



## ***Automatic Identification and Data Capture Techniques Used in Shipping, Receiving, and Transport Applications***

**Approved: DD Month Year**

### **Abstract**

Specifies minimum requirements for design of labels containing linear bar code and two-dimensional (2D) symbols on transport units to convey data between trading partners; provides for traceability of transported units via a Unique Transport Unit Identifier (license plate); provides guidance for formatting data; provides specific symbology recommendations; specifies quality requirements; makes recommendations as to label placement, size, free text and graphics; provides label material guidance.

**Developed by:**

**MH10 Committee, Unit-Loads and Transport-Packages  
Subcommittee 8, Coding & Labeling of Unit-Loads**

**Published by MH10 Secretariat:**

**Material Handling Industry  
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8720 Red Oak Blvd., Suite 201  
Charlotte, NC 28217

**Approved Month DD, YYYY**

American National Standards Institute, Inc.

## Disclaimer

This standard, which was developed under the ANSI Committee method and approved by ANSI on **26 September 2005**, represents suggested design practices and guidance for labeling and direct product marking with linear bar code and two-dimensional symbols. It was developed with the sole intent of offering information to parties engaged in the manufacture, marketing, purchase, or use of automatic identification equipment software and services. This standard is advisory only and acceptance is voluntary and the standard should be regarded as a guide that the user may or may not choose to adopt, modify, or reject. The information does not constitute a comprehensive safety program and should not be relied upon as such. Such a program should be developed and an independent safety adviser consulted to do so.

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## Foreword (This foreword is not part of American National Standard MH10.8.1 – 2012)

This standard is an application standard for the marking of product packages with linear bar code and two-dimensional symbols. It defines minimum requirements for identifying product packages that are distributed outside the originating location. It specifies label data content and requirements, including data element requirements; data representation; rules for encoding of mandatory and optional data elements in machine-readable symbols; and human readable information.

*Bar codes and Two-Dimensional (2D) Symbols for Product Packaging* provides the option of one of four different linear bar code symbols and one of three different two-dimensional symbols. It relies upon the technology standards and data semantic and syntax standards developed within ASC MH10. These standards have in turn been published internationally through the work of ISO/IEC JTC 1/SC 31.

The international equivalent of this standard is the international standard ISO 22389, developed by ISO Technical Committee 122/Working Group 7. ANSI MH10.8.6 and ISO 22389 were developed concurrently and differ primarily with a recommended/preferred two-dimensional symbol in the ANS while the ISO standard provides no such recommendation or preference.

**At the date of approval of this standard, the MH10 Committee, Unit-Loads and Transport-Packages, consisted of the following members:**

AIM, USA  
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American Wood Packaging Association  
APA – The Engineered Wood Association  
Association of American Railroads  
Assoc. of Professional Material Handling Consultants  
ASTM  
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Uniform Code Council  
United Fresh Fruit & Vegetable Association  
United Parcel Service/Intermec Technologies Corporation

Suggestions for improvement, and questions regarding interpretation of this standard will be welcome. They should be sent to: MH 10 Committee (MHIA), Material Handling Industry of America, 8720 Red Oak Blvd., Suite 201, Charlotte, NC, 28217-3992 or [mhstandards@mhia.org](mailto:mhstandards@mhia.org).

# Automatic Identification and Data Capture Techniques Used in Shipping, Receiving, and Transport Applications

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## AMERICAN NATIONAL STANDARD

## ANSI MH10.8.1 – 2012

**Packaging — Bar code and two-dimensional symbols for shipping, transport and receiving labels****1 Scope**

This American National Standard:

- specifies the minimum requirements for the design of labels containing linear bar code and two-dimensional (2D) symbols on Transport Units to convey data between trading partners;
- provides for traceability of transported units via a Unique Transport Unit Identifier (license plate);
- provides guidance for the formatting on the label of data presented in linear bar code, 2D symbol, or human readable form;
- provides specific recommendations regarding the choice of linear bar code and 2D symbologies, and specifies quality requirements;
- makes recommendations as to label placement, size, and the inclusion of free text and any appropriate graphics;
- provides guidance in 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**

This American National Standard incorporates, by dated and undated references, provisions from other publications. These normative references are listed as follows. For dated references subsequent amendments to or revisions of any of these publications apply to this American National Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

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

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 – Bar code symbology specification – Code 128*

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 – Bar code symbology specifications PDF417*

ISO/IEC 15459 (all parts) *Information technology – Unique identification of transport units*

ISO/IEC 16023, *Information technology – International symbology specification – MaxiCode*.

ISO/IEC 16388, *Information technology – Automatic identification and data capture techniques – Bar code symbology specifications – Code 39*

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

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

ISO 21067, *Packaging – Vocabulary*

GS1 *General Specifications*

### 3 Definitions

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

#### 3.1

##### **sortation**

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

### 4 Concepts

#### 4.1 Principles

The purpose of a bar code label is to facilitate the automatic exchange of data among all members within a channel of distribution, for instance supplier, carrier, purchaser, or 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, e.g.:

- 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, which may be presented both in bar code/2D symbols and human readable form.

This 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 document.

## **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 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 standard. The identifier or license 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 Label for shipping / transport / receiving**

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

A unique transport unit identifier ("license plate") and a "Ship to" name and address (for shipment delivery) shall be included on the base label.

In addition to the unique transport unit identifier ("license plate") and a "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 license plate is not this data element);

- key to customer's database (if the license plate is not this data element).

#### **4.4.2 Extended Label for shipping / transport / receiving**

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 key to the carrier's database, this segment may contain additional data, such as shipment identification and delivery instructions;
- Customer segment. In addition to the pointer to the customer's database, this segment may contain additional data such as the customer part number;
- Supplier segment. Additional data may be generated by the supplier, such as product identification, batch number, and dimensions.

## **5 Data structure**

### **5.1 Data presentation**

#### **5.1.1 Data in linear bar code symbols**

#### **5.1 Data representation**

##### **5.1.1 Data in linear bar code symbols**

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

- a) GS1 Application Identifiers (AIs) in accordance with ISO/IEC 15418 shall only be used in conjunction with GS1-128 (being a subset of Code 128 compliant with ISO/IEC 15417);
- b) ASC MH10 Data Identifiers (DIs) in accordance with ISO/IEC 15418 shall be used in conjunction with Code 39 symbols compliant with ISO/IEC 16388;
- c) ASC MH10 Data Identifiers (DIs) in accordance with ISO/IEC 15418 shall be used in conjunction with Code 128 symbols compliant with ISO/IEC 15417.

Refer to Annex X ("D" in 15394) for information on the use of the options and the issues for users encountering them.

##### **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. Data syntax in two-dimensional symbols shall be in accordance with ISO/IEC 15434.

##### **5.1.3 Data in human readable form**

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

### **5.2 Data elements**

### 5.2.1 Unique Transport Unit Identifier

The Unique Transport Unit Identifier assigned by the labeler 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:

- starts with the Issuing Agency Code (IAC), assigned to the issuing agency by the Registration Authority;
- conforms to a format specified by the issuing agency;
- is unique in the sense that no issuer reissues a number until a sufficient period of time has passed so that the first number has ceased to be of significance to any user;
- contains only numeric and upper case alphabetic characters (i.e., does not include lowercase characters or punctuation marks);
- does not contain more than 20 characters, including the ANSI MH10.8.2 Data Identifier or GS1 Application Identifier. The only exception to this rule is when the Unique Transport Unit Identifier is encoded in the Code 39 symbology, in which case the maximum number of characters is 19, in accordance with Table 1 (see clause 0).

The Unique Transport Unit Identifier shall be either:

- the Serial Shipment Container Code (SSCC), that uses GS1 Application Identifier "00";
- the Unique Transport Unit Identifier using the assigned ANSI MH10.8.2 Category 10 Data Identifiers for License Plates (J-999J) represented in either Code 39 or Code 128 symbologies.

**NOTE** This standard recognizes the historical practice in some industries and trading partners of using a 2D symbol or two separate linear bar code symbols to create unique license plate information, for example, using DI "V", "2V", "6V", or "13V" to identify the supplier and DI "S", "3S", "4S", "5S", "6S", or "7S" to identify the Package ID. While ANSI MH10.8.2 Data Identifiers such as "13V" (DUNS code) with a serial number can provide unique identification, the use of two separate linear bar code symbols or the 2D symbol to encode or identify the Unique Transport Unit Identifier or similar information is not recommended. Use of ANSI MH10.8.2 Data Identifiers such as "V", and "6V" with a serial number may not provide unique identification throughout the supply chain, and these historical usages should migrate to either the GS1 SSCC or the Unique Transport Unit Identifier using the ANSI MH10.8.2 DI "J" in a single linear bar code.

### 5.2.2 Ship To

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

### 5.2.3 Ship From

The Ship From data element refers to the address of the party to which Transport Units are to be returned, in case the shipment was unable to be delivered. When used, it shall be represented in a maximum of five lines of human readable characters comprised of no more than 35 alphanumeric (an..35) character 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 identifier described in 5.2.1 above does not provide the key to the carrier's database, one or more of the following keys may be used:

- carrier tracking number that includes class of service,
- carrier code to identify the shipment,
- carrier code to identify the Transport Unit.

