TRADING PARTNER LABELS IMPLEMENTATION GUIDELINES

USING LINEAR AND 2D SYMBOLOGIES

(Combined AIAG B10, B12, and B14)

Trading Partner Labels
Using Linear and 2D Symbols

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FOREWORD

This guideline has been published to combine the B10 *Trading Partner Labels Implementation Guideline*, the B-12 Q*uick Receive Guideline,* and the B14 *Guideline for Use of Two Dimensional Symbols with AIAG Trading Partner Labels* into one cohesive document. The wealth of data required on today's shipping labels, updates to the referenced documents, and the need to review them all in building an effective shipping label necessitated this integration.

This document is presented as a guideline to design and implement trading partner labels.

As a reference;

- The B-10 outlined the requirements for printing labels for Unit Loads and Transport Packages to ensure the scannability of bar code symbols and to provide label format consistency.
- The B-12 supplied information on the Quick Receive function.
- The B-14 provided guidelines on when using 2D is appropriate, which symbology(s) to use, recommended data formats, and printing and scanning recommendations.

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INTRODUCTION

The purpose of a Trading Partner label is to facilitate the movement of goods and the exchange of data among all members within a channel of distribution (suppliers, carriers, customers, and others). The amount of data (bar code, 2D symbol, and human readable text) needed on a label is a function of the needs of the trading partners involved.

1.0 DEFINITIONS

See the AIAG-maintained "Definitions" under AIAG AIDC Glossary link at the URL http://www2.aiag.org/committees/AIAGAIDCGlossary.pdf that applies to this document.

2.0 NORMATIVE REFERENCES

The following national, international, and industry standards and guidelines are referenced in this document.

AIAG B-8	*Quality Assurance Guideline for Shipping Labels*
ANS MH10.8.1	*Linear bar code and two-dimensional symbols used in shipping, receiving, and transport applications*
ANS MH10.8.2	*Data Application Identifiers*
ANS MH10.8.3	*Syntax for high capacity ADC media*
ANS X12	*A collection of all ANSI-approved X12 standards (Note: Unit of Measure codes are found in the Data Element 355 section.)*
DUNS®	*Number Users Guide*
ISO 3166-1	*Codes for the representation of names of countries and their subdivisions, Part 1: Country Codes*
ISO 15394	*Packaging - Bar code and two-dimensional symbols for shipping, transport, and receiving labels*
ISO/IEC 15415	*Bar code print quality test specification - Two dimensional symbols*
ISO/IEC 15416	*Bar code print quality test specification - Linear symbols*
ISO/IEC 15417	*Bar code symbology specification – Code 128*
ISO/IEC 15418	EAN.UCC *Applications Identifiers and FACT Data Identifiers*
ISO/IEC 15424	*Information technology – Automatic identification and data capture techniques – Data carrier identifiers (including Symbology Identifiers)*
ISO/IEC 15434	*Syntax for high capacity ADC media*
ISO/IEC 15438	*Bar code symbology specification – PDF417*
ISO/IEC 15459-1	*Unique identifier for transport units, Part 1: Technical standard*

ISO/IEC 16388	*Bar code symbology specification – Code 39*
ISO/IEC 16023	*Bar code symbology specification – MaxiCode*
ISO/IEC 19762	*Information technology, AIDC techniques — Harmonized vocabulary*
MIL-L-61002	*Labels, pressure-sensitive adhesive, for bar codes and other markings*

3.0 LABEL CONCEPT

When a Trading Partner label is used in conjunction with computerized databases and electronic data interchange (EDI), the amount of data needed on a label may be reduced significantly.

3.1 Symbologies

Two linear symbologies, Code 39 or Code 128, with ANS MH10.8.2 Data Identifiers (DIs), have been selected to implement the label format.

The use of the two-dimensional (2D) symbols, PDF 417 and MaxiCode, on Trading Partner labels is also approved and discussed as to their usage in this guideline.

3.2 Labeler

For the purposes of this document, the term *labeler* **SHALL** refer to the organization responsible for having the label, or a section of the label, printed and applied.

3.3 Segments

Segments are logical groupings of information based on the data needs of the trading partners within the distribution channel. These segments are defined as:

CARRIER

CUSTOMER

SUPPLIER

3.4 Information Exchange Considerations

Trading partners and members within a channel of distribution (suppliers, carriers, customers, and others) may have different information needs. Some required information may be common among two or more trading partners, while other information may be specific to a single trading partner.

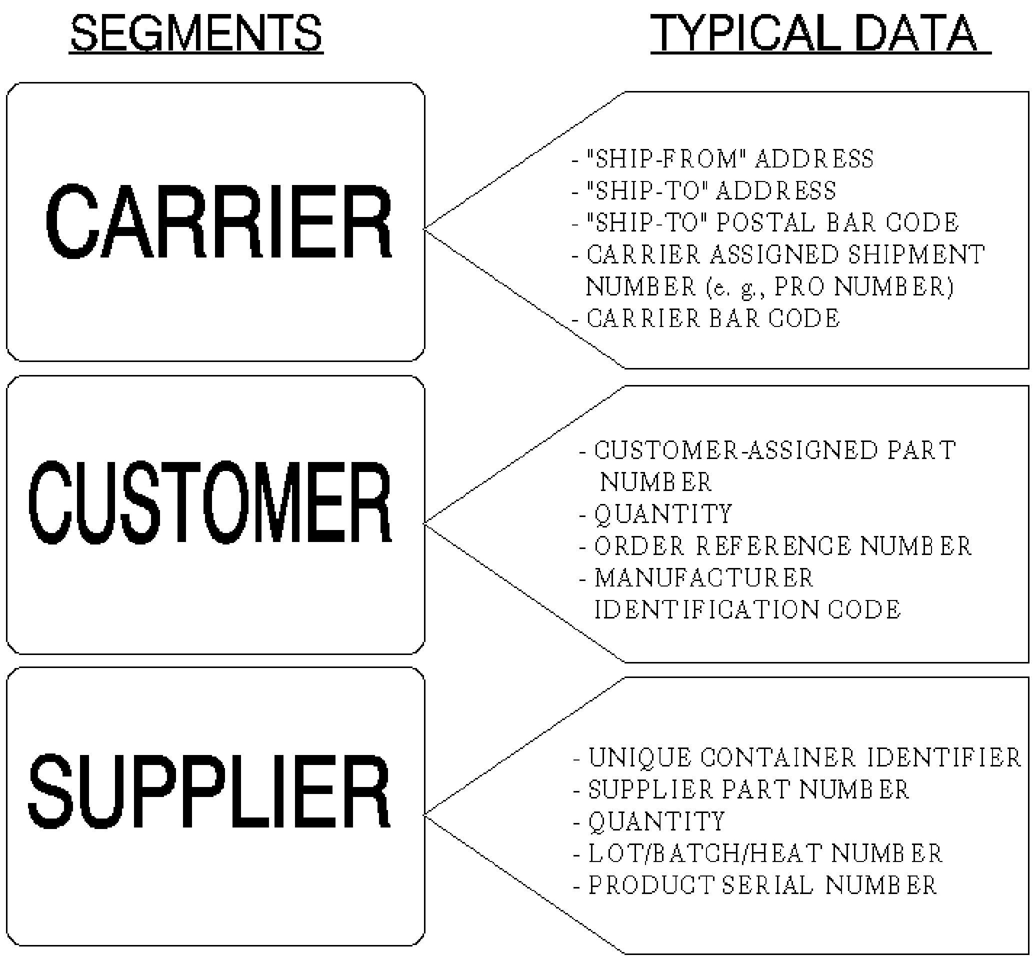
Because information is generally known at different times, the label concept provides for logical groupings of information based on this timing. These logical groupings of information are called *segments*. Examples of information that may be included on unit loads or transport container labels are shown in Figure 1.

3.5 Label Data Content

Control of the data that appear in each segment and the layout of that data is the responsibility of the owner of that segment (i.e., Supplier Segment by the supplier, Customer Segment by the customer, Carrier Segment by the carrier) unless otherwise identified in this guideline.

This label concept provides flexibility by not mandating specific data to be included in any segment except as noted in the Label Data Content section of this document. Appendix D of this standard provides a *recommended* order of data.

Figure 1. Label Segments and Typical Data



4.0 LINEAR SYMBOLOGY SPECIFICATIONS

When a linear symbology is used on a Trading Partner Label, either Code 39 as described in *ISO/IEC 16388 Bar Code Symbology Specification – Code 39* or Code 128 as described in *ISO/IEC 15417 Bar Code Symbology Specification – Code 128* **SHALL** be used.

When Code 39 is used, it **SHALL NOT** use the full ASCII option.

When Code 128 is used, the symbol **SHALL NOT** be a UCC EAN Code 128 symbol.

See Section 13 for 2D Symbology Specifications.

4.1 Bar Code Height

The minimum bar height for both linear symbologies **SHALL** be 0.5 inch (13 mm).

4.2 Narrow Element "X" Dimension

The narrowest bar and space in a linear bar code symbol is called the narrow element and is used to define the "X"-, or width-, dimension of that bar code.

4.2.1 Code 39

The significant parameters of each Code 39 symbol are the average width of the narrow elements (bars and spaces) and the average ratio of narrow elements to wide elements.

For each Code 39 symbol, the average width of the narrow elements **SHALL** be within the range of 0.010 inch (0.25mm) to 0.017 inch (0.43mm), as determined by the printing capability of the supplier/printer of the label.

The ratio of the wide elements to the narrow elements **SHOULD** be 3:1. The measured ratio **SHALL** be between 2.8:1 and 3.2:1.

4.2.2 Code 128

Each Code 128 data character consists of a 1X, 2X, 3X and 4X width element.

For each Code 128 symbol, the average width of the 1X narrow element **SHALL** be within the range of 0.010inch (0.25) to 0.017 inch (0.43mm).

4.2.3 The narrow element "X" dimension -

SHOULD be consistent for all linear bar code symbols contained on the label.

Certain scanning applications require consistent "X" dimensions from one symbol to the next. Printing individual bar codes with different "X" dimensions on the same label may cause scanning problems.

NOTE: Symbols with narrow elements below 0.013 inch (0.33 mm) may require special care to meet bar code print quality and scanning requirements.

4.3 Quiet Zones for Code 39 and Code 128

In order to function properly, bar code-reading equipment must have totally clear areas at both ends of the symbol with no printing or graphics. These clear areas are called *quiet zones*. See Figure 2.

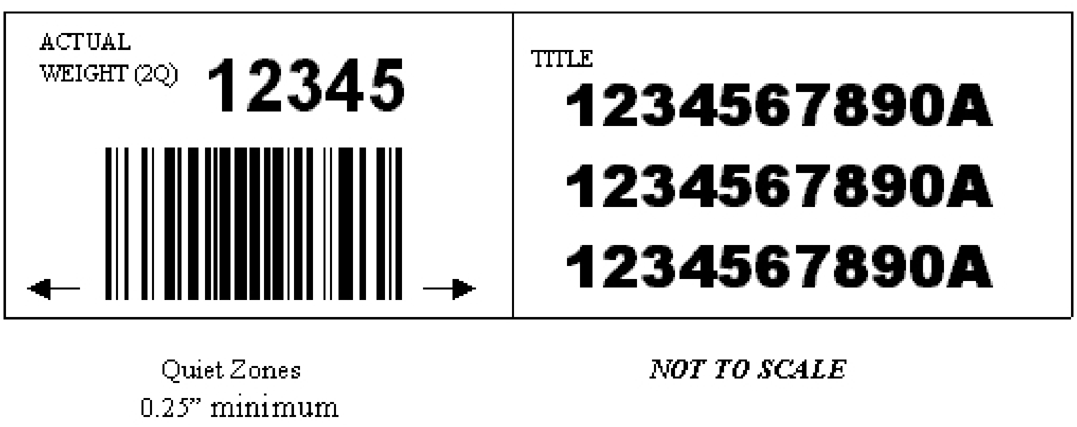
4.3.1 Code 39

Each of the leading and trailing quiet zones for a Code 39 symbol **SHOULD** be 0.25 inch (6.4 mm) and **SHALL** be a minimum of 10 times the width of the narrow element.

4.3.2 Code 128

Each of the leading and trailing quiet zones for a Code 128 symbol **SHALL** be a minimum of 10 times the width of the narrowest element or 0.25 inches (6.4 mm), whichever is greater.

Figure 2. Quiet Zone Dimension



Note: Bar Code in this example is Code 128.

4.4 Check Digits for Code 39 and Code 128

A Check Digit is a digit or character calculated from other characters in a code by means of a defined algorithm and used to check that the code is correctly composed.

4.4.1 Code 39

Check digits **SHALL NOT** be used in Code 39 symbols.

4.4.2 Code 128

The Code 128 symbology includes a mandatory check digit as the last character before the stop character. The check digit **SHALL NOT** be shown in the human readable interpretation.

4.5 Quality for Code 39 and Code 128

Code 39 and Code 128 symbols must be readable throughout the system of use. For this reason quality tests **SHOULD** be performed from label production through end use.

4.5.1 Code 39 and Code 128 Print Quality

The ISO/IEC 15416 Bar Code Print Quality Test Specification - Linear Symbols **SHALL** be used to determine Code 39 and Code 128 symbol print quality. Unless otherwise specified by trading partners, the minimum symbol grade **SHALL** be 2.0/05/660 where:

- Minimum print quality grade = 2.0 (C)
- Measurement aperture = 0.005 inch (0.127 mm)
- Inspection wavelength = 660 nanometers ± 10 nanometers.

The above symbol quality and measurement parameters ensure scannability over a broad range of scanning environments.

- **NOTE:** Previous AIAG standards specified an inspection wavelength of 900 nanometers to accommodate existing infrared scanners. In most cases, compliance at 900 nanometers is an indicator of compliance at 660 nanometers. When discrepancies occur, measurements **SHALL** be made at 660 nanometers.

4.6 Human Readable Interpretation (HRI)

The data encoded in the bar code symbol **SHALL** be represented in human readable characters above the bar code symbol. See Figures 3 and 7 for examples of Human Readable Interpretation (HRI).

Data Identifiers (DIs) and symbology start and stop characters **SHALL NOT** be printed in the human-readable interpretation. ANSI MH10.8.2 Data Identifiers and Code 39 symbology start and stop characters are not considered part of the data.

The Data Identifier (DI) is to be shown in parentheses near the title. See Figures 3 and 7.

The human-readable interpretation **SHALL** be upper case characters. Sans serif fonts (such as Arial or Helvetica) are preferred. A font that clearly differentiates the letter O from the number 0 (as with a dot or line in the number 0) **SHOULD** be used.

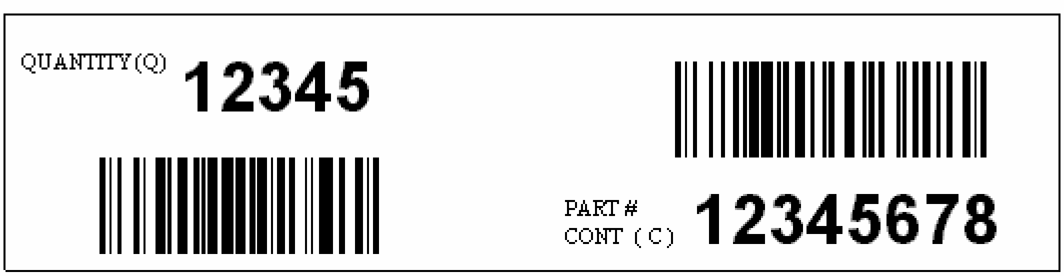
The human-readable interpretation **SHALL** be printed left justified approximately 1.0 to 1.5 inch (25 to 38 mm) from the left edge of the building block or sub-block. The HRI is indented to leave room for the title. See Figure 3.

The human readable interpretation of the data encoded in the bar code symbol **SHALL** be printed at either 2 or 3 LPB. The chosen LPB of the HRI **SHOULD NOT** interfere with the height of the bar code symbol. See Figure 6.

4.7 Side-by-Side Bar Code Block

Previous AIAG label standards have permitted two bar code symbols side by side. The ANSI MH10.8 standard cautions that care **SHOULD** be taken, but it provides no explicit guidance for printing side-by-side bar codes. This guideline for using side-by-side bar codes provides that guidance.

Figure 3. Example of Side-by-Side Bar Codes



NOT TO SCALE

Note: Bar Code in this example is Code 128.

If a second bar code sub-block is required within a single building block, the following rules **SHALL** apply (see Figure 4, and Section 5.1):

- Quiet zones, bar code height, and other bar code specifications must still be maintained.
- There **SHALL NOT** be more than two bar code sub-blocks in any single building block.

- The first bar code sub-block **SHALL** be the left-most sub-block within the building block.
- The second bar code sub-block **SHALL** be the right-most sub-block within the building block.
- The vertical line separating the sub-blocks **MAY** be omitted between two bar code sub-blocks, but caution **SHALL** be exercised to prevent text from intruding on the 0.25-inch quiet zones of each symbol.
- **Bar Code Data Limit:** The total number of characters in the two linear bar codes combined, including Data Identifiers, **SHALL NOT** exceed **16** characters. (For example, if the first linear bar code data field contains 7 characters including the Data Identifier, the second linear bar code data field may contain a maximum of 9 characters including the Data Identifier).
- The first (left-most) bar code sub-block **SHALL** conform to all specifications for Bar Code Building Blocks as stated earlier in this section under the subtitle Bar Code Building Block Contents.
- The second (right-most) bar code sub-block **SHALL** conform to specifications for Bar Code Building Blocks, plus the following:
  - **Block Title Line(s):** A title **SHALL** be printed in conformance with the Bar Code Building Block rules, except that the title **SHALL** be printed in the **lower** left corner of the sub-block.
  - **Bar Code Symbol Placement:** The bar code symbol **SHALL** be printed in the **upper** portion of the sub-block.
  - **Human Readable Interpretation:** The human readable interpretation of the data encoded in the bar code symbol **SHALL** be printed **below** the bar code symbol.

5.0 LABEL FORMAT

This guideline defines rules for formatting the information that appears on a shipping label. This section includes the formatting rules for the following:

- Building blocks and sub-blocks.
- Text in building blocks.
- Bar code in building blocks.
- General label characteristics

5.1 Building Blocks

The building block is the basic unit of the label format.

A modular structure is used to simplify label formatting. An individual building block or sub-block may contain the following:

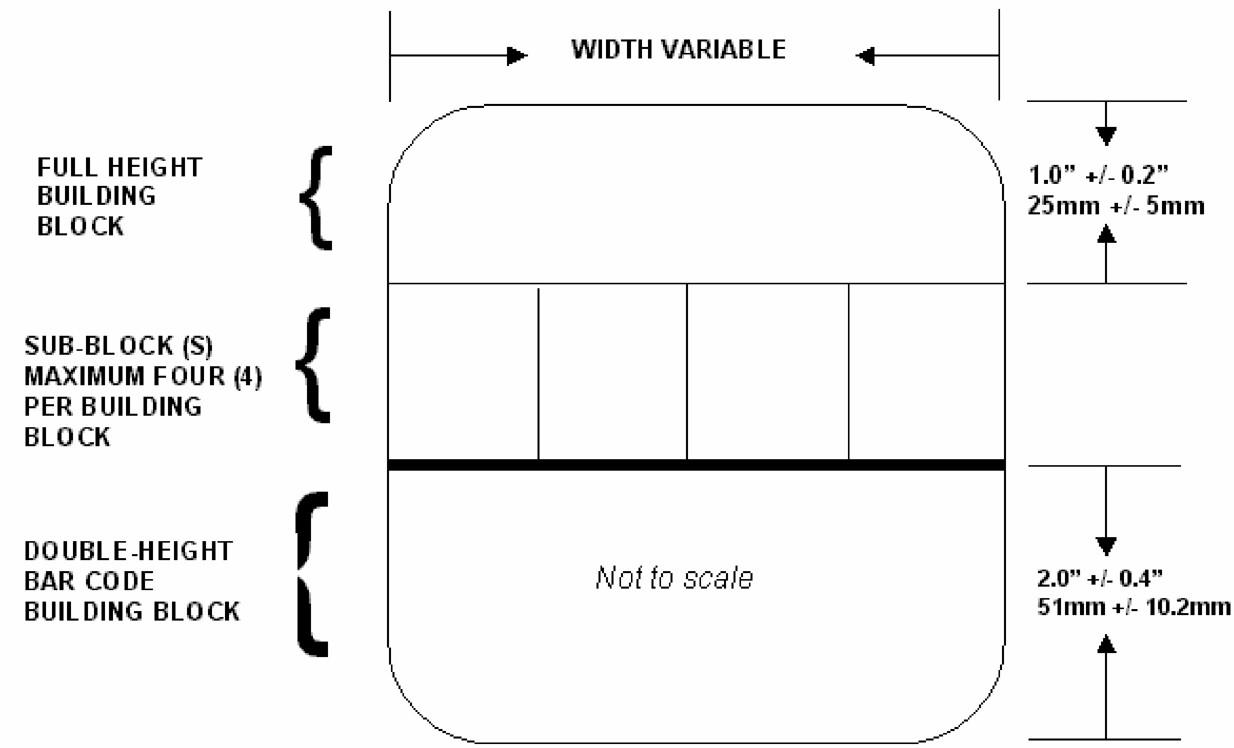
- Text or graphics,
- A single bar code with human readable interpretation,
- A single 2D symbol,
- A linear bar code and a 2D symbol, or
- May be blank.

Building blocks **SHOULD** be stacked vertically

Each building block may be produced separately or in combination with other building blocks. This provides the option of printing data, as it becomes known. See Figure 4.

A horizontal line **SHOULD** separate building blocks from each other. See Figure 4.

Figure 4. Building Block Types and Size



5.2 Building Block Size

Building block height **SHALL** be 1.0 inch +/- 0.2 inch (25 mm +/- 5) as determined by the printing capability of the labeler.

The width of a building block is the width of the label.

A maximum of one double-height bar code block may be used per segment (See Section 7.3 and Figure 1). The double-height block can be used to satisfy special scanning requirements (for example, automated conveyor scanning or long range scanning).

Double-height bar code blocks **SHALL** be 2 inches +/- 0.4 inch (51 mm +/- 10 mm). See Figure 4.

Two half-height text building blocks may be used per segment. The half-height building block may only contain text or graphics, not bar code symbols.

5.3 Sub-blocks

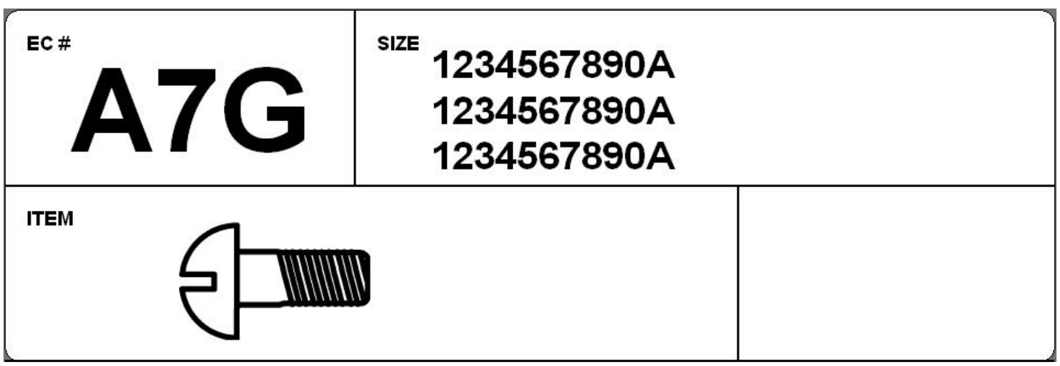
A sub-block **SHALL** be the full height, but less than the full width, of the building block. Vertical lines **SHOULD** be used between sub-blocks and **SHALL** be used to separate two adjacent text sub-blocks. See Figure 4.

Building blocks **SHALL NOT** be divided into 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.

5.4 Text Building Block Format

Figure 5 shows the format of a text building block.

Figure 5. Text Building Block



5.5 Text Building 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. See Figure 3, which contains bar codes.

5.5.1 Text Lines-Per-Block

The height of text characters **SHALL** be specified 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, within the guidelines provided.

The exact character heights corresponding to the eight text sizes **SHALL** be chosen by the labeler based on the capabilities of the printing process. Eight sizes may be specified for text, ranging from one to eight Lines-Per-Block (LPB). See Figure 6.

Figure 6. Illustration of Lines Per Block (LPB)

AIAG12345	1 LPB
AIAG1234567890PQVS AIAG1234567890PQVS	2 LPB
AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS	3 LPB
AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS	4 LPB

Figure 6a. Illustration of Lines Per Block (LPB) (continued)

AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS	5 LPB
AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS	6 LPB
AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS	7 LPB
AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS AIAG1234567890PQVS	8 LPB

5.6 Text Dimensions

Labelers **SHALL** choose a single text height for each of the eight sizes so that clear distinctions **SHALL** be evident between text sizes. For example, 8 LPB text **SHALL** be smaller than 7 LPB text, etc. Figure 6 illustrates 1 through 8 LPB printing.

Characters **SHALL** be clearly legible, regardless of height. For maximum legibility the ratio of the height to width of a character **SHOULD NOT** exceed 2:1. The ratio of the height to width is measured on an "M" character. A sans serif font such as Arial or Helvetica is recommended.

5.7 Text Data Limits

The maximum number of text characters per line in a full width block that can be required of a labeler, regardless of the width of the label supplied, **SHALL** be limited to those shown in the column "Maximum Characters Per Line" in Table 1, below.

Table 1. Suggested LPB Character Parameters

Lines Per Block	Maximum Characters Per Line	Approximate Point Height	Approximate Height in Inches	Approximate Height in Millimeters
1 LPB	8	64	0.90	22.0
2 LPB	18	32	0.40	11.0
3 LPB	28	20	0.25	7.0
4 LPB	34	16	0.20	5.0
5 LPB	42	12	0.15	4.0
6 LPB	48	10	0.12	3.0
7 LPB	59	8	0.10	2.0
8 LPB	68	6	0.08	1.5

NOTE: *Calculation of Maximum Characters Per Line is based on a block/label width of 6 inches. Calculation of approximate heights is based on a block height of 1 inch. Actual text dimensions will depend on the data, the font used, and the capability of the label provider's printer and software.*

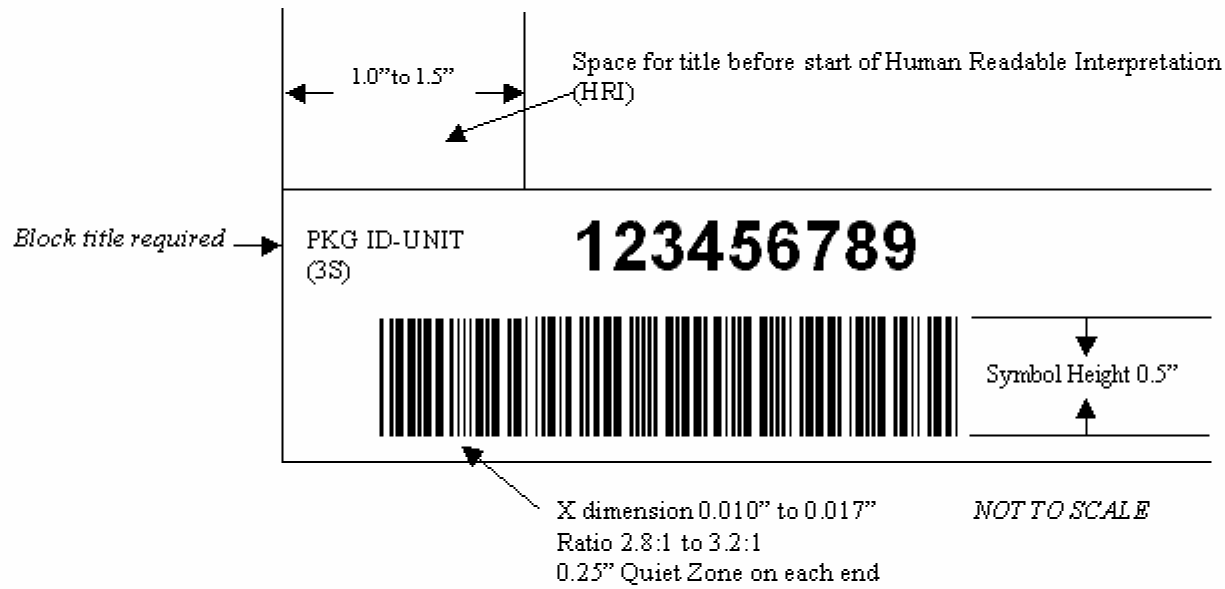
5.8 Titles For Text Building Blocks and Sub-blocks

A title may be used in a text building block. When used, it **SHALL** be printed in the upper left corner of the building block or sub-block.

Sans serif fonts (such as Arial or Helvetica) are preferred, but not required. If possible, a font that clearly differentiates the letter O from the number 0 (as with a dot or line in the number 0) **SHOULD** be used.

The title in a text building block **SHALL** be printed in upper case characters at a height of 6, 7, or 8 LPB, two lines maximum, left justified. See Figure 6.

Figure 7. Bar Code Building Block



5.9 Bar Code Building Block

The linear symbologies Code 39 or Code 128, with Data Identifiers (DIs) **SHALL** be the linear symbologies used in a bar code building block. See Section 4 for Code 39 and Code 128 Specifications.

A building block **SHOULD NOT** contain more than one linear bar code, but may contain a linear bar code and a 2D symbol. A sub-block of a building block **SHALL NOT** contain more than one linear bar code symbol.

Guidelines for implementing two sub-blocks with linear bar code symbols are found in Section 4.7 Side-by-Side Bar Code Block.

The single bar code sub-block **SHALL** be the leftmost sub-block within a building block.

All Code 39 or Code 128 bar code symbols **SHALL** contain a **D**ata **I**dentifier (**DI).** DIs are not considered part of the data they precede. The Data Identifier **SHALL** conform to the ANSI MH10.8.2, Data Application Identifier Standard. See Normative References.

5.10 Bar Code Data Limit

The total number of characters (excluding start/stop) per linear bar code in a building block or sub-block **SHALL NOT** exceed 19. The count of the total number of characters includes both data and DI characters.

5.11 Bar Code Block Title Line(s)

A title **SHALL** be printed in the upper left corner of the bar code building block or sub-block. See Figures 3, 5 or 7. Note the exception for Side-by-Side bar codes discussed in Section 4.7.

The title **SHALL** be printed in upper case characters at a height of 6, 7, or 8 LPB, two lines maximum, left justified. The Data Identifier (DI) **SHALL** be shown in parentheses near the title and **SHALL** follow the title. See Figures 3 and 7.

The bar code block's title **SHOULD** comply with the suggested Short Titles shown in Appendix A of this guideline.

5.12 Bar Code Symbol Placement

The bar code symbol **SHALL** be placed in the lower portion of the bar code building block, as illustrated in Figures 2 and 7. Note the exception for side-by-side bar codes discussed in Section 4.7 and Figure 3.

The bar code symbol **SHALL** be left justified allowing for the quiet zone as specified under Section 4.3 and Figure 2.

When used, a bar code sub-block **SHALL** be the leftmost sub-block within a building block.

5.13 Bar Code Symbol Height

The minimum height of the bar code symbol **SHALL** be 0.5 inch (13 mm). See Figure 7.

5.14 Label Characteristics

Labels SHALL be white, with black print. They SHALL NOT use color for the following reasons:

1. COST
2. The process can be broken too easily due to supply constraints.
3. Approximately 10%+ of the male population has some form of colorblindness.

5.15 Label Height

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

The intended height of a building block is 1 inch, so the height of the label will be 1 inch times the number of building blocks.

5.16 Label Width

The width of the label **SHALL** be determined by the labeler.

Table 2, below, provides guidance. For example, if the labeler intends to print all labels at an "X" dimension of 0.015 inch, label stock of 6 inches width **SHOULD** work for any trading partner labeling specification.

Table 2. Suggested Label Widths for Selected X Dimensions Using Code 39

X DIMENSION	SUGGESTED LABEL WIDTH
0.010 inch (0.25 mm)	4 inches (102 mm)
0.013 inch (0.33 mm)	5 inches (127 mm)
0.015 inch (0.38 mm)	6 inches (152 mm)
0.017 inch (0.43 mm)	6.5 inches (165 mm)

Note: Table 2 shows, for given "X" dimensions, the suggested label widths to accommodate the maximum number of 19 data characters.

The calculations were based on the following for Code 39: 19 characters of data identifier plus data (***maximum allowable)*** plus the two characters of a start character and a stop character, plus two 0.25-inch quiet zones, using a ratio of wide to narrow elements of 3:1.

Table 3. Suggested Label Widths for Selected X Dimensions Using Code 128

X DIMENSION	SUGGESTED LABEL WIDTH
0.010 inch (0.25 mm)	3 inches (64 mm)
0.013 inch (0.33 mm)	3.5 inches (77 mm)
0.015 inch (0.38 mm)	4 inches (83 mm)
0.017 inch (0.43 mm)	4.5 inches (102 mm)

The calculations for Table 3 used the same character count as Table 2.

6.0 LABEL DATA CONTENT

This guideline defines label format, not label content. However, certain information is widely needed for specific application uses of labels. This section describes the recommended data for:

- Unique identification for container content labels
- Identifying individual containers for shipment
- Identifying master pack containers for shipment
- Identifying mixed load containers for shipment
- Identifying entire shipments in conjunction with EDI
- Ship-to and ship-from text format

Although no specific data is mandated, a Unique Container Identifier is highly recommended for traceability throughout the supply chain, as specified in the following section.

The customer is the final arbiter of what data is mandatory.

6.1 Unique Container Identifier (License Plate)

Containers **SHOULD** be uniquely identified each time they are shipped, using a Unique Container Identifier, commonly referred to as a *license plate*.

The Unique Container Identifier, if used, **SHALL** be contained in either one or two linear bar code symbols as described in the following sections.

A Unique Container Identifier is a numeric or alphanumeric code that uniquely identifies a container for traceability for a single shipment within the channel of distribution.

Such identification consists of three elements:

- A package identifier for the container, assigned by the supplier.
- A controlled number for vendor identification,
- A means to identify the controlling authority that assigned the vendor identification number (this is identified by the DI)

The Unique Container Identifier **SHALL NOT** be repeated to a given customer within a minimum period of 366 days.

6.1.1 Unique Container Identifier Using One Building Block

When a single building block is used for the Unique Container Identifier, it **SHALL** comply with the rules for a Unique Transport Unit Identifier as defined in ISO/IEC 15459, using the Data Identifier "1J" for individual packages and "2J" for Master and Mixed Loads.

A container may be uniquely identified by using a single building block containing only text, or a single linear bar code.

The Unique Transport Unit Identifier is defined in ISO/IEC 15459 as follows;

- When using a single linear barcode, uses the appropriate Data Identifier (1J or 2J);
- Is unique and **SHALL NOT** be repeated to a given customer within a minimum period of 366 days;
- The data starts with an Issuing Agency Code (IAC) assigned to the issuing agency by the Registration Authority identified by ISO;
- Conforms to a format specified by the issuing agency;
- Contains only upper case alphabetic and numeric characters.

The purpose of highlighting lines is to assist users in visually locating the Unique Container Identifier. Highlighting lines **SHOULD** be used above and below the single building block. Highlighting lines **SHALL NOT** be used elsewhere on the label. Highlighting lines **SHALL** be easily distinguishable from the other horizontal separator lines.

6.1.2 Unique Container Identifier Using Two Building Blocks

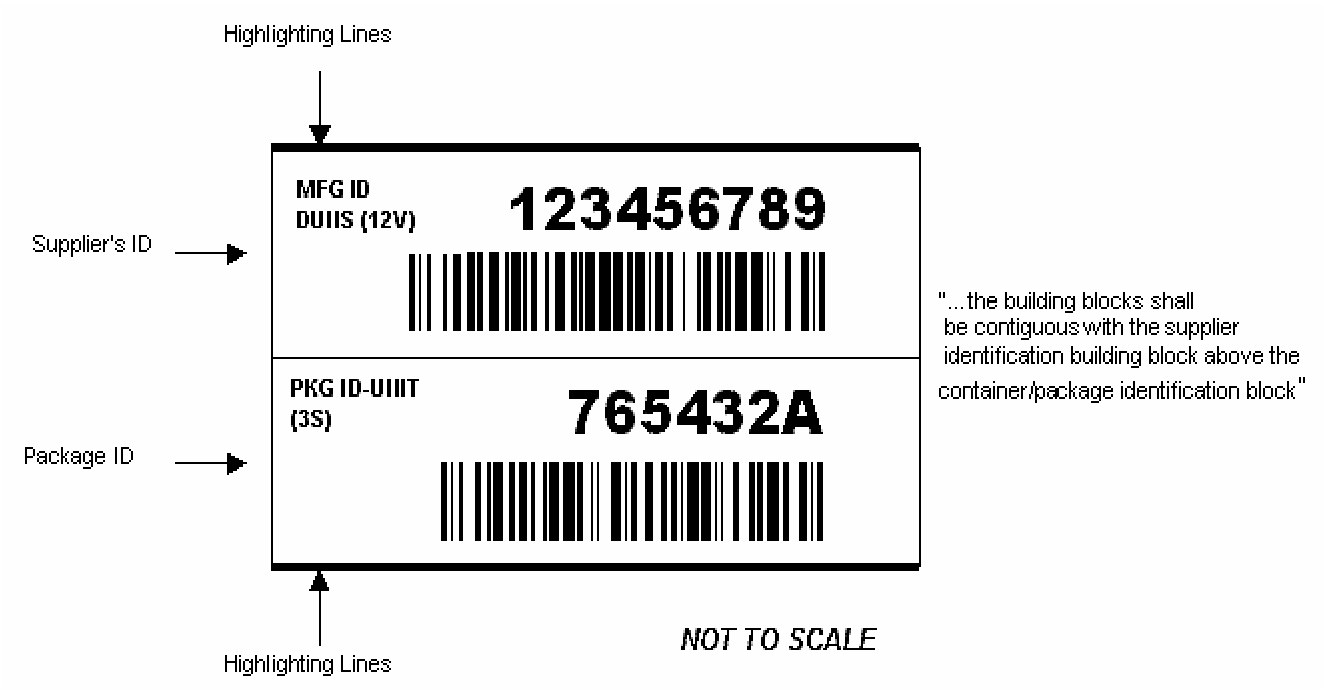
A container may be uniquely identified by using two building blocks containing an identification of the supplier and an identification of the container number of the container, as assigned by the supplier. When two building blocks are used for the Unique Container Identifier, the building blocks **SHALL** be contiguous, with the supplier identification building block above the container/package identification block.

The combination of the two building blocks **SHALL** be unique and **SHALL NOT** be repeated to a given customer within a minimum period of 366 days.

When a bar code symbol is used, the appropriate Data Identifier (DI) from the ANSI MH10.8.2 Data Identifier Standard **SHALL** be used. A brief list of some data identifiers from the ANSI MH10.8.2 Data Identifier Standard can be found in Appendix A of this document.

Highlighting lines **SHOULD** be used above the supplier identification block and below the container/package identification number building block. The purpose of highlighting lines is to assist users in visually locating the Unique Container Identifier. Highlighting lines **SHALL NOT** be used elsewhere on the label. Highlighting lines **SHOULD** be easily distinguishable from the horizontal separator lines. See Figure 8.

Figure 8. Double Building Block License Plate



Note: Bar Code in this example is Code 128.

6.2 Single Pack Label – A Single Container of the Same Part Number

A unique container unit identifier or "license plate" is the key that provides access to information stored in computer files and that may be transmitted by EDI. The identifier may be used by all of the trading partners to retrieve information about the transport unit itself or about the status of the physical movement of the transport unit along the supply chain. It enables systems to track and trace individual transport units.

A Single Pack Label **SHOULD** be used to identify the contents of an individual container of a single part number for a shipment. A Unique Container Identifier **SHOULD** be assigned to each single pack. See Section 14 Examples.

When used, the Unique Container Identifier **SHALL NOT** be repeated to a given customer within a minimum period of 366 days. When multiple labels are used on a container all labels **SHALL** be identical, including the package identifier.

The Data Identifier for package identification for a single container **SHALL** be either:

- "1J" when a single building block is used, or

- "3S" when two building blocks are used.

6.3 Master Load Label – Multiple Single Packs of the Same Part Number

A Master Load Label **SHOULD** be used to identify the total contents of a multiple single pack load of the same part number. For an example, see Section 14 Examples.

Master Labels are similar to single pack labels with the following exceptions:

- Ship-From and Ship-To addresses **SHOULD** be used when applicable.

- The Master Load Label **SHOULD** be easily identified with human readable text. A text sub-block containing the words "MASTER LABEL" in upper case **SHALL** be printed in either the Customer Segment or the Supplier Segment of the label at a minimum height of 3 LPB.

The Data Identifier for a package identification in a bar code on the Master Load Label **SHALL** be either of the following;

- "2J" when a single building block is used, or
- "4S" when two building blocks are used.
  - Note that the "4S" would also appear in parentheses in the title, as:

    PKG ID – MASTER (4S)

- The quantity on the Master Load Label **SHALL** be the accumulated total of all single pack quantities on the load.

- All other data in the customer segment of the Master Load Label **SHALL** be specified by the customer.

When used, the Master Load Label **SHOULD** be placed in such a manner that when the pack is broken apart, the Master Load Label can be discarded.

When used, the Unique Container Identifier **SHALL NOT** be repeated to a given customer in a period of less than 366 days.

When multiple labels are used on a container all labels **SHALL** be identical, including the package identifier.

Each single pack of the multiple pack **SHOULD** be identified with a Single Pack Label.

6.4 Mixed Load Label

A Mixed Load Label **SHALL** be used to identify a load of multiple single packs of different part numbers.

Mixed Load Labels **SHALL** conform to the following specifications:

- Ship-From and Ship-To addresses **SHOULD** be used when applicable.
- A text sub-block containing the words **MIXED LOAD** in upper case **SHALL** be printed in either the Customer Segment or the Supplier Segment of the label at a minimum height of 3 LPB.

The Data Identifier for package identification when used in a bar code on the Mixed Load Label **SHALL** be either of the following:

- "2J" when a single building block is used, or
- "5S" when two building blocks are used.
- All other data in the customer segment of the Mixed Load Label **SHALL** be specified by the customer.

When multiple labels are used on a container all labels **SHALL** be identical, including the package identifier.

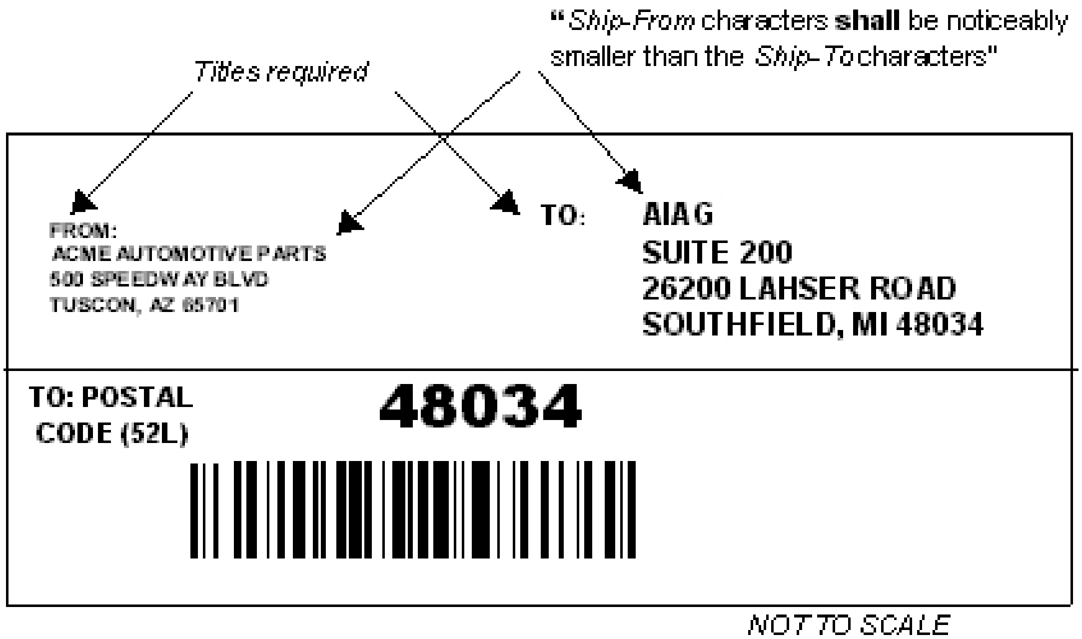
When used, the Unique Container Identifier **SHALL NOT** be repeated to a given customer within a minimum period of 366 days.

Each single pack of the mixed load pack **SHOULD** be identified with a Single Pack Label.

6.5 Ship-From and Ship-To

This section defines Ship-From and Ship-To building block usage.

Figure 9. Ship-From and Ship-To Building Blocks



Note: Bar Code in this example is Code 128.

6.5.1 Ship-From and Ship-To Text

Ship-From and Ship-To addresses **SHOULD** be used when applicable.

The Ship-From sub-block **SHALL** have a title of "FROM:" and the Ship-To sub block **SHALL** have a title of "TO."

Ship-From characters **SHALL** be noticeably smaller than the Ship-To characters. The difference in size makes it easier for carrier personnel to distinguish the destination from the return address. For example, if the Ship-To address is printed at 5 LPB, then the Ship-From address **SHOULD** be printed at 6 or 7 LPB.

When the Ship-From and Ship-To addresses are placed side by side the Ship-From address **SHALL** be placed to the left of the Ship-To address. It is recommended that the Ship-From and Ship-To addresses be placed side-by-side in a single building block, rather than using two building blocks for addressing information.

When placed side by side, the Ship-From address **SHOULD** be separated from the Ship-To address by a vertical line.

If the Ship-From and Ship-To addresses are placed in separate building blocks the Ship-From address **SHALL** be located above the Ship-To address. To ensure that the package arrives at the correct destination, the Ship-To address **SHALL NOT** be located above the Ship-From address.

7.0 QUICK RECEIVE LABEL

7.1 Introduction

The process described in this section promotes cost reduction benefits at shipment levels for partial or completely loaded trucks, rail cars, sea vans or other controlled arrangements of containers. This timesaving option of making material receipts uses both bar code and Electronic Data Interchange (EDI). The process is called "Quick Receive."

The Quick Receive process facilitates the integration of minimal bar code scanning and the ANSI ASC X12 856 Ship Notice/Manifest, known in the automotive industry as the **A**dvance **S**hip **N**otice (**ASN**). This integration allows receipts to be made at shipment levels, requiring little or no manual data entry. The time consumed in scanning individual container labels and inquiring to determine if the ASN was sent from supplier to customer is eliminated.

As an aid in planning and implementing an efficient receiving process, this guideline recommends a method using data encoded in Code 39 or Code 128 bar codes with an electronic ASN to receive material at the shipment level.

7.2 Business Process

The combination of a Quick Receive Label and the ASN provides significant benefits to automotive and related industries. Following is a description of the typical business logistics process performed by suppliers and customers.

Suppliers:

- Place bar code shipping labels on the material according to customer requirements.
- Assign a control number to the ASN.
- Develop the ASN from shipment data.
- Print a Quick Receive Label containing the ASN control number and attach to the freight bill, bill of lading, or packing list (attached to document customer will retain after signing for freight/delivery.) For smaller cartons and/or packages, such as those sent via package carriers, where each package is defined as a shipment, the Quick Receive label can be placed directly on the carton near the "Ship To" address.
- Transmit the ASN to the customer.
- Send the shipment to the customer.

Customer:

- Receive the supplier ASN from the electronic mailbox and store data.
- Scan the Quick Receive Label, process the scanned data against the ASN data file, and receive shipment.

7.3 Purpose of the Quick Receive Label

The purpose of the customer Quick Receive Label is to match a supplier's incoming material to the information on the supplier's EDI ASN (856). To accomplish this, the information on the Quick Receive Label **SHALL uniquely identify the shipment for the customer.**

Using the "building block" design outlined in section 5.0, a Quick Receive Label can be constructed using one, two, or three building blocks.

7.3.1 One Building Block

If the **S**hipment **Id**entification (**SID**) uniquely identifies the shipment for the customer, a single building block can be used. See Figure 10. If the SID is encoded in a bar code symbol, the maximum length **SHALL** be 19 characters, including the **D**ata **I**dentifier (**DI**) "2S." The title **SHALL** be "(2S) ASN SHIPMENT ID/QUICK RECEIVE."

Figure 10. Shipment Identification (SID) uniquely identifies shipment.

NOT TO SCALE
Note: Bar Code in this example is Code 128.

7.3.2 Two Building Blocks

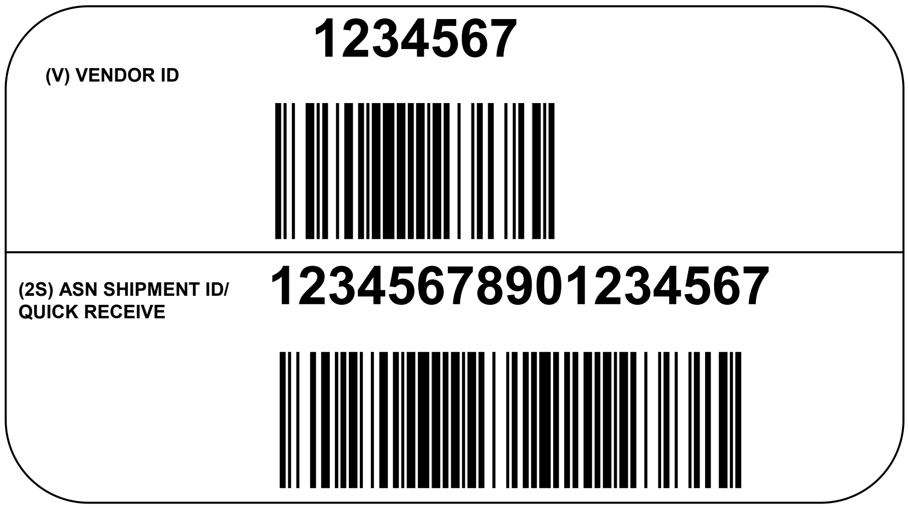
If the SID does not uniquely identify the shipment for the customer, or the bar code in the SID is more than 17 characters, two building blocks SHALL be used, one to identify the supplier and one to identify the shipment. See Figure 11. If either or both building blocks contain bar codes, the maximum is 19 characters per building block, including DI's. For the supplier identification, if the ASN ISA 05 segment is a one (1), use DI "13V".

Figure 11. Shipment Identification (SID) does not uniquely identify shipment

NOT TO SCALE
Note: Bar Code in this example is Code 128.

If the ASN ISA 05 segment is ZZ, use Data Identifier "V". For the shipment identification, the DI **SHALL** be "2S". See Figure 12. The title **SHALL** be "(2S) ASN SHIPMENT ID/QUICK RECEIVE."

Figure 12. Example of Data Identifier “V”.



NOT TO SCALE

Note: Bar Code in this example is Code 128.

7.3.3 Additional Building Block

If trading partners agree that the human readable text “Quick Receive” **SHOULD** be a full building block on the label, an additional building block **SHALL** be used. This block **SHOULD** be the topmost block of the label.

Figure 13. Text Block Added And Shipment Identification (SID) Uniquely Identifies Shipment.

NOT TO SCALE

Note: Bar Code in this example is Code 128.

Figure 14. Text Block Added And Shipment Identification Does Not Uniquely Identify Shipment.

NOT TO SCALE

Note: The Bar Codes in this example are Code 128.

Figure 15. Text-Only Example; Lower Block May Contain Additional Text.

NOT TO SCALE

8.0 SYMBOLOGY QUALITY

To ensure consistent and effective reading of the bar code and 2D symbologies throughout the supply chain, following a quality plan is paramount. The following section outlines minimum requirements.

8.1 Quality Assurance

Quality testing **SHOULD NOT** be limited to label production inspection but **SHOULD** be tested through to the end use.

It is important that the bar code be decodable throughout the system. For this reason, quality needs to be considered from initial printing through to the end user.

The AIAG B-8 document is a guide for determining quality assurance for shipping labels and other bar code applications (both linear and 2D).

8.2 Bar Code Print Quality

ISO/IEC 15416 – *Bar code print quality test specifications – Linear symbols,* describes the parameters used for evaluating a printed bar code symbol. The test result is a print quality grade, either numeric (4,3,2,1,0) or alphabetic (A, B, C, D, F). The ISO/IEC 15416 **SHALL** be used to determine bar code symbol print quality.

When bar code print quality tests are performed an appropriate verifier with a measurement aperture of 0.010 inch and illumination wavelength of 630 – 680 nanometers **SHALL** be used.

The minimum symbol grade SHALL be C (1.5).

These symbol quality and measurement parameters ensure scannability over a broad range of scanning environments.

In addition, it is recommended that quality measurements be taken under consistent conditions; that is, use the same background lighting and the same surface on which the label will be attached.

Note: Previous AIAG Standards (B-3 and B-5) specified an inspection wavelength of 900 nanometers +/- 10% to accommodate existing infrared scanners. Scanners using visible light sources (630 to 680 nanometers) are preferred. Meeting the minimum bar code print quality requirements at the infrared wavelength generally ensures acceptable print quality levels at the visible light wavelength.

8.3 Sampling

Appropriate statistical process control (SPC) techniques **SHOULD** be used.

The sample size must be sufficiently large to be statistically valid within the size of the lot or batch being inspected. Acceptable quality levels must be established prior to quality control inspection.

In addition to statistical sampling, additional points in the process where verification is appropriate include the following:

- When printer is first turned on,
- After changing ribbons,
- After changing toner,
- After changing ink,
- Any time the label stock is changed,
- Beginning of a shift, and
- After maintenance is performed on the printing equipment.

8.4 Obsolete Labels

Obsolete labels **SHALL** be rendered unusable by being removed, defaced, or covered.

If covering obsolete labels with new labels, care **SHOULD** be taken so that the bar code print quality of the new labels is not adversely affected.

If the label stock is not sufficiently opaque, the print from the label underneath can show through and decrease the print contrast. The new label must meet the ANSI bar code print quality requirements.

8.5 Label Durability

Labels **SHOULD** be sufficiently durable to remain in place and be decodable throughout the system of use.

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

Some of the factors that **SHOULD** be considered include temperature, humidity, light exposure, abrasion, chemical contamination and aging.

Military Specification MIL-L-61002, “Labels, Pressure Sensitive Adhesive, for Bar Codes and Other Markings” is a good source for information on environmental factors, consideration, and testing. The following sections of that document are relevant for review.

- 3.2.2 "Performance Test Parameters"
- 4.6 "Performance Tests"
- 6.11 "Application Examples"

8.6 Recyclability

If the label is to be attached to a material that is to be recycled, the label material **SHOULD** be compatible with or removable from the substrate material to which it is attached.

An example of a recyclable material is shrink-wrap.

9.0 LABEL PLACEMENT AND ORIENTATION

As described in Section 7 Label Concepts, this guideline uses segments for logical grouping of information. In this section, rules for placement and orientation of label segments are defined and illustrated.

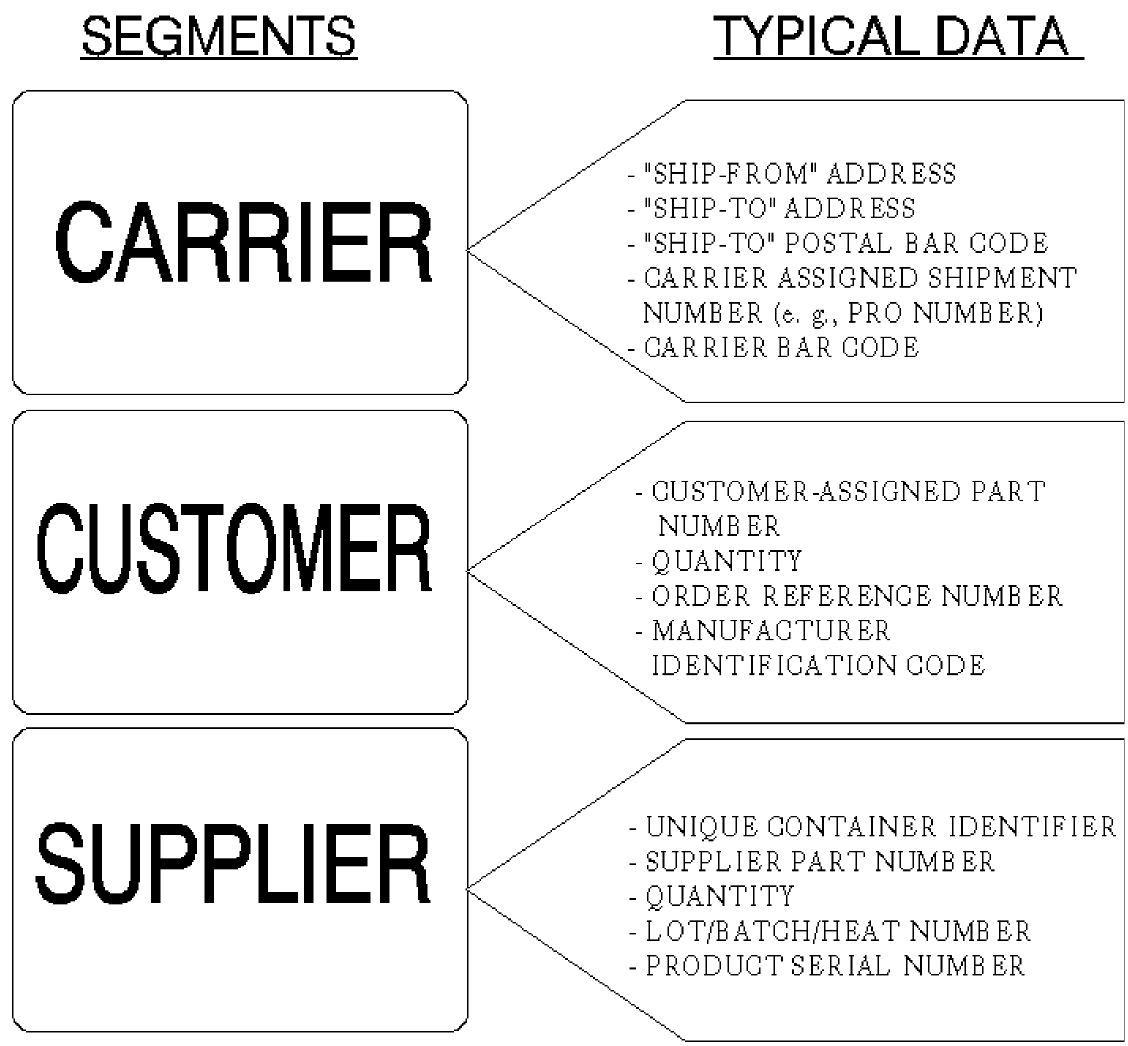
9.1 Segment Placement

Label segments **SHOULD** be stacked vertically. Stacking vertically ensures that the bar codes do not interfere with each other when scanning. See Figure 16 below.

As illustrated below, the Carrier Segment of the label **SHOULD** be the topmost segment. Parcel carriers may require the placement of carrier information (such as addresses) on the top of the transport container.

Due to physical package constraints, it may not be possible to stack all segments vertically. Under these circumstances it is important to position the segments of the label so that bar code blocks are not directly adjacent. Placing bar code symbols side by side can interfere with accurate bar code scanning.

Figure 16. Label Segments



9.2 Placement

Labels **SHOULD** be placed no closer than 1.25 inches (32 mm) from any container edge. See Figure 17.

Label placement toward the center of the sides of rectangular corrugated containers **SHOULD** be avoided.

When label locations are identified on customer containers (especially on returnable containers), they **SHALL NOT** be applied outside the defined area.

Because labels must be accessible for scanning at shipping, transportation, and receiving operations, labels or tags **SHOULD** be applied in an easily accessible location. See Figures 18a and 18b for guidance on label placement for various types of containers.

When multiple labels are used on a container, all labels **SHALL** be identical, including the package identifier.

The label **SHOULD NOT** be placed over a seam.

Sealing tape, shrink-wrap, or bands **SHALL NOT** be placed over the label. These will interfere with the scanning of the label.

The following considerations **SHOULD** be addressed when determining the most appropriate location for the label or segments of the label:

- Survivability of the label,
- Label application (manual/automatic, label/tag /direct marking),
- Container type,
- Packaging level (if multiple labels or bar code symbols are visible),
- Accessibility of location.

Each supplying location **SHALL** be responsible to ensure that bar code marked labels and tags are sufficiently secured and protected and applied wrinkle-free so that they are readable at the point of final customer usage.

9.3 Label Placement on Master and Mixed Loads

For master and mixed loads the label **SHALL** be placed on the upper half of the unit load. The bottom edge of the label **SHOULD NOT** be higher than 60 inches (152 cm) from the bottom.

9.4 Orientation

Labels **SHOULD** be placed on the side of the container with the bars perpendicular (+/-5 degrees) to the natural bottom of the container. See Figure 17. When a label is placed on the top of a container, the bars **SHOULD** be perpendicular to the edge of the container and **SHOULD NOT** be placed over a seam.

Figure 17. Label Orientation

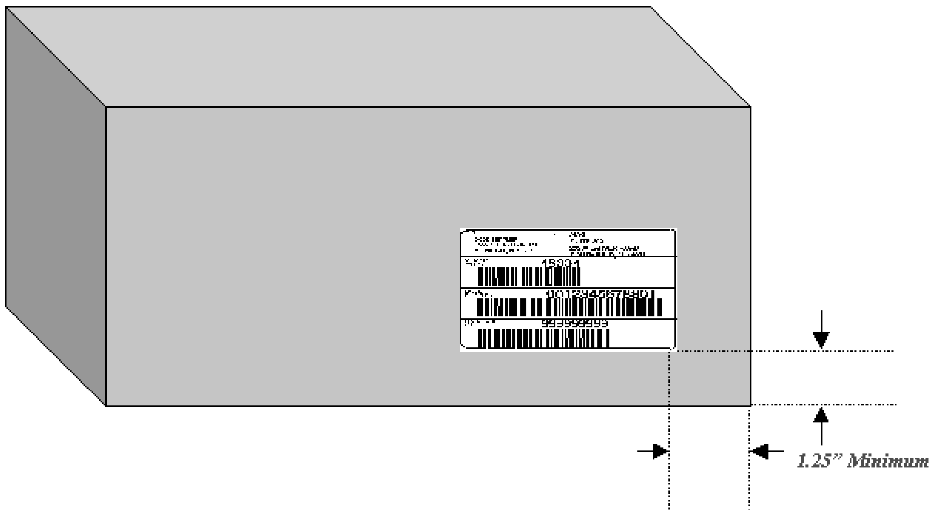
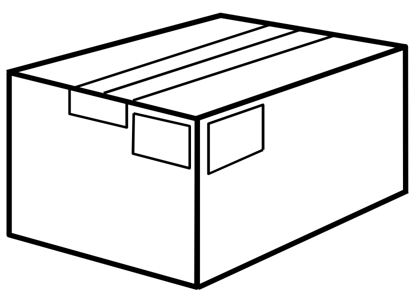
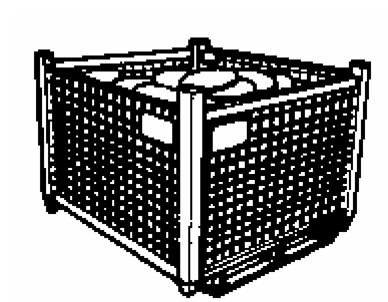


Figure 18. Suggested Label Placement

BOX OR CARTON	BASKET, WIRE MESH CONTAINER
	

Caution: All labels on the container must be identical.

Obsolete labels **SHALL** be rendered unusable by being ***completely*** removed, defaced, or covered.

Figure 18a. Suggested Label Placement (continued)

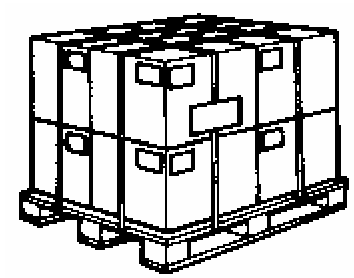
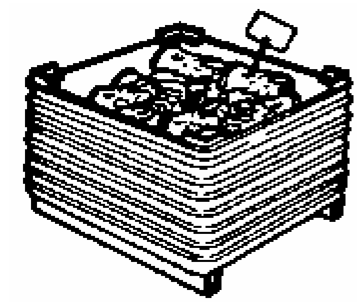
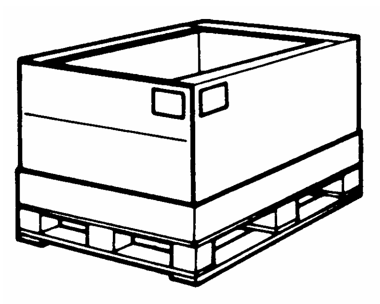
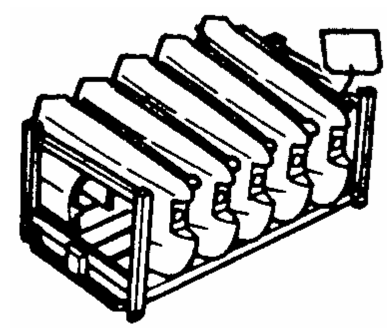
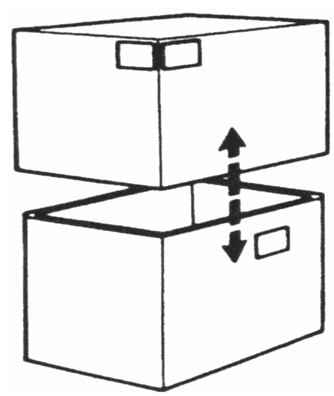
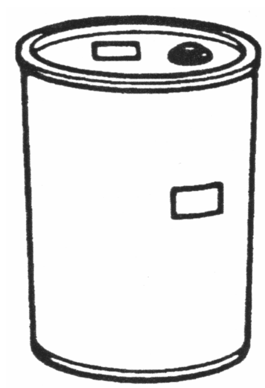
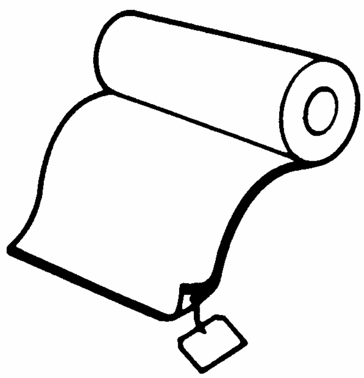
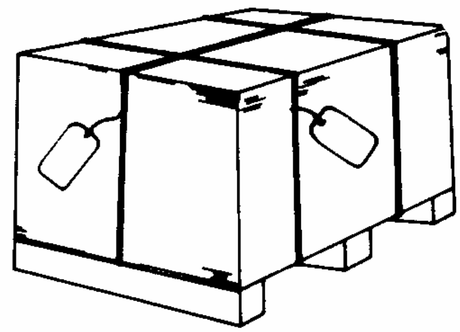
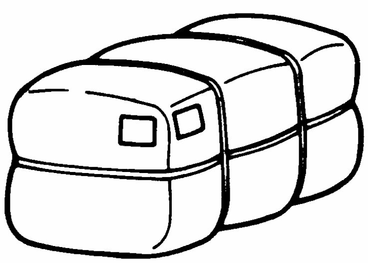
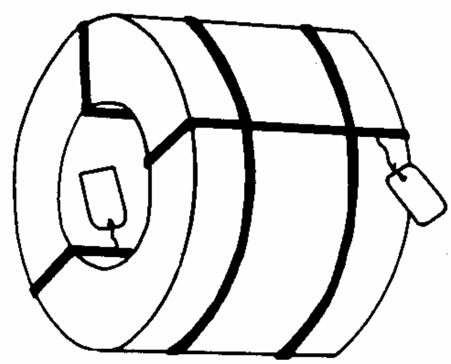
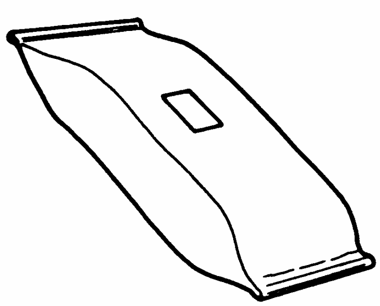
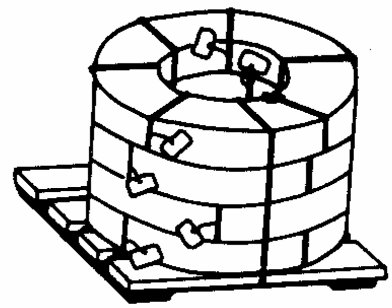
CARTONS ON PALLET 	**OPEN METAL BIN OR TUB** 
PALLET BOX 	**RACK** 
TELESCOPE OR SET-UP CONTAINERS 	**DRUM, BARREL, OR CYLINDRICAL CONTAINER** 

Figure 18b. Suggested Label Placement (continued)

ROLL 	SHEETS/CUT LENGTHS/BLANKS 
BALE 	SINGLE COIL 
BAG 	SLIT COILS 

TUBING AND BARS

10.0 WHEN TO USE A 2D SYMBOLOGY

The primary advantage of 2D symbols is increased information density - the number of characters that can be encoded in a given amount of label area. Smaller machine-readable symbols could result in label size reduction, therefore, a cost savings.

In environments where symbol damage is likely, the error correction capability of 2D symbols may increase read-rates. These symbols may be used as additions to, or replacements for, linear bar codes currently used on a label. Generally, any time a large amount of machine readable information is required on the label and/or label space is limited, 2D symbols are a potential solution. Table 4 gives examples of circumstances in which 2D symbols could be used.

Table 4. When To Use 2D Symbologies

Situation	**Solution**
Goods in a distribution environment may be sorted by several data elements without the aid of an on-line database.	All data fields can be encoded in a single symbol.
Additional logistics services are required of the carrier, but shipment information may not be transmitted until after the carrier's first process point.	Print the information on the shipment in a 2D symbol.
Available label space is insufficient to encode all necessary data elements in linear bar code symbols.	Encode the data from several linear symbols in a single 2D symbol.
Freight/packages sometimes arrive <u>before</u> the EDI transaction from the supplier.	To supplement the EDI transaction, information about the shipment could be encoded in a 2D symbol on the label.
Receiving materials/parts is time-consuming and error-prone because of manual inventory entry or the need to scan each individual item.	The contents of an entire shipment may be contained in a 2D symbol(s) to permit rapid and accurate entry to the inventory database.
The cost of labeling is increasing due to the number of bar	2D codes can contain all the information of the

Situation	Solution
code symbols required to communicate the desired information in the label space available.	conventional bar codes in a fraction of the label space.
Bar code read reliability on cartons, pallets, and containers is reduced because of harsh environments, causing the symbols to be unreadable, requiring considerable and labor- intensive manual reconciliation.	2D symbology offers sophisticated error correction capabilities which provide a higher probability of a successful read, even with considerable symbol damage.
Taking inventory requires the scanning of multiple linear bar codes for each container/pallet. This reduces productivity and increases the duration of the inventory process.	A single 2D symbol used to identify the container and its contents can be scanned during inventory, providing all the required information.
In certain segments of the materials pipeline, there may be no connection to a computer database and no access point to all of the information needed to efficiently receive, inspect, sort, and distribute these materials.	The 2D symbol on the B-10 can contain all information required to identify, receive, inspect, and stock or distribute materials.
Because paperwork may travel independently of the shipment, delays and administrative costs are sometimes involved in getting materials, parts, and/or product through customs.	In a 2D symbol on the B-10, the customs information could travel with the shipment in machine-readable form.

11.0 WHICH SYMBOLOGY TO USE

This section provides guidance for choosing which symbology is appropriate for your application. It is especially important to note that 2D symbologies generally require special equipment for reading and printing. It is advisable to check with your trading partner(s) before implementing a program that requires the use of 2D symbols.

Unless otherwise noted, data for these applications may be represented in any of the formats described in Section 12.3 Data Formats. Data formats are independent of applications, although some applications may require specific formats. Data formats may be combined to represent application data, with the exceptions of those noted in Section 12.3 Data Formats.

11.1 Shipping and Receiving

The Shipping and Receiving application requires information that facilitates staging, transportation, and receipt of goods and materials. This information may include transportation, product, transactional and quality data, as well as structured text and mutually defined formats. For this application the 2D symbol(s) will be placed on a label as outlined in this guideline.

11.1.1 Symbology Recommendation

When a two-dimensional symbol is used for the Shipping and Receiving application, 2D symbology **PDF417 SHALL** be used.

11.1.2 Symbol Titles

Each 2D symbol **SHOULD** use a title to describe the intended user of the data. The printer of the label **SHOULD** select one or a combination of the following titles to best describe the intended user(s). When combined, the titles **SHOULD** be separated by a slash "/" character.

Table 5. Symbol Titles

Symbol Title	Intended User(s)
CARR	Carrier
SPLR	Supplier
CUST	Customer

11.1.3 Data Format Usage

Only Data Format "06" is recommended for use under this guideline.

11.2 Carrier Sortation and Tracking

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

The symbol includes the information that is required to route unit loads and transport containers between multiple points, locate unit loads and transport containers, and provide other supporting data that is relevant to the Sortation and/or Tracking process for internal or external processing.

11.2.1 Symbology Recommendation

When a 2D symbol is used for the Carrier Sortation and Tracking application, the **MaxiCode** symbology **SHALL** be used.

11.2.2 Special Considerations

This Guideline recommends the use of a single MaxiCode symbol for Carrier Sortation and Tracking data. A second MaxiCode symbol can be added if more information is required. Both MaxiCode symbols **SHALL** be encoded in the same mode (See subsection 13.2.3 Symbol Encoding.)

When a carrier is using MaxiCode for automated sortation, the Data Format "01" **SHALL** appear in the MaxiCode symbol.

11.2.3 Data Format Usage

Only Data Format "06" is recommended for use under this guideline.

12.0 MESSAGE FORMAT

This section defines how data **SHALL** be formatted within a 2D symbol or set of concatenated 2D symbols. The data within a 2D symbol or set of concatenated symbols **SHALL** be called a *data stream.*

To allow multiple data formats to be contained within a data stream, a two-level structure of enveloping is used. The outermost layer of the message is called a Message Envelope and defines the beginning and end of the message. Within the Message Envelope are one or more Format Envelopes that contain data (see Figure 19). Reference ISO 15434 for details beyond those listed in this guideline.

Only ANSI MH10.8.3, Format "06" is recommended for use in this guideline.

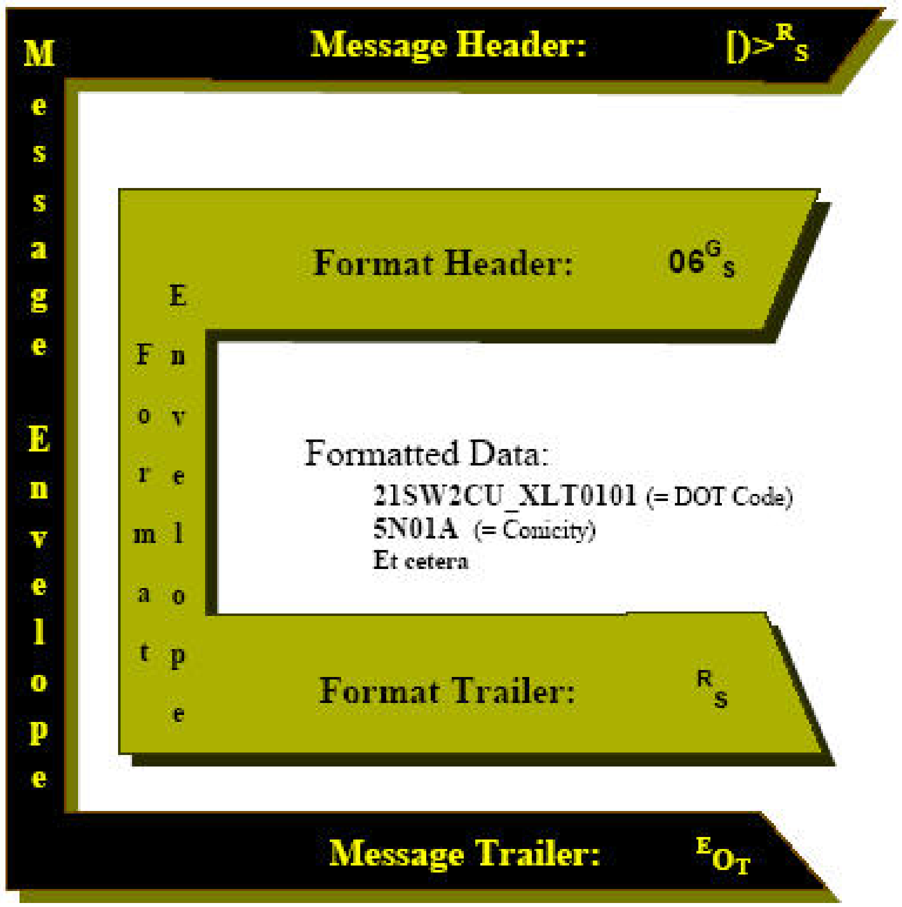
The message envelope **SHALL** consist of the following, in order:

- A Message Header
- A Message Trailer (when required)

Each format envelope within the message envelope **SHALL** consist of the following, in order:

- A Format Header
- A Format Trailer (when required)

Figure 19. Pictorial Illustration of Enveloping Structure



Complete message: $[)>{}^{R}{}_{S}06{}^{G}{}_{S}21SW2CU\_XLT0101{}^{G}{}_{S}5N01A{}^{R}{}_{S}{}^{E}O_{T}$

12.1 Message Envelope

The Message Envelope defines the start and end of the data contained within the data stream and provides the following functions:

- Indicates that the message contained within this symbol is formatted in compliance with the rules of this guideline
- Indicates the character which has been defined to separate Formats within this Message
- Provides a unique character to indicate the end of the Message

The structure within a data stream is as follows:

- A **Message**, containing one or more Formats

- A **Format**, containing one or more Segments

- A **Segment**, containing one or more Data Elements

- A **Data Element** (field), potentially containing one or more Sub-elements (Subfields).

12.1.1 Message Header

The Message Header consists of two parts, as illustrated in Figure 19:

- The three-character **Compliance Indicator “[ ) >”**

    - **NOTE:** Without any spaces between characters; spaces are added to this example for visual clarity only.

- The **Format Trailer Character “$^{R}{}_{S}$”**

The complete Message Header is: **[)>**

- **NOTE:** This example is shown correctly spaced

12.1.1.1 Compliance Indicator

The Compliance Indicator **SHALL** be the first three characters in the Message Header. The Compliance Indicator **SHALL** be **[)>** (left hard bracket, right parenthesis, greater than). See Appendix G for a table of ASCII decimal and hexadecimal values.

12.1.1.2 Format Trailer Character

The Format Trailer Character **SHALL** be the fourth character in the Message Header. The Format Trailer Character **SHALL** be the non-printable ASCII character represented as “$^{R}{}_{S}$” (see Appendix G). The Format Trailer Character is used throughout the message to indicate the end of a Format Envelope. See Figure 19.

12.1.1.3 Message Trailer

The Message Trailer identifies the end of the message within the data stream. The Message Trailer **SHALL** be the nonprintable ASCII End Of Transaction character, "$^{E}O_{T}$" (see Appendix G). The Message Trailer character **SHALL NOT** be used elsewhere in the message. See Figure 19.

12.2 Format Envelope

The Format Envelope defines the start and end of data in a given Format and provides the following functions:

- Identifies the data Format used within the envelope
- Defines the character(s) used to separate the Segments, Data Elements (Fields), and Sub-elements (Sub-fields) within this data Format
- Indicates any applicable date, release, or control information

12.2.1 Format Header

A Format Header **SHALL** consist of two parts:

- A **Format Indicator** (a two-digit numeric identifier which identifies the rules governing the Format).
- **Variable data** (if any) that defines the separators used, version, release, date, or control information of the applicable standards.

12.2.2 Separators and Terminators

The Separator and Terminator are an integral part of the data stream. The Separator and Terminator characters **SHALL NOT** be used in non-binary data elsewhere in the message.

12.2.2.1 Data Element Separator

Data elements in Format “06” **SHALL** be separated by the non-printable Data Element Separator character "$^{G}_{S}$". Refer to Appendix G.

12.2.3 Format Header "06" - Data Using Data Identifiers

The Format Header for data using Data Identifiers **SHALL** be represented as:

06$^{G}_{S}$

where:

$^{G}_{S}$ is the Data Element Separator to be used between Data Fields.

12.2.4 Format Trailer

The Format Trailer identifies the end of a Format Envelope. The Format Trailer **SHALL** consist of the non-printable ASCII Format Trailer Character, “$^{R}_{S}$” (refer to Appendix G). The Format Trailer Character **SHALL NOT** be used in non-binary data elsewhere in the message.

12.3 Data Format

12.3.1 Format "06" - Using Data Identifiers

Each Data Element in the format **SHALL** be preceded by the appropriate Data Identifier (DI) code and followed by the Data Element Separator character $^{G}{}_{S}$. When the Data Element is the last field in the Data Format, the Data Element Separator is not used and the Data Element is immediately followed by the Format Trailer character $^{R}{}_{S}$.

12.3.1.1 Multiple Instances of DIs in Format “06”

Within any single Format “06” envelope, DIs **SHALL NOT** be duplicated. Where, within a message, multiple instances of a DI are required, each instance **SHALL** be encoded in a separate “06” Format envelope. Examples are shown in Appendix J of this document.

12.3.1.2 Ordering of Format “06” Data Elements

Within any “06” format, Data Elements with their associated DI’s **SHOULD** be ordered according to Appendix D.

Table 6. Message Data for Format 06 Examples

Data and formatting characters for Format “06”	Comments
06 $^{G}{}_{S}$	“06” Format Header
52L48507 $^{G}{}_{S}$	‘Ship to’ Postal Code
12V123456789 $^{G}{}_{S}$	Manufacturer’s ID
3S999999999 $^{G}{}_{S}$	Package ID - Unit
$^{R}{}_{S}$	Format Trailer

The information in the 2D symbols on the label examples is encoded in Format “06”. In the examples, for the sake of simplicity, the data for Format 06 is encoded only in the PDF417 symbol. In actual use, either symbol could contain both formats as well as additional information.

In addition to the message data, the above formats will be bounded by the Message Header **[)>**$^{R}{}_{S}$ and Message Trailer $^{E}O_{T}$ respectively when encoded into the symbols.

13.0 2D SYMBOLOGY SPECIFICATIONS

This section will provide guidance on which 2D symbologies to use for Shipping and Receiving, and Sortation and Tracking.

13.1 Shipping and Receiving

13.1.1 Symbology Requirement

This Guideline specifies the use of **PDF417** symbology for the Shipping and Receiving application.

Truncated PDF417 and Macro PDF417 (defined in the *AIM®^{USA} Uniform Symbology Specification PDF417)* **SHALL NOT** be used for the Shipping and Receiving application.

13.1.2 "X" Dimension

The narrow element dimension (X dimension) range **SHOULD** be from 0.010 to 0.017 inch (0.254 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 may require special care to meet the print quality requirements of subsection 13.1.7 Print Quality. Conformance to the print quality requirements **SHALL** be determined according to subsection 13.1.7.

13.1.3 Bar Height

The PDF417 symbol **SHALL** have a minimum bar height (height of the symbol element) of three (3) times the width of the narrow element (X dimension).

13.1.4 Symbol Size

PDF417 symbols **SHALL** fit within the building block structure outlined in Section 5. A symbol **SHALL NOT** exceed a double-height block. A single-height block is 1.0 inch ± 0.2 inch (25.4 mm ± 5 mm high), and a double-height block is 2.0 inches ± 0.4 inch (50.8 mm ± 5 mm) high.

Tables H1 through H7 in Appendix H are provided as guidance when incorporating PDF417 symbols into the design of a shipping label. The actual achieved size of a PDF417 symbol may vary based on data content and printing process. The symbol sizes listed should accommodate most situations.

A PDF417 symbol **SHOULD** be printed with no more than 12 data columns in width. This will ensure readability by the broadest range of reading devices. Up to 18 data columns may be used but only with the agreement of trading partners.

Table 7 below 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, refer to Appendix H.

Table 7. Symbol Width Of A PDF417 Symbol Using 12 Data Columns

X Dimension	PDF417 Symbol Width
0.010 inch (0.25 mm)	2.81 inch (71.37 mm)
0.013 inch (0.33 mm)	3.63 inch (92.20 mm)
0.015 inch (0.38 mm)	4.18 inch (106.17 mm)
0.017 inch (0.43 mm)	4.72 inch (119.89 mm)

13.1.5 Quiet Zone

This guideline recommends that the PDF417 symbol have a quiet zone of 0.04 inch (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.

13.1.6 Error Correction Level

Error correction levels of 3, 4 or 5 **SHALL** be used.

13.1.7 Print Quality

The *AIM® USA Uniform Symbology Specification PDF417* and *ANSI X3.182 Bar Code Print Quality Guideline* **SHALL** be used to determine the print quality of the PDF417 symbol. The minimum symbol grade **SHOULD** be 1.5/10/660, where:

- Minimum Print Quality grade = **1.5** (C) at the final point of receipt of the symbol
  - Recommended Print Quality grade ≥ **2.5** (B) at the point of printing the symbol
- Measurement Aperture = **0.010** inch (0.254 mm)
- Light Source Wavelength = **660** nanometers (nm) ± 10nm

13.1.8 Orientation and Placement

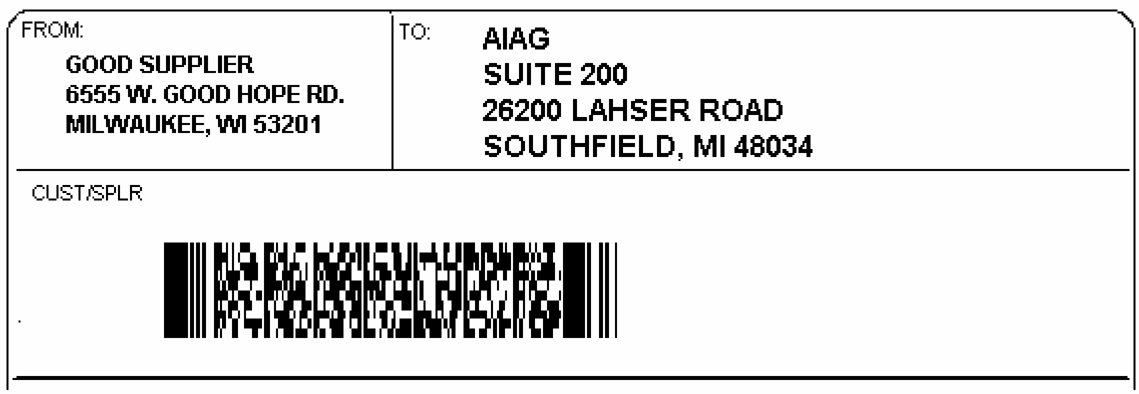
13.1.8.1 Orientation

The bars of the PDF417 symbol SHALL be perpendicular to the natural bottom of the label. See Figure 20.

13.1.8.2 Label Placement

Labels SHALL be placed on packages as specified in this guideline.

Figure 20. Orientation Of PDF417 Symbol On Label



Note: Illustration is not to exact size or scale.

13.2 Carrier Sortation and Tracking

13.2.1 Symbology Requirement

When a two-dimensional symbol is used for the Carrier Sortation and Tracking application, MaxiCode symbology **SHALL** be used.

13.2.2 "X" Dimension

MaxiCode is not a scaleable symbol (does not support different X dimensions). The MaxiCode symbol **SHALL** have an X dimension (the width of a symbol module) and all other dimensions consistent with the *AIM®^{USA} Uniform Symbology Specification MaxiCode,* measured at .035 inch (0.89 mm) yielding a symbol approximately 1 inch square.

13.2.3 Symbol Encoding

Code Set - When encoding information in a MaxiCode symbol, it is recommended that character selection be limited to Code Set A where possible. (Refer to *AIM®^{USA} Uniform Symbology Specification MaxiCode*.)

Mode - A MaxiCode symbol incorporates one Mode per symbol. This Guideline recommends the use of MaxiCode Mode 2 or Mode 3 to ensure that the sortation system can decode the 'Ship To' Postal Code, 'Ship To' Country Code, and Class of Service in the event of symbol damage. (Refer to *AIM®^{USA} Uniform Symbology Specification MaxiCode*).

The determination of which mode to use is established by the data characteristics of the 'Ship To' Postal Code and Class of Service. Table 8 below determines the appropriate Mode.

Table 8. Mode Determination for MaxiCode

If The Ship To Postal Code Is:	And The Class Of Service Is:	Then Use:
numeric only < 10 digits	numeric only	Mode 2
alphanumeric < 7 characters	numeric only	Mode 3
other than above	numeric only	Mode 4
any of the above	alphanumeric	Mode 4

13.2.4 Print Quality for MaxiCodes on Labels

The AIM International Technical Specification **—** *International Symbology Specification* **—** *MaxiCode* **SHALL** be used to determine print quality of a MaxiCode symbol on a label. The minimum allowable grade **SHALL** be "**C**".

In order to accurately measure the quality of a printed MaxiCode symbol, the following guidelines **SHOULD** be followed:

- Illumination of MaxiCodes on labels shall be uniform, that is, of equal intensity over the entire symbol.
- The wavelength of the light chosen should be consistent with the readers used for the intended application.
- Calibration of the verifier must be maintained by using a contrast calibration master.

