DRAFT INTERNATIONAL STANDARD

ISO/DIS 15394

ISO/TC **122**

Secretariat: **JISC**

Voting begins on:
2014-08-13

Voting terminates on:
2014-11-13

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

ICS: 55.020;35.040

Reference number
ISO/DIS 15394:2014(E)

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Foreword

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

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

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

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

This third edition cancels and replaces the second edition (ISO 15394:2009), 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 (or "pointer") 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. This standard was prepared by ISO/TC 122/WG 12, *Supply chain applications of logistics technology*.

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;

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

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

ISO/IEC 15459 (all parts), *Information technology — Unique identifiers*

ISO/IEC 16022, *Information technology — International symbology specification — Data Matrix*

ISO/IEC 16023, *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 bar code symbology specification*

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

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

ISO 21067, *Packaging — Vocabulary*

ANSI MH10.8.2, *Data Identifier and Application Identifier Standard*

GS1 General Specifications

3 Terms and definitions

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

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, and 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 linear bar code and 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 D gives guidance in the definition of these parameters.

4.2 Transport package, unit load, and transport unit

4.2.1 Transport package

For the purposes of this 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.

4.2.2 Unit load

For the purposes of this standard, a unit load is considered to be one or more transport packages or other items held together by means such as pallet, slip sheet, strapping, interlocking, glue, shrink wrap, or net wrap, making them suitable for transport, stacking, and storage as a unit.

4.2.3 Transport unit

Both unit loads and transport packages are referred to as transport units in this International Standard.

4.3 Unique transport unit identifier

One unique transport unit identifier shall be assigned and applied to each transport unit prior to shipment. The unique transport unit Identifier shall be associated with the highest level of packaging intended to be conveyed as a single physical entity by the shipper (e.g., a transport package within an unbreakable unit load does not require a unique transport unit identifier). 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 electronically. 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

The Extended Label is used when the data available from the Base Label is not sufficient to satisfy the requirements of all trading partners. 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.

In order to facilitate the processing and interpretation by trading partners, information provided in the extended label is organized in three segments:

— carrier segment: in addition to the pointer (or “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 (or “key”) 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, and 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 two permissible combinations of data and bar code symbology (also see Annex A):

a) ASC MH10 Data Identifiers (DIs) defined in ANS MH10.8.2 and in accordance with ISO/IEC 15418 shall be used in conjunction with:
   — Code 39 symbols compliant with ISO/IEC 16388;
   — Code 128 symbols compliant with ISO/IEC 15417

b) GS1 Application Identifiers (AIs) defined in the GS1 General Specification and 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);

Refer to Annex D for information on the use of the options and the issues for users encountering them. (Also see clause 6.1)

5.1.2 Data in two-dimensional (2D) symbols

Information may also be provided in two-dimensional symbols as mutually agreed upon between trading partners (See Annex B). Data semantics shall follow either:

a) ASC MH10 Data Identifiers (DIs) defined in ANS MH10.8.2 and in accordance with ISO/IEC 15418, or

b) GS1 Application Identifiers (AIs) defined in the GS1 General Specification and in accordance with ISO/IEC 15418

Data syntax in two-dimensional symbols shall be in accordance with ISO/IEC 15434. (Also see clause 6.2)

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 clause 6.3).

5.2 Data elements

5.2.1 Unique transport unit identifier

The unique transport unit identifier assigned by the labeller shall be encoded in a linear bar code symbol, preceded by the appropriate GS1 Application Identifier or ANSI MH10.8.2 Data Identifier.

The structure of 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, including the ANSI MH10.8.2 Data Identifier or GS1 Application Identifier, and
f) does not contain more characters than specified in Table 1.

The 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 ANSI MH10.8.2 Category 10 Data Identifiers for License Plates (J-999J) represented in either Code 39 or Code 128 symbologies.

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 (an1..35) characters each. It may also be represented by a number identifying the party, in human readable or in bar code format. The Ship From information shall be located in the left, upper-most area or building block of the label (see Annex C for building block information).

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 GS1 Application Identifiers (AI)

When several Application Identifiers (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 ANSI MH10.8.2 Data Identifiers (DI)

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.

Care should be exercised when concatenating data fields in linear symbols since some ANSI MH10.8.2 Data Identifiers prescribe the use of the "+" as an internal data structure syntax. Examples include the ANSI MH10.8.2 Data Identifiers "14K", "19S", and "3W".

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, or when appropriate the GS1 General Specifications.

6 Data carriers

6.1 Linear bar code symbols

Guidelines for using linear bar code symbols is found in Annex A. 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".

6.2 Two-dimensional symbols

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), 2D symbols may be used. This standard specifies the use of MaxiCode, PDF417, Data Matrix, and QR Code 2D symbologies. This standard recommends the

use of MaxiCode, PDF417, Data Matrix, or QR Code for carrier sortation and tracking applications and PDF417 or QR Code for shipping and receiving applications and for supporting documentation applications. The specific two-dimensional symbol to be used shall be mutually agreed upon between trading partners.

For further information and guidance in the use of 2D symbols, see normative Annex B.

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 (see Figure E.1 and E.2). 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 segments 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. See Annex C for information on designing compliant labels using a building block approach.

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 the 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 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 — Minimum 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 characters	50 characters (single DI)	27 characters	20 characters exactly	48 characters	26 characters
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	Not recommended	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 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

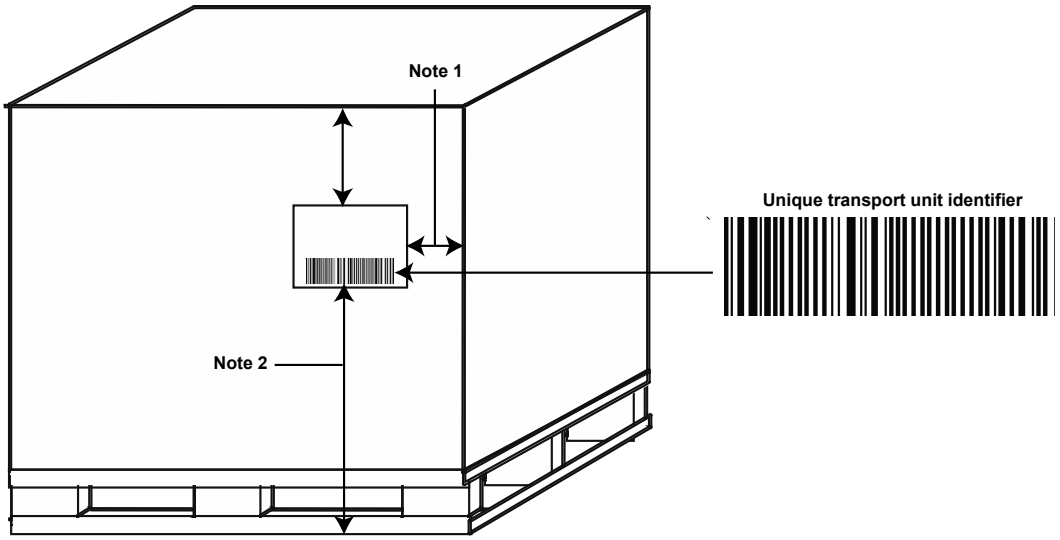
Labels should be affixed at a suitable location where there is a minimum risk of damage. Labels should be placed on the side of the transport unit with the human readable information parallel to the natural bottom of the transport unit. The edge of the label(s) should be a minimum of 32 mm from any transport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

Transport units should have identical bar code labels affixed on two adjacent sides, but minimally shall have at least one bar code label. 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)

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



NOTE 1 50 mm (minimum)

NOTE 2 400 mm to 800 mm

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)
Guidelines for using linear bar code symbols

A.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.

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

For users selecting to operate in a single option environment, there are three procedures to consider.

- For single use of option 1, users may be able to switch off all other symbologies in a decoder, including Code 128, as described in option 3. If the decoder supports Symbology Identifiers, the host system shall validate the appropriate Symbology Identifier, specifically “]C1”, that signifies a GS1-128 symbol having a FNC1 character in the first position after the start code.
- For single use of option 2, users 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 3, users will need to implement fully the Symbology Identifier capability. For decoders that do not support Symbology Identifiers, host computer systems will be unable to automatically distinguish between option 1 and option 3. By using the Symbology Identifier, the host computer can distinguish between the different options and filter out the unwanted options. The host computer shall validate the appropriate Symbology Identifier, specifically "]C0".

A.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 will be unable to automatically distinguish between option a, option b, and option c (See §G.1.1). By using the Symbology Identifier, the host applications can be coded to distinguish between the different options and filter out the unwanted options. The combination of the Symbology Identifier and the ANSI MH10.8.2 Data Identifier or GS1 Application Identifier will provide the user with reliable input.

PDF417, a stacked-linear symbology, is designed to be read by laser scanners, while Data Matrix and QR Codes are designed to be read by imager technology. PDF417 can also be read by imager technology.

A.4 Symbol height

The minimum bar height of a linear bar code symbol shall be 12,7 mm and should be at least 15% of the length of the symbol including quiet zones.

A.5 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 A.8 and label width recommendations of Table 2 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.

A.6 Wide to narrow ratio for Code 39 symbols

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

A.7 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 ten (10) times the X dimension. The label registration parameters of the printer being used should be taken into consideration in order to ensure the minimum quiet zones.

A.8 Orientation

Linear bar code symbols should be presented on transport units with the bars vertical (picket fence orientation) when marked on a flat or slightly curved surface. 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).

A.9 Placement

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

NOTE: 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 to reduce the possibility of interference with successful bar code scanning.

A.10 Linear bar code symbol print quality

The ISO/IEC 15416 standard shall be used to determine the print quality of the linear bar code. The grade is expressed in the form of: grade/aperture/wavelength. The minimum symbol grade shall be 1,5/10/660 which is:

- an overall symbol grade greater than or equal to 1,5 (C) at point of production;
- a measurement aperture equal to 0,250 mm diameter (reference number 10),
- a light source wavelength equal to 660 ±10 nanometres.

It is important that the linear bar code be decodable throughout the system of use. Numerous environmental effects can lead to the degrading of the bar code symbol, substrate, adhesive, or laminate. These changes may affect one or more quality parameters of the label, whether they are optical or physical. The net effect of such changes can be to render the label unusable. It is therefore important to consider these effects when producing and applying bar code labels.

Labellers should not be held responsible for damage to the label incurred by shipping or handling subsequent to leaving the supplier's facilities. Every effort should be made by the labeller to reasonably protect and place the label so it is not damaged in shipment and handling.

It may not be possible to meet the print quality requirements of this standard when printing directly onto kraft coloured corrugated surfaces. Users considering the printing of bar code symbols directly onto kraft coloured corrugated surfaces should consider the scanning capabilities of their entire trading channel.