This data element may be included within a 2D symbol, or 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 above 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 number/ pull signal number,
- shipment ID.

This data element may be included within a 2D symbol, or 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 fulfill the needs of the supplier, carrier, and customer.

### **5.3 Concatenating data fields in linear symbols**

#### **5.3.1 Using GS1 Application Identifiers (AI)**

When several application identifiers 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 ANSI MH10.8.2 Data Identifiers 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 and the GS1 General Specification.

## 6 Data carriers

### 6.1 Linear bar code symbols

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”.

See Annex A for the technical specifications of the various symbologies.

### 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, and QR Code 2D symbologies. This standard recommends the use of MaxiCode, PDF417, or QR Code for carrier sortation and tracking applications and PDF417 or QR Code for shipping and receiving and for supporting documentation applications.

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

### 6.3 Human readable information

There are four types of human readable information that may appear on a label. They are:

- human readable interpretation (HRI),
- human translation,
- data area titles,
- free text and data.

#### 6.3.1 Human readable interpretation (HRI)

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. A portion of the HRI (i.e., the DI or AI) may be included in the data area title. See Figures 1a and 1b.

#### 6.3.2 Human translation

Portions of information encoded in linear bar codes or 2D symbols, along with data field descriptions not encoded in the symbols, may be printed in a separate section of the label. The information is known as the human translation of encoded data. See Figures 1a and 1b.



#### 6.3.3 Data area titles

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

- a single linear bar code symbol concatenating multiple data elements,
- multiple linear bar code symbols that are intended to be scanned in a single data capture operation;
- a 2D symbol.

#### 6.3.4 Free text and data

Free text is human readable information that is other than what is encoded in a linear bar code or 2D symbol. This information may be needed by one or more trading partners. See Figure 1a for data encoded with ANSI MH10.8.2 Data Identifiers and Figure 1b for data encoded with GS1 Application Identifiers.

<b>From:</b> Bellevue Motor Parts 1400 142nd Ave NE Bellevue, WA 98007	<b>To:</b> <b>US MOTORS</b> <b>ARIES ASSEMBLY PLANT</b> <b>LAKE ARIES, MI 48888</b> <small>Plant / Dock:</small> <b>PLANT / DOCK</b>	
<small>KANBAN/PIUS:</small> <b>G1155</b>	<small>MATERIAL HANDLING CODE</small> <b>A6-987</b>	<small>WH LOC</small> <b>28315 JJW</b>
<small>Part Number:</small> <b>1234567890123456789</b>		
<small>License Plate (1J):</small>  <b>UN 123456789 A2B4C6D8E</b>		<small>Quantity:</small> <b>160</b> <small>Date:</small> <b>2012FEB08</b> <small>Gross Weight:</small> <b>10 KG</b>
		<small>Container</small> <b>KLT3214</b>

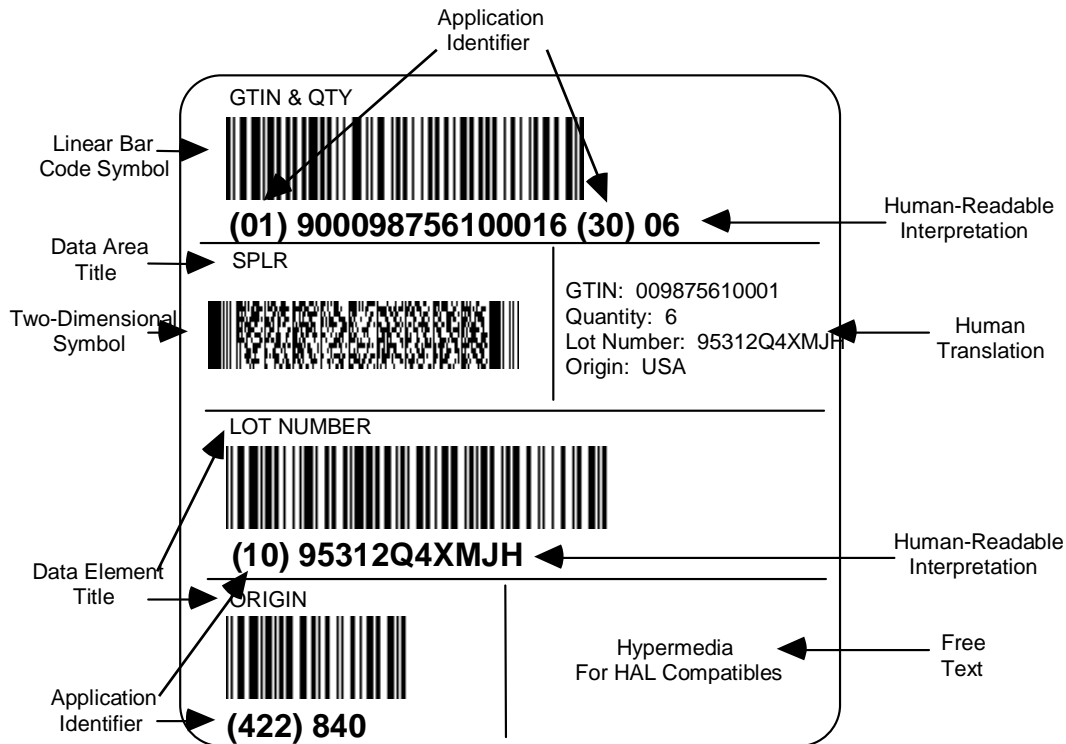
NOTE 1 Data Area Title

NOTE 2 Data Area Title with Data Identifier in Parenthesis

NOTE 3 Linear bar code symbol (Unique License Plate / Tracking Number)

NOTE 4 Two-dimensional symbol (of all label data)

**Figure 1a**  
**Data Encoded with ANSI MH10.8.2 Data Identifiers (not to scale)**



**Figure 1b**  
**Data encoded with GS1 Application Identifiers (not to scale)**

## 7 Label design

### 7.1 General considerations

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 shall be stacked vertically, from top to bottom, in the following order:

- carrier segment,
- customer segment,
- supplier segment.

Examples of labels are provided in **Annexes E and F**. The labels shown in **Annexes E and F** are for illustration only and do not represent all of the possible choices of label designs. Separate sections of the label may be applied at different stages to form the complete label.

### 7.2 Layout

The linear bar code representing the Unique Transport Unit Identifier (license plate), a mandatory element for this standard, shall be printed in the bottom-most area or building block of the label as described in Annex C.

### 7.2.1 Base Label layout

In addition to the required Ship From human readable information and Unique Transport Unit Identifier, a typical Base Label could include the following data areas:

- 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.

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.

### 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;
- 2D symbols;
- human translation of linear bar code information;
- human readable only information;
- graphics.

### 7.2.3 Other data

This standard does not supersede or replace any applicable safety or regulatory marking or labeling requirements. The standard is to be applied in addition to any other mandated labeling requirements. Free areas or certain graphics such as safety, hazard, quality signs, or logos may 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. To simplify label formatting, a modular building block structure is recommended. The building block structure guidance is described in Annex C and shown in Figure C-1. The physical dimensions of the label shall be determined by the labeler. Considerations for label size selection may include: the amount of data to be printed, the physical characteristics of the printing equipment used, or the size of the Transport Unit.

**7.3.2 Label height**

The height of the label shall be determined by the labeler based on the requirements and the type of printer used to print the label.

**7.3.3 Label width**

The width of the label shall be determined by the labeler based on the requirements and the type of printer used to print the label. Label width is determined by bar code symbology printing parameters and the maximum bar code message length. Table 2 shows the correlation between X dimension and label width for selected X dimensions, using the data limits set forth in Table 1.

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

**7.3.4 Data limits**

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

**Table 1**  
**Maximum character limits for linear symbols**

<b>Symbology and format</b>	<b>Character limits</b>
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 width required to print the maximum character limits of Table 1**

	Symbol Maximum Characters and Width (from Table 1)					
	Code 39	Code 128 all numeric	Code 128 alphanumeric	GS1-128 SSCC	GS1-128 all numeric	GS1-128 alphanumeric
	19	50 (single- character DI)	27	20 exactly	48	26
X dimension	Symbol Width					
0.25 mm	105 mm	105 mm	105 mm	Not Recommended	105 mm	105 mm
0.33 mm	148 mm	148 mm	148 mm		148 mm	148 mm
0.38 mm	148 mm	148 mm	148 mm		148 mm	148 mm
0.43 mm	over 148 mm	148 mm	over 148 mm		over 148 mm	over 148 mm
0.50 mm		Not Recommended		105 mm	over 148 mm	over 148 mm
0.66 mm				148 mm	over 148 mm	over 148 mm
0.76 mm				148 mm	over 148 mm	over 148 mm
0.81 mm				over 148 mm	over 148 mm	over 148 mm
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 Table 2 are the following:						
<ul style="list-style-type: none"><li>- 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;</li><li>- for GS1-128 symbols, function one character (FNC1) and symbology check character;</li><li>- for Code 39 symbols, a 3:1 wide to narrow ratio and one X intercharacter gap</li><li>- for Code 128 symbols, the symbology check character</li></ul>						
NOTE 4 GS1 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 as specified in the GS1 General Specifications for a GS1-128 symbol.						