Note: The grade shown above is the result of specific measurements made according to the *AIM International Symbology Specification - MaxiCode* quality definition for the following: 1) symbol decode, 2) symbol contrast, 3) symbol print growth, 4) symbol axial non-uniformity, 5) symbol local non-uniformity, and 6) symbol unused error correction.

13.2.5 Quiet Zone

For the Carrier Sortation and Tracking application, this guideline recommends that the MaxiCode symbol have a quiet zone of 0.04 inch (1 mm) above, below, to the left, and to the right of the symbol. The quiet zone is included in the calculation of the size of the symbol.

13.2.6 Orientation and Placement

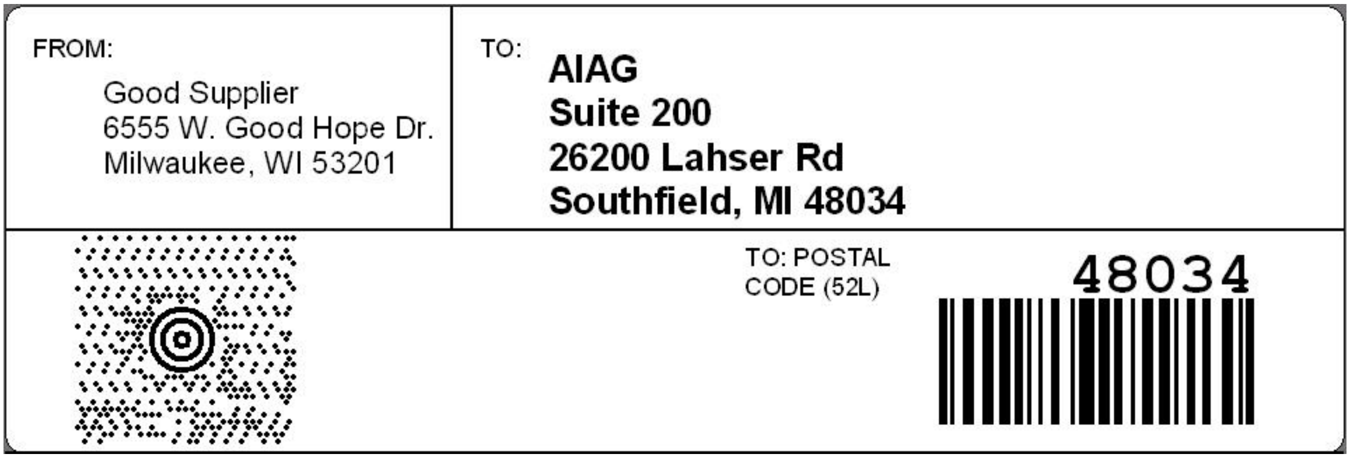
13.2.6.1 Orientation

Due to the nature of the MaxiCode symbology, specific symbol orientation is not required, as long as the requirement for the quiet zones are met.

13.2.6.2 Symbol Placement

As used in this guideline, the MaxiCode symbol **SHALL** be placed in the carrier segment. Refer to Figure 21 .

Figure 21. Placement of MaxiCode Symbol on Label



NOTE: ILLUSTRATION IS NOT TO EXACT SIZE OR SCALE.

13.2.6.3 Label Placement

Labels **SHALL** be placed on unit loads and transport containers as specified in Section 13 of this guideline.

14.0 EXAMPLES

This section provides graphic representations of label constructions referenced in this guideline.

NOTE: The illustrations in this section are <u>NOT</u> to size or scale.

Figure 22. A Carrier Segment For A Single Pack That Has A Ship-To/Ship-From And A Unique Container Identifier

Figure 23. A Customer Segment That Looks Like The Old AIAG B-3

Figure 24. Example of a Customer Segment from the old AIAG B5; Primary Metals Tag.

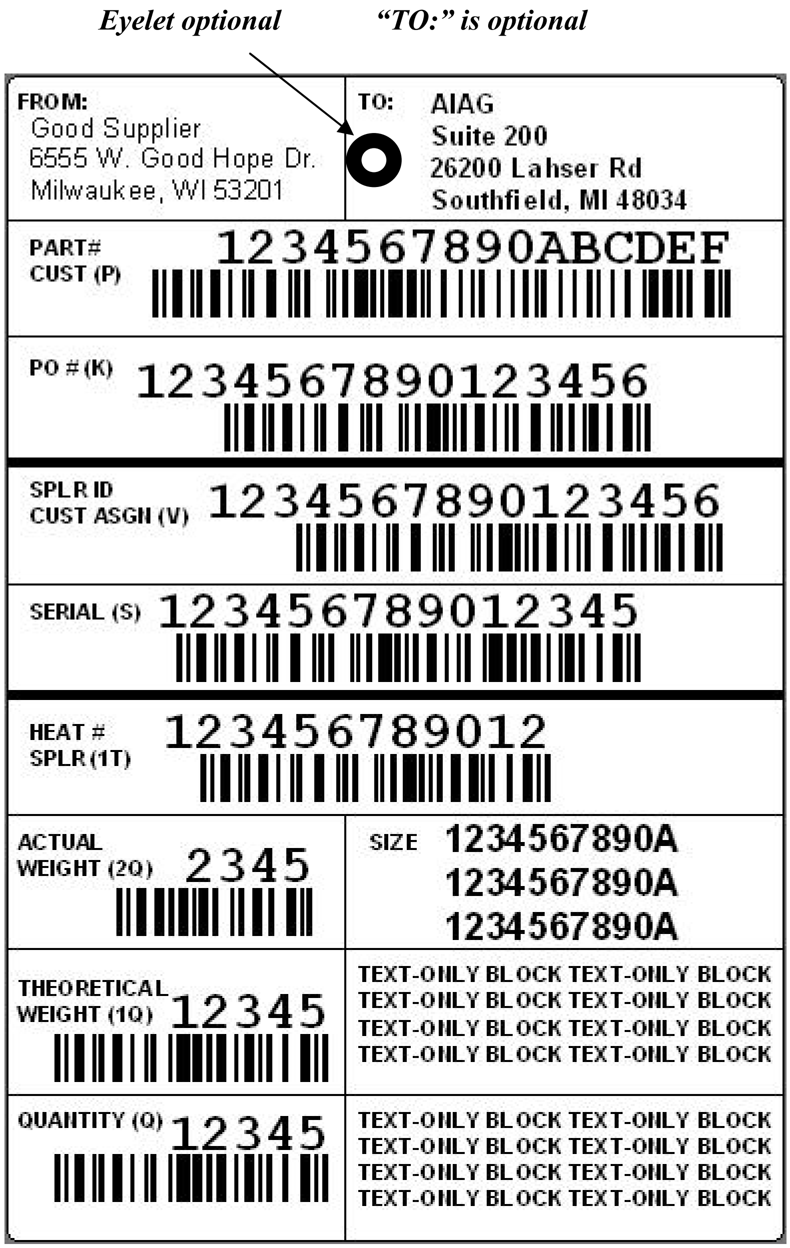


Figure 25. A Supplier Segment With The Supplier's Part Number

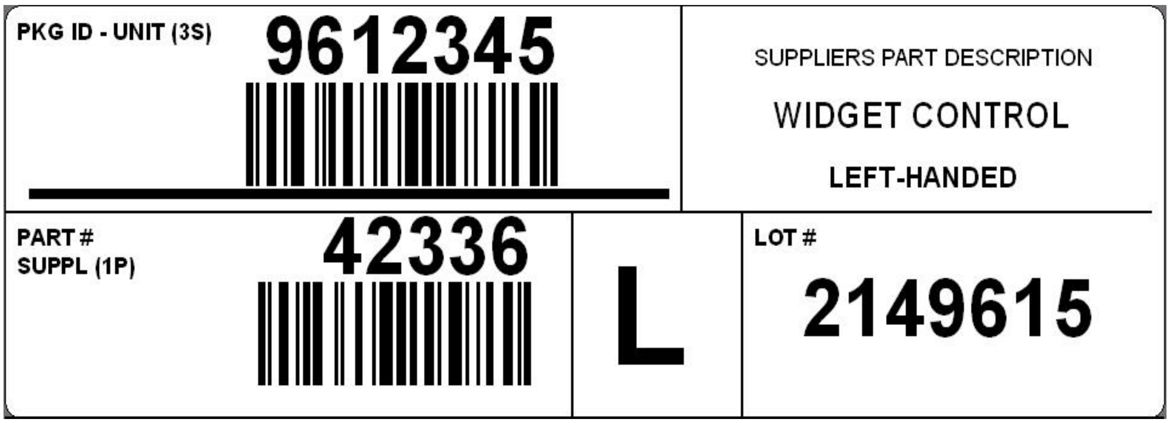


Figure 26. A Customer Segment For A Master Load

Figure 27. A Customer Segment For A Mixed Load

Figure 28. A Supplier Segment For A Master Load

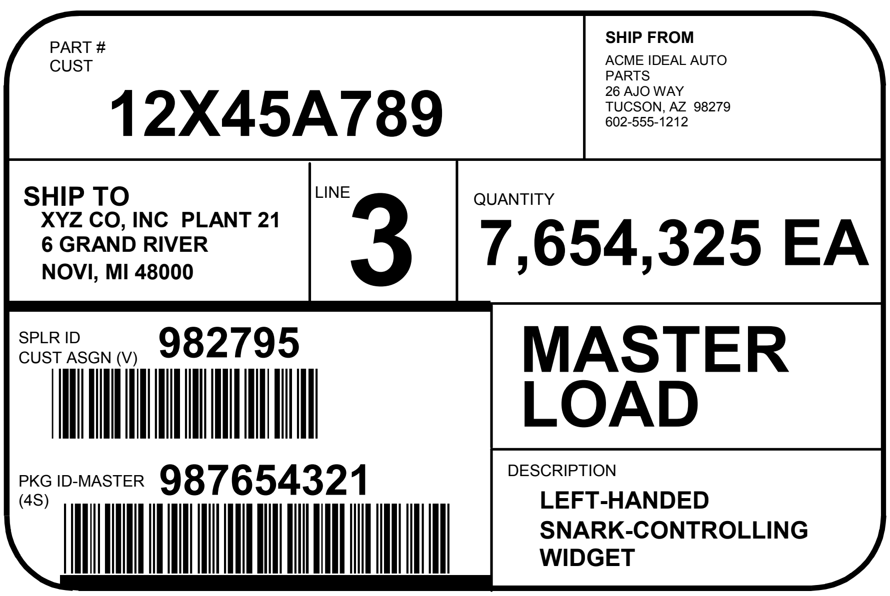


Figure 29. A Supplier Segment For A Mixed Load

Not To Scale

Figure 30. A Shipment Label Example

Figure 31. Trading Partner Label With Only Linear Bar Code Symbols (Code 128)

Figure 32. Trading Partner Label With MaxiCode Sub-Block

Figure 33. Trading Partner Label With MaxiCode And PDF417 Symbols

FROM:
Good Supplier
6555 W. Good Hope Dr.
Milwaukee, WI 53201

TO:
AIAG
Suite 200
26200 Lahser Rd
Southfield, MI 48034

TO: POSTAL
CODE (52L)
48034

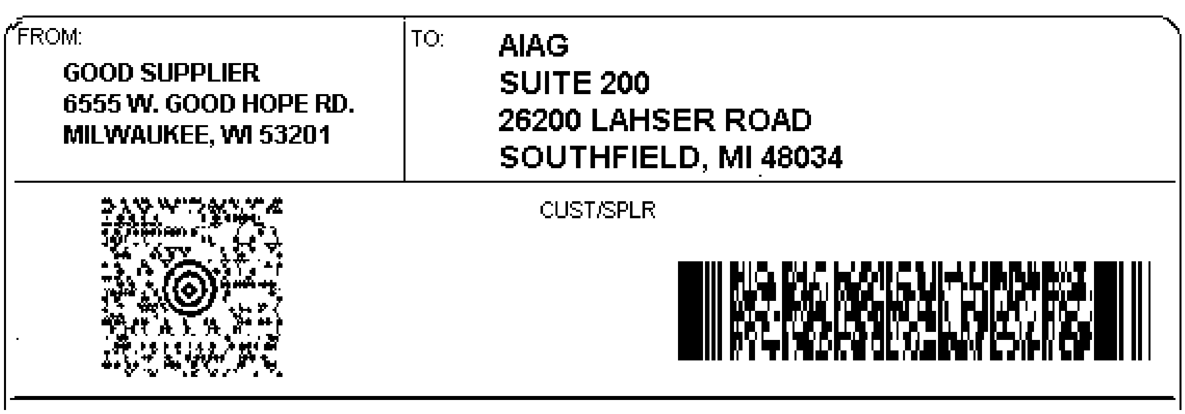
CUST/SPLR

MFG. ID
DUNS (12V)
123456789

PKG. ID - UNIT
(3S)
999999999

Figure 34. Trading Partner Label With Code 128 and PDF417 Symbol

Figure 35. Trading Partner Label with both MaxiCode and PDF417 Symbols



APPENDIX A. BAR CODE BLOCKS: ANSI MH10.8.2 DATA IDENTIFIERS, DATA LENGTHS, AND SHORT TITLES

ANSI FACT-1, was published by the American National Standards Institute (ANSI) in December 1991. It has since been revised as ANSI MH10.8.2. AIAG endorses the use of these Data Identifiers.

ANSI MH10.8.2 has more than 100 data identifiers defined for many purposes in many industries. The ANSI standard can be purchased by contacting the American National Standards Institute (ANSI) and requesting *ANSI MH10.8.2*.

The following table includes some of the DIs in ANSI MH10.8.2 of interest to AIAG members. The Short Title text **SHOULD** be used in the bar code building block, as specified in Section 9.11.

In many cases the Short Title text has been split into two lines to ensure the best fit in the title area of the building block.

Table A1. ANSI Data Identifiers

DI	Suggested Short Title	Recommended Maximum Data Length	Description
B	CONTAINER TYPE (B)		Container Type
1B	RETURNABLE CONTAINER # (1B)		Returnable Container ID number
2B	GAS CYLINDER # (2B)		Gas Cylinder ID number
3B			Motor Freight Transport Equipment Identification assigned by the manufacturer in conformance with International Standards Organization (ISO) standards
4B	SCACTIL (4B)	10	Standard Carrier Alpha Code Trailer Identification Label
C	PART # CONT. (C)		Continuation of a customer's Part Number
D	DATE YYMMDD (D)		Date, in the format YYMMDD, significance of the date mutually agreed among all trading partners

DI	SUGGESTED SHORT TITLE	RECOMMENDED MAXIMUM DATA LENGTH	DESCRIPTION
1D	DATE DDMMYY (1D)		Date, in the format DDMMYY, significance of the date mutually agreed among all trading partners
2D	DATE MMDDYY (2D)		Date, in the format MMDDYY, significance of the date mutually agreed among all trading partners
3D	DATE YDDD (3D)		Date, in the format YDDD (Julian), significance of the date mutually agreed among all trading partners
4D	DATE YYDDD (4D)		Date, in the format YYDDD (Julian), significance of the date mutually agreed among all trading partners
5D	DATE YYMMDDQQ (5D))		Date, in the ISO format YYMMDD immediately followed by an ANSI X12.3 Data Element Number 374 Qualifier (QQ) providing a code for type of date (e.g., ship date, manufacture date)
6D	DATE YYYYMMDDQQ (6D))		Date, in the ISO format YYYYMMDD immediately followed by an ANSI X12.3 Data Element Number 374 Qualifier (QQ) providing a code for type of date (e.g., ship date, manufacture date)
7D	DATE MMYY (7D))		Date, in the format MMYY, significance of the date mutually agreed among all trading partners
10D	DATE YYWW (10D))		Date, in the format YYWW where WW represents week of the year, as agreed between customer and supplier
11D	DATE YYYYWW (11D))		Date, in the format YYYYWW where WW represents week of the year, as agreed between customer and supplier
12D	DATE YYYYMMDD (12D))		Date, in the format YYYYMMDD, significance of the date mutually agreed among all trading partners
1H	EMPLOYEE ID (1H)		Employee ID as assigned by the employer
2H	SSN (2H)		U.S. Social Security Number

DI	SUGGESTED SHORT TITLE	RECOMMENDED MAXIMUM DATA LENGTH	DESCRIPTION
3H	NON-EMPLOYEE ID (3H)		ID number for non-employee (e.g., a contract worker or vendor)
I	VIN		VIN - Vehicle Identification Number
1J	ISO PKG ID (1J)	18	Unique license plate number assigned to a transport unit that is the lowest level of packaging, or the unbreakable unit, as defined in ISO/IEC 15459
2J	ISO MASTER ID (2J)	18	Unique license plate number assigned to a transport unit that contains multiple packages, as defined in ISO/IEC 15459.1
K	P.O. # (K)		Purchase Order Number, customer assigned
2K			Bill of Lading/Waybill/Shipment Identification Code assigned by supplier/shipper
3K			Bill of Lading/Waybill/Shipment Identification Code assigned by the carrier
4K			Line number of the order assigned by the customer to identify a Purchasing Transaction
5K			Reference number assigned by the customer to identify a Shipment Authorization (Release) against an established Purchase Order
6K			PRO# assigned by the carrier
7K			Carrier Mode in Free Text format mutually defined between the customer and supplier (e.g., Air, Truck, Boat, Rail)
8K			Contract Number
9K			Generic Transaction Reference Code (internally assigned or mutually defined)
11K			Packing List Number
12K			SCAC (Standard Carrier Alpha Code) (Alpha Numeric, always four characters, dash "-" filled left) and carrier-assigned progressive number
14K			Combined Order Number and Line Number in the format nn...nn+nn...n where a plus symbol (+) is used as a delimiter between the Order Number and Line Number

DI	SUGGESTED SHORT TITLE	RECOMMENDED MAXIMUM DATA LENGTH	DESCRIPTION
15K	PULL SIGNAL # (15K)		Pull Signal – Kanban ID
16K	DELINS # (16K)		DELINS Number: code assigned to identify a document that contains delivery information
L	STORAGE LOCATION (L)		Storage Location
1L	LOCATION (1L)		Location (generic)
4L	COUNTRY OF ORIGIN (4L)		Country of Origin: two-character code from the ISO 3166 standard country code list
20L - 24L			Additional location numbers. The exact meaning of each DI is assigned internally. {This set of DIs could be used for a hierarchy of locations, for example: BUILDING (20L); BAY (21L); AISLE (22L); SHELF (23L); BIN (24L)}
P	PART # CUST (P)		Part Number, assigned by the customer
1P	PART # SPLR (1P)		Part Number, assigned by the supplier/manufacturer
2P	EC # (2P)		Code assigned to specify the revision level of the part (e.g., Engineering Change Level, revision, or edition)
9P			Combined manufacturer identification code (9-digit DUNS® number assigned by Dun & Bradstreet) and the item code/part number (assigned by the manufacturer)
10P			Hazardous Material Code as defined by ANSI X12.3 in the format Data Element 208 (1-character code qualifier) followed by Data Element 209 (Hazardous Material Code)
Q	QUANTITY (Q)		Quantity (integer numeric) (Unit of measure assumed to be "each" unless otherwise agreed between the supplier and the customer)
1Q	LENGTH (1Q) or THEORETICAL WEIGHT (1Q)		Actual Length or Theoretical Weight (historically used in the shipment of primary metals)

DI	SUGGESTED SHORT TITLE	RECOMMENDED MAXIMUM DATA LENGTH	DESCRIPTION
2Q	ACTUAL WEIGHT (2Q)		Actual Weight
3Q	UNIT OF MEASURE (3Q)		Unit of Measure, as defined by the two character ANSI X12.3 Data Element Number 355 Unit of Measurement Code
7Q	QTY + U/M (7Q)		Quantity and unit of measure in the format: Quantity followed by the two-character Unit of Measure code as defined in Data Element number 355 of the ANS X12.3 Data Element Dictionary standard
11Q	TARE WT. (11Q)		Tare Weight: weight of an empty container, unit of measure mutually agreed among trading partners
S	SERIAL # (S)		Serial Number assigned by the supplier to an entity for its lifetime
2S	SHIPMENT ID (2S)		Shipment ID number. If you are using EDI, this corresponds to the SID (Data Element 396 of ANS X12.3, as used in the 856 Shipment Notification transaction).
3S	PKG ID-UNIT (3S)	9	Package Identification assigned by the supplier to the lowest level of packaging (container) that has a package ID code.
4S	PKG ID-MASTER (4S)	9	Package Identification assigned by the supplier to packaging containing multiple containers of like items on a single customer order (Master Load)
5S	PKG ID-MIXED (5S)	9	Package Identification assigned by the supplier to packaging containing multiple containers of unlike items on a single customer order (Mixed Load)
9S	PKG ID MUTUAL (9S)		Generic Package Identification, significance mutually agreed by customer and supplier
10S	MACHINE ID (10S)		Machine, work cell, or tool ID code
11S	FIXED ASSET ID (11S)		Fixed asset ID code

DI	SUGGESTED SHORT TITLE	RECOMMENDED MAXIMUM DATA LENGTH	DESCRIPTION
21S	TIRE ID (21S)	12	Combined U.S. DOT Tire Manufacturer Plant Code and unique tire identification assigned by the supplier
T	LOT # CUST (T)	18	Traceability number assigned to a unique batch or group of items (lot, heat, batch) by the customer
1T	LOT # SPLR (1T) or HEAT # SPLR (1T)	18	Traceability number assigned to a unique batch or group of items (lot, heat, batch) by the supplier/manufacturer
V	VENDOR ID CUST ASGN (V)		Supplier Code assigned by the customer
12V	MFR ID DUNS (12V)		DUNS® number of the manufacturer
13V	SPLR ID DUNS (13V)		DUNS® number of the supplier, if other than the Manufacturer
14V	CUST ID DUNS (14V)		DUNS® number of the customer
W	WORK ORDER # (W)		Work Order number assigned by the supplier
Z			Mutually defined between customer and supplier (title to reflect mutually agreed meaning)
1Z			Mutually defined between the carrier and the supplier (title to reflect mutually agreed meaning)
2Z			Mutually defined between the customer and the carrier (title to reflect mutually agreed meaning)
4Z			Mutually defined between the carrier and the trading partner (title to reflect mutually agreed meaning)

APPENDIX B. PRECISION AND ROUNDING IN MEASUREMENT

PRECISION & ROUNDING RULE	INTERPRETATION
When determining if a measurement falls within the specifications of this AIAG document, the measurement **SHALL** be used only at the level of precision stated in the document.	**PRECISION** is the degree of exactness with which a quantity is stated. That is, it is the number of significant digits (usually decimal places). **ROUNDING** is the process used to <u>reduce</u> the precision with which a number is stated (that is, decrease the number of decimal places). Rounding is done in order to compare two numbers at the same level of precision.
Any measurement made with greater precision (that is, more decimal places) than that used in the document **SHALL** be rounded.	For example, if the specification for the size of an item is stated with one decimal place, any measurement of that item should be rounded to a single decimal place.