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

Annex B
(normative)
Guidelines for using two-dimensional (2D) symbols

This annex defines the rules for using 2D symbols. These rules apply to the following three applications:

- shipping and receiving (B.1),
- supporting documentation (B.2),
- carrier sortation and tracking (B.3).

B.1 Shipping and receiving applications

The shipping and receiving data facilitates staging, transportation, and receipt of goods and materials. This data shall be printed on the 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 or QR Code symbols for shipping and receiving applications shall conform to the structure and syntax described in ISO/IEC 15434.

B.1.1 Symbology recommendation

This standard recommends the use of the PDF417 symbology (see ISO/IEC 15438) or QR Code (See B.1.3 and ISO/IEC 18004) for shipping and receiving applications.

For the shipping and receiving applications, the Macro PDF417 symbol which is defined in the ISO/IEC 15438, shall not be used.

For the shipping and receiving applications, the Micro PDF417 symbol, which is defined in ISO/IEC 24728, shall not be used.

For the shipping and receiving applications QR Code Model 2 should be used,

B.1.2 PDF417 for shipping and receiving applications

B.1.2.1 PDF417 Error correction level

For shipping and receiving applications using PDF417, the minimum symbol error correction level shall be level 5.

B.1.2.2 PDF417 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.1.7. Conformance to the print quality requirements shall be determined according to B.1.7.

B.1.2.3 PDF417 Row height

The PDF417 symbol shall have a minimum row height (height of the symbol element) of three (3) times the width of the narrow element (X dimension). Increasing the row height may improve scanning performance but will reduce the number of characters that can be encoded in a given space.

B.1.2.4 PDF417 Quiet zone

For shipping and receiving applications, the 2D 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.1.2.5 PDF417 Symbol size

For shipping and receiving applications using PDF417, symbols shall not exceed a height of 61 mm.

Tables B.2 through B.8 are provided as guidance in planning for the incorporation of PDF417 symbols into the design of the labels described in this standard. Actual achieved size of a PDF417 symbol may vary, based on data content and printing process. The sizes listed should accommodate most situations.

A PDF417 symbol for shipping and receiving applications should be printed with no more than 12 data columns in width (see Figure B.2). This will assure readability by the broadest range of reading devices. In no case shall the number of data columns exceed 18 columns. The use of 13 to 18 columns is allowed 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 clause B.1.2.8 and its sub-clauses.

Table B.1
Maximum PDF417 symbol width using 12 data columns

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

B.1.2.6 PDF417 Print quality

The ISO/IEC 15438 standard shall be used with reference to ISO/IEC 15415 to determine the print quality of the PDF417 symbology. The grade is expressed in the form of: grade/aperture /wavelength. For shipping and receiving applications, the minimum symbol grade should be 2,5/10/660 which is:

- an overall symbol grade greater than or equal to 2,5 (B) at point of production;
- a measurement aperture equal to 0,250 mm diameter (reference number 10),

– a light source wavelength equal to 660 ±10 nanometres.

The above symbol quality and measurement parameters assure scannability over a broad range of scanning environments. The print quality requirement at the point of production should be higher than the requirement at the point of use.

It may not be possible to meet the print quality requirements of this standard when printing directly onto kraft coloured corrugated surfaces. Users considering the printing of 2D symbols directly onto kraft coloured corrugated surfaces should consider the scanning capabilities of their entire trading channel.

B.1.2.7 PDF417 Orientation and placement

B.1.2.7.1 PDF417 symbol orientation

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

B.1.2.7.2 PDF417 Label placement

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

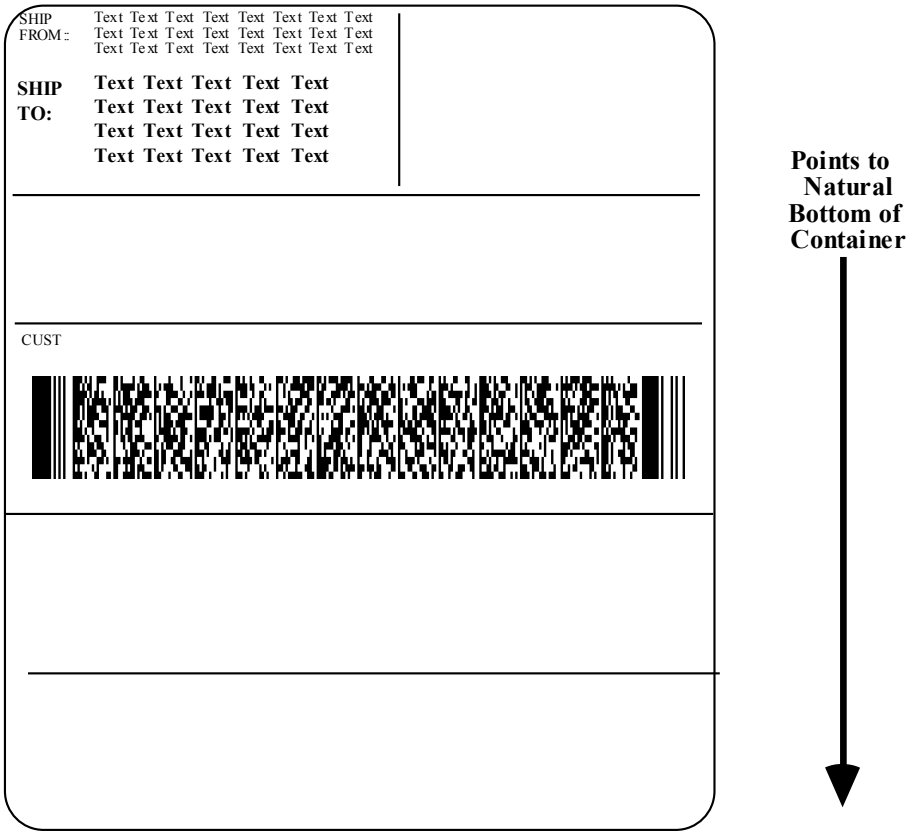


Figure B,1
PDF417 symbol orientation on label (not to scale)

B.1.2.8 Printing PDF417 symbols

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

- data requirements,
- scanner technologies,
- label area requirements,
- printer technologies.

Developers and users of PDF417 symbol printing software should follow these guidelines when determining what PDF417 symbol options should be used. Since no one solution is optimal, trade-offs must sometimes be made. These guidelines will assure that valid symbols are printed. In addition, they will assure that a user's scanning and printing requirements have been considered. The following considerations should be used with Tables B.3 through B.8 to determine approximate symbol size.

B.1.2.8.1 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.1.2.8.2 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. For 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.1.2.8.3 Plan for the maximum X dimension(s) and data columns

When planning for the space required in which a PDF417 symbol will be placed 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 standard recommends that PDF417 symbols for shipping and receiving applications be printed with no more than 12 data columns (see Figure B.3), 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 shown below contained within the data columns.

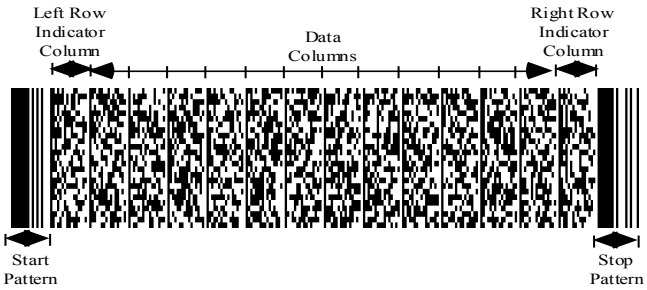


Figure B.3
The anatomy of a PDF417 symbol

B.1.2.8.4 Determine the appropriate label size

Tables B.3 through 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 all tables, the approximate width in the top row of each table includes symbol quiet zones.

B.1.2.8.4.1 Symbols for labels having a width of at least 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
PDF417 symbols
X dimension = 0,25 mm
Approximate alphanumeric capacity

	Width 39 mm		**Width 52 mm**		**Width 65 mm**		**Width 78 mm**		**Width 96 mm**	
	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns
Symbol height	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		1217 characters		1535 characters	
NOTE: The shaded columns are not recommended for use by this standard.										

Table B.4
PDF417 symbols
X dimension = 0,33 mm
Approximate alphanumeric capacity

	Width 39 mm		Width 52 mm		Width 65 mm		Width 78 mm		Width 96 mm	
	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns
Symbol height	36,1	2	47,2	4	55,8	6	75,4	9	92,2	12
25 mm	N/A		13 characters		77 characters		175 characters		272 characters	
50 mm	41 characters		200 characters		358 characters		596 characters		833 characters	
NOTE: N/A means not applicable. Where N/A appears, this means that for the associated label width and error correction level 5, no data can be encoded.										

Table B.5
PDF417 symbols
X dimension = 0,38 mm
Approximate alphanumeric capacity

	Width 39 mm		Width 52 mm		Width 65 mm		Width 78 mm		Width 96 mm	
	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns
Symbol height	34,8	1	47,8	3	60,7	5	73,7	7	93,2	10
25 mm	N/A		N/A		27 characters		85 characters		171 characters	
50 mm	N/A		88 characters		225 characters		362 characters		567 characters	
NOTE N/A means not applicable. Where N/A appears, this means that for the associated label width and error correction level 5, no data can be encoded.										

Table B.6
PDF417 symbols
X dimension = 0,43 mm
Approximate alphanumeric capacity

	Width 39 mm		Width 52 mm		Width 65 mm		Width 78 mm		Width 96 mm	
	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns
Symbol height	31,8	0	46,5	2	61,2	4	75,9	6	90,7	8
25 mm	N/A		N/A		N/A		34 characters		85 characters	
50 mm	N/A		N/A		121 characters		239 characters		358 characters	
NOTE N/A means not applicable. Where N/A appears, this means that for the associated label width and error correction level 5, no data can be encoded.										

B.1.2.8.4.2 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 symbols are assumed to be either 25 mm or 50 mm high. Tables B.7 and B.8

are not recommended by this standard.

Table B.7
PDF417 symbols
X dimension = 0,38 mm
Approximate alphanumeric capacity

	Width 122 mm		Width 137 mm		Width 147 mm	
	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns
Symbol height	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
PDF417 symbols
X dimension = 0,43 mm
Approximate alphanumeric capacity

	Width 122 mm		Width 137 mm		Width 147 mm		Width 159 mm	
	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns	Actual mm	Data columns
Symbol height	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	

B.1.3 QR Code for shipping and receiving applications

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.

B.1.3.1 QR Code error correction level

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

B.1.3.2 QR Code module dimensions

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

B.1.3.3 QR Code 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.

B.1.3.4 QR Code symbol size

The symbol size should be 50 mm or smaller.

