Appendix A4

LETTERING AND ASSOCIATED SYMBOLS

A4.1 Objectives

In this Appendix, which forms the basis of presentation of survey work, a renewed emphasis is given to the art and skills of freehand lettering. Proficiency in lettering not only provides a sense of satisfaction, but is cost effective in the production of some drawings and field records. Accordingly, the objectives are:

- To prepare drawings with consistency in letters and numerals which are capable of being produced at reasonable speed by hand, stencil, machine, or other means, such that they remain legible and unambiguous on a direct photocopy, in a reduced copy, and as an image on a microfilm viewing screen or on computer screen.

- To prepare field records, miscellaneous drawings and sketches by hand to achieve a high degree of legibility and free from ambiguities. (Note: Lettering, not "Printing" is the correct term for making letters and numerals by hand. Printing means the facsimile production of originals by machine methods).

- To have characters of a simple form, preferably without serifs and other embellishments, and not be of exaggerated proportions.

Clarity, style, size and spacing are important, particularly for numerals as, unlike letters, they rarely fall into self-identifying patterns and hence are read individually.

A4.2 Lettering Standards - Australian and International

The Standards applicable to this Section are AS 1100, Part 101-1984, Section 4: Letters, Numerals and symbols, and other information contained in the International Standards Organization, ISO 3098/1-1974: Technical Drawings - Lettering.

A4.2.1 General

The three essential requirements of lettering on survey drawings are:

- legibility
- uniformity
- suitability for microfilming, scanning and other reproduction methods.

To achieve this, the characters are to be clearly distinguishable from each other in order to avoid any confusion between them, even in the case of slight mutilations.
Microfilming, scanning and other photographic reproductions require the distance between two adjacent lines or the space between letters or numerals to be at least equal to twice the line thickness.

To achieve these requirements, there are some basic rules to be observed, and these are summarized in Fig. A4.1 and Table A4.1.

**TABLE A4.1 Lettering Rules**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Ratio</th>
<th>2.5</th>
<th>3.5</th>
<th>5</th>
<th>7</th>
<th>10</th>
<th>14</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lettering height</td>
<td>h</td>
<td>(10/10)h</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height of capitals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height of lower-case letters</td>
<td>c</td>
<td>(7/10)h</td>
<td>2.5</td>
<td>3.5</td>
<td>5</td>
<td>7</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>(without stem or tail)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spacing between characters</td>
<td>a</td>
<td>(2/10)h</td>
<td>0.5</td>
<td>0.7</td>
<td>1</td>
<td>1.4</td>
<td>2</td>
<td>2.8</td>
</tr>
<tr>
<td>Minimum spacing of base lines</td>
<td>b</td>
<td>(16/10)h</td>
<td>4.0</td>
<td>5.5</td>
<td>8</td>
<td>11</td>
<td>16</td>
<td>22.5</td>
</tr>
<tr>
<td>Minimum spacing between words</td>
<td>e</td>
<td>(6/10)h</td>
<td>1.5</td>
<td>2.1</td>
<td>3</td>
<td>4.2</td>
<td>6</td>
<td>8.4</td>
</tr>
<tr>
<td>Thickness of lines</td>
<td>d</td>
<td>(1/10)h</td>
<td>0.25</td>
<td>0.35</td>
<td>0.5</td>
<td>0.7</td>
<td>1</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Values in millimetres

NOTE: The spacing a between two characters may be reduced by half if this gives a better visual effect, as for example LA, TV; it then equals the line thickness d.

![Fig. A4.1 Lettering Rules](image)

**A4.2.2 Character Shapes and Proportions**

The basic form for freehand lettering is illustrated in Fig. A4.2.

Stencil lettering should comply with one of the following styles. See Figs. A4.3 and A4.4.

![ISO 3098/1 Type B Upright](image)

Note: ISO 3098/1 Type A characters which have a height equal to fourteen times the line thickness are not normally used in Australia. The ratio d/h for ISO 3098/1 Type B is 1/10 - See Fig. A4.1 and Table A4.1
Machine-made lettering as produced by mechanical or transferable means should generally adhere to the basic requirements set out in this section.

