INTERNATIONAL STANDARD

ISO/IEC 15419

Second edition
2009-06-01

Information technology — Automatic identification and data capture techniques — Bar code digital imaging and printing performance testing

Technologies de l'information — Techniques automatiques d'identification et de capture des données — Test de performance de la numérisation digitale et l'impression des codes à barres

Reference number
ISO/IEC 15419:2009(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

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. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. 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 document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 15419 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

This second edition cancels and replaces the first edition (ISO/IEC 15419:2001), which has been technically revised.

Introduction

Bar code technology is based on the recognition of patterns encoded in bars and spaces of defined dimensions according to rules defining the translation of characters into such patterns, known as the symbology specification.

Bar code digital imaging systems must be capable of reliably converting the information to be encoded into a bar code symbol meeting the symbology specification and application requirements if the technology is to fulfil its basic objective. Such systems comprise two major components, namely the hardware device which produces the physical image of the bar code symbol on paper, photographic film, printing plate, or other substrate, and the associated software which converts the input data into digital instructions used to drive the hardware device. Each component can take many forms and perform differing functions.

Manufacturers of bar code equipment, the producers of bar code symbols and the users of bar code technology therefore require publicly available standard test specifications for bar code digital imaging systems to ensure the accuracy and consistency of performance of these systems. This International Standard is intended to lay down general principles governing the bar code image generation function in each component, supplemented by more specific details applicable to certain major categories of software and hardware.

Information technology — Automatic identification and data capture techniques — Bar code digital imaging and printing performance testing

1 Scope

This International Standard describes the characteristics and defines categories of bar code digital imaging systems, identifies the attributes of each system which are required to be controlled, and specifies minimum requirements for those attributes. It defines test methods for assessing the conformance of those attributes with this International Standard. It is intended to be used in conjunction with International Standards which detail the methodology for assessing the quality of a bar code symbol, such as ISO/IEC 15416. This International Standard does not apply to Bar Code Masters, which are covered by ISO/IEC 15421.

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 (including any amendments) applies.

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO/IEC 15416, *Information technology — Automatic identification and data capture techniques — Bar code print quality test specification — Linear symbols*

ISO/IEC 15420, *Information technology — Automatic identification and data capture techniques — Bar code symbology specification — EAN/UPC*

ISO/IEC 15426-1, *Information technology — Automatic identification and data capture techniques — Bar code verifier conformance specification — Part 1: Linear symbols*

ISO/IEC 19762-1, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 1: General terms relating to AIDC*

ISO/IEC 19762-2, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 2: Optically readable media (ORM)*

3 Terms, definitions, and abbreviated terms

For the purposes of this document, the terms, definitions and abbreviated terms given in ISO/IEC 19762-1, ISO/IEC 19762-2 and the following apply.

3.1
addressable imaging resolution
maximum number of image positions per unit length along a straight line that can be addressed by the bar code designer

NOTE 1 An example of image positions per unit length is dots per millimetre.

NOTE 2 This resolution would exclude further resolution enhancing techniques performed by the imaging device or software, which are beyond the control of the designer.

3.2
adjusted BWC
value of bar width compensation (BWC) after adjustment to match addressable imaging resolution

3.3
bit map
electronic representation of the individual pixels making up the image to be output by the imaging device

3.4
consumables
print media, i.e. materials that need to be supplied by the user on a regular basis

NOTE Examples of consumables include ribbons, labels or printing substrates, toner and ink.

3.5
dedicated bar code printer
printing device with the resident intelligence capable of converting data into bar code symbols

3.6
digital bar code file
bar code which is designed and stored in a digitized format

3.7
digital bar code imaging system
system which comprises the necessary software and hardware components to produce a bar code image

3.8
distortion
process by which the height to width ratio of a piece of artwork is modified to compensate for the dimensional change that is introduced to an image when a flexible relief printing plate is wrapped around the print cylinder of a rotary printing press

3.9
DPMM
dots per millimetre
measure of printing resolution, in particular the number of individual dots of ink a printer or toner can produce within a linear one-millimetre space

3.10
general purpose printer
printing device without the resident processing ability to convert data sequences into a valid bar code symbol

NOTE An example of a general purpose printer is an office printer.

