British Standard

BRITISH STANDARD

BS 4274-1:2003

Visual acuity test types —

Part 1: Test charts for clinical determination of distance visual acuity — Specification

ICS 11.040.70

BSI British Standards

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee CH/78/6, Ophthalmic Instruments, upon which the following bodies were represented:

Association of British Dispensing Opticians

BMA

College of Optometrists

DoH — Medical Devices Agency

Federation of Ophthalmic and Dispensing Opticians

Federation of Manufacturing Opticians

Flat Glass Manufacturers' Association

Institute of Mechanical Engineers

Medical sterile Products Association

Optic (UK)

Royal College of Ophthalmologists

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 13 January 2003

First published 26 January 1968
This revision 13 January 2003

The following BSI references relate to the work on this British Standard
Committee reference CH/78/6
Draft for comment 00/560371/DC

ISBN 0 580 40644 X

Amendments issued since publication

Amd. No.	Date	Comment

Contents

Foreword

This part of BS 4274, which has been prepared for clinical use by Technical Committee CH/78, supersedes BS 4274-1:1968, which is withdrawn.

The other parts of BS 4274, which are for non-clinical purposes, are:

— Part 2: *Specification for Landolt ring optotype for non-clinical purposes* (BS EN ISO 8596);

— Part 3: *Method for correlating optotypes used for non-clinical purposes* (BS EN ISO 8597).

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to ii, pages 1 to 9 and a back cover.

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Introduction

This British Standard utilizes the logMAR notation (logarithm of the minimum angle of resolution) as opposed to the traditional Snellen notation. Use of the logMAR notation facilitates analysis of visual acuity scores, and changes in such scores, more effectively than other notations because equal linear steps on the logMAR scale represent equal ratios in the standard size sequence. This minimum standard, which in itself does not represent a full logMAR chart, is intended as a stepped approach to the goal of the introduction of a full logMAR chart. This British Standard takes into account the need for these charts to fit into existing hardware/test cabinets. The physical size of a full logMAR chart would exclude this possibility. Nevertheless, although a full chart exceeds the minimum requirements of this British Standard, this British Standard does not preclude the use of a full chart.

1 Scope

This Part of BS 4274 specifies minimum requirements for test charts and test types employing upright sans-serif capital letters for use in the clinical determination of distance visual acuity.

NOTE Unless otherwise indicated by the context, the word "letter" includes, in any orientation, the single letter C (Landolt or broken ring) and the single letter E (illiterate E).

This Part of BS 4274 is primarily intended for clinical measurements but may be used for other purposes such as screening, certification and licensing. It is not applicable to chart projectors, charts or types designed for specialized use (e.g. crowding symbols, lower case letters, isolated letters, low vision evaluation and contrast sensitivity testing).

NOTE This British Standard makes no reference to surrounding luminance because this relates to the conditions in the consulting room or clinic itself and this is outside the Scope of this British Standard. Nevertheless, the level of surrounding luminance can seriously affect the visual acuity scores obtained, for example, by producing glare or excessive contrast. Attention, therefore, should be paid to the level of surrounding luminance when installing and utilizing these test charts.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document applies.

BS EN 60601-1:1990*, Medical electrical equipment — Part 1: General requirements for safety.*

BS ISO 9022-2:1994*, Optics and optical instruments— Environmental test methods — Part 2: Cold, heat, humidity.*

BS ISO 9022-3:1994*, Optics and optical instruments— Environmental test methods —Part 3: Mechanical stress*

3 Terms and definitions

For the purposes of this Part of BS 4274, the following terms and definitions apply.

3.1
Landolt ring
character in the form of a letter C in any one of the orientations described in **4.9**

3.2
letter size
distance, measured in metres, at which the height of the letter subtends an angle of five minutes of arc, expressed as the number only

3.3
limb
constituent component of a letter, which may be straight or curved

3.4
line
row of letters

3.5
logMAR
log minimum angle of resolution
logarithm to base 10 of the smallest visual angle (expressed in minutes of arc) that can be resolved by the subject

3.6
luminance contrast
the ratio:

$$\frac{L_1 - L_2}{L_1}$$

where

L_1 = luminance of the background

L_2 = luminance of the test letter.

