



GS1 GENERAL SPECIFICATIONS

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0.1 Introduction

In February 2005 GS1 was officially launched as the successor to the organisations previously known as EAN and UCC. This document is the concise definition and explanation of the use of the GS1 System standards within Automatic Data Capture (ADC) technologies, and supersedes all previous ADC technical documents provided and/or published by GS1 or its predecessor organisations. The document takes immediate effect as the agreed technical basis for the standards. Every organisation using GS1 System standards is requested to conform fully to the *GS1 General Specifications*.

0.2 Disclaimer

Whilst every effort has been made to ensure that the GS1 System standards contained in the document are correct, GS1 and any other party involved in the creation of the document hereby state that the document is provided without warranty, either expressed or implied, of accuracy or fitness for purpose, and hereby disclaim any liability, direct or indirect, for damages or loss relating to the use of the document. The document may be modified from time to time, subject to developments in technology, changes to the standards, or new legal requirements.

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0.3 Overview

0.3.1 Who Should Read These Specifications

Technical experts working with the GS1 System should read these specifications. They provide a global reference document covering all technical aspects of the GS1 System. Their primary objective is to define the international standard upon which individual GS1 Member Organisations can develop user documentation.

0.3.2 Electronic Data Interchange

The use of Electronic Data Interchange (EDI) is an integral part of the GS1 System philosophy. Full details on the EDI standards are contained in EANCOM® and GS1 XML. EANCOM is an implementation guideline of the EDIFACT standards (Electronic Data Interchange For Administration, Commerce and Transport) developed under the auspices of the United Nations.

0.3.3 Future Updates

The GS1 System embodies an open architecture approach. It has been carefully designed for modular expansion with minimal disruption to existing applications. Enterprise Resource Planning (ERP) and other supply chain application software drive implementation of the system. New, user driven, applications can be expected, and this document will be updated accordingly.

The maintenance of these specifications will be the responsibility of GS1 and will incorporate the four principles of the GS1 System:

1. **Open Standards:** The goal is a single, open, business led, integrated system of identification and information transfer technology standards that enables effective supply chain management in any company, in any industry, anywhere in the world.
2. **Differentiation:** The system is founded on rules-based standards that, when followed, ensure globally unique and discrete identification of such things as products, handling units, assets, and locations. The system includes standard ways to transfer GS1 System identification numbers as well as relevant data related to these numbers.
3. **Transparency:** GS1 System identification numbers must be relevant and applicable to any supply chain, independent of who assigns, receives, and processes the standards. This should enable only one way to perform any given function. New features should only be introduced to the standard if they enable new applications or better ways to perform existing functions.
4. **Non-Significance:** Global uniqueness of GS1 System identification is guaranteed only when the standard number is taken as a whole and processed in its entirety. Fixed attributes of an item or service should be looked up from a computer or other data source by entering the item or service's GS1 System identification number as a reference.

0.3.4 Navigator

These specifications have been developed as a reference document aimed primarily at GS1 Member Organisations (who also produce local language user manuals) and system engineers developing software based upon GS1 System standards. All aspects of the GS1 System are summarised in [Section 1.0](#), which is recommended for those wishing to become familiar with the GS1 System logic and terminology.

The sub-sections of [Section 2.0](#) provide detailed rules for implementing the GS1 System in business applications. These rules represent the requirements that must be met by trading partners to meet the international standards.

Each application section mandates the use of system features defined elsewhere in this document, such as Check Digits, Element Strings, data carriers, and bar code symbol placement.

The sections of these GS1 General Specifications are:

Section 1, Basics and Principles of the GS1 System

This section provides an introduction to the core components of the GS1 System.

Section 2.1, Trade Items

This section defines the international standard for the identification of trade items, which are any item (product or service) upon which there is a need to retrieve pre-defined information and that may be priced or ordered or invoiced at any point in any supply chain.

Section 2.2, Logistic Units

This section defines the international standard for the identification of logistic units, which are items of any composition established for transport and/or storage that need to be managed through the supply chain.

Section 2.3, Assets

This section defines the international standard for the identification of Returnable Assets and Individual Assets.

Section 2.4, Locations

This section defines the international standard for using Global Location Numbers (GLNs) in bar code applications.

Section 2.5, Service Relationships

This section defines the international standard for the identification of service relationships.

Section 2.6, Special Applications

This section defines the international standard for identification of, for example, coupons, Refund Receipts, internal applications, and other special applications.

Section 2.7, Very Small Healthcare Items

This section defines the international standard for identification of, for example, vials, ampoules, very small bottles, and blister packs intended for use in healthcare service environments (e.g., hospital bedside).

Section 2.8, Numbering and Direct Part Marking Using Data Matrix (ECC 200)

This section defines the generic requirements for applying Data Matrix symbols to items using direct part marking. Direct part marking refers to the process of marking a symbol on an item using an intrusive or non-intrusive method.

Section 3, Definitions of the Element Strings

This section introduces the concept of an Element String “A piece of data defined in structure and meaning, comprising an identification part (prefix or Application Identifier) and a data part, represented in a GS1 System endorsed data carrier.” Each element string, or the data content of a bar code, is unambiguously defined in this section. A single page is dedicated to each 'element string' and the rules associated with its definition, structure, approved data carrier and any system considerations are given. This section should be viewed as a 'data dictionary'. It allows the reader to reference the exact meaning of each data element that is defined within the GS1 System.

Section 4, Association of Element Strings to Form Valid Messages

This section provides the rules that allow the unambiguous processing of multiple Element Strings.

Section 5, Data Carriers

This section provides a detailed description of the data carriers that are endorsed by GS1 as well as the related bar code production and quality assessment required to achieve excellent scan rates.

Section 6, Symbol Placement Guidelines

This section provides guidance on symbol placement and packaging measurement methodology.

Section 7, System Processing in EDP Applications

This section provides guidelines and hints on developing systems capable of processing GS1 data correctly.

Section 8, Glossary of Terms

A standard vocabulary used throughout the GS1 System.

Section 1.0:

Basics and Principles of the GS1 System

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1.1 Introduction

The GS1 System originated in the United States and was established in 1973 by the Uniform Product Code Council, known until recently as the Uniform Code Council, Inc.[®] (UCC[™]) and since 2005 GS1 US. The UCC originally adopted a 12-digit identification number, and the first ID numbers and bar code symbols in open trade were being scanned in 1974. Following the success of this U.P.C. System, the European Article Numbering Association, previously known as EAN International, but launched as GS1 in 2005, was established in 1977 to develop a compatible system for use outside North America. The EAN System was designed as a superset of the UCC System and principally used 13-digit numbers. As a consequence of using certain bar code symbols and data structures, the GS1 System has expanded.

Today the two organisations have combined under the single GS1 Brand that **See** One Vision, **Speak** with One Voice, and **Act** as One Organisation..

The GS1 System provides for the use of unambiguous numbers to identify goods, services, assets, and locations worldwide. These numbers can be represented in bar code symbols to enable their electronic reading wherever required in business processes. The system is designed to overcome the limitations of using company, organisation, or sector specific coding systems, and to make trading much more efficient and responsive to customers.

These identification numbers are also used in Electronic Data Interchange (EDI). This document only provides information about the GS1 System's Automatic Data Capture (ADC) standards. For information about EDI, please refer to the EANCOM[®] manual, the GS1 XML standards or the appropriate national standard.

In addition to providing unique identification numbers, the GS1 System provides for supplementary information, such as best before dates, serial numbers, and batch numbers, which can appear in bar code symbol form. Currently, bar code symbols are used as the data carriers, but other technologies, such as radio frequency tags, might be added in the future. Changes take place only after wide consultation and are subject to a significant migration period.

By following the principles and design of the GS1 System, users can design applications to process GS1 System data automatically. The system logic guarantees that data captured from GS1 endorsed bar code symbols produces unambiguous electronic messages, and processing can be fully pre-programmed.

The GS1 System is designed for use in any industry or trade sector, and any changes to the system are introduced so as not to negatively affect current users.

1.2 GS1 Company Prefix

The GS1 Company Prefix is the part of the GS1 data structures. It consists of a GS1 Prefix, which is administered by GS1, and a Company Number, which is assigned by a GS1 Member Organisation.

A GS1 Company Prefix gives access to all the applications using GS1 System identification standards (e.g., identification of traded items or services, locations, logistic units, returnable containers). The GS1 Company Prefix is a component of each data structure described in [Section 2.0](#) except for EAN/UCC-8.

The normal requirements on the re-use of GS1 Identification numbers apply to all organisations at all times. The following additional guidelines apply when a company changes legal status as a result of an acquisition, merger, partial purchase, split, or “spin-off”. GS1 Member Organisation may adapt the following guidelines if the law of the country makes it absolutely necessary. Companies should notify their GS1 Member Organisation of any legal status change, within one year, to facilitate a smooth transition.

1.2.1 Acquisitions and Mergers

For the company being acquired, existing stocks on hand which are numbered before the acquisition or merger, keep the same Global Trade Item Numbers™ (GTIN's™). Products that are produced after the acquisition or merger may keep the GTIN allocated before the acquisition if the acquiring company maintains the GS1 Member Organisation membership.

A merger implies that someone has taken over a company and has assumed responsibility for the company's GS1 Company Prefix, as well as, their assets and locations. Products that the acquired company produced under its GS1 Company Prefix can still be produced using the same prefix after the merger, since the acquiring company has control of the acquired company's GS1 Company Prefix. If it so desires, the acquiring company can label all acquired products using their existing GS1 Company Prefix. The importance of ensuring trading partners are informed of any changes, in a timely manner, cannot be overemphasised. A company should be careful when centralising the allocation of all numbers under one GS1 Company Prefix, thus changing the GTIN of the existing products, which are otherwise unchanged. Centralising the allocation of all numbers under a single GS1 Company Prefix should be an exception, as it results in additional work and data file maintenance for customers.

1.2.2 Partial Purchase

If a company purchases a division of a company whose GS1 Company Prefix is used in divisions not purchased, then the acquiring company must change the GTIN's for products in the purchased division, as well as any related GLNs, within one year.

