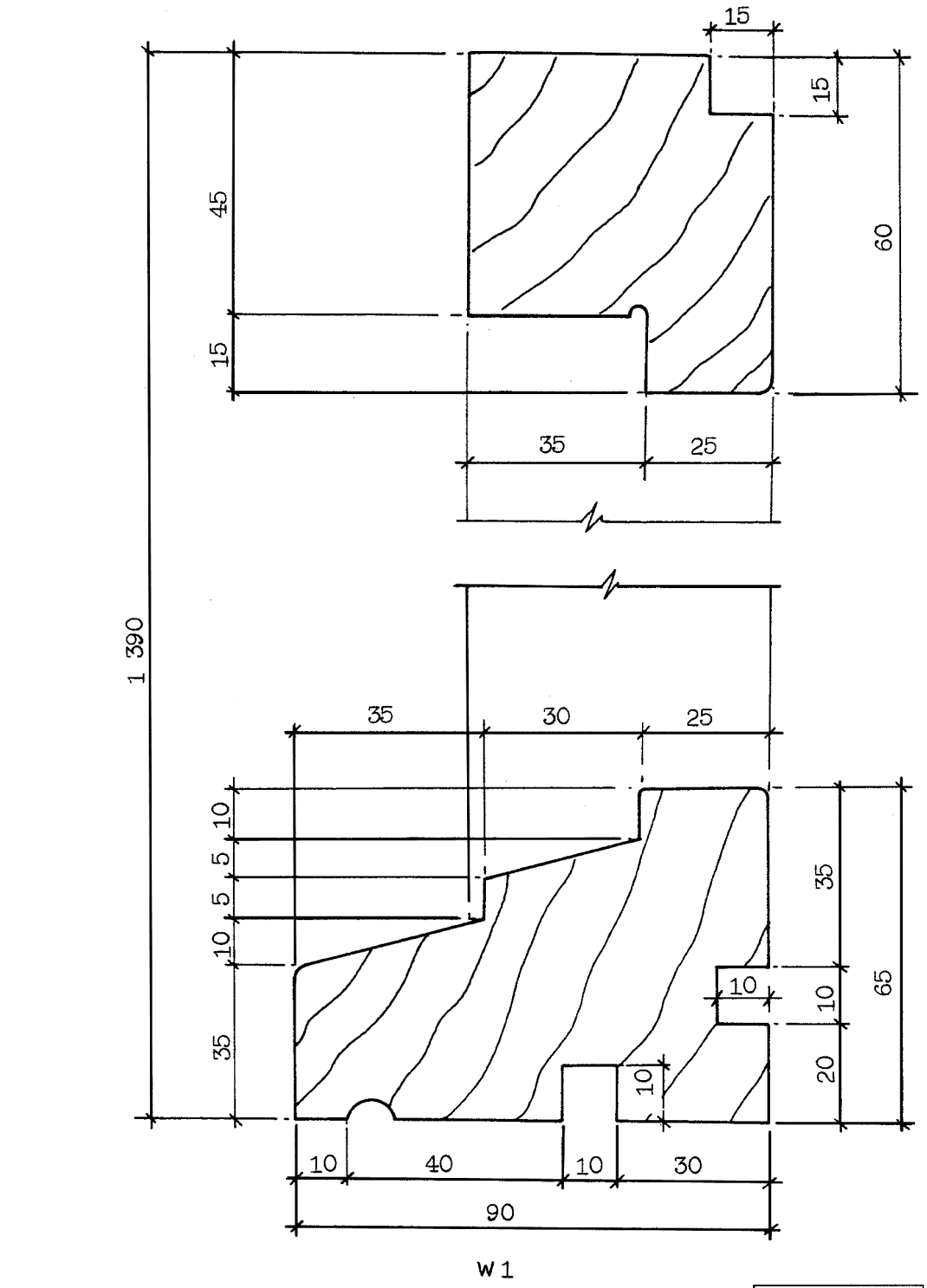


Fig. 5 — Component Detail: Work Sizes

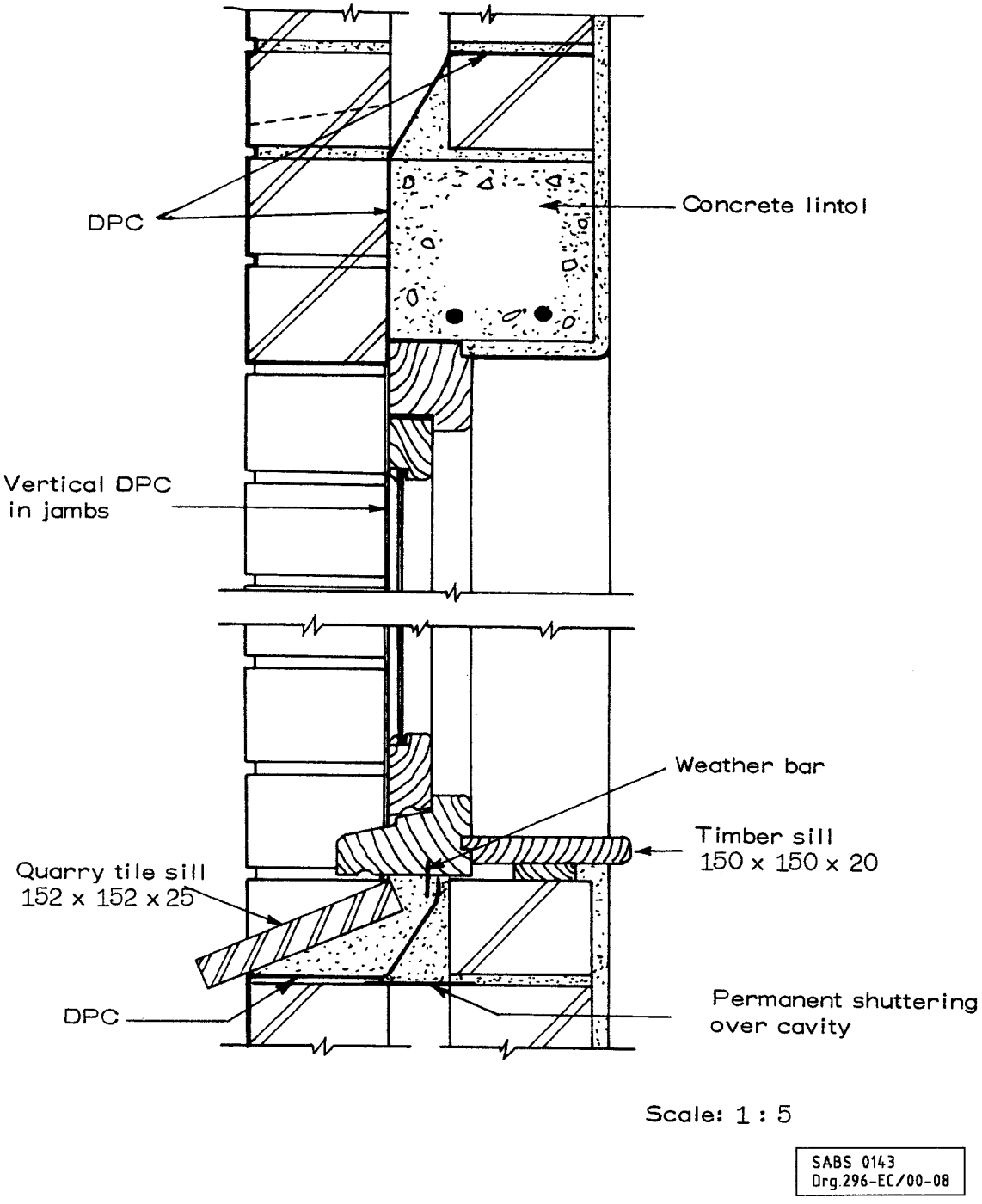


Fig. 6 — Assembly Drawings

3.3 CHECK LIST FOR WORKING DRAWINGS

3.3.1 General. The following check list is given for guidance reference only and does not necessarily cover all the requirements of local authorities. Check the items with the local authority in the area in which the building concerned is being constructed (see also the drawing exceptions in 3.4 and 3.5). Note that all the items in the check list may not necessarily be required on a drawing.

3.3.2 Site Plans

a) Stand boundaries, dimensioned
b) Stand number and adjacent stand numbers
c) Servitudes across the site, set-backs, road widening servitudes, etc.
d) Services (if any) across the site, e.g. power lines, sewers, etc.
e) Service connections and invert depths, positioned
f) Road names and widths
g) Vehicle access
h) Levels (natural and finished)
i) Datum, reference, described
j) Building lines, with distances from fixed reference points
k) Building position on site with adequate dimensions for setting out
l) Building entrances, positioned
m) Sewage drainage and disposal
n) Stormwater drainage and disposal
o) All site works, embankments, retaining walls, boundary walls, gates, fences, roads, paths, etc.
p) Natural features of the site which are to be retained, e.g. existing trees should be shown and suitably annotated
q) North point
r) Scale
s) Unique features

3.3.3 Layout Drawings

3.3.3.1 Plans

a) Foundation plans
1) Foundation, lengths, widths, and depths; strip footing or foundations, excavation levels and changes or steps
2) Any relevant services or structures or both adjacent to the foundations
3) Walls above foundations, shown by full lines and wall thicknesses given
4) Columns, shown by full lines above foundation pads and located in relation to centre lines; columns, numbered and dimensioned
5) Numerical/alphabetical references and cross references on all plans (if grid lines or co-ordinates are used), check for correctness
6) All sleeves, positions, and sizes of incoming or outgoing services
7) Tanking and waterproofing
8) Pile positions
9) Under-floor drainage, sumps, service ducts, lift pits, etc.
10) Expansion joints
11) North point

b) Floor plans

1) Numerical/alphabetical references, and cross reference on all plans (if grid lines or co-ordinates are used), check for correctness
2) Centre line or other locating dimension, identification and size of columns/structures
3) All horizontal dimensions and overall dimensions, including internal wall dimensions, wall thicknesses, centre lines of internal demountable partitions, positions of fittings, etc.
4) Special openings to be left in the structure, e.g. for vertical or horizontal ducts, dimensioned and positioned
5) All set-backs in or projections from the structure, dimensioned
6) Building lines with distances from fixed reference points
7) All door and window openings
8) Door swings and directions of operation of sliding doors
9) All door reference numbers
10) All window reference numbers
11) Ducts, access panels, etc., service runs indicated
12) Electrical distribution boards
13) Telephone requirements (check G.P.O. requirements)
14) Room designations
15) Floor area, window area, and ventilation areas (for Factory Inspector)
16) Stairs, arrow indicating up direction, and number of stair treads
17) Floor levels and finishes
18) All steps, ramps, or changes in level, grading, and falls
19) Fire cupboards, hose reels, hydrants, rising main, sprinkler connections, etc.
20) All sanitary fixtures, annotated
21) Rainwater down pipes and stormwater disposal channels, sumps, etc., adjacent to the buildings
22) Matwells and drainage of matwells
23) Air-bricks, ventilation openings
24) Fittings in outline and reference to detail drawing number
25) Section lines
26) Materials, indicated, for example, by hatching
27) Expansion joints
28) North point

c) Roof plans

1) Pitched roofs

i) Centre lines of roof trusses, ceiling joists, purlins, etc.
ii) Rainwater gutters, down-pipes, vent-pipes, etc., projections through roof, box gutters, concealed gutters, valley gutters, rainwater heads, etc.
iii) Roof finish, and any special waterproofing of or insulation under the roof, indicated
iv) North point

2) Flat roofs
i) All grading and falls, indicated and specified
ii) Outlets, indicated and specified, and required sizes calculated
iii) Roof covering and finish, specified
iv) All kerbs, upstands, etc.
v) Trafficable areas, duck-boards, catwalks, cat ladders, etc.
vi) Vent pipes projecting through the structure
vii) Lift motor rooms, openings in slab; shaft positions, shown by dotted lines
viii) Lightning arresters and conductors
ix) Flag poles
x) Parapet walls (with openings indicated), copings
xi) Expansion joints
xii) North point

3) Possible additional items
i) Roof lights, lantern lights, etc.
ii) Access to roof
iii) Roof tanks, pipe reticulation, sleeper beams or walls, etc.
iv) Mechanical services

3.3.3.2 Elevations and sections

a) Elevations
1) Floor and ceiling lines shown and levels given
2) Natural and finished ground lines
3) All windows and door openings and opening parts of windows
4) Air-bricks and ventilators
5) Sanitary fixtures shown by means of dotted lines and plumbing shown
6) Stairs or changes of level, shown by dotted lines
7) Vertical ducts at external walls, shown by dotted lines
8) All external finishes
9) Expansion joints

b) Sections

NOTE: Sections should be drawn through a building in positions that provide the builder with the maximum information, not where they are most easily drawn.

1) All vertical dimensions, sill, window, and doorhead heights, ceiling heights, floor to floor heights, balustrade and parapet heights, etc. Horizontal dimensions, given only when required to clarify plan dimensions, or to show horizontal dimensions, which, if given in plan, would be confusing
2) Sanitary fixtures and plumbing shown
3) Stairs or changes in level shown
4) All ducts shown
5) Expansion joints
6) DPC's, tanking, and other waterproofing
7) All materials and finishes to be indicated

3.4 RATIONALIZED WORKING DRAWINGS. The requirements for preparing rationalized working drawings are somewhat different from those for normal working drawings, although the same symbolic representations set out in this code are applicable.

The rationalized working drawings, instead of containing all the elements of a building, are separated into sets of drawings for each element of the building.

Anyone requiring further information on these techniques should refer to the relevant series in the Architects Journal (on project documentation) dated 22 October 1970 to 6 January 1971

3.5 SECTIONAL TITLES ACT DRAWINGS. Special diagrams have to be prepared for projects involving the Sectional Titles Act, 1971 (Act 66 of 1971). Reference should be made to the relevant documents that set out the procedures for preparing such diagrams.

3.6 REVISIONS OF DRAWINGS. Mark all drawings that are revised with a revision letter in the appropriate title block and mark each item revised on the appropriate drawing with the same revision letter, which is placed in a triangle adjacent to the revision. In addition to the above, it is desirable to highlight in red on all prints issued the revision triangles that have been added to the drawing.

4. SIZE OF DRAWING SHEETS

4.1 STANDARD SIZES. Use drawing sheet sizes of the International A series as given in Table 1.

TABLE 1) SIZES OF DRAWING SHEETS

1	2	3
Reference	Trimmed sizes, mm	Width of border, mm
A0	841 × 1 189	25
A1	594 × 841	20
A2	420 × 594	20
A3	297 × 420	15
A4	210 × 297	15

NOTE: The border comes within the trimmed size of the sheet and no information except that required for microfilming should be placed in this space.