B.1.3.5 QR Code symbol print quality

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

- The print quality grade at the point of symbol printing should be 3,0 (B) or higher.
- Light source wavelength = 660 nm ±10 nm

The above 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 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 for the requirement at the point of use.

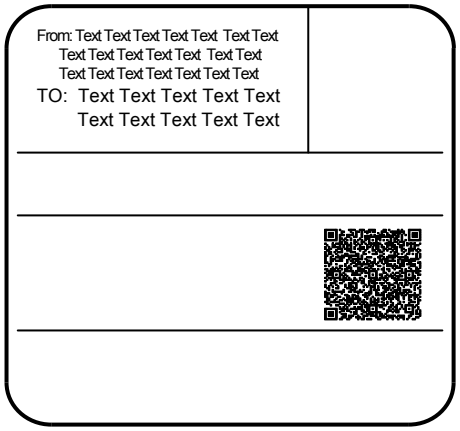
B.1.3.6 QR Code orientation and positioning

B.1.3.6.1 Orientation

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

B.1.3.6.2 Label positioning

To include a QR Code symbol in a label of this Standard, a QR Code symbol must be positioned within the customer segment. See Figure B.4 for an example of positioning.



Note: This figure is not to scale.

Figure B.4 — Positioning of QR Code symbol on label

B.1.3.7 Considerations when printing QR Code symbols

B.1.3.7.1 General

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

- data requirements
- scanner technologies
- label area requirements
- printer technologies

When determining what module dimensions should be used, it is desirable that a developers and users of QR Code printing software should follow these guidelines. These guidelines should assure 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 contents of Table B.9.

B.1.3.7.2 Designing of the label layout

B.1.3.7.2.1 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 of this standard, it is desirable that the designer consider the largest module dimension that may 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 a range of from 0,42 mm and 0,33 mm.

B.1.3.7.2.2 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.

B.1.3.7.2.3 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 B.9 — 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	39,93 mm
1 500	650	N/A	42,57 mm
1 750	770	N/A	46,53 mm
2 000	890	N/A	49,17 mm
Note: "N/A" indicates "not applicable."			

B.1.3.7.2.4 Selecting appropriate sizes in the tables

Table B.9 gives approximate QR Code symbol widths for 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 B.9, 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 reducing the character count.

B.1.3.7.3 Printing of the symbol on the label

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

For reference, Table B.10 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 an error correction level is M (approximately 15%).

Table B.10 — Approximate alphanumeric capacity of QR Code symbols in two sizes (incorporating on error correction level of M and quiet zones)

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

B.1.4 Data Matrix for shipping and receiving applications

B.1.4.1 Data Matrix error correction

For shipping and receipt applications, an error correction by ECC200 shall be used.

B.1.4.2 Data Matrix module dimensions

Module dimensions (X dimensions) should be within a range of 0,254 mm to 0,42 mm and it is desirable to define dimensions according to the printing performances of label suppliers and/or of label issuers.

B.1.4.3 Data Matrix quiet zone

For shipping and receipt applications, the Data Matrix Code symbol should incorporate a minimum quiet zone of 2X, both vertically and horizontally. The 2X quiet zone is accordingly included within the calculation of the size of the symbol.

B.1.4.4 Data Matrix Code symbol size

The symbol size should be 50 mm or smaller.

B.1.4.5 Data Matrix symbol print quality

The print quality of the Data Matrix Code symbol should be determined in accordance with ISO/IEC 16022 and ISO/IEC 15415. For carrier sortation and tracking applications the symbol grade should satisfy the following minimum requirements:

— The print quality grade at the point of symbol printing should be 3,0 (B) or higher.

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 for the requirement at the point of use.

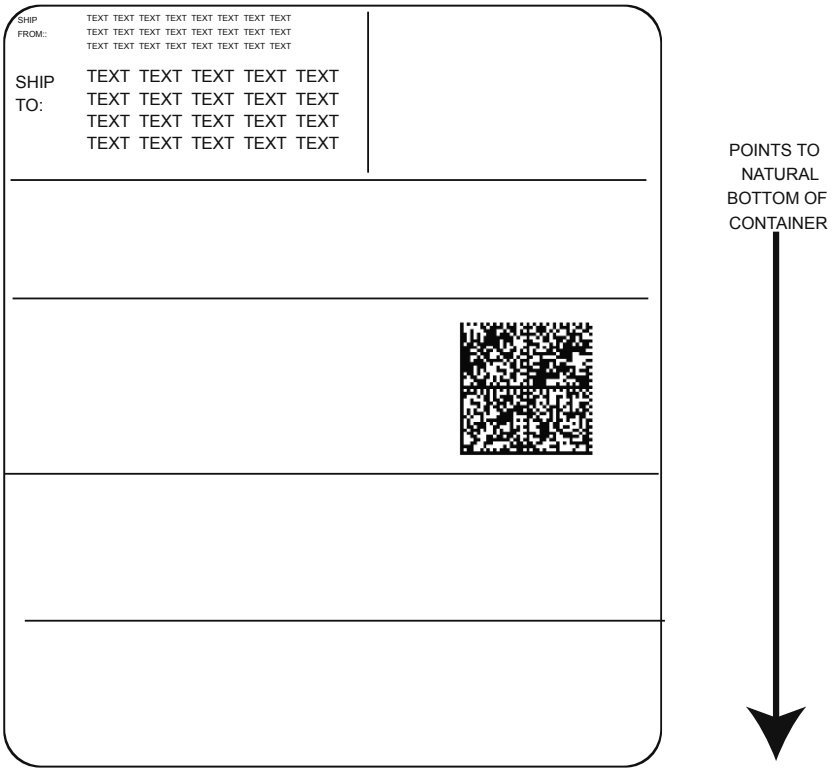
B.1.4.6 Data Matrix orientation and positioning

B.1.4.6.1 Orientation

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

B.1.4.6.2 Symbol positioning

To include a Data Matrix Code symbol in a label of this Standard, a Data Matrix symbol must be positioned within the customer segment. See Figure B.4 for an example of positioning.



Note: This figure is not to scale.

Figure B.1.4.6.3.2 — Positioning of Data Matrix Code symbol on label

B.1.4.7 Considerations when printing Data Matrix symbols

B.1.4.7.1 General

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

- data requirements
- scanner technologies
- label area requirements
- printer technologies

When determining what module dimensions should be used, it is desirable that a developers and users of Data Matrix Code printing software should follow these guidelines. These guidelines should assure 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 contents of Table B.9.

B.1.4.7.2 Designing of the label layout

B.1.4.7.2.1 Design of the maximum module dimension(s) that can be used

When designing for the space required for positioning a Data Matrix symbol on a label of this standard, it is desirable that the designer consider the largest module dimension that may 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 Data Matrix symbol may be printed at any module dimension within a range of from 0,42 mm and 0,25 mm.

B.1.4.7.2.2 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.

B.1.4.7.2.3 Design of scanning equipment likely to be used

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

Table B.11 — Approximations of symbol width and character count for Data Matrix symbol (including error correction ECC200 and quiet zones)

Size	Max Alphanumeric capacity	Quiet Zone (number of cells)	symbol size with module dimension 0.42 mm incl. quiet zone	symbol size with module dimension 0.254 mm incl. quiet zone
24 x 24	52	2	10,92	6,60
26 x 26	64	2	11,76	7,11
32 x 32	91	2	14,28	8,64
36 x 36	127	2	15,96	9,65
40 x 40	169	2	17,64	10,67
44 x 44	214	2	19,32	11,68
48 x 48	259	2	21,00	12,70
52 x 52	304	2	22,68	13,72
64 x 64	418	2	27,72	16,76
72 x 72	550	2	31,08	18,80
80 x 80	682	2	34,44	20,83
88 x 88	862	2	37,80	22,86
96 x 96	1042	2	41,16	24,89
104 x 104	1222	2	44,52	26,92
120 x 120	1573	2	n.a.	30,99
132 x 132	1954	2	n.a.	34,04
144 x 144	2335	2	n.a.	37,08

B.1.4.7.2.4 Selecting appropriate sizes in the tables

Table B.11 gives approximate Data Matrix ECC200 symbol widths for module dimensions of 0,42 mm and 0,254 mm and a maximum of 2 335 alphanumeric characters. In Table B.11, 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. Sequences of more than 6 numbers can be encoded more efficiently than when mixed with alpha-characters.

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

B.1.4.7.3 Printing of the symbol on the label

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

B.2 Supporting documentation applications

The shipping, transportation, and receiving of transport units often requires supporting documentation data such as a bill of lading, manifest, packing slip, customs data, or information that might 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 encodation of data in 2D symbols in support of shipping, receiving, and transportation sortation and tracking. See Figure E.8.

B.2.1 Symbology recommendation

This standard recommends the use of PDF417 symbology (see ISO/IEC 15438) or Data Matrix, using ECC 200 (see ISO/IEC 16022), or QR Code (see ISO/IEC 18004) for supporting documentation applications.

The structure and syntax of symbologies for supporting documentation applications shall conform to the structure and syntax described in ISO/IEC 15434.

For supporting documentation applications, a Macro PDF417 symbol, which is defined in ISO/IEC 15438, may be used.

For supporting documentation applications, a MicroPDF417 symbol, which is defined in ISO/IEC 24728, shall not be used.

For supporting documentation applications when using QR Code, Model 2 shall be used.

B.2.2 Using PDF417 in supporting documentation applications

B.2.2.1 PDF417 error correction levels

For supporting documentation applications, the minimum PDF417 symbol error correction level

shall be as identified in Table B.11. Level 5 is the preferred correction level.

Table B.11
PDF417 Error Correction Level

Number of Data Characters	PDF417 Error Correction Level
under 100	3
100 to 399	4
400 or more	5

B.2.2.2 PDF417 narrow element dimension

For supporting documentation applications, the PDF417 symbol X dimension should be 0,254 mm.

B.2.2.3 PDF417 row height

For supporting documentation applications, the PDF417 symbol should have a row height (height of the symbol element) three (3) times the width of the narrow element (X dimension).

B.2.2.4 PDF417 quiet zones

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

B.2.2.5 PDF417 print quality

The ISO/IEC 15438 standard shall be used with reference to ISO/IEC 15416 to determine the print quality of the PDF417 symbol. The grade is expressed in the form of: grade/aperture/wavelength. For supporting documentation applications, the minimum symbol grade shall be 2,5/10/660 which is:

- an overall symbol grade greater than or equal to 2,5 (B) at point of production;
- a measurement aperture equal to 0,250 mm diameter (reference number 10);
- a light source wavelength equal to 660 ±10 nanometres;

B.2.2.6 PDF417 orientation and placement

B.2.2.6.1 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 supporting documentation applications, symbol skew shall not be more than ±5 degrees.

B.2.2.6.2 Placement

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

NOTE As the document is likely to be folded after printing, tests should be carried out to select appropriate symbol locations.