## 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 labeler 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 the labeler.

**Table 3**  
**Character height and character limits**

<b>Lines-per-block (LPB)</b>	<b>Approximate character height (millimeters)</b>	<b>Character limits for full width 102 mm label (# of characters)</b>
1 LPB	25.4 mm	8
2 LPB	12.7 mm	18
3 LPB	8.4 mm	28
4 LPB	6.4 mm	34
5 LPB	5.1 mm	42
6 LPB	4.3 mm	48
7 LPB	3.6 mm	59
8 LPB	3.2 mm	68
10 LPB	2.5 mm	77
NOTE 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. The character height includes ascenders, descenders, and leading.		

#### **7.4.2 Specific text dimensions**

Data area titles shall be no smaller than 10 LPB.

The Ship From address shall be no smaller than 10 LPB, and in any case shall be smaller than the Ship To address text.

The Ship To address shall be not smaller than 6 LPB 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 10 LPB.

Primary human-readable information (also known as human translation) shall be no smaller than 5 LPB.

Secondary human-readable information (also known as text or descriptive information) shall be no smaller than 10 LPB.

#### **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;
- 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.

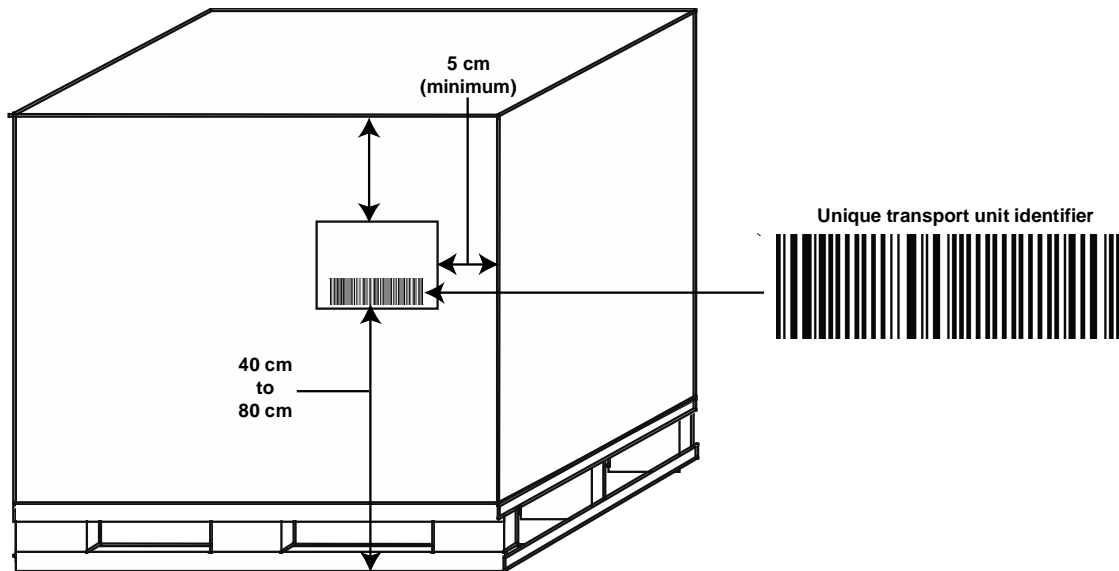
Carrier sortation and tracking application symbols shall be placed on top of Transport Units (see clause B.4.7.3, Annex F, Annex H, and Annex A).

Parcel carriers may require the placement of carrier information on the top of a Transport Unit.

All other 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.

### 8.2 Unitized Loads (pallets)

Each Unitized Load shall have at least one bar code label and should have identical labels affixed on two adjacent sides.



**Figure 2**  
**Unitized Load (pallet) label location**

Labels shall be placed right of center on a vertical face, allowing a minimum of 50 mm from either edge. Labels should not be placed over a seam, nor should sealing tape or bands be placed over a 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 labels should be placed as high as possible on the pallet.

### 8.3 Transport Packages

For Transport Packages up to 1 meter in height, the target location for the Unique Transport Unit Identifier symbol should be within a range of 25 mm to 430 mm from the natural bottom of the package. Labels containing a symbol for carrier sortation and tracking applications shall be placed on top of the package in accordance with clause B.4.7.3. The edge of the label(s) should be a minimum of 25 mm from any Transport Package top or side edge. Transport Packages greater than 1 meter in height should follow the recommendations of §8.2, "Unitized loads".



## **8.4 Other Transport Units**

Annex F provides examples of the labeling 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 Symbology**

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

- Code 39 in accordance with ISO/IEC 16388;
- Code 128 in accordance with ISO/IEC 15417.

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

### **A.2 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.3 Narrow element dimension**

The minimum narrow element dimension (X dimension) shall not be less than 0.25 mm. The X dimension for Code 39 and Code 128 symbols should be in the range of 0.25 mm to 0.43 mm, as determined by the printing capability of the supplier/printer of the label. The X dimension for GS1-128 symbols should be in the range of 0.25 mm to 0.81 mm, as determined by the printing capability of the supplier/printer of the label. The X dimension for GS1-128 SSCC symbols should be in the range of 0.50 mm to 0.81 mm, as determined by the printing capability of the supplier/printer of the label.

In the case that fewer characters than specified in Table 1 are required, a larger X dimension may be used, as long as the bar code print quality requirements specified in 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.4 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.5 Quiet zones**

Linear bar code symbols should be printed with leading and trailing quiet zones not less than 6.4 mm. Where the X dimension is greater than 0.64 mm, the quiet zones shall not be less than 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.6 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.7 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.8 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 nanometers.

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.

Labelers 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 labeler 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 colored corrugated surfaces. Users considering the printing of bar code symbols directly onto kraft colored 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 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.4).

#### **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 ANS MH10.8.3 (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 Annex I 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.

See Annex I for procedures using QR Code for shipping and receiving applications.

##### **B.1.2 Error correction level**

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

##### **B.1.3 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.1.4 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.1.5 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.1.6 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.3 and its sub-clauses.

**Table B-1**  
**Maximum PDF417 symbol width using 12 data columns**

<b>X dimension</b>	<b>Maximum width (including quiet zones)</b>
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.1.7 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 nanometers.

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 colored corrugated surfaces. Users considering the printing of 2D symbols directly onto kraft colored corrugated surfaces should consider the scanning capabilities of their entire trading channel.

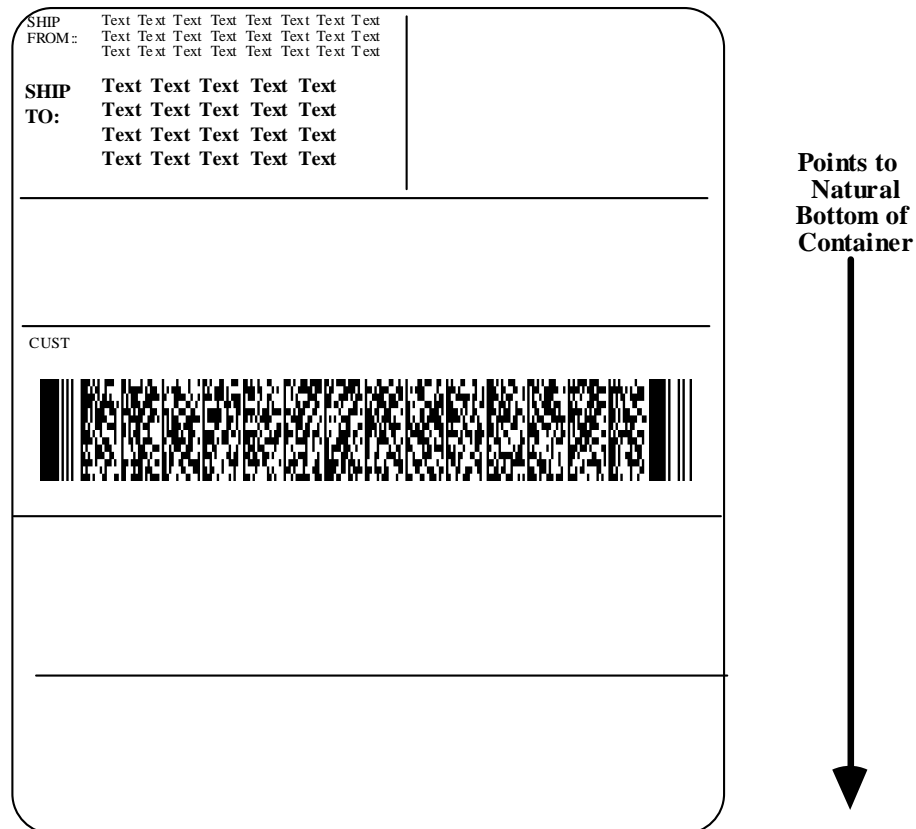
## B.1.8 Orientation and placement

### B.1.8.1 PDF417 symbol orientation

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

### B.1.8.2 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.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 the shipping, receiving, and transportation sortation and tracking. See Figure E-33.