These sizes are all proportional, leading to simple reduction and enlargement, and sheets may also be easily folded for filing or dispatch. The relatively small sizes make for easier handling in the drawing office and on the building site. It is, in any case, desirable to keep the number of different sizes on any one job to a minimum to permit easy binding and reference.

It is important that original drawings and contact copies are both of the same size and therefore any trimming of sheets to a size smaller than the appropriate standard A size should be avoided.

When drawings are to be microfilmed, use the smallest drawing sheet listed in Table 1 that is consistent with clarity and unambiguity.

4.2 FOLDING. Prints of any size larger than A4 may be folded easily to A4 size.

When prints are to be filed, it is necessary to fold them in such a way that the punch holes penetrate only one layer. The methods of folding prints of different sizes are illustrated in Fig. 7 and 8.

NOTE: If drawings are rolled, ensure that the title panel appears on the outside and, when the drawings are placed in a container, is at the open end.

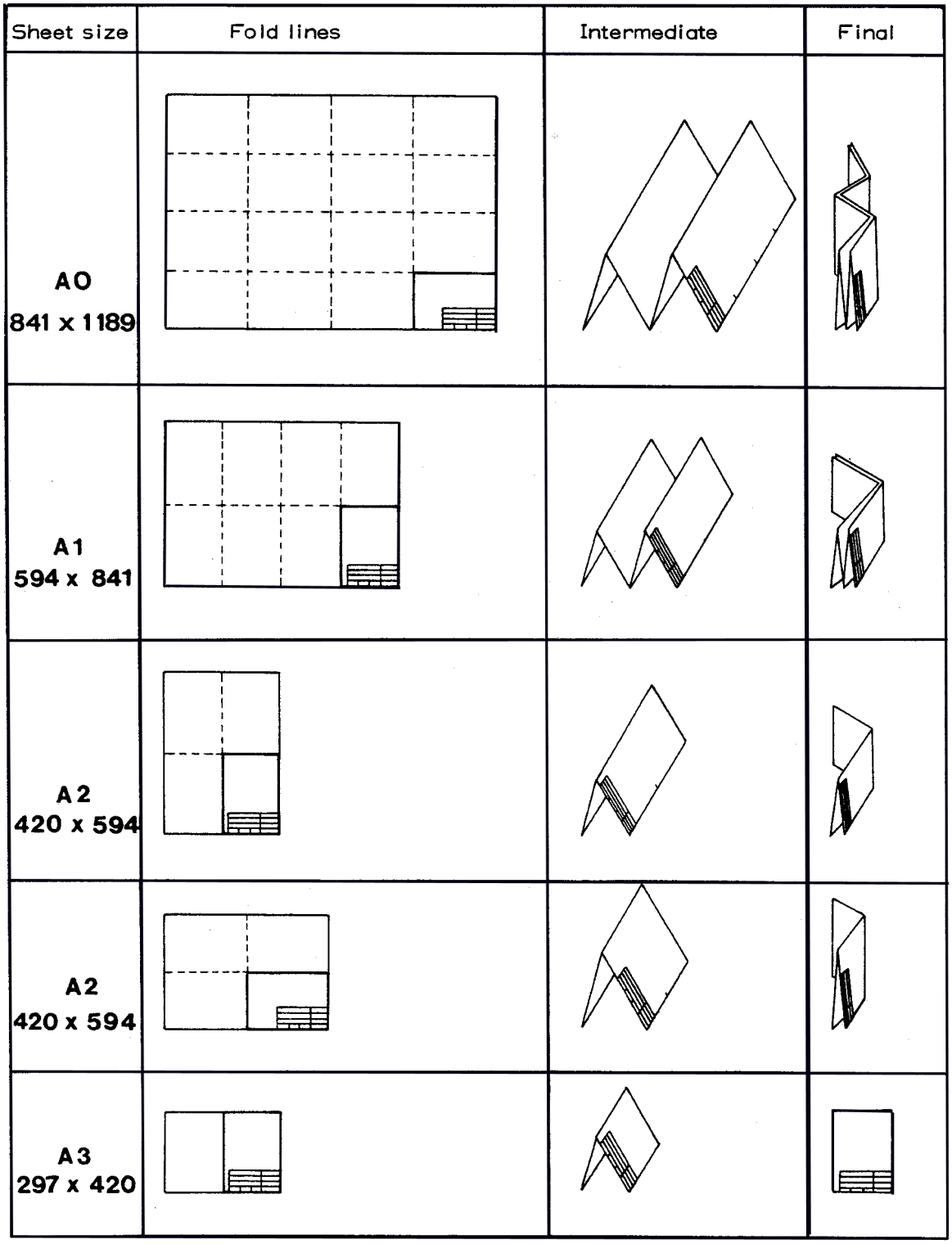


Fig. 7 — Simple Folding of Prints

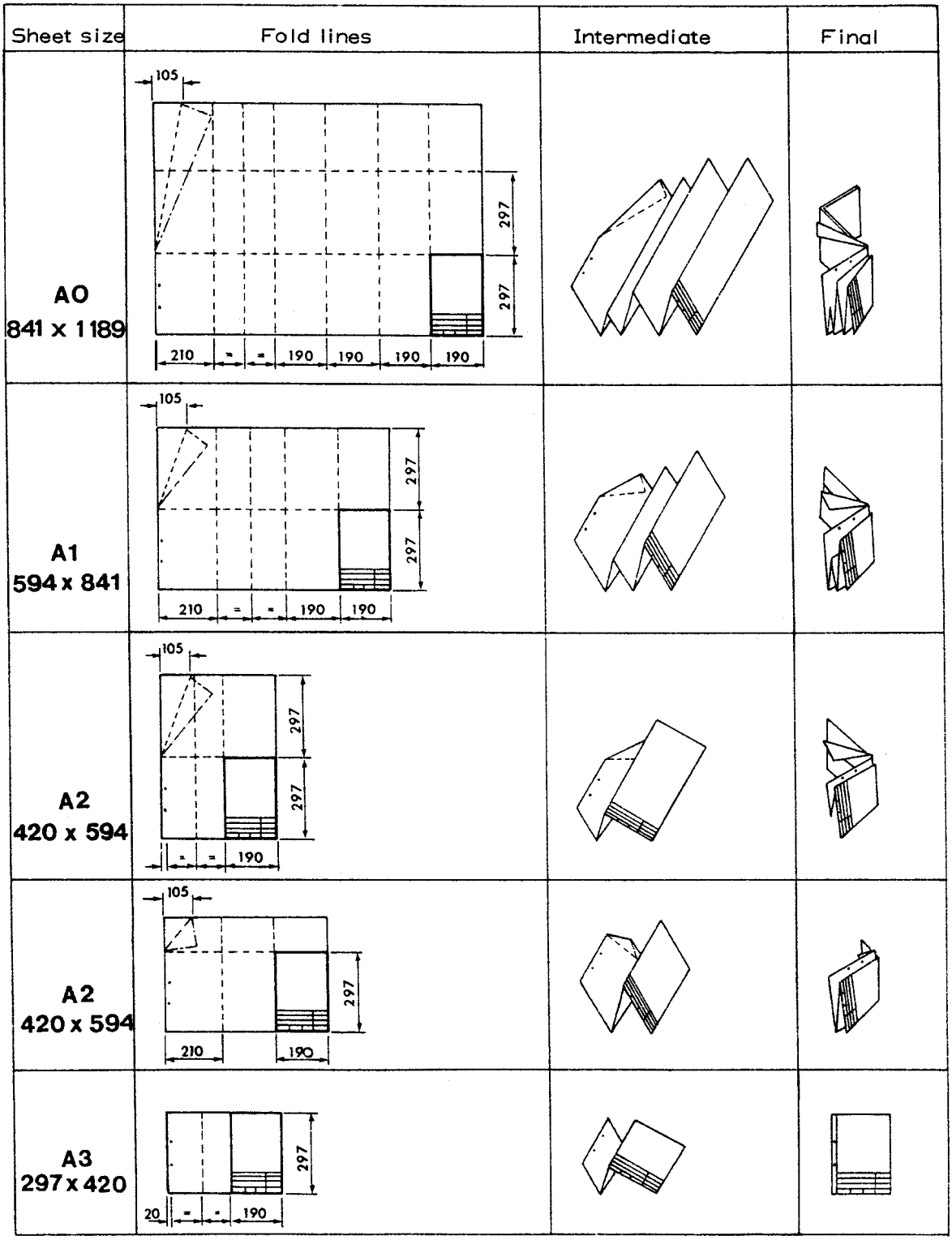


Fig. 8 — Folding of Prints for Filing

5. LAYOUT OF DRAWING SHEETS

5.1 LAYOUT

5.1.1 Filing Margins. If necessary provide a filing margin of minimum width 20 mm that contains no marks other than the manufacturer's or dealer's code references and filing punch marks and fold marks printed as ticks at the edges of the sheet.

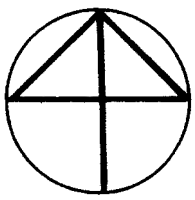
5.1.2 Title Panel. To facilitate reference when prints are filed or folded, place the title panel in the bottom right-hand corner of the sheet. The title panel provides the following information: project title; subject of drawing; scale; date of drawing; project number; drawing number and revision letter; code references if appropriate; name of architect, engineer, planner, surveyor, etc.; address and telephone number; name of project architect, engineer, etc. It should also give the names or initials of the persons who draw, trace, and check the drawing. Change the revision letter each time the drawing is issued after revision.

Fig. 9 and 10 show typical title panels. The use of drawing sheets with blank preprinted title panels or the use of transfers, title stencils, or rubber stamps will save labour.

5.1.3 Information Panel. If an information panel is used, link it to the title panel as shown in Fig. 9 and 10. During the process of building up a set of drawings it is probable that no recording of revisions and renumbering is necessary, but after the first copy of a drawing leaves the office such recording should be undertaken (see 3.6). It is further recommended that the nature and date of each revision be noted and initialled by the architect. Start at the bottom of the information panel and work upwards. When general notes are included in the panel in which revisions are recorded, start them at the top and work downwards.

5.2 KEY. On large projects provide a key diagram that shows at a glance all contiguous drawing sheets. Include a copy of the key, with the appropriate part close hatched, on each relevant drawing.

5.3 ORIENTATION OF PLANS. A north point, as shown below, must appear on every plan, positioned in the bottom right-hand corner of the sheet adjacent to the title panel. Whenever practicable, so orient the drawing that this points to the top or left of the drawing. Draw all plans in the project, including the site plan, using the same orientation for each.