3.11
imagesetter
device used to output a computer image at an addressable resolution onto a photographic film, paper or printing plate

3.12
imaging tool
mechanism that transfers an image directly or indirectly to a printed substrate

3.13
rounding errors
allocation of imaging device dots to bar or space modules in an inconsistent manner, i.e. where all of the modules based on the user's target dimensions fail to be composed of a consistent number of dots

4 Bar code design software

4.1 General requirements

The testing procedures in this section are intended to report the conditions under which software, in conjunction with a printing device, is capable of producing quality symbols. The tests performed under the reported conditions will typically be performed in a controlled setting. Ongoing verification of symbols produced in an operational setting should be performed using the methodology contained in ISO/IEC 15416. In addition, visual checks should be performed to confirm the correct formatting of the symbol in accordance with the symbology and other applicable specifications. Further guidance on equipment maintenance and supplies is found in Annex C.

4.1.1 Data input

The human-readable text and symbol characters for all symbols should, wherever possible, be generated from the same key entry input. The software should apply appropriate formatting algorithms to meet relevant application standards.

The input process should also allow for the input of relevant symbol parameters such as target X dimension or magnification factor, wide:narrow ratio, and bar height, where these are user-definable according to the symbology specification; such input shall be subject to the capabilities of the imaging or printing system, in particular the adjustment of target element dimensions as described in the subclauses of 4.2.

Check characters for encoded data shall either be calculated or verified by the software. For example, if the software prompts for the entry of only twelve digits for an EAN-13 symbol, the software shall automatically calculate the check character. Alternatively, the software might prompt for the entry of thirteen digits and indicate an error if the check character input is incorrect. The latter approach assures that valid data has been entered.

It is desirable for the input data to be displayed when the label or layout is designed, subject to the limitations of the display device, to enable the operator to validate it. Optionally, the software may also display the symbol characters encoded.

4.1.2 Quiet zones

The software should indicate, either graphically or in text, the appropriate area surrounding the symbol required for quiet zones.

NOTE In order to ensure that the minimum quiet zones are respected when printing or positioning the symbol, if for example print growth or variations in print to substrate register are expected, adjustment of the position of any graphical mark on the digital image adjacent to the quiet zone boundary, or of the position of the symbol relative to the edges of the area in which, or substrate on which, it is to be printed, may be required.

4.2 Considerations by software and imaging device categories

Refer to Annex D for a review of software categories and Annex E for a review of imaging device categories.

4.2.1 Direct bar code imaging devices

This section provides software design requirements for imaging devices that create the final bar code symbol on the substrate. This category is divided into the two sub-categories, dedicated bar code printer software and general-purpose printer software.

4.2.1.1 Dedicated bar code printers

This section provides software requirements for dedicated bar code printers. Dedicated bar code printers contain all of the low-level software required to generate bar code symbols. This means that various symbol formats are stored in the firmware specific to the printer. The bar code design software simply sends commands to address the firmware in the printer to create the symbol. These commands typically relate to data characters, element sizes (typically expressed as a multiple of addressable dots), symbol orientation, and symbol placement.

4.2.1.1.1 Adjustment of target element dimensions

This procedure is intended to produce symbols with a revision in the target module width of the symbol to eliminate rounding errors. The software must be able to make adjustments to symbol character element widths based on the output resolution specified. This means the overall symbol width will be adjusted to produce an integer number of addressable dots consistently across all element widths. For symbols with a fixed aspect ratio, a proportional adjustment should be applied to the module height (Y-dimension).

These adjustments should be made by rounding down to the closest integer value, provided the value falls within the range of widths prescribed by the symbology specification or application standard. Rounding down is preferred because rounding up could cause reduction of or interference in the area allocated to the quiet zone. Quiet zone reduction could result from selecting a label width that is very close to the target symbol width. Quiet zone interference could result from adjacent graphic layout images remaining constant as the symbol width expands. When symbol module widths are rounded up, the software should clearly indicate the required quiet zone area to the designer.

