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Packaging — Bar code and two-dimensional symbols for shipping, transport and receiving labels

Emballage — Codes à barres et symboles bidimensionnels pour l'expédition, le transport et les étiquettes de réception

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member 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 shall not be held responsible for identifying any or all such patent rights.

ISO 15394 was prepared by Technical Committee ISO/TC 122, *Packaging*.

This second edition cancels and replaces the first edition (ISO 15394:2000), which has been technically revised.

Introduction

The use of electronic data interchange (EDI) in association with the physical transport and handling of packages and when traceability is appropriate, such as that described in ISO 9000, requires a clear and unique identifier linking the electronic data and the transport unit.

Bar code marked transport labels are in widespread use in the global industries. A number of different standards exist, each designed to meet the requirements of the specific industry sector. For effective and economic use within and between industry sectors, one common multi-industry standard is a necessity.

A bar code marked transport label is designed to facilitate the automation of shipping and handling administrative operations. The bar code information on the transport label may be used as a key to access the appropriate database that contains detailed information about the transport unit, including information transmitted via EDI. In addition, a transport label may contain other information as agreed between the trading partners.

Two-dimensional symbols may be included to assist moving large amounts of shipping label or EDI data from sender to recipient and to assist the transportation carrier automated sortation and tracking systems.

This International Standard incorporates the technology, data structure and conformance standards of ISO/IEC JTC 1/SC 31, *Automatic identification and data capture techniques*, with the user requirements for shipping labels, into a single application standard.

While this International Standard provides an international shipping label standard, ISO 22742 provides an International Standard for product packaging. These two standards are complementary. ISO 17365 is an International Standard on the use of RF tags on shipping/transport units and was prepared by the ISO/TC 122/104 Joint Working Group (JWG), *Supply Chain Applications of RFID*.

Packaging — Bar code and two-dimensional symbols for shipping, transport and receiving labels

1 Scope

This International Standard:

— specifies the minimum requirements for the design of labels containing linear bar code and two-dimensional symbols on transport units to convey data between trading partners;

— provides for traceability of transported units via a unique transport unit identifier (licence plate);

— provides guidance on the formatting on the label of data presented in linear bar code, two-dimensional symbol or human readable form;

— provides specific recommendations regarding the choice of bar code symbologies, and specifies quality requirements and classes of bar code density;

— makes recommendations as to label placement, size and the inclusion of free text and any appropriate graphics;

— provides guidance on the selection of label material.

This International Standard is not applicable to the direct printing on to kraft coloured corrugated surfaces.

NOTE Guidance on the direct printing of bar code symbols on to kraft coloured corrugated surfaces can be found in texts such as *The Fibre Box Handbook* [7].

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 17365, *Supply chain applications of RFID — Transport units*

ISO 21067, *Packaging — Vocabulary*

ISO/IEC 15415, *Information technology — Automatic identification and data capture techniques — Bar code print quality test specification — Two-dimensional symbols*

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

ISO/IEC 15417, *Information technology — Automatic identification and data capture techniques — Code 128 bar code symbology specification*

ISO/IEC 15418, *Information technology, Automatic identification and data capture techniques — GS1 Application Identifiers and ASC MH10 Data Identifiers and maintenance*

ISO/IEC 15434, *Information technology — Automatic identification and data capture techniques — Syntax for high-capacity ADC media*

ISO/IEC 15438:2006, *Information technology — Automatic identification and data capture techniques — PDF417 bar code symbology specification*

ISO/IEC 15459-1, *Information technology — Unique identifiers — Part 1: Unique identifiers of transport units*

ISO/IEC 16023:2000, *Information technology — International symbology specification — MaxiCode*

ISO/IEC 16388, *Information technology — Automatic identification and data capture techniques — Code 39 bar code symbology specification*

ISO/IEC 18004, *Information technology — Automatic identification and data capture techniques — QR Code 2005 bar code symbology specification*

ISO/IEC 19762 (all parts), *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19762, ISO 21067 and the following apply.