### B.2.1 Symbology recommendation

This standard recommends the use of PDF417 symbology (see ISO/IEC 15438) for supporting documentation applications. The structure and syntax of the PDF417 symbols for supporting documentation applications shall conform to the structure and syntax described in ANS MH10.8.3 (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.

### B.2.2 Error correction levels

For supporting documentation applications, the minimum PDF417 symbol error correction level shall be as identified in Table B-2. Level 5 is the preferred correction level.

**Table B-2**  
**PDF417 Error Correction Level**

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

### B.2.3 Narrow element dimension

For supporting documentation applications, the PDF417 symbol X dimension should be 0.254 mm.

### B.2.4 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.2.5 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.2.6 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  $660 \pm 10$  nanometers;

## **B.2.7 Orientation and placement**

### **B.2.7.1 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  $\pm 5$  degrees.

### **B.2.7.2 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.2.8 Concatenation of 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.2.8.1 Planning for large messages**

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.2.8.2 Printing concatenated symbols**

Printing systems should be configured in such a manner that when the amount of data encoded in a single message for a supporting documentation application exceeds the capacity of a single symbol, the printing system should either automatically use or be configurable to use Macro PDF417 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.2.8.3 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, "JL1". 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.3 Printing PDF417 symbols**

When printing PDF417 symbols compliant with this American National 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, tradeoffs 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 following Tables B-3 through B-8 to determine approximate symbol size.

### **B.3.1 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.3.2 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.

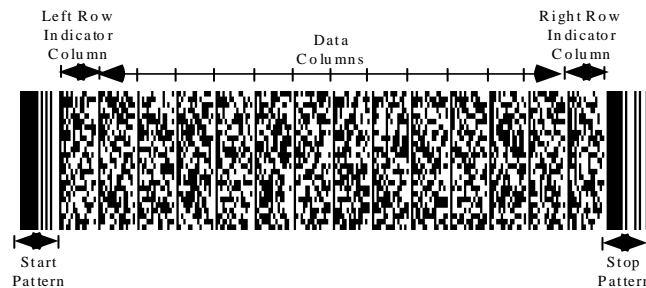
### **B.3.3 Plan for the maximum X dimension(s) and data columns**

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-2), unless otherwise agreed by all trading partners involved. This limitation, combined with the amount of space allocated for the symbol on the label, may influence the choice of X dimension for printing the symbol.

The encoded data is shown below contained within the data columns.



**Figure B-2**  
**The anatomy of a PDF417 symbol**

### B.3.4 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.3.4.1 Symbols for labels having a width of at least 102 mm.

Tables B-3 through B-6 illustrate at given X dimensions, at various symbol widths, the number of data columns and the number of alphanumeric characters which 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.3.4.2 Symbols for labels having a width of greater than 102 mm.**

Tables B-7 and B-8 illustrate at given X dimensions, at various symbol widths, the number of data columns and the number of alphanumeric characters which 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
<b>Symbol height</b>	119	14	132	16	145	18
<b>25 mm</b>	286 characters		344 characters		401 characters	
<b>50 mm</b>	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
<b>Symbol height</b>	120	12	135	14	142	15	157	17
<b>25 mm</b>	185 characters		236 characters		261 characters		311 characters	
<b>50 mm</b>	596 characters		715 characters		747 characters		770 characters	

## **B.4 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), or the QR Code symbology (ISO/IEC 18004) 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 ANS MH10.8.3 (ISO/IEC 15434).

### **B.4.1 Symbology usage guidance**

Usage of MaxiCode in carrier sortation and tracking applications is defined in Annex B.4

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

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

## B.4.2 Data encoding

### B.4.2.1 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.4.2.2 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-9 determines the appropriate Mode.

**Table B-9**  
**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.4.3 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.4.4 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 28.14mm wide x 26.91mm high.

### B.4.5 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.4.6 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. Labelers 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 colored corrugated surfaces. Users considering the printing of bar code symbols directly onto kraft colored corrugated surfaces should consider the scanning capabilities of their entire trading channel.

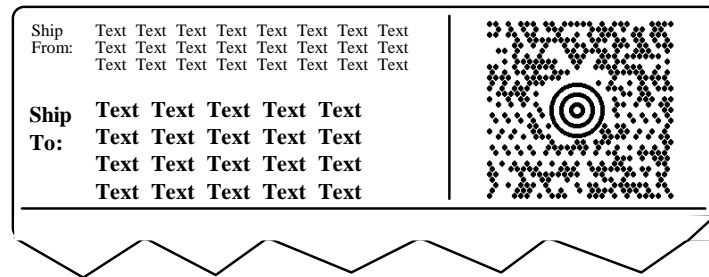
## B.4.7 Orientation and placement

### B.4.7.1 MaxiCode symbol orientation

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

### B.4.7.2 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-3 for example of placement.



**Figure B-3**  
**MaxiCode symbol placement on a label (not to scale)**

### B.4.7.3 Label placement

Labels shall be placed on the top of Transport Units.

## B.4.8 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.4.8.1 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.4.8.2 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.



## **Annex C**

(informative)

### **Designing compliant labels using a building block approach**

#### **C.1 Label definition**

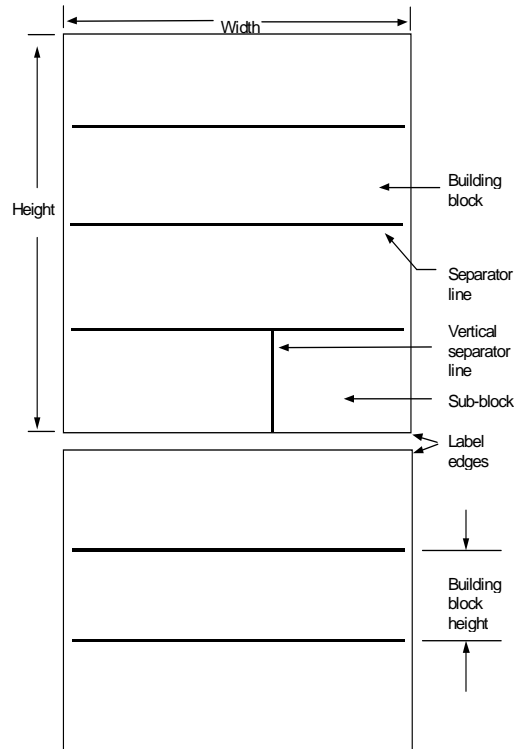
The general term “label” means the printed area on the package that includes the text and/or bar code data (including linear bar code, composite, or 2D symbols), as covered in this document. The label is constructed by the use of indirect marking (e.g., pressure-sensitive labels, tags). Separate sections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

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

- carrier segment,
- consignee 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 labeler. 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 labeler.

## **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  $\pm$  5 mm, as determined by the printing capability of the labeler. 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 planning). Double-height building blocks shall be 51 mm  $\pm$  10.2 mm.

One half-height text building block per segment may be used at the discretion of the labeler. Half-height building blocks shall be 13 mm  $\pm$  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 measurements calculated**

<b>Lines-per-block</b>	<b>Character Height (Points)</b>	<b>Character Height (Millimeters)</b>	<b>Character Height (Inches)</b>
<b>1 LPB</b>	72 pts	25.4 mm	1.00 in
<b>2 LPB</b>	36 pts	12.7 mm	0.50 in
<b>3 LPB</b>	24 pts	8.4 mm	0.33 in
<b>4 LPB</b>	18 pts	6.4 mm	0.25 in
<b>5 LPB</b>	14 pts	5.1 mm	0.20 in
<b>6 LPB</b>	12 pts	4.3 mm	0.17 in
<b>7 LPB</b>	10 pts	3.6 mm	0.14 in
<b>8 LPB</b>	8 pts	3.2 mm	0.13 in
<b>10 LPB</b>	7 pts	2.5 mm	0.10 in
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.

Labelers 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. Title exceptions are in clause 0. 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 American National Standard**

This standard is a framework to which various industry application standards for a bar code shipping and receiving label should conform. The American National Standard defines the minimum and common elements and specifies the symbology options. The application guideline should, within the overall constraint of complying with this American National 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 clauses 5.1.1 and 5.1.2) is (are) to be used:

- linear Code 39 and Code 128 bar codes,
- 2D PDF417, MaxiCode or QR Code 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 labelers 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 2D symbol**

If 2D symbol(s) are incorporated, specify the selected ANSI MH10.8.3 (ISO/IEC 15434) formats. The precise rules of normative Annex B need to be incorporated.

## **D.7 Linear bar code**

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

## **D.8 The X dimension**

Specify the narrow element X dimension (see clauses A.3 and B.1.3). Ideally, this should offer the full range of 0.25 mm to 0.43 mm in accordance with this American National 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.8, B.1.7, B.2.6, and B.4.6). Ideally, this should be identical to that of this American National 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 the American National Standard.

### **D.10 Label design**

Specify, in as much detail as is appropriate for the application, the label design (see clause 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 8).