Refer to Annex F for a programmer's example for an illustration of this procedure.

4.2.1.1.2 Record of design attributes

Digital bar code files for dedicated bar code printers are generally created for a specific printer make and model at a specific resolution. It is wise for the party printing the symbol to create the bar code at the production stage closest to the symbol output. When this is not possible and the digital bar code file is transferred between two parties, certain design attributes should be communicated. The following design attributes should be communicated for dedicated bar code printers to ensure symbol quality in the output stage:

— The output resolution specified for symbol output

— The adjusted symbol module dimensions based on the specified output resolution (see 4.2.1.1.1)

4.2.1.2 General purpose printers

This section provides software requirements for general-purpose printers. General-purpose printers do not contain low-level software for generating bar code symbols.

4.2.1.2.1 Adjustment of target element dimensions

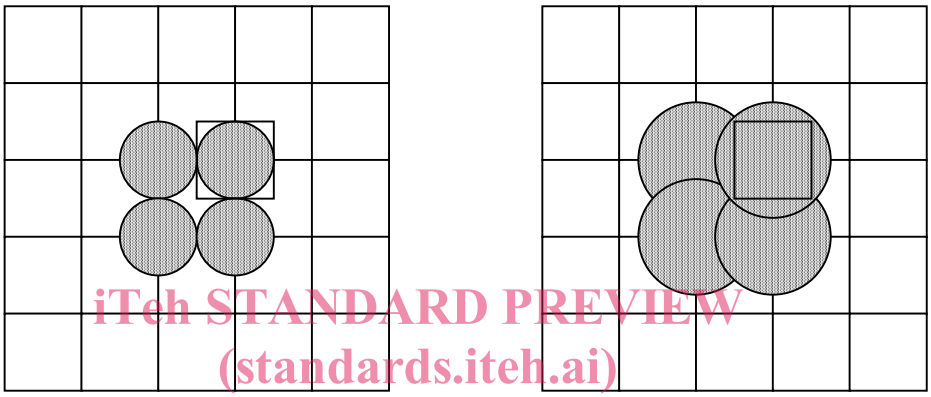
This procedure is intended to produce symbols with a revision in the target module width of the symbol to eliminate rounding errors. The software must be able to make adjustments to symbol character element widths based on the output resolution specified. This means the overall symbol width will be adjusted to produce an integer number of addressable dots consistently across all element widths. For symbols with a fixed aspect ratio, a proportional adjustment should be applied to the module height (Y-dimension).

These adjustments should be made by rounding down to the closest integer value, provided the value falls within the range of widths prescribed by the symbology specification or application standard. Rounding down is preferred because rounding up could cause reduction or interference in the area allocated to the quiet zone. Quiet zone reduction could result from selecting a label width that is very close to the target symbol width. Quiet zone interference could result from adjacent graphic layout images remaining constant as the symbol width expands. When symbol module widths are rounded up, the software should clearly indicate the required quiet zone area to the designer.

Refer to Annex F for a programmer's example for an illustration of this procedure.

4.2.1.2.2 Adjusted BWC

The printed dot width for general-purpose printers is typically larger than the measurement between the centres of two adjacent dots (pixel dimension) as shown on the right grid in Figure 1.



NOTE Dot width equal to pixel width (left) and dot width oversize compared to pixel width (right).

Figure 1 — General purpose printer dot / pixel comparison

This enlarged dot size causes the bars to be printed wider and the spaces narrower than nominal, unless the software driving the printer corrects for this condition. BWC is a procedure that is commonly performed during bar code design, which compensates for the bar width gain or loss experienced in the printing process.