B.2.2.7 Concatenation of PDF417 symbols

For supporting documentation applications, the Macro PDF417 symbol version of the PDF417 symbology, as defined in the 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. Application programmers should become familiar with the technical specifications for Macro PDF417 symbology to understand how the concatenated data will be transmitted to the application software.

B.2.2.7.1 Planning for large messages using PDF417

When designing an application that will encode large amounts of data, consideration must 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, could exceed approximately 1 200 alphanumeric characters, planning must be done to assure that all the concatenated symbols that constitute the entire Macro PDF417 symbol message be read in a single scanning sequence. Scanning an intervening symbol, either linear or 2D, will break the scanning sequence and may give unpredictable results.

B.2.2.7.2 Printing concatenated PDF417 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 symbology. The Macro PDF417 symbol 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.2.2.7.3 Reading Macro PDF417 symbols

To read Macro PDF417 symbols properly, the transmission protocol of the decoder shall comply with Macro PDF417 symbology as defined in Annex H of ISO/IEC 15438. The symbols may be transmitted in buffered or unbuffered mode.

The decoder shall be capable of fully supporting the Symbology Identifier options for a PDF417 symbol. The decoder will transmit the Symbology Identifier, "]L1". This header signifies that escape and sequence characters have been inserted into the message by the reader, and must be handled by the application program. The application program must 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 a Macro PDF417 symbol is defined in ISO/IEC 15438.

B.2.3 Using QR Code in supporting documentation applications

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.

B.2.3.1 QR Code error correction levels

For supporting documentation applications, an error correction level M (approximately 15%) is recommended.

B.2.3.2 QR Code module dimensions

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

B.2.3.3 QR Code quiet zones

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

B.2.3.4 QR Code 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 = B (3,0) or higher at the point of printing the symbol;
- light source wavelength = 660 nm ± 10 nm

B.2.3.5 QR Code orientation and positioning

B.2.3.5.1 Orientation

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

B.2.3.5.2 Positioning

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

Note: Because a document may be folded after printing, it is recommended that a test be conducted to select an appropriate position for the symbol.

B.2.3.6 Concatenation of QR Code symbols

B.2.3.6.1 General

For supporting documentation applications, use of the concatenation QR Code symbol defined in ISO/IEC18004 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.

B.2.3.6.2 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/IEC18004), use of concatenated QR Code symbols is desirable.

B.2.3.6.3 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, or be configured so as to be able to concatenate QR Code symbols.

B.2.3.6.4 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.

B.2.4 Using Data Matrix in supporting documentation applications

For Data Matrix in supporting documentation the same aspects as for shipping and receiving applications apply (See Annex B.1.4).

B.3 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 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, locate transport units, and other supporting data which is relevant to sortation and/or tracking for internal and external processing.

When a 2D symbol is used for carrier sortation and tracking applications, either the MaxiCode symbology (see ISO/IEC 16023), the PDF417 symbology (ISO/IEC 15438), the QR Code symbology (ISO/IEC 18004), or the Data Matrix symbology (see ISO/IEC 16022) are capable of being read in a high speed scanning environment. The structure and syntax of the 2D symbols for carrier sortation and tracking applications shall conform to the structure and syntax described in ISO/IEC 15434.

B.3.1 Symbology usage guidance

Usage of MaxiCode in carrier sortation and tracking applications is defined in Annex B.3.2

Usage of QR Code in carrier sortation and tracking applications is defined in Annex B.3.3

Usage of PDF417 in carrier sortation and tracking applications is defined in Annex B.3.4

Usage of Data Matrix in carrier sortation and tracking applications is defined in Annex B.3.5.

B.3.2 MaxiCode for carrier sortation and tracking applications

B.3.2.1 MaxiCode code set

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

B.3.2.2 MaxiCode mode

The MaxiCode symbol incorporates one Mode per symbol. This standard recommends the use of MaxiCode Mode 2 or Mode 3 to ensure 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 B.12 determines the appropriate Mode.

Table B.12 — 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

B.3.2.3 MaxiCode error correction levels

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

B.3.2.4 MaxiCode 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 consistent with ISO/IEC 16023. Each symbol, including the quiet zone, is of a fixed physical size, nominally 28,14 mm wide by 26,91 mm high.

B.3.2.5 MaxiCode quiet zones

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

B.3.2.6 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 is:

- an overall symbol grade greater than or equal to 2,5 (B) at point of production;
- a measurement aperture equal to 0,250 mm diameter (reference number 10),
- a broad band light source.

The above symbol quality and measurement parameters assure 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 higher than the requirement at the point of use.

It may not be possible to meet the print quality requirements of this standard when printing directly onto kraft coloured corrugated surfaces. Users considering the printing of bar code symbols directly onto kraft coloured corrugated surfaces should consider the scanning capabilities of their entire trading channel.

B.3.2.7 MaxiCode orientation and placement

B.3.2.7.1 Symbol orientation

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

B.3.2.7.2 Symbol placement

If the symbol is included in the Extended Label described in this standard, the MaxiCode symbol shall be placed in the carrier segment. See Figure B.5 for example of placement.

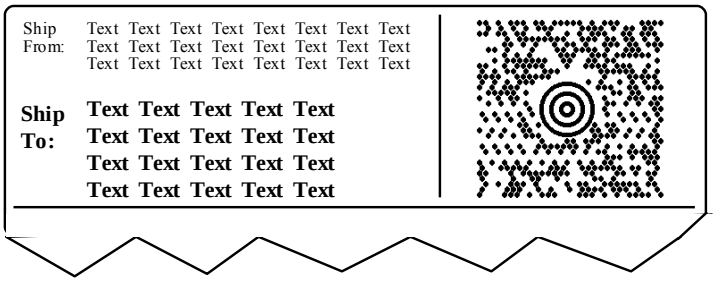


Figure B.5
MaxiCode symbol placement on a label (not to scale)

B.3.2.7.3 Label placement

Labels shall be placed on the top of transport units.

B.3.2.8 Concatenation

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 standard recommends the use of Modes 2 and 3, Structured Append 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;
- the continuation of the data message shall be in the secondary message of the second

symbol.

B.3.2.8.1 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 sortation and tracking application exceeds the capacity of a single symbol, the printing system will automatically use the Structure Append sequence.

The symbols shall be printed side by side.

B.3.2.8.2 Reading Structured Append MaxiCode symbols

When Structured Append is used with Modes 2 and 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 normative Annex B of ISO/IEC 16023.

B.3.3 QR Code for carrier sortation and tracking applications

B.3.3.1 QR Code code set

When encoding information in a QR Code symbol, it is recommended that the bit string length be optimized.

B.3.3.2 QR Code symbology

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

B.3.3.3 QR Code error correction levels

The error correction level shall be M (approximately 15%), Q (approximately 25%) or H (approximately 30%).

B.3.3.4 QR Code module dimension

The module dimension shall be within the range of 0,85 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.

B.3.3.5 QR Code quiet zones

The QR Code symbol shall have a minimum quiet zone of 4 modules on the left, right, top and bottom.

B.3.3.6 QR Code 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;
b) a light source wavelength = 660 nm ±10 nm

The above symbol quality and measurement parameters assure 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.

B.3.3.7 QR Code orientation and placement

B.3.3.7.1 Orientation

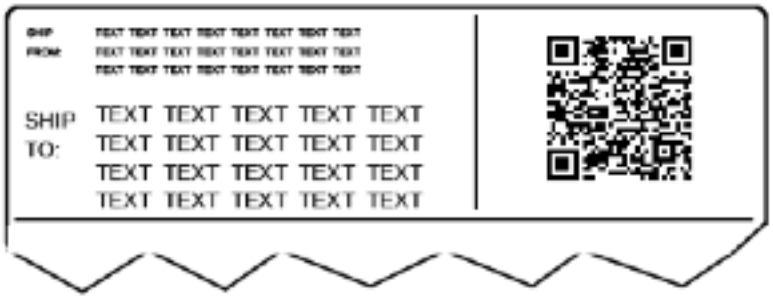
Due to the nature of the QR Code symbology, specific symbol orientation is not required.

B.3.3.7.2 Symbol placement

If the QR Code symbol is included, this symbol shall be placed in the carrier segment. See Figure B.6 for example of placement.

B.3.3.7.3 Label placement

Labels shall be placed on the top of transport units.



NOTE This figure is not to scale.

Figure B.6 — Positioning of QR Code symbol on label

B.3.4 PDF417 for carrier sortation and tracking applications

B.3.4.1 PDF417 code set

When encoding information in a PDF417 symbol for carrier sortation and tracking applications, the Byte Compaction Mode, as defined in ISO/IEC 15438, shall be utilized to enable the use of the full ASCII character set.

B.3.4.2 PDF417 symbology

The technical specifications for carrier sortation and tracking applications shall be as defined in ISO/IEC 15438. The options available in MicroPDF417, Compact PDF417, and Composite

PDF417 shall not be used.

B.3.4.3 PDF417 security correction levels

The error correction level for the use of PDF417 in carrier sortation and tracking applications shall be 5 (See ISO/IEC 15438).

B.3.4.4 PDF417 X dimension

The X dimension should be 0,254 mm. The X dimension shall be no smaller than 0,254 mm. Any larger X dimension should be agreed upon between trading partner.

B.3.4.5 PDF417 module aspect ratio

The module aspect ratio of the height of a module ("Y Dimension") to the width of a module ("X Dimension") shall be 5:1.

B.3.4.6 PDF417 data columns

To facilitate both high speed over-the-belt scanning and hand held scanning the PDF417 symbol shall contain 12 data columns.

B.3.4.7 PDF417 quiet zones

The top and bottom quiet zones shall be no smaller than 1,016 mm and the zones to the left and right of the symbol shall be no smaller than 2,54 mm.

B.3.4.8 PDF417 print quality

ISO/IEC 15417 shall be used to determine the print quality of the PDF417 symbol. For carrier sortation and tracking applications the minimum symbol grade shall be one that has:

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

— a light source wavelength = 660 nm ±10 nm

The above symbol quality and measurement parameters assure 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.

B.3.4.9 PDF417 orientation and placement

B.3.4.9.1 Orientation

The PDF417 symbol shall be oriented parallel to the linear bar code symbols on the label.

B.3.4.9.2 Symbol placement

If the PDF417 symbol is included in an MH10.8.1 label, this symbol shall be placed in the carrier segment. See Figure B.7.

B.3.4.9.3 Label placement

Labels shall be placed on the top of transport units.