3.7
Snellen notation
fraction in which the numerator indicates the test distance, expressed in metres, and the denominator indicates the distance, expressed in metres, at which the limb width of the letter subtends one minute of arc and the letter size subtends five minutes of arc

3.8
test chart
test type (non-preferred)

optotype (non-preferred)

presentation of letters of graduated sizes for the purpose of determining distance visual acuity

NOTE The presentation may be by means of a printed chart, projection, electronic display or other means.

3.9
unit length
linear distance subtending one minute of arc at the distance indicated by the letter size

NOTE This equates to $\frac{1}{5}$ of the height of the letter.

3.10
visual angle
angle subtended by the unit length of the letter at the testing distance.

3.11
5 × 5 letter
upright letter which is capable of being framed tangentially by a square, 5 unit lengths in height and width

4 Requirements

4.1 Range of letter sizes

The minimum range of letter sizes shall be from logMAR –0.1 to logMAR 1.0. The minimum graduation of letter sizes shall be in not more than 0.1 logMAR steps between logMAR -0.1 and logMAR 0.4, and in not more than 0.2 logMAR steps thereafter to logMAR 1.0, as shown in Table 1.

NOTE Conversions of different visual acuity notations are given in Annex A.

Table 1 — Range of letter sizes, heights and number of letters per line

Letter size		Minimum number of letters per line	Linear height of letter	Tolerance on letter height
logMAR	Snellen		mm	mm
1.0	60	1	87.30	± 1.0
0.8	38	2	55.08	± 0.5
0.6	24	3	34.75	± 0.5
0.4	15	4	21.93	± 0.3
0.3	12	5	17.42	± 0.3
0.2	9.5	5	13.84	± 0.3
0.1	7.5	5	10.99	± 0.3
0	6	5	8.73	± 0.2
–0.1	4.8	5	7.03	± 0.15

NOTE The letter heights given have been calculated on the basis of a 6 metre testing distance.

4.2 Testing distance

The design testing distance shall be not less than 4 m.

4.3 Indication of letter size

The letter size shall be indicated in Snellen denominator and logMAR notation by figures not more than 3 mm high placed below or at either side of each line.

4.4 Selection of letters

The letters employed shall be sans-serif 5 × 5 letters, the selection being from the following:

C D E F H K N P R U V Z

No letter shall be repeated on any one line except for Landolt rings and illiterate Es.

Letters shall be reversed if the chart is to be viewed via a mirror.

NOTE It is recommended that no letter be repeated as either the first or last letter of a line although it is acknowledged that, if the chart carries more than 12 lines, this will not be possible.

4.5 Spacing of letters

The letters on each line shall be evenly spaced and centrally disposed. The gap between letters shall be equal to the width of the letters. The space exposed at the ends of each line, as presented, shall be not less than the limb width of the letters.

4.6 Spacing of lines

Lines of letters shall be separated by a gap not less than the letter height in the smaller line or 20 mm whichever is the smaller.

4.7 Additional lines

If additional lines are included, their size shall be in accordance with the logMAR notation (see **4.1**). The number of letters per line shall correspond to the number of letters in the immediately adjacent larger line, and the selection size and spacing shall conform to the requirements of **4.1**, **4.2**, **4.3**, **4.4** to **4.5**.

4.8 Dimensions and styles of letters

All letters shall have a limb width of 1 unit length, the clear space between parallel limbs in a letter being 1 or 3 unit lengths as appropriate.

In order to unify letter styles all letters shall conform to the formats given in Annex B.

4.9 Dimensions of Landolt ring characters

The overall diameter of each broken ring shall be 5 unit lengths, with a limb width of 1 unit length. The length of the break shall be 1 unit, the break being placed in the vertical or in any positions either 90º or 45° from the vertical. There shall be a minimum of four different positions.

4.10 Dimensions of illiterate E characters

Each letter E shall be of 5 × 5 unit length dimensions, the overall length of the middle bar being 4 unit lengths. The position of the open side of the E shall be selected from one of four orientations: top, bottom, right or left.