Adjusted BWC is the result of a procedure, which has been introduced to make BWC result in a consistent, integer number of addressable imaging device dots based on the specified output resolution. The two types of BWC are BWR and BWI. When print gain is anticipated, BWR is used. Adjustments to BWR should be made by rounding up to the closest integer value. Rounding up is preferred because slightly narrower bars are preferred to slightly narrower spaces. When print loss is anticipated, BWI is used. Adjustments to BWI should be made by rounding down to the closest integer value. Rounding down is preferred because slightly narrower bars are preferred to slightly narrower spaces.

Refer to Annex F for a programmer's example for an illustration of this procedure.

4.2.1.2.3 Record of design attributes

If the printer supplies are appropriate and the printer's operating condition is maintained, the printer should provide quality symbols when the output conditions match the specified design attributes and the symbol has not been distorted by importing it into a secondary illustration or page layout software package. It is wise for the party printing the symbol to create the bar code at the production stage closest to the symbol output. When this is not possible and the digital bar code file is transferred between two parties, certain design attributes should be communicated. The following design attributes should be communicated for general-purpose printers to ensure symbol quality in the output stage:

— The output resolution specified for symbol output

— The adjusted symbol module dimensions based on the specified output resolution

— The adjusted BWC (bar width compensation) based on the specified output resolution

4.2.2 Indirect bar code imaging devices

This section provides software requirements for indirect imaging devices (e.g. imagesetters). Imagesetters commonly process and produce photographic film or paper, which is then used to produce imaging tools (e.g. printing plates) for traditional printing presses. Imagesetters may be used to produce bar code symbols directly where high-resolution symbols are required. Imagesetters can also be used to produce printing plates directly (e.g. direct-to-plate imaging).

4.2.2.1 Adjustment of target element dimensions

This procedure is intended to produce symbols with a revision in the target module width of the symbol to eliminate rounding errors. The software must be able to make adjustments to symbol character element widths based on the output resolution specified. This means the overall symbol width will be adjusted to produce an integer number of addressable dots consistently across all element widths. For symbols with a fixed aspect ratio, a proportional adjustment should be applied to the module height (Y-dimension).

These adjustments should be made by rounding down to the closest integer value, provided the value falls within the range of widths prescribed by the symbology specification or application standard. Rounding down is preferred because rounding up could cause reduction or interference in the area allocated to the quiet zone. Quiet zone reduction could result from selecting a label width that is very close to the target symbol width. Quiet zone interference could result from adjacent graphic layout images remaining constant as the symbol width expands. When symbol module widths are rounded up, the software should clearly indicate the required quiet zone area to the designer.

Refer to Annex F for a programmer's example for an illustration of this procedure.

4.2.2.2 Adjusted BWC (Bar Width Compensation)

BWC refers to a procedure in bar code design, which compensates for the bar width gain or loss experienced in the printing process. For instance, if a press prints a 0,254 mm bar width as 0,330 mm wide, it would have print gain of 0,038 mm on both sides of the bar. In order to print a bar close to the 0, 254 mm target, a BWR of 0,076 mm would be applied to the bar on the final film and imaging tool. In this example, every bar is reduced in width by 0,076 mm and every adjacent space is increased by 0,076 mm.

Adjusted BWC is the result of a procedure, which has been introduced to make BWC result in a consistent, integer number of addressable imaging device dots based on the specified output resolution. The two types of BWC are BWR and BWI. When print gain is anticipated, BWR is used. Adjustments to BWR should be made by rounding up to the closest integer value. Rounding up is preferred because slightly narrower bars are preferred to slightly narrower spaces. When print loss is anticipated, BWI is used. Adjustments to BWI should be made by rounding down to the closest integer value. Rounding down is preferred because slightly narrower bars are preferred to slightly narrower spaces.

Refer to Annex F for a programmer's example for an illustration of this procedure.

4.2.2.3 Adjustments for planned distortion (disproportioning)

Bar codes are typically imaged in an orientation where the bars run parallel to the press feed direction (picket fence orientation). In certain cases, running a symbol's bars perpendicular to the press direction (ladder orientation) is unavoidable and requires distortion of the image in the web direction based on the specified plate roll circumference. The following software procedure can be used in the bar code design stage to eliminate rounding errors when the symbol will be distorted at a later production stage: