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CEA Standard

Product Marking Standard

CEA-802

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(From Project Number 4901, formulated under the cognizance of the CEA R9 Auto Data Capture Committee.)

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Product Marking Standard

1 Scope

This standard defines minimum requirements for identifying products. This standard provides guidelines for product marking with machine-readable symbols. This standard covers both labels and direct marking of products. This standard includes testing procedures for label adhesive characteristics and mark durability.

Intended applications include, but are not limited to, support of systems that automate the control of products during the processes of production, inventory, distribution, field service, and repair.

The location of the marking is not defined in this standard. Before implementing this standard, suppliers and manufacturers should review and mutually agree on these details with their trading partners.

This document includes three sections to meet the needs of various market sectors that have different operational requirements.

Section 5 provides a common set of definitions and parameters for product marking in general.

Section 6 provides a set of requirements, which in addition to those within Section 5, are intended to respond to the needs of the industrial to industrial trading channel, namely, where a finished good is provided by one manufacturer to another manufacturer for the production of the second manufacturer's product. An example of this trading channel is a non-commercially available electronic control module manufacturer who provides a product to an appliance manufacturer.

Section 7 provides a set of requirements, which in addition to those within Section 5, are intended to respond to the needs of the consumer electronics trading channel, namely, where a finished good is provided by a manufacturer, through a distributor, reseller, other retail oriented means, or directly to the end user/consumer of the electronic product. Examples of this trading channel includes audio and video electronics, microcomputers, computer peripherals, and home appliances sold to the consumer/end-user.

Section 8 provides a set of requirements, which in addition to those within Section 5, are intended to respond to the needs of the telecommunications trading channel, namely, where a finished good is provided by a manufacturer, through a distributor, reseller, or directly to the end user/consumer of the electronic product. An example of this trading channel includes telecommunications industry plug-in boards.

> NOTE--For component marking applications see ANSI/EIA-706 – Component marking standard.
>
> NOTE--For applications that require the marking of reels, tubes, tray, bags and boxes of first level packages containing components see ANSI/EIA 624 – Product Package Label standard for non-retail applications.

2 Purpose

The purpose of this standard is to establish the machine-readable (linear, two dimensional, and composite symbols) and human readable content for direct marking and labeling of products. A product is a first level or higher assembly that is sold in a complete end-usable configuration.

This standard provides a means for products to be marked, and read in either fixtured or handheld scanning environments at any manufacturer's facility and then read by customers purchasing products for subsequent manufacturing operations or for final end use.

3 Definitions

3.1 ANSI

The American National Standards Institute. A non-governmental organization responsible for the coordination of voluntary national (United States) standards. ANSI, 11 West 42nd Street, New York, NY 10036, Telephone: (212) 642-4900 Telefax: (212) 302-1286.

3.2 Application Identifier (AI)
A specified string of characters that defines the general category or specific intended use of the data that follows. Originally designed as numeric identifiers to take advantage of the numeric compaction feature of UCC/EAN-128. These identifiers are specified in ANSI/UCC4.

3.3 Bar code
An array of parallel rectangular bars and spaces arranged according to the encodation rules of a particular symbol specification in order to represent data in machine-readable form. For the purposes of this standard the term “bar code” includes linear (e.g., Code 39 and Code 128), two-dimensional (e.g., Data Matrix), and composite (e.g., CC-A) machine-readable symbols.

3.4 Cell
The smallest element of a two-dimensional matrix symbol.

3.5 Character
Data Character - A letter, digit or other member of the ASCII character set.

Symbol Character - A unique bar and/or space pattern, or a dark and light cell pattern, which is defined for a specific symbology.

There is not necessarily a one-to-one unique correlation between symbol characters and data characters. Depending on the symbology, symbol characters may have a unique associated symbol value.

3.6 Character Set
Those characters available for encodation in a particular automatic identification technology.

3.7 CLEI™ Code
A coding structure maintained by Telcordia that identifies communications equipment, in a concise, uniform feature-oriented language, describing product type, features, source document and associated drawings and vintages.

3.8 Components
For the purposes of this document, electronic or electrical parts (e.g., bare printed circuit boards, integrated circuits, capacitors, diodes, electronic modules, switches, heat sinks, resistors, electronic/electrical connector, etc.) of a first level assembly.

3.9 Data Element Separator
A specified character used to delimit discrete fields of data.

3.10 Data Identifier (DI)
A specified character string that defines the specific intended use of the data that immediately follows. The identifier shall be an alphabetic character or an alphabetic character preceded by up to three numeric characters as defined by ANSI MH10.8.2, Data Application Identifier Standard. A character (or set of characters) within a machine-readable symbol that defines the general category or specific use of the data that is encoded in the same machine-readable symbol.

3.11 First Level Assembly
For the purposes of this document, a manufactured electronic item (e.g., populated printed circuit board, plug-in or PCMCIA card) made up of components or a mechanical assembly of an electronic item.

3.12 Human-Readable Interpretation
The letters, digits or other characters associated with specific symbol characters and printed along with the linear bar code or two-dimensional symbol.

3.13 Label
For the purposes of this document, an adhesive backed media capable of being marked with information in machine-readable and/or human-readable form. Both labels and direct marking methods are referred to in this standard under the term “label”.

3.14 Manufacturer
Actual producer or fabricator of an item; not necessarily the supplier in a transaction.

3.15 Overhead Characters
Those characters included within a symbol that are not data characters, e.g., start, stop, error checking, concatenation, and field identifier characters.

3.16 Product
A first level or higher assembly that is sold in a complete end-usable configuration.

3.17 Quiet Zone
Areas of high reflectance (spaces) surrounding the machine-readable symbol. Quiet zone requirements may be found in application and symbology specifications. Sometimes called the "Clear Area" or “Margin.”

3.18 Structure
The order of data elements in a message.

3.19 Symbol
A machine-readable pattern typically including a quiet zone, finder pattern, symbol characters (which include special function and error detection and/or correction characters) required by a particular symbology. See also 3.3.

3.20 Substrate
The material (paper, plastic, metal, etc.) upon which a symbol is marked.

3.21 Supplier
In a transaction, the party that produces, provides, or furnishes an item or service.

3.22 Syntax
The way in which data is put together to form messages. Syntax also includes rules governing the use of appropriate identifiers, delimiters, separator character(s), and other non-data characters within the message. Syntax is the equivalent to grammar in spoken language.

4 References
The following standards contain provisions that, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed in Section 4.1.

4.1 Reference List
ANSI MH10.8.2 Data Application Identifier Standard (see ANSI for standard. See MH10.8 Data Application Identifier Work Group for requests for new data identifiers)-

ANSI MH10.8.3M Unit Loads and Transport Packages - Two Dimensional Symbols (see MH10 Secretariat)

ANSI T1.220 - Telecommunications - Information Interchange - Coded Representation of the North American Telecommunication Industry Manufacturers, Suppliers, and Related Service Companies

ANSI T1.213, Coded Identification of Equipment Entities of the North American Telecommunications System for Information Exchange

ANSI X3.182, Bar Code Print Quality Guidelines

ASCII/ISO 646 Information Processing - ISO 7-Bit Coded Character Set for Information Interchange-available from the

ASTM E29-93a Using Significant Digits in Test Data to Determine Conformance with Specifications

ASTM D374-94 Thickness of Solid Electrical Insulation

ASTM D1000-93 Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications
Commercial and Government Entity (CAGE) Code, Defense Logistics Service Center

GR-485 - COMMON LANGUAGE Equipment Coding Processes and Guidelines

Dun & Bradstreet DUNS® Number

CEA-802

ANSI/EIA-556B - Outer Shipping Container Bar Code Label Standard, 1998

ANSI/EIA-621, Consumer Electronics Group Product and Packaging Bar Code Standard, 1995

ANSI/EIA-624, Product Package Label Standard for Non-Retail Applications, 1995

ANSI/EIA-706, Component Marking Standard, 1997

ANSI/UCC1, U.P.C. Symbol Specification, 1995

ANSI/UCC4, Application Identifier Standard, 1995

Uniform Symbology Specification Code 39

Uniform Symbology Specification Code 128

International Symbology Specification Data Matrix

International Symbology Specification PDF417 (ISO/IEC DIS 15438)

International Symbology Specification MicroPDF417

International Symbology Specification UCC/EAN Composite Symbols

ISO/IEC 15416, Automatic Identification and Data Capture Techniques-Bar Code Print Quality Test Specification-Linear Symbols

4.2 Reference Acquisition

International Symbology Specifications:

- AIMI, 634 Alpha Drive, Pittsburgh, PA, 15238-2802; Phone 412-963-8009; Fax 412-963-8753

American National Standards T1 and X3, and ASCII/ISO:

- American National Standards Institute (ANSI), 11 West 42nd Street, New York, NY 10036; Phone 212-642-4900; Internet http://www.ansi.org

ANSI MH10.8 Data Application Identifier Work Group for requests for new data identifiers:

- ANSI MH10.8 Data Application Identifier Work Group chairperson at P.O. Box 2524, Cedar Rapids, IA 52406-2524; Phone 319-364-0212; Fax 319-365-8814

ASTM Standards

- ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959; Phone 610-832-9585; Fax 610-832-9555; Email service@astm.org; Web http://www.astm.org

CAGE Code

- Defense Logistics Service Center, Federal Center, 74 N. Washington, Battle Creek, MI 49017-3084

DUNS® Number

- Dun & Bradstreet Business Credit Services, Office of Data Quality, DUNS Number Administration, One Imperial Way, Department 21, Allentown, PA 18195-0021; Phone 800-333-0505; Internet http://www.dnb.com.

EAN Standards & UCC/EAN Specifications:

- EAN International**,** Rue Royale 145, B-1000 Brussels, Belgium; Phone +32 2 218 76 74; Fax +32 2 218 75 85

EIA Standards and ANSI/EIA Standards:

- Global Engineering Documents, World Headquarters, 15 Inverness Way East, Englewood, CO USA 80112-5776; Phone 800-854-7179; Fax 303-397-2740; Internet http://global.ihs.com; Email global@ihs.com

MH10 Secretariat:

- MH10 Secretariat, The Material Handling Industry, 8720 Red Oak Blvd., Suite 201, Charlotte, NC 28217-3992; Phone 704-522-8644

Telcordia GR485:

- Telcordia, Language Standard Division Production Control, Room 4C863, 444 Hoes Lane, CN 1300, Piscataway, NJ 08854-4182; Phone 732-699-2700

UCC Membership, to receive a UCC Company Prefix, ANSI/UCC standards, and UCC/EAN Composite Symbols:

- Uniform Code Council, 7887 Washington Village Drive, Suite 300, Dayton, OH 45459-8605; Phone 937-428-3741; Fax 937-435-7317

Uniform Symbology Specification Codes:

- AIM^{USA}, 634 Alpha Drive, Pittsburgh, PA, 15238-2802; Phone 412-963-8588; Fax 412-963-8753

5 Common Requirements

5.1 Data Format Common Requirements

5.1.1 General Format

This label will accommodate both mandatory and optional data fields. The maximum length of each discrete data field shall be 25 data characters unless otherwise specified. This character count is exclusive of overhead characters.

Overhead characters include identifiers and symbology overhead characters. It is important that the appropriate identifiers [i.e., Data Identifiers (DIs) and Application Identifiers (AIs)] and symbology overhead (e.g., Start and Stop Characters, Check Characters, Field Separators, Finding Patterns, Error Correction Characters, etc.) are utilized in accordance with their associated industry and symbology standards.

All mandatory data fields shall be machine-readable. Recommended data fields should be machine-readable.

Where appropriate, human-readable interpretations are covered in this standard.

5.1.2 Mandatory Data Fields

Supplier Identification Code
Item Identification Code

Supplier Identification Code and Item Identification Code may be combined in a single data field. See Section 5.1.2.2.

5.1.2.1 Supplier Identification Code

The ***Supplier Identification Code*** should be one of the following: the UCC/EAN Company Prefix, the Dun and Bradstreet Entity ID, or the U.S. Department of Defense CAGE Code. The use of more than one ***Supplier Identification Code*** is permitted. The choice of Supplier Identification Code(s) should be mutually agreed upon between trading partners. The appropriate Data Identifier shall precede the Supplier Identification when separate data fields are used to identify the supplier and the item identification. See Table 1.

Data Identifier	Data Field	Data characteristics Type/length	Description
3V	UCC/EAN Supplier Code	an2+n7	Company identification assigned by the appropriate EAN International (EAN) authority
12V	DUNS Number Identifying Manufacturer	an3+n9	Entity (Manufacturer) Identification assigned by Dun and Bradstreet
17V	U.S. Department of Defense (DoD) CAGE Code	an3+an5	Company identification assigned by the U.S. Department of Defense

Application Identifier	Data Field	Data characteristics Type/length	Description
N/A	Part Number (Supplier/Item) UPC-12/ EAN-13	n13 (See Annex E)	UPC-A/EAN-13 Symbology (Combination of Supplier & Item Identification)
01	Part Number (Supplier/Item) EAN.UCC-14	n2+n14	UPC-A/EAN-13/EAN.UCC-14 Format with UCC/EAN-128 (Combination of Supplier and Item)

Table 1 Data and Application Identifier Choices for Supplier Identification Code

5.1.2.2 Item Identification

The maximum length of the ***Item Identification*** shall be 25 data characters, which excludes the associated Data Identifier or Application Identifier. Item identification codes may be concatenated with the supplier identification to produce a unique item identification.

The ***Item Identification Code*** (e.g., supplier or customer part number) shall be designated as mutually agreed upon between the supplier or manufacturer and customer. The supplier's part number is the recommended item identification code.

An ***Item Identification Code*** may be concatenated with the supplier identification to produce a unique item identification code. UPC-A or EAN-13 formats are fixed length numeric examples of supplier identification codes concatenated with item identification codes to provide worldwide item identification uniqueness.

Likewise, variable length examples of a fixed length supplier identification codes concatenated with a variable length alphanumeric item identification codes to provide worldwide item identification uniqueness may be provided with Data Identifiers such as "9P" and "17P". See Table 2.

Data Identifier	Data Field	Data characteristics Type/length	Description
P	Part Number	an1+an...25	Customer Assigned Part Number
1P	Part Number	an2+an...25	Supplier Assigned Part Number
8P	Part Number	an2+n14	UCC/EAN EAN.UCC-14
9P	Part Number	an2+n9+an...16	Combined DUNS-9 supplier identification and item code assigned by the supplier
11P	Part Number	an3+an10	CLEI Code for telecommunications equipment
17P	Part Number	an3+an7+an...25	Combined UCC supplier identification and item code assigned by the supplier

Application Identifier	Data Field	Data characteristics Type/length	Description
N/A	Part Number (Supplier/Item) UPC-12 /EAN-13	n13 (See Annex E)	UPC-A/EAN-13 Symbology (Combination of Supplier & Item Identification)
01	Container Code (Supplier/Item & Quantity)	n2+n14	UPC-A/EAN-13/EAN.UCC-14 Format with UCC/EAN-128 (Combination of Supplier, Item Identification & Packaging Indicator)
241	Part Number	n3+an...25*	Customer Assigned Part Number
*Note—UCC/EAN permits AI “241” to be a maximum of 30 characters. This standard recommends Customer Assigned Part Number to be limited to no more than 25 characters.			

Table 2 Data and Application Identifier Choices for Item Identification

5.1.3 Optional Data fields
Specific applications and trading partner agreements may require additional data fields. Such fields include:

a) Traceability Code
b) Country of Origin

5.1.3.1 Traceability Code
The ***Traceability Code*** is assigned by the supplier to identify a unique item or group of entities (e.g., lot, batch, date code, revision level or serial number). The Data Identifier or Application Identifiers shown in Annex B represent a partial list of the ANSI MH10.8.2 listing that may be applicable to traceability codes. See Table 3.

Data Identifier	Data Field	Data characteristics Type/length	Description
S	Serial No.	an1+an...25	Serial number or code assigned by the supplier to an entity for its lifetime
22S	Electronic Serial Number	an3+an...25	Electronic Serial Number for Cellular Mobile Telephones
1T	Traceability Code	an2+an...25	Traceability code defined by the manufacturer
"D" Category	Date Code	See Data Identifier List Annex B	Date code defined by the manufacturer.

Application Identifier	Data Field	Data characteristics Type/length	Description
21	Serial No.	n2+an...20	Serial number or code assigned by the supplier to an entity for its lifetime
10	Traceability Code	n2+an...20	Traceability code defined by the manufacturer
11	Date Code	n2+n6*	Production Date
8002	Electronic Serial Number	n4+an...20	Electronic Serial Number for Cellular Mobile Telephones
*Note—Date code construction using UCC/EAN Application Identifiers use a two-digit designation for year. Users wishing more information on the UCC/EAN implementation of Year 2000 issues should contact the Uniform Code Council.			

Table 3 Data and Application Identifier Choices for Traceability Code

Traceability information is assigned by the manufacturer or supplier. The maximum length of a single ***Traceability*** data field shall be 18 characters, which excludes the associated Data Identifier or Application Identifier. ***Traceability*** information may be any one of the following data fields: ***lot or batch number, manufacturing location, date of manufacture, serial number, revision level, country of origin***, etc. These individual data fields may also be encoded as a single ***Traceability*** data element. The data element consists of the appropriate Data Identifier or Application Identifier and its associated data. If more ***Traceability*** data is required, then it may be included as additional data fields.

5.1.3.2 Country of Origin

When the Country of Origin Code is used on the label, it shall be in the format shown in Table 4.

Data Identifier	Data Field	Data characteristics Type/length	Description
4L	Country of Origin	an2+an2	The two-character country code as defined by ISO 3166. The country of origin is defined as the manufacturing country wherein the product obtained its present identity as a part, subassembly, or finished product.

Application Identifier	Data Field	Data characteristics Type/length	Description
422	Country of Origin	n3+n3	The three-digit country code as defined by ISO 3166. The country of origin is defined as the manufacturing country wherein the product obtained its present identity as a part, subassembly, or finished product.

Table 4 Data and Application Identifier Choices for Country of Origin

5.1.4 Syntax

5.1.4.1 Linear Bar Code Symbol Data Field Syntax

Data encoded in the U.P.C. Version A/EAN-13 symbology include no identifiers. Data encoded in the Code 39 symbology shall be preceded by a Data Identifier, per ANSI MH10.8.2. Data encoded in UCC/EAN-128 symbology shall be formatted as defined in ANSI/UCC-4 preceded by an Application Identifier. All readers decoding UCC/EAN-128 symbols must be equipped to process Symbology Identifiers and pass the Symbology Identifier "]C1" as a preamble to the UCC/EAN-128 symbol's data stream. Data encoded in Code 128, not using UCC/EAN Application Identifiers shall be preceded by a Data Identifier, per ANSI MH10.8.2. Data encoded in UPC-A symbology shall be in accordance with ANSI/UCC-1.

5.1.4.1.1 Concatenation of Multiple Data Fields

When concatenating data in a linear bar code symbol the total length should be limited to 25 data characters, not including the associated Data Identifiers and Application Identifiers. This character count is exclusive of overhead characters. If the length exceeds the 25-character maximum message length, two-dimensional symbols should be used.

a) When concatenating data in a linear bar code message, the appropriate data element separator shall be used in accordance with the specific industry standard. The maximum length of the concatenated data field is limited by the symbology, the reading technology, and the available space.

b) Specific Data or Application Identifiers are assigned to accommodate concatenation of specific fixed length data fields.

c) When variable length data fields need to be concatenated using the Code 39 symbology, the plus "+" character (ASCII Decimal 43) should be used to delineate between data fields, per ANSI MH10.8.2.

d) When multiple variable length data fields need to be concatenated using the Code 128 symbology with Data Identifiers, the plus "+" character (ASCII Decimal 43) should be used to delineate between data fields, per ANSI MH10.8.2.

e) When multiple variable length data fields need to be concatenated using the UCC/EAN-128 symbology, the function one "FNC1" character (transmitted as "$^{G}_{S}$" ASCII Decimal 29) is used to delineate between data fields. (See ANSI / UCC 4).

5.1.4.2 Two-dimensional Symbology Data Field Syntax

Messages compliant with this standard shall use the syntax identified in ANSI MH10.8.3. The message Header (first 7 characters "[)>$^{R}_{S}$06$^{G}_{S}$") and message Trailer (the last 2 characters "$^{R}_{S}$$^{E}_{O}$$_{T}$") are fixed for this application, in accordance with the ANSI MH10.8.3M standard, when Data Identifiers are used within the message. The Message Header (first 7 characters "[)>$^{R}_{S}$05$^{G}_{S}$") and Message Trailer (the last 2 characters "$^{R}_{S}$$^{E}_{O}$$_{T}$") are fixed for this application, in accordance with the ANSI MH10.8.3M standard, when Application Identifiers are used within the message. The "$^{R}_{S}$" character is ASCII/ISO 646 Decimal 30. The "$^{E}_{O}$$_{T}$" character is ASCII/ISO 646 Decimal 04. All characters supported by this standard are shown in Annex C.

When combining data fields within a two dimensional symbol, the "$^{G}_{S}$" (ASCII/ISO 646 Decimal 29) character shall be used with the appropriate Data or Application Identifier to identify each of the combined fields.

5.2 General Layout and Location - Common Requirements

5.2.1 Layout

Layout refers to the positioning of the fields on the label. Layout of bar code symbols or two dimensional symbols will depend on the available space on the product and other factors such as customer labeling requirements.

5.2.2 Location
Location refers to the positioning of the label on the product. Each label should be located in a position which facilitates scanning.

5.2.3 Titles

5.2.3.1 Bar Code Symbol Titles
Titles are recommended for all bar code fields. When Data Identifiers are used the title shall include the appropriate Data Identifier, enclosed in parentheses, e.g., (1P) PART # SPLR. When Application Identifiers are used the AI is part of the human readable interpretation, not as part of the title. Titles shall be in accordance with ANSI/MH10.8.2. Titles may be positioned above or below the bar code symbol in accordance with industry guidelines and application standards.

If the real estate available for marking is insufficient to support the marking of the title and the user is employing linear bar code symbols, the title may be abbreviated to only include the Data Identifier enclosed in parentheses. In extreme cases of insufficient real estate for marking the title may be eliminated.

5.2.3.2 Two-dimensional Symbol Titles
When two-dimensional symbologies are used, the appropriate title should be included as follows:

a) For symbols with data that is only to be used by the supplier, the title “SPLR” should be displayed in human readable text.

b) For symbols with data that is only to be used by the customer, the title “CUST” should be displayed in human readable text.

c) For symbols with data to be used by both supplier and customer, the title should be represented as "SPLR/CUST".

If the real estate available for marking is insufficient to support the marking of the title and the user is employing two-dimensional symbols, the title may be eliminated.

5.2.4 Human readable interpretation
For linear bar code symbols, the human-readable interpretation of the data encoded shall be printed legibly. The recommended height of the text characters is 2.0 mm (0.080 inch). The minimum height of the text characters shall be 1.25 mm (0.050 inch).

For bar code symbols, when Data Identifiers are used, the human-readable interpretation shall include all of the data within the bar code symbol less the Data Identifier. See Figure 1.

Figure 1 Label Example with Data Identifier in Bar Code Symbol

When an Application Identifier is used, the human-readable interpretation shall include the data as well as the Application Identifier in parentheses. See Figure 2.

Figure 2 Label Example with Application Identifier in Bar Code Symbol

For two dimensional symbologies, pertinent portions of the data should be shown in human-readable form, however, human-readable interpretation of two-dimensional symbols is not mandatory.

5.3 Symbol Requirements - Common Requirements

5.3.1 Linear Bar Code Symbol Requirements

The linear symbologies referenced in this document are Code 39, U.P.C. Versions A and E, EAN-13, UCC/EAN-128, Code 128, and the EAN.UCC RSS family. Users contemplating applications of Code 128 with Data Identifiers should become familiar with the issues identified in Annex F. In the future all purchased equipment should be capable of printing, reading, and verifying all linear symbologies identified in this standard. See Figures 3-8.

Figure 3 U.P.C. Version A Symbol

Figure 4 EAN-13 Symbol

Figure 5 UCC/EAN 128 Symbol

Figure 6 Code 39 Symbol

(1P) PART # SPLR **MH80312**

Figure 7 Code 128 Symbol

Figure 8 UCC RSS-14 Symbol

5.3.1.1 "X" Dimension
The narrow element dimension (X dimension) range should be from 0.19 mm (0.0075 inch) to 0.38 mm (0.015 inch) as determined by the printing capability of the supplier/printer of the label. Conformance to bar code print quality requirements shall be determined according to Section 5.3.1.4.

For on-demand printing of U.P.C. Version A and EAN-13 symbols the narrow element dimension range should be from 0.25 mm (0.010 inch) to 0.33 mm (0.013 inch).

5.3.1.2 Symbol Height
Bar code symbol height should be no less than 15 percent of the length of the bar code symbol.

U.P.C. Version A and EAN-13 symbols symbol height range should be from 20.73 mm (0.816 inch) to 25.91 mm (1.020 inch).

5.3.1.3 Quiet Zone
The linear symbol should have minimum quiet zones of 0.25 inch (6.4 mm) adjacent to the start and stop characters. To enable the user to easily scan the bar code symbol, quiet zones shall be a minimum of ten times the narrow element width (X dimension).

U.P.C. Version A and EAN-13 symbols shall have quiet zones as follows:
a) EAN-13 symbols: left, 11X; right, 7X;
b) UPC-A symbols: 9X

5.3.1.4 Print Quality
Linear bar code print quality shall be measured in accordance with ANSI X3.182 in the **visible light range (660 nm).** The minimum print quality grade shall be **C (1.5)** using the appropriate measuring aperture as recommended in the ANSI X3.182 standard. When measuring U.P.C.-A, EAN-13, or EAN-8 symbols the recommended aperture size is 0.006" (0.0152 mm).

When symbols are intended to be read through translucent packaging, the minimum symbol grade shall be met when scanned through the packaging. This requirement is to ensure that the symbol can be read when scanned through protective packaging, such as an ESD container for circuit boards.

5.3.2 Two-Dimensional Symbol Requirements
The two-dimensional symbols referenced in this document are Data Matrix ECC 200 and MicroPDF417. The encoding of data in Data Matrix ECC 200 shall be in accordance with *AIM International Technical Specification - International Symbology Specification - Data Matrix* using ECC 200. The encoding of data in MicroPDF417 shall be in accordance with *AIM International Technical Specification - International Symbology Specification – MicroPDF417*. The encoding of data shall follow the ANSI MH10.8.3M/ISO 15434 message format and syntax rules.

5.3.2.1 Data Matrix Symbol Requirements
The Data Matrix symbols referenced in this document are defined in the *International Symbology Specification – Data Matrix – ECC 200.*

Figure 9 Data Matrix ECC 200 Symbol

5.3.2.1.1 "X" Dimension
The appropriate feature size for a symbol is determined by many factors including marking area available, surface type, environment and reading device(s) used. It is recommended that the user implement their system using the largest cell size that will fit in the available area. The minimum open system "X" Dimension shall be 0.13 mm (0.005 inch). "X" Dimension sizes below 0.19 mm (0.0075 inch) or greater than 0.38 mm (0.015 inch) are not recommended because these symbols may be difficult to scan in an open systems environment. Regardless of the element width the symbol shall meet the Print Quality requirements of Section 5.3.2.1.6.

5.3.2.1.2 Element Height
The Data Matrix symbol should have a bar height (height of the symbol element) to be equal to the width of the narrow element ("X" dimension).

5.3.2.1.3 Symbol Size
The symbol size should not be greater than 12 mm by 12 mm. The reason for this stipulation is to establish a known field of view for reading the label or mark.

The user should implement their system using the largest "X" Dimension that will enable the symbol to fit in the available area, up to the maximum dimensions shown in this table. This will allow for the best possible scanner performance. The particular symbol size that is printed will depend on the amount and type of data encoded. The character count in Table 1.1A includes data overhead characters (specifically, Message Header, Data Identifiers, Data Element Separators, Data and Message Trailer Characters). See Table 5.

	"X" Dimension				
Symbol Size (with Quiet Zone)	**0.127 mm (0.005 inch)**	**0.150 mm (0.006 inch)**	**0.175 mm (0.007 inch)**	**0.200 mm (0.008 inch)**	**0.250 mm (0.010 inch)**
3 mm x 3 mm	43	25	10	6	3
4 mm x 4 mm	64	52	31	25	10
5 mm x 5 mm	127	64	64	43	25
6 mm x 6 mm	214	127	91	64	43
7 mm x 7 mm	304	214	127	91	64
10 mm x 10 mm	550	418	214	127	91
12 mm x 12 mm	862	550	418	304	214

Table 5 Data Matrix ECC200 Alphanumeric Data Capacity

5.3.2.1.4 Quiet zone
The Data Matrix ECC200 symbol should have minimum quiet zones of one (1) cell width on all four sides of the symbol. It is not the intent of this standard to require additional quiet zone beyond the minimum required by *AIM International Technical Specification - International Symbology Specification - Data Matrix*

5.3.2.1.5 Error Correction Level
The Data Matrix symbol shall have an error correction level of ECC200 as defined in the *AIM International Technical Specification - International Symbology Specification - Data Matrix.*

5.3.2.1.6 Print quality
The Data Matrix ECC200 symbol shall have a minimum Print Quality of 1.5/05/660, where the minimum grade is 1.5 (C), measured with an aperture size of 0.127 mm (0.005 inch), with a lightsource wavelength of 660 nm ±10 nm. The methodology for measuring the print quality shall be as specified in *AIM International Technical Specification - International Symbology Specification - Data Matrix* and ANSI X3.182.

The minimally acceptable grade of 1.5 applies to the final symbol on the product at the point of receipt. It is recommended that the symbol grade, at the point of printing the symbol, be equal to or exceed 2.5 to allow for process variations and possible degradation from packaging, storage, shipping, and handling.

When symbols are intended to be read through translucent packaging, the minimum symbol grade shall be met when scanned through the packaging. This requirement is to ensure that the symbol can be read when scanned through protective packaging, such as an ESD container for circuit boards.

5.3.2.1.7 Encryption
Encryption shall not be used for mandatory data fields.

5.3.2.1.8 Character set
The character set shall be upper case alphabetic characters, numeric digits, and the eight characters (-, ., Space, $, /, +, *, and %), as well as the recommended field separators, record separators, segment terminators and compliance indicator. A table of these characters and their hexadecimal and decimal equivalent is included as Annex C. It is recommended that the resultant data stream from scanning a Data Matrix symbol follow the syntax described in ANSI MH10.8.3M/ISO 15434.

5.3.2.2 MicroPDF417 Symbol Requirements
The MicroPDF417 symbols referenced in this document are defined in the *International Symbology Specification – MicroPDF417.* See Figure 10.

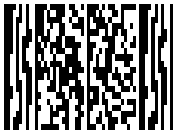


Figure 10 MicroPDF417 Symbol

5.3.2.2.1 "X" Dimension
The appropriate feature size for a symbol is determined by many factors including marking area available, surface type, environment and reading device(s) used. It is recommended that the user implement their system using the largest cell size that will fit in the available area. The minimum open system "X" Dimension shall be 0.127 mm (0.005 inch). "X" Dimension sizes below 0.25 mm (0.010 inch) are not recommended because symbols with these small "X" dimensions cause a reduced depth of field and may be difficult to scan in an open systems environment. Regardless of the element width the symbol shall meet the Print Quality requirements of Section 5.3.2.2.5

5.3.2.2.2 Element Height
The MicroPDF417 symbol should have a bar height (height of the symbol element) two times the width of the narrow element ("X" dimension).

5.3.2.2.3 Quiet Zone
MicroPDF417 symbols should have minimum quiet zones of one (1) cell width on all four sides of the symbol. It is not the intent of this standard to require additional quiet zone beyond the minimum required by the *International Symbology Specification - MicroPDF417.*

5.3.2.2.4 Error Correction Level
For MicroPDF417 symbols error correction levels are automatically selected in accordance with the *International Symbology Specification - MicroPDF417.*

5.3.2.2.5 Print Quality
Two-dimensional symbols compliant with this section shall have a minimum Print Quality of 1.5/05/660, where the minimum grade is 1.5 (C), measured with an aperture size of 0.127 mm (0.005 inch), with a lightsource wavelength of 660 nm ±10 nm. The methodology for measuring the print quality shall be as specified in ANSI X3.182 and the *International Symbology Specification - MicroPDF417.*

The minimally acceptable grade of 1.5 applies to the final symbol on the product at the point of receipt. It is recommended that the symbol grade, at the point of printing the symbol, be equal to or exceed 2.5 to allow for process variations and possible degradation from packaging, storage, shipping, and handling.

When symbols are intended to be read through translucent packaging, the minimum symbol grade shall be met when scanned through the packaging. This requirement is to ensure that the symbol can be read when scanned through protective packaging, such as an ESD container for circuit boards.

5.3.2.2.6 Encryption
Encryption shall not be used for mandatory data fields.

5.3.2.2.7 Character Set
The character set shall be upper case alphabetic characters, numeric digits, and the eight characters (-, ., Space, $, /, +, *, and %), as well as the recommended field separators, record separators, segment terminators and compliance indicator. A table of these characters and their hexadecimal and decimal equivalent is included as Annex C.

5.3.3 Composite Symbol Requirements
The Composite symbols referenced in this document are the UCC/EAN Composite Symbols, as defined in *International Symbology Specification - UCC/EAN Composite Symbols,* consisting of either a U.P.C. Version A, U.P.C. Version E, EAN-13, EAN-8, UCC/EAN-128, EAN.UCC-14 , RSS-14, RSS-14 Stacked, or RSS-14 Limited symbols as the Composite Linear Component and a variant of MicroPDF417 (CC-A and CC-B) or PDF417 (CC-C) as the 2D Composite Component. The 2D Composite Component cannot be used by itself.

5.3.3.1 Composite Symbols Dimensions
The dimensions of composite symbols will be determined by a number of factors. The width of the symbol will be determined by the choice of linear symbology. The height of the symbol will be determined by width of the chosen linear symbol and the amount and mix of the alpha and numeric data to be encoded. A wider linear symbol allows more data to be encoded in each row of the 2D Composite Component. For example, an RSS-14 Limited symbol is wider than an RSS-14 Stacked symbol. Numeric data can be encoded more efficiently than alphanumeric data and will result in a smaller symbol.

5.3.3.2 Cell Size and "X" Dimension
The minimum open system "X" Dimension shall be 0.127 mm (0.005 inch). "X" Dimension sizes of 0.168 mm (0.0066 inch) or greater are recommended because symbols with smaller "X" dimensions cause a reduced depth of field and may be difficult to scan in an open systems environment. Regardless of the element width, the symbol shall meet the Print Quality requirements of Section 5.3.3.5.

5.3.3.3 Symbol Height
The linear components have a minimum symbol height defined in their respective symbology specifications (see Clause 4 References). These minimum heights support all scanning technologies, including wand scanning and omni-directional Point of Sale scanning. For the applications supported by this guideline, a height to width aspect ratio of 15% will provide optimum performance and is recommended when space constraints permit.

The MicroPDF417 based Composite Components (e.g., CC-A and CC-B) shall have a minimum row height (height of the symbol element) of two times the width of the narrow element ("X" dimension). PDF417 based Composite Components shall have a minimum row height (height of the symbol element) of three times the width of the narrow element ("X" dimension).

5.3.3.4 Quiet Zone
The linear components have a minimum quiet zone requirement defined in their respective symbology specifications.

CC-A and CC-B Composite Components have a minimum "1X" left and right quiet zone requirement. CC-C Composite Components have a minimum "2X" left and right quiet zone requirement. No quiet zone is required above or below a UCC/EAN Composite Symbol.

5.3.3.5 Print Quality
UCC/EAN Composite Symbols shall have a minimum Print Quality of 1.5/05/660, where the minimum grade is 1.5 (C), measured with an aperture size of 0.127 mm (0.005 inch), with a lightsource wavelength of 660 nm ± 10 nm. The methodology for measuring the print quality shall be as specified in the ISO/IEC 15416, and the applicable symbology specification.

The minimally acceptable grade of 1.5 applies to the final symbol on the product at the point of receipt. It is recommended that the symbol grade, at the point of printing the symbol, be equal to or exceed 2.5 to allow for process variations and possible degradation from packaging, storage, shipping, and handling.

When symbols are intended to be read through translucent packaging, the minimum symbol grade shall be met when scanned through the packaging. This requirement is to ensure that the symbol can be read when scanned through protective packaging, such as an ESD container for circuit boards.

5.3.3.6 Error Correction Level

CC-A and CC--B Composite Components shall incorporate the number of error correction codewords defined *International Symbology Specification - UCC/EAN Composite Symbols*. CC-C Composite Components shall meet or exceed the minimum error correction level recommended in the ISO/IEC 15438, *Automatic Identification and Data Capture Techniques -International Symbology Specifications PDF 417.*

5.3.3.7 Encryption

Encryption shall not be used for mandatory data fields.

5.3.3.8 Character Set

The character set shall be upper case alphabetic characters, numeric digits, and the six characters (-, ., /, Comma, Space and *), as well as the recommended field separators, record separators, segment terminators and compliance indicator. A table of these characters and their hexadecimal and decimal equivalent is included as Annex C. It is recommended that the resultant data stream from scanning a UCC/EAN Composite Symbol follow the syntax described in ANSI MH10.8.3M/ISO 15434 and not that of UCC/EAN-128 emulation.

6 Industrial to Industrial Requirements

6.1 Purpose

This section provides a set of requirements, which in addition to those within Section 5, are intended to respond to the needs of the industrial to industrial trading channel, namely, where a finished good is provided by one manufacturer to another manufacturer for the production of the second manufacturer's product. This part of this standard does not recommend the use of the UCC/EAN system.

6.2 Data Format

The requirements of Section 5.1.1 within this document shall apply. In addition to those requirements, Data Identifiers are recommended and Application Identifiers may be used only with mutual agreement between trading partners.

6.2.1 Mandatory data fields

The requirements of Section 5.1.2 within this document shall apply. In addition to those requirements, the Dun and Bradstreet Entity ID is recommended to identify the supplier of a product.

When the item identification code is a stand-alone data element the Data Identifier "1P" should be used.

An ***Item Identification Code*** may be concatenated with the supplier identification to produce a unique item identification code. When the item identification codes is concatenated with the supplier identification, the Data Identifier "9P" should be used.

Likewise, variable length examples of a fixed length supplier identification codes concatenated with a variable length alphanumeric item identification codes to provide worldwide item identification uniqueness may be provided with Data Identifiers such as "8P", "9P", and "17P".

6.2.2 Optional Data Fields

The requirements of Section 5.1.3 within this document shall apply.

6.2.3 Data Field Syntax

The requirements of Section 5.1.4 within this document shall apply.

6.2.3.1 Example of Message Syntax Containing Mandatory and Optional Data

The 63 character total message length shown below illustrates what a typical message might look like using the DUNS entity ID for manufacturer identification. This assumes the use of Data Identifiers and a

25 character maximum length ***Item Identification*** and an 18-character maximum length ***Traceability*** identification. See Figure 11.

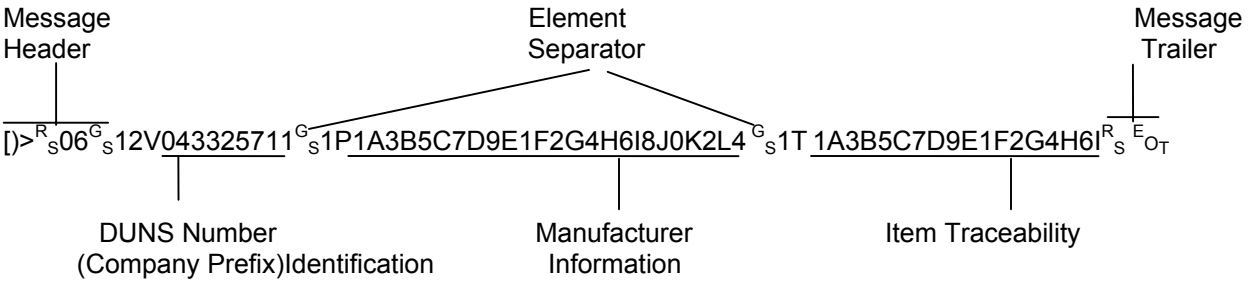


Figure 11 2D Message Syntax Containing Mandatory and Optional Data Example

6.3 General Layout and Location
The requirements of Section 5.2 within this document shall apply.

6.4 Symbol Requirements for Industrial to Industrial Applications

6.4.1 Linear Bar Code Symbol Requirements
The linear symbologies referenced in this Section for Industrial to Industrial applications include Code 39 and Code 128. See Figure 12 and Figure 13. Users contemplating applications of Code 128 with Data Identifiers should become familiar with the issues identified in Annex F.

Figure 12 Code 39 Symbol

Figure 13 Code 128 Symbol

6.4.1.1 "X" Dimension
The requirements of Section 5.3.1.1 within this document shall apply.

6.4.1.2 Symbol Height
The requirements of Section 5.3.1.2 within this document shall apply.

6.4.1.3 Quiet Zone
The requirements of Section 5.3.1.3 within this document shall apply.

6.4.1.4 Print Quality
The requirements of Section 5.3.1.4 within this document shall apply.

6.4.2 Two-dimensional Symbol Requirements
The requirements of Section 5.3.2 within this document shall apply.

6.4.2.1 "X" Dimension
The requirements of Section 5.3.2.1.1 within this document shall apply.

6.4.2.2 Element Height
The requirements of Section 5.3.2.1.2 within this document shall apply.

6.4.2.3 Symbol Size
The requirements of Section 5.3.2.1.3 within this document shall apply.

6.4.2.4 Quiet Zone
The requirements of Section 5.3.2.1.4 within this document shall apply.

6.4.2.5 Error Correction Level
The requirements of Section 5.3.2.1.5 within this document shall apply.

6.4.2.6 Print Quality
The requirements of Section 5.3.2.1.6 within this document shall apply.

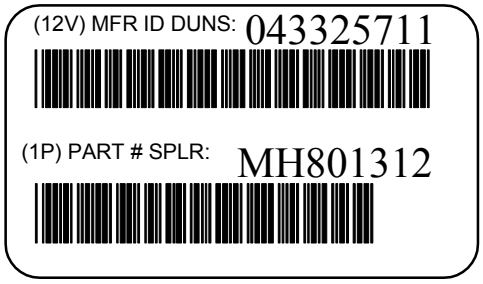
6.4.2.7 Encryption
The requirements of Section 5.3.2.1.7 within this document shall apply.

6.4.2.8 Character set
The requirements of Section 5.3.2.1.8 within this document shall apply.

6.4.3 Sample Labels

6.4.3.1 Sample Labels using Linear Bar Code Symbols
See Figure 14 for sample labels showing the mandatory data fields with linear bar code symbols. This label sample shows the supplier identification code & item identification denoted by the Data Identifier **12V** & **1P** in the bar code and the data field title. Also shown is the combined data structure encoded with a single Data Identifier.

Two Symbols



One Symbol Combining Supplier & Product ID

Figure 14 Sample Labels—Mandatory Data Linear Bar Code Symbols

6.4.3.2 Mandatory Data Encoded in a Two-dimensional Symbol
See Figure 15 for a sample label showing the mandatory data fields of supplier identification, and item code encoded in Data Matrix ECC200 (data structure employs Data Identifiers).

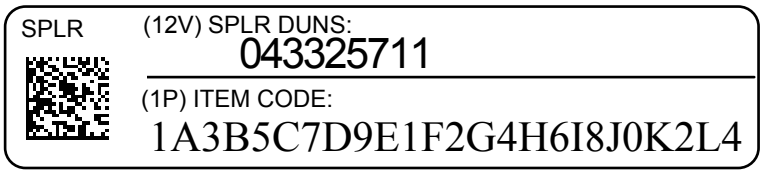


Figure 15 Minimum Sample Label—Mandatory Data in Two-Dimensional Symbol

6.4.3.3 Mandatory and Optional Data Fields Encoded in a 2D Symbol

See Figure 16 for a sample label showing recommended and optional data with product identification / supplier identification combined in a single symbol, along with traceability number, and country of origin; all encoded in Code 39 with ANSI MH10.8.2 Data Identifiers.

The sample label in Figure 16 shows equivalent data in a single symbol encoding the minimum data fields of supplier identification, item code, and traceability number encoded in Data Matrix ECC200 (data structure employs Data Identifiers).

Figure 16 Sample Label—Mandatory & Optional Data in a 2D Symbol

7 Consumer Electronics Requirements

7.1 Purpose

This section provides a set of requirements, which in addition to those within Section 5, are intended to respond to the needs of the consumer electronics trading channels, namely, where a finished good is provided by a manufacturer, through a distributor, reseller, other retail oriented means, or directly to the end user/consumer of electronic product.

7.2 Data Format

7.2.1 General Format

This label will accommodate both mandatory and optional data fields. The maximum length of each discrete data field shall be 25 data characters unless otherwise specified. This character count is exclusive of overhead characters.

Overhead characters include identifiers and symbology overhead characters. It is important that the appropriate identifiers [i.e., Application Identifiers (AIs) and symbology overhead (e.g., Start and Stop Characters, Check Characters, Field Separators, Finding Patterns, Error Correction Characters, etc.) are utilized in accordance with their associated industry and symbology standards.

All mandatory data fields shall be machine-readable. Recommended data fields should be machine-readable.

Where appropriate, human-readable interpretations are covered in this standard.

7.2.2 Mandatory Data Fields

a) - Supplier Identification Code
b) - Item Identification Code

Consumer electronic (Section 7) products utilize either the U.P.C. Version A/EAN-13 data structure or the UCC/EAN-14 data structure, combining the supplier identification code and the item identification code in a single data structure.

7.2.2.1 UCC/EAN Product Code

The U.P.C. Version A/EAN-13 and SCC data structures combine the company prefix of the supplier and the item identification code assigned by the supplier. A detailed discussion of UCC/EAN structures appears in Annex E of this standard.

7.2.2.1.1 Company Prefix

The ***Company Prefix*** is assigned by the Uniform Code Council or the supplier's country EAN affiliate.

7.2.2.1.2 Item Code

The combined length of the item code and the company prefix is 12 digits. A right-most digit is a modulus 10 check digit of the prior digits in the data structure. For practical purposes, the U.P.C. Version A/EAN-13 is considered a 13-digit structure. The UCC/EAN-14 is a 14-digit structure, adding a Packaging Indicator at the left-most position.

7.2.2.2 Application Identifiers

See Table 6.

Application Identifier	Data Field	Data characteristics Type/length	Description
N/A	Part Number (Supplier/Item) UPC-12/ EAN-13	n13	UPC-A/EAN-13 Symbology (Combination of Supplier & Item Identification)
01	EAN/UCC-14 (Supplier/Item & Quantity)	N2+n14	UPC-A/EAN-13/EAN/UCC-14 Format with UCC/EAN-128 (Combination of Supplier, Item Identification & Quantity)

Table 6 Application Identifiers for Company Prefix and Item Code

7.2.3 Optional Data Fields

The requirements of Section 5.1.3 within this document shall apply.

7.2.3.1 Traceability Code

The traceability code is assigned by the supplier to identify a unique item or group of entities (e.g., lot, batch, date code, revision level or serial number). The Application Identifiers shown in Annex B represent a partial list of the ANSI MH10.8.2 listing that may be applicable to traceability codes. See Table 7.

Application Identifier	Data Field	Data characteristics Type/length	Description
21	Serial No.	n2+an...20	Serial number or code assigned by the supplier to an entity for its lifetime
10	Lot/Batch Code	n2+an...20	Traceability code defined by the manufacturer
11	Date Code	n2+n6*	Production Date
8002	Electronic Serial Number	n4+an...20	Electronic Serial Number for Cellular Mobile Telephones
8004	Company Prefix + Serial Number	n4+an...30	UCC/EAN Company Prefix and Serial number or code assigned by the supplier to an entity for its lifetime
*Note—Date code construction using UCC/EAN Application Identifiers use a two-digit designation for year. Users wishing more information on the UCC/EAN implementation of Year 2000 issues should contact the Uniform Code Council.			

Table 7 Application Identifier Choices for Traceability Codes

Traceability information is assigned by the manufacturer or supplier. The maximum length of a single traceability data field shall be as shown in the table above which concurs with the ANSI UCC-4 *UCC/EAN-128 Application Identifier Standard*. *Traceability* information may be any one of the following data fields: *lot or batch number, date of manufacture, serial number,* etc.

7.2.3.2 Country of Origin

When the Country of Origin Code is used on the label, it shall be in the format indicated in Table 8.

Application Identifier	Data Field	Data characteristics Type/length	Description
422	Country of Origin	n3+n3	The three-digit country code as defined by ISO 3166. The country of origin is defined as the manufacturing country wherein the product obtained its present identity as a part, subassembly, or finished product.

Table 8 Application Identifier for Country of Origin

7.2.4 Syntax

The data field syntax for linear bar code symbols and for Composite symbols is described in the following sections.

