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Information technology — Automatic identification and data capture techniques — Bar code master test specifications

Technologies de l'information — Techniques d'identification automatique et de capture des données — Spécifications pour essai principal de codes à barres

Reference number
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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 15421 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

Annex A of this International Standard is for information only.

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Introduction

The technology of bar coding is based on the recognition of patterns encoded in bars and spaces of specified dimensions. A wide variety of methods exists by which these bar and space patterns can be reproduced as a physical image. Conventional printing processes such as offset lithography, photogravure, letterpress, screen process, hot foil stamping and flexography, require one or more intermediate image carriers for example, artwork, photographic film, printing plates or cylinders, screens or dies.

The term bar code master refers to the first physical image of the complete bar code symbol from which the other image carriers can be produced. In order to make allowances for variability of the production processes, and to ensure the correct encoding of the data to be represented, certain procedures must be performed during the preparation of the bar code master.

This International Standard does not define the procedures but states the requirements for a bar code master.

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Information technology — Automatic identification and data capture techniques — Bar code master test specifications

1 Scope

This International Standard defines the physical and related attributes of a bar code master and the quality criteria by which its conformity with this standard is to be assessed, and contains guidelines to assist in its use. The standard covers all forms of bar code master, irrespective of the mode of origination of the initial image, intended for reproduction by conventional printing processes.

2 Conformance

Conformance with this International Standard shall be established by measurement of the bar code master in accordance with the test methods defined in clause 7 to establish that the dimensional and optical density requirements set out in clause 6 have been met.

3 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 5-3, *Photography — Density measurements — Part 3: Spectral conditions*.

ISO 5466, *Photography — Processed safety photographic films — Storage practices*.

EN 1556, *Bar coding — Terminology*.

4 Terms and definitions

For the purposes of this International Standard, the terms and definitions given in EN 1556 and the following apply.

4.1
achieved bar width difference
The average difference in width between specified and actual dimensions, for all bars within the symbol.

4.2
bar edge
The junction between a bar and space in a bar code symbol.

4.3
bar edge conformance
The accuracy with which a bar edge or part of a bar edge is located, relative to its specified location.

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4.4
bar edge contour
The line joining all bar/space transitions at all points along the height of a bar.

4.5
bar edge gradient
The rate of change in optical density at a bar edge per unit distance, measured from the Optical Density Profile.

4.6
bar width adjustment (BWA)
The amount of decrease (bar width reduction) or increase (bar width increase) by which the bars of a bar code master are adjusted, to compensate respectively for gain or loss of bar widths during reprographic and printing processes.

4.7
bar width increase
See bar width adjustment.

4.8
bar width reduction
See bar width adjustment.

4.9
bar width tolerance
The maximum permitted variation between the target dimensions and the achieved dimensions of a bar.

4.10
base density
The lowest optical density of the bar code master material.

4.11
negative image
An image where the bars are of low optical density and the spaces are of high optical density.

4.12
nominal bar width (EAN/UPC Symbols)
The reference bar width defined by the symbology specification at magnification = 1,0, with which other bar widths included in the symbology specification are compared or related.

4.13
optical density profile
A continuous plot of the optical density of the image of a bar code master, constructed from measurements of optical density made at micrometric intervals of distance, along a line which passes at a right angle through all of the bars of the symbol. (Reference annex A.)

4.14
polarity
The negative or positive property of an image.

4.15
positive image
An image where the bars are of high optical density and the spaces are of low optical density.

4.16
specified bar width
(1). (EAN/UPC Symbols)
Equal to the nominal bar width, modified by magnification factor and bar width adjustment, if applicable i.e. (NOMINAL multiplied by MAGNIFICATION) ± BAR WIDTH ADJUSTMENT.

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(2).(other symbols)
Equal to the X dimension multiplied by the ratio or number of modules, as appropriate, modified by bar width adjustment, if applicable, i.e. (X multiplied by RATIO) ± BAR WIDTH ADJUSTMENT, or (X multiplied by NO. OF MODULES) ± BAR WIDTH ADJUSTMENT.

4.17
target element width
The calculated dimension for an element including bar width adjustment.