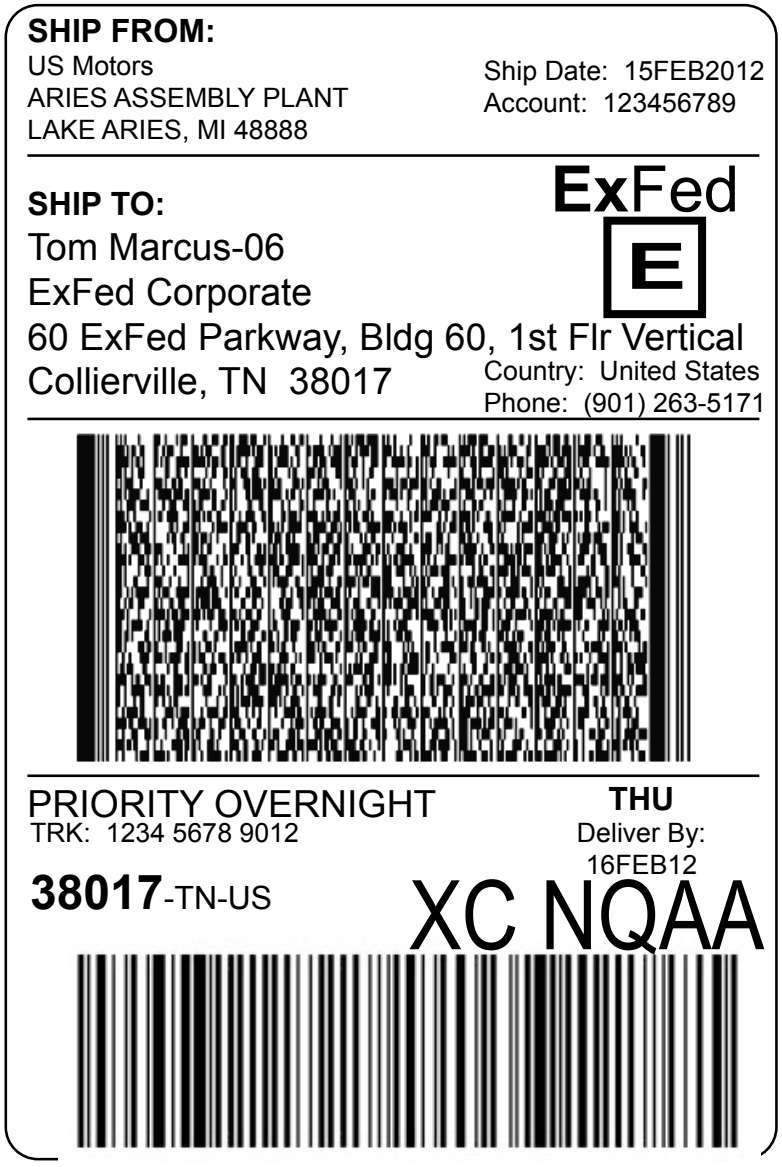


Figure B.7 — Positioning of PDF417 symbol on label
Note: This figure is not to scale

Annex C
(informative)
Designing compliant labels using a building block approach

C.1 Label definition

The general term “label” means the printed area on the package that includes the text and/or bar code data (including linear bar code, composite, or 2D symbols), as covered in this document. The label is constructed by the use of indirect marking (e.g., pressure-sensitive labels, tags). Separate sections of the label may be applied at different stages to form the complete label.

Direct marking (e.g. inkjet, letterpress, and flexographic directly onto the package) may also be used, if it meets the quality requirements in Annexes A and B. The label layout and principles still apply.

C.2 Building blocks

To simplify label formatting, a modular building block structure is described (see Figure C.1). The building block is the basic standard unit of the label format. An individual building block or sub-block may contain one of the following:

- text or graphics,
- bar code symbol (2D symbol or linear bar code symbol with human readable interpretation),
- a blank.

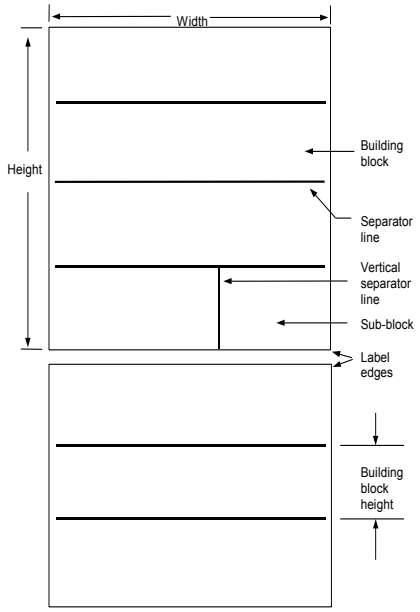


Figure C.1 - Modular label structure

Each building block may be physically produced separately or in combination with other building blocks. This provides the option of printing data as it becomes known. Generally, building blocks should be stacked vertically.

C.3 Text lines-per-block

The height of text characters is defined using a unit of measure called lines-per-block (LPB), rather than inches, millimetres, or points. This enables the printer of the label to determine the actual height and font of text for a given LPB requirement. See clause C.6.2.

C.4 Segments

Segments are logical groupings of information based on the data needs of the trading partners within the distribution channel. Three segments are defined below: carrier segment, customer segment, and supplier segment.

Note: The customer segment may contain consignee data, and the supplier segment may contain shipper data.

When the size and structure of the package permits, segments shall be stacked vertically, from top to bottom, in the following order:

- carrier segment,
- customer segment,
- shipper segment.

When stacked vertically, information required by carriers shall be placed top-most on the label.

C.5 Label dimensions

The size of the label should be consistent with the data requirements of all trading partners in the supply chain, with the only constraint being the size of the unit load or transport package.

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 units.

The full label height will be determined by the number of building blocks included on the label.

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

C.6 Label format

This section defines a standardized format for shipping labels.

C.6.1 Building blocks

Building blocks are stacked vertically to construct the label. Building blocks should be separated from each other by a horizontal line.

C.6.1.1 Building block size

Building block height shall be 25 mm ± 5 mm, as determined by the printing capability of the labeller. The width of a building block is the width of the label.

One double-height bar code block per segment may be used to satisfy special scanning requirements (e.g., automated conveyor scanning, long range scanning). Double-height building blocks shall be 51 mm ± 10,2 mm.

One half-height text building block per segment may be used at the discretion of the labeller. Half-height building blocks shall be 13 mm ± 2 mm.

C.6.1.2 Sub-blocks

Building blocks can be divided into no more than four sub-blocks. The minimum width of a sub-block shall be determined by the amount of data that will be printed in that sub-block. A sub-block shall be the full height of the building block. Vertical lines should be used between sub-blocks.

C.6.2 Text block

A text building block or sub-block may contain text or graphics or both. A text building block or sub-block shall not contain a bar code symbol.

Table C.1
Lines-per-block (LPB) alternatives and calculated measurements

Lines-per-block	Character Height (Points)	Character Height (Millimetres)
1 LPB	72 pts	25,4 mm
2 LPB	36 pts	12,7 mm
3 LPB	24 pts	8,4 mm
4 LPB	18 pts	6,4 mm
5 LPB	14 pts	5,1 mm
6 LPB	12 pts	4,3 mm
7 LPB	10 pts	3,6 mm
8 LPB	8 pts	3,2 mm
10 LPB	7 pts	2,5 mm
NOTE The character height includes ascenders, descenders, and leading.		

Nine LPB sizes may be specified for text, ranging from one to eight and ten LPB. The exact character heights corresponding to the nine LPB sizes shall be chosen by the labeler based on the capabilities of the printing process.

Labellers shall choose a single height for each of the nine LPB sizes so that clear distinctions shall be evident between character heights (i.e., 8 LPB text shall be smaller than 7 LPB text, etc.). Table C.1 provides dimensional considerations for 1, 2, 3, 4, 5, 6, 7, 8, and 10 LPB printing.

The characters shall be clearly legible. For maximum legibility, the ratio of the height to width of a character should not exceed 2:1 (measured on an "M" character).

Character heights for double-height and half-height building blocks shall be the same as specified for a single-height block.

C.6.3 Text building block and sub-block title line(s)

A title should be used. When a title is used, it should be printed in the upper left corner of the text building block or sub-block. The title should be printed in upper case characters at a height of 6 LPB, two lines maximum, left justified.

C.6.4 Bar code symbol block

A bar code symbol may be specified for either a building block or sub-block.

A title should be used for a bar code symbol building block. When a title is used, it should be printed in the upper left corner of the bar code symbol building block or sub-block. In the case when two linear symbols appear in the same building block, the right-hand symbol may have the title printed in the lower left corner of the machine readable building block or sub-block. The title should be printed in upper case characters at a height of 6 LPB, two lines maximum, left justified. The title should consist of a description of the data type. The title should also identify the respective ANSI MH10.8.2 Data Identifier or GS1 Application Identifier if not part of the printed human readable interpretation of the bar code symbol.

Annex D
(informative)
Issues to consider in the drafting of application guidelines or standards conforming to this International Standard

This 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 symbology options. The application guideline should, within the overall constraint of complying with this International Standard, be more specific. This annex describes the features which need to be defined in the application guideline.

D.1 The domain

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 partners covered by the application guideline.

D.2 Data presentation

Define which method(s) of data presentation (see Annex A and Annex B) is (are) to be used:

- Code 39 and Code 128 linear bar code symbols,
- QR Code, PDF417, or MaxiCode 2D symbols.

D.3 The label

The document should make it clear whether the base label and/or extended label are acceptable to trading partners.

D.4 Data elements

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

- The required data element of the unique transport unit identifier (see clause D.5) shall be fully defined as per ISO/IEC 15459-1.
- If GS1 Application Identifiers are used, then those suppliers shall comply with the rules of the GS1 General Specifications.
- If ANSI MH10.8.2 Data Identifiers are used, then those labellers shall comply with the rules for ISO/IEC 15459-1.
- The information needs of the carrier shall be considered, particularly for the key to carrier information.
- The information needs of the customer shall be considered, particularly for the key to customer information.

- Other data shall be considered by mutual agreement between the supplier, carrier, and customer.

D.5 The unique transport unit Identifier

When the unique transport unit identifier is encoded with the ANSI MH10.8.2 Data Identifiers:

- A single international Registration Authority is designated in accordance with ISO/IEC 15459-2.
- The Registration Authority assigns a unique Issuing Agency (IAC) code.
- 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.
- The organizations or persons then use the IAC and their own Issuing Agency assigned identifier to create a license plate number for the transport unit, using the ANSI MH10.8.2 Data Identifier "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; this will ensure that the data will be unique in a sense that no issuer re-issues a number until a sufficient period of time has passed so that the first number has ceased to be of significance to any user of data.

D.6 Linear bar code

Specify which linear symbology shall be used. If migrating from Code 39, see Annex G.

D.7 2D symbol

If 2D symbol(s) are incorporated, specify the selected ISO/IEC 15434 formats. The precise rules of normative Annex B shall be incorporated.