4.11 Luminance contrast

Letters shall be black on a white background. The luminance contrast shall not be less than 0.9.

4.12 Luminance

The luminance of the presentation shall be uniform and not less than 120 cd/m^2. Any variation across the test chart shall not exceed 20 %.

5 Environmental conditions

5.1 Conditions in use

When tested as described in BS ISO 9022:Parts 2 and 3, the accuracy of the test charts shall be maintained under the environmental conditions specified in Table 2.

Table 2 — Conditions in use

Criterion	Environmental condition
Temperature	+10 °C to +40 °C
Relative humidity	⩽95 %
Atmospheric pressure	800 mbar to 1060 mbar[a]
Mains power supply voltage[b](20 °C)	±10 %

[a] 1 mbar = 10^2 Pa.
[b] If applicable.

5.2 Storage conditions

After being exposed to the conditions specified in Table 3, test charts shall meet the manufacturer's specifications and the requirements of this standard under the conditions in use specified in **5.1**.

Table 3 — Storage conditions

Criterion	Environmental condition
Temperature	–10 °C to +55 °C
Relative humidity	⩽95 %
Atmospheric pressure	700 mbar to 1060 mbar[a]

[a] 1 mbar = 10^2 Pa.

5.3 Transport conditions

After exposure of the charts in the original packing to the conditions given in Table 4, the test charts shall meet the manufacturer's specifications and the requirements of this standard under the conditions in use specified in **5.1**.

Table 4 — Transport conditions

Criterion	Environmental condition
Temperature	–40 °C to +70 °C
Relative humidity	⩽100 %
Atmospheric pressure	500 mbar to 1060 mbar[a]
Vibration sinusoidal	10 Hz to 500 Hz, 0.5 g
Shock	30 g; duration 6 ms
Bump	10 g; duration 6 ms

[a] 1 mbar = 10^2 Pa.

6 Electrical safety

All electrically-powered (e.g. illuminated) test charts shall conform to the requirements of BS EN 60601-1:1990. All applicable tests of BS EN 60601-1:1990 shall be carried out in the sequence specified within Annex C of that standard.

7 Labelling

Test charts for which compliance with this Part of BS 4274 is claimed shall be labelled at least with the following information:

a) name of manufacturer or manufacturer's logo;

b) reference to this standard, i.e. BS 4274-1:2002;

c) markings as specified in BS EN 60601-1:1990, as appropriate.

Annex A (informative)
Conversion of different visual acuity notations

Table A.1 provides a means of converting visual acuity data from one notation to another.

Table A.1 — Conversion of different visual acuity notations

Snellen Notation indicating measurement at:				Decimal notation	Visual angle	LogMAR
6 m	5 m	4 m	20 ft	(independent of test distance)		
6/3.0	5/2.5	4/2.0	20/10.0	2.00	0.50	–0.3
6/3.8	5/3.2	4/2.5	20/12.5	1.60	0.63	–0.2
6/4.8	5/4.0	4/3.2	20/16	1.25	0.80	–0.1
6/6.0	5/5.0	4/4.0	20/20	1.00	1.00	0.0
6/7.5	5/6.3	4/5.0	20/25	0.80	1.25	+0.1
6/9.5	5/8.0	4/6.3	20/32	0.63	1.6	+0.2
6/12	5/10.0	4/8.0	20/40	0.50	2.0	+0.3
6/15	5/12.5	4/10.0	20/50	0.40	2.5	+0.4
6/19	5/16	4/12.5	20/63	0.32	3.2	+0.5
6/24	5/20	4/16	20/80	0.25	4.0	+0.6
6/30	5/25	4/20	20/100	0.20	5.0	+0.7
6/38	5/32	4/25	20/125	0.16	6.3	+0.8
6/48	5/40	4/32	20/160	0.125	8.0	+0.9
6/60	5/50	4/40	20/200	0.10	10.0	+1.0
6/75	5/63	4/50	20/250	0.08	12.5	+1.1
6/95	5/80	4/63	20/320	0.06	16.0	+1.2
6/120	5/100	4/80	20/400	0.05	20.0	+1.3

