INTERNATIONAL STANDARD

ISO 15394

Second edition
2009-04-15

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

Reference number
ISO 15394:2009(E)

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

COPYRIGHT PROTECTED DOCUMENT

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 ... iv
Introduction ... v
1 Scope ... 1
2 Normative references ... 1
3 Terms and definitions ... 2
4 Concepts ... 2
5 Data content ... 4
6 Data carriers ... 6
7 Label design ... 9
8 Label placement ... 13
Annex A (normative) **Procedures for using MaxiCode** ... 15
Annex B (normative) **Procedures for using PDF417** ... 18
Annex C (informative) **Issues to consider in the drafting of application guidelines or standards conforming to this International Standard** ... 28
Annex D (informative) **The impact of systems being confronted with multiple symbologies and formats** ... 30
Annex E (informative) **Label examples** ... 34
Annex F (informative) **Label locations** ... 45
Annex G (normative) **Procedures for using QR Code in carrier sortation and tracking applications** ... 47
Annex H (normative) **Procedures for using QR Code in shipping and receiving applications** ... 49
Bibliography ... 55

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.

For shipments within a single country and where that country has a national standard recommending an alternative label layout, e.g. where “Ship from” address and “Ship to” address are reversed, such alternative label layout may be used with the agreement of the trading partners.

7.2.2 Extended label layout

The extended label comprises more information than the base label. In addition to the information contained in the base label, the extended label may include

— linear bar codes representing other discrete data elements,

— linear bar codes representing concatenated data elements,

— two-dimensional symbols,

— human translation of linear bar code information,

— human-readable-only information, and

— graphics.

7.2.3 Other data

This International Standard does not supersede or replace any applicable safety or regulatory marking or labelling requirements. This International Standard is to be applied in addition to any other mandated labelling requirements. Free areas or certain graphics, such as safety, hazard, quality signs or logos could be required.

7.3 Label dimensions

7.3.1 General considerations

The size of the label shall be consistent with the data requirements of all trading partners in the supply chain with the only constraint being the size of the transport unit.

The label format described does not dictate a fixed size for the total label. The physical dimensions of the label shall be determined by the labeller. Considerations for label size selection may include the amount of data to be printed, the physical characteristics of the printing equipment used or the size of the transport unit.

7.3.2 Label height

The height of the label shall be determined by the labeller.

7.3.3 Label width

The width of the label shall be determined by the labeller. Label width is determined by the x-dimension of the printed bar code symbol and the maximum bar code message length. Table 2 shows the correlation between x-dimension and label width for selected x-dimensions, using the data limits set forth in Table 1.

Some existing industry standards have other data limits. If a trading partner needs a single Code 39 bar code data field that contains more characters than specified in Table 1, the labeller may choose to use a wider label stock or an x-dimension at the lower limits of this International Standard.

7.3.4 Data limits

Limits on the number of characters which can be required of the labeller for a single bar code symbol are shown in Table 1.

Table 1 — Maximum character limits for linear symbols

Symbology and format	Character limits
Code 128 (numeric)	50 digits (after a single-character DI)
Code 128 (alphanumeric)	27
GS1-128 (all numeric)	48
GS1-128 (alphanumeric)	26
Code 39	19
NOTE 1 For GS1-128, the character count includes all characters between the Function 1 (FNC1) character and the symbology check character.	
NOTE 2 For Code 39, character count includes all characters between the start and stop characters.	

Table 2 — Recommended label widths for symbol, maximum characters and x-dimension

Dimensions in millimetres

x-dimension	**Code 39**	**Code 128** all numeric	**Code 128** alphanumeric	**GS1-128** SSCC	**GS1-128** all numeric	**GS1-128** alphanumeric
	19	50 (single DI)	27	20 exactly	48	26
0,25	105	105	105	Not recommended	105	105
0,33	148	148	148		148	148
0,38	148	148	148		148	148
0,43	over 148	148	over 148		over 148	over 148
0,50		Not recommended		105	over 148	over 148
0,66				148	over 148	over 148
0,76				148	over 148	over 148
0,81				over 148	over 148	over 148

NOTE 1 This table is intended to provide guidance to the printer/applier of a label on the size of label stock needed to accommodate the maximum character limits as stated in Table 1.

NOTE 2 This label width guidance is based on only two label sizes, 105 mm and 148 mm.

NOTE 3 Included in the minimum label width calculations in this table are the following:

- symbology start and stop characters, 2,54 mm print registration and quiet zones of 6,4 mm or 10 times the bar code symbol x-dimension, whichever is greater;
- for GS1-128 symbols, Function 1 character (FNC1) and symbology check character;
- for Code 39 symbols, a 3:1 wide to narrow ratio and one x-intercharacter gap;
- for Code 128 symbols, the symbology check character.

NOTE 4 GS1-128 SSCC bar code symbols have minimum x-dimensions greater than 0,432 mm. In order to fit on a label size of 102 mm, this symbol should be printed at the smallest x-dimension specified in the GS1 specifications.

7.4 Text size

7.4.1 General considerations

The height of text characters is associated with the number of characters that can be required on a single line.

Nine sizes may be specified for text. The exact character heights corresponding to the nine text sizes shall be chosen by the labeller based on the capabilities of the printing process.

The characters shall be clearly legible.

Table 3 shows the maximum number of text characters per line that can be required of a labeller.

Table 3 — Character heights and character limits

Approximate character height (mm)	**Character limits for full-width label** [a] (number of characters)
25,4	8
12,7	18
8,4	28
6,4	34
5,1	42
4,3	48
3,6	59
3,2	68
2,5	77

[a] Calculations for the text character count limits are based on the following assumptions: a 102 mm wide label segment, clear distinction between the character sizes used, and fixed-width characters.

7.4.2 Specific text dimensions

The specific heights of the text characters shall be as follows:

— the data area titles shall be no smaller than 2,5 mm;

— the “Ship from” address shall be no smaller than 2,5 mm and in any case shall be smaller than the “Ship to” address text;

— the “Ship to” address shall be no smaller than 4,3 mm and in any case shall be larger than the “Ship from” address text;

— the literal translation of the associated linear bar code symbol [also known as human readable interpretation (HRI)] shall be no smaller than 2,5 mm;

— the primary human readable information (also known as human translation) shall be no smaller than 5,1 mm;

— the secondary human readable information (also known as text or descriptive information) shall be no smaller than 2,5 mm.

7.5 Material

Label material and the method of attaching the label to the transport unit shall be selected such as to ensure that the label

— remains attached to the transport unit for the intended life of the label,

— remains readable for the life of the label,

— survives the environments for the life of the label, for example contamination, heat, light, moisture, and

— meets disposability requirements.

8 Label placement

8.1 General considerations

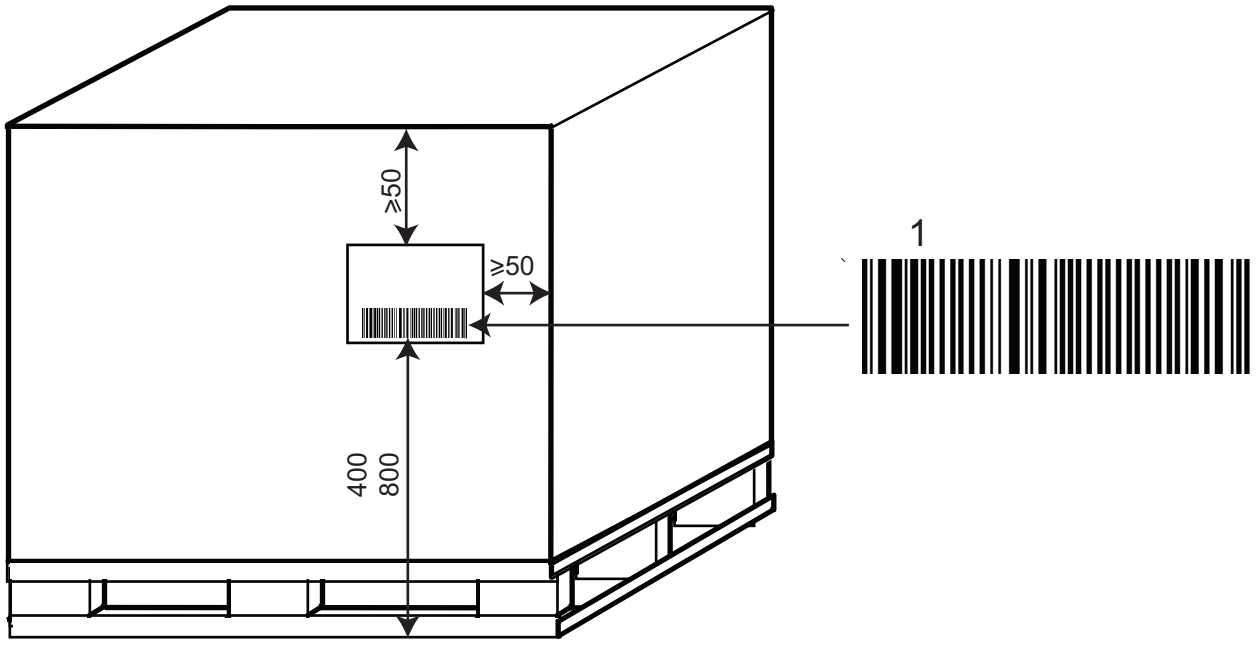
Labels should be affixed at a suitable location where there is a minimum risk of damage. Labels should be placed on the side of the transport unit with the human readable information parallel to the natural bottom of the transport unit. The edge of the label(s) should be a minimum of 32 mm from any transport unit edge.

Transport units should have identical labels affixed on two adjacent sides. Parcel carriers may require the placement of carrier information on the top of a transport unit, in addition to customer and supplier information which would continue to be placed in accordance with the preceding paragraph.

8.2 Unit loads (pallets)

Each pallet shall have at least one bar code label. The label shall be placed right of centre on a vertical face, allowing a minimum of 50 mm from either edge. The label should not be placed over a seam nor should sealing tape or bands be placed over the label in a manner that interferes with the scanning of the label. The bottom edge of the unique transport unit identifier symbol should be within the range of 400 mm to 800 mm from the bottom of the pallet. If the pallet is less than 500 mm in height, the label should be placed as high as possible on the pallet. See Figure 1.

Dimensions in millimetres



Key

1 unique transport unit identifier

Figure 1 — Pallet label location

8.3 Transport packages

For transport packages up to 1 m in height, the target placement for the unique transport unit identifier symbol is 32 mm from the natural bottom of the package. Transport packages greater than 1 m in height should follow the recommendations of 8.2.

8.4 Other transport units

Annex F provides examples of the labelling of various transport units. Label placement requirements should be developed in conjunction with specific application guidelines.

Annex A
(normative)

Procedures for using MaxiCode

A.1 Carrier sortation and tracking applications

Carrier sortation is the process in which transport units are routed between two or more points. Carrier tracking is the process by which the location of unit loads and transport units being transported by a carrier is updated in the carrier's database.

Data to be included comprises that which is required to route transport units between multiple points, to locate transport units, and other supporting data that is relevant to sortation and/or tracking for internal and external processing.

When a two-dimensional symbol is used for the carrier sortation and tracking applications, the MaxiCode symbology (see ISO/IEC 16023) is capable of being read in a high-speed scanning environment. The structure and syntax of the MaxiCode symbols for the carrier sortation and tracking applications shall conform with the structure and syntax given in ISO/IEC 15434.

A.2 Data encoding

A.2.1 Code set

When encoding information in a MaxiCode symbol, it is recommended that character selection be limited to Code Set A where possible (see ISO/IEC 16023).

A.2.2 Mode

A MaxiCode symbol incorporates one mode per symbol. This International Standard recommends the use of MaxiCode Mode 2 or Mode 3, to ensure that the sortation system can decode the "Ship to" postal code, "Ship to" country code and class of service in the event of symbol damage (see ISO/IEC 16023).

The determination of which mode to use is established by the data characteristics of the "Ship to" postal code and class of service. Table A.1 determines the appropriate mode.

Table A.1 — Determining which MaxiCode mode to use

If the "Ship to" postal code is	*and the class of service is*	*then use*
numeric-only maximum of 9 digits	numeric-only	Mode 2
alphanumeric maximum of 6 characters	numeric-only	Mode 3
other than above	numeric-only	Mode 4
any of the above	alphanumeric	Mode 4

A.3 Error correction levels

MaxiCode has fixed levels of error correction. The MaxiCode symbol should use the standard error correction level identified within ISO/IEC 16023.