5 Symbols and abbreviated terms

D = optical density as defined in ISO 5-3.

6 Physical requirements

6.1 Material

A bar code master shall be produced on material which conforms to the following physical requirements.

6.1.1 Dimensional stability

The finished bar code master shall be such that dimensional variations due to changes in ambient conditions do not exceed:

— 0,01 per cent per 1 % change in relative humidity (RH).

— 0,01 per cent per 1 °C change in temperature.

Dimensional stability requirements shall be satisfied within the temperature range of 0 °C to 60 °C and the relative humidity range of 10 % to 70 %.

Samples shall be measured as specified in 7.1 and at the specified temperature and relative humidity.

6.1.2 Archival properties

For optimum life a bar code master (produced on photographic film) needs to be properly stored and used in controlled conditions which are in accordance with ISO 5466.

6.2 Physical requirements controlled by the manufacturing process

6.2.1 Target bar width

When measured according to the methods described in clause 7, the width of each element of the bar code master shall equal the target width for that element, subject to the tolerances defined in 6.3.

6.2.2 Bar width adjustment

Bar width adjustment shall be applied uniformly and symmetrically to every bar throughout the symbol.

NOTE In consequence, where bar width increase is applied, the widths of spaces will also be reduced by an equal amount, and vice versa.

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6.3 Tolerances

The achieved bar widths measured according to the methods of clause 7 shall be compared with the target bar widths of the symbology.

6.3.1 Tolerance A - all symbologies

The achieved bar width difference of a symbol must be < ± 0,008 mm.

The achieved bar width difference of the symbol shall be determined by the method specified in 7.1.2.

6.3.2 Tolerance B - two width symbologies

The tolerance on the achieved width of individual bars and spaces in a symbol, shall be subject to Tolerance B_1 or B_2 according to X dimension.

Tolerance B_1 equals ± 0,005 mm for symbols with X dimension less than 0,5 mm.

Tolerance B_2 equals ± 0,013 mm for symbols with X dimension equal to or greater than 0,5 mm.

Reference Figure A.4.

6.3.3 Tolerance C - (n,k) symbologies

The achieved widths of individual bars and spaces in a symbol or any consecutive bar and space combination within a character shall be subject to tolerance C.

Tolerance C equals ± 0,005 mm

Reference Figure A.5.

6.3.4 Tolerance D - all symbologies

The overall achieved width of a character shall be subject to tolerance D.

Tolerance D equals ± 0,013 mm

Reference Figure A.6.

6.4 Bar edge characteristics

6.4.1 Bar edge conformance

The bar edge contour shall conform to the specified edge ± 0,002 mm.

6.4.2 Bar edge gradient

The slope of the line joining intersections on the density profile plot at the specified densities of Table 1 (ii) (iii), shall be not less than that specified in Table 1 (iv).

Reference Figure A.2.

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6.5 Defects

There shall be no spots in low density areas or voids in high density areas which, regardless of shape, would include a circle of 0,010 mm diameter.

6.6 Quiet zones

The quiet zones for symbols shall be at least the minimum specified by the symbology specification.

NOTE In order to ensure that the minimum quiet zones are respected when printing or positioning the symbol (e.g. to compensate for print growth or to allow registration of the bar code symbol position relative to other graphics or label edges), adjustment of the position of any graphical mark on the bar code master adjacent to the quiet zone boundary may be required.

6.7 Corner marks

When the bar code master is supplied as a discrete component, corner marks shall be applied to indicate the minimum area required for the bar code symbol, including quiet zones. This area must not be encroached on by other design detail.

6.8 Optical densities

6.8.1 Minimum density (D_{min})

The optical density values of low density areas shall not exceed that given in Table 1 (v).

6.8.2 Maximum density (D_{max})

The optical density values of high density areas shall not be less than that given in Table 1 (vi).

6.9 Orientation

The orientation of a film based bar code master shall be specified as ‘emulsion up’ or ‘emulsion down’.

6.10 Polarity

The polarity of a bar code master shall be specified as positive or negative.

6.11 Encodation

For a bar code master, the image shall be composed by a method which ensures that the encodation rules of the symbology specification are followed.

Where an application specification requires that data be modified before encodation in the bar code master, the logical rules defined by the application specification shall be implemented for this procedure.

6.12 Human readable interpretation

The human readable interpretation of the data encoded in the bar code master shall conform to the requirements of the symbology or application specification to which it is manufactured.

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Table 1 — Reference Density Values

PARAMETER			OPTICAL DENSITIES	
			TRANSMISSION	REFLECTION
i	Density threshold level at which bar edge position is determined[a]		0,50	0,40
ii	Density levels for defining bar edge gradient[a]	MIN	0,10	0,10
iii		MAX	2,90	1,65
iv	Minimum edge gradient		0,50D per micron	0,29D per micron
v	Maximum value of D_{min}[b]		0,10	0,15
vi	Minimum value of D_{max}[b]		3,0	1,80

[a] These density values are above base density.
[b] These density values include base density.

7 Test methods

7.1 Bar and space width measurement

The bar and space widths shall be determined by measurement of an optical density profile plot at the density threshold level defined in Table 1 (i).

Any system used for the purpose of measuring bar code masters shall conform to the following requirements.

a) It shall be capable of determining the relative positions of bar space transitions to an accuracy of ± 0,002 5 mm.

b) For bar code masters which are measured by transmission densitometry, the spectral conditions shall be those set out in ISO 5-3, Printing Density.

c) For bar code masters which are measured by reflection densitometry, the spectral conditions shall be those set out in ISO 5-3, Narrow Band Densities.

7.1.1 Conditions for dimensional measurements

The conditions for measurement shall be:

Relative Humidity (RH): 50 % ± 10 %

Temperature: 20 °C ± 5 °C

Samples shall be conditioned for a minimum period of 2 h in free air circulation, at the specified humidity and temperature.

The dimensions determined by measurement of the samples, under the specified test conditions, shall be compared with the target dimensions defined in accordance with the symbology specifications and application specifications.

7.1.2 Calculation of the achieved bar width adjustment

The average difference between the target bar widths excluding bar width adjustment and the measured bar widths shall be determined as follows.

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a) Measure individual bar widths.

b) Find the difference between the target bar width (excluding bar width adjustment) and the measured bar width for each bar.

c) Sum the differences.

d) Calculate the average by dividing the sum by the number of bars.

NOTE Measured space widths will vary by an equal amount in the opposite direction, such that the combined width of any bar and space pair remains unchanged.

7.2 Test report and traceability

Descriptive information and a record of test measurements shall accompany every bar code master. This shall include the minimum information specified below:

— A unique identification shall appear on the bar code master.

— The name of the manufacturer or distributor of the bar code master.

— Magnification factor or X dimension and ratio, according to the symbology specification.

— Symbology.

— Target bar width adjustment, which wherever possible shall appear on the bar code master.

— Emulsion orientation.

— Image polarity.

— Encoded data.

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Annex A
(informative)

Optical density profiles

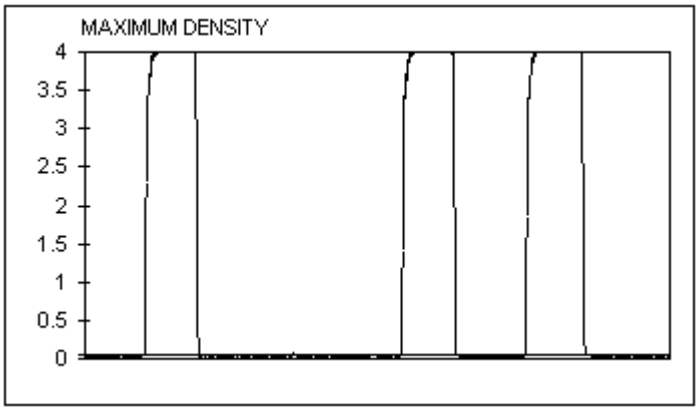


Figure A.1 — Minimum and maximum values of optical density (D_{min} and D_{max})