3.1
sortation
process by which an automated material-handling system routes packages and freight in a distribution environment

4 Concepts

4.1 Principles

The purpose of a bar code label is to facilitate the automatic exchange of data among all members within a channel of distribution, for instance supplier, carrier, purchaser, other intermediaries. The amount of data, in linear bar code, two-dimensional symbols and in human readable form, is dependent on the requirements of the trading partners. Where a bar code label is used in conjunction with electronic databases and/or electronic data interchange (EDI) systems, the amount of data may be significantly reduced and may consist of only one piece of data, the unique identifier for the transport unit. If radio frequency identification (RFID) enabled labels or tags are used in conjunction with labels in conformance with this International Standard, ISO 17365 shall be used for RFID usage with transport units. Human and optically readable data for the representation of RFID applications should be in accordance with ISO/IEC TR 24729-1.

Trading partners have different information requirements. Some information may be common to two or more trading partners while other information may be specific to a single trading partner. Information for various trading partners becomes available at different times, for instance:

— product specific information at the point of manufacture or packaging;

— order processing information at the time of processing the order;

— transport information at the time of shipment.

Trading partners may find it necessary to include significant data elements dealing with the above that may be presented both in bar code/two-dimensional symbols (see Annexes A and B) and human readable form.

This International Standard shall be used in conjunction with application guidelines defining the parameters chosen by the trading partners concerned. Annex C gives guidance in the definition of these parameters.

4.2 Unit load and transport package

For the purposes of this International Standard, a unit load is considered to be one or more transport packages or other items held together by means such as a pallet, a slip sheet, strapping, interlocking, glue, shrink wrap or net wrap, making them suitable for transport, stacking and storage as a unit. For the purposes of this International Standard, a transport package is considered to be a package intended for the transportation and handling of one or more articles, smaller packages or bulk material. Both unit loads and transport packages are referred to as transport units in this document.

4.3 Unique transport unit identifier

A unique transport unit identifier is assigned to each individual transport unit. This is a common requirement for all label formats specified by this International Standard. The identifier or “licence plate” is the key providing access to information stored in computer files and which may be transmitted by EDI. The identifier may be used by all of the trading partners to retrieve information about the transport unit itself or about the status of the physical movement of the transport unit along the supply chain. It enables systems to track and trace individual transport units.

4.4 Label formats

4.4.1 Base shipping/transport/receiving label

The base label defined by this International Standard includes the minimum set of data that fulfils the requirements of all trading partners in a supply chain when data is exchanged electronically between the parties involved.

A unique transport unit identifier shall be, and a “Ship to” name and address should be, included on the base label.

In addition to the unique transport unit identifier (“licence plate”) and the “Ship to” name and address (for shipment delivery), the following information should be included on a base label:

— “Ship from” name and address (to be able to return the shipment in the event that delivery is not possible);

— key to carrier’s database (if the licence plate is not this data element);

— key to customer’s database (if the licence plate is not this data element).

4.4.2 Extended shipping/transport/receiving label

In practice, fully automated communication channels which make it possible to rely exclusively on electronic files for retrieving information on the movements of the transport units are not always available. For this reason, there is a need to indicate relevant information on the transport units themselves, in addition to their identification. The various fields of information shall be organized in a standard way in order to facilitate their interpretation and processing by the trading partners involved.

The extended label is used when the data available from the base label is not sufficient to satisfy the requirements of all trading partners. The information provided in the extended label is organized in three segments:

— carrier segment: in addition to the key to the carrier’s database, this segment may contain additional data, such as shipment identification and delivery instructions;

— customer segment: in addition to the pointer to the customer's database, this segment may contain additional data such as the customer part number;

— supplier segment: additional data may be generated by the supplier, such as product identification, batch number, dimensions.

