

Specification for

# Paper and print for optical character recognition (OCR)

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- Association for Payment Clearing Services
- British Computer Society Ltd.
- British Paper and Board Industry Federation (PIF)
- British Printing Industries Federation
- British Telecommunications plc
- Business Equipment Trade Association
- Electricity Supply Industry in England and Wales
- Her Majesty's Stationery Office
- HM Treasury (Central Computer and Telecommunications Agency)
- Institute of Printing
- National Girobank

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## Foreword

BS 6616 was prepared under the direction of the Office and Information Standards Committee at the request of the clearing banks that arose as a result of the automation of the credit clearing system, involving the optical reading of bank giro credit vouchers. However, the standard is of general relevance to other optical reading applications.

This standard is based on ISO 1831:1980. The United Kingdom voted against ISO 1831 when it was circulated as a Draft International Standard (DIS), not for reasons of technical content but because it was considered that ISO 1831 was not sufficiently precise for use as a specification. BS 6616 differs principally from ISO 1831 in that the computer-aided method for determining character outline has been omitted and the visual method has been relegated to an appendix. The computer-aided method is primarily used for reading printed material of print quality tolerance range Z, which has also been omitted from this British Standard as it is not used in the United Kingdom. The visual method was considered to lack the precision required for a reference procedure but it has been retained in Appendix D as it may be a convenient method to use as a rough check on print quality for character sets OCR-A and OCR-B. ISO 1831 also includes a requirement and test method for the assessment of variation in paper reflectance. This was not considered to be sufficiently important for inclusion in this British Standard as a requirement but for guidance the test method has been included in Appendix A.

BS 6616 also covers the use of the character set E 13 B for OCR. Although E 13 B is designed to be magnetically read there is an increasing trend for it to be optically read in which case the requirements of this standard apply.

Fluorescence of paper can adversely affect the reading or sorting capabilities of some OCR systems and, as a consequence, this British Standard includes in Appendix A a recommendation for the maximum fluorescence to be exhibited by paper for OCR use. Currently there is no reference method for determining fluorescence, although the International Organization for Standardization (ISO) hopes to prepare one. When this method is available it is envisaged that the recommended fluorescence limit in Appendix A will become a requirement of this British Standard to be verified using the ISO method of test.

White paper is generally used where the technique of OCR is to be applied but the use of lightly tinted paper may be acceptable, provided the requirements of sections 2 and 3 are met.

Print quality is critical to the machine recognition of characters and it is necessary for OCR characters to be of higher print quality than characters to be read by the unaided human eye. Assessment of print quality includes the examination of the geometry of the character shape as well as the intensity of inking on the paper (print contrast). Ink of a high carbon black content is particularly suitable. The requirements of this standard apply to the printed image, not to the printing device (e.g. line printer) by which the printed image is produced.

The character positioning requirements ensure that each OCR character is read by the reader without interference from other OCR characters or from non-OCR elements.

Reference is made in this standard to the need for calibrated reference standards to be used for reflectance measurements. Within the United Kingdom ISO reference standards of level 3<sup>1)</sup>, which are issued by authorized laboratories, can be obtained from the Research Association for Paper and Board, Printing and Packaging Industries (PIRA), Randalls Road, Leatherhead.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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

### Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 16, an inside back cover and a back cover.

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.

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<sup>1)</sup> See measurement procedure described in BS 4432-1.



# Section 1. General

## 1 Scope

This British Standard specifies requirements for the optical properties of paper to be used for optical character recognition (OCR), for print quality, including character shape, quality, and positioning, and describes appropriate methods of test. The requirements are specifically for printed matter using one of the three character sets OCR-A<sup>2)</sup>, OCR-B<sup>2)</sup> and E 13 B<sup>3)</sup> (the latter where optically read), although the requirements for paper quality, character quality and character positioning may be applied irrespective of the character set or font, the printing system, or the end use of the printed material.

This specification does not include other dimensional requirements for the arrangement of characters. No specific dimensional measurements with respect to fields are given in this standard. No measurement of the distance between the average horizontal centreline on a line of OCR characters and a top or bottom reference edge is defined since this is dependent on varying systems requirements.

Colorimetric requirements are not specified, as they are considered unnecessary, other than by reference to the reflectance of the paper and the contrast between the paper and the print. The mechanical properties of the paper are not specified as the characteristics required will vary according to the reader being used; a list of appropriate standards is given in Sectional list SL 22.

NOTE The titles of the publications referred to in this British Standard are given on the inside back cover.

## 2 Definitions

For the purposes of this British Standard the following definitions apply.

### 2.1 Terms relating to paper quality

#### 2.1.1

##### fluorescence *F*

the portion of the reflectance that can be directly attributed to the effect of a fluorescent whitening agent

#### 2.1.2

##### gloss

the property of a surface responsible for a lustrous or mirror-like appearance

#### 2.1.3

##### opacity<sup>4)</sup>

the relationship, expressed as a percentage, between the reflectance factor  $R_0$  and the intrinsic reflectance factor  $R_\infty$  of the same sheet of paper, obtained from the expression

$$100 \frac{R_0}{R_\infty}$$

### 2.1.4 Terms relating to reflectance

#### 2.1.4.1

##### intrinsic reflectance factor $R_\infty$

the reflectance factor of a sheet or pad of paper thick enough to be opaque

#### 2.1.4.2

##### reflectance factor $R^5)$

the relationship, expressed as a percentage, between the light reflected by a sheet of paper and that reflected by a perfect reflecting diffuser (i.e. having 100 % reflectance) under the same conditions

#### 2.1.4.3

##### reflectance factor $R_0$

the reflectance factor  $R$  of a single sheet of paper with a black backing

### 2.1.5 Terms relating to sampling<sup>6)</sup>

NOTE See Figure 1.