7.2.4.1 Linear Bar Code Symbol Data Field Syntax

Data encoded in the U.P.C. Version A/EAN-13 symbology include no identifiers. Data encoded in UCC/EAN-128 symbology shall be formatted as defined in ANSI/UCC-4 preceded by an Application Identifier. All readers decoding UCC/EAN-128 symbols must be equipped to process Symbology Identifiers and pass the Symbology Identifier "]C1" when as a preamble to the UCC/EAN-128 symbol's data stream. Data encoded in UPC-A symbology shall be in accordance with ANSI/UCC-1, *U.P.C. Symbol Specification.*

7.2.4.1.1 Concatenation of Multiple Data Fields in UCC/EAN-128

When concatenating data in a linear bar code symbol, the total length should be limited to 48 data characters. This character count is exclusive of overhead characters.

When multiple variable length data fields need to be concatenated using the UCC/EAN-128 symbology, the function one "FNC1" character (transmitted as "$^{G}_{S}$" ASCII Decimal 29) is used to delineate between data fields. (See ANSI/UCC 4).

7.2.4.2 Composite Symbol Syntax Requirements

Two syntax formats may be used within the consumer electronics sector. One uses the syntax of the *International Symbology Specification - UCC/EAN Composite Symbols.* The other uses the syntax of ANSI MH10.8.3M/ISO 15434.

7.2.4.2.1 Composite Symbol Syntax

The requirements of Section 5.3.3 shall apply.

The output data stream of a CC-A symbol is identical to the output of a UCC/EAN-128 symbol consisting of multiple data fields. When multiple variable length data fields need to be concatenated using the CC-A Composite Supplement symbology, the function one "FNC1" character (transmitted as "$^{G}_{S}$" ASCII Decimal 29) is used to delineate between data fields. The Composite Primary is always transmitted first, regardless of the order in which the Primary and Supplement were scanned.

The example in Figure 17 shows the output data stream from reading a U.P.C. Symbol (Composite Primary) encoding "0098756100013" and the 2D (Composite Supplement) encoding a production date of 7 November 1998 and a batch number of MH80312110780.

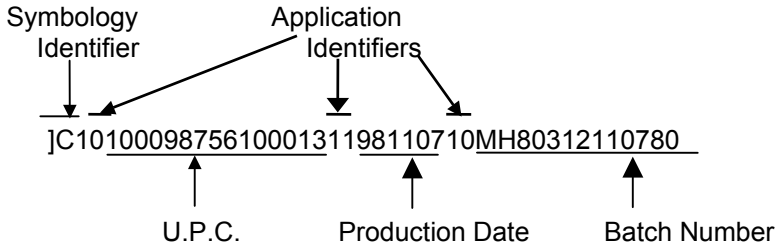


Figure 17 Example—Composite Symbol Syntax

7.2.4.2.2 ANSI MH10.8.3M Syntax

The syntax described in ANSI MH10.8.3M shall be used when the number of data characters is greater that 58 or the symbology being employed is not a composite symbol. When using the ANSI MH10.8.3M syntax for Consumer Electronic product marking, the EAN/UCC Composite Symbology shall be used.

The message Header (first 7 characters "[)>$^{R}_{S}$05 $^{G}_{S}$") and message Trailer (the last 2 characters "$^{R}_{S}$ ^{E}O$_{T}$") are fixed for this application, in accordance with the ANSI MH10.8.3M standard, when Application Identifiers are used within the message. The "$^{R}_{S}$" character is ASCII/ISO 646 Decimal 30. The " ^{E}O$_{T}$ " character is ASCII/ISO 646 Decimal 04. All characters supported by this standard are shown in Annex C.

When combining data fields within a two-dimensional symbol, the "$^{G}_{S}$" (ASCII/ISO 646 Decimal 29) character shall be used with the appropriate Application Identifier to identify each of the combined fields.

7.2.4.2.3 Example of Message Containing Mandatory and Optional Data

The message shown in Figure 18 illustrates what a typical message might look like using the ANSI MH10.8.3M syntax and Application Identifiers. Encoded is the SCC ("00098756100013"), the production date (7 November 1998), the batch number ("MH80312110780"), and the country of origin ("840" = U.S.).

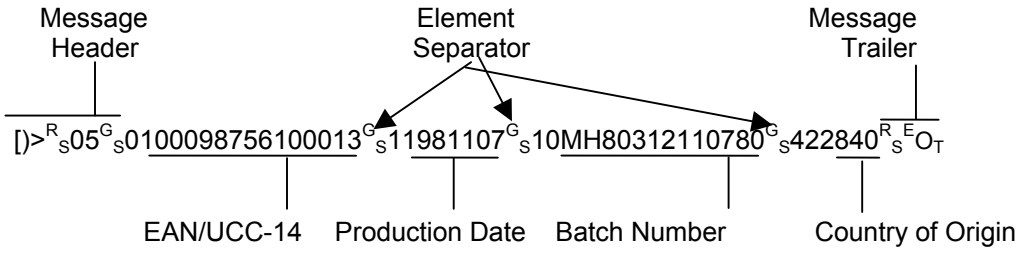


Figure 18 Example—Message Containing Mandatory & Optional Data

7.3 Symbol Requirements for Consumer Electronics

7.3.1 Linear Bar Code Symbol Requirements
The linear symbologies recommended in this section for Consumer Electronics are all symbologies listed in Section 5.3.1.

7.3.1.1 "X" Dimension
The requirements of Section 5.3.1.1 shall apply.

7.3.1.2 Symbol Height
The requirements of Section 5.3.1.2 shall apply.

7.3.1.3 Quiet Zone
The requirements of Section 5.3.1.3 shall apply.

7.3.1.4 Print Quality
The requirements of Section 5.3.1.4 shall apply.

7.3.1.5 Composite Symbol Requirements
The requirements of Section 5.3.3 shall apply.

7.3.2 Sample Labels

7.3.2.1 Minimum data encoded in UCC/EAN-128
See Figure 19 for a sample label showing the mandatory data fields. This label sample shows the supplier identification / item code with Application Identifier "01". Minimum data can also be encoded using U.P.C. Version A or EAN-13. Samples of these symbols can be found in Section 5.3.1.

Figure 19 Sample—Minimum Label Mandatory Data in UCC/EAN-128

7.3.2.2 Mandatory and optional data fields encoded in a Composite Symbol
The sample label in Figure 20 shows recommended and optional data with product identification/supplier identification combined in a single U.P.C. symbol, along with production date and number; encoded in CC-A Composite Supplement with UCC/EAN Application Identifiers.

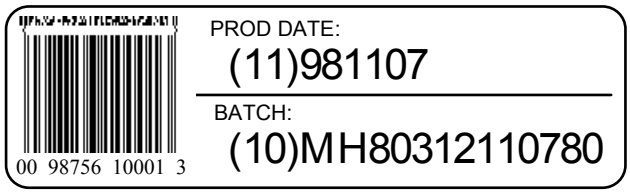


Figure 20 Sample—Mandatory & Optional Data Fields in Composite Symbol

8 Telecommunications Industry Requirements

8.1 Purpose
This section provides a set of requirements, which in addition to those within Section 5, are intended to respond to the needs of the telecommunications industry trading channels.

8.2 Data Format

8.2.1 General Format

This label will accommodate both mandatory and optional data fields. The maximum length of each discrete data field shall be 25 data characters unless otherwise specified. This character count is exclusive of overhead characters.

Overhead characters include identifiers and symbology overhead characters. It is important that the appropriate identifiers (i.e., Application Identifiers [AIs], Data Identifiers [DIs]), and symbology overhead (e.g., Start and Stop Characters, Check Characters, Field Separators, Finding Patterns, Error Correction Characters, etc.) are utilized in accordance with their associated industry and symbology standards.

All mandatory data fields shall be machine-readable. Recommended data fields should be machine-readable.

Where appropriate, human-readable interpretations are covered in this standard.

8.2.2 Mandatory Data Fields

a) - Supplier Identification Code
b) - Item Identification Code

Telecommunications products utilize either or both the U.P.C. Version A/EAN-13 data structure/ UCC/EAN-14 data structure or a 10-character CLEI code.

8.2.2.1 UCC/EAN Product Code

The U.P.C. Version A/EAN-13 and SCC data structures combine the company prefix of the supplier and the item identification code assigned by the supplier. A detailed discussion of UCC/EAN structures appears in Annex E of this standard.

8.2.2.1.1 Company Prefix

The ***Company Prefix*** is assigned by the Uniform Code Council or the supplier's country EAN affiliate.

8.2.2.1.2 Item Code

The combined length of the item code and the company prefix is 12 digits. A right-most digit is a modulus 10 check digit of the prior digits in the data structure. For practical purposes, the U.P.C. Version A/EAN-13 is considered a 13-digit structure. The UCC/EAN-14 is a 14-digit structure, adding a Packaging Indicator at the left-most position.

8.2.2.2 CLEI Product Code

The CLEI code is a 10-character code used to identify a product that is part of a communications network. It identifies communications equipment, in a concise, uniform feature-oriented language, describing product type, features, source document and associated drawings and vintages. The 8th character in the CLEI code can be used to identify the manufacturer of the product.

8.2.2.3 Application Identifiers

See Table 9.

Application Identifier	Data Field	Data characteristics Type/length	Description
N/A	Part Number (Supplier/Item) UPC-12/ EAN-13	n13	UPC-A/EAN-13 Symbology (Combination of Supplier & Item Identification)
01	EAN/UCC-14 (Supplier/Item & Quantity)	N2+n14	UPC-A/EAN-13/EAN/UCC-14 Format with UCC/EAN-128 (Combination of Supplier, Item Identification & Quantity)
9011P	Part Number	n2+an3+an10	10-character CLEI Code for telecommunications equipment

Table 9 Application Identifiers For Supplier ID and Item Code

8.2.2.4 Data Identifiers

See Table 10.

Data Identifier	Data Field	Data characteristics Type/length	Description
3P	Part Number (Supplier/Item) UPC-12/ EAN-13	an2+n13	UPC-A/EAN-13 Symbology (Combination of Supplier & Item Identification)
8P	EAN/UCC-14 (Supplier/Item & Quantity)	an2+n14	UPC-A/EAN-13/EAN/UCC-14 Format with UCC/EAN-128 (Combination of Supplier, Item Identification & Quantity)
11P	Part Number	an3+an10	10-character CLEI Code for telecommunications equipment

Table 10 Data Identifiers for Supplier ID and Item Code

8.2.3 Optional Data Fields

The requirements of Section 5.1.3 within this document shall apply.

8.2.3.1 Traceability Code using Application Identifiers

The traceability code is assigned by the supplier to identify a unique item or group of entities (e.g., lot, batch, date code, revision level or serial number). See Table 11. The Application Identifiers shown in Annex B represent a partial list of the ANSI MH10.8.2 listing that may be applicable to traceability codes.

Application Identifier	Data Field	Data characteristics Type/length	Description
21	Serial No.	n2+a4+an...16	ANSI T1.220 Manufacturer/Supplier code followed by a Serial number or code assigned by the supplier to an entity for its lifetime
10	Lot/Batch Code	n2+an...20	Traceability code defined by the manufacturer
11	Date Code	n2+n6*	Production Date
8002	Electronic Serial Number	n4+an...20	Electronic Serial Number for Cellular Mobile Telephones
8004	Company Prefix + Serial Number	n4+an...30	UCC/EAN Company Prefix and Serial number or code assigned by the supplier to an entity for its lifetime
*Note--Date code construction using UCC/EAN Application Identifiers use a two-digit designation for year. Users wishing more information on the UCC/EAN implementation of Year 2000 issues should contact the Uniform Code Council.			

Table 11 Application Identifier Choices for Traceability Code

8.2.3.2 Traceability Code using Data Identifiers

The traceability code is assigned by the supplier to identify a unique item or group of entities (e.g., lot, batch, date code, revision level or serial number). See Table 12. The Data Identifiers shown in Annex B represent a partial list of the ANSI MH10.8.2 listing that may be applicable to traceability codes.

Data Identifier	Data Field	Data characteristics Type/length	Description
S	Serial No.	an1+a4+an...18	ANSI T1.220 Manufacturer/Supplier code followed by a Serial number or code assigned by the supplier to an entity for its lifetime
1T	Lot/Batch Code	An2+an...20	Traceability code defined by the manufacturer
17D	Date Code	an3+n8	Production Date
22S	Electronic Serial Number	An3+an...20	Electronic Serial Number for Cellular Mobile Telephones

Table 12 Data Identifier Choices for Traceability Code

Traceability information is assigned by the manufacturer or supplier. The maximum length of a single Traceability data field shall be as shown in the tables above which concurs with the ANSI MH10.8.2 *Data Application Identifier Standard*. Traceability information may be any one of the following data fields: lot or batch number, date of manufacture, serial number, etc.

8.2.3.3 Country of Origin

When the Country of Origin Code is used on the label, it shall be in the format indicated in Table 13 when using Application Identifiers.

Application Identifier	Data Field	Data characteristics Type/length	Description
422	Country of Origin	n3+n3	The three-digit country code as defined by ISO 3166. The country of origin is defined as the manufacturing country wherein the product obtained its present identity as a part, subassembly, or finished product.

Table 13 Application Identifier for Country of Origin

When the Country of Origin Code is used on the label, it shall be in the format indicated in Table 14 when using Data Identifiers.

Data Identifier	Data Field	Data characteristics Type/length	Description
4L	Country of Origin	an2+n2	The two-digit country code as defined by ISO 3166. The country of origin is defined as the manufacturing country wherein the product obtained its present identity as a part, subassembly, or finished product.

Table 14 Data Identifier for Country of Origin

8.2.4 Syntax

8.2.4.1 Linear Bar Code Symbol Data Field Syntax

Data encoded in the U.P.C. Version A/EAN-13 symbology include no identifiers. Data encoded in UCC/EAN-128 symbology shall be formatted as defined in ANSI/UCC-4 preceded by an Application Identifier. All readers decoding UCC/EAN-128 symbols must be equipped to process Symbology

Identifiers and pass the Symbology Identifier "]C1" when as a preamble to the UCC/EAN-128 symbol's data stream. Data encoded in Code 128, not using UCC/EAN Application Identifiers shall be preceded by a Data Identifier, per ANSI MH10.8.2. Data encoded in UPC-A symbology shall be in accordance with ANSI/UCC-1, *U.P.C. Symbol Specification.*

8.2.4.2 ANSI MH10.8.3 Syntax for Two-dimensional Symbols
The message Header (first 7 characters "[)>$^{R}_{S}$05 $^{G}_{S}$") and message Trailer (the last 2 characters "$^{R}_{S}$ $^{E}O_{T}$") are fixed for this application, in accordance with the ANSI MH10.8.3 standard, when Application Identifiers are used within the message. The "$^{R}_{S}$" character is ASCII/ISO 646 Decimal 30. The " $^{E}O_{T}$ " character is ASCII/ISO 646 Decimal 04. All characters supported by this standard are shown in Annex C.

The message Header (first 7 characters "[)>$^{R}_{S}$06 $^{G}_{S}$") and message Trailer (the last 2 characters "$^{R}_{S}$ $^{E}O_{T}$") are fixed for this application, in accordance with the ANSI MH10.8.3 standard, when Data Identifiers are used within the message. The "$^{R}_{S}$" character is ASCII/ISO 646 Decimal 30. The " $^{E}O_{T}$ " character is ASCII/ISO 646 Decimal 04. All characters supported by this standard are shown in Annex C.

When combining data fields within a two-dimensional symbol, the "$^{G}_{S}$" (ASCII/ISO 646 Decimal 29) character shall be used with the appropriate Application Identifier to identify each of the combined fields.

8.2.4.2.1 Example of Message Containing Mandatory and Optional Data
The message shown in Figure 21 illustrates what a typical message might look like using the ANSI MH10.8.3M syntax and Application Identifiers. Encoded is the EAN/UCC-14 ("00098756100013"), the production date (7 November 1998), the batch number ("MH80312110780"), and the country of origin ("840" = U.S.).

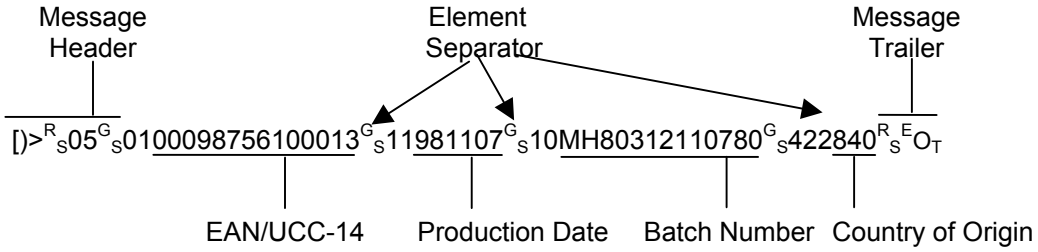


Figure 21 Example—Message Containing Mandatory & Optional Data

8.2.4.3 Two-dimensional Symbols for Telecommunications Products

8.2.4.3.1 MicroPDF417 Symbol Requirements
The requirements of Section 5.3.2.2 within this document shall apply.

8.2.4.4 TCIF Linked Code 39 - Transitional Symbology for Migrating to MicroPDF417
The Telecommunications Industry Forum (TCIF) has developed a strategy for migrating to MicroPDF417 two-dimensional symbology for products which have been assigned CLEI codes. This migration strategy uses the existing Code 39 CLEI code label and incorporates a MicroPDF417 symbol and a special link character in approximately the same label area. The resulting combined symbol is called the **TCIF Linked Code 39** ("TLC39") symbol. The use of this symbology shall be discontinued after October 1, 2005 at which time the use of MicroPDF417 shall replace the use of TCIF Linked Code 39. This Section will help suppliers and users benefit from product marking with two-dimensional symbols while maintaining compatibility with data collection systems designed to accept data from existing linear bar code symbols.

The strategy allows suppliers to encode a serial number and other optional data elements in a MicroPDF417 symbol that is "logically linked" to the current Code 39 label encoding a six-digit ECI (Equipment Catalog Item) number.

Existing scanning equipment will still be able to scan the CLEI code and transmit the six-digit ECI as before. New scanners can be modified to recover both the CLEI code and the supplementary information, and to transmit all of the encoded data in a choice of formats.

A sample TCIF Linked Code 39 symbol is shown in Figure 22. The Code 39 linear bar code encodes the ECI **123456** (the full CLEI code is still printed in the human-readable). The single Code 39 character to

the right of the linear bar code encodes the letter “T” denoting this TCIF application. The MicroPDF417 portion above the linear Code 39 symbol encodes the serial number **ABCD12345678901234.**

Figure 22 Example--TCIF Linked Code 39 Symbol

8.2.4.4.1 Encoding a TCIF Linked Code 39 symbol

Special encoding software is required to encode a TCIF Linked Code 39 symbol. Encoding software designed for this TCIF application needs to perform the following steps:

1. Encode the six-digit ECI number as a standard Code 39 symbol (per ISO/IEC 16388 symbology specification for Code 39).
2. If no serial number or other optional data is required, then encoding is complete – do not perform the remaining steps of this section.
3. If optional data needs to be encoded, first validate the input data, to ensure that it fully complies with the rules of Section 8.2.4.4. If the data matches the TCIF format, proceed with the remaining steps.
4. Encode a link flag immediately to the right of the Code 39 symbol’s right Quiet Zone (nominally, 10X to the right of the last bar of the Code 39 symbol, but may be up to 15X to the right). For the TCIF application, this link flag is the single Code 39 symbol character (5 bars and 4 spaces) representing the letter ‘T’. An additional Quiet Zone (minimum 1X) is required to the right of this link flag. The link flag uses the same X dimension and wide-to-narrow ratio as the body of the Code 39 symbol. As is shown in Figure 23, the link flag is taller than the body of the Code 39 symbol, so that the link flag will be detected within corner-to-corner scans of the Code 39 symbol. The required minimum extensions of the link flag depend on the Code 39 symbol’s length and height. The calculation of the upward extension is given below; an equal downward extension of the link flag is also required. Refer to the Figure 23, which shows a maximum-angle scan line through a Code 39 symbol, and shows the minimum height extension to the top of the link flag:

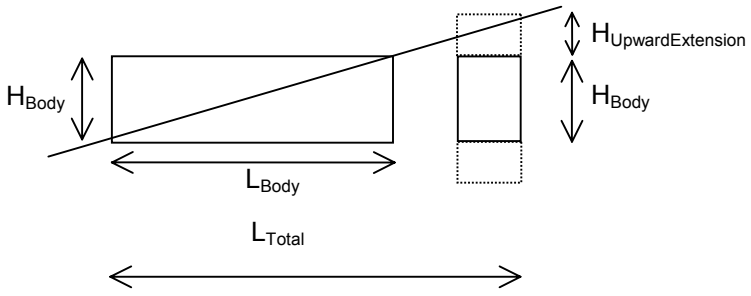


Figure 23 TLC 39 Symbol Aspects

As can be seen from Figure 23:

$$H_{Body} / L_{Body} = (H_{UpwardExtension} + H_{Body}) / L_{Total}$$

The minimum upward extension is therefore calculated as:

$$H_{UpwardExtension} = L_{Total} * (H_{Body} / L_{Body}) - H_{Body}$$

Where:

H_{Body} is the height of the body of the Code 39 symbol

L_{Body} is the width of the body of the Code 39 symbol. For the TCIF application, the number of data characters is fixed at 6, and the intercharacter gaps are assumed to be 1X wide. Therefore, the length of the symbol is calculated from X (the nominal narrow element width) and N (the wide-to-narrow ratio) as:

$$L_{Body} = ((3N + 6) * 8X) + 7X$$

L_{Total} is the width of the TLC39 symbol (excluding its outer quiet zones), calculated as:

$$L_{Total} = L_{Body} + 10X + (3N + 6)X$$

The minimum downward extension of the link flag is the same size as the upward extension. It is permissible for either or both of the link flag extensions to be taller than the minimum height.

5. Encode the optional data in a four-column MicroPDF417 symbol above the Code 39 symbol. Alignment and spacing between the two components are not critical. However, the MicroPDF417 symbol shall be horizontally placed within the bounds of the Code 39 symbol (including its 10X Quiet Zones), and the MicroPDF417 symbol shall be vertically placed so that a quiet zone of no more than 5X exists between the MicroPDF417 symbol and the top edge of the Code 39 symbol. To print the smallest possible TCIF Linked Code 39 symbol, the MicroPDF417 symbol shall be printed with the minimum 1X Quiet Zone directly adjacent to the top edge of the Code 39 symbol. The first (leftmost) bar of the MicroPDF417 symbol can be aligned with the first interior space of the Code 39 symbol. The data is encoded into the MicroPDF417 symbol as follows:

a) Before encoding the input data into the MicroPDF417 symbol, perform the following two character conversions on the input, in order to improve the efficiency of encoding. Note that if these conversions are not performed, the result will still be a valid TLC39 symbol, but the symbol may be larger than necessary.

i) For each $^{G}_{S}$ character (ASCII 29) found in the input data, convert that character to an asterisk character (ASCII 42).

ii) For each single digit in the input data that is both preceded and followed by a letter character, convert that digit to a punctuation character according to Table 15.

Isolated digit character	Converted punctuation character	Converted decimal value
0	;	59
1	<	60
2	>	62
3	@	64
4	[	91
5	\	92
6	]	93
7	_	95
8	‘	96
9	~	126

Table 15 Conversion Table for Punctuation Characters

b) Encode a four-column MicroPDF417 symbol whose first codeword is 918 (which is also the link flag specified in the AIM Code 93i specification), and whose second codeword is a mode latch (typically 900 for Text mode, but this is dependent upon the characteristics of the Serial Number to be encoded).

c) Encode the Serial Number (without a leading Data Identifier ‘S’) and any additional data according to the AIM specification for MicroPDF417.

8.2.4.4.2 Decoding a TCIF Linked Code 39 symbol

Special decoding software is required to decode a TCIF Linked Code 39 symbol. Decoding software designed for this TCIF application needs to perform the following steps. Note that the first two major steps

(decoding the Code 39 symbol, and decoding the MicroPDF417 symbol) may be performed in either order.

1. **Decode the Code 39 symbol, and its link flag**. This operation consists of the following sub-steps:

a) Find and decode the body of the Code 39 symbol, in accordance with the AIM Code 39 specification.
b) If the complete decoded message does not consist of a six-digit number, then it is not part of a TCIF Linked Code 39 symbol. Transmit it as a standard Code 39 symbol, and do not perform the remaining steps.
c) If the complete decoded message consists of a six-digit number, then:
   (1) Look past the symbol's right Quiet Zone. If at least 5 more bars and 5 more spaces are present, attempt to decode these as a single Code 39 character, using the same scan direction that was determined from the body of the symbol. If these bars and spaces represent the letter 'T', then a TCIF Linked Code 39 symbol has been detected. Save the six-digit data, but do not transmit the data until the MicroPDF417 portion of the symbol has also been decoded.
   (2) If a 'T' link flag was not decoded next to this six-digit Code 39 symbol, then transmit it as a standard Code 39 symbol, and do not perform the remaining steps. Note: scanners can be programmed to virtually eliminate the possibility of "missing" a printed link flag, by applying a "voting" algorithm, as is commonly done for auto-discriminating the presence of EAN/UPC supplemental blocks.

2. **Decode the MicroPDF417 symbol, and its link flag**. This operation consists of the following sub-steps:

a) Find and decode (to the codeword level) the body of the MicroPDF417 symbol, in accordance with the AIM MicroPDF417 specification.
b) If the first codeword is not 918, then complete the decode process (from codewords to ASCII), and transmit as a standard MicroPDF417 symbol (or as an EAN.UCC Composite, if the first codeword is 920).
c) If the first codeword is 918, then a non-EAN.UCC Composite has been detected. Decode the codewords into bytes, per the standard MicroPDF417 procedures, but do not transmit these bytes until the associated linear portion has also been decoded.

3. **Combine the data from the linear and MicroPDF417 portions of the TCIF Linked Code 39 symbol.** After both steps 1. and 2. above have been completed, perform the following sub-steps:

a) If the linear symbol was not a six-digit Code 39 with a trailing 'T' link flag, this is not a TCIF Linked Code 39 symbol. Transmit the data according to the relevant symbology and/or application specification(s), and do not perform the remaining sub-steps below.
b) Translate the MicroPDF417 symbol characters into ASCII characters, using the standard method described in the AIM specification for MicroPDF417.
c) If the resulting ASCII character sequence contains any asterisk characters, convert these to ASCII **$^{G}_{S}$** characters.
d) If the resulting ASCII character sequence contains any other punctuation characters, convert these to digits according to the encoding table given above.
e) Transmit per the host system requirements using one of the options described in section 8.2.4.4.3 below. For example, the data can be transmitted as a single message, using the ANSI MH10.8.3M (ISO/IEC 15434) 2D syntax as:
   (1) The leading characters of an ISO/IEC 15434 Format 06 message, transmitted as **[)>$^{R}_{S}$06$^{G}_{S}$**
   (2) The ECI code, transmitted as **6P** followed by the six digits encoded in the Code 39 symbol
   (3) A $^{G}_{S}$ character (to separate this data item from the next), followed by the Data Identifier "S"
   (4) The ASCII data that was decoded from the MicroPDF417 symbol.
   (5) A trailing $^{R}_{S}$ $^{E}_{O T}$, to complete the ISO/IEC 15434 Format 06 message.

8.2.4.4.3 Transmitted Data

The following subsection describes the method for transmitting the data from a scanned TCIF Linked Code 39 symbol.

8.2.4.4.3.1 ISO/IEC 15434 (ANSI MH10.8.3) 2D Syntax

Scanners capable of reading a complete TCIF Linked Code 39 symbol must be configured to transmit the data conforming to the ISO 15434 2D syntax. Per the example in Section 8.2.4.4, this would be transmitted as:

[)>$^{R}_{S}$06$^{G}_{S}$6P123456 $^{G}_{S}$ SABCD12345678901234 $^{R}_{S}$ $^{E}O_{T}$

Note that the “06 Format” shown above is used when transmitting data items labeled with Data Identifiers. If the serial number encoded in the 2D portion had begun with a number rather than a letter, the transmission would use an “05 Format” envelope, for transmitting data items labeled with Application Identifiers. For example, a TLC39 symbol encoding an ECI number of “123456” in the Code 39 portion, and encoding a Serial Number of “00123451234567890” in the 2D portion, would be transmitted as:

[)>$^{R}_{S}$05$^{G}_{S}$906P123456 $^{G}_{S}$ 8004001234512345678 90 $^{R}_{S}$ $^{E}O_{T}$

Within an “05 Format” transmission, as shown above, an Application Identifier (AI) of “90” shall precede the Data Identifier (DI) of “6P” that labels the six-digit number encoded in the Code 39 portion of the TLC39 symbol.

8.2.4.4.4 Data Format

The TCIF Linked Code 39 application specifies the use of two required data elements, which may optionally be followed by additional data elements.

a) A six-digit ECI number (representing a CLEI Code).
b) A Serial Number is required. A Serial Number compatible with TLC39 will always begin either with a Data Identifier (DI) of “S” followed by a letter, or with an Application Identifier (AI) of “8004”, followed by a number. In either case, the remaining data of the serial number is alphanumeric, and may be up to 25 characters long. Note that the leading DI of “S”, or the leading AI of “8004”, is not encoded, but will be added to the decoded message before transmission.
c) Additional data items, such as a Country of Origin, may optionally follow the Serial Number. Any such additional items must each be preceded by a DI (if the serial number began with “S”*)* or an AI (if the Serial Number began with “8004”). In either case, each data item (except the last) shall be terminated by an ASCII $^{G}_{S}$ (Decimal 29/Hex 1D) character.

8.3 Symbol Requirements for Telecommunications

8.3.1 Linear Bar Code Symbol Requirements

The linear symbologies recommended in this section for Telecommunications are Code 39, U.P.C. Versions A, EAN-13, UCC/EAN-128, and Code 128.

8.3.1.1 “X” dimension

The requirements of Section 5.3.1.1 shall apply.

8.3.1.2 Symbol Height

The requirements of Section 5.3.1.2 shall apply.

8.3.1.3 Quiet Zone

The requirements of Section 5.3.1.3 shall apply.

8.3.1.4 Print Quality

The requirements of Section 5.3.1.4 shall apply.

8.3.2 Sample Labels

8.3.2.1 Minimum data encoded in UCC/EAN-128

See Figure 24 for a sample label showing the mandatory data fields. This label sample shows the supplier identification / item code with Application Identifier "01". Minimum data can also be encoded using U.P.C. Version A or EAN-13. Samples of these symbols can be found in Section 5.3.1.

Figure 24 Sample Label—Minimum Data in UCC/EAN-128

8.3.2.2 Mandatory and Optional Data Fields Encoded in a UCC/EAN-128
The sample label in Figure 25 shows the CLEI code preceded by the Application Identifier “90” followed by the Data Identifier “11P”.

(9011P) or (90) (11P) A1B2C3DAAA

Figure 25 Sample Label—Mandatory & Optional Data in a UCC/EAN-128

8.3.2.3 Mandatory and Optional Data Fields Encoded in a MicroPDF417 Symbol
The sample label Figure 26shows mandatory and optional data with product identification / supplier identification combined in a single MicroPDF417 symbol, along with unique serial identification and country of origin; encoded in the MicroPDF417 symbol with Data Identifiers.

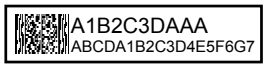


Figure 26 Sample Label—Mandatory & Optional Data in a MicroPDF417 Symbol

The sample label in Figure 27 shows mandatory and optional data with product identification / supplier identification combined in a single MicroPDF417 symbol, along with unique serial identification and country of origin; encoded in the MicroPDF417 symbol with UCC/EAN Application Identifiers.

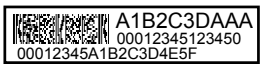


Figure 27 Sample Label—Mandatory & Optional Data in a MicroPDF417 Symbol

Annex A Label Adhesive Characteristics and Mark Durability (Normative)

The following requirements and tests are intended to ensure that labels and marks can withstand extended long term exposure to a variety of indoor environments, which could include an assembly process, remain affixed to products and are scannable for the intended life of the product.

NOTE--Additional tests may be required for specific exports to specific countries.

A.1 General

This standard covers the manufacturing and printing requirements for pressure sensitive adhesive backed bar code labels intended primarily to automate product tracking, inventory control and serialized warranty systems. Labels being tested for conformance to Sections A.3.4 and A.3.5 are intended to withstand harsh environment exposures.

It is the responsibility of the trading partners to agree upon specifications of labels covered by this standard and to test the label in their operating environment prior to acceptance.

All labels shall be easily separable from the release liner without damage, be smudge-resistant and be reasonably flat. Label stock should be examined visually for evidence of particles of paper, dust, or other foreign material that would adversely affect print quality.

Observed or calculated values obtained from analysis, measurement, or test shall be rounded off in accordance with the Rounding-Off Method per ASTM E 29 to the nearest unit in the last right-hand place of figures used in expressing the specified limit.