Annex B (normative)
Letter formats

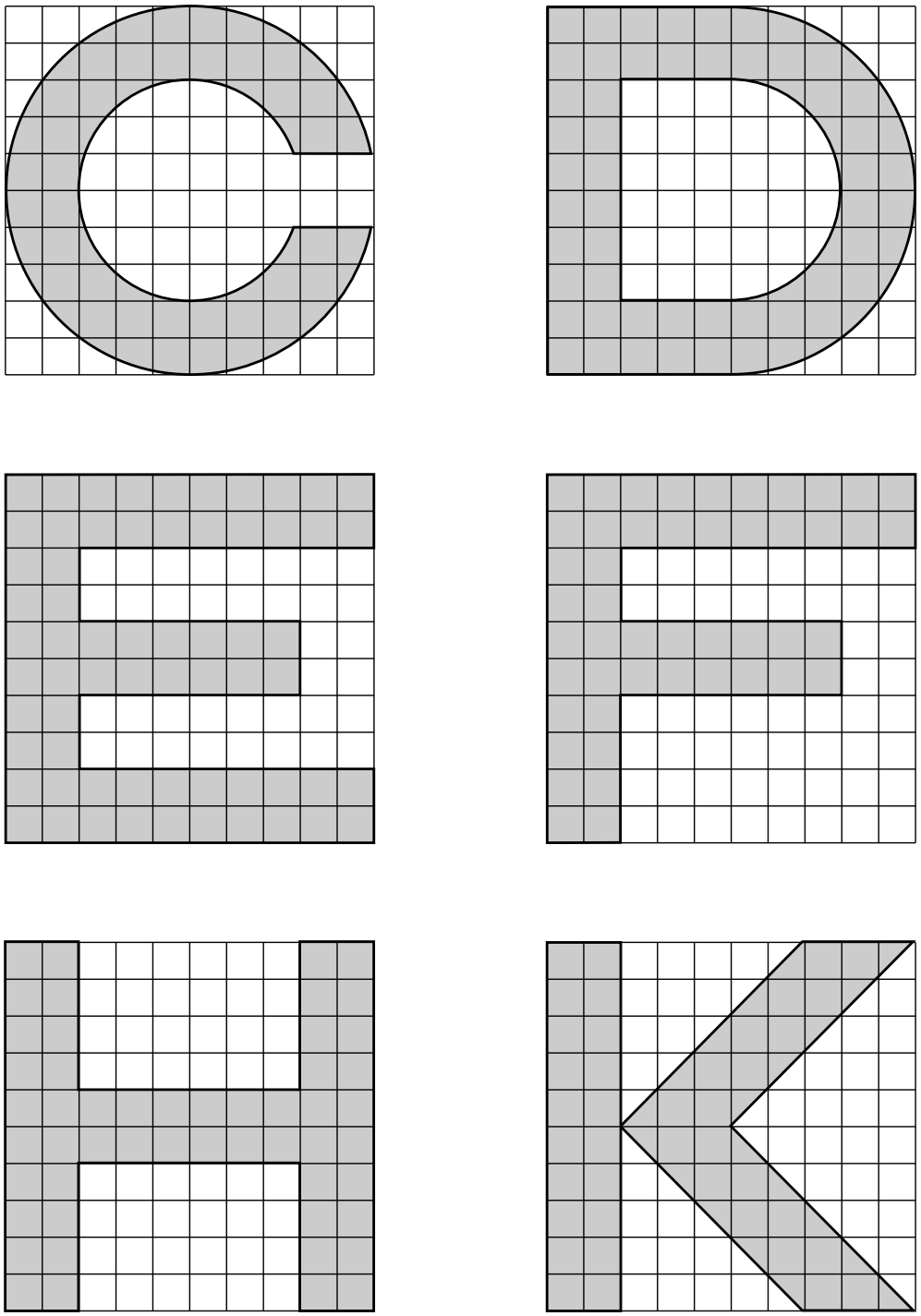

Figure B.1 — Letter formats

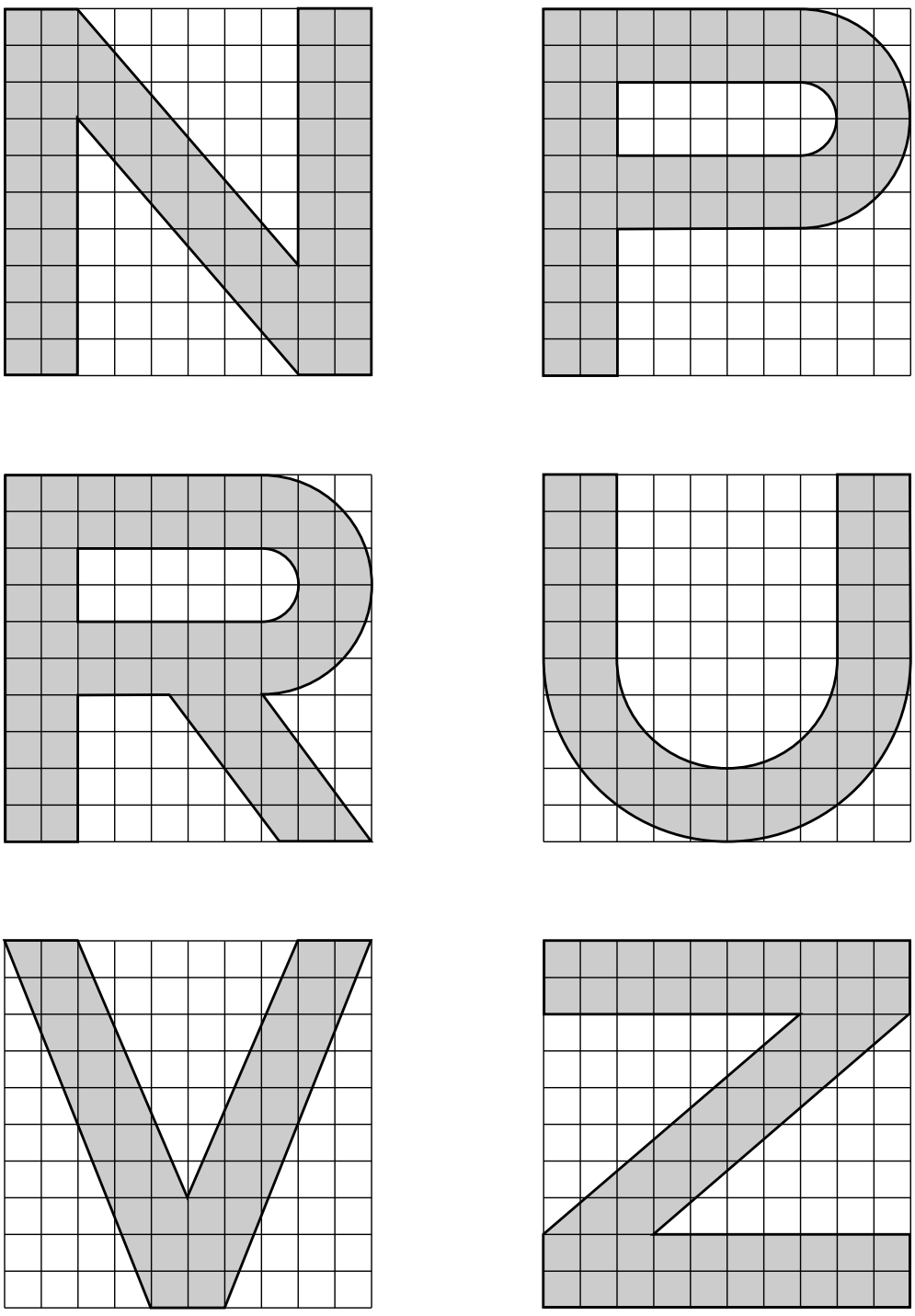

Figure B.1 — Letter formats (*continued*)

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BS 3521-1:1991, *Glossary of terms relating to ophthalmic lenses*

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