## Annex E (informative)

### Label examples

#### E.1 Base Label examples

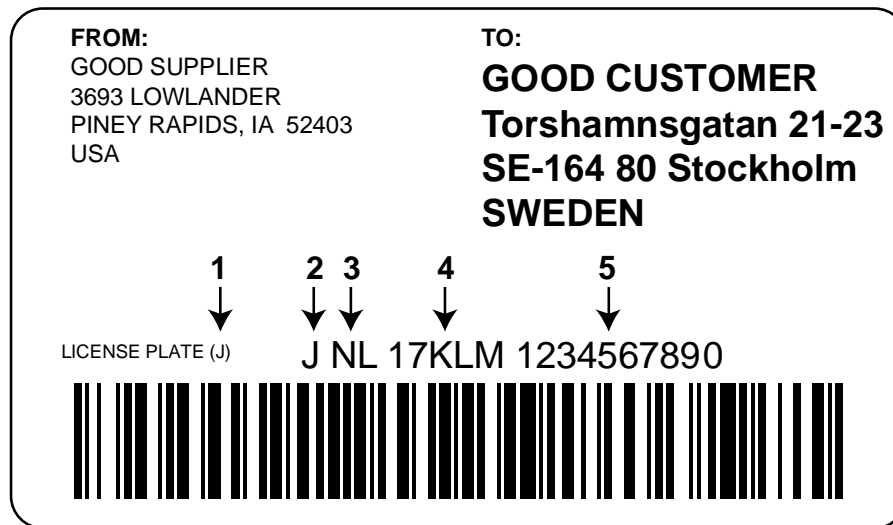
##### E.1.1 Minimum data examples

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



**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

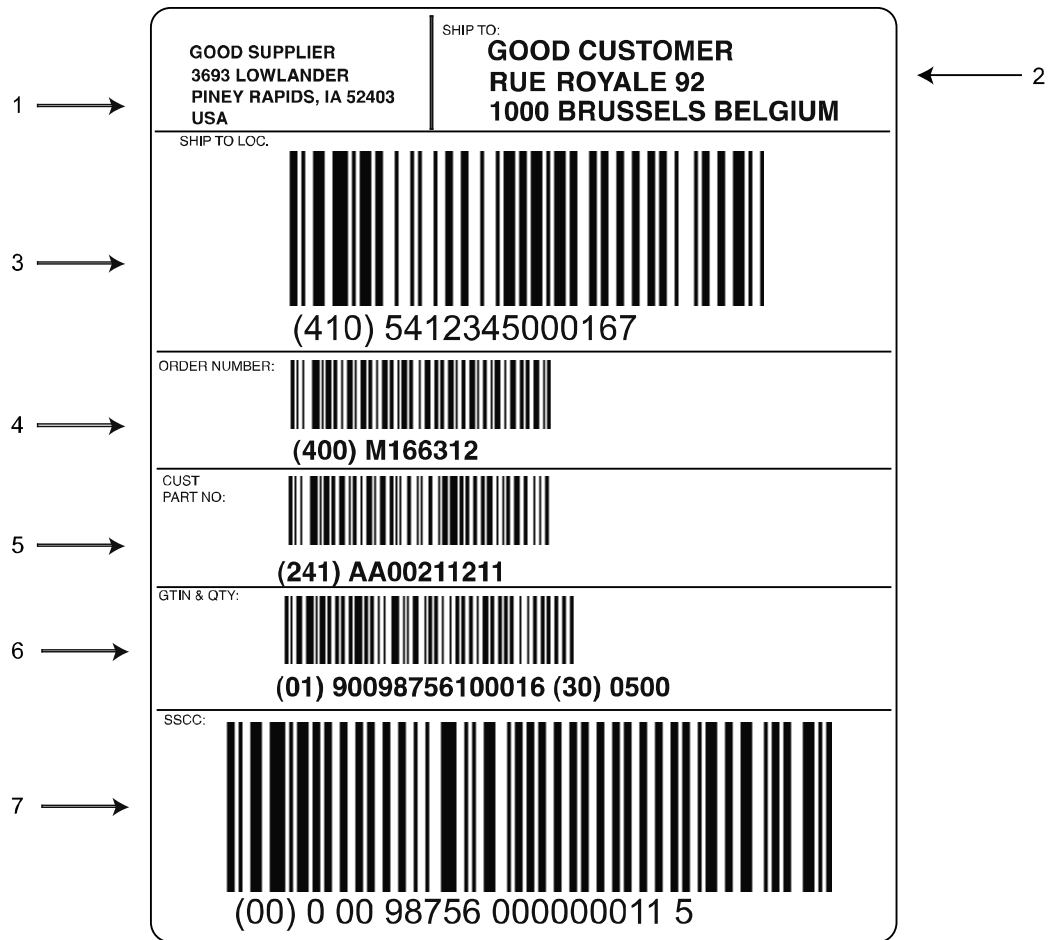
NOTE 5 Code 39 DI "J" license plate

**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

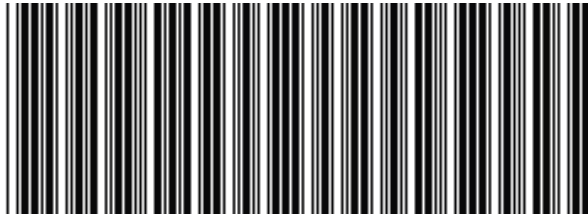
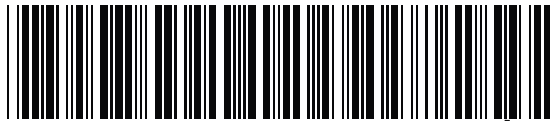

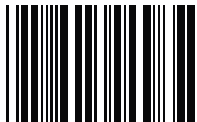

NOTE 4 Pointer to recipients or customer's database

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)**

1 →	SHIP FROM: GOOD SUPPLIER 3693 LOWLANDER PINEY RAPIDS, IA 52403 USA	
2 →	SHIP TO: TELEFONAKTLEBOLAGET OLAFSSON - PHYSICAL DISTRIBUTION STOCKHOLM S-131 89 SWEDEN	
3 →	(12K) SCAC & PRO #: SCAC110780 	
4 →	(14K) P.O. + LINE # M166312+04 	
5 →	(1P) PART # SPLR MH80312 	P.O. NUMBER: M166312
6 →	(Q) QTY 16 	P.O. LINE NUMBER: 04 PART NUMBER: MH80312 QUANTITY: 16
7 →	(J) LICENSE PLATE UN0433257110000001 	

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 partner, 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 ANSI MH10.8.2 data formats identified as Format 01 through Format 06.

SHIP FROM: GOOD SUPPLIER 3693 LOWLANDER PINEY RAPIDS, IA 52403	SHIP TO: GOOD CUSTOMER 2020 VALLEYDALE ROAD BIRMINGHAM, AL 35244
SHIPMENT ID: 480546160 PO#: 123456789 PO LINE #: 1 COUNTRY OF ORIGIN: US CARTON 1 OF 3 CARTONS	
CUSTOMER PRODUCT ID: 098756100013 SUPPLIER ID: 098756 TRACEABILITY CODE: MJH110780 QUANTITY: 500 EACH SHIPMENT WEIGHT: 263.2 KG SHIPMENT VOLUME: 1.65 CR SSCC:	
 (00) 0 00 98756 000000011 5	

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

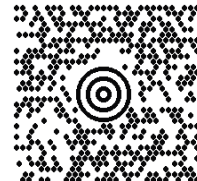

**Figure E-7**  
**Label using GS1-128 license plate and**  
**additional trading partner data in 2D symbols (not to scale)**

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

Compliance Indicator	[> <sup>R</sup> <sub>S</sub>
Format 01 Sortation/Tracking Header	01 <sup>G</sup> <sub>S</sub> 96
Carrier Data	352440000 <sup>G</sup> <sub>S</sub> 840 <sup>G</sup> <sub>S</sub> 001 <sup>G</sup> <sub>S</sub> 9631415926535984147098 <sup>G</sup> <sub>S</sub> SCAC <sup>G</sup> <sub>S</sub> 5215716587 <sup>G</sup> <sub>S</sub> <sup>G</sup> <sub>S</sub> 480546160 <sup>G</sup> <sub>S</sub> <sup>G</sup> <sub>S</sub> 580 <sup>R</sup> <sub>S</sub>
Format 05 Application Identifier Header	05 <sup>G</sup> <sub>S</sub>
Supplier's Transport Unit ID	00000987560000000115 <sup>R</sup> <sub>S</sub> <sup>E</sup> <sub>O<sub>T</sub></sub>