Where reference is made to an ASTM designation in this standard, the issue listed in the latest published ASTM index to standards shall apply unless otherwise specified.

Generation of voltage levels significant enough to cause ESD and damage to sensitive components can occur when using pressure sensitive labels. If meeting the requirements for ESD protected areas outlined in EIA-625 *Requirements For Handling Electrostatic-Discharge-Sensitive [ESDS] Devices* is required, using static control measures such as static dissipative labels or air ionization may be necessary.

A.2 Requirements

The labels shall be capable of meeting the requirements of Clauses 5.3, Symbol Requirements and A.2, Requirements when tested in accordance with Clause A.3, Methods of Test.

Labels shall not show delamination within the label, blistered areas, or chipped edges. The bar code symbol and all alphanumeric characters printed on each label shall be black. Bar code labels shall be scannable and reasonably free from scratches, marks, dots or misplaced color. All labels should have minimum outside corner radii of 0.03 inch (0.76 mm) unless otherwise specified.

A.2.1 Label Thickness

The maximum overall thickness of the label (not including the release liner) shall be 0.22 mm (0.0085 inch).

A.2.2 Nature of Adhesive

The adhesive shall be pressure sensitive and permanent. It shall be applied in a uniform layer and be free from bubbles and foreign matter.

A.2.3 Adhesion Strength

The minimum initial adhesion strength two hours ±10 minutes after application at ambient room temperature and humidity shall be 0.23 Newton/mm. (25.0 oz/inch).

The minimum adhesion strength after stainless-steel test panel (ASTM D1000, Section 40.2) application and conditioning, per Section A.3.3, shall be 0.44 Newton/mm (40.0 oz/inch).

The labels shall show no evidence of delamination, bubbles, adhesive migration or degraded image quality for either the text or the bar code symbol.

A.2.4 Label Requirements after Conditioning and Printed Circuit Board Processing
The labels shall meet the minimum print quality requirements of Section 5.3.1.4 after conditioning and passing through the printed circuit board processing cycles.

The minimum adhesion strength after test panel application and conditioning shall be 0.44 Newton/mm (40.0 oz/inch).

The labels shall show no evidence of delamination, bubbles, adhesive migration or degraded image quality for either the text or the bar code symbol.

A.2.5 Abrasion
Labels or marks shall be capable of meeting the requirements of the appropriate clauses in 5.3, Symbol Requirements after being subjected to the abrasion test in clause A.3.5.

A.3 Method of Test

A.3.1 Label Thickness
Conformance to the overall label thickness requirements shall use the ASTM D 374, Method C as referenced and modified in ASTM D 1000. Measure the thickness of the label plus the release liner, the release liner alone, and obtain the label thickness by subtraction.

A.3.2 Nature of Adhesive
The general nature of the adhesive shall be permanent, pressure sensitive and free from bubbles and foreign matter.

A.3.3 Adhesive Strength
A minimum label size of 10 mm (0.25 inch) by 25.4 mm (1.0 inch) should be used for adhesion measurements. When possible, it is recommended to use the actual label size intended for the application. Obtain a rubber-covered steel roller (per ASTM D-100 Section 40.3) and prepare at least 2 stainless steel panels (per ASTM D 1000, Method A).

A.3.3.1 Label Test Panel Preparation
Remove labels from the release liner and apply at least four labels to an ASTM stainless steel test panel, and roll per ASTM D 1000 Section 42 taking care to leave approximately 3 mm (0.125 inch) of release liner on each label for clamping purposes.

A.3.3.2 Initial Adhesion Strength
Remove at least three labels from the release liner, apply them to 1 or more stainless steel panels, and roll per ASTM D 1000 Section 42 taking care to leave approximately 3 mm (0.125 inch) of release liner on each label for clamping purposes. In 2 hours (±10 minutes), measure the adhesion strength to conform to the requirements of A.2.3 using a crosshead tensile tester making a 90-degree peel (Figure 28) at a rate of 50 mm (2 inch) per minute using a wire length of approximately 762 mm (30 inch). Calculate the average value of adhesion.

A.3.3.3 Short Term 100 Degrees Celsius - Medium Temp
Place the panel in an oven maintained at 100 degrees Celsius (212 degrees Fahrenheit). At the end of 168 hours, remove the panel and allow it to cool to room temperature. Within 1 to 3 hours of removing the panel from the conditioning chamber, measure the bar code print quality of the labels on one panel in accordance with Section 5.3.1.4 or 5.3.2.1.6 as appropriate and the adhesion strength of the labels on the other panel in accordance with Section A.3.3 to determine conformance with the requirements of Section A.2.3. Determine the adhesion strength by measuring the adhesive strength of at least 3 test labels and averaging the results for the overall value. The labels shall show no evidence of self-lifting, delaminating, smudging, or discoloring after conditioning.

A.3.3.4 Short Term 49 Degrees Celsius 95% RH - Temp/Humidity
Place the panel in an oven maintained at 49 degrees Celsius (120 degrees Fahrenheit) and a controlled relative humidity of 95% non-condensing. At the end of 96 hours remove the panel and allow it to cool to room temperature. Within 1 to 3 hours of removing the panel from the conditioning chamber, measure the bar code print quality of the labels on one panel in accordance with Section 5.3.1.4 or 5.3.2.1.6 as appropriate and the adhesion strength of the labels on the other panel in accordance with Section A.3.3 to determine conformance with the requirements of Section A.2.3. Determine the adhesion strength by measuring the adhesive strength of at least 3 test labels and averaging the results for the overall value. The labels shall show no evidence of self-lifting, delaminating, smudging, or discoloring after conditioning.

A.3.3.5 Long Term 82 Degrees Celsius - Medium Temp
Place the panels in a circulating air oven at 82 degrees Celsius ± 3 degrees Celsius (180 degrees Fahrenheit ± 5 degrees Fahrenheit. At the conclusion of 30 days, measure the bar code print quality of the labels on one panel in accordance with Section 5.3.1.4 or 5.3.2.1.6 as appropriate and the adhesion strength of the labels on the other panel in accordance with Section A.3.3 to determine conformance with the requirements of Section A.2.3. Determine the adhesion strength by measuring the adhesive strength of at least 3 test labels and averaging the results for the overall value. The labels shall show no evidence of self-lifting, delaminating, smudging, or discoloring after conditioning.

A.3.3.6 Long Term 32 Degrees Celsius 95% RH - Temp/Humidity
Place two panels of labels in a circulating air oven at 32 degrees Celsius ± 3 degrees Celsius (90 degrees Fahrenheit ± 5 degrees Fahrenheit and 95 ± 2 percent relative humidity non-condensing. At the conclusion of 30 days, measure the bar code print quality of the labels on one panel in accordance with Section 5.3.1.4 or 5.3.2.1.6 as appropriate and the adhesion strength of the labels on the other panel in accordance with Section A.3.3 to determine conformance with the requirements of Section A.2.3. Determine the adhesion strength by measuring the adhesive strength of at least 3 test labels and averaging the results for the overall value. The labels shall show no evidence of self-lifting, delaminating, smudging, or discoloring after conditioning.

A.3.4 Additional Label Conditioning Tests for Labels or Marks Required to Withstand Printed Circuit Board Processes
The tests described in the subsections to Section A.3.5 represent a baseline to approximate the performance of pressure-sensitive labels in a variety of application processes. These tests are not intended to precisely duplicate the processes encountered in a manufacturing environment. To precisely predict the performance of the label it is recommended to test the process used in the intended manufacturing application.

A.3.4.1 Short Term 260 Degrees Celsius - High Temp - for Bottom Side Labels for Printed Circuit Boards
This test applies only to labels applied to the bottom side of printed circuit boards that are intended to withstand wavesolder processes. Place six labeled, printed ASTM D1000 test panels in an oven maintained at 260 degrees Celsius (500 degrees Fahrenheit). After seven minutes, remove the printed test panels and allow them to cool to room temperature. Within one to three hours, measure the bar code print quality of the labels in accordance with Section 5.3.1.4 or 5.3.2.1.6 as appropriate. Determine the adhesion strength by measuring the adhesive strength of at least 3 test labels using a crosshead tensile tester making a 90-degree peel (Figure 28) at a rate of 50 mm (2 inch) per minute using a wire length of approximately 762 mm (30 inch). Calculate the average value of adhesion to determine conformance to the requirements specified in Section A.2.4. The labels shall show no evidence of self-lifting, delaminating, smudging, or discoloring after conditioning.

If the requirements of Section 5.3 are met, then subject one of the labeled test panels to the short term 100 degree Celsius test described in Section A.3.3.1 and the remaining labeled test panels to the short term 49 degree Celsius 95% RH test described in Section A.3.3.2. Determine conformance to the bar code print quality requirements of Section 5.3.1.4 or 5.3.2.1.6 as appropriate and the adhesion requirements of Section A.2.4.

If the labels pass both short term tests then simultaneously subject a set of labeled test panels that has successfully gone through the short term 260 degree Celsius - High Temp test to each of the Long Term tests described in Section A.3.3.5 and A.3.3.6. Determine conformance to the bar code print quality requirements of clause 5.3.1.4 or 5.3.2.1.6 as appropriate and the adhesion requirements of Section A.2.4.

A.3.4.2 Initial Cleaning
Apply at least four labels to sample printed circuited boards. Subject the circuit board to an aqueous water cleaning process and then proceed to submit the labels to the IR Reflow test described in Section A.3.4.3. The substitution of other cleaners for the aqueous water cleaner may adversely affect the adhesive and/or bar code print quality of the labels. When such a substitution is necessary, the labels shall be inspected to meet the requirements of Section A.2.4 after the initial cleaning cycle.

A.3.4.3 IR Reflow
Subject the labels to an IR reflow process test that meets the conditions in Table 16. The temperatures in Table 16 are the actual board temperatures.

Conditions	Temperature	
	Degrees Celsius	**Equivalent Degrees Fahrenheit**
Preheat Temperature	150 +/- 5	302 +/- 8
Peak Temperature	232 +/- 2.5	450 +/- 4.5
Maximum Temperature Rise	2 degrees per second	4 degrees per second
Time Above 180 degrees Celsius	120 seconds +/- 5 seconds	

Table 16 IR Reflow Conditions & Temperatures

A.3.4.4 Post IR Reflow Cleaning
Within one hour of completing the IR Reflow test, subject the labels to an aqueous water cleaning process and proceed to subject the labels to the Wavesolder test described in Section A.3.4.5. The substitution of other cleaners for the aqueous water cleaner may adversely affect the adhesive and/or bar code print quality of the labels. When such a substitution is necessary, the labels shall be inspected to meet the requirements of Section A.2.4 after the Post IR Reflow cleaning cycle.

A.3.4.5 Wavesolder
Subject the labels to a wavesolder process at the conditions indicated in Table 17. Within one hour of the completion of the Wavesolder test, subject the labels to Post Wavesolder Cleaning as described in Section A.3.4.6.

Conditions	Temperature	
	Degrees Celsius	**Equivalent Degrees Fahrenheit**
Preheat Temperature	90	194
Maximum Preheat Temperature Rise	2 degrees per second	4 degrees per second
Solder Temperature	260	500
Conveyor Angle	7 degree angle from the horizontal plane	
Process Time	4 to 9 minutes	

Table 17 Simulated Wavesolder Cycle Conditions

A.3.4.6 Post Wavesolder Cleaning
Subject the labels to an aqueous water cleaning process. The substitution of other cleaners for the aqueous water cleaner may adversely affect the adhesive and/or bar code print quality of the labels. When such a substitution is necessary, the labels shall be inspected to meet all the requirements of Section A.2.4, after the Post Wavesolder cleaning cycle.

A.3.5 Abrasion test
The Teledyne Taber Abraser Model 5130 has been found to be a suitable apparatus for abrasion testing. The components needed for this abrasion procedure are:

- Specimen Holder E100-125.
- Specimen Plate S-16.
- Abrading Wheel CS-10.

a) The specimen plate shall be clean and dry. Two labels shall be attached to the specimen plate in such a position that the path of abrasion covers a maximum area of the bar code symbol. The labels shall not be trimmed, rather they are allowed to extend beyond the path of the abrasive wheel. The test labels shall be attached to the specimen plate in accordance with ASTM D-1000, where applicable.

b) When possible the test will be conducted in atmosphere controlled to 50 percent humidity and 21-23 degrees Celsius (70-74 degrees Fahrenheit). The test samples should be conditioned in the test atmosphere for at least 24 hours before testing.
c) Select one character from the middle of the bar code symbol on each label and measure all the bars and spaces.
d) The specimen plate shall be rotated beneath the abrasion wheels for a period of 100 cycles ± 1 cycle with 250 grams of weight. After the required number of cycles, remove the specimen plate and examine the test character on each label.
e) Following the abrasion test, linear symbols must meet the print quality requirements of the applicable Section 5.3.1.4. Following the abrasion test two-dimensional symbols must meet the print quality requirements of the applicable Section 5.3.2.1.6.

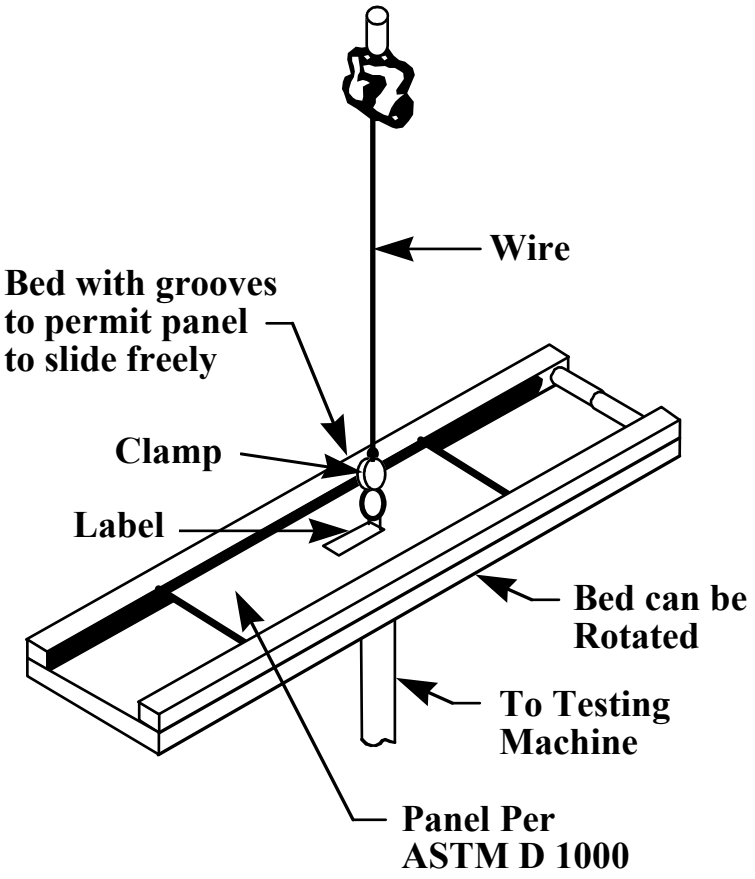


Figure 28 90 Degree Peel Test Apparatus

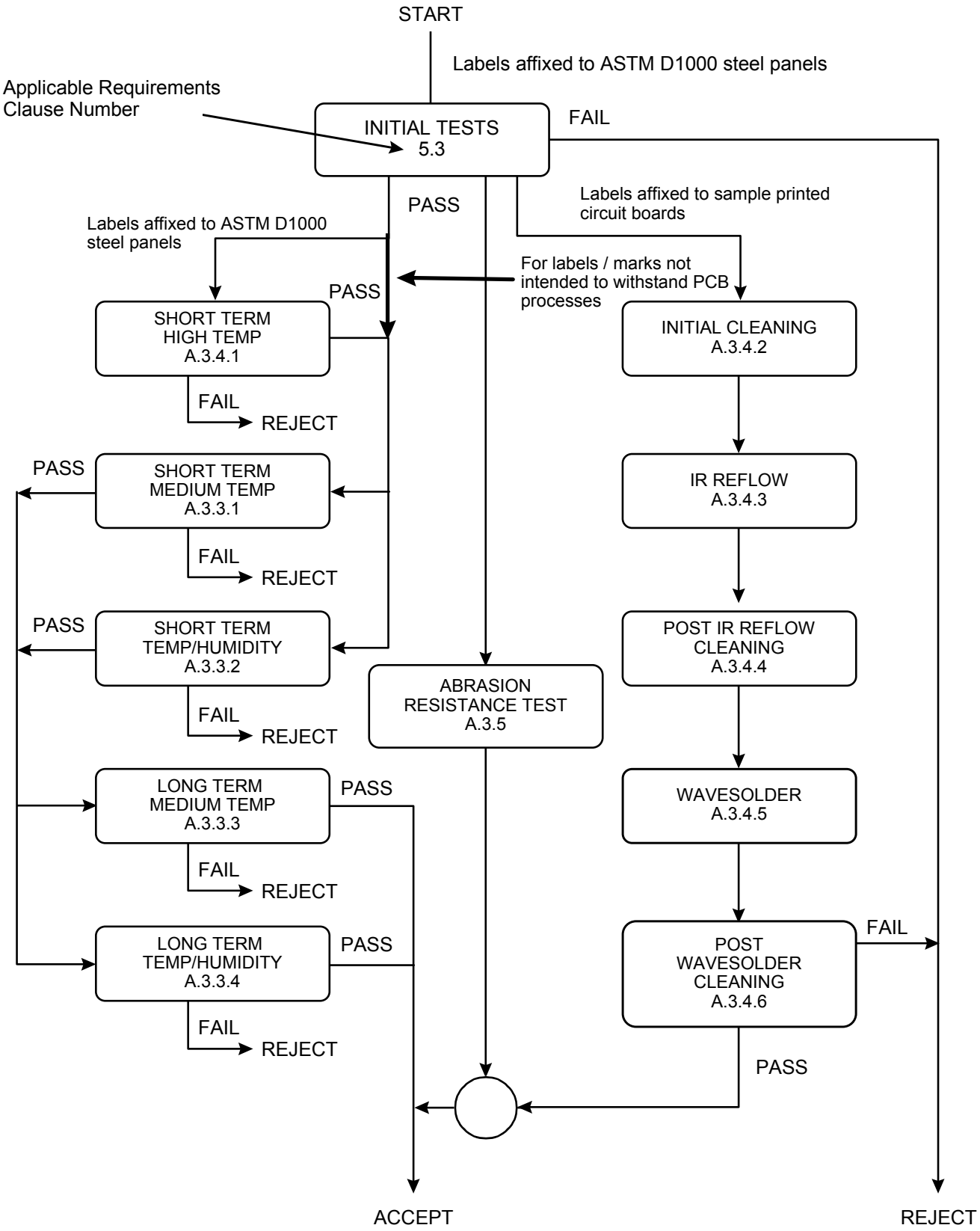


Figure 29 Flow Chart

Annex B Commonly Used Identifiers (Informative, not part of standard)

Data Identifier	Identifier Description	Application Identifier
5D	ISO format YYMMDD immediately followed by an ANSI X12.3 Data Element Number 374 Qualifier providing a code specifying type of date (e.g., manufacture date “094”)	11 (Production Date)
6D	ISO format YYYYMMDD immediately followed by an ANSI X12.3 Data Element Number 374 Qualifier providing a code specifying date type (e.g., manufacture date “094”)	906D
J	Unique license plate number*	00 (SSCC)
4L	Country of Origin, two-character ISO 3166 country code	422 (3-digit ISO 3166 Code)
52L	"Ship To:" - Location code defined by a postal authority (e.g., 5-digit and 9-digit ZIP codes identifying U.S. locations or 6-character postal codes identifying Canadian locations)	420
55L	"Ship To:" - Location code defined by a postal authority in the format: postal code (e.g., 5-digit ZIP codes identifying U.S. locations or 6- or 7-character postal codes identifying United Kingdom locations) followed by two character ISO 3166 country code (e.g., US or GB)	421 (Note--AI uses 3-digit 3166 Code)
N	National/NATO Stock Number (NSN)	90N
P	Item Identification Code assigned by Customer	241
1P	Item Identification Code assigned by Supplier	01 (UCC/EAN-14)
2P	Code assigned to specify the revision level for an Item (e.g., engineering change level, edition, or revision)	240
3P	Combined manufacturer identification code/item code (12 digit U.P.C. data preceded by the digit zero [0])	01 (UCC/EAN-14)
8P	14-digit UCC/EAN format for Product Shipping Container Symbol code structure	01 (UCC/EAN-14)
9P	Combined DUNS-9 supplier identification and item code assigned by the supplier	909P
11P	10-character (alphanumeric) CLEI Code for Telecommunications Equipment	9011P
Q	Quantity, Number of Pieces, or Amount (numeric only) (unit of measure and significance mutually defined)	30
7Q	Quantity, Amount, or Number of Pieces in the format: Quantity followed by the two character ANSI X12.3 Data Element Number 355 Unit of Measurement Code	3xxx
S	Serial number or code assigned by the Supplier to an entity for its lifetime, (e.g., computer serial number, traceability number, contract tool identification)	21
1S	Additional code assigned by the Supplier to an entity for its lifetime (e.g., traceability number, computer serial number)	250
1T	Traceability Number assigned by the Supplier to identify/trace a unique group of entities, (e.g., lot, batch, heat)	10
V	Supplier Code assigned by Customer	90V
1V	Supplier Code assigned by Supplier	01 (UCC/EAN-14)
3V	6-digit Company Code as assigned by the Uniform Code Council (UCC) preceded by the digit zero (0)	01 (UCC/EAN-14)
12V	9-digit DUNS number as assigned by Dun & Bradstreet to identify a manufacturer	9012V
13V	9-digit DUNS number as assigned by Dun & Bradstreet to identify a supplier	9013V
17V	U.S. DoD CAGE Number	9017V
*Note--For a license plate number to be unique world wide requires: 1) A unique number assigned by the trading partner, 2) A unique code assigned to the trading partner by an organization, and 3) A unique code providing global identification of the assigning organization.		

Annex C Subset of ASCII/ISO 646 (Table of Hexadecimal and Decimal Values) (Informative, not part of standard)

HEX	DEC	ASCII / ISO 646	HEX	DEC	ASCII / ISO 646	HEX	DEC	ASCII / ISO 646
00	00	NUL	**30**	**48**	**0**	60	96	'
01	01	SOH	**31**	**49**	**1**	61	97	a
02	02	STX	**32**	**50**	**2**	62	98	b
03	03	ETX	**33**	**51**	**3**	63	99	c
04	**04**	**EOT**	**34**	**52**	**4**	64	100	d
05	05	ENQ	**35**	**53**	**5**	65	101	e
06	06	ACK	**36**	**54**	**6**	66	102	f
07	07	BEL	**37**	**55**	**7**	67	103	g
08	08	BS	**38**	**56**	**8**	68	104	h
09	09	HT	**39**	**57**	**9**	69	105	i
0A	10	LF	3A	58	:	6A	106	j
0B	11	VT	3B	59	;	6B	107	k
0C	12	FF	3C	60	<	6C	108	l
0D	13	CR	3D	61	=	6D	109	m
0E	14	SO	**3E**	**62**	**>**	6E	110	n
0F	15	SI	3F	63	?	6F	111	o
10	16	DLE	40	64	@	70	112	p
11	17	DC1	**41**	**65**	**A**	71	113	q
12	18	DC2	**42**	**66**	**B**	72	114	r
13	19	DC3	**43**	**67**	**C**	73	115	s
14	20	DC4	**44**	**68**	**D**	74	116	t
15	21	NAK	**45**	**69**	**E**	75	117	u
16	22	SYN	**46**	**70**	**F**	76	118	v
17	23	ETB	**47**	**71**	**G**	77	119	w
18	24	CAN	**48**	**72**	**H**	78	120	x
19	25	EM	**49**	**73**	**I**	79	121	y
1A	26	SUB	**4A**	**74**	**J**	7A	122	z
1B	27	ESC	**4B**	**75**	**K**	7B	123	{
1C	**28**	**FS**	**4C**	**76**	**L**	7C	124	|
1D	**29**	**GS**	**4D**	**77**	**M**	7D	125	}
1E	**30**	**RS**	**4E**	**78**	**N**	7E	126	~
1F	**31**	**US**	**4F**	**79**	**O**	7F	127	DEL
20	**32**	**SP**	**50**	**80**	**P**			
21	33	!	**51**	**81**	**Q**			
22	34	"	**52**	**82**	**R**			
23	35	#	**53**	**83**	**S**			
24	**36**	**$**	**54**	**84**	**T**			
25	**37**	**%**	**55**	**85**	**U**			
26	38	&	**56**	**86**	**V**			
27	39	'	**57**	**87**	**W**			
28	40	(	**58**	**88**	**X**			
29	**41**	**)**	**59**	**89**	**Y**			
2A	**42**	*****	**5A**	**90**	**Z**			
2B	**43**	**+**	**5B**	**91**	**[**			
2C	44	,	5C	92	\			
2D	**45**	**-**	5D	93	]			
2E	**46**	**.**	5E	94	^			
2F	**47**	**/**	5F	95	_			

Values shown in **BOLD** are specifically supported by this standard.

Annex D User Guidance for Implementation of the ISO 15434 Data Syntax (Informative, not part of the standard)

ISO 15434 employs as a header, the three character sequence [)>. ISO 15434 further employs the following special characters as separators and terminators: <GS>, <FS>, <RS>, <US>, and <EOT>. These characters may be difficult to implement without specific knowledge of the programming language and character sets employed

Information and guidance on the use of ISO 15434 special characters can be found by contacting specific printer or software manufacturers or by referring to the Internet Web site http://www.autoid.org/ansi_mh10sc8_special_characters.htm.

Annex E Data Format for UPC-A (UPC-12), EAN-13 and UCC/EAN-14 (Informative, not part of standard)

One set of formats recommended within this standard is that of UCC / EAN product identification standards. U.P.C. Version A is often considered a 12-digit code. EAN-13 is a 13-digit code. Coding for levels of packaging above an individual item is referred to as the 14-digit UCC/EAN-14. This coding structure provides for international article uniqueness at all packaging levels. An example of this uniqueness is shown in Table 18. In both examples, all three codes are logically equivalent. If read into a database as a numeric 14-digit field, the data would be right-hand justified, zero-filled to the left. Read into such a numeric field each structure is now identical.

	Position 14	Position 13	Position 12	Position 11	Position 10	Position 9	Position 8	Position 7	Position 6	Position 5	Position 4	Position 3	Position 2	Check Digit
Example 1														
UPC-12			7	9	9	9	9	9	9	9	9	9	9	9
EAN-13		0	7	9	9	9	9	9	9	9	9	9	9	9
UCC/EAN-14	0	0	7	9	9	9	9	9	9	9	9	9	9	9
Example 2														
UPC-12			0	9	8	7	5	6	1	0	0	0	1	3
EAN-13		0	0	9	8	7	5	6	1	0	0	0	1	3
UCC/EAN-14	0	0	0	9	8	7	5	6	1	0	0	0	1	3

Table 18 UCC/EAN Coding Conventions

As shown in Table 18, UCC/EAN coding structures are able to provide for article uniqueness across the supply chain. The United States initially developed UPC-A as a 12-digit code. The symbol is constructed from 30 bars and 29 intervening spaces (Figure 30) where each character is comprised of 2 bars and 2 spaces over seven modules (Figure 31). The symbol uses odd-parity (Table 19 - Number Set A) for the left side of the symbol and even parity (Table 19 E-2 Number Set C) for the right side of the symbol. One of the original purposes for different parity patterns on left and right sides of the symbol was to enable scanners to be able to read the left side with one scanning beam, the right side with another scanning beam, and to enable the decoding software to reassemble the entire coded message.

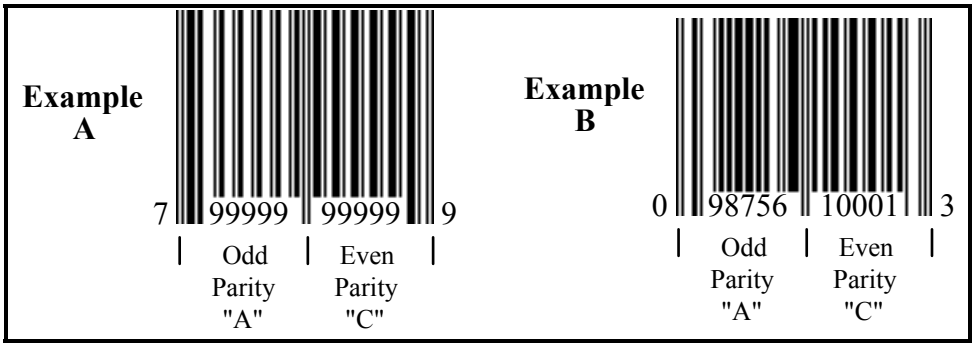


Figure 30 UPC-A Parity

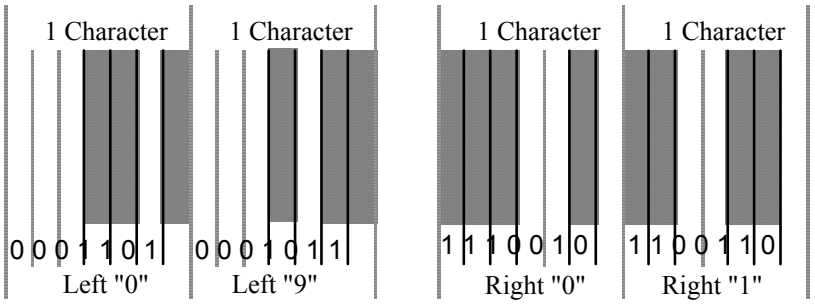


Figure 31 UPC/EAN Character Structure (7 modules – 2 bars & 2 spaces)

Character Value Value	Number Set A	Number Set B	Number Set C
0	0001101	0100111	1110010
1	0011001	0110011	1100110
2	0010011	0011011	1101100
3	0111101	0100001	1000010
4	0100011	0011101	1011100
5	0110001	0111001	1001110
6	0101111	0000101	1010000
7	0111011	0010001	1000100
8	0110111	0001001	1001000
9	0001011	0010111	1110100

Table 19 UCC/EAN Character Parity Assignments

The first digit of UPC-A is referred to as the Number System Character. The Uniform Code Council (UCC) has assigned the Number Systems indicated in Table 20.

Number System	Defined Use
00, 06, 07	General trade product
02	Variable quantity product, e.g., meat and produce
03	National Drug Codes (NDC) or National Health Related Items Code (HRI) on
	Pharmaceutical products including health and beauty aids
04	Used for in-store marking
05	For use on coupons
01, 08, 09	Reserved for future assignment by the UCC
10-13	Newly identified systems for UCC use
14-19	Reserved for future assignment

Table 20 UCC Number Systems

The design of UPC-A in the U.S. led to the desire to have a single system world-wide, though a concern developed that there was insufficient capacity in this 12-digit number to support world-wide numbering. A method was developed to expand the 12-digit code to a 13-digit code through the creation of another number set (Table 19, Number Set B) and deriving the 13th digit through individual character parity of the left side of the symbol. The left-hand side of a UPC-A/EAN-13 symbol encodes six 2 bar / 2 space / over seven modules characters. Both UPC-A and EAN-13 have 30 bars and 29 intervening spaces. Table 21 shows the technique employed by UCC/EAN to derive the 13th digit in EAN-13.

Value of 13th Digit	Parity Number Sets of Digits 7 through 12					
	12	**11**	**10**	**9**	**8**	**7**
0	A	A	A	A	A	A
1	A	A	B	A	B	B
2	A	A	B	B	A	B
3	A	A	B	B	B	A
4	A	B	A	A	B	B
5	A	B	B	A	A	B
6	A	B	B	B	A	A
7	A	B	A	B	A	B
8	A	B	A	B	B	A
9	A	B	B	A	B	A

Table 21 EAN Character 13 Value Assignments

As can be seen from Table 21, when all characters are composed within Number Set A (as is the case in UPC-A), the 13th digit derived for UPC-A is a zero “0”. Therefore, the Number System Characters could be interpreted as “00” to “09” instead of “0” to “9”. Such a method makes UPC-A a 13-digit code, fully compatible with EAN systems.

Table 22 and Table 23 are examples that show how this 13th digit might be developed for both a U.S. and a French company.

Character Position	13	12	11	10	9	8	7	6	5	4	3	2	1
Parity Number Set		A	A	A	A	A	A	C	C	C	C	C	C
Character (Example #A)	0	7	9	9	9	9	9	9	9	9	9	9	9
Character (Example #B)	0	0	9	8	7	5	6	1	0	0	0	1	3

Character position 1 is the Modulus 10 check digit.
Character positions 2 though 6 are the manufacturer assigned item code
Character positions 7 through 11 are the UPC Manufacturer ID Number
Character position 12 is the UPC Number System Character
Character position 13 is the filled "0" value of a 12-digit code in a 13-digit field

Table 22 Example—UPC Parity Structures for EAN Scanning

Character Position	13	12	11	10	9	8	7	6	5	4	3	2	1
Parity Number Set		A	A	B	B	B	A	C	C	C	C	C	C
Character	3	0	9	8	7	5	6	1	0	0	0	1	0

Character position 1 is the Modulus 10 check digit.
Character positions 2 though 11 are the EAN Numbering Organization Assigned Company Code and Item Code
Character position 13 is the derived 13th digit (See Table E-3)

Table 23 Example—EAN Parity Structures

Having developed a way to expand a 12-digit symbol into a 13-digit symbol EAN International set upon a course to assign unique prefices to each of their Numbering Organizations. These prefices are sometimes referred to as country codes. Today there are 74 Numbering Organizations, representing 80 different countries, e.g., a single body, UCC is responsible for assigning codes in both the U.S. and Canada and ANA is responsible for assigning codes in both the U.K. and Ireland. Table E-6 shows a partial list of these EAN Numbering Organizations or “Country Codes”.

	Position 14	Position 13	Position 12	Position 11	Position 10	Position 9	Position 8	Position 7	Position 6	Position 5	Position 4	Position 3	Position 2	Check Digit
U.S. / Canada	0	**0**	**0-9**	N	N	N	N	N	N	N	N	N	N	N
France	0	**3**	**0-7**	N	N	N	N	N	N	N	N	N	N	N
Germany	0	**4**	**0-3**	N	N	N	N	N	N	N	N	N	N	N
Taiwan	0	**4**	**7**	**1**	N	N	N	N	N	N	N	N	N	N
Hong Kong	0	**4**	**8**	**9**	N	N	N	N	N	N	N	N	N	N
U.K. / Ireland	0	**5**	**0**	N	N	N	N	N	N	N	N	N	N	N
Greece	0	**5**	**2**	**0**	N	N	N	N	N	N	N	N	N	N
South Africa	0	**6**	**0**	**0-1**	N	N	N	N	N	N	N	N	N	N
Mexico	0	**7**	**5**	**0**	N	N	N	N	N	N	N	N	N	N
Sweden	0	**7**	**3**	N	N	N	N	N	N	N	N	N	N	N
Singapore	0	**8**	**8**	**8**	N	N	N	N	N	N	N	N	N	N
Australia	0	**9**	**3**	N	N	N	N	N	N	N	N	N	N	N
Malaysia	0	**9**	**5**	**5**	N	N	N	N	N	N	N	N	N	N
Bookland	0	**9**	**7-8**	**8**	N	N	N	N	N	N	N	N	N	N

Table 24 Partial List of EAN "Country Codes"

It should be noted that these "Country Codes" are not the same thing as "Country of Origin". For example, the UCC could assign a manufacturer identification code (company code) for a non-U.S. manufacturer, e.g., located in Canada. Also a German manufacturer can receive a UCC company code. Over the past 10 years some non-U.S. manufacturers were compelled to secure UCC company codes so that U.S. retailers could read the manufacturer's article number into their 12-digit databases.

It should be further noted that while some Numbering Organizations have two digit codes, other countries have three digit codes. Numbering Organizations / Countries which have a large number of manufacturers may have two digits, while Numbering Organizations / Countries with a smaller number of manufacturers may have three. Also, some Numbering Organizations / Countries have a range of two or three digit codes, e.g., the U.S. / Canada has "00" to "09", France has "30" to "37", South Africa has "600" to "601", Bookland has "978" to "979", and so on.

The UCC has historically issued a 6-digit (or from an international perspective - 7-digit) company code to members. The member can then assigns a unique 5-digit code to each of their products. The one-time membership fees shown below were effective on January 1, 1999 but may be adjusted periodically. The fee to join the UCC and secure a Company Code is based on annual U.S. domestic sales.

- $0-2 Million - $300
- $2-5 Million - $800
- $5-50 Million - $1,500
- $50-100 Million - $3,000
- $100-500 Million - $6,000
- >$500 Million - $10,000

If the company has more than 100,000 products (the number of products one can encode in five digits), the UCC will provide additional codes as needed at no additional cost.

Other Numbering Organizations have different rules for the length of the Company Code, Item Code, and dues structures. Some Numbering Organizations charge a membership fee comparable to the UCC Company Code fee **annually**. Other Numbering Organizations assign unique codes to the individual items and may charge annually to maintain that number. However, regardless of the length of the company and/or item codes, all Numbering Organizations are responsible to ensure that a unique 13-digit article number is assigned for each of the member's products.

E.1 Labeling for Containers Having More than One of the Same Article Inside

A single bar code symbol is available within the UCC/EAN system to indicate both article code and quantity within the container. As an example, this may be accomplished by assuming an individual item has a U.P.C. of: 09875610001 3 where the "3" is the check digit. To the U.P.C. add a zero to the left-most position for international compatibility, leaving a data structure as follows:

009875610001 3
Base Number CD

The Base Number is the unique identification of the article. The standard to be applied to the numbering of higher levels of packaging is the UCC/EAN-14, where the base number remains constant over all levels of packaging. The level of packaging is indicated by the addition of a packaging indicator as the left-most position in the code, e.g.,

5 009875610001 8
PI Base Number CD

Packaging Level	*Packaging Indicator (PI)*	*UCC/EAN Base Number*	*Check Digit*
Each	na (0)	009875610001	3
Inner (if applicable)	3	009875610001	4
Shipper (Case)	5	009875610001	8
Pallet (if applicable)	7	009875610001	2

The symbol in Figure 32 shows the UCC/EAN-14 of a case ("5") of a given product. The Application Identifier for the UCC/EAN-14 is “01”. The symbol below follows UCC/EAN-128 rules.

Figure 32 Example—UCC/EAN-14

E.2 Database Design - Product Numbering

Databases should be designed to facilitate 14 digits for item identification (UPC-A., EAN-13, and UCC/EAN-14) and the appropriate lengths and data field attributes of UCC/EAN-128. Assume an individual item has a U.P.C. of:

09875610001 3 where the "3" is the check digit ("CD")

For multi-packs (multiples of the same product, e.g., shelf packs, inner packs, shipping containers and pallets) add a Packaging Indicator (PI) as the left most position, e.g., 5 = Shipping Container. A sample 14-digit record is shown in Table 25.

Packaging Indicator	Base Number	Check Digit
0	009875610001	3
3		4
5		8
7		2
0	009875610002	0
5		5
7		9
..	..	..
0	841000110179	8
3		9
5		3
7		7
..	..	..

Table 25 Sample—14-digit Item ID Record

The PI of a specific base number in the above record points to the database which associates the quantity of the base number with a specific PI for that base number. Databases should be able to identify at a minimum base number, quantity, and description. A sample layout is shown Table 26.

Base Number	PI	Qty	Description
009875610001	0	1	Best 1
	3	6	Inner pack (IP) of 6 - Best 1
	5	36	Shipper (SH) of 6 IP - Best 1
	7	1728	Pallet of 48 SH - Best 1
009875610002	0	1	Best 2
	5	12	Shipper (SH) of 12 – Best 2
	7	480	Pallet of 40 SH - Best 2
..	..	..	..
079999999999	0	1	Excellent A
	3	12	Inner pack (IP) of 12 - Excellent A
	5	144	Shipper (SH) of 12 IP - Excellent A
	7	5184	Pallet of 36 SH – Excellent A
..	..	..	..
841000110179	0	1	M60 ABC1
	3	10	Inner pack (IP) of 10 - M60 ABC1
	5	120	Shipper (SH) of 12 IP - M60 ABC1
	7	5760	Pallet of 48 SH - M60 ABC1
..	..	..	..

Table 26 Sample—PI Functionality

E.3 European Implementation of UCC/EAN-14

EAN, on the other hand, believes that the 14-digit numbering structure simply needs to be unique. Therefore, EAN supports either changing the first digit as described above or changing the item portion of the coding structure. Many in the U.S. believe the EAN method will require far more sophisticated databases than the North American implementation. Presuming that North American business will need to support global numbering, it is suggested that databases be designed to simply handle the 14-digit structure as a unique number (the EAN approach). The alternative is for customers to counsel their suppliers to support the North American approach that permits simplified database design.

Annex F For Applications using Code 39 and Code 128 Symbologies (Informative, not part of standard)

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

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

The options, as defined in clause, are:

1. Application Identifiers with UCC/EAN 128 symbology
2. Data Identifiers with Code 39 symbology
3. Data Identifiers with Code 128 symbology

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

F.1 Systems Where a Single Option is Intended to be Scanned

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

a) For single use of option 1 users may be able to switch off all other symbologies in a decoder, including Code 128, as described in option 3. If the decoder supports Symbology Identifiers the host system shall validate the appropriate Symbology Identifier, specifically **]C1** that signifies a UCC/EAN-128 symbol having a FNC1 character in the first position after the start code.

b) For single use of option 2 users shall switch off all other symbologies in any decoder. If the decoder supports Symbology Identifiers the host computer system shall validate the appropriate Symbology Identifier, specifically **]A0**.

c) For single use of options 3, users will need to implement fully the Symbology Identifier capability. For decoders that do not support Symbology Identifiers, host computer systems will be unable to automatically distinguish between option 1 and option 3. By using the Symbology Identifier, the host computer can distinguish between the different options and filter out the unwanted options. The host computer system shall validate the appropriate Symbology Identifier, specifically **]C0**.

F.2 Systems Where Multiple Options are Intended to be Scanned

Users, who choose to provide their systems with information scanned from labels using two or all of the options, shall fully implement Symbology Identifier capabilities. For decoders that do not support Symbology Identifiers, host computer systems will be unable to automatically distinguish between option 1, option 2, and option 3. By using the Symbology Identifier, the host computer can distinguish between the different options and filter out the unwanted options. The combination of the Symbology Identifier and the FACT Data Identifier or Application Identifier will provide the user with reliable input. Users should consider adopting additional reliability features described in Annex F.4.3 as appropriate.

F.3 Migration Choices

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

a) Code 39 using FACT DIs to UCC/EAN-128 using AIs.
b) Code 39 using FACT DIs to Code 128 using FACT DIs.
c) Code 128 using FACT DIs to UCC/EAN-128 using AIs.

Migration paths require some (usually considerable) period of parallel operation. This has implications for both systems (see Annex F.3.1) and equipment (see Annex F.3.2).

F.3.1 Systems Considerations

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

If there is a change between FACT DIs and UCC/EAN AIs (for example migration choices "A "and "C") the computer systems supporting label production and customers' computer systems need to be upgraded to handle UCC/EAN Application Identifiers prior to any switch.

Each of the migration choices requires the host computer system software to be able to recognize Symbology Identifiers (see Annex F.3.2), which provide the only reliable means of distinguishing between the symbologies and some of their optional features.

Such migrations involve significant changes which need to be mutually agreed to by supplier and customer groups. Failure to do so could result in problems with well-established systems and even to the corruption of data.

F.3.2 Equipment Considerations

F.3.2.1 Printing Considerations

Printing hardware, printing software, and users implementing printing hardware and software must be capable of producing the new format symbols by including the FACT Data Identifiers and UCC/EAN-128 Application Identifiers correctly and generating the correct symbol.

F.3.2.2 Decoder Considerations

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

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

NOTE--Migration choice "C" requires a different decoder setting between the old and new standards.

Not all decoders are capable of transmitting Symbology Identifiers. The use of non-conforming equipment in a system with the old and new symbologies could result in the inability to correctly distinguish between them. Some decoders may be upgradable, others may not be upgradable and will need to be replaced.

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

F.4 Recommended Actions to Manage Migration

F.4.1 By the Responsible Industry Body

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

a) Identify and carefully consider the migration issues.
b) Survey suppliers and customers to assess the extent that equipment will be made obsolete.
c) Survey these groups to assess the extent that databases will need to be upgraded.
d) Allow for an upgrade path for the enhancement of equipment and computer systems, bearing in mind that users required to scan symbols consistent with the new standard need to have systems in place before the new label formats are introduced.
   NOTE--This is a completely different implementation strategy to that commonly adopted when initially implementing bar code systems, where a number of labels usually precede the implementation of scanning.
e) Plan for a phase-out of the old label format.

F.4.2 By Those Organizations Producing the Label

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

a) If changing to UCC/EAN AIs, ensure that the mapping software between the internal database and the Application Identifiers is correct.

   NOTE--The format of data can be different between FACT DIs and UCC/EAN AIs for the nominal data, for example, the way dates or units of measure are encoded.

b) If changing to UCC/EAN-128, ensure that printing software and/or hardware fully supports the options in that symbology, including FNC1 in the first position after the start code and in other positions.
c) Carry out print quality tests of Code 128 and UCC/EAN-128 prior to a live launch of the new format label.

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

F.4.3 By Those Organizations Scanning the Label

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

a) Ensure that decoders are fully compliant with to the applicable ISO/IEC 15424 Symbology Identifier specification with respect to Code 39 and Code 128.
b) Implement software that checks on the validity of both FACT Data Identifiers and UCC/EAN Application Identifiers.
c) Implement software that parses the data for format and length.
d) If changing to UCC/EAN AIs, implement software to convert the data from the AI format to the format requirements of the host computer.

   NOTE--This is required because the format of some data fields is different between FACT DIs and UCC/EAN AIs.

Annex G Using DUNS (Data Universal Numbering System) Numbers by Dun & Bradstreet, with ANSI/FACT Data Identifiers (DIs) in Linear Bar Code and Two-Dimensional Symbols (Informative, not part of standard)

G.1 About the DUNS Number

The DUNS number is a non-indicative nine-digit number assigned by Dun & Bradstreet to identify unique business entities. It is also used to access and link global business data. The DUNS number can "not only identify the company", but can "also identify the exact location of that company's plant" that actually manufactured the product. The first eight digits of the DUNS are sequentially machine generated. The ninth digit is a check digit that is mathematically related to the other digits. Once a DUNS Number is assigned, it will not be reused or be reissued to another company.

There are approximately 45+ million DUNS Numbers already issued. To ensure an adequate supply of DUNS Numbers for the future, Dun & Bradstreet has implemented an alternate check digit calculation; which provides an additional 100 million DUNS Numbers.

The DUNS Number (when appearing in 'human readable' text) always has a distinct fixed format: two digits, hyphen, three digits, hyphen, four digits. For example: **04**-**332**-**5711**

However, when appearing in a bar code or 2D symbol the "hyphens" are not encoded. The ANSI MH10.8.2 Data Identifier preceding the number identifies it as a DUNS Number, and therefore the locations of the hyphens are understood.

The DUNS Number can be used by itself in a separate bar code symbol, or as a separate field in a 2D symbol. The DUNS Number can also be combined with a Product Number in one bar code symbol, or in one data field in a 2D symbol. Whatever type of machine-readable code used, linear bar code or 2D, the appropriate ANSI MH10.8.2 DI(s) must precede them.

There is no charge to receive a DUNS Number for your business.

G.2 Using the DUNS Number in Bar Codes

See Figure 33 for an example using Code 39 or Code 128 to identify the manufacturer in one bar code and the product number in another bar code.

(12V) = ANSI MH10.8.2 'DI' immediately followed by (043325711) = 9-digit DUNS Number

(1P) = ANSI MH10.8.2 'DI' immediately followed by (MH80312) = Manufacturer's Product Number

Figure 33 Example—Using the DUNS Number as Manufacturer ID

See Figure 34 for an example using Code 39 or Code 128 to identify the manufacturer & the product number in one combined bar code symbol.

(9P) = ANSI/FACT 'DI' immediately followed by the 9-digit DUNS (043325711) plus Mfr's. Product Number (MH80312)

Code 39 Example

Code 128 Example

Figure 34 Example—Using DUNS Number and Item ID in Bar Codes

G.3 Using the DUNS Number in 2D Symbols

Figure 35 shows a label including a Data Matrix symbol encoding DUNS and product ID, 'Traceability Number' (e.g., Serial number, Lot/Batch number, Manufacture Date), and Country of Origin.

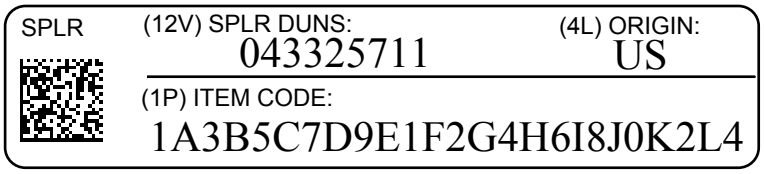


Figure 35 Example—Using the DUNS Number and Item ID in 2D Symbols

CEA Document Improvement Proposal

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