D.8 The X dimension

Specify the narrow element X dimension (see clauses A.6, B.1.2.2, B.1.3.2, B.2.2.2, B.2.3.2, B.3.2.4, B.3.3.4, and B.3.4.4). 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 within this range.

D.9 Symbol quality

Specify the symbol quality (see clauses A.11, B.1.2.6, B.1.3.5, B.2.2.5, B.2.3.4, B.3.2.6, B.3.3.6, and B.3.4.8). Ideally, this should be identical to that of this International Standard. However, there can be industry-specific requirements which call for a higher print quality. In drafting the application guideline, consideration needs to be given to the cross-over effect both for:

- labels from suppliers covered by the application guideline going to customers outside the domain of the industry,
- labels coming from suppliers outside the domain of the industry.

In both these cases, the expectation of trading partners will be to conform to the print quality as specified in this International Standard.

D.10 Label design

Specify, in as much detail as is appropriate for the application, the label design (see clause B.1.2.8 and B.1.3.7) taking into consideration the size of label and any special label materials.

D.11 Label placement

Specify the label placement appropriate for the application (see clause A.10, B.1.2.7, B.1.3.6, B.2.2.6, B.2.3.5, B.3.2.7, B.3.3.7, and B.3.4.9).

Annex E
(informative)
Label examples

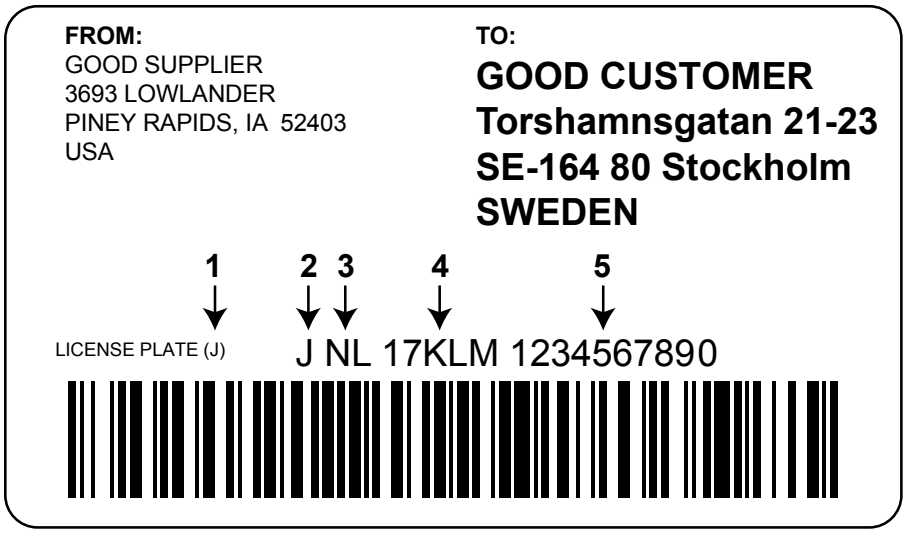
E.1 Base Label examples

E.1.1 Data examples

One of the two following formats shown in Figures E.1 or E.2 are required

NOTE 1 GS1 Data Title
NOTE 2 Machine-readable symbol (GS1-128 Serial Shipping Container Code)
NOTE 3 Human Readable Interpretation

Figure E.1
Base Label using GS1-128 license plate (not to scale)



NOTE 1 MH10 Area Data Title (MH10.8.2 Data Identifier “J” for “License Plate”
NOTE 2 ISO/IEC 15459 Issuing Agency Code - IAC (“J” for UPU)
NOTE 3 National prefix
NOTE 4 Company prefix
NOTE 5 Serial number for unique ID

Figure E.2
Base Label using "J" ANSI MH10.8.2 Data Identifier license plate (not to scale)

E.1.2 Bar code symbols as pointers to a trading partner's databases

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

NOTE 1 Sender
NOTE 2 Recipient
NOTE 3 Pointer to carrier’s database
NOTE 4 Pointer to recipients or customer’s database
NOTE 5 GS1-128 license plate

Figure E.3
Label using GS1-128 license plate
with pointers to carrier's and customer's databases (not to scale)

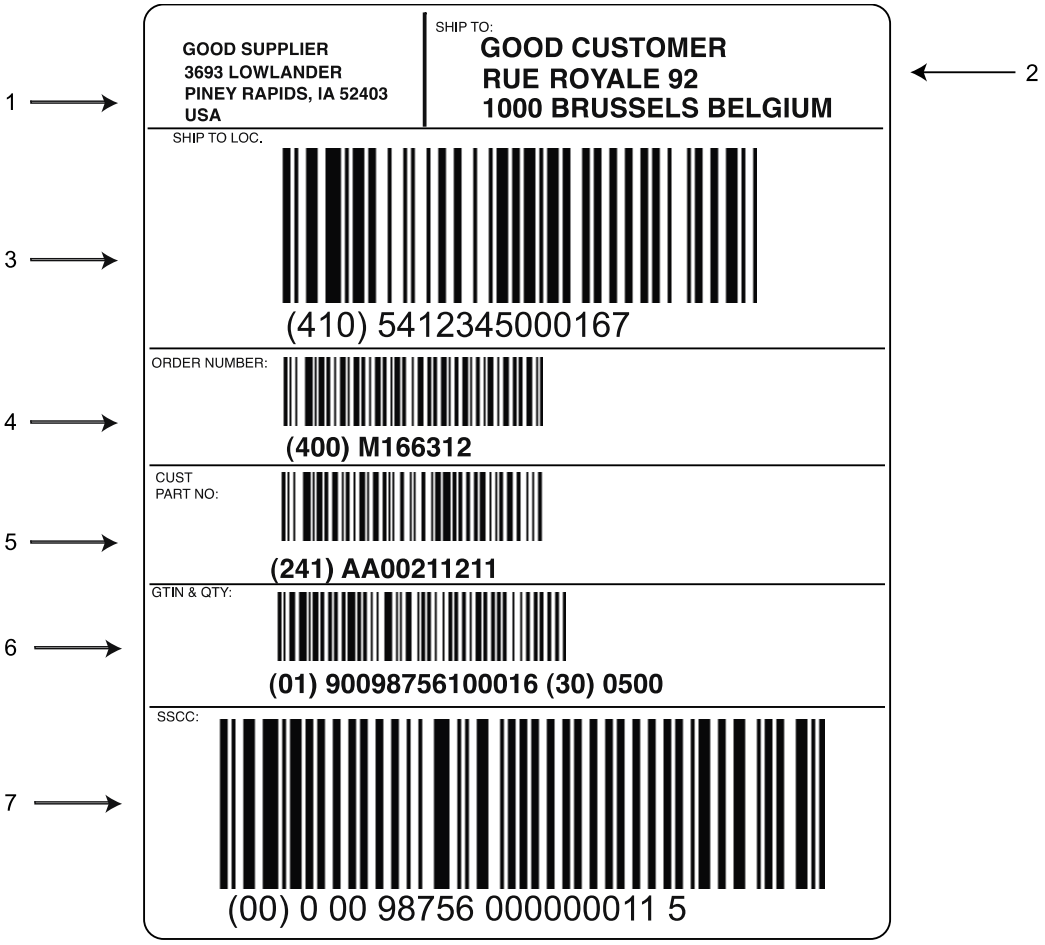
NOTE 1 Sender
NOTE 2 Recipient
NOTE 3 Pointer to carrier’s database
NOTE 4 Pointer to recipients or customer’s database
NOTE 5 Code 39 DI “J” license plate

Figure E.4
Label using "J" ANSI MH10.8.2 Data Identifier license plate with pointers to carrier's and customer's databases (not to scale)

E.2 Extended Label Examples

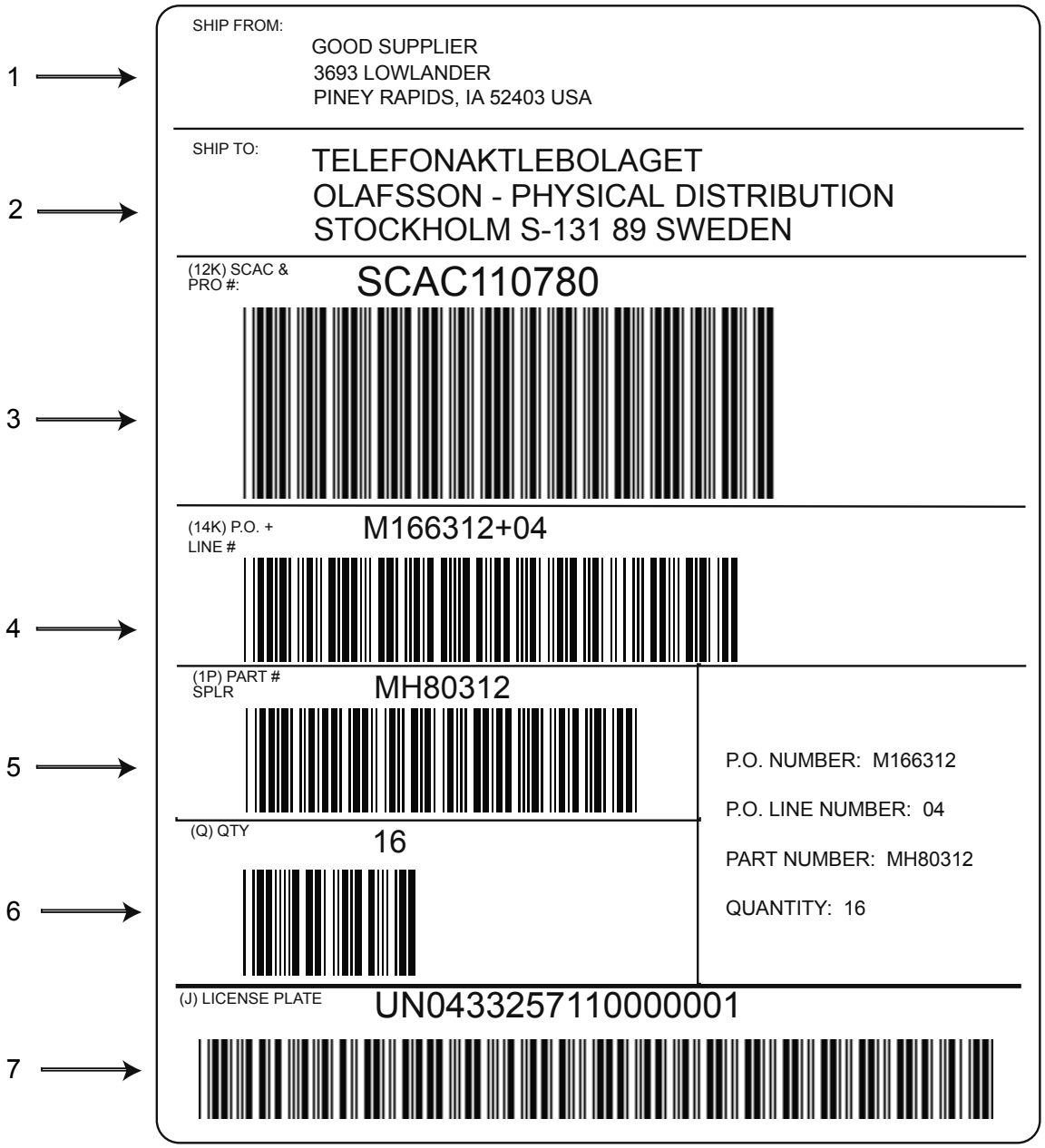
E.2.1 Bar code symbols as pointers to trading partner's databases