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

Header	[> <sup>R</sup> <sub>S</sub>
Format 03 Header	03003030 <sup>F</sup> <sub>S</sub> <sup>G</sup> <sub>S</sub> <sup>U</sup> <sub>S</sub>
Ship From Name	N1 <sup>G</sup> <sub>S</sub> SF <sup>G</sup> <sub>S</sub> GOOD SUPPLIER <sup>F</sup> <sub>S</sub>
Ship From Street Address	N3 <sup>G</sup> <sub>S</sub> ANY STREET <sup>F</sup> <sub>S</sub>
Ship From City, State, and Postal Code	N4 <sup>G</sup> <sub>S</sub> ANY CITY <sup>G</sup> <sub>S</sub> ANY STATE <sup>G</sup> <sub>S</sub> POSTAL CODE <sup>F</sup> <sub>S</sub>
Ship To Name	N1 <sup>G</sup> <sub>S</sub> ST <sup>G</sup> <sub>S</sub> GOOD CUSTOMER <sup>F</sup> <sub>S</sub>
Ship To Street Address	N3 <sup>G</sup> <sub>S</sub> ANY ROAD <sup>F</sup> <sub>S</sub>
Ship To City, State, and Postal Code	N4 <sup>G</sup> <sub>S</sub> ANY CITY <sup>G</sup> <sub>S</sub> ANY STATE <sup>G</sup> <sub>S</sub> POSTAL CODE <sup>R</sup> <sub>S</sub>
Format 05 Application Identifier Header	05 <sup>G</sup> <sub>S</sub>
Shipment ID	902S480546160 <sup>G</sup> <sub>S</sub>
Transport Unit ID (Container License Plate)	00000987560000000115 <sup>G</sup> <sub>S</sub>
Carrier Shipment Number	9631415926535984147098 <sup>G</sup> <sub>S</sub>
Customer PO # and Line Item #	400123456789+001 <sup>G</sup> <sub>S</sub>
SCC-14 (Item Code) & Quantity (Each)	019009875610001630500 <sup>G</sup> <sub>S</sub>
Customer Product ID	241AA00211211 <sup>G</sup> <sub>S</sub>
Country of Origin	904LUS <sup>G</sup> <sub>S</sub>
Lot / Batch Number	10MJH110780 <sup>G</sup> <sub>S</sub>
Carton "n of x"	9013Q1/3 <sup>G</sup> <sub>S</sub>
Shipment Weight	3301263 <sup>G</sup> <sub>S</sub>
Shipment Volume	3362165CR <sup>R</sup> <sub>S</sub>
Trailer	<sup>E</sup> <sub>O<sub>T</sub></sub>

1 → SHIP FROM: GOOD SUPPLIER 185 MONMOUTH PKWY E. SHORT BRANCH, NJ 07764-1394	SHIP TO: TELEFONAKTLEBOLAGET OLAFSSON - PHYSICAL DISTRIBUTION STOCKHOLM S-131 89 SWEDEN	← 2
DESPATCH ADVICE #: 9305678ML PO#: PO505054 COUNTRY OF ORIGIN: US CARTON 1 OF 3 CARTONS		CARR 
4 →	CUST 	
CUSTOMER PRODUCT ID: AA00211211 SUPPLIER ID: 0662742 TRACEABILITY CODE: MJH110780 QUANTITY: 500 EACH SHIPMENT WEIGHT: 263.2 KG SHIPMENT VOLUME: 1.65 CR		
(J) LICENSE PLATE UN0433257110000001 5 → 		

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)**

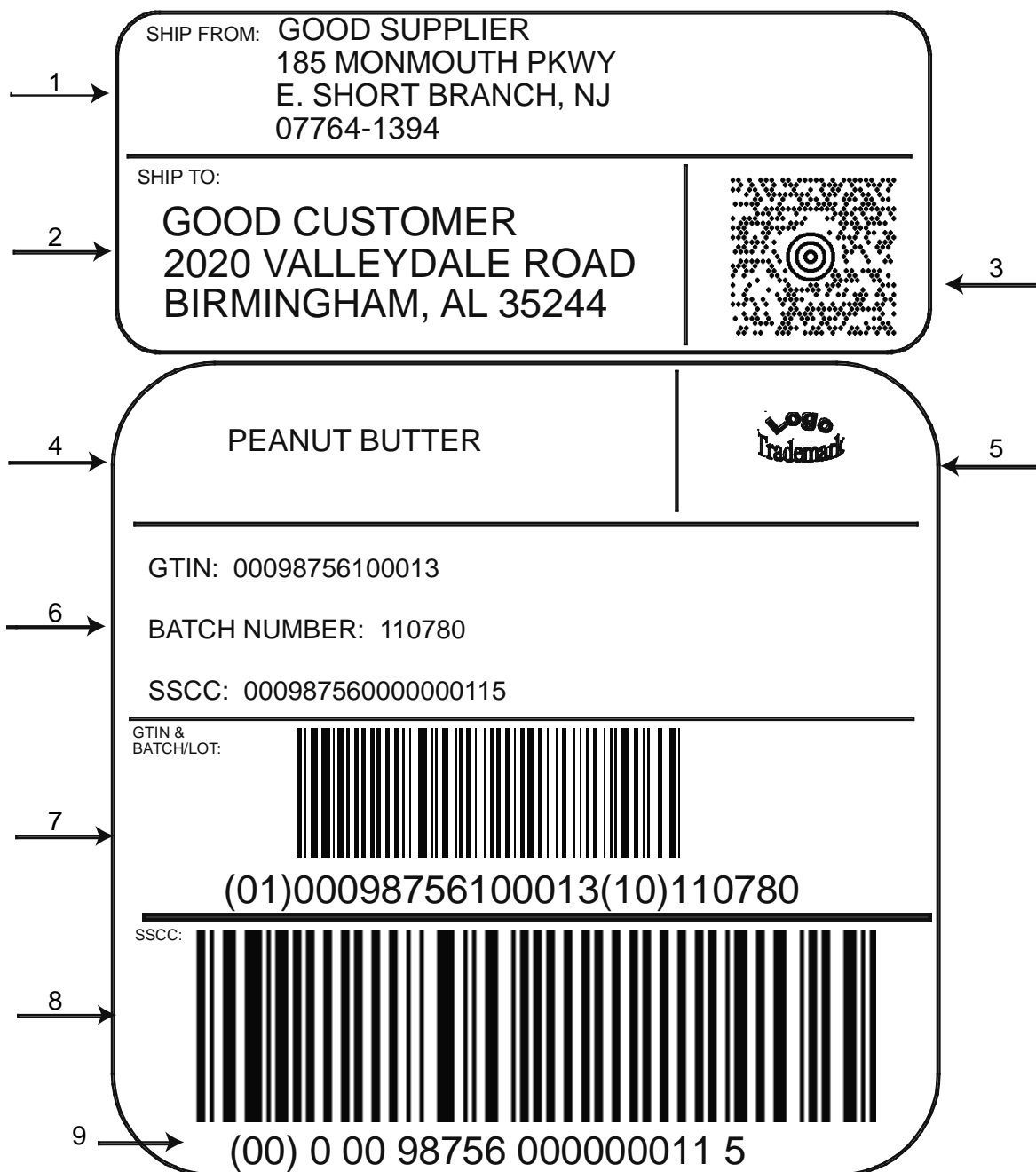


The carrier data encoded in the MaxiCode symbol in Figure E-8 is as follows:

Header	$() >^R_S$
Format 01 Sortation/Tracking Header	$01^G_S 96$
Carrier Data	$S-13189^G_S 752^G_S 006^G_S MH80312^G_S SCAC^G_S$ $5215716587^G_S 1JEABCXXA^G_S 580^R_S E_{O_T}$

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	$NAD^G_S ST^G_S G_S G_S GOOD CUsTOMER^G_S G_S ANY$ $CITY^G_S ANY STATE^G_S POSTAL CODE^F_S$
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 Sender

NOTE 7 GS1 GTIN &amp; batch number

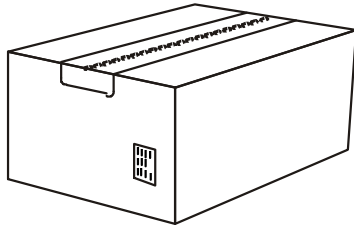
NOTE 8 GS1-128 license plate

NOTE 9 Human Readable Interpretation

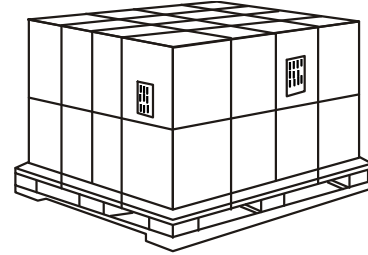
**Figure E-9**  
Two labels (top label is carrier label,  
bottom label is supplier label (not to scale))

## Annex F (informative)

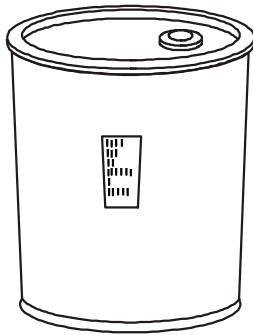
### Recommended label locations on various containers



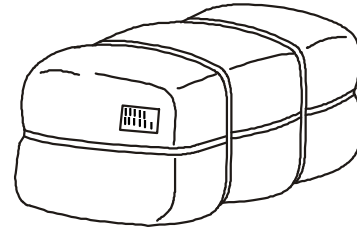
a) Box or carton with transport package label



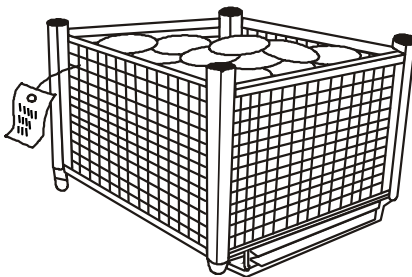
b) Pallet with two unit load labels



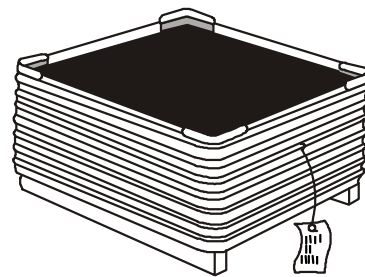
c) Drum, barrel, or cylindrical container



d) Bale



e) Basket, wire mesh container



f) Metal bin or tub

Figure F.1 — Examples of label locations

## Annex F – Label placement on various packages

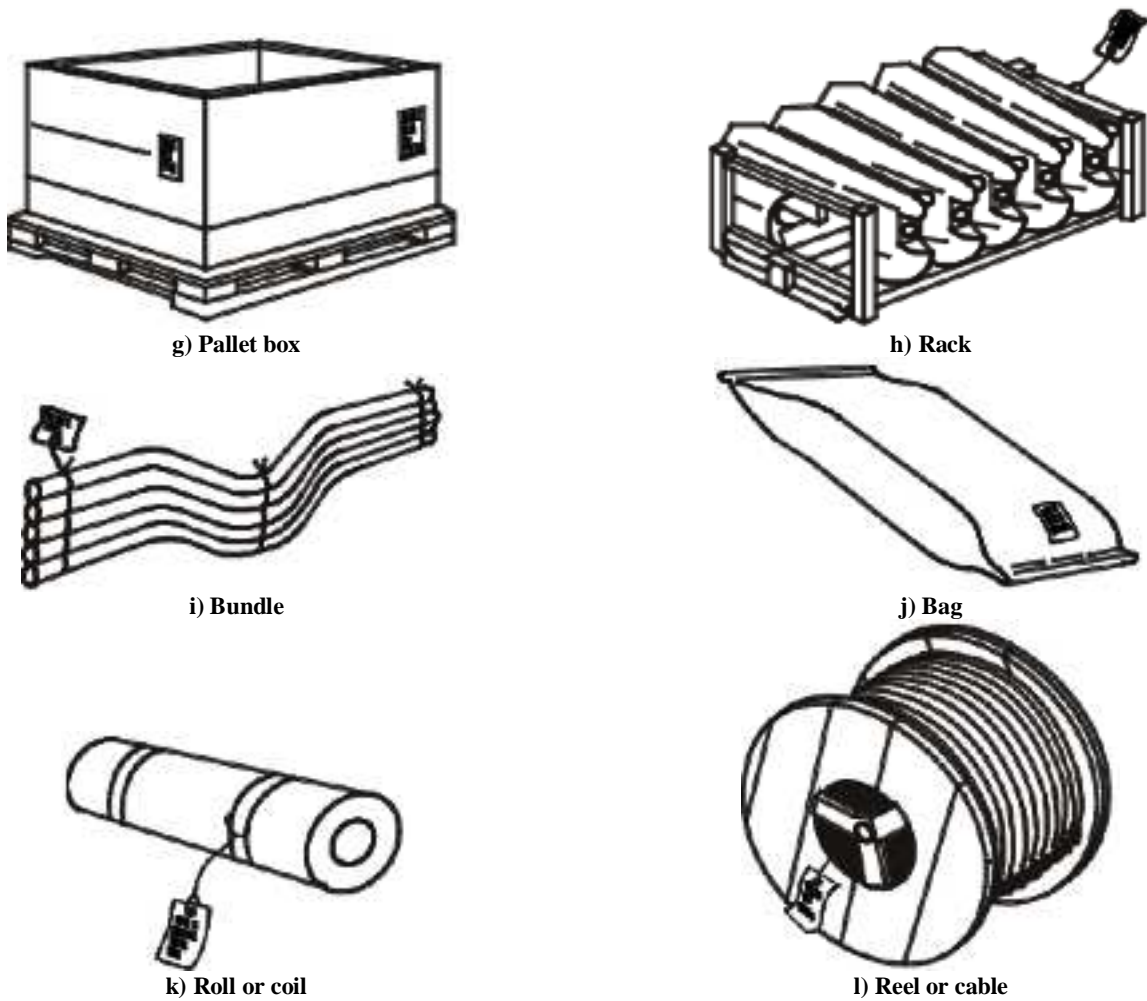
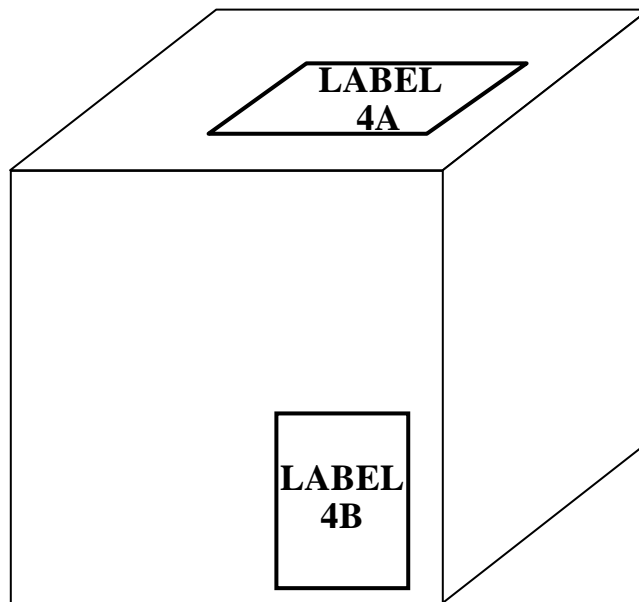


Figure F.1 — Examples of label locations (*continued*)

(m) 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.



**m) Location of transportation (4A) and customer labels (4B); (not to scale)**

## **Annex G**

(informative)

### **Applications using Code 39 and Code 128 symbologies**

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

This annex describes the use of Symbology Identifiers as identified in ISO/IEC 15424. The Symbology Identifier is a prefix to the data transmitted by a decoder. Symbology Identifiers are not encoded in the symbol.

The options are:

1. Application Identifiers with GS1-128 symbology,
2. ANSI MH10.8.2 Data Identifiers with Code 39 symbology,
3. ANSI MH10.8.2 Data Identifiers 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.

#### **G.1 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 “JC1”, 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 “JA0”.
- 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 “JC0”.

## **G.2 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 1, option 2, and option 3. 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.

## **Annex H**

### **(Normative)**

## **Procedures for using QR Code in carrier sortation and tracking applications**

### **H.1 Carrier sortation and tracking applications**

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

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

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

### **H.2 Data encoding**

#### **H.2.1 Code set**

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

#### **H.2.2 Symbology**

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

### **H.3 Error correction levels**

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

### **H.4 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.



## H.5 Quiet zones

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

## H.6 Print quality

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

- a) a print quality grade of greater than or equal to 3.0 (B) at the point of printing the symbol;
- b) a light source wavelength =  $(660 \pm 10)$  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.

## H.7 Orientation and placement

### H.7.1 Orientation

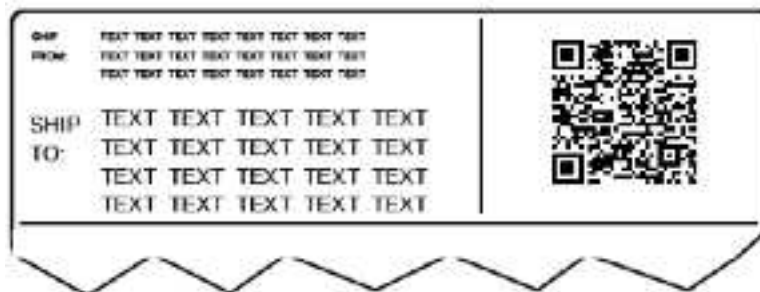
Due to the nature of the QR Code symbology, specific symbol orientation is not required.

### H.7.2 Symbol placement

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

### H.7.3 Label placement

Labels shall be placed on the top of transport units.



Note: This figure is not to scale.

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

## **Annex I**

### **(Normative)**

## **Procedures for using QR Code in shipping and receiving applications**

### **I.1 General considerations**

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

Shipping and receiving data that enables all bar coded data on a label to be incorporated into a single QR Code symbol. (Refer to Annex I.2.)

Complete EDI messages and transactions to be encoded in the QR Code symbol. (Refer to Annex I.3.)

### **I.2 Shipping and receipt applications**

#### **I.2.1 Outline**

Shipping and receipt data facilitates the scheduling of, transportation, and the receipt of goods and materials. This data should be printed on a "label", as defined in this standard. A QR Code symbol is intended to be scanned in the same environment as other symbols on the label. The structure and syntax used in shipping and receipt applications should conform to the structure and syntax set out in ISO/IEC18004.

#### **I.2.2 Symbology recommendation**

For shipping and receipt applications, this International Standard recommends use of the QR Code model 2 symbols stipulated in ISO/IEC18004. The coupling structure defined in ISO/IEC18004 should not be used in this application for the shipping and receipt application.

#### **I.2.3 Error correction level**

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

#### **I.2.4 Module dimensions**

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

### **I.2.5 Quiet zone**

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

### **I.2.6 Symbol size**

The symbol size should be 5 cm or smaller.

### **I.2.7 Symbol print quality**

The print quality of the QR Code symbol should be determined in accordance with ISO/IEC18004. For classification of carriers and tracking of transportation, applications, the symbol grade should satisfy the following minimum requirements:

The print quality grade at the point of symbol printing should be B (3.0) or higher.

Light source wavelength =  $660 \pm 10$  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.

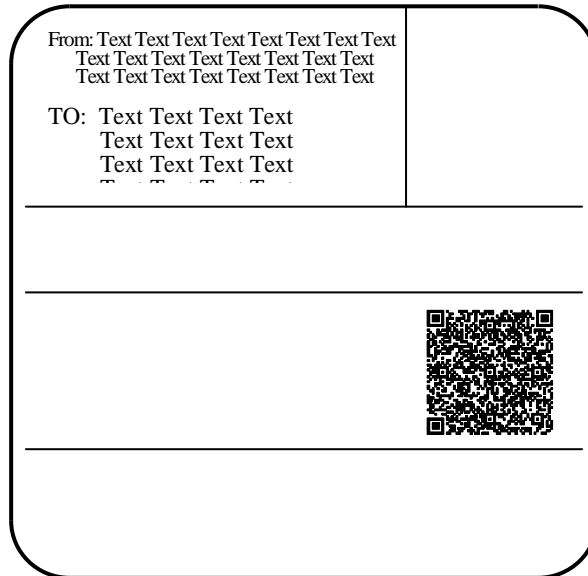
### **I.2.8 Orientation and positioning**

#### **I.2.8.1 Orientation**

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

### I.2.8.2 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 I.1 for an example of positioning.



Note: This figure is not to scale.

**Figure I.1 — Positioning of QR Code symbol on label**

## I.3 Supporting documentation application

### I.3.1 General

The shipping, transportation, and receipt of transport units often require supporting documentation data such as bills of lading, manifests, packing slips, customs data, or information that may also be transmitted by EDI. It is not intended that this kind of data is not intended to be printed on a "label", not that it be scanned in the same environment as data on a label. Applications considered to be in this category involve the encoding of data in two-dimensional symbols in support of shipping, receipt, and classification of transportation and tracking of goods.

### I.3.2 Symbology recommendation

For the supporting documentation applications, this international Standard recommends the use of the QR Code model 2 symbols defined in ISO/IEC18004. The structure and syntax of the QR Code symbol for supporting documentation applications should conform to the structure and syntax set out in ISO/IEC18004.

### I.3.3 Error correction levels

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

### **I.3.4 Module dimensions**

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

### **I.3.5 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.

### **I.3.6 Symbol print quality**

ISO/IEC18004 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 =  $660 \pm 10$  nm

### **I.3.7 Orientation and positioning**

#### **I.3.7.1 Orientation**

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

#### **I.3.7.2 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.

### **I.3.8 Concatenation of symbols**

#### **I.3.8.1 Outline**

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.

#### **I.3.8.2 Designing for large messages**

When designing an application that encodes large amounts of data, consideration should be given to the amount of data that can be encoded in a single message. If it is anticipated that a single data message may exceed a total of 22 characters in the QR Code number (refer to ISO/IEC18004), use of concatenated QR Code symbols is desirable.

#### **I.3.8.3 Printing of concatenated symbols**

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

### **I.3.8.4 Reading of concatenated symbols**

To read QR Code symbols properly, the transmission protocol of the decoder should comply with the concatenated QR Code symbols defined in ISO/IEC18004. The decoder should be capable of fully supporting the symbology identifier options of the QR Codes.

## **I.4 Considerations when printing QR Code symbols**

### **I.4.1 Outline**

When QR Code symbols are printed, a number of factors should be taken into consideration. All of these factors should be used in determining 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 I.1.

### **I.4.2 Designing of the label layout**

#### **I.4.2.1 Design of the maximum module dimension(s) that can be used**

When designing for the space required for positioning a QR Code symbol on a label 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 0,33 mm to 0,42 mm.

#### **I.4.2.2 Design of the maximum amount of data**

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

#### **I.4.2.3 Design of scanning equipment likely to be used**

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

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

Number of characters		Module dimension	
Alphanumeric	Kanji	0,42 mm	0,33 mm
50	25	15,91 mm	12,21 mm
100	50	19,35 mm	14,85 mm
150	65	21,07 mm	16,17 mm
200	90	24,51 mm	18,81 mm
250	110	26,23 mm	20,13 mm
300	130	27,95 mm	21,45 mm
400	170	31,39 mm	24,09 mm
500	220	34,83 mm	26,73 mm
750	345	41,71 mm	32,01 mm
1,000	435	46,87 mm	35,97 mm
1,250	560	N/A	39,93 mm
1,500	650	N/A	42,57 mm
1,750	770	N/A	46,53 mm
2000	890	N/A	49,17 mm
Note: "N/A" indicates "not applicable."			

**I.4.2.4 Selecting appropriate sizes in the tables**

Table I.1 gives approximate widths of symbols for QR Code symbol in circumstances an error correction level of M (approximately 15%), module dimensions of 0.42mm and 0.33m, and a maximum of 2000 alphanumeric characters. In Table I.1, select the maximum module dimension that is anticipated for the application, and on this basis determine the number of characters that represents the maximum size. The sizes are an approximation; actual sizes may vary, depending on factors such as the compaction algorithm and the nature of the data to be encoded.

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

**I.4.3 Printing of the symbol on the label**

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

For purposes of reference and with regard to two types of module different dimensions, Table I.2 gives approximations of the number of alphanumeric characters that can be encoded in QR Code symbols where the QR Code symbol sizes are 3cm and 5cm and an error correction level is M (approximately 15%).

**Table I.2 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 3 cm	366 characters	155 characters	656 characters	277 characters
Symbol size 5 cm	1,248 characters	528 characters	2,113 characters	894 characters

## **Annex J**

### **(Normative)**

## **Procedures for using PDF417 in carrier sortation and tracking applications**

### **J.1 Carrier sortation and tracking applications**

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

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

When a two-dimensional symbol is used for the carrier sortation and tracking applications, the PDF417 symbology (see ISO/IEC 15438) is capable of being read stably in a high-speed scanning environment. The structure and syntax of the PDF417 symbols for the carrier sortation and tracking applications shall conform to the structure and syntax specified in ISO/IEC 15434.

### **J.2 Data encoding**

#### **J.2.1 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.

#### **J.2.2 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..

### **J.3 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).

### **J.4 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.



## **J.5 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.

## **J.6 Data columns**

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

## **J.7 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.

## **J.8 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. 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 =  $(660 \pm 10)$  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.

## **J.9 Orientation and placement**

### **J.9.1 Orientation**

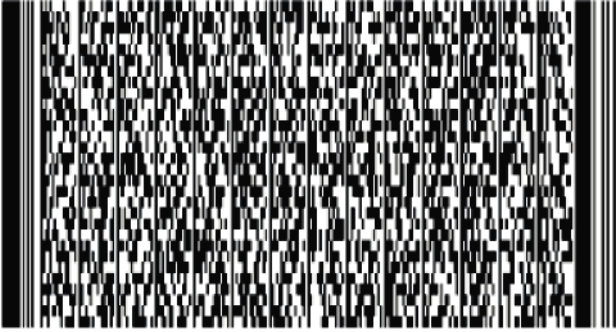
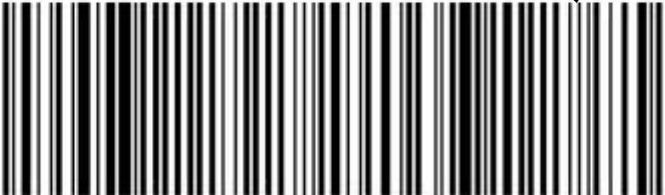
The PDF417 symbol shall be oriented parallel to the linear bar code symbols on the label.

### **J.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 J.1.

### J.9.3 Label placement

Labels shall be placed on the top of transport units.

<b>SHIP FROM:</b> US Motors ARIES ASSEMBLY PLANT LAKE ARIES, MI 48888		Ship Date: 15FEB2012 Account: 123456789
<b>SHIP TO:</b> Tom Marcus-06 ExFed Corporate 60 ExFed Parkway, Bldg 60, 1st Flr Vertical Collierville, TN 38017		<b>ExFed</b> <b>E</b> Country: United States Phone: (901) 263-5171
		
<b>PRIORITY OVERNIGHT</b> TRK: 1234 5678 9012		<b>THU</b> Deliver By: 16FEB12
<b>38017</b> -TN-US		<b>XC NQAA</b>
		

**Figure J.1 — Positioning of PDF417 symbol on label**

Note: This figure is not to scale.

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- [12] GS1 Standards Membership, and to receive a GS1 Company Prefix – Uniform Code Council, 7887 Washington Village Drive, Suite 300, Dayton, OH, 45459-8605. Telephone: (937) 435-3870 • Telefax: (937) 435-7317