A4.2.3 Height of Characters

The height of the capital letters is taken as the base of dimensioning.

| Range of standard heights (h) for lettering |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 2.5             | 3.5             | 5               | 7               | 10              | 14              | 20 mm           |

The ratio of $\sqrt{2}$ in the range of heights for lettering is derived from the standardized progression of dimensions for paper sizes.

The height of the characters, related to the size of the drawing sheet used, shall be not less than the height stated in Table A4.2. Where the drawing is to be reduced, $h$ shall be selected such that the height as reproduced is not less than 1.7 mm.

A4.2.4 Thickness of Character Lines

The maximum thickness of the lines used to form the characters shall be $0.1h$, where $h$ is the height of the characters as shown in Fig. A4.1 and Table A4.1. The line thickness of both lower and upper case letters shall be the same.
Fig. A4.2 Character Shapes & Proportions
Either of these characters is acceptable by ISO, but 'a' and '?' are not recommended for use in Australia.

Fig. A4.3 ISO 3098/1 TYPE B UPRIGHT CHARACTERS
* Either of these characters is acceptable by ISO but a and 7 are not recommended for use in Australia

Fig. A4.4 ISO 3098/1 TYPE B SLOPING CHARACTERS
A4.2.5 Spacing

A4.2.5.1 Spacing of Characters

Characters forming a word or a number should be spaced so that the distance/s between the characters (See Fig. A4.1 and Table A4.1) is approximately twice the thickness of the line forming such characters or 1 nun, whichever is the greater.

**TABLE A4.2**

Minimum Height of Characters on Drawings

<table>
<thead>
<tr>
<th>Character use</th>
<th>Character height (h ; (\text{mm}))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freehand and stencil characters</td>
</tr>
<tr>
<td></td>
<td>Sheet size</td>
</tr>
<tr>
<td></td>
<td>A0, B1</td>
</tr>
<tr>
<td>Titles and drawing numbers</td>
<td>7</td>
</tr>
<tr>
<td>Subtitles, headings, view and section designations, etc</td>
<td>5</td>
</tr>
<tr>
<td>General notes, material lists, dimensions, etc</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>A1, A2, A3, A4, B2, B3, B4</td>
</tr>
<tr>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>2.5</td>
</tr>
</tbody>
</table>

**NOTES**

1. Table A4.2 specifies minimum character heights for upper case lettering only. For upper and lower case combinations, the minimum character height should be one size larger than that specified in the table.

2. The minimum values stated in the table are suitable for copies produced according to current copying practice i.e. A0, B1, and A1 sizes reduced to A2 size, and A2, A3 and A4 sizes not reduced in size.

A4.2.5.2 Space between Words

The space between words shall not be less than 0.6 \(h\) and should not be more than 2 \(h\).

A4.2.5.3 Space between lines of Lettering

The space between lines of lettering shall not be less than 0.6 \(h\).

A4.2.6 Use of Characters

Vertical characters are preferred to sloping characters. Only one style of character should be used for a particular purpose throughout a drawing, and vertical characters should be used for titles, drawing numbers and reference numbers.

Upper case lettering should be used except that lower case letters shall be used for conventional signs and symbols normally requiring such characters, eg. mm, kg, kPa and all other SI units where required.

Underlined lettering should be avoided. Special emphasis, where required, may be given by the use of larger characters.
Where necessary for clarity or to prevent misinterpretation between upper case ‘I’ lower case ‘l’ and the numeral ‘1’, serifs may be added, or use made of the ISO alphabet and numerals in Figs. A4.3 and A4.4. The following examples indicate possible solutions:

**Illustration 1 a**

The letters ‘O’ and ‘I’ should not be used in combination with numbering owing to the liability of confusion with the numerals ‘0’ and ‘1’.

All characters in a drawing shall be kept clear of lines.

Note: Where a line precludes this requirement, the line may be interrupted sufficiently to accommodate characters. See Fig. A4.5.

![Illustration 1 a](image)

Fig. A4.5 Characters clear of lines

**A4.2.7 Decimal Sign and Fractions**

**A4.2.7.1 Decimal Sign**

The decimal sign for technical drawings and associated documents should be a dot preferably on the line, or at mid-height. An example is shown in Fig. A4.6.