A.4 Narrow element dimension

MaxiCode is not a scalable symbol (supporting different x-dimensions). The MaxiCode symbol shall have an x-dimension (the width of a symbol module) and all other dimensions as defined in ISO/IEC 16023. Each symbol, including the quiet zone, is of a fixed physical size nominally 28,14 mm wide $\times$ 26,91 mm high.

A.5 Quiet zones

For the carrier and sortation application, the MaxiCode symbol shall have a minimum quiet zone of 1 mm above, below, to the left and to the right.

A.6 MaxiCode symbol print quality

ISO/IEC 15415 shall be used to determine the print quality of the MaxiCode symbol. For carrier sortation and tracking applications, the minimum symbol grade shall be 2,5/10/W, defined as follows:

— an overall symbol grade greater than or equal to 2,5 (B) at the point of production;

— a measurement aperture equal to 0,25 mm diameter (reference number 10);

— a broad band light source.

The above symbol quality and measurement parameters ensure scannability over a broad range of scanning environments. Labellers might not be able to guarantee the print quality of a label when it is received by the customer. Therefore, the print quality requirement at the point of production should be higher than the requirement at the point of use.

A.7 Orientation and placement

A.7.1 MaxiCode orientation

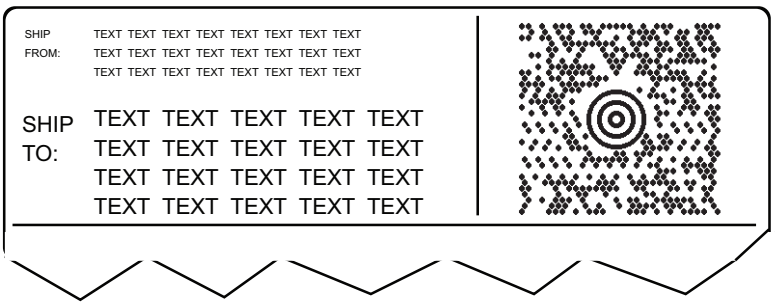
Due to the nature of the MaxiCode symbology, specific symbol orientation is not required.

A.7.2 Symbol placement

If the symbol is included in an “ISO label”, the MaxiCode symbol shall be placed in the carrier segment. See Figure A.1 for an example of placement.

A.7.3 Label placement

Labels shall be placed on the top transport units.



NOTE This figure is not to scale.

Figure A.1 — Placement of MaxiCode symbol on label

A.8 Concatenation

A.8.1 Use of structured append MaxiCode symbols

If the data message is greater in length than the maximum amount of data that can be encoded in a single MaxiCode symbol, two structured append symbols shall be used as follows. As this International Standard recommends the use of Modes 2 and 3, structured append symbols shall be as defined in ISO/IEC 16023 and particularly

— the primary message shall be repeated in both symbols,

— the structured append indicator sequence shall be placed in the first two data symbol characters in the secondary message, and

— the continuation of the data message shall be in the secondary message of the second symbol.

A.8.2 Printing structured append MaxiCode symbols

Printing systems should be configured in such a manner that when the amount of data to be encoded in a single message for a carrier and sortation application exceeds the capacity of a single symbol, the printing system shall automatically use structured append.

The symbols shall be printed side by side.

A.8.3 Reading structured append MaxiCode symbols

When structured append is used with Mode 2 and Mode 3 symbols, the primary message may be decoded from any of the symbols in the structured append sequence.

The entire message shall be reconstructed as defined in Annex B of ISO/IEC 16023:2000.

Annex B
(normative)

Procedures for using PDF417

B.1 General considerations

This annex gives requirements that shall be followed if one or both of the following is mutually agreed as part of the customer information:

— shipping and receiving data (B.2) that effectively allows all the bar-coded data on the label to be combined in one PDF417 symbol;

— complete EDI message/transaction (B.3) to be encoded in PDF417 symbol(s).

B.2 Shipping and receiving applications

B.2.1 General

The shipping and receiving data facilitates staging, transportation and receipt of goods and materials. This data shall be printed on a “label” as defined by this document. This symbol is intended to be scanned in the same environment as other symbols on the label. The structure and syntax of the PDF417 symbols for shipping and receiving applications shall conform with the structure and syntax given in ISO/IEC 15434.

B.2.2 Symbology recommendation

This International Standard recommends the use of the PDF417 symbology (see ISO/IEC 15438) for shipping and receiving applications.

For shipping and receiving applications, compact PDF417 as defined in the ISO/IEC 15438 shall not be used.

For shipping and receiving applications, macro PDF417 as defined in ISO/IEC 15438 shall not be used.

For shipping and receiving applications, a MicroPDF417 symbol as defined in ISO/IEC 24728 shall not be used.

B.2.3 Error correction level

For shipping and receiving applications, PDF417 symbols shall use error correction level 5.

B.2.4 Narrow element dimension

For shipping and receiving applications, the narrow element dimension (x-dimension) range should be from 0,254 mm to 0,432 mm as determined by the printing capability of the supplier/printer of the label. Symbols with narrow elements at the lower end of this range, i.e. 0,254 mm to 0,330 mm, may require special care to meet the print quality requirements of B.2.8. Conformance to the print quality requirements shall be determined according to B.2.8.

B.2.5 Row height

The PDF417 symbol shall have a minimum row height (height of the symbol element) of three times the width of the narrow element (x-dimension). Increasing the row height may improve scanning performance but reduces the number of characters that can be encoded in a given space.

B.2.6 Quiet zone

For shipping and receiving applications, the PDF417 symbol shall have a minimum quiet zone of 1 mm above, below, to the left and to the right. The quiet zone is included within the calculation of the size of the symbol.

B.2.7 Symbol size

For shipping and receiving applications, PDF417 symbols shall not exceed 61 mm in height including quiet zones.

A PDF417 symbol for shipping and receiving applications should be printed with no more than 12 data columns in width. This ensures readability by the broadest range of reading devices. Up to 18 data columns may be used only with the agreement of trading partners. Table B.1 shows the width of PDF417 symbols (including quiet zones) with 12 data columns at different x-dimensions. For further information on data columns, symbol widths, character counts and print densities, see B.4.2 and B.4.3.

Tables B.2 to B.8 are provided as guidance in planning for the incorporation of PDF417 symbols into the design of an “ISO label”. Actual achieved size of a PDF417 symbol may vary, based on data content and printing process. The sizes listed should accommodate most situations.

Table B.1 — Maximum symbol width using 12 data columns

x-dimension (mm)	**Maximum width** (including quiet zones) (mm)
0,25	71,37
0,33	92,20
0,38	106,17
0,43	119,89

B.2.8 Print quality

ISO/IEC 15438 shall be used to determine the print quality of the PDF417 symbol. For shipping and receiving applications the minimum symbol grade should be 2,5/10/660, where

— recommended print quality grade = 2,5 (B) at the point of printing the symbol,

— measurement aperture = 0,250 mm (approximately 10 mil/0,010 inch), and

— light source wavelength = 650 nm to 670 nm.

The above symbol quality and measurement parameters assure 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. Therefore, the print quality requirement at the point of production should be higher than the requirement at the point of use.

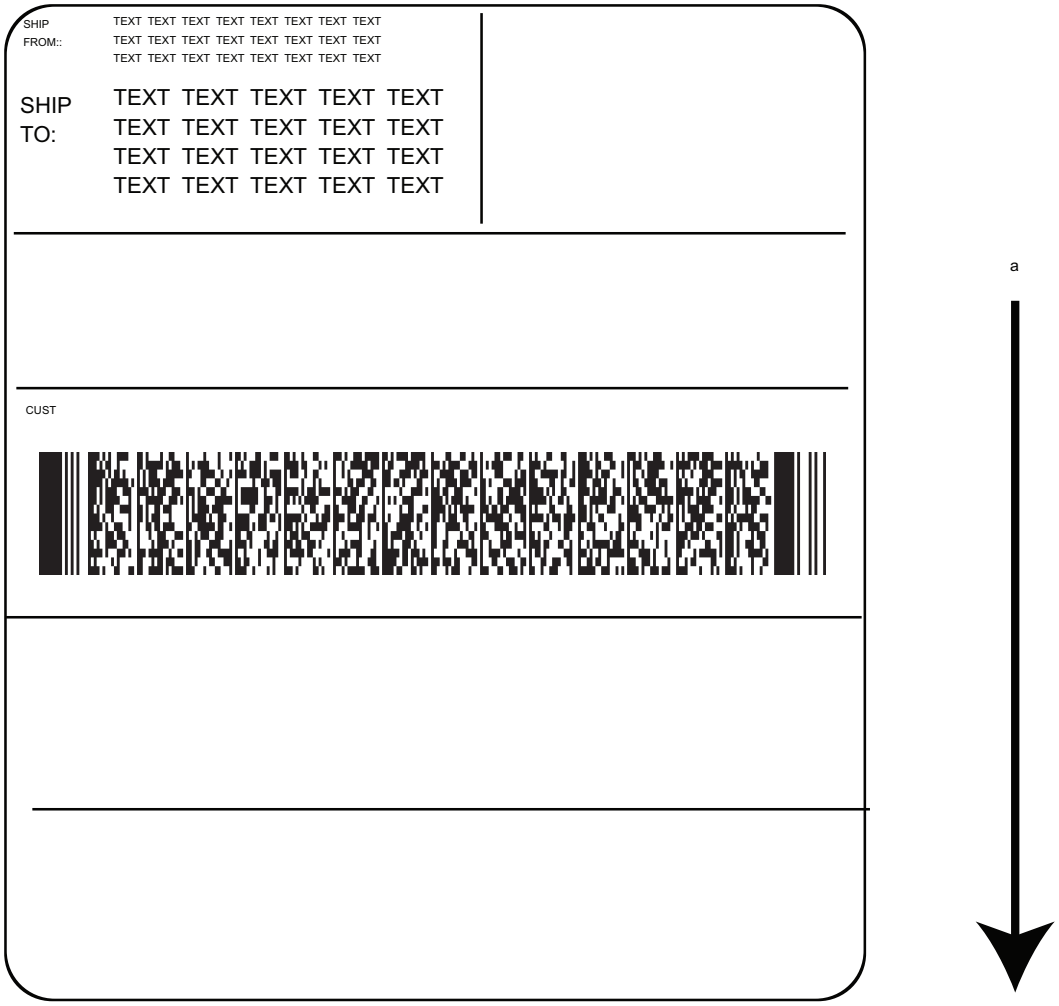
B.2.9 Orientation and placement

B.2.9.1 PDF417 orientation

The bars of the PDF417 symbol shall be perpendicular to the natural bottom of the label (see Figure B.1).

B.2.9.2 Label placement

Labels shall be placed on packages as specified in Clause 8.



a Direction of the natural bottom of the container.

NOTE This figure is not to scale.

Figure B.1 — Orientation of PDF417 symbol on label

B.3 Supporting documentation application

B.3.1 General

The shipping, transportation and receiving of transport units often requires supporting documentation data such as bill of lading, manifest, packing slip, customs data or information that may also be transmitted by EDI. This data is not intended to be printed on a “label”. This data is not intended to be scanned in the same

environment as data on a label. The application considered in this category involves the encoding of data in two-dimensional symbols in support of the shipping, receiving and transportation sortation and tracking.

B.3.2 Symbology recommendation

This International Standard recommends the use of PDF417 symbology (see ISO/IEC 15438 for the supporting documentation applications). The structure and syntax of the PDF417 symbols for the supporting documentation application shall conform with the structure and syntax given in ISO/IEC 15434.

B.3.3 Error correction levels

For the supporting documentation application, PDF417 symbols shall use error correction level 5.

B.3.4 Narrow element dimension

This International Standard recommends, for the supporting documentation application, the use of a PDF417 symbol with an x-dimension of 0,254 mm.

B.3.5 Row height

The PDF417 symbol should have a row height (height of the symbol element) three times the width of the narrow element (x-dimension).

B.3.6 Quiet zones

For the supporting document application, the PDF417 symbol shall have a minimum quiet zone of 1 mm above, below, to the left and to the right.

B.3.7 Print quality

ISO/IEC 15438 and ISO/IEC 15415 shall be used to determine the print quality of the PDF417 symbol. For the supporting documentation application, the minimum symbol grade shall be 2,5/06/660, where

— recommended print quality grade = 2,5 (B) at the point of printing the symbol,

— measurement aperture = 0,150 mm (approximately 6 mil/0,006 inch), and

— light source wavelength = 650 nm to 670 nm.