PRECISION & ROUNDING RULE	INTERPRETATION
The rule used for rounding **SHALL** be: add 5 to the digit to the immediate RIGHT of the level of precision required, then drop (truncate) the extra digits -- those beyond the required level of precision.	As an example: Assume that document states that a dimension is 0.6 inches. Then the required precision is one decimal place. If the measurement device used shows it to be 0.6465 inches, is that measurement "in spec"? Since one (1) digit of decimal precision is stated in the AIAG document, the measurement **SHALL** be rounded to a single decimal place before comparing it to the standard, as follows: 1. Add 0.05 (2 digits) to the measurement: (0.6465 + 0.05 = 0.6965) 2. Drop the digits past (to the right of) the decimal required: 0.6965 yields 0.6, which **IS** within specifications. Note that the measurement (0.6465) would be "out of spec" if the standard specification had stated 0.64, since rounding to two decimal places would have given 0.65 (0.6465 + 0.005 = 0.6515 >> 0.65).

As another example, assume the instrument used can measure to a certain number of decimal places of precision:

Table B1. Rounding and Acceptable Measurements

THIS DOCUMENT STATES	ROUNDING FACTOR	ACCEPTABLE MEASUREMENTS ON A....		
		2-DIGIT READING	3-DIGIT READING	4-DIGIT READING
1	0.5	0.50 to 1.49	0.500 to 1.499	0.5000 to 1.4999
1.0	0.05	0.95 to 1.04	0.950 to 1.049	0.9500 to 1.0499
1.00	0.005	1.00 only	0.995 to 1.004	0.9950 to 1.0049
1.000	0.0005	cannot be used	1.000 only	0.9950 to 1.0040

APPENDIX C. COUNTRY CODES

The following table contains some of the country codes from the ISO 3166 standard:

Table C1. ISO Country Codes

ARGENTINA	AR	LUXEMBOURG	LU
AUSTRALIA	AU	MEXICO	MX
AUSTRIA	AT	NETHERLANDS	NL
BELGIUM	BE	PHILIPPINES	PH
BOSNIA AND HERZEGOVINA	BA	POLAND	PL
BRAZIL	BR	RUSSIAN FEDERATION	RU
CANADA	CA	SINGAPORE	SG
CHINA	CN	SLOVAKIA	SK
CZECH REPUBLIC	CZ	SLOVENIA	SI
FRANCE	FR	SOUTH AFRICA	ZA
GERMANY	DE	SPAIN	ES
HONG KONG	HK	SWEDEN	SE
INDIA	IN	TAIWAN, PROVINCE OF CHINA	TW
IRELAND	IE	UNITED KINGDOM	GB
ITALY	IT	UNITED STATES	US
JAPAN	JP	VENEZUELA	VE
KOREA, REPUBLIC OF	KR	YUGOSLAVIA	YU

APPENDIX D. RECOMMENDED ORDER OF DATA

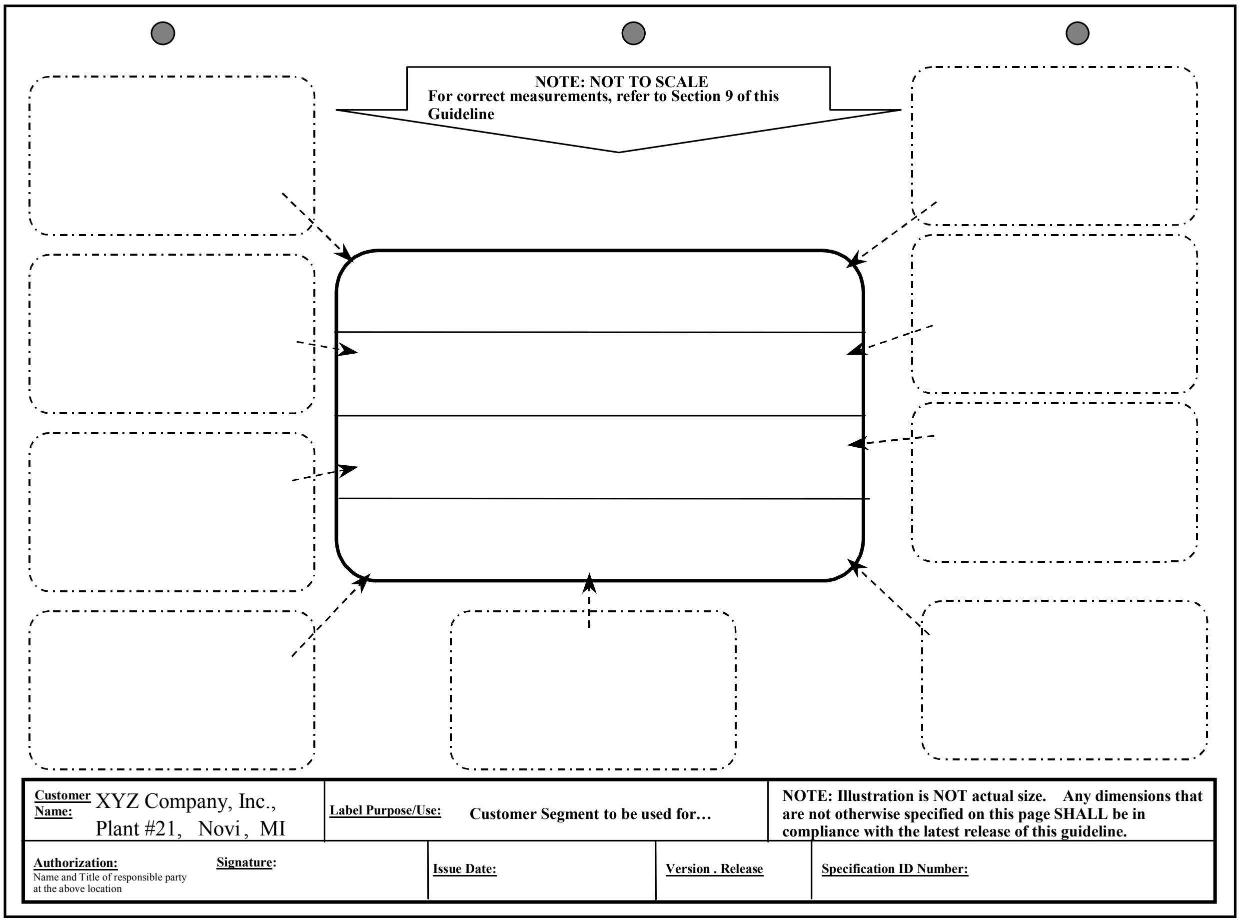
The following list is a recommended order of typical data contained within a label as outlined within this document. It is recommended that trading partners recognize that some data may be common between segments and **SHOULD**, where practical, try not to duplicate data –for example: quantity (Q) could appear in both the customer segment and the supplier segment where both use the same definition of unit of measure.

- Address – Ship-From / Ship-To / For (delivery location / line feed location)
- Sequence Number / Broadcast Code (customer-assigned)
- Purchase Order Number (customer-assigned)
- Part Number (P) / Safety Indicator / Part Description / Engineering Change Level (customer-assigned)
- Quantity (Q) (if the customer's unit of measure is <u>different</u> from the supplier's)
- Supplier's Identification (customer-assigned)
- Package ID / Label Serial Number / Unique Container Identification (supplier-assigned)
- Part Number (1P) / Description (supplier-assigned)
- Quantity with ANSI Unit of Measure (7Q) (supplier-assigned)
- Actual Quantity (2Q) (supplier-assigned)
- Theoretical Quantity (1Q) (supplier-assigned)
- Quantity (Q) (if the customer's unit of measure is the <u>same</u> as the supplier's)
- Returnable Container ID Code
- Date of Manufacture
- Quality Checker ID
- Country of Origin
- Part Traceability Data: Lot Number / Heat Number / Individual Part Serial Number
- Work Order Number

APPENDIX E. RECOMMENDED FORMAT FOR COMPLIANCE SPECIFICATIONS

COMPLIANCE SPECIFICATION RULE	INTERPRETATION
Customer trading partners who require their suppliers to provide labels in compliance with this guideline **SHOULD** use the following format to document their label compliance specification.	The single-page documentation format described in this appendix was designed by the AIAG Bar Code Applications Work Group to provide a commonized approach to creating documentation for customer labeling standards. This format has been shown to support the documentation requirements of QS-9000 and ISO 9000.
Each type of label required by a customer **SHOULD** be documented on a single page.	The commonized approach requires that every customer provide a single page specification for each specific layout of a label that will be required by that customer. For example, if the customer requires a single-container label, a master label, and a mixed load label, the customer's compliance specification would have three pages in it, showing the requirements for those three layouts.
Supplier trading partners **SHOULD** keep a file of the customer compliance specifications for their customers.	The commonized approach to Trading Partner Label specifications requires that every supplier who must comply with a customer compliance specification create a "Label Compliance" three-ring binder. The first thing in the binder should be a copy of this standard. Following that should be a divider for each customer to whom that supplier ships. In the section for any one customer should be the information about that customer's label specification(s).

Appendix E Figure 1. An Example of a Blank Customer Compliance Specification Sheet

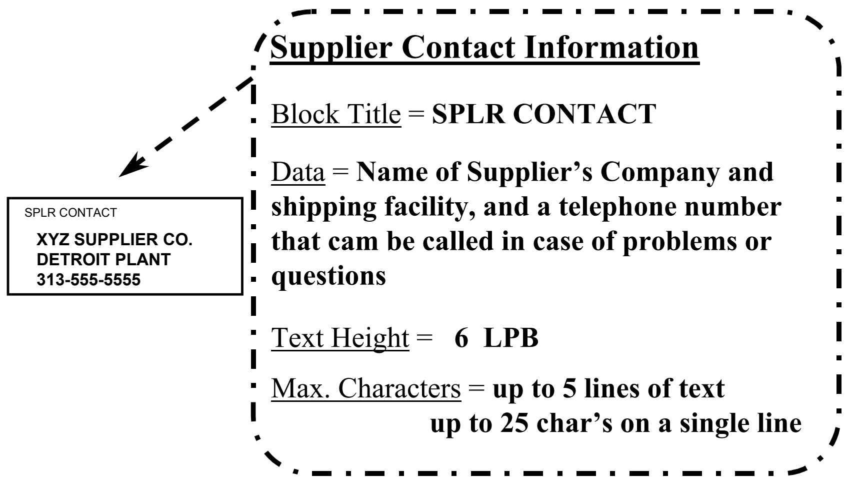


COMPLIANCE SPECIFICATION RULE	INTERPRETATION
The compliance specification sheet **SHOULD** show a sample of the label layout required by the customer.	In the center of the suggested specification page should be an example of the label, printed according to the layout designed by the customer.
A note **SHOULD** appear somewhere on the sheet that says “Not to Scale.”	The example will probably need to be scaled down to about 60% to 80% of the planned size.
A title block **SHOULD** appear on the bottom of the compliance specification sheet.	The title block provides the information needed to properly track customer compliance specifications as required by ISO 9000 and QS-9000.

COMPLIANCE SPECIFICATION RULE	INTERPRETATION
The title block **SHOULD** include: 1. The name of the customer (and, if necessary, the facility) for which this format is required; 2. Contact information of the person (or department) at the customer's location responsible for this label; 3. The date on which the specification was issued, and its revision level; 4. The situation in which this format is to be used (for example, container vs. pallet label); 5. A note that says that all the rules not specified on this page are to be found in this guideline.	
"Balloons" around the edges of the label example **SHOULD** contain descriptions of the exact data needed inside each sub-block.	
The description balloon provided for **a bar code sub-block** **SHOULD** include: 1. A name that can be used when referring to this sub-block; 2. The title to be printed in this block; 3. The data that should go in the bar code; 4. The Data Identifier to be used as the prefix of the data in the bar code; 5. The maximum number of characters allowed in this field (data length and Data Identifier length).	See the example of a bar code block balloon.

COMPLIANCE SPECIFICATION RULE	INTERPRETATION
The description balloon provided for **a text sub-block** **SHOULD** include: 1. A name that can be used when referring to this sub-block; 2. The title to be printed in this block; 3. The data that should be printed in the text; 4. The maximum number of characters allowed in this field; 5. The text height required (stated in Lines Per Block).	See the example of a text block balloon in the Example, below. If no title is to be printed for this text block, indicate "none." If the text is to be printed on multiple lines (such as an address), indicate the number of lines and the maximum number of characters per line.

Appendix E Figure 2. Example of a Description Balloon for a Text Sub-block



Appendix E Figure 3. Example of a Description Balloon for a Bar Code Sub-block

Container Label Serial Number

Block Title = **PKG ID-UNIT**
(3S)

Data = **Control number, assigned by supplier, unique for this container, not to be repeated within 365 days**

Data Identifier (DI) = **3S**

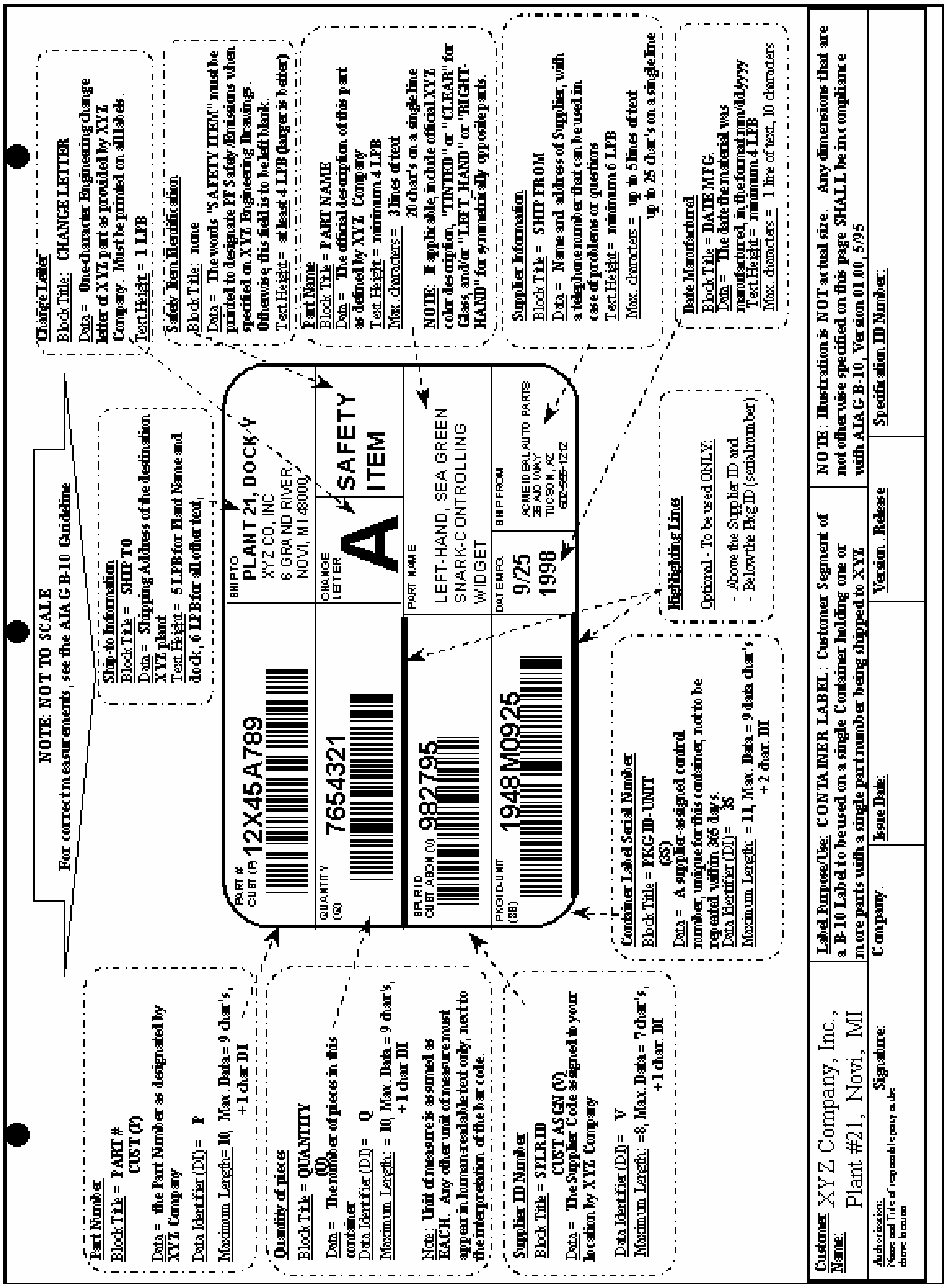
Maximum Length = **11: Max. Data Chars = 9**
DI Chars = 2

COMPLIANCE SPECIFICATION RULE	INTERPRETATION
The compliance specification sheet(s) **SHOULD** be sent to suppliers with a cover letter explaining its purpose and its relationship to the AIAG B-10 document. At a minimum the cover letter **SHOULD** state: 1. The name and phone number of a contact at the customer company who could answer questions; 2. The due date for the supplier to reply indicating their intended date of compliance; 3. The due date for submission of a sample label for evaluation;	Copies of this copyrighted document can be purchased by calling AIAG's Customer Service Representatives at (248) 358-3003.

COMPLIANCE SPECIFICATION RULE	INTERPRETATION
4. The due date for the start of labeling; 5. A requirement that this specification be kept in a file or binder along with a copy of the AIAG B-10 guideline, accessible to the people applying the labels, the people quality-checking the labels, and the people supporting the system that produces the labels; 6. Information about how the supplier can purchase a copy of this *TPL Guideline*.	

Appendix E Figure 4. Example of a Completed Customer Compliance Specification Sheet

DI Container ID Supplier/Vendor ID



APPENDIX F. RECOMMENDED FORMAT FOR SMALL LABELING AREA (SLA)

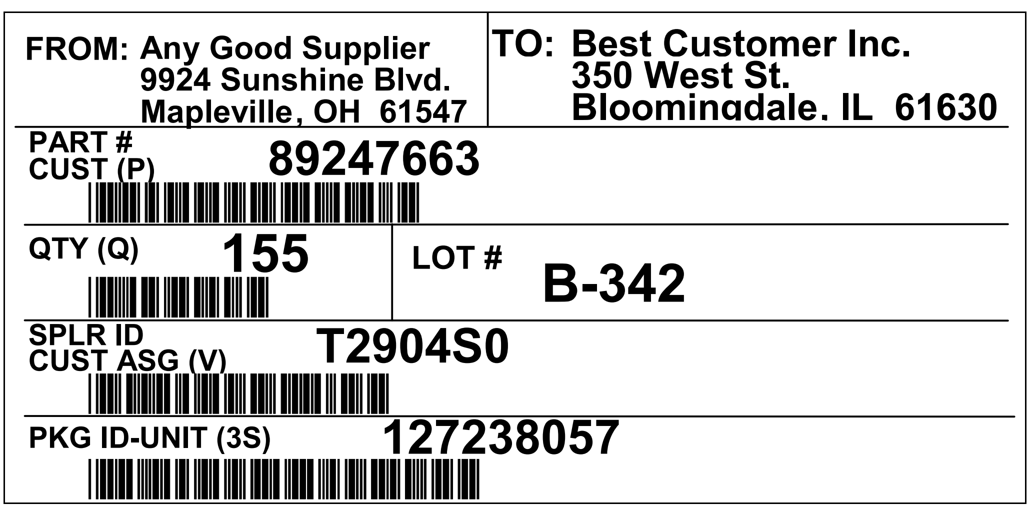
Designers of label segments are urged to plan no more than four building blocks per label segment, normally resulting in a label segment size of four inch by six inch or smaller, which generally fit in a label area of 36 square inches. This section describes a variation from the rules of ANSI MH10.8, which could be used when the area on a container available for a label is less than 36 square inches.

SLA LABEL RULE	INTERPRETATION
What is a Small Labeling Area (SLA)?	The heights and widths of bar-coded shipping labels being used today are often larger than the packaging. Packaging often requires a container larger than necessary to make the bar coded shipping label fit the container. Often, users wrap labels around the edges of containers to make labels fit. These conditions can drive up costs and can affect the scan performance of bar code symbols. This appendix does not attempt to define how small is small but to offer a method for labeling containers having labeling surfaces of thirty-six (36) square inches or less. The following describes requirements for developing a Small Labeling Area (SLA) label to ensure scan performance of the bar code symbols while providing consistency of label formats.
A Small Labeling Area (SLA) label **shall not** be used for labeling surfaces greater than thirty-six (36) square inches. Also, the SLA label **shall not** be used when an area greater than thirty-six square inches is available for labeling. Trading partners **should** agree on the use of the SLA Label.	The SLA label was developed to more closely match label size to the container and to provide a more cost-effective labeling method. Label applications for small containers such as those transported by commercial package carriers will benefit from using the SLA label. The information contained in this appendix is not intended to replace any existing commercial

SLA LABEL RULE	INTERPRETATION
	package carrier labeling used for sortation and tracking. Both label and tag marking methods are covered under the general term *label*. If you are including the carrier information in the SLA label you should check with your carrier for their bar code specifications. This appendix recommends that the SLA label be structured based on this documents' Label Concepts. Due to the SCA label's smaller physical size, the major differences between the SLA label and the "normal" labels are noted below.
Building Block Size Building block height **SHALL** be 0.5 inch +/- 0.1 inch (13 mm +/- 3 mm) as determined by the printing capability of the labeler. One double-height bar code block per segment may be used to satisfy special printing and scanning requirements of symbols used on SCLs. Double-height bar code blocks **SHALL** be 1.0 inch +/- 0.2 inch (25 mm +/- 5 mm). **Bar Code Symbol Height** The minimum height of the Code 39 bar code symbol **SHALL** be 0.25 inch (6 mm). **Bar Code Symbol Quiet Zone** The bar code symbol **SHALL** have leading and trailing quiet zones with minimum widths of 0.250 inch (6 mm).	

SLA LABEL RULE	INTERPRETATION
Symbology Narrow Element X Dimension The narrow element X dimension when using Code 39 or Code 128 **SHALL NOT** be less than 0.010 inch (0.25 mm). **Human Readable Interpretation (HRI) for Code 39 or Code 128 Symbols** The height of the HRI **SHOULD** be chosen so that it does not interfere with the minimum height of the bar code. **Print Quality for Code 39** The *ANSI X3.182 Guideline for Bar Code Print Quality* **SHALL** be used to determine the print quality of Code 39 and Code 128 symbols.	