![Fig. A4.6 Example of decimal form](image)

Notes:

1. Standards Australia, after an earlier recommendation in favour of the comma as the decimal sign, has now reverted to the use of the dot, following an overwhelming preference for the dot by the Australian community.

2. The decimal comma is commonly used in some overseas countries.
3. The preferred location of the dot on the line, prevents some numbers being inadvertently read upside down, eg. 60.9.

A4.2.7.2 Decimal Fractions

Where the quantity is less than unity, the decimal sign shall be preceded by the cipher ‘0’ (See Fig. A4.6).

A4.2.8 Reference Numbers

Numbers referring to items in lists should be enclosed as shown in Fig. A4.7. The enclosing lines should be the same thickness as Type B lines in Table A3.1.

![Figure A4.7 Numbers for referring to item lists](image)

A4.2.9 Dimension Lines and Symbols

A4.2.9.1 General

A dimension line on any drawing must clearly and accurately indicate the extent and direction of the dimension, and the work so arranged to permit the dimension figure to be clearly identified.

Associated with dimension lines are extension lines, arrowheads, dots and leaders, which have developed as the universal method of providing the reader with an accurate identification of the lines and surfaces to which they refer.

Extension lines are usually drawn at right angles to dimension lines, but may be varied in the interests of clarity. See Fig A4.8.

In general, the shorter dimensions are placed closest to the object outline. This makes for a tidy presentation, and makes it unnecessary for extension lines to cross dimension lines, which is to be avoided. A dimension line should never co-incide with, or form a continuation of any hue on a drawing, and dimension lines should not cross one another.
Where these lines and symbols are used on technical drawings, the size of characters, and spacing and thickness of lines and characters shall comply with Tables A3.1 and A4.1 and Fig. A3.2.1 and A3.2.2.

A4.2.9.2 Arrowheads

Arrowheads should be uniform in size and style throughout the drawing, and should not vary with size of the drawing sheet, or the length of dimensions. They should be drawn freehand with the length and width in ratio of 3:1, or in the open style as illustrated in Fig. A4.9.

A4.2.9.3 Leaders

A leader should be a thin continuous line leading from a note, reference cipher, or dimension, and terminating with a dot or arrowhead touching the part to which it refers. A leader should generally be an inclined straight line, and if near each other, drawn parallel. Leader lines should not intersect. This helps to preserve neatness and clarity, always essential qualities in a drawing.

A leader to a circle should be radial, so that if extended, it would pass through the centre.
A4.2.10 Dots

A4.2.10.1 Dots terminating Line

Dots used for terminating dimension lines shall be of a diameter that is approximately three times the thickness of the dimension line which they terminate, but shall not be less than 1.5 mm. See Fig. A4.10.

![Fig A4.10 Dots terminating line](image)

A4.2.10.2 Dots terminating Leaders

Dots used for terminating leaders shall be of a diameter that is approximately twice the thickness of the leaders which they terminate, but shall not be less than 1 mm.

4.2.11 Use of Arrowheads and Dots

In drawings of individual items, leaders to notes should terminate in arrowheads; however, in assembly drawings dots are preferred for the termination of leaders to notes and item numbers. See Fig. A4.11.

![Fig. A4.11 Leaders terminating in dots within the outlines of the objects](image)
A4.3 Standard Characters and Freehand Lettering

The general form and proportions of characters used in surveying and engineering presentations is shown in Fig A4.2.

In all forms of lettering, uniformity is essential. Uniformity in height, inclination, line thickness, spacing of letters within words, spacing of words and lines of lettering ensures a pleasing effect. Uniformity in height and inclination should be controlled by the use of guidelines.

A4.4 Optical Illusions

Good lettering is a function of artistic design, in which white and black areas are harmoniously balanced to give a pleasing appearance. Letters are designed to compensate for anomalies in perception.

The height/width ratio of letters vary, as well as the placing of horizontal strokes in B, E, F and H slightly higher and lower to overcome optical illusions.