In those applications where an aperture size of 0,125 mm (approximately 5 mil/0,005 inch) is being used to verify other symbols, the 0,125 mm aperture may be used for PDF417 symbols.

B.3.8 Orientation and placement

B.3.8.1 Orientation

All PDF417 symbols shall have the same orientation. The bars of the PDF417 symbol shall be oriented such that they are perpendicular to the natural bottom of the page. For the supporting documentation application, symbol skew shall not be more than ± 5°.

B.3.8.2 Placement

All PDF417 symbols for the supporting documentation application shall be placed so that they are clear of any folds or creases in the document itself.

NOTE Since the document can be folded after printing, tests will help determine appropriate symbol locations.

B.3.9 Concatenation of symbols

B.3.9.1 General

For the supporting documentation application, the macro PDF417 version of the PDF417 symbology, as defined in ISO/IEC 15438, shall be used to encode data messages that are greater in length than the maximum amount of data that can be encoded in a single PDF417 symbol.

B.3.9.2 Planning for large messages

When designing an application that encodes large amounts of data, consideration shall be given to the amount of data to be encoded in a single message. If it is anticipated that a single data message, including formatting characters, can exceed approximately 1 500 alphanumeric characters, planning shall be done to ensure that all the concatenated symbols that constitute the entire macro PDF417 message be read in a single scanning sequence. Scanning an intervening symbol, either linear or two-dimensional symbols, breaks the scanning sequence and can give unpredictable results.

B.3.9.3 Printing concatenated symbols

Printing systems should be configured in such a manner that, when the amount of data encoded in a single message for a supporting documentation application exceeds the capacity of a single symbol, the printing system should either automatically use, or be configurable to use, macro PDF417. The macro PDF417 control block should include the optional segment count field in addition to the mandatory fields to enable the macro PDF417 symbols to be scanned in either a buffered or unbuffered mode.

B.3.9.4 Reading macro PDF417 symbols

To read macro PDF417 symbols properly, the transmission protocol of the decoder shall comply with macro PDF417 as defined in Annex H of ISO/IEC 15438:2006. The decoder shall be capable of fully supporting the symbology identifier options for PDF417.

The symbols may be transmitted in the buffered or unbuffered mode.

The data in each symbol shall be preceded by the symbology identifier “]L1”. This header signifies that escape and sequence characters have been inserted into the message by the reader and shall be handled by the application program. The application program shall then recognize the symbology identifier, interpret escape characters and reassemble the original message. The exact content of the escape and sequence characters, their usage and the structure of macro PDF417 is defined in ISO/IEC 15438.

B.4 Considerations when printing PDF417 symbols

B.4.1 General

When printing PDF417 symbols compliant with this International Standard, several factors shall be considered. All of these factors shall be used to determine which PDF417 options to use. These considerations include

— data requirements,

— scanner technologies,

— label area requirements, and

— printer technologies.

Developers and users of PDF417 printing software should follow these guidelines when determining which PDF417 options should be used. Since no one solution is optimal, tradeoffs sometimes need to be made. These guidelines ensure that valid symbols are printed. In addition, they ensure that a user's scanning and printing requirements have been considered. The following considerations should be used with Table B.2.

B.4.2 Designing the label layout

B.4.2.1 Plan for the maximum amount of data

Determine the fields that will be required in the message and the maximum anticipated length of each field. Add the additional characters needed for formatting.

B.4.2.2 Plan for scanning equipment likely to be used

When choosing a space in which to encode a PDF417 symbol, it is important to consider the capabilities of the scanning equipment likely to be used.

EXAMPLE If the equipment has a maximum field of view of 76 mm, it would be impossible to read a symbol that is 100 mm wide, but the same data could fit in a taller configuration that is only 66 mm wide.

B.4.2.3 Plan for the maximum x-dimension(s) that may be used

When planning for the space required to place a PDF417 symbol on the label, the designer should plan for the largest x-dimension and the number of data columns that might be used in printing. These two factors essentially determine the width of the symbol.

Since the supplier/printer of the label ultimately determines the x-dimension at which the symbol will be printed, it is possible that a PDF417 symbol printed for a shipping and receiving application could be printed at any x-dimension from 0,254 mm to 0,432 mm. The capability of the printing equipment being used will determine the possible choices of x-dimension.

This International Standard recommends that PDF417 symbols for shipping and receiving applications be printed with no more than 12 data columns (see Figure B.2), unless otherwise agreed by all trading partners involved. This limitation, combined with the amount of space allocated for the symbol on the label, may influence the choice of x-dimension for printing the symbol.

The encoded data is given in Table B.2 contained within the data columns.

B.4.2.4 Find the appropriate size in the tables

Table B.2 gives the approximate width of PDF417 symbols having heights of 2 cm and 4 cm, up to the stated number of alpha-numeric characters, using x-dimensions of 0,43 mm, 0,38 mm, 0,33 mm and 0,25 mm. In Table B.2, find the maximum x-dimension that is anticipated for the application, then find the number of characters that represents the maximum size. The sizes are an approximation; actual sizes may vary based on factors including the compaction algorithm and the nature of the data to be encoded.

If the space available does not accommodate the initial character count, one option is to consider reducing the character count.

Table B.2 — Symbol width and character count for PDF417 symbols

Number of characters	*x*-dimension 0,43 mm		*x*-dimension 0,38 mm		*x*-dimension 0,33 mm		*x*-dimension 0,25 mm	
	Symbols 20 mm high	Symbols 40 mm high	Symbols 20 mm high	Symbols 40 mm high	Symbols 20 mm high	Symbols 40 mm high	Symbols 20 mm high	Symbols 40 mm high
50	83,31 mm	61,21 mm	73,66 mm	47,75 mm	58,42 mm	41,66 mm	41,15 mm	28,19 mm
100	105,16 mm	68,58 mm	80,26 mm	54,36 mm	64,01 mm	47,24 mm	45,47 mm	36,83 mm
150	119,89 mm	75,95 mm	93,22 mm	60,71 mm	75,44 mm	52,83 mm	49,78 mm	36,83 mm
200	134,62 mm	83,31 mm	106,17 mm	67,31 mm	86,61 mm	52,83 mm	54,10 mm	36,83 mm
250	149,35 mm	90,68 mm	119,13 mm	73,66 mm	92,20 mm	58,42 mm	62,74 mm	41,15 mm
300	164,08 mm	97,79 mm	132,08 mm	80,26 mm	103,38 mm	64,01 mm	67,06 mm	41,15 mm
400	200,66 mm	112,52 mm	157,99 mm	93,22 mm	125,98 mm	75,44 mm	80,01 mm	49,78 mm
500	230,12 mm	127,25 mm	183,90 mm	106,17 mm	142,75 mm	81,03 mm	88,65 mm	54,10 mm
750	310,90 mm	164,08 mm	248,67 mm	132,08 mm	187,71 mm	103,38 mm	118,87 mm	67,06 mm
1 000	391,41 mm	208,03 mm	313,44 mm	164,34 mm	238,25 mm	125,98 mm	144,78 mm	80,01 mm
1 250	472,19 mm	244,60 mm	371,60 mm	196,85 mm	282,96 mm	148,34 mm	175,01 mm	92,96 mm
1 500	560,32 mm	281,43 mm	436,37 mm	222,76 mm	333,50 mm	170,69 mm	200,91 mm	105,92 mm

The following assumptions are made:

— the width includes quiet zones;

— an error correction level 5.

B.4.3 Printing the symbol on the label

B.4.3.1 General

When printing a PDF417 symbol for a pre-defined “ISO shipping label”, the supplier/printer shall consider the amount of space allocated for the symbol.

B.4.3.2 Determine the *x*-dimension to be used

This International Standard recommends that PDF417 symbols for the shipping/receiving application be printed with no more than 12 data columns (see Figure B.2), unless otherwise agreed by all trading partners involved. This limitation, combined with the amount of space allocated for the symbol on the label, may influence the choice of *x*-dimension for printing the symbol. The capability of the printing equipment to be used shall determine the possible choices of *x*-dimension.

The encoded data is given in Figure B.2 contained within the data columns.

Key

1 left row indicator column
2 data columns
3 right row indicator column
4 start pattern
5 stop pattern

Figure B.2 — The anatomy of a PDF417 symbol

B.4.4 Determine the appropriate label size

Tables B.3 to B.8 show the approximate number of characters that can be accommodated by a PDF417 symbol. Within each table, use the height and approximate width combinations to determine the actual width, number of data columns and the estimated number of characters that can be accommodated. The sizes are an approximation; actual sizes may vary based on factors including the compaction algorithm and the nature of the data to be encoded. Error correction levels are defined as error correction level 5. For Tables B.3 to B.8, the approximate width in the top row of each table includes symbol quiet zones.

B.4.4.1 Symbols for labels having a width of up to 102 mm

Tables B.3 through B.6 illustrate at given x-dimensions and at various symbol widths, the number of data columns and the number of alphanumeric characters that can be encoded in PDF417 symbols where the symbols are assumed to be either 25 mm or 50 mm high.

Table B.3 — Approximate alphanumeric capacity of PDF417 symbols at specific widths and heights, x-dimension = 0,25 mm

Symbol height	Width 38,1 mm		Width 50,8 mm		Width 63,5 mm		Width 76,2 mm		Width 96,5 mm	
	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns
	36,8	4	49,8	7	62,7	10	75,7	13	93,0	17
25 mm	56 characters		185 characters		315 characters		445 characters		617 characters	
50 mm	293 characters		601 characters		909 characters		1 217 characters		1 535 characters	
It is assumed that width includes quiet zones.										

Table B.4 — Approximate alphanumeric capacity of PDF417 symbols at specific widths and heights, x-dimension = 0,33 mm

Symbol height	Width 38,1 mm		Width 50,8 mm		Width 63,5 mm		Width 76,2 mm		Width 96,5 mm	
	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns
	36,1	2	47,2	4	55,8	6	75,4	9	92,2	12
25 mm	N/A[a]		13 characters		77 characters		175 characters		272 characters	
50 mm	41 characters		200 characters		358 characters		596 characters		833 characters	
It is assumed that width includes quiet zones.										
[a] N/A means not applicable. Where N/A appears this means that, with the associated label width and an error correction level of 5, no data can be encoded.										

Table B.5 — Approximate alphanumeric capacity of PDF417 symbols at specific widths and heights, x-dimension = 0,38 mm

Symbol height	Width 38,1 mm		Width 50,8 mm		Width 63,5 mm		Width 76,2 mm		Width 96,5 mm	
	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns
	34,8	1	47,8	3	60,7	5	73,7	7	93,2	10
25 mm	N/A[a]		N/A[a]		27 characters		85 characters		171 characters	
50 mm	N/A[a]		88 characters		225 characters		362 characters		567 characters	
It is assumed that width includes quiet zones.										
[a] N/A means not applicable. Where N/A appears this means that, with the associated label width and an error correction level of 5, no data can be encoded.										

Table B.6 — Approximate alphanumeric capacity of PDF417 symbols at specific widths and heights, x-dimension = 0,43 mm

Symbol height	Width 38,1 mm		Width 50,8 mm		Width 63,5 mm		Width 76,2 mm		Width 96,5 mm	
	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns
	31,8	0	46,5	2	61,2	4	75,9	6	90,7	8
25 mm	N/A[a]		N/A[a]		N/A[a]		34 characters		85 characters	
50 mm	N/A[a]		N/A[a]		121 characters		239 characters		358 characters	
It is assumed that width includes quiet zones.										
[a] N/A means not applicable. Where N/A appears this means that, with the associated label width and an error correction level of 5, no data can be encoded.										

B.4.4.2 Symbols for labels having a width of greater than 102 mm

Tables B.7 and B.8 illustrate at given x-dimensions and at various symbol widths, the number of data columns and the number of alphanumeric characters that can be encoded in PDF417 symbols where the label is greater than 102 mm wide. In Tables B.7 and B.8, PDF417 symbols are assumed to be either 2,5 cm or 5 cm high. Error correction levels are defined as error correction level 5.