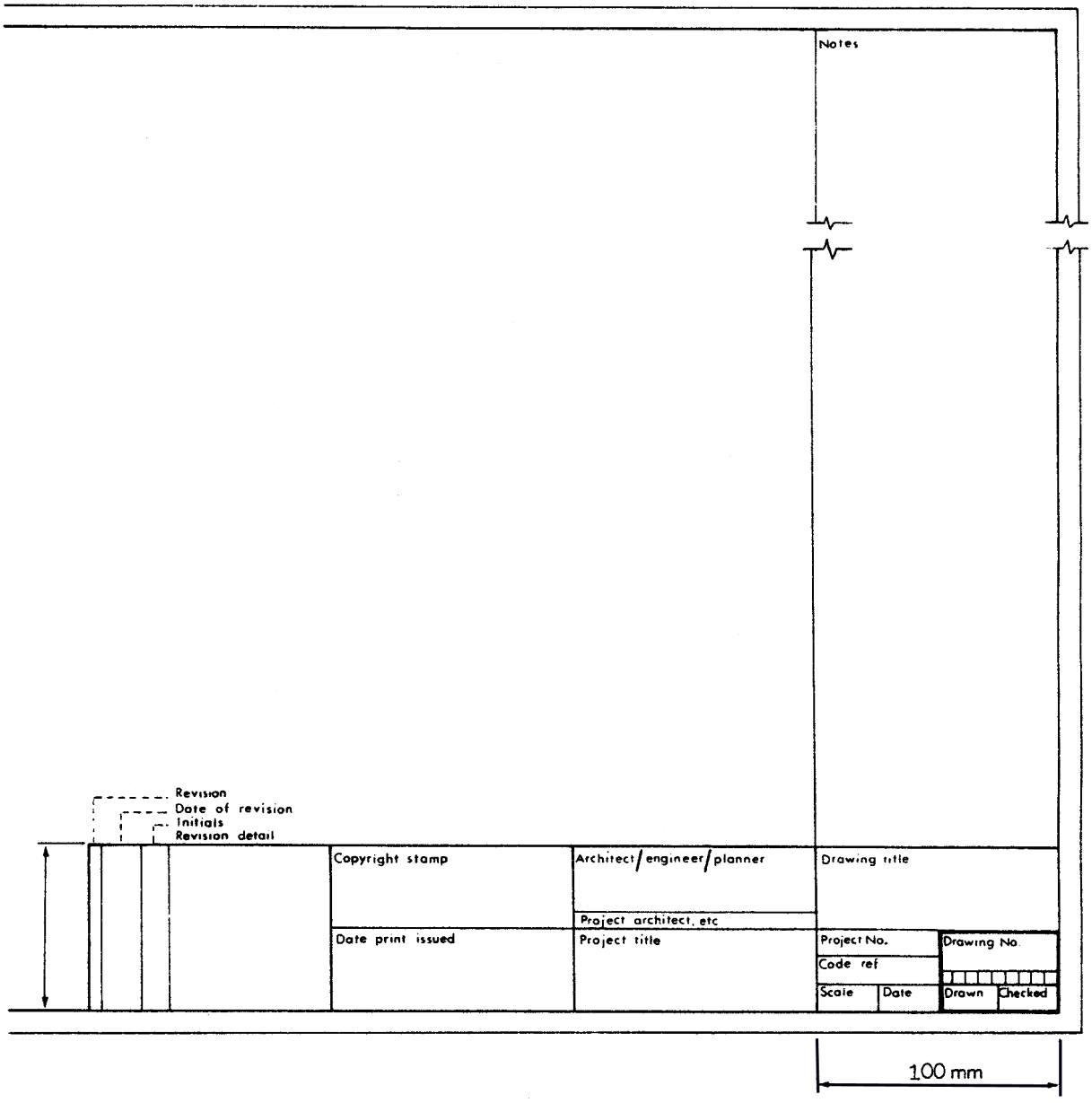


Fig. 9 — Typical Title Panel: Horizontal

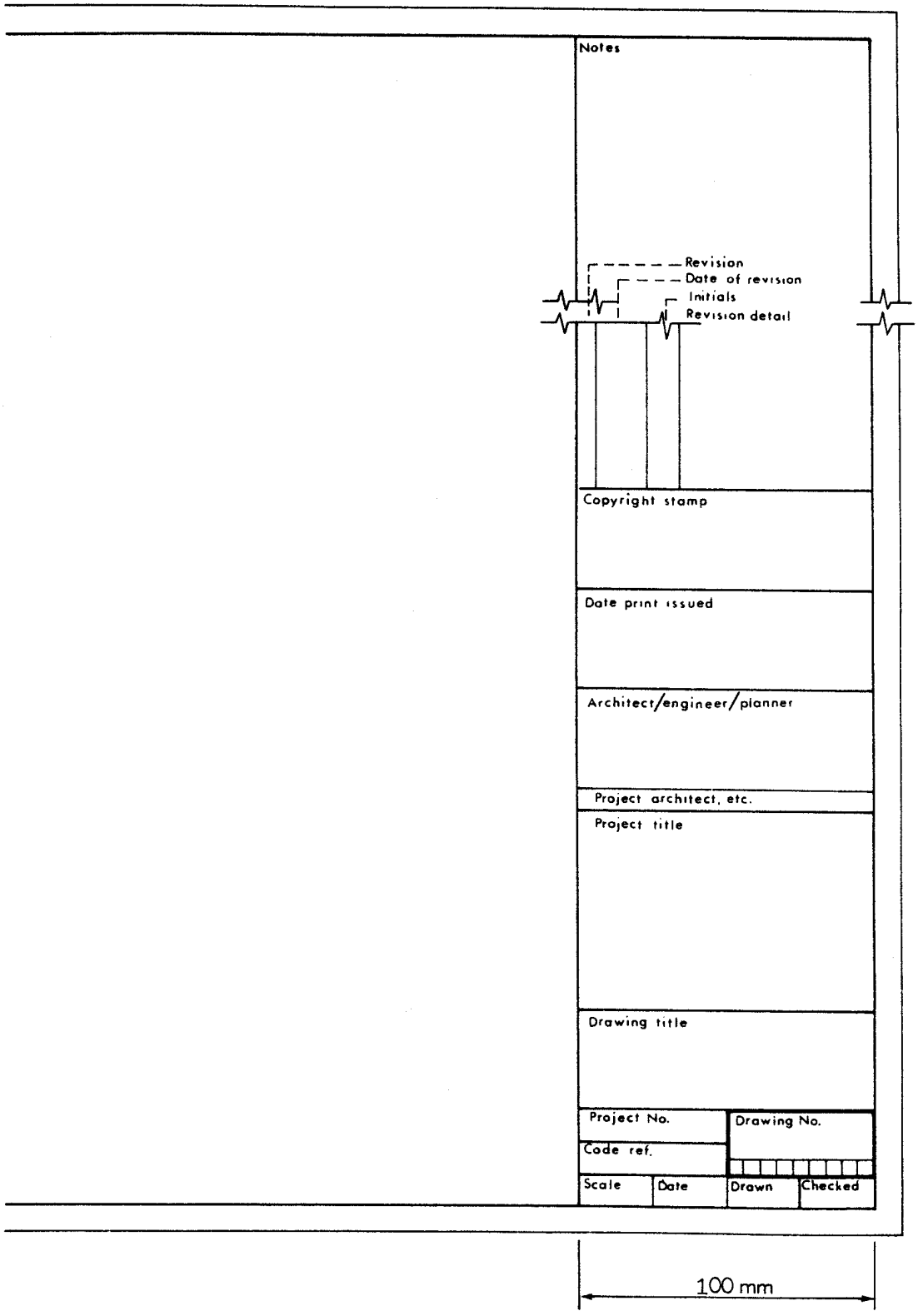


Fig. 10 – Typical Title Panel: Vertical

6. SCALES

6.1 GENERAL. State the scale on every drawing. In addition, include a drawn scale of 100 mm on drawings that are to be read by the non-specialist (e.g. sketch drawings) or that are to be microfilmed or published.

Where more than one scale is used on a drawing, state the general scale in the title panel and clearly indicate the other scales in prominent positions adjacent to the appropriate details.

The system of using "As shown" in the title panel may be adopted in preference to stating the general scale in order to eliminate any possibility of error.

6.2 CHOICE OF SCALE. When choosing the scale, give careful consideration to the following factors that govern the choice:

a) The need to communicate both adequately and accurately the information necessary for carrying out the work;
b) the need to achieve economy of effort and time in the preparation of drawings;
c) the character and size of the project;
d) the desirability of keeping the sheets for one project to one size.

For sections of drains, sewers, earthworks, etc. it is often convenient to use an exaggerated vertical scale so as to show clearly differences in levels (see Fig. 11).

The preferred scales commonly used for various types of drawings are given in Table 2.

TABLE 2) SCALES FOR DIFFERENT TYPES OF DRAWINGS

NOTE: The table is based on ISO 1047.

1	2	3
Type of drawing		Scale
Sketch drawings Design drawings		Scales will vary but it is recommended that preference be given to the scales below
Working drawings	Locality plan	1:1 000 or smaller
	Site plan	1:500 1:200
	Layout drawing: (plans; sections; and elevations)	1:200 1:100 1:50
	Component drawings: (ranges; details; assembly)	1:50 1:20 1:10 1:5 1:2 1:1

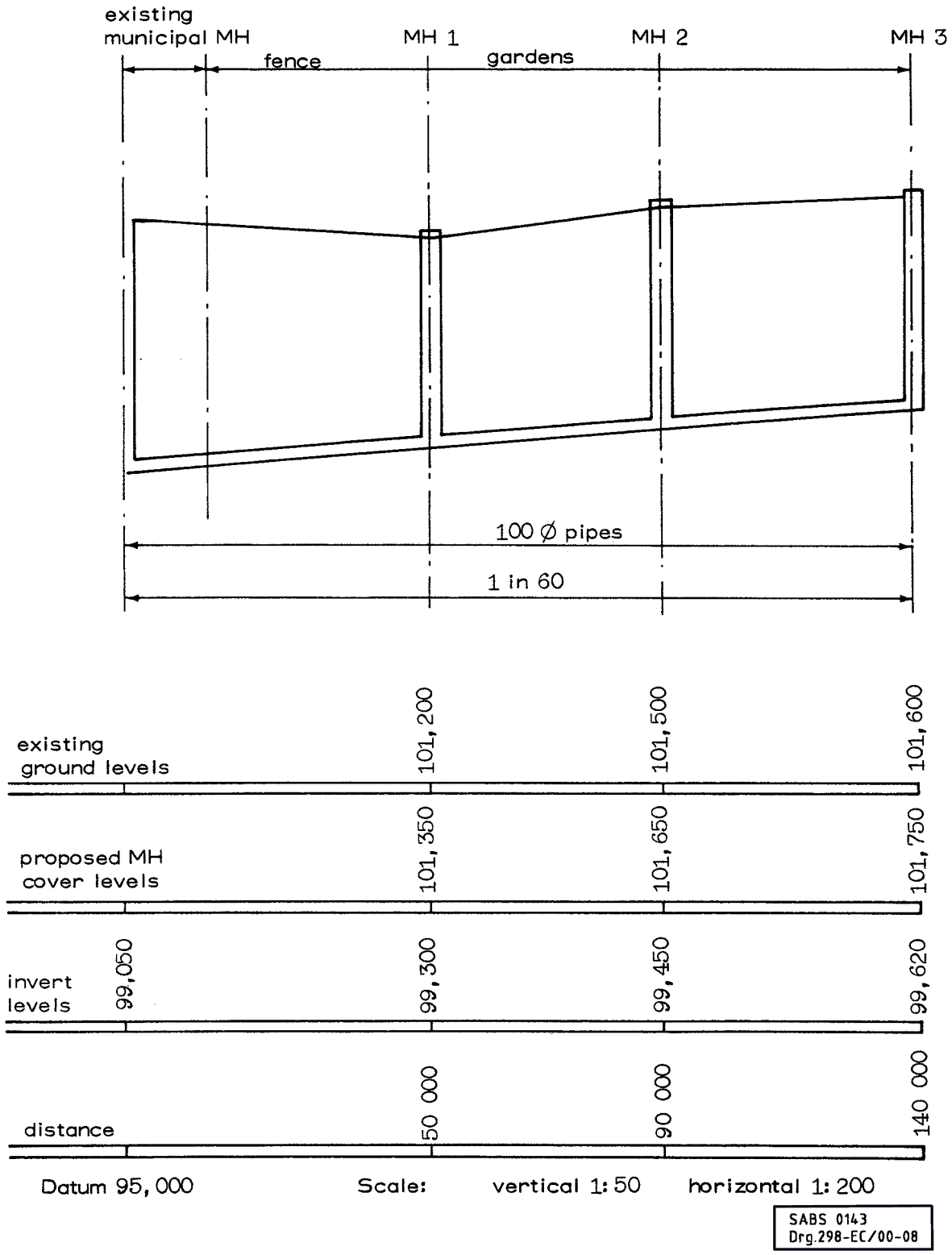


Fig. 11 — Section of Drain with Exaggerated Vertical Scale

7. LINES

7.1 GENERAL. Use lines of differing thicknesses to make a drawing as clear as possible (see Table 3). Keep the thickness of the lines on a drawing constant for a specific purpose (e.g. use thick continuous lines only for showing contours of objects seen in section). The actual thicknesses of lines used will depend upon the purpose of the drawing, the size of the drawing, the scale, whether the lines are in ink or pencil, and the method of reproduction. Once determined, use them consistently for the same type of drawing throughout a project.

Use ratios of line thicknesses of 1:2:4, or as near to this as is practicable. For most purposes three thicknesses such as 0,25 mm, 0,5 mm, and 1 mm are sufficient.

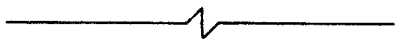
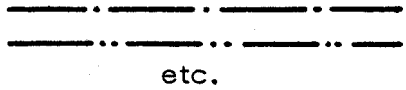
If drawings are to be microfilmed, do not draw lines too close together, e.g. draw one thick line (rather than two thin lines close together) to represent the thickness of a thin steel section.

7.2 MINIMUM THICKNESS. The minimum thickness of lines used on a drawing is determined by the limitations imposed by methods of reproduction. An ink line thickness of 0,25 mm should be regarded normally as the minimum for 1:1 diazo reproduction.

7.3 DENSITY OF LINES. The density of lines drawn for reproduction should be such as to ensure clear reproduction by whatever method is chosen.

Lines are usually in black ink or lead pencil. A line drawn with undiluted black ink is dense enough to cause no difficulty in reproduction. Graphite lead pencils produce lines made up of flakes of graphite. The harder the pencil lead, the more difficult it is to obtain a deposit of graphite flakes dense enough for clear reproduction. For microfilm reproduction suitable pencils must be used but do not use ink and pencil on the same drawing.

TABLE 3 – LINES FOR SPECIFIC PURPOSES

1	2
Planes of sections Thick broken line Use pointers to show the direction of view Label sections with capital letters (omitting O and I) or numbers	(drawing number, if required) 
Work not visible Work to be removed	
Breaks in continuity of drawings Thin continuous line with a zig zag	
Pipe lines, services, drains Thick chain lines	
Centre and axial lines Thin chain line	
Controlling line Indicated by a circle at the end of the line (see SABS 993) NOTE: A thin chain line should be used only when the controlling line is also the centre line	
Dimension lines See Section 9	

8. ANNOTATION

8.1 NOTES. The object of annotation is to provide concise information that is not easily conveyed by the drawing.

Notes should be grouped wherever possible and not dispersed over the drawing. Notes related to specific details should be neatly lined up as near as possible to the items to which they refer. Avoid obscuring any part of the drawing and ensure that if lines are necessary to link details to their notes, they will not cause ambiguity.

Notes should be so arranged as to be approximately parallel to the bottom edge of the sheet. If notes at right angles to this are unavoidable, they should be readable from the right-hand edge of the sheet.

Do not underline notes. Where it is necessary to emphasize a note or heading, larger characters than the others on a drawing should be used.

8.2 LETTERING. It is important for the characters to be legible and capable of being produced by hand, stencil, or other means at reasonable speed. Characters should be open form and all serifs and other embellishments must be avoided for clarity. The specimens shown in Fig. 12 are given for guidance.

Vertical or sloping characters are suitable for general use, but they should not be mixed on any one drawing.

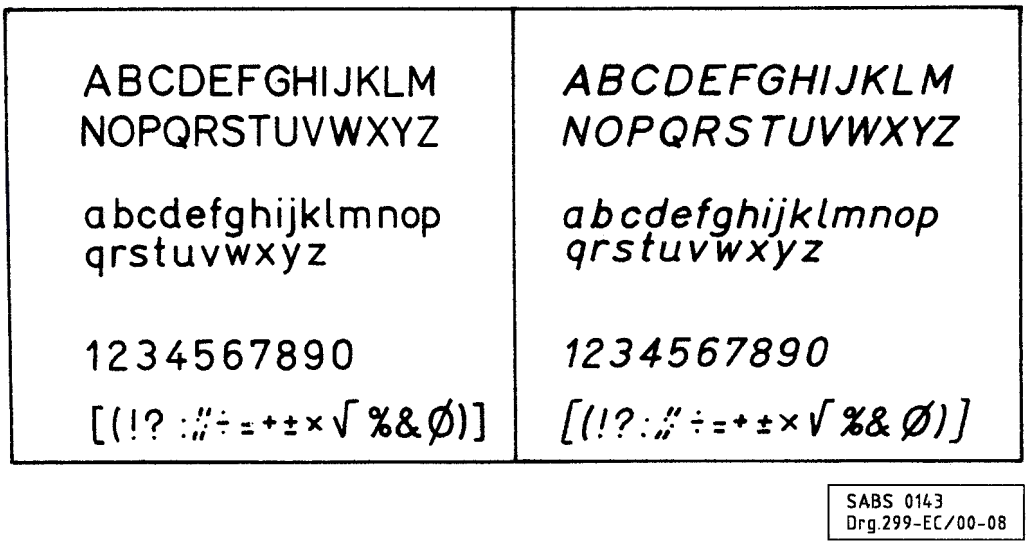


Fig. 12 — Types of Lettering

8.3 SPACING. Space letters evenly in words by taking into account the varying characteristics of adjacent letters. Form compact words separated by the equivalent of the letter O. Space sentences with double the space between words. The space between lines of lettering should not be less than half the character height.

The characters should be legible for a direct print as well as a reduction such as a microfilm print. Spacing of characters and clarity of technique are essential to ensure that "filling in" will not take place during reduced reproduction. Table 4 sets out minimum character heights for different applications and drawing sheet sizes.

If lowercase letters are used they should be 0,7 times the capital letter height. The stroke thickness should be approximately 0,1 times the character height.

TABLE 4) CHARACTER HEIGHT

1	2	3
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

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8.4 SCRIBERS. When a scriber is used, select the letter type, size and pen thickness to fit the drawing. Special pens and ink for use with polyester translucent originals are available.