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



NOTE 1 Sender
NOTE 2 Recipient
NOTE 3 Pointer to carrier's database
NOTE 4 Pointer to recipients or customer's database
NOTE 5 optional data
NOTE 6 optional data
NOTE 7 GS1-128 license plate

Figure E.5
Label using GS1-128 license plate with
pointers to carrier's and customer's databases (not to scale)

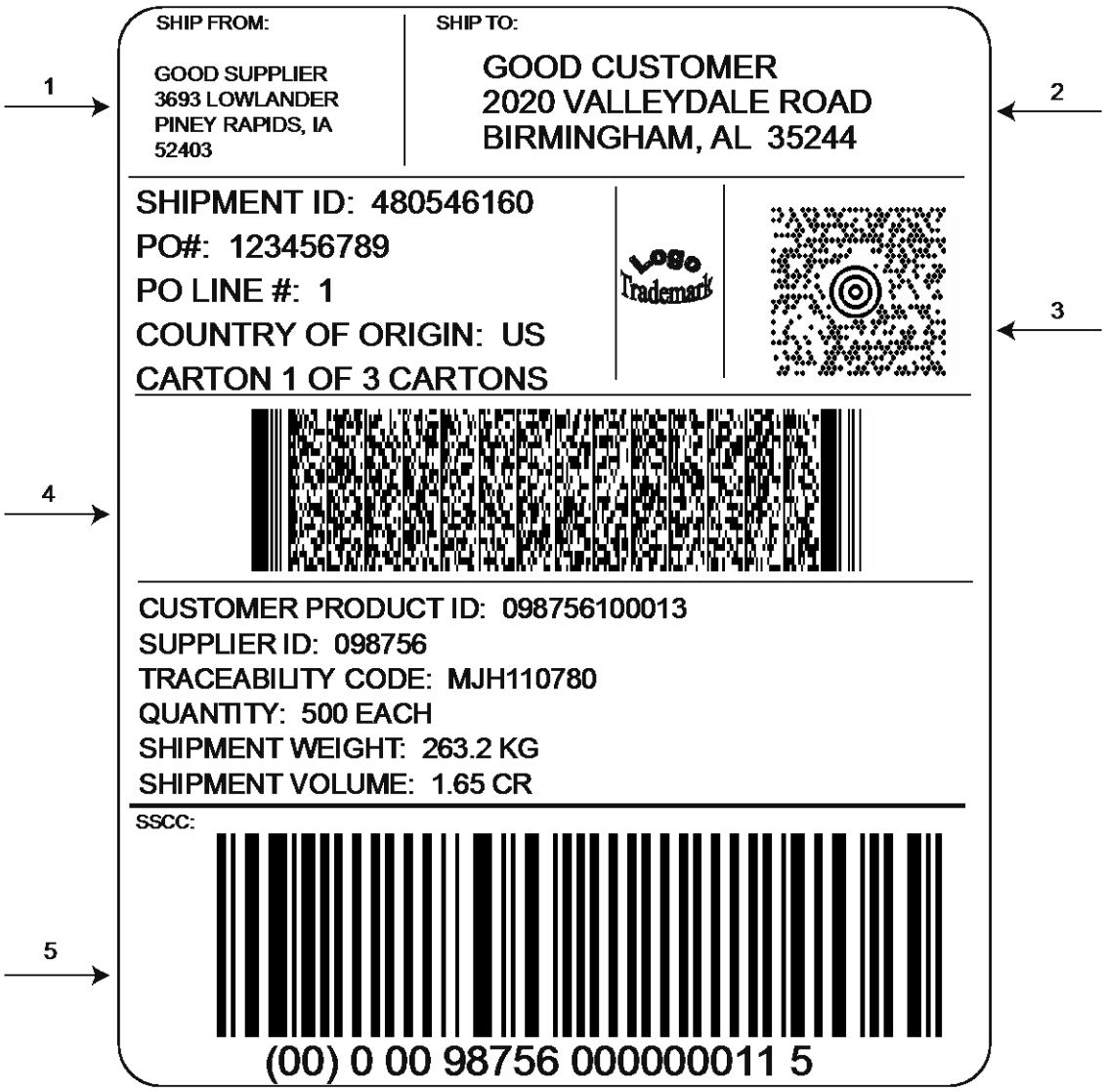


NOTE 1 Sender
NOTE 2 Recipient
NOTE 3 Pointer to carrier's database
NOTE 4 Pointer to recipients or customer's database
NOTE 5 optional data
NOTE 6 optional data
NOTE 7 Code 39 "J" license plate

Figure E.6
Label using "J" ANSI MH10.8.2 Data Identifier license plate with pointers to carrier's and customer's databases (not to scale)

E.2.2 Using license plate and 2D symbols for trading partner data

When, with mutual agreement of the trading partners, data in 2D symbols are needed, the formats shown in Figure E.7, Figure E.8 or Figure E.9 are recommended. The 2D symbol examples in Figure E.7, Figure E.8, and Figure E.9 are encoded in accordance with ISO 15434 data formats identified as Format 01 through Format 06.



NOTE 1 Sender
NOTE 2 Recipient
NOTE 3 Carrier sortation/tracking 2D symbol
NOTE 4 Recipient's or customer's data 2D symbol
NOTE 5 GS1-128 licence plate

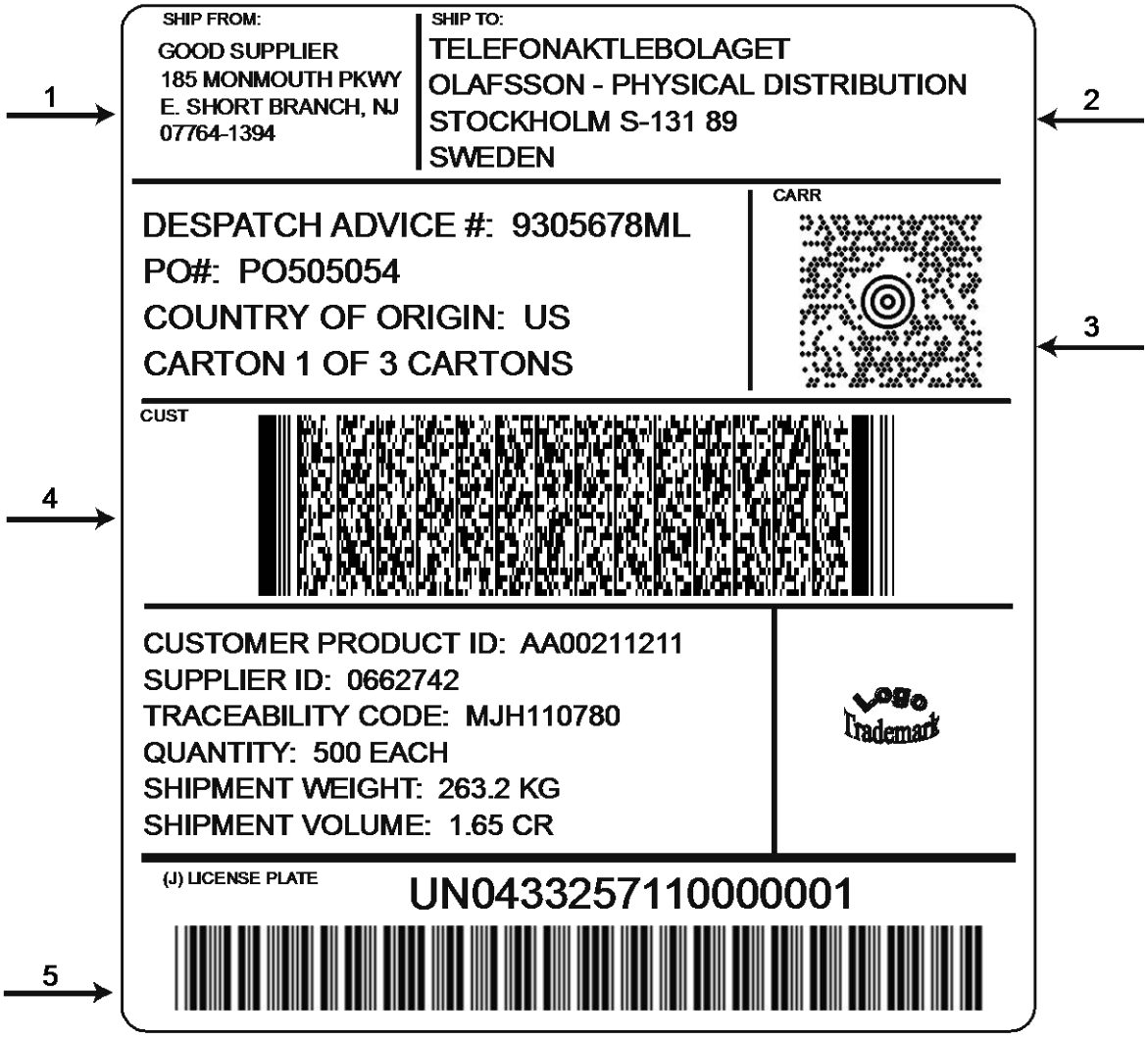
Figure E.7
Label using GS1-128 license plate and
additional trading partner data in 2D symbols (not to scale)

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

Compliance Indicator	[)>$^{R}_{S}$
Format 01 Sortation/Tracking Header	01$^{G}_{S}$96
Carrier Data	352440000$^{G}_{S}$840$^{G}_{S}$001$^{G}_{S}$ 9631415926535984147098$^{G}_{S}$SCAC$^{G}_{S}$ 5215716587$^{G}_{S}$$^{G}_{S}480546160^{G}_{S}$$^{G}_{S}580^{R}_{S}$
Format 05 Application Identifier Header	05$^{G}_{S}$
Supplier's transport unit ID	0000098756000000000115$^{R}_{S}$$^{E}O_{T}$