Table B.7 — Approximate alphanumeric capacity of PDF417 symbols at specific widths and heights, x-dimension = 0,38 mm

Symbol height	Width 122 mm		Width 135 mm		Width 147 mm	
	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns
	119	14	132	16	145	18
25 mm	286 characters		344 characters		401 characters	
50 mm	841 characters		891 characters		920 characters	

Table B.8 — Approximate alphanumeric capacity of PDF417 symbols at specific widths and heights, x-dimension = 0,43 mm

Symbol height	Width 122 mm		Width 135 mm		Width 147 mm		Width 160 mm	
	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns
	120	12	135	14	142	15	157	17
25 mm	185 characters		236 characters		261 characters		311 characters	
50 mm	596 characters		715 characters		747 characters		770 characters	
It is assumed that width includes quiet zones.								

Annex C
(informative)

Issues to consider in the drafting of application guidelines or standards conforming to this International Standard

C.1 General considerations

This International Standard is a framework to which various industry application standards for a bar code shipping and receiving label should conform. This International Standard defines the minimum and common elements and specifies the options for DIs and symbologies. The application guideline should, within the overall constraint of complying with this International Standard, be more specific. This annex describes the features which have to be defined in the application guideline.

C.2 Application guidelines

C.2.1 Define the domain of the application guideline or standard in terms of:

— the responsible agent (typically a trade association, federation or similar body) publishing and maintaining the application guideline;

— the industry sector;

— the geographic domain;

— classes of trading partner covered by the application guideline.

C.2.2 Define which method of data representation (see 5.1.1 and 5.1.2) is to be used:

— GS1 Application Identifiers;

— ASC MH10 Data Identifiers;

— if two-dimensional symbols are part of the standard, specify which formats from ISO/IEC 15434 are permitted.

C.2.3 The structure of the document should make it clear whether the base and/or extended label (see 4.4) are acceptable to trading partners.

C.2.4 Specify the set of data elements together with a definition of whether they are required or optional.

a) The required data element of the unique transport unit identifier (5.2.1) is fully defined as follows:

   — if GS1 Application Identifiers are used, then all suppliers shall comply with the rules for the GS1 serial shipping container code;

   — if ASC MH10 Data Identifiers are used, then the publisher of the application standard shall ensure that, as an organization, it fully complies with the responsibilities of an issuing agency (as defined in ISO/IEC 15459-2) and registers with the registration authority. All suppliers shall comply with the rules of the unique identifier incorporated into the application guidelines.

b) The information needs of the carrier shall be considered, particularly for the key to carrier information (see 5.2.4).

c) The information needs of the customer shall be considered, particularly for the key to customer information (see 5.2.5).

d) Other data shall be considered by mutual agreement between the supplier, carrier and customer (see 5.2.6). This may need a deeper analysis of the encoding capabilities of the GS1 Application Identifiers or of the ASC MH10 Data Identifiers.

C.2.5 When the unique transport unit identifier is encoded with ASC MH10 Data Identifiers, the following applies:

a) a single international registration authority is designated by ISO/IEC JTC 1/SC 31;

b) the registration authority assigns a unique code to an issuing agency (IAC);

c) the issuing agency then controls and assigns identifiers to individual organizations or persons, ensuring that those identifiers are unique within the system of the issuing agency;

d) the organizations or persons then use the IAC and their own issuing agency assigned identifier to create a “licence plate” number for a transport unit, using the DI “J”. The data following the “J” identifier starts with the issuing agency code (IAC) and then conforms to a format specified by the issuing agency, which shall ensure that the data 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 data.

C.2.6 If two-dimensional symbol(s) are to be incorporated, specify the selected formats. The precise rules of Annex A and/or Annex B and/or Annex G and/or Annex H have to be incorporated.

C.2.7 Specify which linear symbology shall be used (see 6.1). If migrating from Code 39, see Annex D.

C.2.8 Specify the x-dimension (see 6.1.3). Ideally, this should offer the full range of 0,25 mm to 0,43 mm in accordance with this International Standard. However, there can be industry-specific reasons for being more restrictive.

C.2.9 Specify the symbol quality grade (see 6.1.8, A.6, B.2.8 and B.3.7). Ideally, this should be identical to that of this International Standard. However, there can be industry-specific requirements that call for a different symbol quality grade. In drafting the application guideline, consideration needs to be given to the crossover effect for both

— labels from suppliers covered by the application guideline going to customers outside the domain of the industry, and

— labels coming from suppliers outside the domain of the industry.

In both these cases, the expectation of trading partners is to conform to the symbol quality grade as specified in this International Standard.

C.2.10 Specify, in as much detail as is appropriate for the application, the label design (see Clause 7), taking into consideration the size of the label (see 7.3) and any special label materials (see 7.5).

C.2.11 Specify the label placement appropriate for the application (see Clause 8). Note that if the application includes carrier sortation and tracking data, the MaxiCode or QR Code symbol should be located on top of the transport unit (see A.7.3).

Annex D
(informative)

The impact of systems confronted with multiple symbologies and formats

D.1 General considerations

Open systems, such as identified in this International Standard, encourage the free movement of transport units between any supplier and customer via any carrier. Organizations scanning the bar code label for shipping and receiving may be presented with symbols that do not conform to their specific requirements but which are useful elsewhere in the supply chain. This annex addresses issues that are associated with this situation. These issues can affect any organization. This annex also addresses the issues that have to be considered in a planned migration between options.

This annex describes the use of data carrier/symbology identifiers as identified in ISO/IEC 15424. The symbology identifier is a prefix to the data transmitted by a decoder. Data carrier/symbology identifiers are not encoded in the symbol.

The options, as defined in 5.1.1, are as follows:

a) AIs with GS1-128 symbology;

b) DIs with Code 39 symbology;

c) DIs with Code 128 symbology.

Although it may be intended that only one of these combinations be in a system, it is important for all users to be aware that any of the other combinations can appear in a scanning system. Given this fact, organizations may choose to support a single option or support other options as well. These are discussed below.

D.2 Systems where a single option is intended to be scanned

For users selecting to operate in a single-option environment, the following procedures should be considered.

— For single use of option a), users may be able to switch off all other symbologies in a decoder, including Code 128, described in option c). If the decoder supports symbology identifiers, the host system shall validate the appropriate symbology identifier, specifically]C1, which signifies a GS1-128 symbol with a FNC1 character in the first position after the start code.

— For single use of option b), users shall switch off all other symbologies in any decoder. If the decoder supports symbology identifiers, the host computer system shall validate the appropriate symbology identifier, specifically]A0.

— For single use of option c), users need to implement fully the symbology identifier capability. For decoders that do not support symbology identifiers, host computer systems are unable to automatically distinguish between option a) and option c). By using the symbology identifier, the host computer can distinguish between the different options and filter out the unwanted options. The host computer system shall validate the appropriate symbology identifier, specifically]C0.

D.3 Systems where multiple options are intended to be scanned

Users, who choose to provide their systems with information scanned from labels using two or all of the options, shall fully implement symbology identifier capabilities. For decoders that do not support symbology identifiers, host computer systems are unable to automatically distinguish between option a), option b) and option c). By using the symbology identifier, the host computer can distinguish between the different options and filter out the unwanted options. The combination of the symbology identifier and the ASC MH10 Data Identifier or application identifier shall provide the user with reliable input. Users should consider adopting additional reliability features described in B.4.3, as appropriate.

D.4 Migration choices — considerations

D.4.1 General

It is feasible to migrate from one option to another. The realistic migrations are as follows:

a) Code 39 with ASC MH10 DIs to GS1-128;

b) Code 39 with ASC MH10 DIs to Code 128 with ASC MH10 DIs;

c) Code 128 with ASC MH10 DIs to GS1-128.

Migration paths require a (usually considerable) period of parallel operation. This has implications for both systems (see D.4.2) and equipment (see D.4.3).

D.4.2 Systems

Industry bodies and individual suppliers migrating between any two options need be aware of their responsibilities to customers. While it is relatively easy for a company or industry body to assume that its bar code label standards affect all customers equally, this is an over-simplification.

If there is a change between ASC MH10 DIs and GS1 AIs [for example migration choices a) and c)], the computer systems supporting label production and the carriers' and customers' computer systems must be upgraded to handle GS1 Application Identifiers prior to any switch.

Each of the migration choices requires the host computer system software to be able to recognize symbology identifiers (see D.4.3), which provide the only reliable means of distinguishing between the symbologies and some of their optional features.

Such migrations involve significant changes that have to be mutually agreed by supplier, carrier and customer groups. Failure to do so can result in problems with well-established systems and even in the corruption of data.

D.4.3 Equipment

D.4.3.1 Printing

Printing hardware, printing software and users implementing printing hardware and software shall be capable of producing the new format symbols by including the ASC MH10 Data Identifiers and/or GS1-128 Application Identifiers correctly and generating the correct symbology.

D.4.3.2 Decoder

In order to avoid errors in automatic data capture, bar code readers that can automatically read more than one symbology should be configured to read only those symbologies required by the application.

Decoders must be configured to read and transmit data from both the old and the new symbology and to transmit the relevant symbology identifier.

NOTE Migration choice c) requires a different decoder setting between the old and new standards.

Not all decoders are capable of transmitting symbology identifiers. The use of non-conforming equipment in a system with the old and new symbologies can result in the inability to correctly distinguish between them. Some decoders may be able to be upgraded, others may not be able to be upgraded and must be replaced.

Scanners are unlikely to be affected. Models that have integrated decoders may be affected.

D.5 Recommended actions to manage migration

D.5.1 Responsible industry body

The industry body responsible for initiating the migration needs to identify any potential transition problems likely to be experienced by suppliers, carriers and customers. Liaison should take place with bodies representing carriers' and customers' interests as soon as the supplying industry is contemplating a migration. In particular, it should

— identify and carefully consider the migration issues,

— survey suppliers, carriers and customers to assess the extent to which equipment will be made obsolete,

— survey these groups to assess the extent to which databases must be upgraded,

— allow for an upgrade path for the enhancement of equipment and computer systems, bearing in mind that users required to scan symbols consistent with the new standard need to have systems in place before the new label formats are introduced, and

NOTE This is a completely different implementation strategy to that commonly adopted when initially implementing bar code systems, where a number of labels usually precede the implementation of scanning.

— plan for a phase-out of the old label format.

D.5.2 Organizations producing the label

Suppliers implementing a change of identifier standard and/or symbology should

— if changing to GS1 AIs, ensure that the mapping software between the internal database and the AIs is correct,

NOTE The format of data can be different between ASC MH10 DIs and GS1 AIs for the nominal data; for example, the way dates or units of measure are encoded.

— if changing to GS1-128, ensure that printing software and/or hardware fully supports the options in that symbology, including FNC1 in the first position after the start code and in other positions, and

— carry out print quality tests of Code 128 and GS1-128 prior to a live launch of the new format label.

These systems tests can identify the need to upgrade or replace existing systems and hardware.

D.5.3 Organizations scanning the label

Organizations needing to scan the new format label should take the following actions prior to the live introduction of the label:

— ensure that decoders are fully compliant with the ISO/IEC 15424 data carrier/symbology identifier specification with respect to Code 39 and Code 128;

— implement software that checks on the validity of both ASC MH10 Data Identifiers and GS1 Application Identifiers;

— implement software that parses the data for format and length;

— if changing to GS1 AIs, implement software to convert the data from the AI format to the format requirements of the host computer.

NOTE This is required because the format of some data fields is different between ASC MH10 DIs and GS1 AIs.

Annex E
(informative)

Label examples

E.1 Base label examples

E.1.1 Minimum base label examples

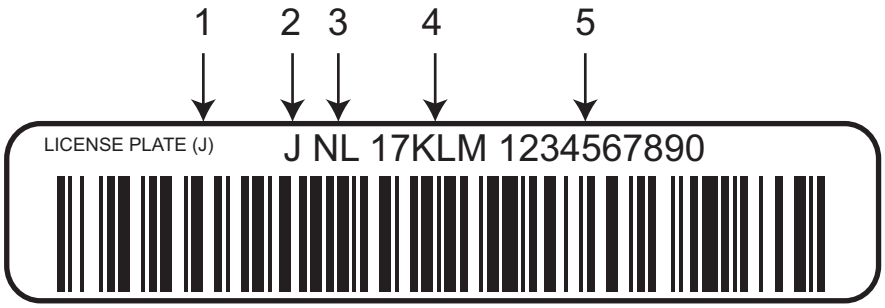
At a minimum, one of the two following formats shown in Figures E.1 and E.2 is required.