#### 2.1.5.1

##### lot

the aggregate of paper or board of a single kind, of special characteristics comprising one or more nominally identical units

NOTE The unit may be in the form of a reel, a bale, a bundle, the contents of a packing case, a pallet load, etc. Where the material to be tested has already been incorporated into a manufactured article (for example a packing case), the lot is the aggregate of such articles of a single kind, of specified characteristics.

#### 2.1.5.2

##### sample

the aggregate of all the specimens

#### 2.1.5.3

##### specimen

a rectangle of paper or board cut to given dimensions, from the sheet (or manufactured articles) taken from the selected units which form the lot

<sup>2)</sup> Described in BS 5464.

<sup>3)</sup> Described in BS 4810.

<sup>4)</sup> Definition based on 2.4 of BS 4432-3:1980.

<sup>5)</sup> Definition based on 2.1 and 2.3 of BS 4432-1:1975.

<sup>6)</sup> Definitions taken from BS 3430.

## 2.2 Terms relating to print quality

### 2.2.1

#### best fit

the position of a COL gauge over a character at which the character fills the minimum COL as much as possible and at the same time extends as little as possible beyond the maximum COL

NOTE See Figure 8 and Appendix C.

### 2.2.2

#### character outline limit (COL)

the outlines of a character. The minimum and maximum COL for a given character, in a specified font, character size and tolerance type, are the outlines of the printed image at the extremes of the tolerances for the strokewidth

### 2.2.3

#### character reflectance $R_p$

the reflectance factor of a point on a character

### 2.2.4

#### edge irregularity

that part of the stroke edge extending either inside the minimum COL or outside the maximum COL

### 2.2.5

#### local reflectance $R_w$

the reflectance of the paper within the area of interest around a character

NOTE See C.1.

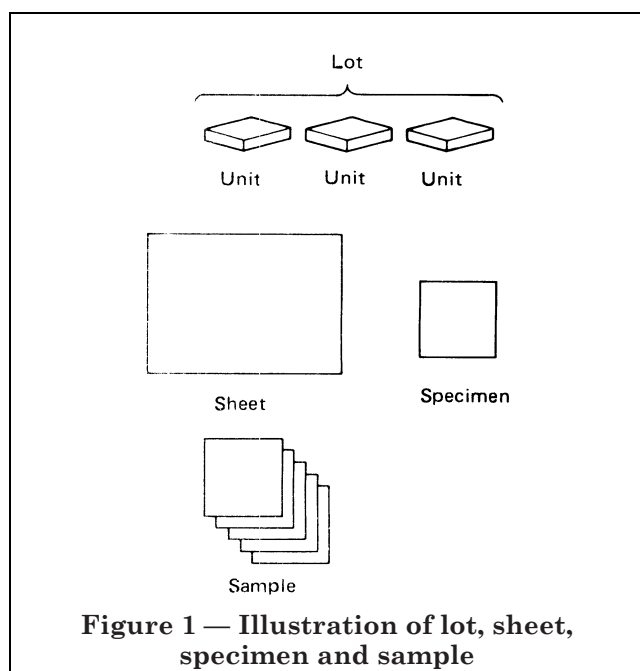


Figure 1 — Illustration of lot, sheet, specimen and sample

### 2.2.6

#### print contrast (PC), $P$

the arithmetic difference between the local reflectance  $R_w$  of the paper and the character reflectance  $R_p$ , i.e.  $R_w - R_p$

### 2.2.7 print contrast signal (PCS), $P_s$

The print contrast divided by the reflectance factor  $R_o$  of the paper.

#### 2.2.7.1

##### basic PCS values

a set of PCS values obtained with a COL gauge in the best fit

#### 2.2.7.2

##### contrast variation ratio within a character (CVR), $C$

the relationship between the means of the highest three and lowest three basic  $P_s$  values for a character

#### 2.2.7.3

##### $P_{sa}$

the arithmetic mean of the highest 80 % of the basic  $P_s$  values

#### 2.2.7.4

##### $P_{smax}$

the highest mean value of any three consecutive basic PCS values for characters with a centreline 2 mm or more long or of five such consecutive values for characters with a centreline less than 2 mm long

#### 2.2.7.5

##### $P_{smin}$

the lowest mean value of any three consecutive basic PCS values for characters with a centreline 2 mm or more long or of five such consecutive values for characters with a centreline less than 2 mm long

#### 2.2.7.6

##### $P_{s80\%}$

the lowest value of the upper 80 % of the basic  $P_s$  values

#### 2.2.7.7

##### print contrast signal within a character

the  $P_s$  value measured along the centreline of a character

### 2.2.8

#### spots

any extraneous ink outside the maximum COL

NOTE Spots could be connected to or adjacent to the printed image, or could be free-standing within the clear area.