

Method for

Calculation of small colour differences

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Multitechnics Council (M/-) to Technical Committee M/2, upon which the following bodies were represented:

- British Ceramic Research Ltd.
- British Ceramic Tile Council
- British Paper and Board Industry Federation (PIF)
- Institute of Vitreous Enamellers
- International Wool Secretariat
- Lighting Industry Federation Ltd.
- Ministry of Defence
- Oil and Colour Chemists Association
- Paintmakers' Association of Great Britain Ltd.
- Royal Institute of British Architects
- Society of British Printing Ink Manufacturers
- Society of Dyers and Colourists
- Society of Leather Technologists and Chemists
- Textile Research Council

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Foreword

This British Standard has been prepared under the direction of the Multitechnics Council.

In 1976 Commission Internationale d'Eclairage (CIE) published a colour difference formula known as CIELAB (currently given in CIE Publication No. 15.2) which has since become widely used internationally for quantifying the perceived colour difference between surface colours.

It has been established as section J01 of BS 1006 for textiles and as BS 3900-D10 for paints and varnishes. For industry and commerce, however, this formula has a major weakness. Over 50 000 assessments made by 44 professional shade passers in the textile and paint industries against reference specimens of 262 different colours were analysed. It was found that if the decisions had been made using the optimum CIELAB ΔE^* value of the pass/fail boundary for each of the four data sets the number of wrong decisions would have been significantly greater than the average number of wrong decisions made by the assessors.

This weakness has been overcome by dividing CIELAB colour space into an infinite number of ellipsoidal microspaces defined by semi-axes oriented in the directions of lightness, chroma and hue scaled so as to correlate with visual assessment. The relative importance of lightness and chroma differences compared with differences in hue varies in different industries, and to allow for this, relative tolerances I and c are included in the formula. When $I = c = 1$ the formula quantifies the perceptibility (magnitude) of the colour difference. Different values of I and/or c allow for variations in the relative importance of lightness and chroma differences, and when these are used the formula quantifies the acceptability of the colour difference. This formula was devised by the Colour Measurement Committee of the Society of Dyers and Colourists and is known as CMC ($I : c$). The ideas and reasoning behind the modifications made to the JPC79 colour difference formula in developing it into the CMC equation are given by F.J.J. Clarke, R. McDonald and B. Rigg in "Modification to the JPC79 colour-difference formula", *Journal of the Society of Dyers and Colourists*, 1984, **100**, 128–132 and 281–282. Applying CMC (2 : 1) to the four data sets already mentioned gives fewer wrong decisions than would be made by the average observer, and in the only data set giving individual assessments (8 observers), the number of wrong decisions was no greater than that made by the most reliable assessor.

Currently, optimum values of I and c have only been determined for the textile industry. However, work is proceeding on determining optimum values for I and c for other industries, e.g. ceramics, leather, paper, paint and plastics, which will lead to revisions of this standard.

Some test data are given in Appendix A and an example of a simple computer program is given in Appendix B.

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Summary of pages

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This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.