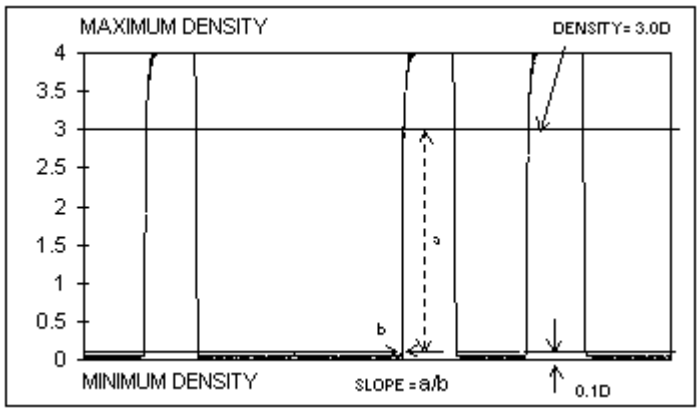


Figure A.2 — Measurement of slope

NOTE Slope = a / b

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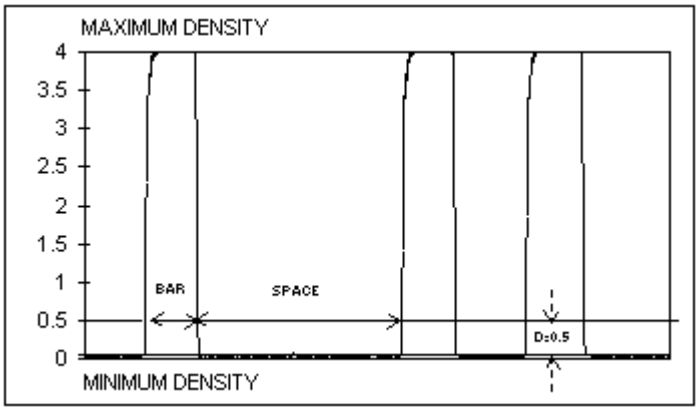


Figure A.3 — Threshold point for bar edge determination

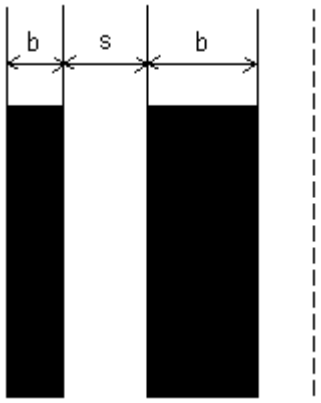


Figure A.4 — Measurements for ratio-based symbologies

For ratio-based symbologies, bar and space widths are individually subject to tolerance B. Cumulative widths of successive combinations of bars and spaces are also subject to tolerance B.

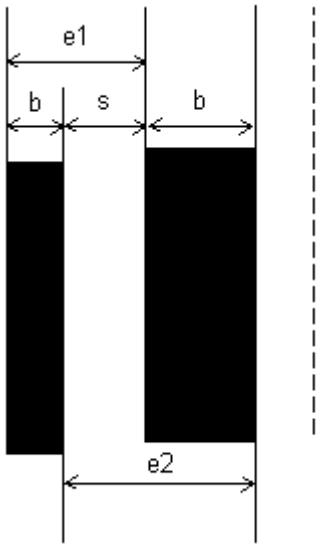


Figure A.5 — Measurements for (n, k) symbologies

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For (n, k) symbologies, bar and space widths are subject to tolerance C. The cumulative widths of successive combinations of bars and spaces are also subject to tolerance C.

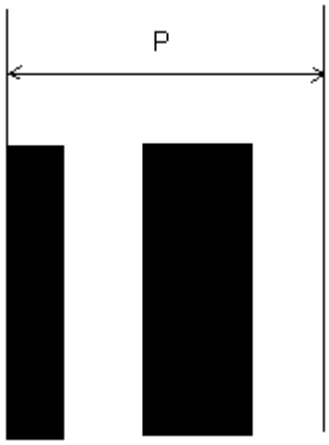


Figure A.6 — Symbol character pitch measurement (all symbologies)

For all symbologies, the symbol character pitch P is subject to tolerance D.

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