Appendix F Figure 1. Example Of A Label Printed According To The SLA Label Rules (Not To Scale)



APPENDIX G. CHARACTER REPRESENTATION

Table G1. Hexadecimal And Decimal Values; Subset Of ASCII/ISO 646

HEX	DEC	ASCII /ISO 646 Character	HEX	DEC	ASCII /ISO 646 Character	HEX	DEC	ASCII /ISO 646 Character
00	00	NUL	2B	43	+	56	86	V
01	01	SOH	2C	44	,	57	87	W
02	02	STX	2D	45	-	58	88	X
03	03	ETX	2E	46	.	59	89	Y
04	**04**	**EOT**	2F	47	/	5A	90	Z
05	05	ENQ	30	48	0	**5B**	**91**	**[**
06	06	ACK	31	49	1	5C	92	\
07	07	BEL	32	50	2	5D	93	]
08	08	BS	33	51	3	5E	94	^
09	09	HT	34	52	4	5F	95	_
0A	10	LF	35	53	5	60	96	'
0B	11	VT	36	54	6	61	97	a
0C	12	FF	37	55	7	62	98	b
0D	13	CR	38	56	8	63	99	c
0E	14	SO	39	57	9	64	100	d
0F	15	SI	3A	58	:	65	101	e
10	16	DLE	3B	59	;	66	102	f
11	17	DC1	3C	60	<	67	103	g
12	18	DC2	3D	61	=	68	104	h
13	19	DC3	**3E**	**62**	**>**	69	105	i
14	20	DC4	3F	63	?	6A	106	j
15	21	NAK	40	64	@	6B	107	k
16	22	SYN	41	65	A	6C	108	l
17	23	ETB	42	66	B	6D	109	m
18	24	CAN	43	67	C	6E	110	n
19	25	EM	44	68	D	6F	111	o
1A	26	SUB	45	69	E	70	112	p
1B	27	ESC	46	70	F	71	113	q
1C	**28**	**FS**	47	71	G	72	114	r
1D	**29**	**GS**	48	72	H	73	115	s
1E	**30**	**RS**	49	73	I	74	116	t
1F	**31**	**US**	4A	74	J	75	117	u
20	32	SP	4B	75	K	76	118	v
21	33	!	4C	76	L	77	119	w
22	34	"	4D	77	M	78	120	x
23	35	#	4E	78	N	79	121	y
24	36	$	4F	79	O	7A	122	z
25	37	%	50	80	P	7B	123	{
26	38	&	51	81	Q	7C	124	|

HEX	DEC	ASCII /ISO 646 Character		HEX	DEC	ASCII /ISO 646 Character		HEX	DEC	ASCII /ISO 646 Character
27	39	'		52	82	R		7D	125	}
28	40	(		53	83	S		7E	126	~
29	**41**	)		54	84	T		7F	127	DEL
2A	42	*		55	85	U				
NOTE: Values shown in **BOLD** are specifically referenced in this guideline.										

Table G2. Values For Special Characters Referenced In This Document

ASCII/ISO 646 Character	DECIMAL	HEX
[	91	5B
)	41	29
>	62	3E
RS	30	1E
FS	28	1C
GS	29	1D
EOT	04	04

APPENDIX H. USER GUIDANCE WHEN PRINTING ANSI COMPLIANT PDF417 SYMBOLS

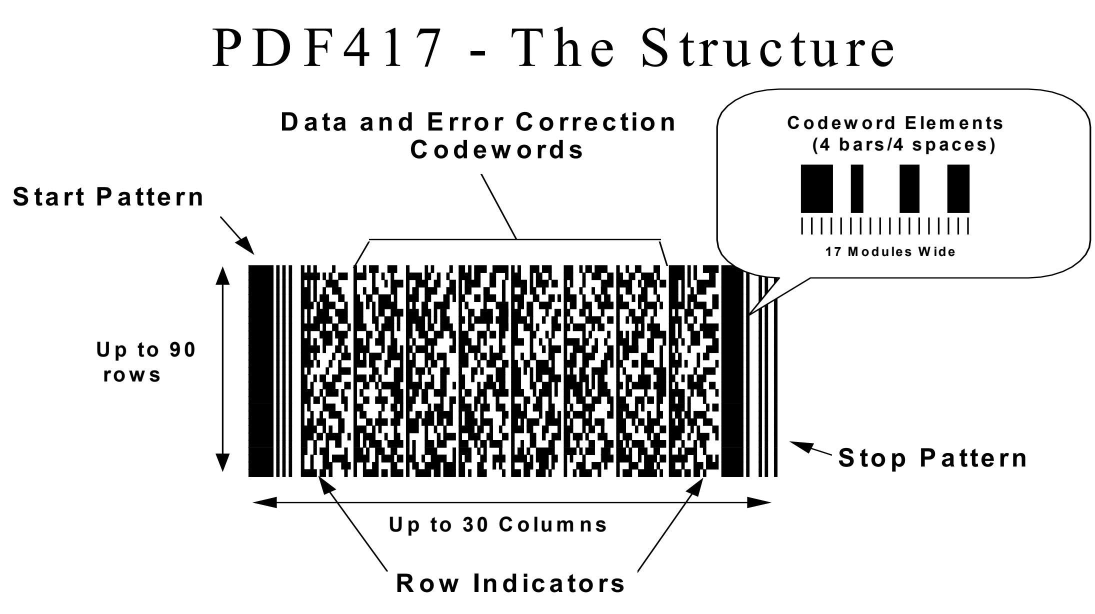
Several factors must be considered when printing PDF417 symbols on a Trading Partner Label. These considerations include:

- Data requirements
- Label area limitations
- Printer capabilities
- Scanner capabilities

All of these factors must be used to determine which values to use for PDF417 options, including:

- Number of data columns
- Narrow element dimension

Appendix H Figure 1. Structure of PDF417



Note: This guideline recommends that no more than 12 columns be used

Developers and users of 2D printing software should use the following guidelines when determining which values to use for PDF417 options. Since there are many design decisions and potential solutions when configuring PDF417 symbols, Tables H1 through H7 have been included to aid in that selection. These guidelines will help ensure that valid symbols are printed. In addition, they will help ensure that a user's scanning and printing requirements have been considered.

Part I - Designing The Label Layout

The following steps will help the label designer to plan the size of block that should be set aside for the PDF417 symbol on a label.

1. Plan for the maximum amount of data

- Determine which data fields that you will require in the message, and the maximum anticipated length of each field.
- Add in the additional characters needed for formatting, such as Data Element Separators, Format Headers, etc.
- Plan for a data size equal to, or greater than the sum of all the data fields plus the additional characters.

2. Plan for scanning equipment capabilities

The symbol width may be constrained by the label width or the capabilities of the scanning equipment you are planning to use. It is also important to consider the capabilities of the scanning equipment you are planning to use when choosing a block or sub-block size in which to encode a PDF417 symbol.

For example, if your equipment has a maximum field width of 3 inches, it would be impossible to read a symbol in a single-height block that is 4 inches wide, but the same data in a double-height block could fit in a symbol that is only 2.6 inches wide

3. Plan for the maximum "X" dimension that may be used

"X" dimension is another name for narrow element width. Since the supplier/printer of the label ultimately determines the "X" dimension at which the symbol will be printed (see Section 17), it is possible that a PDF417 symbol printed for a Shipping/Receiving application could be printed at any "X" dimension from 0.010 to 0.017 inch (0.25 to 0.43 mm). The label designer should plan for the largest "X" dimension that might be used in printing.

4. Find the appropriate size in the tables

Table H1 gives approximate width of symbols for single-height and double-height blocks containing a PDF417 symbol up to the stated number of alphanumeric characters, using "X" dimensions 0.017 inch (0.43 mm), 0.015 inch (0.38 mm), 0.013 inch (0.33 mm), and 0.10 inch (0.25 mm).. 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.

In Table H1:

- Find the maximum number of characters (from step 1) you anticipate will be used for your application
- Find the maximum "X" dimension you anticipate will be used for your application (from step 3)
- Look under the Single-Height or Double-Height column to find symbol width.

If the space available on your label width or the capabilities of the scanning equipment you are planning to use does not accommodate the symbol size, one option is to consider reducing the character count; another might be to gain trading partner agreement to reduce the "X" dimension.

Table H1: Symbol Width and Character Count for PDF417 Symbols

"X" Dimension	0.017 inch (0.43 mm)		0.015 inch (0.38 mm)		0.013 inch (0.33 mm)		0.010 inch (0.25 mm)	
Number of Characters	Single Height Block	Double Height Block	Single Height Block	Double Height Block	Single Height Block	Double Height Block	Single Height Block	Double Height Block
50	3.28 in (83.31 mm)	2.41 in (61.21 mm)	2.90 in (73.66 mm)	1.88 in (47.75 mm)	2.30 in (58.42 mm)	1.64 in (41.66 mm)	1.62 in (41.15 mm)	1.11 in (28.19 mm)
100	4.14 in (105.16 mm)	2.70 in (68.58 mm)	3.16 in (80.26 mm)	2.14 in (54.36 mm)	2.52 in (64.01 mm)	1.86 in (47.24 mm)	1.79 in (45.47 mm)	1.28 in (36.83 mm)
150	4.72 in (119.89 mm)	2.99 in (75.95 mm)	3.67 in (93.22 mm)	2.39 in (60.71 mm)	2.97 in (75.44 mm)	2.08 in (52.83 mm)	1.96 in (49.78 mm)	1.45 in (36.83 mm)
200	5.30 in (134.6 .mm)	3.28 in (83.31 mm)	4.18 in (106.17 mm)	2.65 in (67.31 mm)	3.41 in (86.61 mm)	2.08 in (52.83 mm)	2.13 in (54.10 mm)	1.45 in (36.83 mm)
250	5.88 in (5149.3 mm	3.57 in (90.68 mm)	4.69 in (119.13 mm)	2.90 in (73.66 mm)	3.63 in (92.20 mm)	2.30 in (58.42 mm)	2.47 in (62.74 mm)	1.62 in (41.15 mm)
300	6.46 in (164.08m m)	3.85 in (97.79m m)	5.20 in (132.08 mm)	3.16 in (80.26 mm)	4.07 in (103.38 mm)	2.52 in (64.1 mm)	2.64 in (67.6 mm)	1.62 in (41.15 mm)
400	7.90 in (200.66 mm)	4.43 in (112.52 mm)	6.22 in (157.99 mm)	3.67 in (93.22 mm)	4.96 in (125.98 mm)	2.97 in (75.44 mm)	3.15 in (80.1 mm)	1.96 in (49.78 mm)
500	9.06 in (230.14 mm)	5.01 in (127.25 mm)	7.25 in (183.90 mm)	4.18 in (106.17 mm)	5.62 in (142.75 mm)	3.19 in (81.03 mm)	3.49 in (88.65 mm)	2.13 in (54.10 mm)
750	12.24 in (310.90 mm)	6.46 in (164.8 mm)	9.79 in (248.67 mm)	5.20 in (132.08 mm)	in (187.71 mm)	4.07 in (103.38 mm)	4.68 in (118.87 mm)	2.64 in (67.6 mm)
1000	15.41 in (391.41 mm)	8.19 in (208.3 mm)	12.34 in (313.44 mm)	6.47 in (164.34 mm)	9.38 in (238.25 mm)	4.96 in (125.98 mm)	5.70 in (144.98 mm)	3.15 in (80.1 mm)
1250	18.59 in (472.19	9.63 in (244.60	14.63 in (371.60	7.75 in (196.85	11.14 in (282.96	5.84 in (148.34	6.89 in (175.1	3.66 in (92.96

	mm)	mm)	mm)	mm)	mm)	mm)	mm)	mm)
1500	22.06 in (560.32 mm)	11.08 in (281.43 mm)	17.18 in (436.37 mm)	8.77 in (222.76 mm)	13.13 in (333.50 mm)	6.72 in (170.69 mm)	7.91 in (200.91 mm)	4.17 in (105.92 mm)

Assumptions:

Symbol Width Includes Quiet Zones

Single-Height Block Assumed to be 0.8 inch (20.32 mm).

Double-Height Block Assumed to be 1.6 inch (40.64mm).

Part II - Printing The Symbol On The Label

This guideline recommends that PDF417 symbols for the Shipping and Receiving application be printed with no more than 12 Data Columns, unless mutually agreed upon by all trading partners involved. This limitation, combined with the amount of space allocated for the symbol on the label, may influence the choice of “X” dimension for printing the symbol. The capability of your printing equipment will determine your possible choices of “X” dimension.

Tables H2 through H7 illustrate the number of alphanumeric characters and the number of Data Columns that can be encoded in single-height and double-height blocks. Each table illustrates a different “X” dimensions. Tables H2 through H5 describe symbol widths for labels up to 4.0 inches (102 mm) wide. Tables H6 and H7 describe symbol widths for labels above 4 inches wide.

- The tables were calculated using the following assumptions:
- Symbol width includes quiet zones of 0.04 inch on all sides.
- Single-height block is assumed to be 1.0 inch (25.4 mm).
- Double-height block is assumed to be 2.0 inches (50.8 mm).
- Bar height is assumed to be 3”X” (3 times the “X” dimension).

Table H2: Sizes and Character counts up to Four Inches with .010 inch “X” **Dimension**

	Approximate Alphanumeric Capacity of PDF417 Symbol at Specified Widths with Single-Height and Double-Height Blocks “X” **Dimension = 0.010 inch (0.25 mm)**									
	Width ≅ 1.5 inches (≅ 38.1 mm)		Width ≅ 2.0 inches (≅ 50.8 mm)		Width ≅ 2.5 inches (≅ 63.5 mm)		Width ≅ 3.0 inches (≅ 76.2 mm)		Width ≅ 3.8 inches (≅ 96.5 mm)	
	Inches (mm)	Data Columns	Inches (mm)	Data Columns	Inches (mm)	Data Columns	Inches (mm)	Data Columns	Inches (mm)	Data Columns
	1.45 (36.8)	4	1.96 (49.8)	7	2.47 (62.7)	10	2.98 (75.7)	10	3.66 (93)	13
Single-height Block	56 characters		185 characters		315 characters		445 characters		617 characters	
Double-height Block	293 characters		601 characters		909 characters		1217 characters		1535 characters	

Table H3: Sizes And Character Counts Up To Four Inches With .013 Inch “X” Dimension

	Approximate Alphanumeric Capacity of PDF417 Symbol at Specified Widths with Single-Height and Double-Height Blocks **"X" Dimension = 0.013 inch (0.33 mm)**									
	Width ≅ 1.5 inches (≅ 38.1 mm)		Width ≅ 2.0 inches (≅ 50.8 mm)		Width ≅ 2.5 inches (≅ 63.5 mm)		Width ≅ 3.0 inches (≅ 76.2 mm)		Width ≅ 3.8 inches (≅ 96.5 mm)	
	Inches (mm)	Data Columns	Inches (mm)	Data Columns	Inches (mm)	Data Columns	Inches (mm)	Data Columns	Inches (mm)	Data Columns
	1.42 (36.1)	2	1.86 (47.2)	4	2.30 (55.8)	6	2.97 (75.4)	9	3.63 (92.2)	12
Single-height Block	N/A		13 characters		77 characters		175 characters		272 characters	
Double-height Block	41 characters		200 characters		358 characters		596 characters		833 characters	

Table H4: Sizes And Character Counts Up To Four Inches With .015 Inch "X" **Dimension**

	Approximate Alphanumeric Capacity of PDF417 Symbol at Specified Widths with Single-Height and Double-Height Blocks "X" **Dimension = 0.015 inch (0.38 mm)**									
	Width ≅ 1.5 inches (≅ 38.1 mm)		Width ≅ 2.0 inches (≅ 50.8 mm)		Width ≅ 2.5 inches (≅ 63.5 mm)		Width ≅ 3.0 inches (≅ 76.2 mm)		Width ≅ 3.8 inches (≅ 96.5 mm)	
	Inches (mm)	Data Columns	Inches (mm)	Data Columns	Inches (mm)	Data Columns	Inches (mm)	Data Columns	Inches (mm)	Data Columns
	1.37 (34.8)	1	1.88 (47.8)	3	2.39 (60.7)	5	2.90 (73.7)	7	3.67 (93.2)	10
Single-height Block	N/A		N/A		27 characters		85 characters		171 characters	
Double-height Block	N/A		88 characters		225 characters		362 characters		567 characters	

Table H5: Sizes And Character Counts Up To Four Inches With .017 Inch "X" Dimension

	Approximate Alphanumeric Capacity of PDF417 Symbol at Specified Widths with Single-Height and Double-Height Blocks "X" **Dimension = 0.017 inch (0.43 mm)**									
	Width ≅ 1.5 inches (≅ 38.1 mm)		Width ≅ 2.0 inches (≅ 50.8 mm)		Width ≅ 2.5 inches (≅ 63.5 mm)		Width ≅ 3.0 inches (≅ 76.2 mm)		Width ≅ 3.8 inches (≅ 96.5 mm)	
	Inches (mm)	Data Columns	Inches (mm)	Data Columns	Inches (mm)	Data Columns	Inches (mm)	Data Columns	Inches (mm)	Data Columns
	1,25 (31.8)	0	1.83 (46.5)	2	2.41 (61.2)	4	2.99 (75.9)	6	3.57 (90.7)	8
Single-height Block	N/A		N/A		N/A		34 characters		85 characters	
Double-height Block	N/A		N/A		121 characters		239 characters		358 characters	

Note: In the above tables, the symbol N/A means that no data can be encoded in the associated width with an error correction level of 5.

Table H6: Sizes And Character Counts Greater Than Four Inches With .015 Inch "X" Dimension

	Approximate Alphanumeric Capacity of PDF417 Symbol at Specified Widths with Single and Double-Height locks "X" **Dimension = 0.015 inch (0.38 mm)**					
	Width ≅ 4.8 inches (≅ 122 mm)		Width ≅ 5.3 inches (≅ 135 mm)		Width ≅ 5.8 inches (≅ 147 mm)	
	Inches (mm)	Data Columns	Inches (mm)	Data Columns	Inches (mm)	Data Columns
	4.69 (119)	14	5.20 (132)	16	5.71 (145)	18
Single-height Block	286 characters		344 characters		401 characters	
Double-height Block	841 characters		891 characters		920 characters	

Table H7: Sizes And Character Counts Greater Than Four Inches With .017 Inch "X" Dimension

	Approximate Alphanumeric Capacity of PDF417 Symbol at Specified Widths with Single and Double-Height Blocks "X" **Dimension = 0.017 inch (0.43 mm)**							
	Width ≅ 4.8 inches (≅ 122 mm)		Width ≅ 5.3 inches (≅ 135 mm)		Width ≅ 5.8 inches (≅ 147 mm)		Width ≅ 6.3 inches (≅ 160 mm)	
	Inches (mm)	Data Columns	Inches (mm)	Data Columns	Inches (mm)	Data Columns	Inches (mm)	Data Columns
	4.72 (120)	12	5.30 (135)	14	5.59 (142)	15	6.17 (157)	17
Single-height Block	185 characters		236 characters		261 characters		311 characters	
Double-height Block	596 characters		715 characters		747 characters		770 characters	

APPENDIX I - SCANNING GUIDANCE

Scanning issues that are valid for all types of scanners and all symbologies:

- Keep the reader-to-symbol distance within the range recommended by the manufacturer.
- When using a handheld reader, be sure to hold the reader within the allowable angles. Pitch, yaw and skew are used to describe the angles of the reader to the symbol.
- In an omnidirectional reader, yaw (rotation) does not matter. Pitch causes the top and bottom of the symbol to be at different distances from the reader and skew causes the left and right sides of the symbol to be at different distances.
- Be sure to select a reader that is best for the normal lighting of the application. Readers are designed to work over a wide range of lighting conditions, but some may work better in sunlight while others work better in darker conditions.
- Although readers are generally motion tolerant, handheld CCD readers achieve best results when held steady while reading.
- Be sure the reader is capable of reading at the speed of the system, and if necessary, have the reader tuned by the manufacturer for the expected speed. Fixed-position readers often require the label to be in motion. There may be upper or lower limits to the allowable velocity of the label.
- The area in which the symbol can be seen (field of view) is defined. The symbol must be within the field of view when the reader is triggered.

Scanning issues Specific to Reading MaxiCode:

MaxiCode is intended to be read by omni-directional fixed-position or omnidirectional handheld readers. Care should be taken to use a reader that has the appropriate firmware installed to make MaxiCode reading possible.

The following guidance is provided for the types of readers available for reading MaxiCode:

- <u>Omnidirectional fixed-position CCD</u>: Two types of fixed-position CCD readers, 2D and linear, are commonly available for reading MaxiCode.
- 2D CCD readers are typically used for low throughput applications. The label's image must be brought to a virtual stop (possibly with a strobe or shutter) to take a blur-free image.
- Linear CCD readers are typically used for higher volume applications or where a larger field of view is required. The label is transported past the reader and the image is built up line by line.
- <u>Omnidirectional handheld CCD</u>: An omnidirectional handheld CCD reader takes a digital snapshot of the MaxiCode symbol. The digital image thus formed is processed by the onboard computer to extract the bit values from each of the cells.
- As with any reader, take care to hold the omnidirectional handheld CCD readers steady when taking the picture.

Scanning issues Specific to Reading PDF417:

PDF417 is specifically designed to be read by a range of products based on Laser and CCD technology, both in handheld and fixed-position devices, as well as integrated with handheld portable computers. Laser technology provides very high performance (speed), a large depth of field, and a wide field of view. It is generally immune to environmental considerations such as ambient light.

The following types of readers are available for reading PDF417:

- Raster Laser: A raster laser device scans the 2D symbol horizontally and vertically at high speed, permitting "aim and shoot" operation in a handheld device. The raster laser pattern must be aligned with the rows in the PDF417 symbol. The raster laser generally provides full backward compatibility with linear bar codes (Code 39/Code 128) used today. A Raster Laser may be used in a fixed-position along a moving assembly line or conveyor while the label is moved through the scanner's field of view.
- Linear Laser: A linear laser beam must be moved across the PDF417 symbol ("painted") to collect (row by row) all codeword elements to accomplish a complete symbol decode. One example of an application for a linear laser is with a continuously "on" fixed-position scanner reading a label attached to an object moving along an assembly line.
- Linear CCD: A linear CCD reader in a handheld device may be moved across the PDF417 symbol ("painted") to collect (row by row) all of the codeword elements. The device needs to be aligned with the rows in the PDF417 symbol. A linear CCD reader also captures an image of a PDF417 symbol if passed under the field of view of the CCD at a fixed speed (overhead scanner mounted above a conveyor).
- 2D CCD Reader: PDF417 may be imaged (entire picture captured at one time) using 2D CCD array technology in a handheld or a fixed-position reader. The benefit of a 2D reader is that it provides omnidirectional capability.

APPENDIX J - ENCODING DUPLICATE DIS IN A SINGLE MESSAGE

Encoding Multiple Occurrences Of The Same Data Identifier (DI) In A Single Message

This section provides a guideline for using two methods of encoding multiple occurrences of the same Data Identifier (DI) in a single two-dimensional (2D) symbol message:

- “Nesting”, as outlined under this Guideline.
- “Looping”, as outlined under in Section VI of ANSI MH10.8.2 1995 DSTU (R2002) Data Identifier and Application Identifier Standard.

Both encoding structures use the same formats for the Message Header, Data Element Separator and Message Trailer:

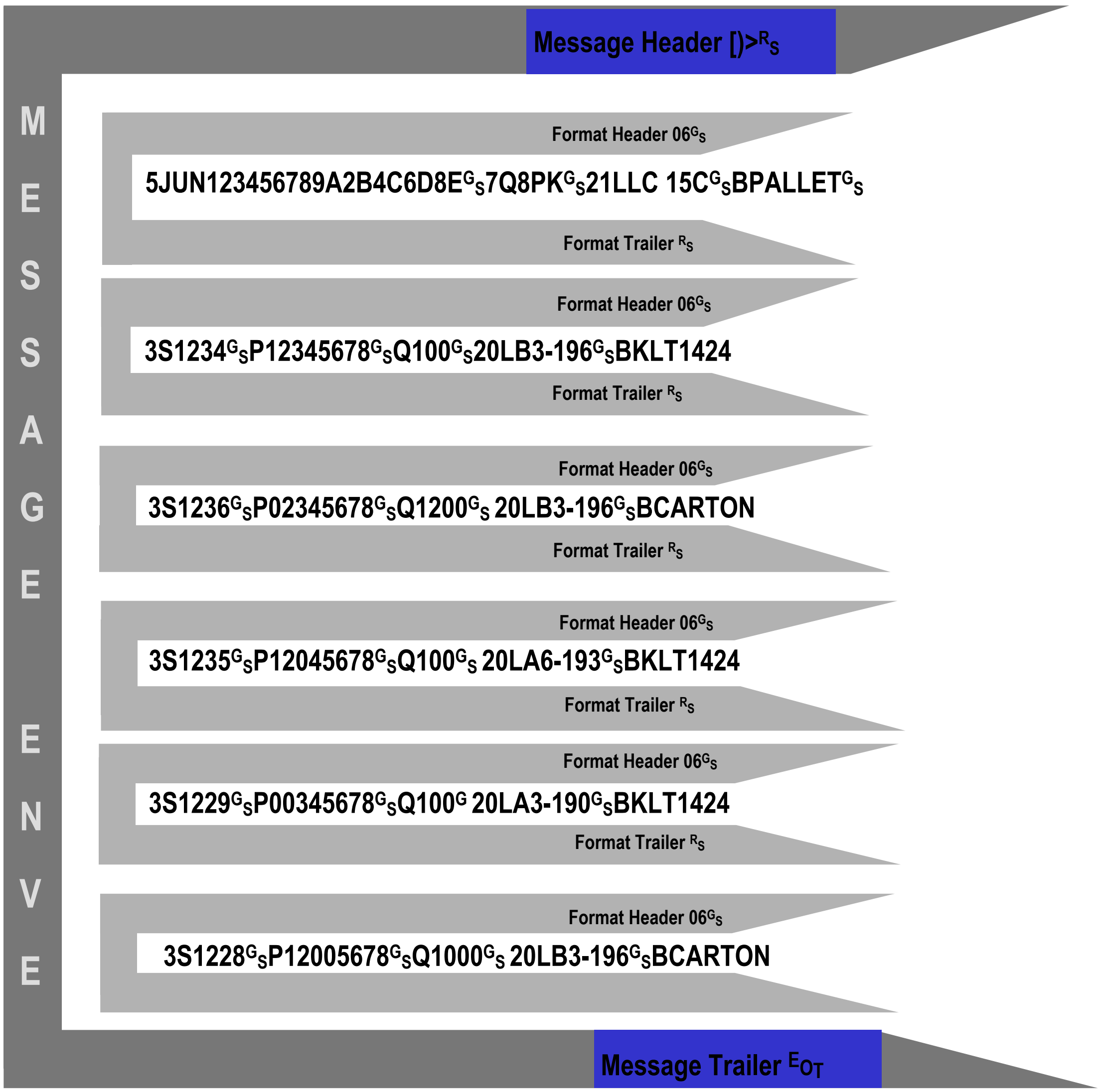
- Message Header: [)>^{R}S
  - [)> is the Compliance Indicator
    - Counted as 3 characters
  - ^{R}S = Format Separator
    - Counted as a single character
- Data Element Separator = ^{G}S
  - Counted as a single character
- Message Trailer: ^{R}S $^{E}O_{T}$
  - ^{R}S = Format Separator
    - Counted as a single character
  - $^{E}O_{T}$ = End of Transaction
    - Counted as a single character

When using the “Nesting” method, multiple instances of the same data type are encoded in separate Format Envelopes within the Message Envelope.

The figure below illustrates the “Nesting” data format of a Mixed Load Pallet with various part numbers, containers types and serial numbers to be delivered to several locations:

Appendix J Figure 1. Example of Mixed Load "Nesting"

In this example, each Format Envelope inside the Message Envelope requires the use of both a Format



Header and a Format Trailer. The complete message encodes 274 characters of data.

The table below provides an explanation of the data stream in the example above.

Appendix J Figure 2. "Nesting" data stream for a Mixed Load encoding 274 characters

Portion of Message	Data	Formatted Data
Message Header		**[)>$^{R}_{S}$**
Format Header		**06$^{G}_{S}$**
Formatted Data	DI for Mixed Load = 5J DUNS # = 123456789 Serial # = A2B4C6D8E Quantity (7Q) = 8 packs (PK) Location (21L) = LC15C Container type (B) = Pallet	**5JUN123456789A2B4C6D8E $^{G}_{S}$ 7Q8PK $^{G}_{S}$21LLC 15C$^{G}_{S}$ BPALLET**
Format Trailer		**$^{R}_{S}$**
Format Header		**06$^{G}_{S}$**
Formatted Data	Serial # (3S) = 1234 Item Code (P) = 12345678 Quantity (Q) = 100 Location (20L) = B3-196 Container type (B) = KLT1424	**3S1234$^{G}_{S}$P12345678$^{G}_{S}$Q100$^{G}_{S}$20LB3-196$^{G}_{S}$BKLT1424**
Format Trailer		**$^{R}_{S}$**
Format Header		**06$^{G}_{S}$**
Formatted Data	Serial # (3S) = 1236 Item Code (P) = 02345678 Quantity (Q) = 1200 Location (20L) = B3-196 Container type (B) = Carton	**3S1236$^{G}_{S}$P02345678$^{G}_{S}$Q1200$^{G}_{S}$20LB3-196$^{G}_{S}$BCARTON**
Format Trailer		**$^{R}_{S}$**
Format Header		**06$^{G}_{S}$**
Formatted Data	Serial # (3S) = 1237 Item Code (P) = 12245678 Quantity (Q) = 100 Location (20L) = AB3-190 Container type (B) =KLT1424	**3S1237$^{G}_{S}$P12245678$^{G}_{S}$Q100$^{G}_{S}$20LA3-190$^{G}_{S}$BKLT1424**
Format Trailer		**$^{R}_{S}$**
Format Header		**06$^{G}_{S}$**
Formatted Data	Serial # (3S) = 1235 Item Code (P) = 12045678 Quantity (Q) = 100 Location (20L) = A6-193 Container type (B) = KLT1424	**3S1235$^{G}_{S}$P12045678$^{G}_{S}$Q100$^{G}_{S}$20LA6-193$^{G}_{S}$BKLT1424**
Format Trailer		**$^{R}_{S}$**
Format Header		**06$^{G}_{S}$**
Formatted Data	Serial # (3S) = 1228 Item Code (P) = 12005678 Quantity (Q) = 1000 Location (20L) = B3-196 Container type (B) = Carton	**3S1228$^{G}_{S}$P12005678$^{G}_{S}$Q1000$^{G}_{S}$20LB3-196$^{G}_{S}$BCARTON**
Format Trailer		**$^{R}_{S}$**
Message Trailer		**$^{E}O_{T}$**

Below is the complete data stream:

> [)>$^{R}{}_{S}$06$^{G}{}_{S}$5JUN123456789A2B4C6D8E$^{G}{}_{S}$7Q8PK$^{G}{}_{S}$21LLC15C$^{G}{}_{S}$BPALLET$^{R}{}_{S}$06$^{G}{}_{S}$3S1234$^{G}{}_{S}$P12345
> 678$^{G}{}_{S}$Q100$^{G}{}_{S}$20LB3-196$^{G}{}_{S}$BKLT1424$^{R}{}_{S}$06$^{G}{}_{S}$3S1236$^{G}{}_{S}$P02345678$^{G}{}_{S}$Q1200$^{G}{}_{S}$20LB3-
> 196$^{G}{}_{S}$BCARTON$^{R}{}_{S}$06$^{G}{}_{S}$3S1237 $^{G}{}_{S}$P12245678$^{G}{}_{S}$Q100$^{G}{}_{S}$20LA3-
> 190$^{G}{}_{S}$BKLT1424$^{R}{}_{S}$06$^{G}{}_{S}$3S1235$^{G}{}_{S}$P12045678$^{G}{}_{S}$Q100$^{G}{}_{S}$20LA6-
> 193$^{G}{}_{S}$BKLT1424$^{R}{}_{S}$06$^{G}{}_{S}$3S1228$^{G}{}_{S}$P12005678$^{G}{}_{S}$Q1000$^{G}{}_{S}$20LB3-196$^{G}{}_{S}$BCARTON$^{R}{}_{S}$$^{E}O_{T}$

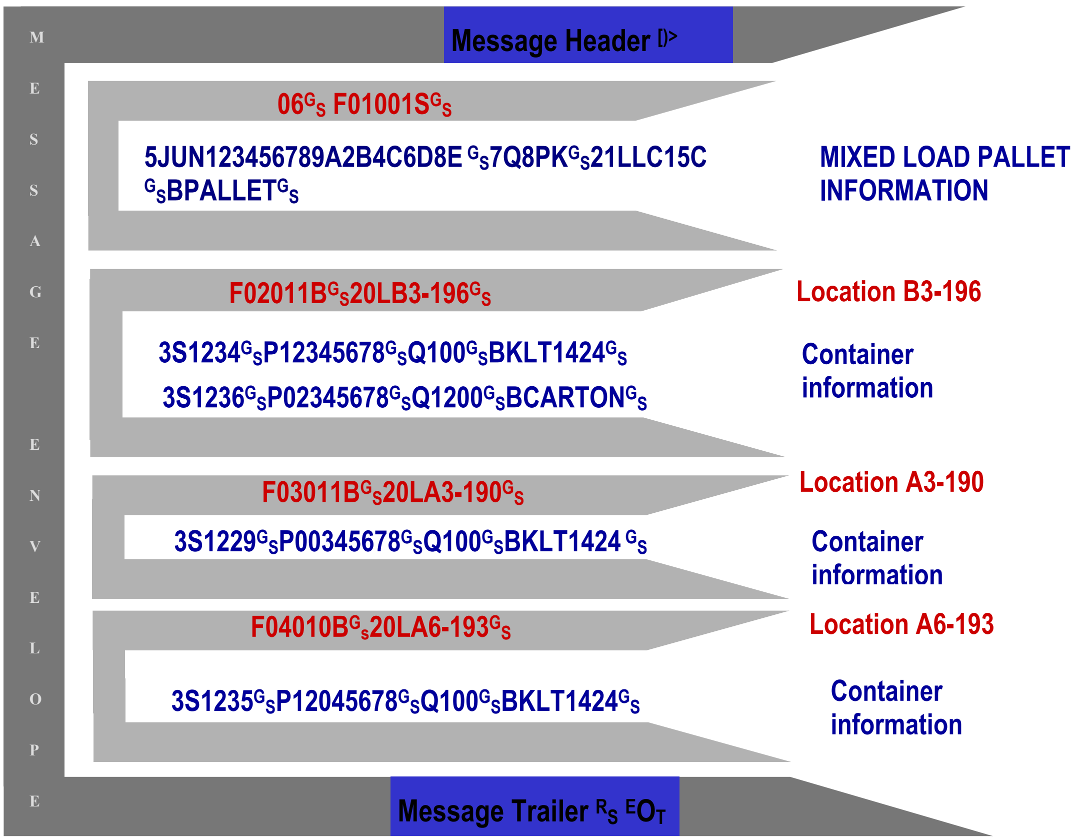
However, using the data from the example above, “Looping” can encode the same message in 240 characters of data, saving 34 characters.

See next page.

The ANSI MH10.8.2 "Looping" structure, following the Hierarchical Level (HL) structure of the ASC X12 EDI 856 Ship Notice / Manifest, uses the Data Identifier "F", as illustrated in the example below.

In this particular example, the containers on the Mixed Load are sorted according to delivery location. The Hierarchical structure will accommodate almost any sortation approach.

Appendix J Figure 3. Looping Structure for a Mixed Load encoding 240 Characters



The structure of the "Header" information for the "Looping" hierarchy is as follows:

- Hierarchical ID Number: 2 alphanumeric characters (always, or up-to?)
  - Answers the question, "Who am I?"
- Parent ID Number: 2 alphanumeric characters -
  Answers the question, "Who is my Parent?"
- Child Code: 0 = No; 1 = Yes -
  - Answers the question, "Do I have a child?"
- Hierarchical Level Code: 1 or 2 characters. From Data Element 735 of the ASC X12 Data Element Dictionary -
  Answers the question, "What am I?"

The following examples describe the interpretation of the first two format headers.

F01001S	**F**	is the DI for "Looping"
	01	answers the question, "Who am I?" I am the highest level of this Hierarchy.
	00	answers the question, "Who is my Parent?" Since this is the highest level of the Hierarchy, there is no parent.
	1	answers the question, "Do I have a child?" The number "1" means "Yes," there are subordinate segments.
	S	answers the question, "What am I?" S = "S"hipment in Data Element 735 of the ASC X12 Data Element Dictionary
F02011B	**F**	is the DI for "Looping."
	02	answers the question, "Who am I?" I am the second level of the Hierarchy.
	01	answers the question, "Who is my Parent?" Since this is the second level of the Hierarchy, "01" is the parent.
	1	answers the question, "Do I have a child?" The number "1" means "Yes," there are subordinate segments.
	B	answers the question, "What am I?" B = "B"uyer's location in Data Element 735 of the ASC X12 Data Element Dictionary.

Table J1. Looping Data Format For Mixed Load Encoding 240 Characters Of Data

Portion of Message	Data	Formatted Data
Message Header		[)>$^{R}{}_{S}$
Format Header	DI Format Indicator = 06 DI for "Looping" = F Hierarchy Level ID = 01 Parent ID = 00 Child ID = 1 Hierarchical Level = S (Shipment)	**06$^{G}{}_{S}$ F01001S$^{G}{}_{S}$**
Formatted Data for Mixed Load Pallet	License Plate Information: DI for Mixed Load = 5J DUNS # = 123456789 Serial # = A2B4C6D8E Quantity (7Q) = 8 packs (PK) Location (21L) = LC15C Container type (B) = Pallet	**5JUN123456789A2B4C6D 8E$^{G}{}_{S}$7Q8PK $^{G}{}_{S}$21LLC 15C $^{G}{}_{S}$BPALLET$^{G}{}_{S}$**
Format Header	DI for "Looping" = F Hierarchical level ID = 02 Parent ID = 01 Child ID = 1 Hierarchical Level = B (Customer's ["B"uyer's] location) DI for Location = 20L Location = B3-196	**F02011B$^{G}{}_{S}$20LB3-196$^{G}{}_{S}$**
Example of Formatted Data for Container #1	DI for Serial # (3S) = 1234 DI for Item Code (P) = 2345678 DI for Quantity (Q) = 100 DI for Container Type (B) = KLT1424	**3S1234$^{G}{}_{S}$P12345678$^{G}{}_{S}$Q10 0$^{G}{}_{S}$BKLT1424$^{G}{}_{S}$**
Formatted Data for Container #2	Same data format as above	**Data for remaining container at Location B3-196**
Format Header	DI for "Looping" = F Hierarchical level ID = 02 Parent ID = 01 Child ID = 1 Hierarchical Level = B (Customer's ["B"uyer's] location) DI for Location = 20L Location = A3-190	**F03011B$^{G}{}_{S}$20LA3-190$^{G}{}_{S}$**
Formatted Data for Container #3	Same data format as above	**Data for container at Location A3-190**
Format Header	DI for "Looping" = F Hierarchical level ID = 02 Parent ID = 01 Child ID = 1 Hierarchical Level = B (Customer's	**F04010B$^{G}{}_{S}$20LA6-193$^{G}{}_{S}$**

	[“B”uyer’s] location) DI for Location = 20L Location = A6-193	
Formatted Data for Container #4	Same data format as above	**Data for container at Location A6-193**
Message Trailer		^{R}S $^{E}O_T$

A Master Load has the potential of saving even more data when using the “Looping” structure.

Following is an example of “Nesting” data for a Master Load.

Appendix J Figure 4. Example of Master Load “Nesting” structure encoding 460 data characters.

In this example, the same Part Number, Quantity, Location and Container Type are repeated eight times, along with the Format Envelope Header and Trailer information, requiring 460 data characters to encode the message.

Using “Looping”, the duplication is eliminated, thereby requiring only 203 data characters, saving 257 characters.

Appendix J Figure 5. "Looping" Structure Of Master Load Encoding 203 Characters Of Data.

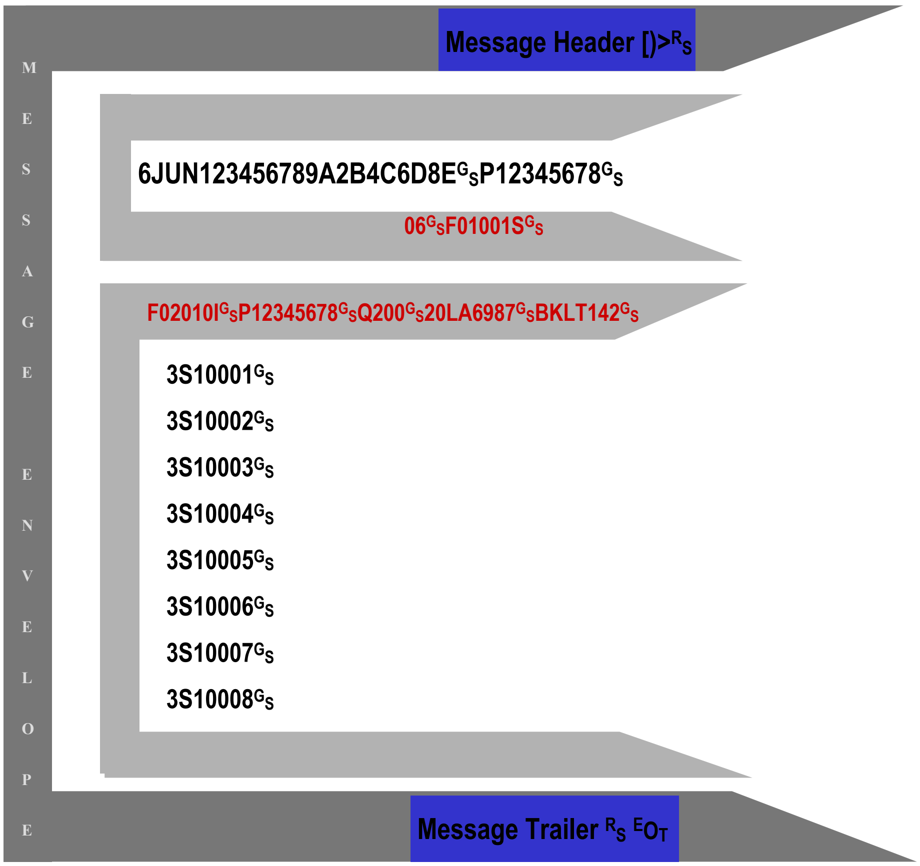


Table J2. Looping Data Format For Master Load Encoding 203 Characters Of Data

Portion of Message	Data	Formatted Data
Message Header		**[)>$^{R}_{S}$**
Format Header for First Format Envelope	DI Format Indicator = 06 DI for “Looping” = F Hierarchy Level ID = 01 Parent ID = 00 Child ID = 1 Hierarchical Level = S (Shipment)	**06$^{G}_{S}$F01001S$^{G}_{S}$**
Formatted Data for Master Load Pallet	License Plate Information: DI for Master Load = 6J DUNS # = 123456789 Serial # = A2B4C6D8E Part Number (P) = 12345678 Quantity (7Q) = 1600 (PL) Quantity (7Q) = 9999 kilograms GrossWeight Location (21L) = LC15C Container type (B) = Pallet	**6JUN123456789A2B4C6D8E$^{G}_{S}$P12345678$^{G}_{S}$7Q1600PL$^{G}_{S}$7Q9999GT$^{G}_{S}$21LLC15C$^{G}_{S}$BPALLET$^{G}_{S}$**
Format Header for Second Format Envelope	DI for “Looping” = F Hierarchical level ID = 02 Parent ID = 01 Child ID = 0 Hierarchical Level = I (Item) DI for Item = P Part Number = 12345678 DI for Quantity = Q Quantity = 200 DI for Location = 20L Location = A6-987 DI for Container type = B Container type = KLT1424	**F02010I$^{G}_{S}$P12345678$^{G}_{S}$Q200$^{G}_{S}$20LA6987$^{G}_{S}$BKLT1424$^{G}_{S}$**
Example of Formatted Data for First Serial Number	DI for Serial # = 3S Serial # = 10001	**3S10001 $^{G}_{S}$**
Formatted Data	Same data format as above	**Formatted Data for 7 remaining Serial Numbers**
Message Trailer		**$^{R}_{S}$ $^{E}O_{T}$**

APPENDIX K. OBTAINING NORMATIVE REFERENCES

Contact these organizations for information on the references in this document:

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New York, NY 10036
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