Key

1 field title
2 symbol representation of unique transport unit identifier
3 human readable representation of unique transport unit identifier

NOTE This figure is not to scale.

Figure E.1 — Base label using GS1-128 licence plate



Key

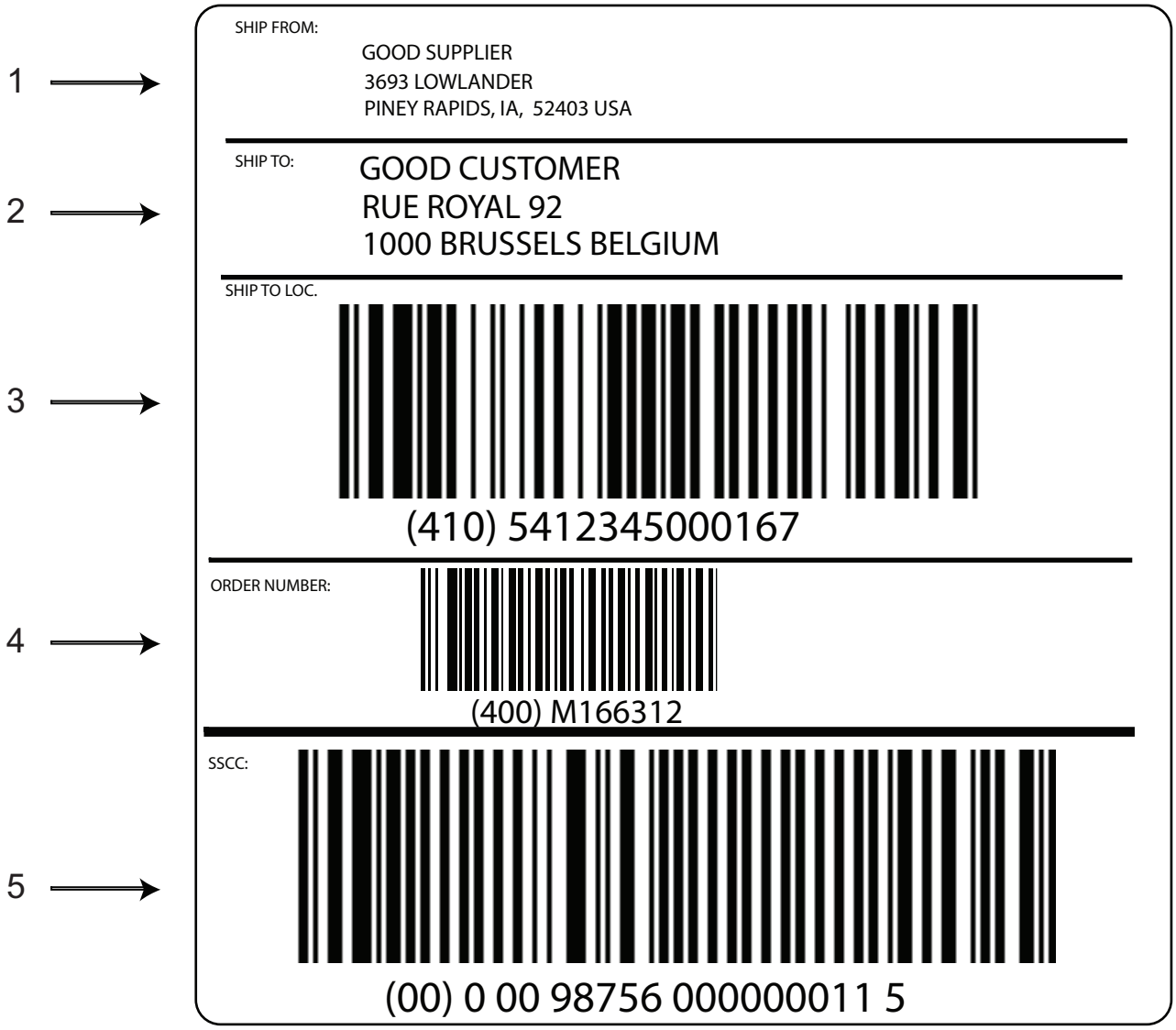
1 Data Identifier
2 IAC
3 national prefix
4 company prefix
5 unique ID

NOTE In this example the issuing agency code is “J” for the Universal Postal Union (UPU).

Figure E.2 — Base label using “J” Data Identifier licence plate with Code 128

E.1.2 Base label examples using bar code symbols as pointers to trading partner's databases

When, with the mutual agreement of the trading partners, pointers to the carrier's or customer's databases are needed, either the format shown in Figure E.3 or that in Figure E.4 is recommended.



Key

1 sender
2 recipient
3 pointer to carrier's database
4 pointer to recipient's or customer's database
5 GS1-128 licence plate

NOTE This figure is not to scale.

Figure E.3 — Label using GS1-128 licence plate with pointers to the carrier's and customer's databases

Key

1 sender
2 recipient
3 pointer to carrier's database
4 pointer to recipient's or customer's database
5 Code 39 DI “J” licence plate

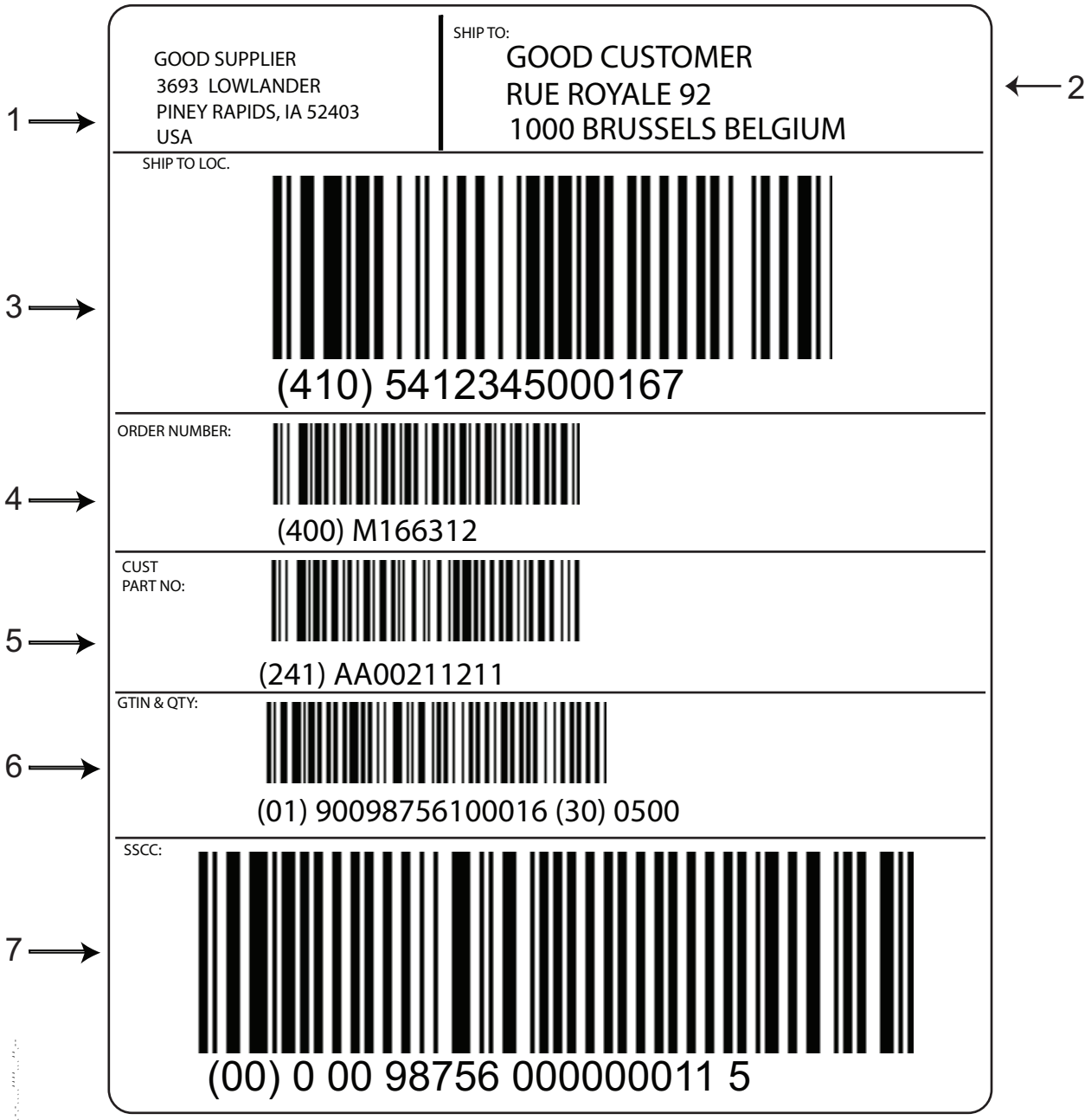
NOTE This figure is not to scale.

Figure E.4 — Label using “J” Data Identifier licence plate with pointers to the carrier's and customer's databases

E.2 Extended labels

E.2.1 Label examples using bar code symbols as pointers to trading partner's databases

When, with the mutual agreement of the trading partners, pointers to the carrier's or customer's databases are needed, the formats shown in either Figure E.5 or Figure E.6 are recommended.

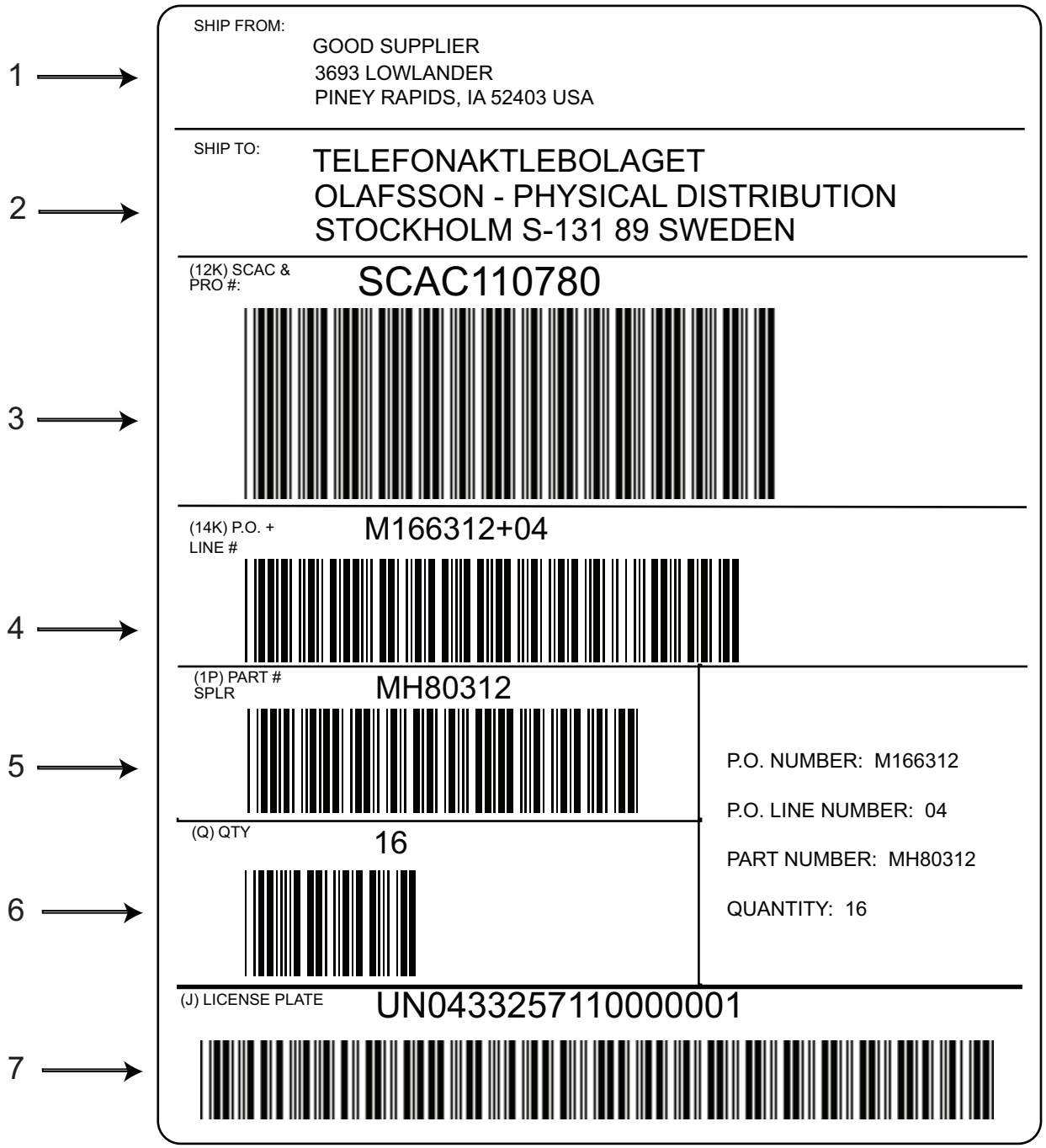


Key

1 sender
2 recipient
3 pointer to carrier's database
4 pointer to recipient's or customer's database
5 optional data
6 optional data
7 GS1-128 licence plate

NOTE This figure is not to scale.

Figure E.5 — Label using GS1-128 licence plate with pointers to the carrier's and customer's databases



Key

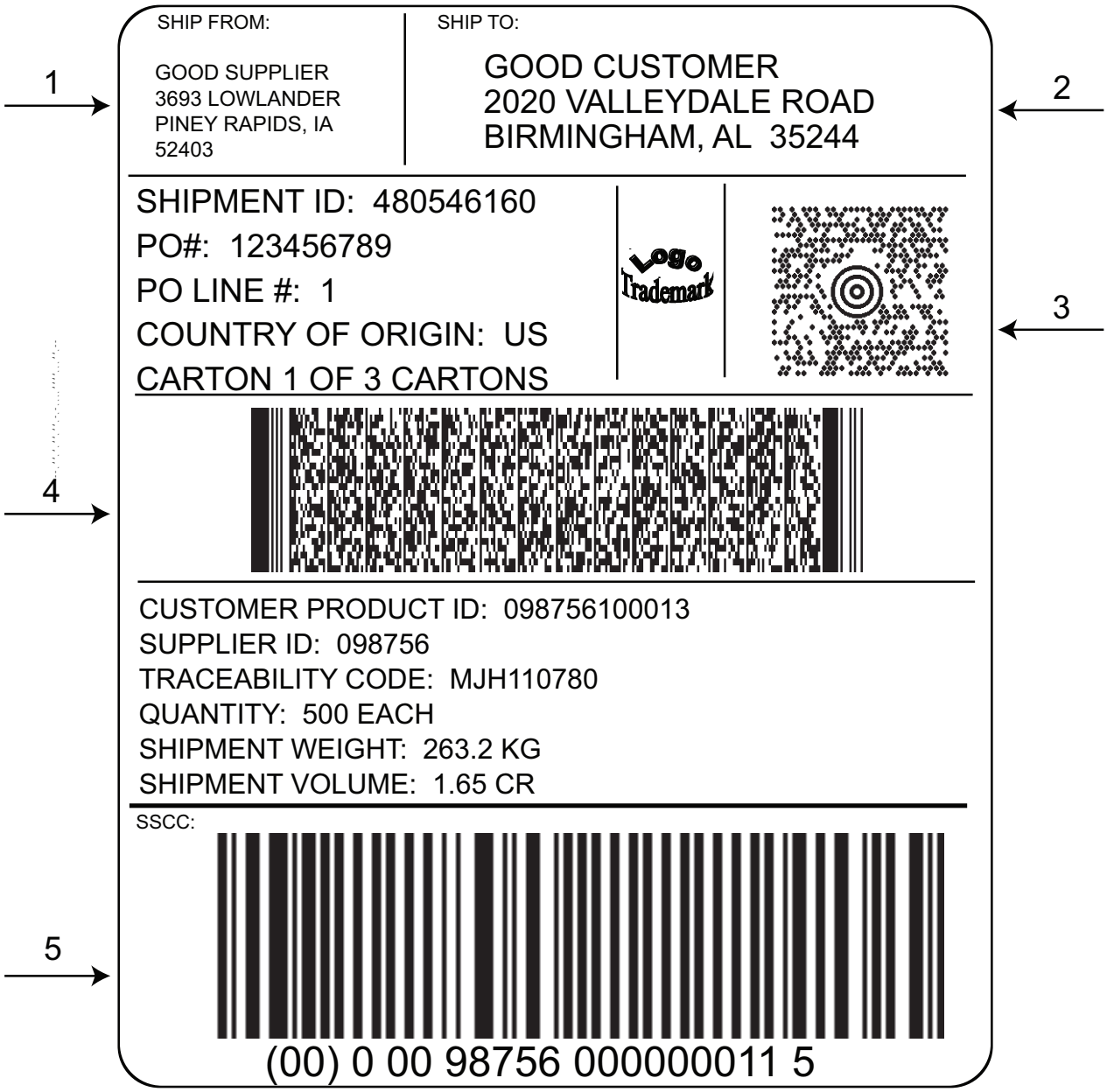
1 sender
2 recipient
3 pointer to carrier's database
4 pointer to recipient's or customer's database
5 optional data
6 optional data
7 Code 39 DI “J” licence plate

NOTE This figure is not to scale.

Figure E.6 — Label using “J” Data Identifier licence plate with pointers to the carrier's and customer's databases

E.2.2 Label examples using licence plate and two-dimensional symbols for additional trading partner data

When, with the mutual agreement of the trading partners, trading partner data in two-dimensional symbols are needed, use of a format shown in Figure E.7, Figure E.8 or Figure E.9 is recommended. Users should be aware that different scanners are needed to scan two-dimensional symbols, unless their existing scanners already read two-dimensional symbols.



Key

1 sender
2 recipient
3 carrier sortation/tracking two-dimensional symbol
4 recipient's or customer's data two-dimensional symbol
5 GS1-128 licence plate

NOTE This figure is not to scale.

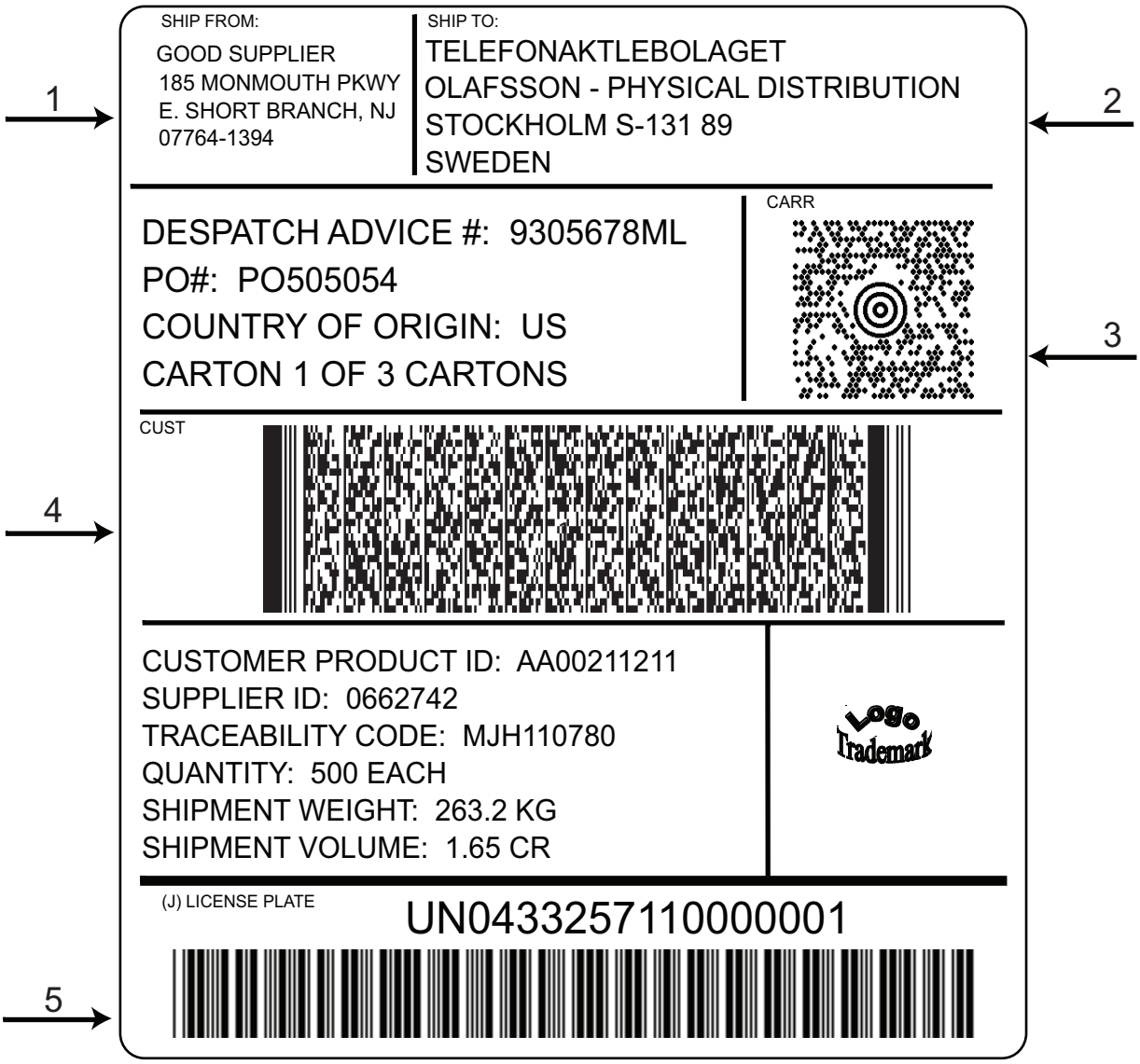
Figure E.7 — Label using GS1-128 licence plate and additional trading partner data in two-dimensional symbols

The data encoded in the MaxiCode symbol in Figure E.7 is as follows:

Compliance indicator	[)>$^{R}_{S}$
Sortation and tracking format header	01$^{G}_{S}$96
Carrier data	352440000$^{G}_{S}$840$^{G}_{S}$001$^{G}_{S}$
Carrier data	96314159265359841470 98$^{G}_{S}$SCAC$^{G}_{S}$
Carrier data	5215716587$^{G}_{S}{}^{G}_{S}$480546160$^{G}_{S}{}^{G}_{S}$580$^{G}_{S}$Y$^{R}_{S}$
Application Identifier format header	05$^{G}_{S}$
Supplier's transport unit ID	00000987560000000115$^{R}_{S}{}^{E}O_{T}$

The data encoded in the PDF417 symbol in Figure E.7 is as follows:

Header	[)>$^{R}_{S}$
Data format "03" format header	03003030$^{F}_{S}{}^{G}_{S}{}^{U}_{S}$
Sender's name	N1$^{G}_{S}$SF$^{G}_{S}$GOOD SUPPLIER$^{F}_{S}$
Sender's street address	N3$^{G}_{S}$3693 LOWLANDER$^{F}_{S}$
Sender's city, state and postal code	N4$^{G}_{S}$PINEY RAPIDS$^{G}_{S}$IA$^{G}_{S}$52403$^{F}_{S}$
Recipient's name	N1$^{G}_{S}$ST$^{G}_{S}$GOOD CUSTOMER$^{F}_{S}$
Recipient's street address	N3$^{G}_{S}$2020 VALLEYDALE ROAD$^{F}_{S}$
Recipient's city, state and postal code	N4$^{G}_{S}$BIRMINGHAM$^{G}_{S}$AL$^{G}_{S}$35244$^{R}_{S}$
Application Identifier format header	05$^{G}_{S}$
Shipment ID	902S480546160$^{G}_{S}$
Transport unit ID (container licence plate)	00000987560000000115$^{G}_{S}$
Carrier shipment number	96314159265359841470 98$^{G}_{S}$
Customer PO number and line item number	400123456789+001$^{G}_{S}$
SCC-14 (item code) and quantity (each)	01900987561000163050 0$^{G}_{S}$
Customer product ID	241AA00211211$^{G}_{S}$
Country of origin	904LUS$^{G}_{S}$
Lot/batch number	10MJH110780$^{G}_{S}$
Carton "*n* of *x*"	9013Q1/3$^{G}_{S}$
Shipment weight	3301263$^{G}_{S}$
Shipment volume	3362165CR$^{R}_{S}$
Trailer	$^{E}O_{T}$



Key

1 sender
2 recipient
3 carrier sortation/tracking two-dimensional symbol
4 recipient's or customer's data two-dimensional symbol
5 Code 39 DI “J” licence plate

NOTE This figure is not to scale.

Figure E.8 — Label using “J” Data Identifier licence plate and additional trading partner data in two-dimensional symbols

The carrier data encoded in the MaxiCode symbol in Figure E.8 is as follows:

Header	[)>$^{R}_{S}$
Sortation and tracking format header	01$^{G}_{S}$96
Carrier data	S-131 89$^{G}_{S}$752$^{G}_{S}$006$^{G}_{S}$MH80312$^{G}_{S}$SCAC$^{G}_{S}$
Carrier data	5215716587$^{G}_{S}{}^{G}_{S}$1JEABCXXXA$^{G}_{S}{}^{G}_{S}$580$^{G}_{S}$Y$^{R}_{S}{}^{E}_{O_T}$

The customer data encoded in the PDF417 symbol in Figure E.8 is as follows:

Header	[)>$^{R}_{S}$
Data format “04” format header	04092001$^{F}_{S}{}^{G}_{S}{}^{U}_{S}$
Sender's name and address	NAD$^{G}_{S}$SF$^{G}_{S}{}^{G}_{S}{}^{G}_{S}$GOOD SUPPLIER$^{G}_{S}$185 MONMOUTH PKWY$^{G}_{S}$E. SHORT BRANCH$^{G}_{S}NJ^{G}_{S}$07764-1394$^{G}_{S}USA^{F}_{S}$
Recipient's name and address	NAD$^{G}_{S}$ST$^{G}_{S}{}^{G}_{S}{}^{G}_{S}$ TELEFONAKTLEBOLAGET OLAFSSON+PHYSICAL DISTRIBUTION$^{G}_{S}{}^{G}_{S}{}^{G}_{S}$STOCKHOLM$^{G}_{S}{}^{G}_{S}{}^{G}_{S}$S-131 89$^{G}_{S}$ SEK$^{F}_{S}$
Despatch advice number	BGM$^{G}_{S}$351$^{G}_{S}$93-5678ML$^{G}_{S}$9$^{R}_{S}$
Data Identifier format header	06$^{G}_{S}$
Transport unit ID (container licence plate)	JEABCXXXA$^{G}_{S}$
Carrier shipment number	12KSCACMH80312$^{G}_{S}$
Customer PO number	KPO505054$^{G}_{S}$
Quantity (each implied)	Q500$^{G}_{S}$
Supplier ID	3V0662742$^{G}_{S}$
Customer product ID	PAA00211211$^{G}_{S}$
Country of origin	4LUS$^{G}_{S}$
Lot/batch number	1TMJH110780$^{G}_{S}$
Carton “*n* of *x*”	13Q1/3$^{G}_{S}$
Shipment mass	7Q263.2KG$^{G}_{S}$
Shipment volume	7Q1.65CR$^{R}_{S}$
Trailer	$^{E}_{O_T}$

Key

1 sender
2 recipient
3 carrier sortation/tracking two-dimensional symbol
4 product description
5 logo
6 human translation
7 GS1 number and batch number
8 GS1-128 licence plate
9 human readable interpretation

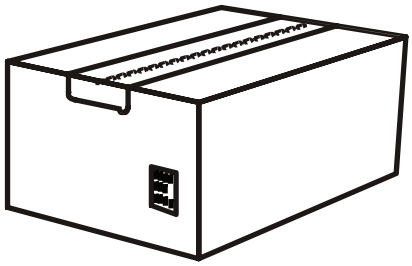
NOTE This figure is not to scale.

Figure E.9 — Carrier label (upper) **and supplier label** (lower)

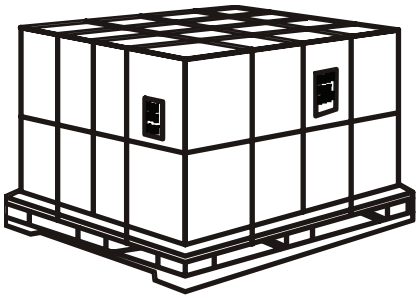
Annex F
(informative)

Label locations

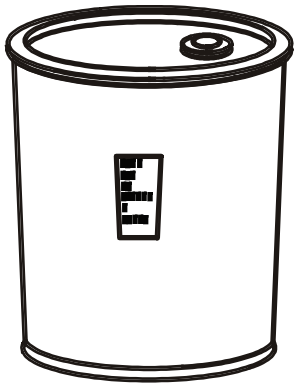
Figure F.1 shows examples of the labelling of various transport units.



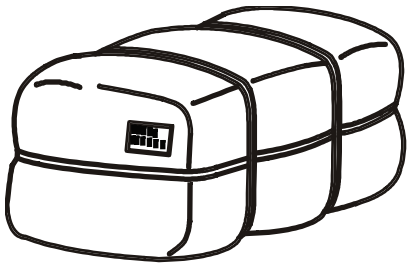
a) Box or carton with transport package label



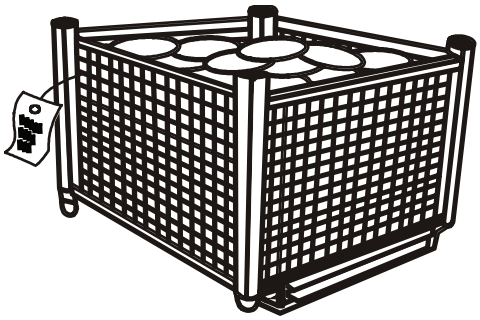
b) Pallet with two unit load labels



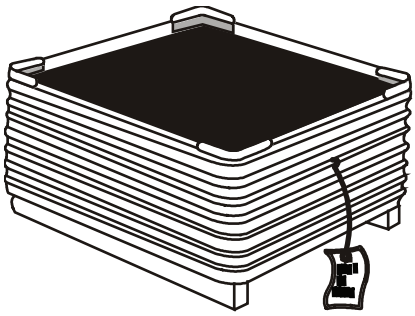
c) Drum, barrel or cylindrical container



d) Bale

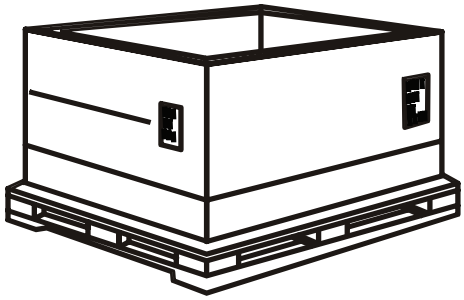


e) Basket, wire-mesh container

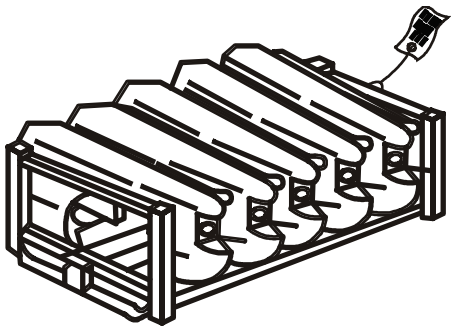


f) Metal bin or tub

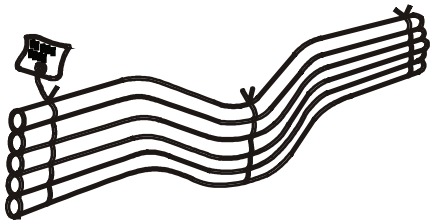
Figure F.1 — Examples of label locations (*continued*)



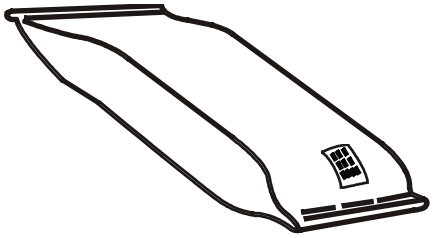
g) Pallet box



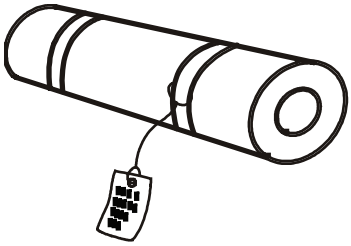
h) Rack



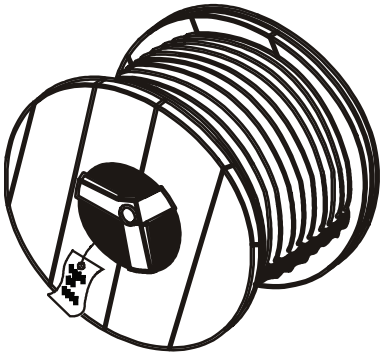
i) Bundle



j) Bag



k) Roll or coil



l) Reel or cable

Figure F.1 — Examples of label locations

Annex G
(normative)

Procedures for using QR Code in carrier sortation and tracking applications

G.1 Carrier sortation and tracking applications

Carrier sortation is the process in which transport units are routed between two or more points. Carrier tracking is the process by which the location of unit loads and transport units being transported by a carrier is updated in the carrier's database.

Data to be included comprises that which is required to route transport units between multiple points, to locate transport units, and other supporting data that is relevant to sortation and/or tracking for internal and external processing.

When a two-dimensional symbol is used for the carrier sortation and tracking applications, the QR Code symbology (see ISO/IEC 18004) is capable of being read stably in a high-speed scanning environment. The structure and syntax of the QR Code symbols for the carrier sortation and tracking applications shall conform to the structure and syntax specified in ISO/IEC 15434.

G.2 Data encoding

G.2.1 Code set

When encoding information in a QR Code symbol, it is recommended that the bit string length be optimized (see ISO/IEC 18004).

G.2.2 Symbology

It is recommended that QR Code Model 2 symbology be used for the carrier sortation and tracking applications (see ISO/IEC 18004) when QR Code is used. The concatenation structure, which is specified in ISO/IEC 18004, shall not be used for these applications.

G.3 Error correction levels

The error correction level shall be M (approximately 15 %), Q (approximately 25 %) or H (approximately 30 %). (See ISO/IEC 18004.)

G.4 Module dimension

The module dimension shall be within the range of 0,8 mm to 1,5 mm. It is recommended that the dimension be determined according to the print qualities of the label supplier and/or producer.

G.5 Quiet zones

The QR Code symbol shall have a minimum quiet zone of four modules on the left, right, top and bottom.

G.6 Print quality

ISO/IEC 18004 shall be used to determine the print quality of the QR Code symbol. For carrier sortation and tracking applications, the minimum symbol grade shall be one that has

a) a print quality grade of greater than or equal to 3,0 (B) at the point of printing the symbol, and

b) a light source wavelength equal to (660 ± 10) nm.

The above symbol quality and measurement parameters ensure scannability over a broad range of scanning environments. Labellers may not be able to guarantee the print quality of a label when it is received by the customer. Therefore, the print quality requirement at the point of production should be set higher than the requirement at the point of use.

G.7 Orientation and placement

G.7.1 Orientation

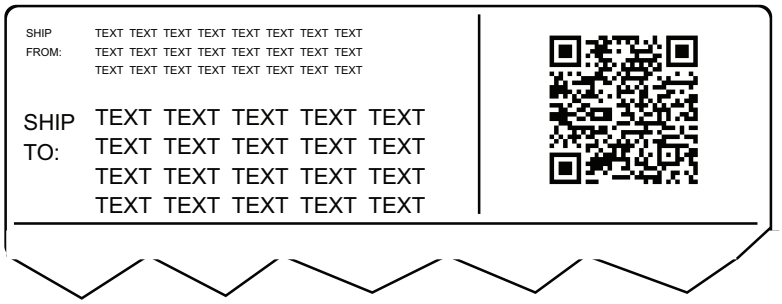
Due to the nature of the QR Code symbology, specific symbol orientation is not required.

G.7.2 Symbol placement

If the QR Code symbol is included in an “ISO label”, this symbol shall be placed in the carrier segment. See Figure G.1 for an example of placement.

G.7.3 Label placement

Labels shall be placed on the top of transport units.



NOTE This figure is not to scale.

Figure G.1 — Positioning of QR Code symbol on label

Annex H
(normative)

Procedures for using QR Code in shipping and receiving applications

H.1 General considerations

This annex defines rules that should to be followed if one or both of the following factors is mutually agreed as part of customer information:

a) shipping and receiving data that enables all bar-coded data on a label to be incorporated into a single QR Code symbol (see H.2);

b) complete EDI messages and transactions to be encoded in the QR Code symbol (see H.3).

H.2 Shipping and receipt applications

H.2.1 Outline

Shipping and receipt data facilitates the scheduling, transportation and receipt of goods and materials. This data should be printed on a "label", as defined in this International Standard. A QR Code symbol is intended to be scanned in the same environment as other symbols on the label. The structure and syntax used in shipping and receipt applications should conform to the structure and syntax set out in ISO/IEC 18004.

H.2.2 Symbology recommendation

For shipping and receipt applications, this International Standard recommends use of the QR Code Model 2 symbols stipulated in ISO/IEC 18004. The coupling structure defined in ISO/IEC 18004 should not be used in this application for the shipping and receipt application.

H.2.3 Error correction level

For shipping and receipt applications, an error correction level M (approximately 15 %) should be used.

H.2.4 Module dimensions

Module dimensions (x-dimensions) should be within a range of between 0,33 mm and 0,42 mm, and it is desirable to define dimensions according to the printing performances of label suppliers and/or of label issuers.

H.2.5 Quiet zone

For shipping and receipt applications, the QR Code symbol should incorporate a minimum quiet zone of $4x$, both vertically and horizontally. The $4x$ quiet zone is accordingly included within the calculation of the size of the symbol.

H.2.6 Symbol size

The symbol size should be 50 mm or smaller.

H.2.7 Symbol print quality

The print quality of the QR Code symbol should be determined in accordance with ISO/IEC 18004. For the classification of carriers and tracking of transportation applications, the symbol grade should satisfy the following minimum requirements:

a) the print quality grade at the point of symbol printing should be B (3,0) or higher;

b) the light source wavelength is equal to 660 ± 10 nm.

The above 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 at the stage where a customer receives goods. Therefore, it is desirable that the print quality requirement at the point of production be set at a level higher than that at the point of use.

H.2.8 Orientation and positioning

H.2.8.1 Orientation

The properties of a QR Code symbol do not in particular specify orientation of the symbol.

H.2.8.2 Label positioning

To include a QR Code symbol in a label of this International Standard, a QR Code symbol must be positioned within the customer segment. See Figure H.1 for an example of positioning.

H.3 Supporting documentation application

H.3.1 General

The shipping, transportation and receipt of transport units often require supporting documentation data such as bills of loading, manifests, packing slips, customs data or information that may also be transmitted by EDI. It is not intended that this kind of data be printed on a “label”, nor that it be scanned in the same environment as data on a label. Applications considered to be in this category involve the encoding of data in two-dimensional symbols in support of shipping, receipt and classification of transportation and tracking of goods.

H.3.2 Symbology recommendation

For the supporting documentation applications, this International Standard recommends the use of the QR Code Model 2 symbols defined in ISO/IEC 18004. The structure and syntax of the QR Code symbol for supporting documentation applications should conform to the structure and syntax set out in ISO/IEC 18004.

H.3.3 Error correction levels

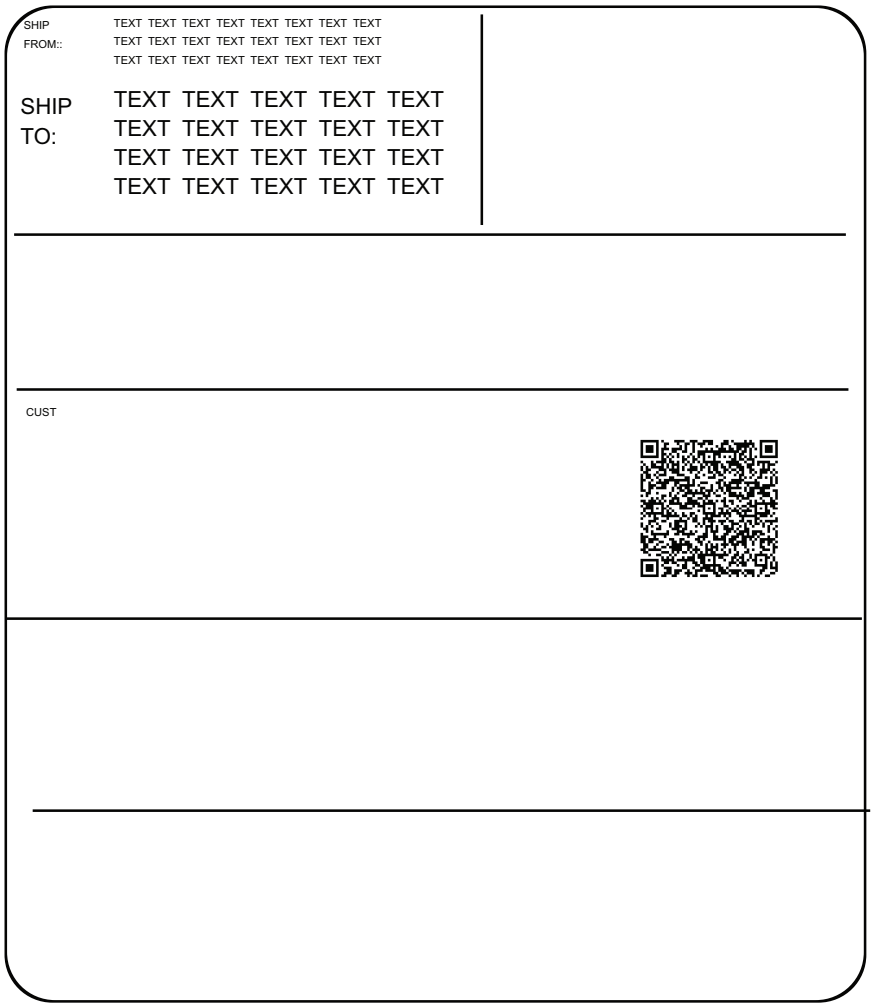
For shipping and receipt applications, an error correction level M (approximately 15 %) is recommended.

H.3.4 Module dimensions

A module dimension (x-dimension) of 0,33 mm is recommended.

H.3.5 Quiet zones

A QR Code symbol includes a minimum quiet zone of $4x$, both vertically and horizontally. Symbol size is accordingly calculated with quiet zones as $4x$.



NOTE This figure is not to scale.

Figure H.1 — Positioning of QR Code symbol on label

H.3.6 Symbol print quality

ISO/IEC 18004 should be used to determine the print quality of the QR Code symbol. For the supporting documentation applications, the symbol grade should be, at a minimum, the following:

— recommended print quality grade equal to B (3,0) or higher at the point of printing the symbol;

— light source wavelength equal to 660 ± 10 nm.

H.3.7 Orientation and positioning

H.3.7.1 Orientation

The properties of a QR Code symbol do not in particular specify orientation of the symbol.

H.3.7.2 Positioning

Any QR Code symbols shall be positioned so as not to impinge on the folds of document pages.

NOTE Since the document can be folded after printing, tests will help determine appropriate symbol locations.

H.3.8 Concatenation of symbols

H.3.8.1 Outline

For supporting documentation applications, use of the concatenation QR Code symbol defined in ISO/IEC 18004 is recommended to encode data messages that are greater in length than the maximum amount of data that can be encoded in a single QR Code symbol. A maximum of 16 QR Code symbols can be concatenated in a single QR Code symbol.

H.3.8.2 Designing for large messages

When designing an application that encodes large amounts of data, consideration should be given to the amount of data that can be encoded in a single message. If it is anticipated that a single data message may exceed a total of 22 characters in the QR Code number (refer to ISO/IEC 18004), use of concatenated QR Code symbols is desirable.

H.3.8.3 Printing of concatenated symbols

The printing system should be configured in such a manner that when the amount of data encoded in a single message for a supporting documentation application exceeds the capacity of a single symbol, the printing system should either automatically use concatenated QR Code symbols or be configured so as to be able to do so.

H.3.8.4 Reading of concatenated symbols

To read QR Code symbols properly, the transmission protocol of the decoder should comply with the concatenated QR Code symbols defined in ISO/IEC 18004. The decoder should be capable of fully supporting the symbology identifier options of the QR Codes.

H.4 Considerations when printing QR Code symbols

H.4.1 Outline

When QR Code symbols are printed, a number of factors should be taken into consideration. All of these factors should be used in determining which module dimensions are to be used. These considerations include

a) data requirements,

b) scanner technologies,

c) label area requirements, and

d) printer technologies.

When determining which module dimensions should be used, developers and users of QR Code printing software should follow these guidelines. These guidelines should ensure that valid symbols are printed. In addition, they should ensure that a user's scanning and printing requirements are being taken into consideration. To these ends, it is desirable that the following considerations be used in conjunction with the information given in Table H.1.

H.4.2 Design of label layout

H.4.2.1 Design of the maximum module dimension(s) that can be used

When designing for the space required for positioning a QR Code symbol on a label conforming with this International Standard, it is desirable that the designer consider the largest module dimension that can be

used in printing. Since a supplier and/or a printer of the label ultimately determines the module dimension at which a symbol shall be printed, for a shipping/receiving application, a QR Code symbol may be printed at any module dimension within the range 0,33 mm to 0,42 mm.

H.4.2.2 Design of the maximum amount of data

It is essential to determine the fields required for the message and the maximum anticipated length of each field. Additional characters required for formatting also need to be added.

H.4.2.3 Design of scanning equipment likely to be used

When choosing a space in which to encode a QR Code symbol, it is important to consider the capabilities of the scanning equipment likely to be used.

Table H.1 — Approximations of symbol width and character count for QR Code symbol
(including error correction level M and quiet zones)

Number of characters		Module dimension	
Alphanumeric	**Kanji**	0,42 mm	0,33 mm
50	25	15,91 mm	12,21 mm
100	50	19,35 mm	14,85 mm
150	65	21,07 mm	16,17 mm
200	90	24,51 mm	18,81 mm
250	110	26,23 mm	20,13 mm
300	130	27,95 mm	21,45 mm
400	170	31,39 mm	24,09 mm
500	220	34,83 mm	26,73 mm
750	345	41,71 mm	32,01 mm
1 000	435	46,87 mm	35,97 mm
1 250	560	N/A[a]	39,93 mm
1 500	650	N/A[a]	42,57 mm
1 750	770	N/A[a]	46,53 mm
2 000	890	N/A[a]	49,17 mm

[a] N/A means not applicable.

H.4.2.4 Selecting appropriate sizes in the tables

Table H.1 gives approximate widths of symbols for QR Code symbol in the case of an error correction level of M (approximately 15 %), module dimensions of 0,42 mm and 0,33 mm and a maximum of 2 000 alphanumeric characters. In Table H.1, select the maximum module dimension that is anticipated for the application and, on this basis, determine the number of characters that represents the maximum size. The sizes are an approximation; actual sizes may vary, depending on factors such as the compaction algorithm and the nature of the data to be encoded.

If the space available is not capable of accommodating the initial character count, one option is to consider reduction in the character count.

H.4.3 Printing of the symbol on the label

When printing a QR Code symbol defined in this Standard, the supplier and/or printer should take into consideration the amount of space allocated to the symbol.

For purposes of reference and with regard to two different types of module dimensions, Table H.2 gives approximations of the number of alphanumeric characters that can be encoded in QR Code symbols where the QR Code symbol sizes are 30 mm and 50 mm and the error correction level is M (approximately 15 %).

Table H.2 — Approximate alphanumeric capacity of QR Code symbols in two sizes
(incorporating an error correction level of M and quiet zones)

Symbol size	Module size 0,42 mm		Module size 0,33 mm	
	Alphanumeric	Kanji	Alphanumeric	Kanji
30 mm	366 characters	155 characters	656 characters	277 characters
50 mm	1 248 characters	528 characters	2 113 characters	894 characters

Bibliography

[1] ISO 9000, *Quality management systems — Fundamentals and vocabulary*

[2] ISO/IEC 15424, *Information technology — Automatic identification and data capture techniques — Data Carrier Identifiers (including Symbology Identifiers)*

[3] ISO/IEC 15459-2, *Information technology — Unique identifiers — Part 2: Registration procedures*

[4] ISO 22742, *Packaging — Linear bar code and two-dimensional symbols for product packaging*

[5] ISO/IEC 24728, *Information technology — Automatic identification and data capture techniques — MicroPDF417 bar code symbology specification*

[6] ISO/IEC TR 24729-1, *Information technology — Radio frequency identification for item management — Implementation guidelines — Part 1: RFID-enabled labels and packaging supporting ISO/IEC 18000-6C*

[7] *The Fibre Box Handbook*, Fibre Box Association, 25 Northwest Point Blvd. Suite 510, Elk Grove Village, IL 60007, USA, http://www.fibrebox.org/

ICS 35.040; 55.020

Price based on 55 pages