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

Header	[)>$^{R}_{S}$
Format 03 Header	03003030$^{F}_{S}$$^{G}_{S}$$^{U}_{S}$
Ship From Name	N1$^{G}_{S}$SF$^{G}_{S}$GOOD SUPPLIER$^{F}_{S}$
Ship From Street Address	N3$^{G}_{S}$ANY STREET$^{F}_{S}$
Ship From City, State, and Postal Code	N4$^{G}_{S}$ANY CITY$^{G}_{S}$ANY STATE$^{G}_{S}$POSTAL CODE$^{F}_{S}$
Ship To Name	N1$^{G}_{S}$ST$^{G}_{S}$GOOD CUSTOMER$^{F}_{S}$
Ship To Street Address	N3$^{G}_{S}$ANY ROAD$^{F}_{S}$
Ship To City, State, and Postal Code	N4$^{G}_{S}$ANY CITY$^{G}_{S}$ANY STATE$^{G}_{S}$POSTAL CODE$^{R}_{S}$
Format 05 Application Identifier Header	05$^{G}_{S}$
Shipment ID	902S480546160$^{G}_{S}$
Transport unit ID (Container License Plate)	0000098756000000000115$^{G}_{S}$
Carrier Shipment Number	9631415926535984147098$^{G}_{S}$
Customer PO # and Line Item #	400123456789+001$^{G}_{S}$
SCC14 (Item Code) & Quantity (Each)	01900987561000163050$^{0G}_{S}$
Customer Product ID	241098756100013$^{G}_{S}$
Country of Origin	904LUS$^{G}_{S}$
Lot / Batch Number	10MJH110780$^{G}_{S}$
Carton "n of x"	9013Q1/3$^{G}_{S}$
Shipment Weight	3303263200$^{G}_{S}$
Shipment Volume	3365165000$^{R}_{S}$
Trailer	$^{E}O_{T}$



NOTE 1 Sender
NOTE 2 Recipient
NOTE 3 Carrier sortation/tracking 2D symbol
NOTE 4 Recipient's or customer's data 2D symbol
NOTE 5 Code 39 “J” licence plate

Figure E.8
Label using "J" ANSI MH10.8.2 Data Identifier license plate and additional trading partner data in 2D symbols (not to scale)

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

Header	[)>$^{R}_{S}$
Format 01 Sortation/Tracking Header	01$^{G}_{S}$96
Carrier Data	S-13189$^{G}_{S}$752$^{G}_{S}$006$^{G}_{S}$MH80312$^{G}_{S}$SCAC$^{G}_{S}$ 5215716587$^{G}_{S}{}^{G}_{S}$1JEABCXXXA$^{G}_{S}{}^{G}_{S}$580$^{R}_{S}{}^{E}O_{T}$

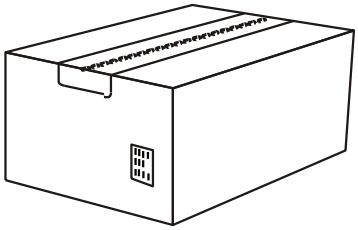
The customer data encoded in the PDF417 symbol in Figure E.8 is as follows:

Header	[)>$^{R}_{S}$
Format 04 Header	04092001$^{F}_{S}{}^{G}_{S}{}^{U}_{S}$
Ship From Name & Address	NAD$^{G}_{S}$SF$^{G}_{S}{}^{G}_{S}{}^{G}_{S}$GOOD SUPPLIER$^{G}_{S}$ANY STREET$^{G}_{S}$ANY CITY$^{G}_{S}$ANY STATE$^{G}_{S}$ANY STATE$^{G}_{S}$POSTAL CODE$^{F}_{S}$
Ship To Name & Address	NAD$^{G}_{S}$ST$^{G}_{S}{}^{G}_{S}{}^{G}_{S}$GOOD CUSTOMER$^{G}_{S}{}^{G}_{S}{}^{G}_{S}$ANY CITY$^{G}_{S}$ANY STATE$^{G}_{S}$POSTAL CODE$^{F}_{S}$
Despatch Advice Number	BGM$^{G}_{S}$351$^{G}_{S}$93-5678ML$^{G}_{S}$9$^{R}_{S}$
Format 06 Data Identifier Header	06$^{G}_{S}$
Transport unit ID (Container License Plate)	JUN0433257110000001$^{G}_{S}$
Carrier Shipment Number	12KSCACMH80312$^{G}_{S}$
Customer PO #	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 Weight	7Q263,2KG$^{G}_{S}$
Shipment Volume	7Q1,65CR$^{R}_{S}$
Trailer	$^{E}O_{T}$

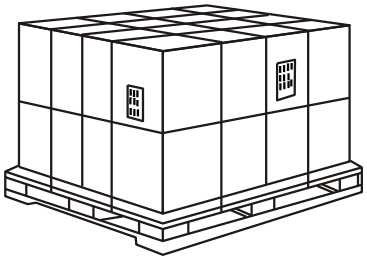
NOTE 1 Sender
NOTE 2 Recipient
NOTE 3 Carrier sortation/tracking 2D symbol
NOTE 4 Product description
NOTE 5 Logo
NOTE 6 Human Readable Translation
NOTE 7 GS1 GTIN & batch number
NOTE 8 GS1-128 license plate
NOTE 9 Human Readable Interpretation

Figure E.9
Two labels (top label is carrier label, bottom label is supplier label) (not to scale)

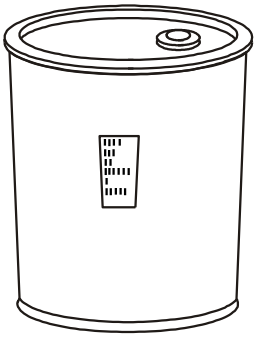
Annex F
(informative)
Recommended label locations on various containers



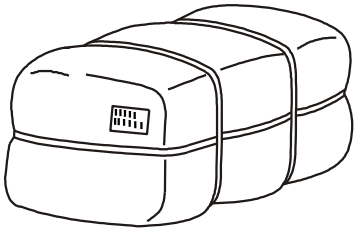
a) Box or carton with transport package label



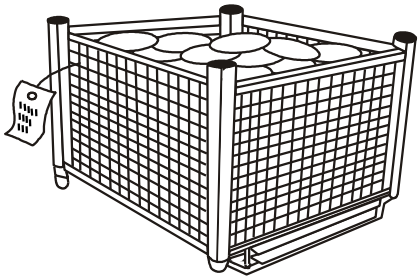
b) Pallet with two unit load labels



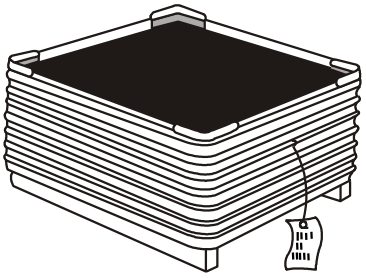
c) Drum, barrel, or cylindrical container



d) Bale



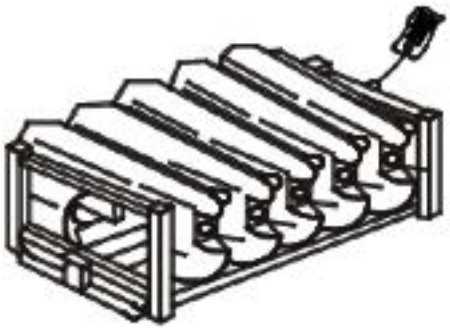
e) Basket, wire mesh container



f) Metal bin or tub

Figure F.1 — Examples of label locations

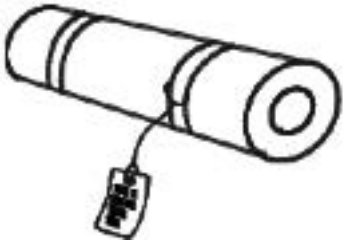
g) Pallet box



h) Rack

i) Bundle

j) Bag



k) Roll or coil

l) Reel or cable

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

Figure F.2 below shows possible locations for the transportation MaxiCode sortation/tracking label and for the customer's label.

— Users may choose one label combining the needs of both transportation and customer.
— Also see above for additional label placement examples.

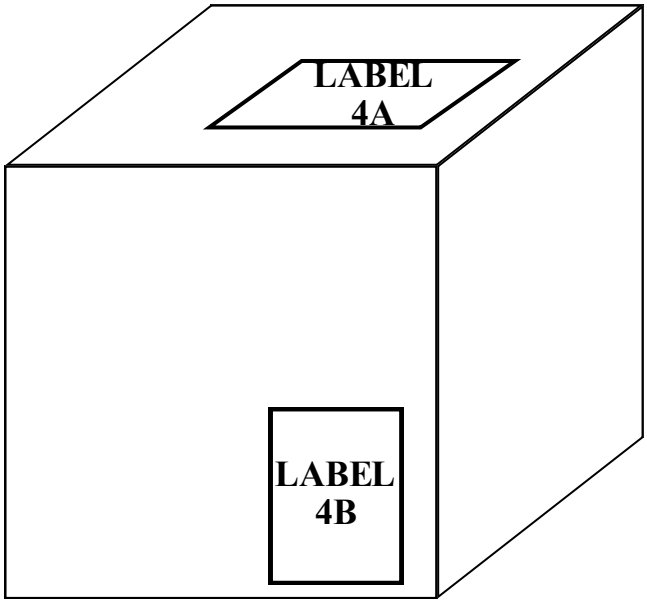


Figure F.2 — Location of transportation (4A) and customer labels (4B) (not to scale)

Annex G
(informative)

The impact of systems confronted with multiple symbologies and formats

G.1 Migration choices — considerations

G.1.1 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).

G.1.2 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.

G.1.3 Equipment

G.1.3.1 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.

G.1.3.2 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.

G.2 Recommended actions to manage migration

G.2.1 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.

G.2.2 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.

G.2.3 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.

Bibliography

[1] ISO/IEC 15418, *Information technology – GS1 Application Identifiers and ASC MH10 Data Identifiers and Maintenance*

[2] ISO/IEC 15419, *Information technology -- Automatic identification and data capture techniques -- Bar code digital imaging and printing performance testing*

[3] ISO/IEC 15421, *Information technology -- Automatic identification and data capture techniques -- Bar code master test specifications*

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

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

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

[7] ISO 646, *Information technology – ISO 7-bit coded character set for information interchange*

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

[9] 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*

[10] ANSI MH10.8.1, *Automatic Identification and Data Capture Techniques Used in Shipping, Receiving, and Transport Applications*

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

[12] *D-U-N-S® Number Users' Guide*, Available from Dun & Bradstreet, 1 Diamond Hill Road, Murray, NJ, 07974

[13] *GS1 Standards*, GS1 AISBL, Blue Tower, Avenue Louise, 326 BE 1050 Brussels Belgium (V): +32 2 788 7800 (F): +32 2 788 7899

ICS 35.040; 55.020

Price based on 55 pages