5 Data content

5.1 Data representation

5.1.1 Data in linear bar code symbols

Such data shall be represented in one of the three permissible combinations of data and bar code symbology:

a) GS1 Application Identifiers (AIs) in accordance with ISO/IEC 15418 shall only be used in conjunction with GS1-128 (being a subset of Code 128 compliant with ISO/IEC 15417);

b) ASC MH10 Data Identifiers (DIs) in accordance with ISO/IEC 15418 shall be used in conjunction with Code 39 symbols compliant with ISO/IEC 16388;

c) ASC MH10 Data Identifiers (DIs) in accordance with ISO/IEC 15418 shall be used in conjunction with Code 128 symbols compliant with ISO/IEC 15417.

Refer to Annex D for information on the use of the options and the issues for users encountering them.

5.1.2 Data in two-dimensional symbols

Information may also be provided in two-dimensional symbols as mutually agreed upon between trading partners. Data syntax in two-dimensional symbols shall be in accordance with ISO/IEC 15434.

5.1.3 Data in human readable form

The human readable interpretation of information presented in linear bar code form should be provided. Some information may be presented in human readable form only (see 6.3).

5.2 Data elements

5.2.1 Unique transport unit identifier

A unique transport unit identifier shall be assigned to each individual transport unit.

The unique transport unit identifier shall be either

— the serial shipping container code (SSCC) that uses AI "00", represented in GS1-128, or

— the unique transport unit identifier using the ASC MH10 Data Identifier "J" or one of the DIs "1J" through "6J" represented in either Code 39 or Code 128.

The unique transport unit identifier is defined in ISO/IEC 15459-1. The unique transport unit identifier

a) starts with the issuing agency code (IAC), assigned to the issuing agency by the registration authority,

b) conforms to a format specified by the issuing agency,

c) is unique in the sense that no issuer re-issues a number until a sufficient period of time has passed that the first number has ceased to be of significance to any user of this International Standard,

d) contains only numeric and upper case alphabetic characters (not including lower case characters or punctuation marks),

e) does not contain more than 20 characters, and

f) does not contain more characters than specified in Table 1.

5.2.2 Ship to

The “Ship to” data element refers to the address of the party to which transport units are to be delivered. When used, it shall be represented in a maximum of five lines of human readable characters comprised of no more than 35 alphanumeric (an..35) characters each. It may also be represented by a number identifying the party, in human readable or in bar code format.

5.2.3 Ship from

The “Ship from” data element refers to the address of the party to which transport units are to be returned, in case the shipment was unable to be delivered. When used, it shall be represented in a maximum of five lines of human readable characters comprised of no more than 35 alphanumeric (an..35) characters each. It may also be represented by a number identifying the party, in human readable or in bar code format.

5.2.4 Key to carrier's database

The key to the carrier's database should be mutually agreed upon with the carrier. If the unique transport unit identifier described in 5.2.1 does not provide the key to the carrier’s database, one or more of the following keys may be used:

— the carrier tracking number that includes class of service;

— the carrier code to identify the shipment;

— the carrier code to identify the transport unit.

This data element may be included within a two-dimensional symbol, a linear bar code symbol or both.

5.2.5 Key to customer's database

The key to the customer’s database should be mutually agreed upon with the customer. If the unique transport unit identifier described in 5.2.1 does not provide the key to the customer's database, one or more of the following keys may be used:

— customer’s purchase order number;

— part number;

— KANBAN/pull signal number;

— shipment ID.

This data element may be included within a two-dimensional symbol, a linear bar code symbol or both.

5.2.6 Other data elements

As much additional data as required may be included in the extended label to fulfil the needs of the supplier, carrier and customer.

5.3 Concatenating data fields in linear bar code symbols

5.3.1 Using Application Identifiers

When several AIs and their data are concatenated into one GS1-128 symbol, each variable length field shall be followed by the FNC1 (Function 1) character, unless it is the last field encoded in the symbol. The FNC1 character used for this purpose assumes a value of $^{G}_{S}$ when transmitted by the decoder.

5.3.2 Using Data Identifiers

When several DIs and their data are concatenated into one Code 39 or Code 128 symbol, each field shall be followed by a plus symbol, "+", unless it is the last field encoded in the symbol.

5.4 Structured data files

Structured data files, such as documentation supporting the handling of the transport units or complete EDI messages, may be included, for example delivery note, quality certificate, insurance certificate. High capacity two-dimensional symbols shall be used to represent this data. Structured data files shall comply with the syntax described in ISO/IEC 15434.

6 Data carriers

6.1 Linear bar code symbols

6.1.1 Symbology

The linear bar code symbologies shall be one of the following:

— "Code 39" in accordance with ISO/IEC 16388;

— "Code 128" in accordance with ISO/IEC 15417.

NOTE "GS1-128" is a subset of "Code 128".

6.1.2 Symbol height

The minimum bar height of a bar code symbol shall be 12,7 mm.

6.1.3 Narrow element dimension

The minimum narrow element dimension (x-dimension) shall not be less than 0,25 mm. The x-dimension for Code 39 and Code 128 symbols should be in the range of 0,25 mm to 0,43 mm, as determined by the printing capability of the supplier/printer of the label. The x-dimension for GS1-128 symbols should be in the range of 0,25 mm to 0,81 mm, as determined by the printing capability of the supplier/printer of the label. The x-dimension for GS1-128 SSCC symbols should be in the range of 0,50 mm to 0,81 mm, as determined by the printing capability of the supplier/printer of the label.

In the case that fewer characters than specified in Table 1 are required, a larger x-dimension may be used as long as the bar code print quality requirements specified in 6.1.8 and label width recommendations are met.

NOTE Symbols with the x-dimension at the lower end of this range, specifically 0,25 mm to 0,33 mm, may require special care in order to meet the quality requirements.

6.1.4 Wide-to-narrow ratio for “Code 39” symbols

The wide-to-narrow ratio (N) of elements of “Code 39” symbols should be 3,0:1. The measured ratio shall be between 2,4:1 and 3,2:1.

6.1.5 Quiet zones

Linear bar code symbols should be printed with leading and trailing quiet zones not less than 6,4 mm. Where the x-dimension is greater than 0,64 mm the quiet zones shall not be less than $10x$. The label registration parameters of the printer being used should be taken into consideration in order to ensure the minimum quiet zones.

6.1.6 Orientation

Linear bar code symbols should be presented on transport units with the bars vertical (picket fence orientation). Subject to agreement between trading partners, bars may be presented horizontally (ladder orientation).

Linear bar code symbols should be presented on transport units with the bars perpendicular to the longitudinal axis (ladder orientation) when marked on a tightly curved surface (tubes, rods, cylinders).

6.1.7 Placement

Linear bar code fields should be placed to ensure that they do not interfere with each other when scanned.

No more than two linear symbols should appear side by side on a label. If two linear symbols are placed side by side, the symbols should be placed so that they will not be in the same horizontal scan path so as to reduce the possibility of interference with successful bar code scanning.

6.1.8 Linear bar code symbol print quality

The quality of the printed linear bar code symbol shall be measured in accordance with ISO/IEC 15416. The minimum symbol grade shall be 1,5/10/660 where

— minimum print quality grade at point of production = 1,5 (C),

— measurement aperture = 0,250 mm (reference number 10), and

— inspection wavelength = 650 nm to 670 nm.

It is important that the linear bar code be decodable throughout the system of use. For this reason, quality tests should not be limited to label production inspection but should also be followed through to the end use. The above symbol quality and measurement parameters ensure scannability over a broad range of scanning environments. Labellers should not be required to guarantee the print quality of a label when it is received by the customer. Print quality at the point of production should be higher than the requirement at the point of use.

Unattended scanning may require a higher print quality grade than identified above. Consequently, those implementing this International Standard for unattended scanning applications should discuss print quality requirements with trading partners.

6.2 Two-dimensional symbols

Within this International Standard, linear bar code symbols serve as the default symbology. The use of two-dimensional symbols and the specific two-dimensional symbol to be used shall be mutually agreed upon between trading partners. Users should ensure that the scanning technology they select is capable of reading the symbols they choose to read.

If more data than can be accommodated with a linear bar code is required to be encoded on the label in optically readable symbol(s), two-dimensional symbols may be used. This International Standard recommends either “MaxiCode” in accordance with ISO/IEC 16023 or “QR Code” in accordance with ISO/IEC 18004, subject to trading partner agreement (shippers, carriers, consignees), for carrier sortation and tracking applications and “PDF 417” in accordance with ISO/IEC 15438 or QR Code for other applications covered by this International Standard.

Linear bar code symbols and the PDF417 symbology can be read by either 2D-capable imaging or 2D-capable laser scanning technologies. QR Code and MaxiCode require 2D-capable image scanning technology.

For further information and guidance on the use of two-dimensional symbols, see Annex A, B.2, B.3, Annex G, and Annex H.

6.3 Human readable information

6.3.1 Human readable interpretation

In order to provide a fall-back key entry and a diagnostic, a human readable interpretation of each linear bar code symbol shall be provided adjacent to the bar code. Such human readable interpretation shall represent the encoded data. See Figure E.9.

6.3.2 Human translation

In addition to the human readable interpretation, human translation of linear bar code information may be provided in a separate section of the label. See Figure E.9.

6.3.3 Data area titles

Data areas comprise information in bar code or human readable form. Data areas shall be identified with the corresponding data area title in human readable text, which may be prefixed, if relevant, by the appropriate AI or DI. A data area title is not required when a data area contains

— a single linear bar code symbol concatenating multiple data elements, or

— multiple linear bar code symbols that are intended to be scanned in a single data capture operation, or

— two-dimensional symbols.

6.3.4 Free text and data

Human readable information that is not a translation of the bar code information may be provided according to the requirements of the trading partners.

6.3.5 Choice of language

6.3.5.1 Applicability

Choice of language is applicable to human translation, data area titles and free text.

6.3.5.2 Domestic shipments

Human-readable information within a single country should be in the national language of that country.

6.3.5.3 Export shipments

Shipments for export should have human-readable information in the language(s) mutually agreed upon between trading partners.

6.3.5.4 Multiple languages

Regulations may require multiple languages on the shipping label.

7 Label design

7.1 General considerations

The linear bar code representing the unique transport unit identifier (“licence plate”), a mandatory element for this International Standard, shall be printed in the lowest area of the label.

Label segments are logical groupings of information based on the data needs of the trading partners within the distribution channel. Three segments are defined: carrier segment, customer segment and supplier segment. Label segments may or may not be printed at the same time on a single physical label. When the size and structure of the transport unit permits, segments should be stacked vertically, from top to bottom, in the following order:

— carrier segment;

— customer segment;

— supplier segment.

Examples of labels are provided in Annex E. The labels shown in Annex E are for illustration only and do not represent all of the possible choices of label designs.

Separate sections of the label may be applied at different stages to form the complete label.

7.2 Layout

7.2.1 Base label layout

In addition to the unique transport unit identifier, a typical base label may include the following data areas:

— “Ship from” address, human readable;

— “Ship to” address, human readable;

— “Ship to” postal code or location number, linear bar code;

— carrier shipment tracking number (if required), linear bar code;

— customer purchase order number (if required), linear bar code.

Only linear bar codes shall be used to represent data in a machine-readable form on a base label.

The “Ship to” address shall be located below or to the right of the “Ship from” address. “Ship from” characters shall be noticeably smaller than the “Ship to” characters and the fields shall be easily distinguishable. All international shipments shall conform to this requirement.