9. DIMENSIONS

9.1 GENERAL. Dimensions record the distance apart of two points. State only those dimensions essential for carrying out the work. Do not duplicate dimensions unnecessarily, but always give overall dimensions.

Relate all dimensions to faces, structural materials, or to centre lines. If other relationships are necessary, indicate them clearly.

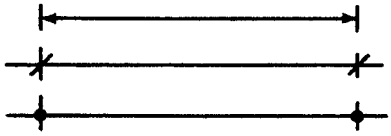
Never take physical measurements from negatives or prints, because of the inevitable movement of the material on which drawings are prepared or reproduced.

State clearly on a drawing, by means of a note, if the designer requires site dimensions to be taken.

9.2 DIMENSION LINES. Always draw dimension lines in a position in which they cannot be confused with the subject.

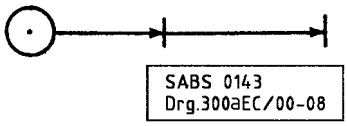
Clearly indicate the points to which the dimension lines relate. To make the termination of dimension lines explicit the following methods are recommended:

Dimensions (care should be taken with drawings that have to be microfilmed)



Basic modular dimensions of a space or component taken to grid lines, centre lines, or unfinished carcase surfaces, (whichever is applicable)

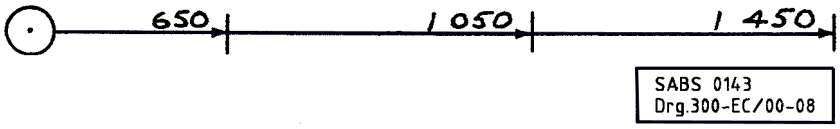
Running dimensions, the starting point being given as a dot in a circle and the cumulative points being given by arrow-heads



9.3 DIMENSION FIGURES

9.3.1 General. Write dimension numerals distinctly and of size large enough to reproduce clearly (see 8.2). Except in the case of running dimensions, write them immediately above and along the dimension lines to which they relate. Their positions on the dimension lines are not critical, but they should preferably be towards the centre and reasonably constant in position.

In the case of running dimensions, place numerals towards that end of the dimension line that is marked with the arrow.



Write dimension numerals to be viewed from the bottom or from the right-hand edge of the drawing.

Modular dimensions may be expressed in terms of the basic module M, e.g. 18 M represents 1 800 mm (i.e. 100 mm × 18). For further information see SABS 993.

When parts of a drawing are not drawn to scale, add NTS (i.e. not to scale) after the dimension numerals.

9.3.2 Decimal Notation. Use the comma as a decimal sign. In numbers smaller than unity a zero must precede the decimal sign, e.g. 0,15.

9.3.3 Thousands Markers. In the case of four digits or more, separate each set of three digits by means of a space, e.g. 1 204.

9.3.4 Linear Dimensions on Drawings. Express all linear dimensions in millimetres. Where the use of both metres and millimetres is unavoidable, write the values in metres to three places of decimals to avoid the risk of incorrect interpretation when dimensions from drawings are transferred to actual site measurements or when quantities are taken off. For example, write "two comma one metres" as 2,100 m, which is visually compatible with and could be used as an alternative to 2 100 mm.

Where no ambiguity can arise, the symbol for the unit selected may be omitted. When both metres and millimetres are used on the same drawing, discard symbols only in accordance with the following rules:

a) A number without the decimal sign indicates millimetres.
b) A number with the decimal sign indicates metres.

9.4 SEQUENCE OF DIMENSIONING. When dimensions are tabulated on a drawing or in a schedule, their sequence must be consistent; length, usually the largest, is given first; width, second; depth or height, third. Where only two dimensions are given, the same order is followed (see Fig. 13).

In view of the varying practices in industry involving different interpretations of the terms "width", "depth", etc., follow the above recommendations at all times. If the word "depth" is used as a horizontal dimension of a component such as a cupboard, it can lead to confusion. "Width" is therefore recommended in preference. The term "thickness" may be applied to horizontal or vertical dimensions of materials but should be confined as far as practicable to simple components. Thickness must always be given last.

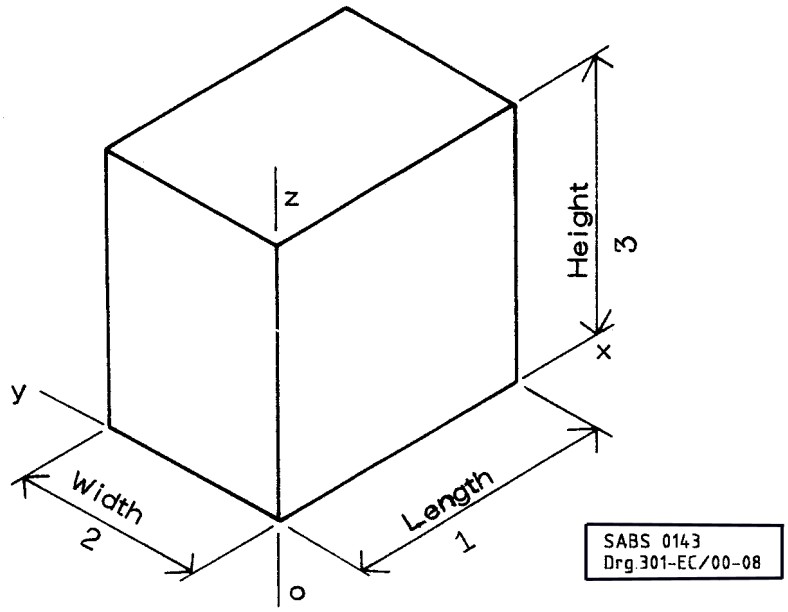


Fig. 13) Sequence of Dimensioning

9.5 TOLERANCES[1)]. Where applicable, tolerances must be clearly specified.

In general the work sizes of most components should be less than their basic sizes, so that they will fit into the spaces designed for them. This is particularly important in modular co-ordination; assuming, for example, a component of basic size 1 800 mm, the work size might be 1 790 mm.

Indicate the tolerance on the work size as follows:

1 790 ± 5

1) A development draft document from the British Standards Institution, DD 22, gives recommendations for tolerances and fits for building.

10. LEVELS

10.1 GENERAL. Levels record the distance of a position above or below a defined datum.

10.2 DATUM LEVELS. Select a datum point so that reference is made to a positive level, as a minus sign is easily misread. Clearly indicate or describe this datum on the drawings and relate all levels and vertical dimensions to it. Express levels in metres to three places of decimals above this datum. Particularly on large projects, it is usually necessary to relate the project datum level to the trigonometrical survey datum level or a datum level acceptable to the Local Authority.

10.3 LEVELS ON PLANS. It is important to differentiate on site and layout drawings between existing levels and required levels using the symbols shown in T6.1 of Table 6 thus:

Existing level : X 58,210

Required level or structural level : 60,255 X

where X indicates the exact position to which the level applies.

Finished floor levels should be indicated by the figures of the level, thus:

12,335

10.4 LEVELS ON SECTIONS AND ELEVATIONS. The same method should be used as for levels on plans except that the level should be projected beyond the drawing with an open arrowhead indicating the appropriate line as in Fig. 14.

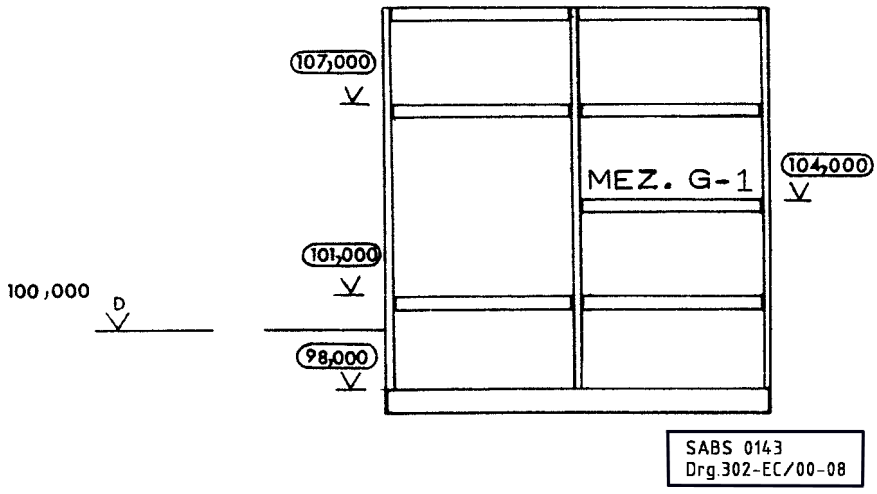


Fig. 14 – Levels on Section and Elevation

11. REFERENCE GRIDS

11.1 GENERAL. The use of reference grids, to which sizes and positions of building components may be related, is helpful in the preparation of most types of drawing and particularly those relating to projects in which modular co-ordination is applied to design and construction.

11.2 GRID NOTATION. Most current methods of grid notation apply only to planning and structural grids and use letters to define the lines on one axis and numerals to define the lines on the other axis.

Use a three-dimensional reference grid only where necessary for intermediate levels or where it might be necessary to use the z-axis when computers are used. The axis which is horizontal and parallel to the sight line of the observer is defined as the x-axis; the axis at right angles to the x-axis and in the same horizontal plane is defined as the y-axis; and the axis vertical to this horizontal plane is defined as the z-axis. The point of origin O must be constant for any one project and is placed outside the area defined by the drawing. Each grid line may be represented by a simple numeral or letter or, if required, by a multiple of the basic module.

In this way any point on a plan, section, or elevation on any type of drawing and for any type of structure or component may be identified, and its position defined by its x, y, and z co-ordinates (i.e. appropriate distances, parallel to the x-, y-, and z-axes, from the point of origin).

If the positional notations of the components follow the sequence of dimensioning contained in 9.4, it will be possible to avoid confusion and at the same time to use a quite simple numerical system of notation that nevertheless accurately locates a component within the structure as a whole.

11.3 MODULAR GRIDS. For information on modular grids see SABS 993.

11.4 GRIDDED PAPER. With the increasing application of reference grids, particularly for modular co-ordination, the use of printed grids on backing sheets is an obvious aid to drafting.

12. PROJECTION

12.1 GENERAL. There are many good text books on projection and for details these should be consulted.

On small projects where several views, such as plans, sections, and elevations of a building, are assembled on one drawing, it is essential to relate the various views in a systematic way.

The two main forms of projection used for building drawing are first angle and isometric. Traditionally, in the case of steel construction, third angle projection has been used. For convenience a mixture of first and third angle projection is often used where more than one view is put on a drawing.

13. DESIGNATION AND LOCATION OF SPACES AND COMPONENTS ON DRAWINGS

13.1 GENERAL. Designate spaces, components, units of equipment, and any other items embraced by a project to facilitate identification both on drawings and on schedules.

Adopt a method of numbering or referencing that accords with the nature of the project and follow a logical sequence in applying it. Indicate items on drawings with bold figures. Suggested applications are given with the details for each item.

13.2 FLOORS. Number floors from the first upwards, and use the letters G and B for ground floor and basement respectively. If there are two or more floors in the basement designate them B1, B2, etc., B1 being next to the ground floor. Indicate mezzanine floors by the levels below and above, i.e. Mez. G-1 means the mezzanine between ground and first floor (see Fig. 15).

When floors are referred to alone, prefix the number with the word "Floor", i.e. Floor B2 or Floor 17.

In projects with complex floor levels, denote the levels by heights relating to datum in addition to or instead of the above system, e.g. 9,600 AD would mean a floor whose level is 9,600 m above the datum for the site.

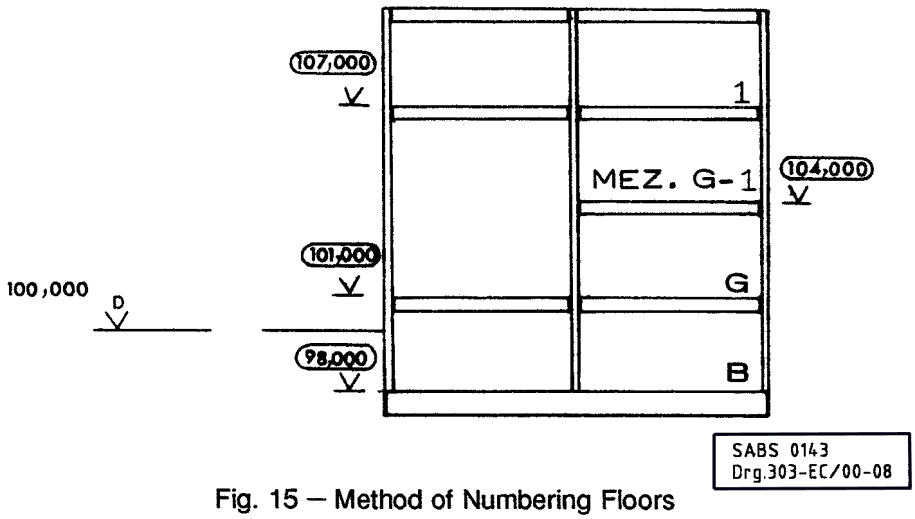


Fig. 15 — Method of Numbering Floors

13.3 ROOMS AND SPACES (INCLUDING WALK-IN CUPBOARDS AND OTHER SPACES). Use a separate consecutive sequence for the spaces of each floor, with rooms first, followed by corridor and other circulation spaces, and preferably place the number above the name of a room (see Fig. 3 and Fig. 16). Allocate a sufficiently high number to stairs so that they have the same number on each floor. Do not give separate numbers to small cupboards and spaces off rooms, but allocate the numbers of the rooms in which they are situated combined with appropriate suffixes. Prefix zero to single numbers, e.g. 09.

When the space reference is given off plan (e.g. in a schedule), place the floor number before the reference and the numbers of the floors between which the landing is situated before the landing number, for example:

708	:	Room 08 on the 7th floor
G51	:	Room 51 on the ground floor
G-1/99	:	Landing space 99, is the landing between the ground floor and the 1st floor
Mez.G-1/02	:	2nd room on the mezzanine between the ground floor and the 1st floor
Level 9,600/08	:	8th room on floor 9,600 AD
903a	:	Cupboard in room 3 on the 9th floor

13.4 NON-STRUCTURAL COMPONENTS. Allocate appropriate identification letters to each component or item of equipment, such as D for a door, W for a window, etc.

Use a sequence of numbering that is both logical and consecutive for each type of component or item of equipment.

Number components starting from the bottom left-hand corner of the drawing in a clock-wise direction for each floor round the exterior of the building, followed by interior courts also clockwise (see Fig. 16).

When reference is made off plan or in schedules to components or items of equipment, the appropriate floor number must precede the reference, as for spaces, for example:

G/W8	:	Window No. 8 on the ground floor
Mez. 2-3/W2	:	Window No. 2 on the mezzanine floor between the second and the third floors
G/D16	:	Door No. 16 on the ground floor

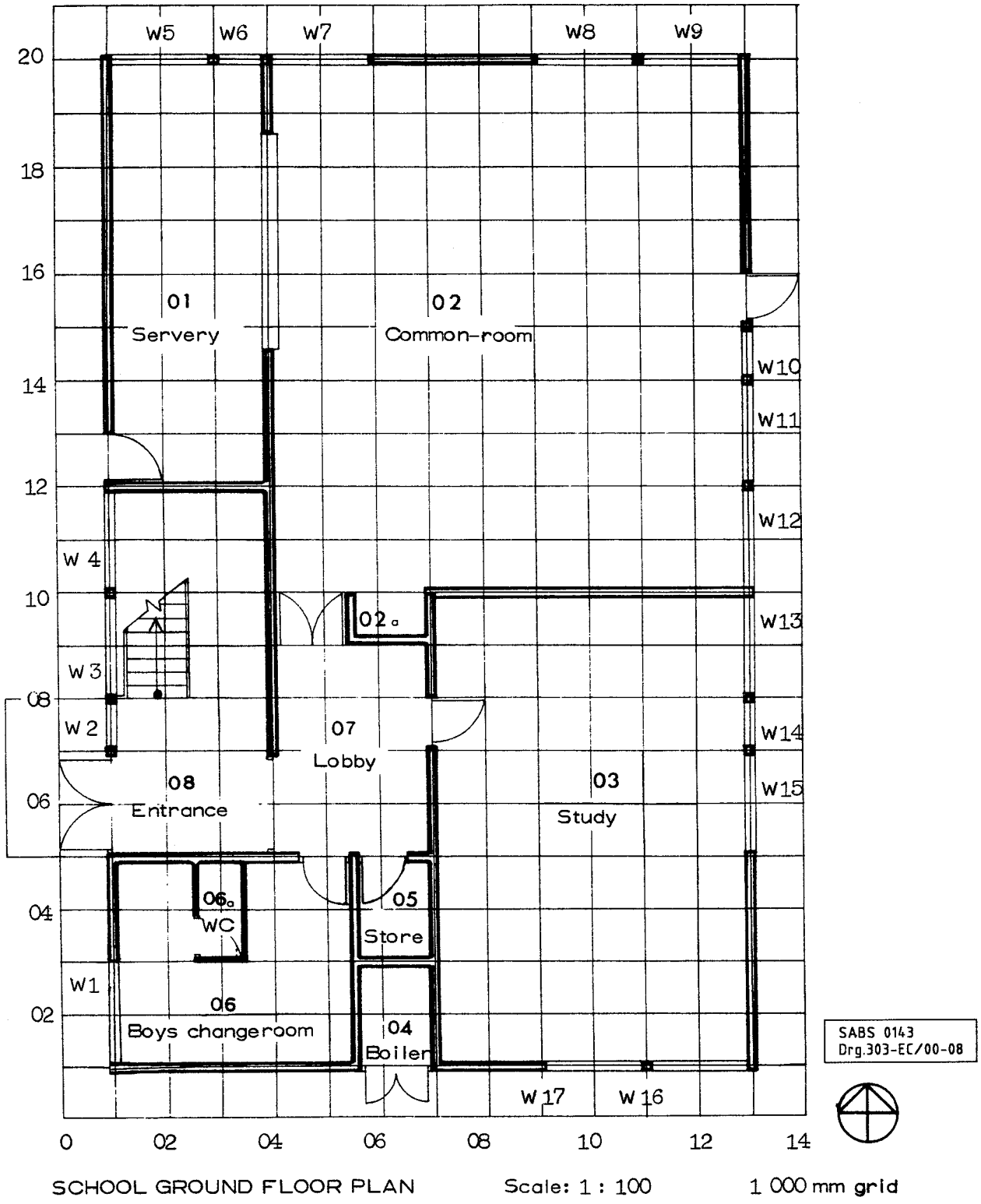


Fig. 16 — The Numbering of Rooms or Areas for Identification

14. REPRESENTATION OF MATERIALS

14.1 GENERAL. Recommended methods of indicating materials on plans and sections are shown in Table 5. Use these only where confusion is likely to occur in the interpretation of drawings, but in all cases add a descriptive note, stating the type of material, thickness, etc. Do not hatch existing work and show demolished work by means of dotted lines (see Table 3).

14.2 COLOURING. Colouring is costly, laborious, and conducive to error and is consequently to be avoided. Hatching is preferable where it is necessary to differentiate between materials.

When copies of drawings are to be coloured use the standard colours specified in the National building regulations.

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TABLE 5) DRAWING SYMBOLS FOR MATERIALS

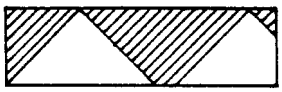
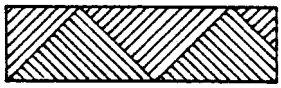
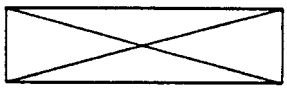
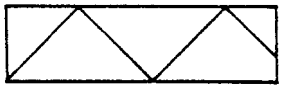
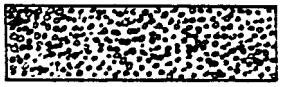
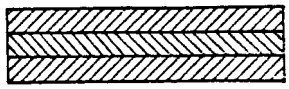
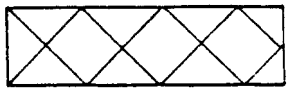
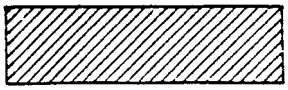
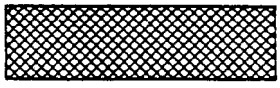
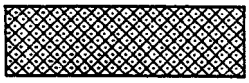
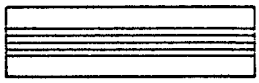
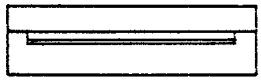
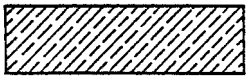
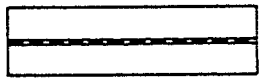
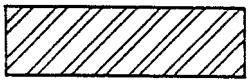
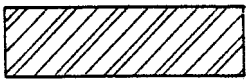
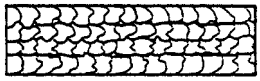
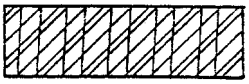
1	2	1	2
Material	Symbol	Material	Symbol
undisturbed earth		face brick (elevation drawn to brickscale)	
earth fill		undressed wood	
hard core		dressed wood	
stone concrete		wood (elevation)	
no fines concrete		plywood	
sand plaster or screed		blockwood	
cinder concrete		metal (large scale)	
slate		metal (small scale)	

TABLE 5 (continued)

1	2	1	2
Material	Symbol	Material	Symbol
terrazzo		glass (large scale)	
marble		glass (small scale)	
natural stone		sheet membrane	
common brick		insulation (loose)	
face brick		insulation (solid)	
fire brick			

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15. GRAPHICAL SYMBOLS AND REPRESENTATION

15.1 GENERAL. The use of symbols on a drawing makes it possible to convey the maximum amount of information in a clear and legible manner with the minimum of effort.

15.2 TYPES OF SYMBOLS. The principal types of symbols used in building drawing practice are graphical. Many of these, as well as other kinds of symbols such as letters, numbers, and signs, are covered by standards, of which the following may be relevant:

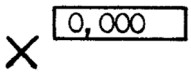
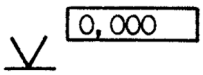
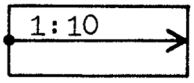
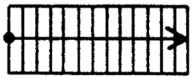
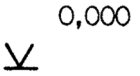
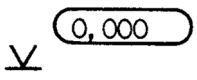
BS 504	Drawn lead traps
BS 1553	Specification for graphical symbols for general engineering Part 1: Piping systems and plant
BS 1635	Graphical symbols and abbreviations for fire protection drawings
BS 1991	Letter symbols, signs and abbreviations Part 1: General Part 4: Structures, materials and soil mechanics
BS 3939	Graphical symbols for electrical power, telecommunications and electronics diagrams
SABS 044	Welding Part II: Symbols
SABS 82	Bending dimensions of bars for concrete reinforcement

15.3 GRAPHICAL SYMBOLS. Building drawing practice requires the use on drawings of graphical symbols that are additional to those covered in the above standards. Examples of some of the most commonly used graphical symbols are given in Table 6. Reference should be made to Fig. 17 for the method of indicating components of a service installation.

The size of the symbol is related to the scale of the drawing.

TABLE 6 — GRAPHICAL SYMBOLS AND REPRESENTATION

T6.1 - GENERAL

1 Description	2 Symbol	3 Description	4 Symbol
Centre line		Level, invert	
Datum level		Level, required on plan	
Diameter		Level, required on section	
Diameter, inside		North point	
Diameter, outside		Ramp *	
Level, existing on plan		Staircase *	
Level, existing on section			
Level, finished floor			

* Direction of arrow always to point up staircase or ramp, for the entire length of it

TABLE 6 (continued)

T6.2 - SERVICES

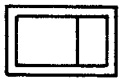
1 Description	2 Symbol	3 Description	4 Symbol
DRAINAGE		WATER SUPPLY	
Drain		Check valve	
Grease trap		Draw-off tap	
Gully		Hot water cylinder	
Stormwater drain		Safety valve	
		Stop valve	
		Terminal anti-vacuum valve	
		Water cistern	
		Water meter	
		Water-storage tank	

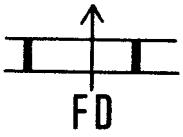
TABLE 6 (continued)

T6.3 - INSTALLATIONS (MAINLY ELECTRICAL)

1 Description	2 Symbol	3 Description	4 Symbol
POWER		LIGHTING	
Distribution board		Emergency light	
Earth		Fluorescent light (3 tubes of 40 W)	 3 x 40 W
Electricity meter (Watt-meter recording)		Light (3 lamps of 40 W)	 3 x 40 W
One-way switch single pole		Light wall-mounted	
One-way switch double pole		COMMUNICATIONS	
One-way switch three pole		Telephone, internal	
Two-way switch		Telephone, public	
Regulating switch, e.g. dimmer			
Socket outlet			
Switched socket outlet			

TABLE 6 (continued)

T6.4 - FIRE PROTECTION

1	2	3	4
Description	Symbol	Description	Symbol
Fire alarm		Hose cradle with rubber hose	
Fire door		Fire hydrant (state what type)	
Fire extinguisher (state what type)		Sprinkler	
		Smoke detector	
Heat detector		Smoke extractor	

T6.5 - FIXTURES AND FITTINGS

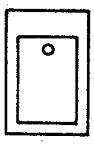
1	2	3
Description	Symbol	
	View in plan	View in elevation
Bath		
Bidet (state whether water supply is over or under the rim)		

TABLE 6 (continued)

T6.5 - FIXTURES AND FITTINGS (continued)

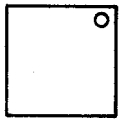
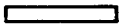
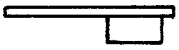
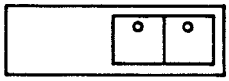
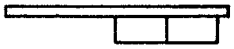
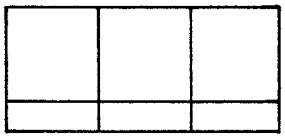
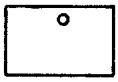
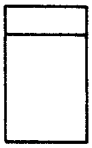
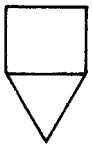
1	2	3
Description	Symbol	
	View in plan	View in elevation
Shower-bath		
Sink unit - single (kitchen, hospital, or laboratory)		
Sink unit - double (kitchen, hospital, or laboratory)		
Urinal - slab or stall type (state which type)		
Urinal - wall-mounted type		

TABLE 6 (continued)

T6.5 - FIXTURES AND FITTINGS (continued)

1	2	3
Description	Symbol	
	View in plan	View in elevation
Wash-basin		
Wash tub		
Water-closet pan		

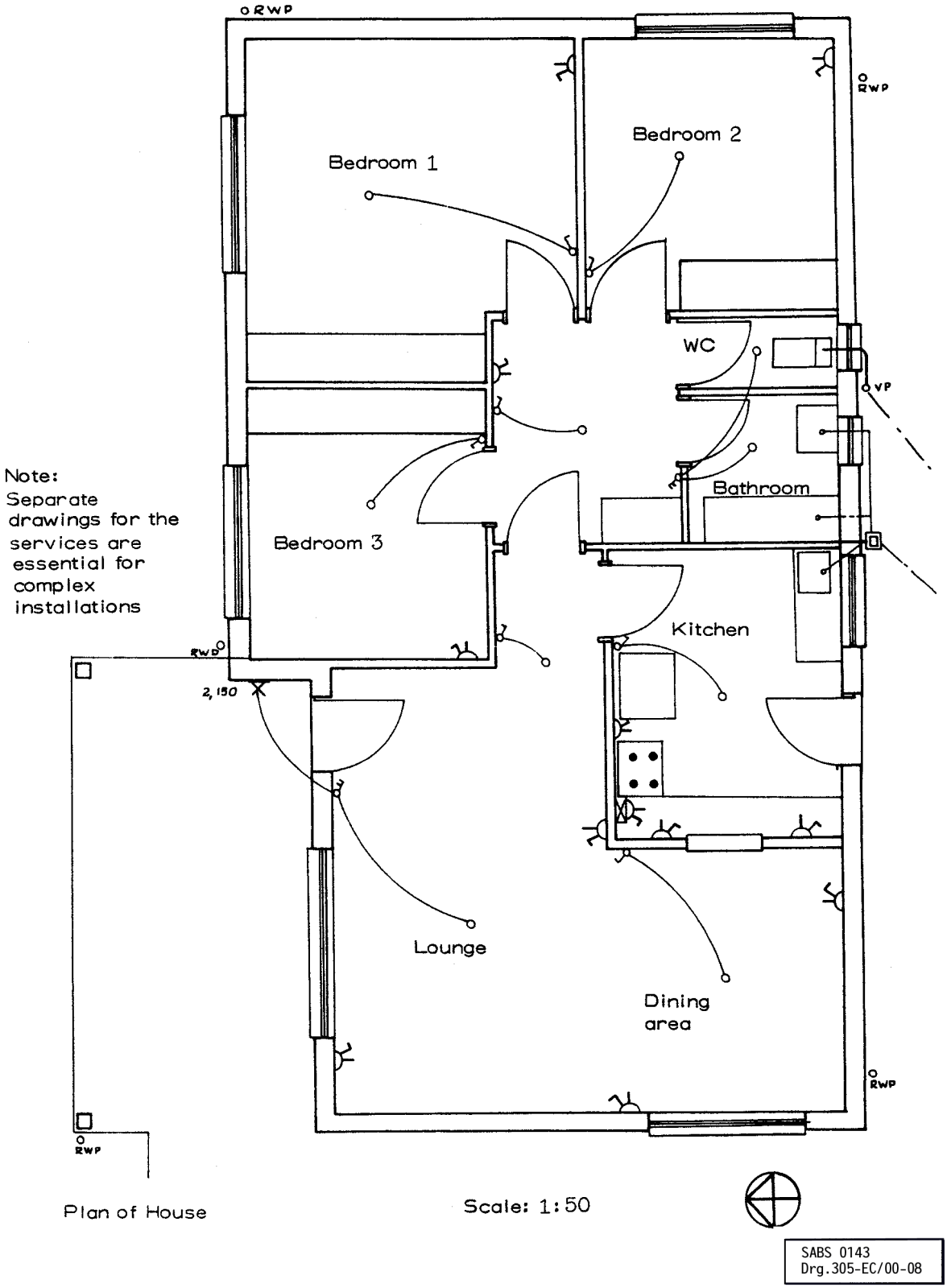


Fig. 17 — Application of Symbols for a Service Installation

16. SYMBOLS

Amdt 1, Mar. 1994

Symbols are the same in singular and plural. Where components, equipment, etc., can be clearly shown by graphical symbols only (see Section 15), no other symbol should be used and other symbols are excluded from this section. Examples of the most commonly used symbols are given in Table 7. (See also 19.7.3.)

TABLE 7) SYMBOLS FOR COMPONENTS AND MATERIALS Amdt 1, Mar. 1994

1	2
Components/Material	Symbol
Access eye	AE
Access opening	AO
Acrylonitrile butadiene styrene	ABS
Air brick	AB
Aluminium	AL
Asphalt	ASPH
Bath	B
Bidet	BT
Bitumen	BIT
Brickwork	BWK
British standard pipe thread	BSPT
Cast iron	CI
Caulking bush	CB
Cement mortar joint	CMJ
Cleaning eye	CE
Cold compound caulked joint	CCCJ
Concrete	CONC
Copper	COP
Copper alloy	CA
Column	COL
Cover level	CL
Damp-proof course	DPC
Damp-proof membrane	DPM
Drawing	DRG
Each face	EF
Each way	EW
Female iron	FI
Fibre cement	FC
Fire extinguisher	FE
Fire hydrant	FH
Fire main	FM
Fire pump connection	FPC
Fire stopping	FS
Foam inlet	FIN

TABLE 7 (continued)

1	2
Components/Material	Symbol
Galvanized steel	GALVS
Granolithic	GRANO
Hardboard	HBD
Hardcore	HC
Hardwood	HWD
Heat detectors	HD
High density polyethylene	HDPE
Hose reel	HR
Inspection chamber	IC
Inspection eye	IE
Invert level	IL
Lead caulked alloy	LCA
Lead caulked joint	LCJ
Manhole	MH
Male iron	MI
Mechanical joint	MJ
Modified unplasticized polyvinyl chloride	MuPVC
Near face	NF
Not to scale	NTS
Overall	OA
Overflow gully	OG
Plaster board	PBD
Pressed metal	PM
Pitch impregnated fibre	PF
Polyethylene	PE
Polypropylene	PP
Reflux valve	RV
Rising main	RM
Rodding eye	RE or AE
Shower	SH
Sink	S
Softwood	SW
Soilpipe	SP
Standpipe	STP
Stormwater drain	SWD
Slop hopper	SH
Stainless steel	SS
Stormwater channel	SC
Stormwater pipe	SWP
Structural floor level	SFL
Smoke detector	SD

TABLE 7 (continued)

1	2
Components/Material	Symbol
Sprinkler system	SS
Smoke extractor	SX
Stainless steel shield	SSS
Tongued & grooved	T&G
Top	T
Unplasticized polyvinyl chloride	uPVC
Urinal	U
Vent or ventilation pipe	VP
Vitrified clay	VC
Valve	V
Wash basin	WB
Wash trough	WT
Waste pipe	WP
WC pan (water closet)	WC

17. REINFORCED CONCRETE DRAWINGS

17.1 GENERAL. Use the architectural drawings as a basis for setting out drawings of concrete work (see 2.1).

17.2 SKETCH DRAWINGS. These are preliminary drawings, sketches, or diagrams that show the designer's general intentions and may be done freehand. Use these drawings to brief the architect.

17.3 DESIGN DRAWINGS. These are amplified sketch drawings by the designer that are sufficiently dimensioned and co-ordinated to enable contract documents, including bills of quantities, to be prepared, if required, and for other members of the professional team concerned to complete their similar drawings. The drawings may be done freehand.

17.4 WORKING DRAWINGS

17.4.1 Layout Drawings

17.4.1.1 General. These consist of plans, elevations, and sections that show the lay-out of all reinforced concrete work, including setting-out dimensions, sizes of all members, and the design live load. On a plan give beam sizes in the following order: The length numeral first; the width numeral second; and the total depth numeral (including the slab depth) third. If no length is given, give the width first and the depth second.

Describe on these drawings all special requirements of the structural designer, e.g. details of chamfers, sequence of construction, position and types of joints, etc.

17.4.1.2 Plans. Draw a plan as a horizontal section through all structural members just above the portion of the structure under consideration. Keep dimension lines clear of the structural details. Indicate elements below the section, e.g. load-bearing walls and columns, by heavy dotted line outlines and thinner hatching (see Fig. 18).

Indicate elements above the section by full thin line outlines and shading (see Fig. 19).

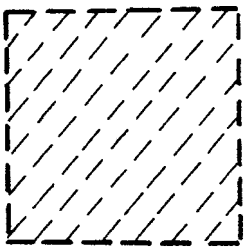


Fig. 18 — Elements under the Section

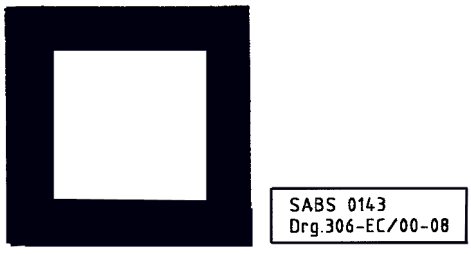


Fig. 19 — Elements cut by the Section

17.4.1.3 Sectional elevations. Draw a sectional elevation as a vertical section through the portion of the structure under consideration. Indicate structural members cut by the section by means of strong full line outlines and shading. Indicate elements behind the section by means of dotted line outlines and hatching (see Fig. 18 and Fig. 19).

Where detailed sections are taken through structural elements, show only the material actually cut by the section plane and omit details beyond the section where relevant.

So choose the direction of sections as to view consistently in the same direction, view downwards for columns, and view towards the top or towards the left of the drawing for all other structural elements.

Take a section as near as possible to the detail to which it relates and identify it by letters or numbers (see Table 3). Whatever the direction of the section so mark the section letters as to be readable with the drawing in its normal orientation.

17.4.2 Concrete Details. These are large-scale details that are read in conjunction with the layout drawings. Give column sizes in the following order: the plan dimension left to right first, and the other plan dimension second. Indicate rainwater inlets, downpipes, and outlets where embedded in concrete.

17.4.3 Services Details. This is a concrete layout transparency that is marked up by the architect or his appointed co-ordinator and gives the sizes and positions of all holes, fixings, etc.

17.4.4 Reinforcement Details. These are drawings that describe and locate the reinforcement. They are intended primarily for the use of the steel fixer. For methods of detailing steel reinforcement see SABS 0144.

It is preferable that concrete details and reinforcement details be kept separate and adequately cross-referenced. For simple structures a combined drawing showing both will suffice.

Circular holes of diameter not exceeding 250 mm and square holes of size not exceeding 150 mm × 150 mm in slabs or walls need not be indicated on the reinforcement drawings unless they affect reinforcement placing, but a note should be added giving the number of the general layout drawing on which they are shown. Indicate holes of larger size on the reinforcement drawing and trim them with suitable reinforcing bars. The number and size of trimming bars are a function of the design and must be determined by the designer.

17.4.5 Representation of Special Type Floors. Dimension service openings, etc., from the main setting-out lines, i.e. from beams or columns and not from ribs and blocks.

Give sections through all special types of floors where these clarify the plan descriptions.

If coffers or blocks are tapered, show their size as the bottom periphery and draw only this on the plan.

Describe and position stiffening ribs on the plan.

Exercise care when designating similar floor panels as having the same mark, because the positions of service openings are seldom exactly the same.

Detail the various floor types as follows:

a) Rib floors with coffer type shutters or filler blocks: One way and two way. Detail the perimeter lines of blocks by means of dotted lines.

Dimension the edge from which setting out is desirable; omit the dimension affected by creep and mark the space "balance" (see Fig. 20 and Fig. 21).

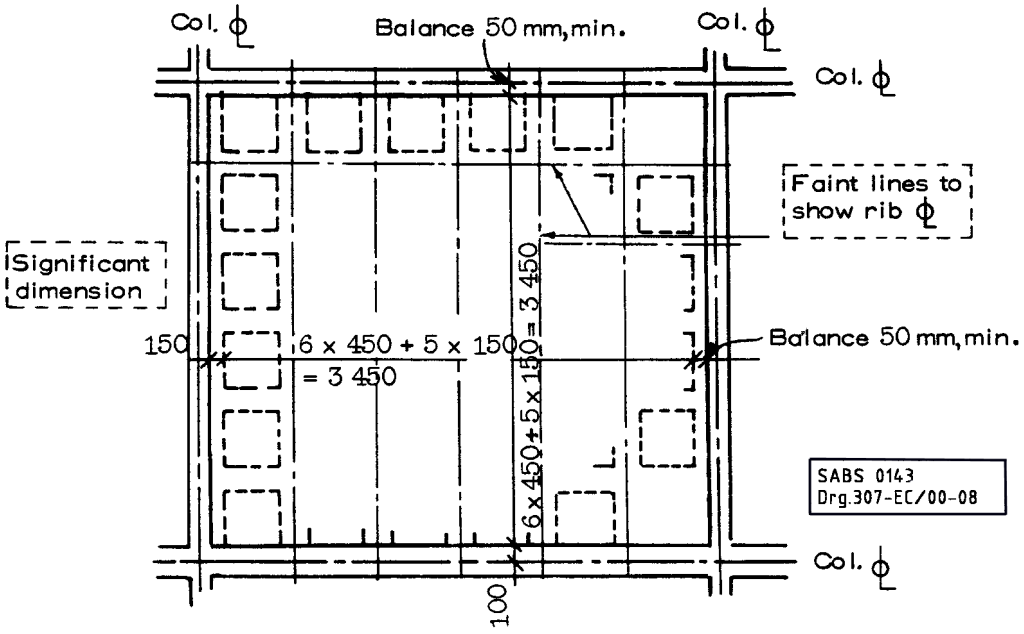


Fig. 20) Two-Way Rib Coffer Shutters or Filler Blocks

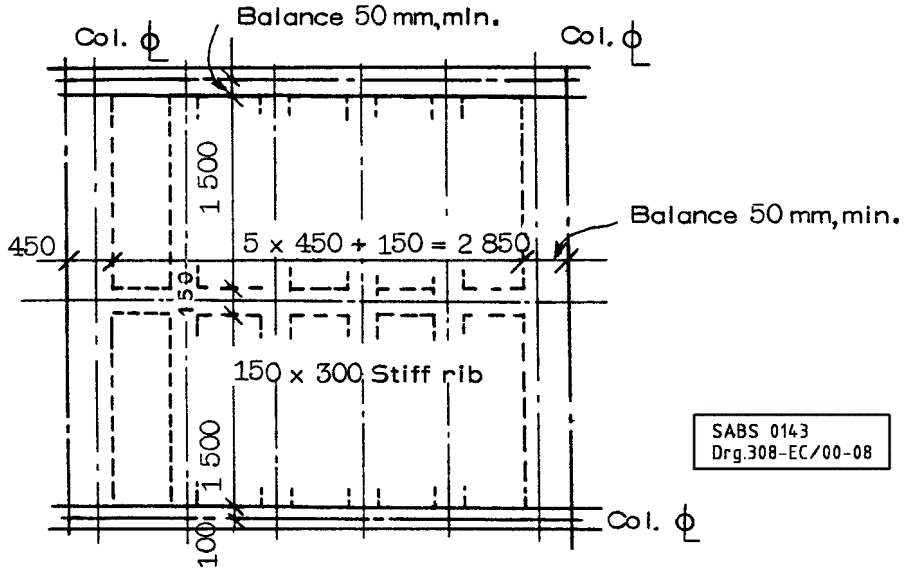


Fig. 21 — One-Way Rib Coffer Shutters or Filler Blocks

b) Prefabricated soffit component floors. In principle proceed as in (a) above, but indicate the components as a heavy, chain dotted centreline. This chain dotted line represents the length and position of the prefabricated soffit (see Fig. 22).

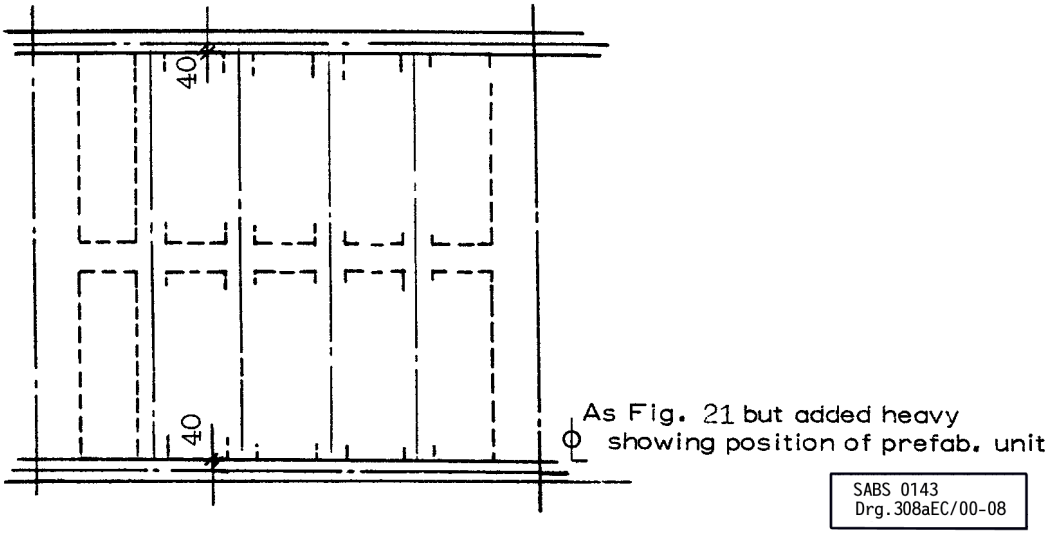


Fig. 22 — One-Way Rib Prefabricated Soffit

c) Pan type floors and other specials. Describe the floor and number of components, if known. Leave the shop detailing of such to the subtrade involved.

18. STRUCTURAL STEELWORK DRAWINGS

18.1 GENERAL. Use drawings supplied by the principal agent as a basis for setting out structural steelwork drawings (see 2.1).

18.2 SKETCH DRAWINGS. These are preliminary drawings, sketches, or diagrams that show the steel designer's general intentions and may be drawn freehand. Use these drawings to brief the other members of the design team.

18.3 DESIGN DRAWINGS. These are amplified sketch drawings or line diagrams by the designer that are sufficiently dimensioned and co-ordinated to enable contract documents, including bills of quantities, to be prepared, if required, and to enable other members of the professional team concerned to complete their similar drawings. The drawings may be done freehand.

18.4 WORKING DRAWINGS

18.4.1 Layout Drawings. These are plans, elevations, and sections that show the layout and general arrangement of all structural steelwork members and either member forces or the sizes of these members and the design live load.

Clearly indicate the relationship between structural steelwork and other structural elements and services.

Adopt a scale of 1:100 for layout drawings, but provide point details to a larger scale for structural connections and any other details that the engineers wish to bring to the attention of the fabricators.

Note fire protection requirements on these drawings.

18.4.2 Fabricators' Drawings. Drawings produced by fabricators must show the north part together with all components and member marks necessary for the erection of the steelwork. Prepare all drawings strictly to scale.

18.5 DRAWING SIZES. It is recommended that A0 and A1 sheet sizes be used for drawings and A4 for sketches (see Table 1).

18.6 DIMENSIONS. Mark all dimensions on steel drawings only in millimetres.

18.7 NOTATION OF MEMBERS. The following method of noting members is recommended:

Member	Notation
I-sections (parallel flange)	203 × 133 × 25 I
I-sections (taper flange)	203 × 102 × 25 I
H-sections	203 × 203 × 52 H
H-sections (piles)	203 × 203 × 54 H (PILE)
Channels	200 × 75 × 25 C
Angles	80 × 80 × 8 L
	80 × 60 × 8 L
T-sections	51 × 51 × 6,4 T

18.8 REVISIONS OF DRAWINGS. Mark all drawings that are revised with a revision letter in the appropriate title block and mark each item revised on the appropriate drawing with the same revision letter, which is placed in a triangle adjacent to the revision. In addition to the above, it is desirable to highlight in red on all prints issued the revision triangles that have been added to the drawing.

18.9 FASTENERS

18.9.1 General. The following nominal diameters of fasteners (bolts and rivets) are recommended for general use in structural steelwork: M12; M16; M20; and M24. Use the symbols given in Table 8 on drawings to denote the various types of holes and fasteners: Amdt 1, Mar. 1994

TABLE 8 — SYMBOLS FOR HOLES AND FASTENERS Amdt 1, Mar. 1994

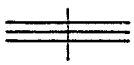
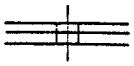
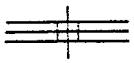
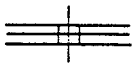
1	2	3
Holes and fasteners	Symbols	
	Elevation	Section
Open holes		
Open holes csk. near side		
Open holes csk. far side		
Shop rivets		
Shop rivets csk. near side		
Shop rivets csk. far side		

TABLE 8 (continued)

1	2	3
Holes and fasteners	Symbols	
	Elevation	Section
Shop bolts		
Shop bolts csk. near side		
Shop bolts csk. far side		
Shop hsfg bolts		
Site hsfg bolts		

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In the case of countersunk fasteners, indicate whether the countersinking is to be done on the near side or on the far side and whether such countersinking is to be flush.

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18.9.2 Holding-Down Bolts. Holes in base plates vary from fabricator to fabricator and the following clearances can be used as a guide:

1	2
Bolt size, mm	Hole diameter* (theoretical) mm
Up to M24	Bolt diameter +10
M30) M48	Bolt diameter +15
M56 and larger	Bolt diameter +25

* a) Smaller holes are permissible where holding down bolts are grouted into pockets.
b) For bolt sizes in excess of M24, round bar and thread diameters do not coincide, e.g. M56 bolt has a 60 mm diameter shank and the hole diameter required is 85 mm (60 + 25).

18.10 WELDING SYMBOLS. Ensure that all welding symbols used on a drawing are in accordance with Part II of SABS 044.

19. SERVICES DRAWINGS

19.1 GENERAL. Use architectural drawings as a basis for setting out drawings of services (see 2.1). Services design drawings are usually prepared by consulting engineers and services working drawings by the subcontractor. They include the air-conditioning, electrical, mechanical, and plumbing drawings. The principal agent is responsible for the co-ordination of the services, and for structural and other building elements. To ensure that services do not clash, special services co-ordination drawings may be prepared. These drawings are generally copy-negatives of the architect's drawings on which he overlays the various services. On the basis of these he alerts the consultants whose work is clashing, or determines, for instance, where a service requires a hole through the structure or fabric.

19.2 SKETCH DRAWINGS. These are preliminary drawings, sketches, or diagrams that show the designer's general intentions and may be done freehand. Use these drawings in discussions with the architect.

19.3 DESIGN DRAWINGS. These are amplified sketch drawings by the designer that are sufficiently dimensioned and co-ordinated to enable contract documents to be prepared. These drawings may be issued together with a specification as tender documents on which specialist subcontractors can quote. The drawings may be done freehand.

19.4 WORKING DRAWINGS

19.4.1 Installation Drawings. These are layout plans and sections of the building that show the positions of the services at each level. Each consultant normally prepares his own drawings, but it is recommended that the architect should issue copy-negatives of his "master" drawings to the consultants or subcontractors to enable them to locate their services accurately in relationship to the structure. Methods of preparing these drawings by tracing prints often result in costly errors on site.

19.4.2 Detail Drawings. Details are mostly special shop drawings which may have to be approved by the principal agent but are generally checked by the main contractor and approved by the consultant. The subcontractor prepares shop drawings for his own use so that his workshops can manufacture the ducts, pipework, etc., required on site.

19.5 MECHANICAL VENTILATION AND AIR-CONDITIONING

19.5.1 General. The successful subcontractor prepares all necessary working drawings using the consultant's design drawings. These working drawings are for use on site and must be checked by the main contractor and approved by the consultant before they are issued to the site. If the subcontractor requires a special layout to a larger scale than the architect's copy-negative, then he must carefully check that the structure concerned is correctly enlarged by his draughtsman. The updating and amendment of working drawings are the responsibility of the subcontractor.

19.5.2 Layout Drawings. These are plans, elevations, and sections that show the layout of all ventilation ducts as they are to be installed in relation to the building structure. In the case of complicated installations that are shown on a separate set of plans, select the section that allows the ducting to be shown in the vertical as well as the horizontal plane.

a) Plans. Draw plans as a horizontal section through all structural members just above the portion of the structure under consideration. Keep dimension lines clear of the details.
b) Sectional elevations. Draw a sectional elevation as a vertical section through the portion of the structure under consideration.

Where detailed sections are taken through structural elements, show only the material actually cut by the section plane and omit irrelevant details beyond the section.

Choose the direction of sections so that the building is viewed consistently in the same direction; view downwards for columns and view towards the top or towards the left of the drawing for all other structural elements. Take a section as near as possible to the detail to which it relates and identify the section by letters, not numbers (see Table 3). Whatever the direction of the section, mark the section letters so that they are readable with the drawing in its normal orientation.

19.5.3 Dimensioning of Ducts. Using heavy lines, clearly indicate all ducts on the drawings, correctly positioned and fully dimensioned, to ensure that the structural engineers allow for them on their structural layouts. On plans, show the dimensions of duct risers and return ducts in sequence from the top downwards (see Fig. 23). Show any change in duct dimensions at the point of transition, clearly indicating the sizes on each side of the change. Mark the dimensions above and below each branch (see Fig. 23).

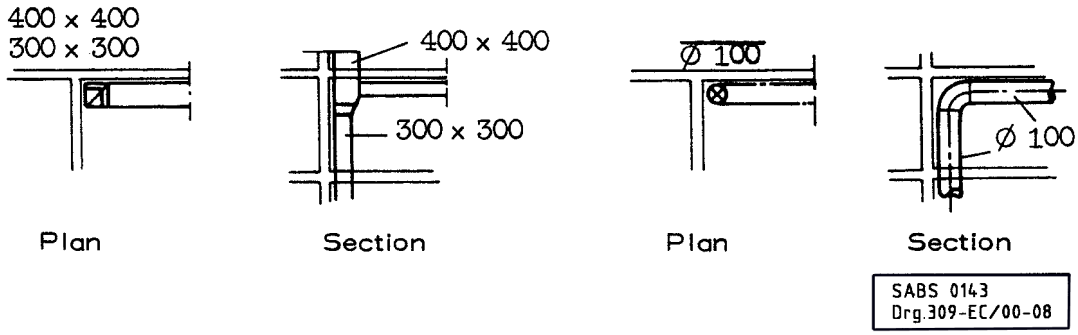


Fig. 23 — Dimensioning of Ducts

19.5.4 Holes through Structure. Give the overall sizes of holes through the structure. The consultant should check to ensure that allowance has been made for all fixings, lagging, bends, etc.

19.5.5 Illustrative Example. Fig. 24 shows a compacted duct system, with examples of drawing conventions and the marking of various components.

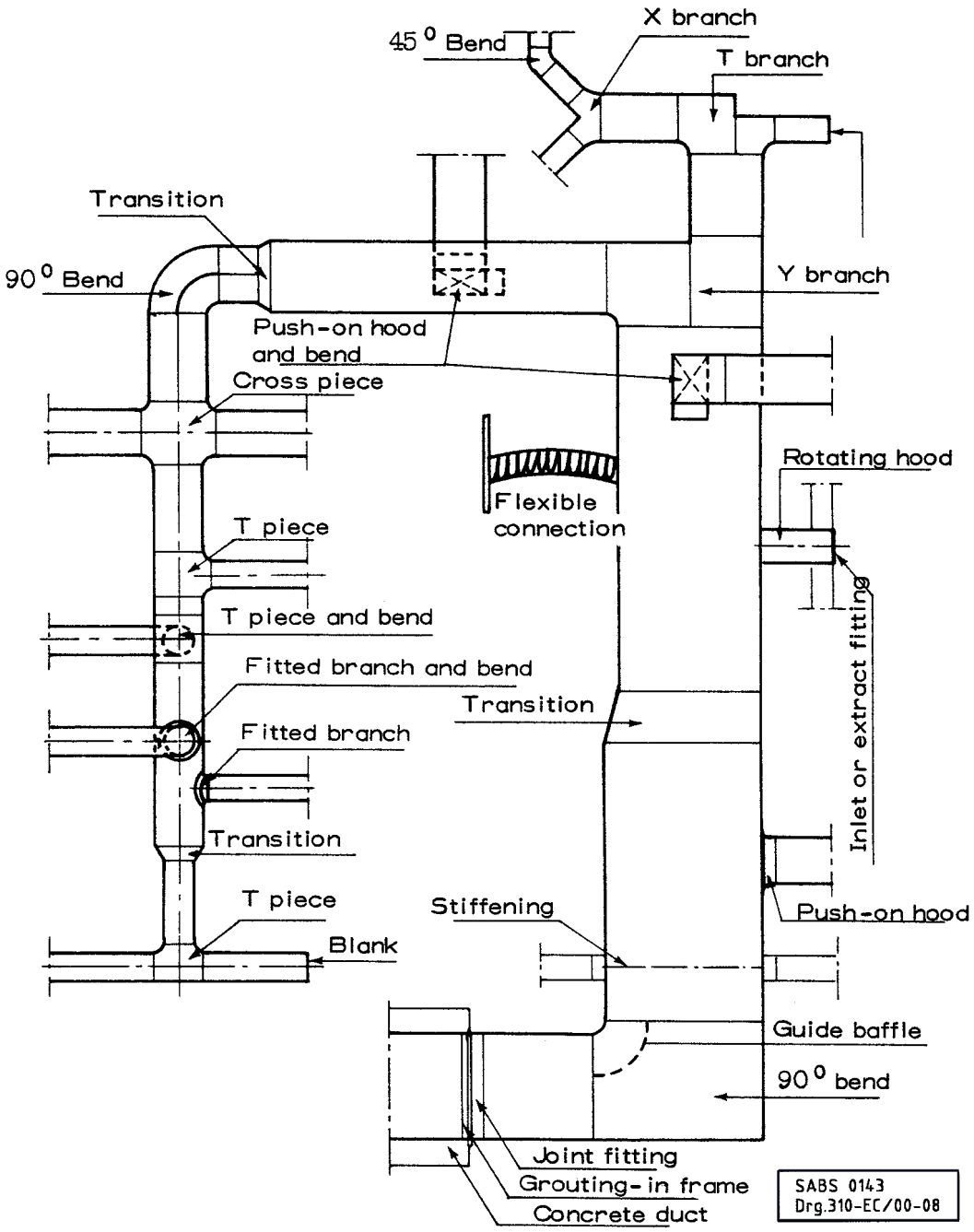


Fig. 24 — Illustration of a Compacted Duct System

19.6 ELECTRICAL WORK

19.6.1 General. It is the responsibility of the consultant to prepare and update drawings for issue to the subcontractor through the architect. Where necessary, the electrical subcontractor should prepare drawings for the approval of the consultant.

19.6.2 Layout Drawings

a) Plans. Use copy-negatives of the architectural drawings overdrawn in heavy black ink. Underline notes or enclose them in boxes in order to highlight their existence and distinguish them from the architect's notes. Show on layout plans the location of main distribution boards, switches, power outlets, and light positions. While conduits are not usually shown on the layouts, curved lines are used to connect light fittings with their switch controls. A typical example of such a layout is shown in Fig.17. Examples of conventional symbols used on electrical drawings are given in T6.3 of Table 6.
b) Sections and elevations. These are not often used for electrical drawings.

19.6.3 Symbolic or Diagrammatic Drawings. Use diagrams to show the arrangement of wiring where the circuits are specialized.

19.7 PIPEWORK

19.7.1 General. It is the responsibility of the consultant to prepare and update pipework drawings for issue to the subcontractor through the architect.

19.7.2 Layout Drawings. Except where special drawings are required, use copy-negatives of the architect's layouts overdrawn in heavy black ink.

a) Water installations. Use diagrammatic representations drawn in isometric projection to indicate pipe runs.

On plans, show the dimensions of risers and downpipes in sequence from the top downwards.

Mark the dimensions above and below each branch.

Use a thick line below or above the dimension to indicate that the pipe does not pass through the floor below or above, respectively (see Fig. 25).

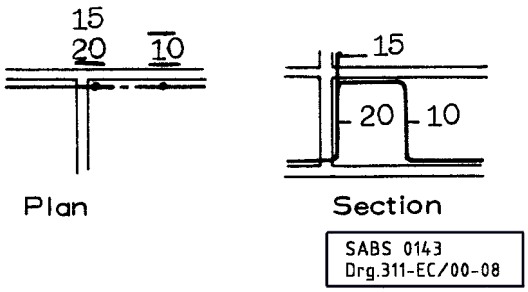


Fig. 25 — Dimensioning of Risers and Downpipes

b) Drainage installations. Show discharge pipes by means of heavy black ink lines on copy-negatives of the architect's basic drawings (see Fig. 26). State whether a pipe is a soilwater pipe (SP), or a waste-water pipe (WP). Show ventilation pipes (VP) by means of a broken line. Indicate all points of access, i.e. cleaning eyes, inspection eyes, inspection chambers and manholes. Give the diameter of the pipes, their gradients, and the materials of which they are made.

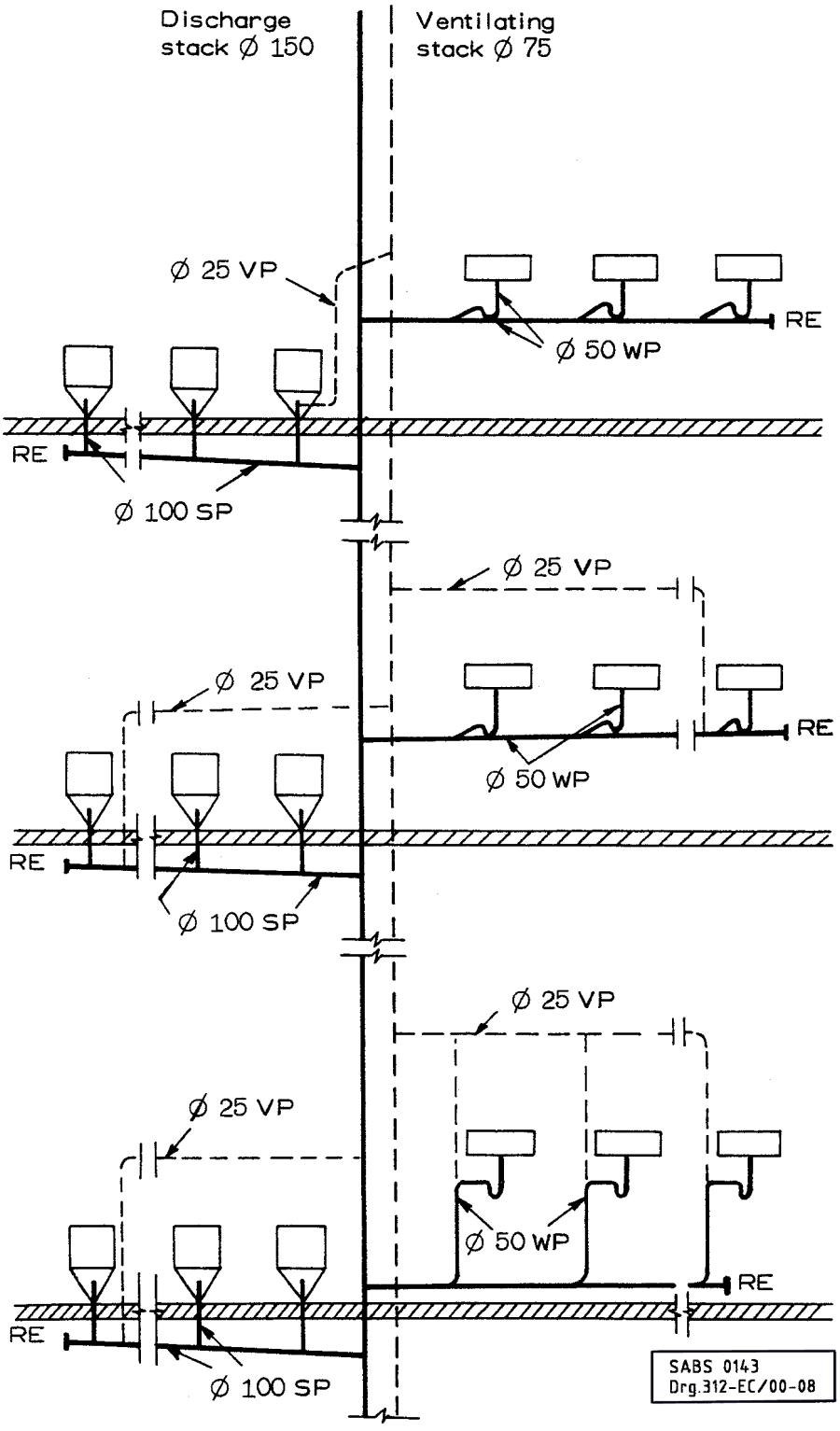


Fig. 26 – Illustration of Drainage Installations

19.7.3 Symbols. For reference include a key of the symbols used on the drawings.

a) Use identification letters as symbols to denote services as follows:

A — compressed air
O — oil
F — fire
R — chilled or refrigerated water
W — potable water
S — steam
G — gas

b) Use the initial letters set out below to enable pipe routes and the direction of liquid flow to be fully indicated on plans:

Upward flow — TA — through floor to space above

FB — through floor from space below

Downward flow — TB — through floor to space below

FA — through floor from space above

19.7.4 Pipelines. On services drawings it is important to identify the different pipelines. Use one of the following types of line to indicate a pipe run:

a) Indicate a drain thus:

Drain — — . — — . — — . — — . — —

Stormwater drain — — •• — — •• — — • — — • — —

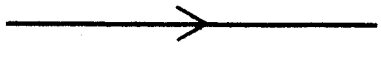
Effluent ••••••••••••••••••••••••••••••••

b) Indicate other pipelines by means of a thick black line interrupted at intervals with the appropriate identification letter from 19.7.3(a) thus:

— — A — — — — A — —

— — W — — — — W — —

c) Indicate the direction in which the fluid flows in a pipe by means of an arrowhead thus:

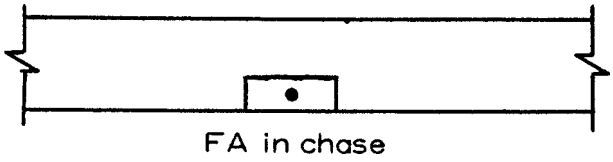


d) Indicate the fall on a pipe thus:

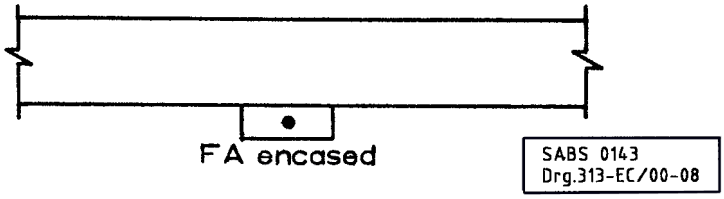
Fall 1:50

e) Indicate a vertical pipe on a plan as a dot in conjunction with one of the abbreviations recommended in 19.7.3(b).

f) Indicate a vertical pipe chased into the wall thus:



g) Indicate an encased vertical pipe (outside the thickness of the wall) thus:



20. SCHEDULES

20.1 GENERAL. Scheduling is a method of tabulating requirements that are numerous and repetitive.

A schedule usually combines two categories of information:

a) A specification of a material, component, or activity; and
b) the location of the item specified.

Some special schedules may be restricted to one of these categories.

As a guide the following are typical subjects for schedules:

Doors, including frames and ironmongery;
electrical fittings and outlets;
finishes, decorations, and colours;
fixed joinery fittings other than doors and windows;
grilles, registers, and similar items;
lintels, copings, and similar precast concrete items;
loose furniture;
manholes;
sanitary appliances;
steel reinforcement; and
windows, including surrounds, and ironmongery, etc.

20.2 USES. The most common uses of schedules are as follows:

Advance programming of production;
checking delivery of components;
checking subcontractors and suppliers;
estimating and obtaining costs;
formulating the basis of a nominated subcontract;
locating and carrying out work;
measuring quantities;
measuring manufacturing quantities; and
tendering on special work and components.

20.3 FORMULATION. Standardization of the content and arrangement of schedules is not possible because of the diversity of the subjects, but the formulation of a schedule is more easily achieved by following a simple logical procedure in all cases.

The following is an example of such a procedure:

a) Decide the scope of the items to be scheduled;
b) identify the position in which each item occurs with a code number or symbol; and
c) identify the items by reference to a South African standard by description or specification, by manufacturer's code or catalogue number, or by separate design details.

20.4 DETAIL OF SCHEDULE. The identification of the items and their locations should be clearly unique, but restrict duplication of information to a minimum.

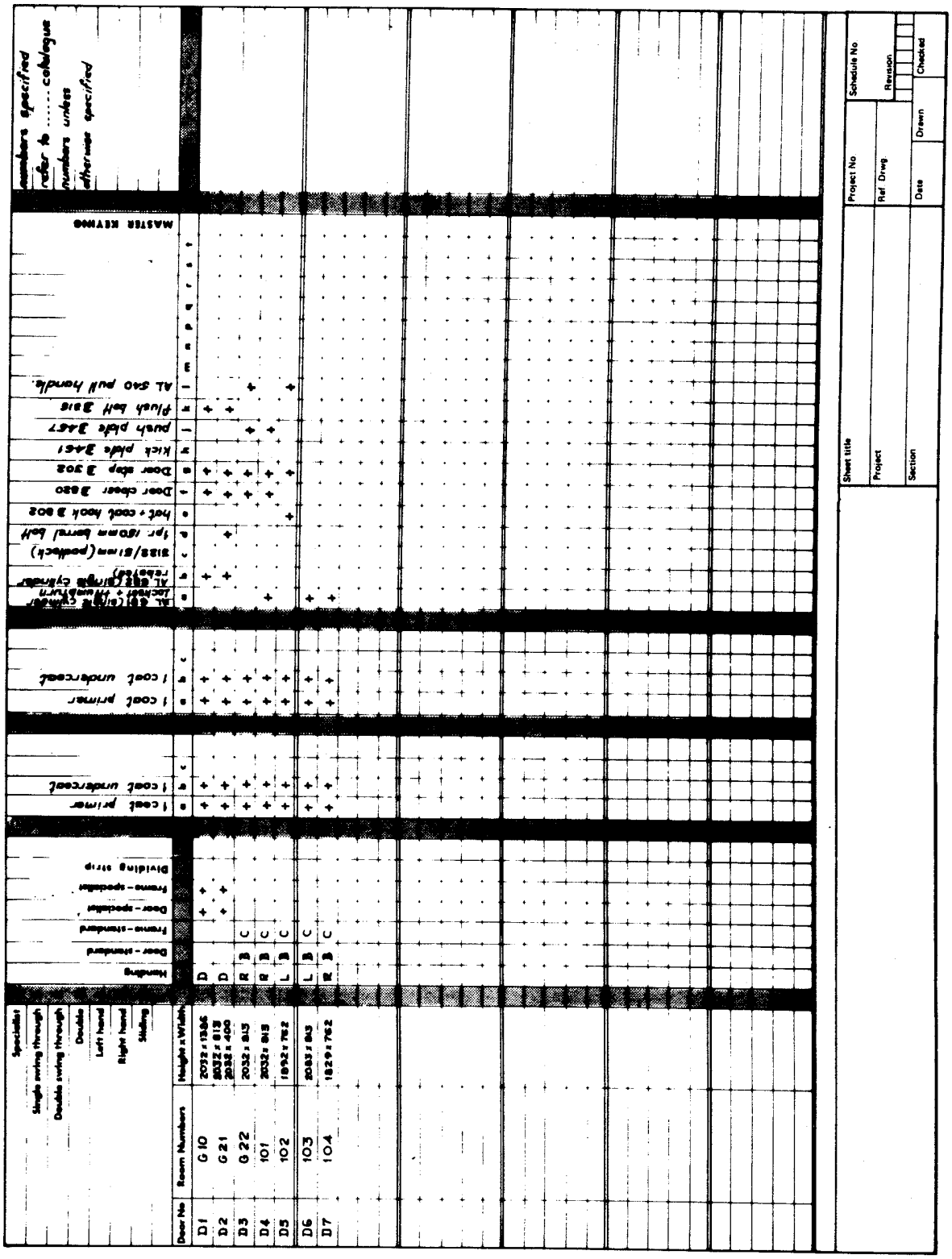
As with drawings, keep unnecessary information out of schedules and avoid cross references as far as possible.

Do not duplicate in schedules information that is given on drawings or in the specification and vice versa, and do not allow the information in one schedule to duplicate or overlap that in another schedule except for the purpose of classification; otherwise revision becomes complicated and time wasting.

Check lists for different types of schedules may be seen in the technical publications.

An example of a schedule set out on an A3 (reduced to A4) size drawing sheet is given in Table 9. Prepare schedules for other items on the same lines, but they may be set out on larger sheets of the A series if desired.

TABLE 9 – EXAMPLE OF DOOR SCHEDULE
(This example was drawn on A3 paper
and then reduced to A4)



APPENDIX A. APPLICABLE STANDARDS

Reference is made to the latest issues of the following publications:

Architects Journal (on project documentation) dated 22 October 1970 to 6 January 1971

BS 504	Drawn lead traps
BS 1553	Specification for graphical symbols for general engineering Part 1: Piping systems and plant
BS 1635	Graphical symbols and abbreviations for fire protection drawings
BS 1991	Letter symbols, signs and abbreviations Part 1: General Part 4: Structures, materials and soil mechanics
BS 3939	Graphical symbols for electrical power, telecommunications and electronics diagrams
DD 22	Recommendations for the co-ordination of dimensions in building. Tolerances and fits for building. The calculation of work sizes and joint clearances for building components
ISO 1047	Architectural and building drawings) presentation of drawings) scales
SABS 82	Bending dimensions of bars for concrete reinforcement
SABS 993	Modular co-ordination in building
SABS 044	Welding Part II: Symbols
SABS 048	Microcopying of engineering drawings and production of prints from microcopies
SABS 0144	Detailing of steel reinforcement for concrete

APPENDIX B. PLAN OF WORK

B-1 The "Plan of Work" (see p.75) was prepared by a joint subcommittee of architects, quantity surveyors and engineers and was based on the "Plan of Work" of the Institute of South African Architects. However, instead of being in a written form it was produced in the form of a flow diagram.

B-2 The important aspects of the flow diagram are

a) to show who is involved in the preparation of documents;
b) to show what types of documents are prepared;
c) to show the stage at which the documents are prepared;
d) to show the stages at which a client can make changes.

NOTE: After stage 3 it is not economical for the client to make major changes to the project.

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