The rules concerning the use of the seller's Global Trade Item Numbers™ (GTINs™), and other GS1 Identification Keys, should be taken into consideration when drawing up the purchase contract.

At the earliest opportunity, the buyer should phase in new numbers, from its own range of numbers, for items whose brand name it has acquired. The buyer will be able to do this, for example, when packaging is redesigned or reprinted.

If a company sells an asset to another company then the asset identifier should ideally be replaced by another GIAI or GRAI within one year or be removed from the physical item.

During a company sale, and for four years following, the selling company must not reallocate the original numbers to other items.

1.2.3 Split or Spin-Off

When a company splits into two or more separate companies it is necessary for each GS1 Company Prefix assigned to the original company to be transferred to only one of the new companies. Any company left without a GS1 Company Prefix will need to apply to a GS1 Member Organisation to obtain one. The decision about which of the new companies should take the original GS1 Company Prefixes should be made in such a way as to minimise the number of additional Global Trade Item Numbers™ (GTINs™) required. The decision should be part of the legal arrangements of the new companies.

It is not necessary for existing stocks of items to be renumbered. However, when any of the split or spin-off companies has trade items that are numbered with a GS1 Company Prefix that it no longer holds, the company should renumber those items using its own GS1 Company Prefix when new labelling or packaging is produced. Customers should be notified well in advance of the changes.

Split or spin-off companies that retain a GS1 Company Prefix must keep a record of the GTINs created that have been allocated to items they no longer own. They must not re-use these GTINs for a period of at least four years after the company that split away owning those items last supplied goods identified by those GTINs. Therefore, the company that did not retain the GS1 Company Prefix has to keep the company that now maintains it informed of the dates on which goods were last supplied using that GS1 Company Prefix or to guarantee a date by which the number change will be made.

1.3 The Data Structures

The GS1 System provides data structures for different applications. The application will determine how the number is to be used, but regardless of application, each number must be used in its entirety and not broken into constituent parts. The data structure guarantees worldwide uniqueness within the relevant area of application.

1.3.1 Global Trade Item Number (GTIN™)

The Global Trade Item Number™ (GTIN™) is used for the unique identification of trade items worldwide.

A trade item is any item (product or service) upon which there is a need to retrieve pre-defined information and that may be priced, or ordered, or invoiced at any point in any supply chain. This includes individual items as well as all their different configurations in different types of packaging.

These data structures provide unique identification when they are right-justified in a 14-digit reference field, called the GTIN Format (see Figure 1.3.1 – 5).

Figure 1.3.1 – 1

EAN/UCC-14 Data Structure

Indicator	GTIN™ of the Items Contained (Without Check Digit)	Check Digit
N ₁	N ₂ N ₃ N ₄ N ₅ N ₆ N ₇ N ₈ N ₉ N ₁₀ N ₁₁ N ₁₂ N ₁₃	N ₁₄

Figure 1.3.1 – 2

EAN/UCC-13 Data Structure

GS1 Company Prefix	Item Reference	Check Digit
N ₁ N ₂ N ₃ N ₄ N ₅ N ₆ N ₇ N ₈ N ₉ N ₁₀ N ₁₁ N ₁₂		N ₁₃

Figure 1.3.1 – 3

UCC-12 Data Structure

UCC Company Prefix	Item Reference	Check Digit
N ₁ N ₂ N ₃ N ₄ N ₅ N ₆ N ₇ N ₈ N ₉ N ₁₀ N ₁₁		N ₁₂

Figure 1.3.1 – 4

EAN/UCC-8 Data Structure

GS1-8 Prefix	Item Reference	Check Digit
N ₁ N ₂ N ₃ N ₄ N ₅ N ₆ N ₇		N ₈

Figure 1.3.1 - 5

Data Structures	GTIN Format*													
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	T ₁₁	T ₁₂	T ₁₃	T ₁₄
EAN/UCC-14	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄
EAN/UCC-13	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃
UCC-12	0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂
EAN/UCC-8	0	0	0	0	0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈

*T represents the position of each individual digit in a computer file format, N represents the position of each individual digit in a given data structure, and 0 represents a filler digit.

Note: This format is used in business transactions, especially for Electronic Data Interchange (e.g., orders, invoices, price catalogues).

1.3.2 SSCC (Serial Shipping Container Code)

The SSCC is used for the unique identification of logistic units.

Figure 1.3.2 - 1

Extension Digit	GS1 Company Prefix	Serial Reference	Check Digit
N ₁	N ₂ N ₃ N ₄ N ₅ N ₆ N ₇ N ₈ N ₉ N ₁₀ N ₁₁ N ₁₂ N ₁₃ N ₁₄ N ₁₅ N ₁₆ N ₁₇		N ₁₈

N_i' represents a digit

1.3.3 Global Location Number (GLN)

The Global Location Number (GLN) is used to uniquely identify a physical location or legal entity.

Figure 1.3.3 – 1

GS1 Company Prefix	Location Reference	Check Digit
N ₁ N ₂ N ₃ N ₄ N ₅ N ₆ N ₇ N ₈ N ₉ N ₁₀ N ₁₁ N ₁₂		N ₁₃

N_i' represents a digit

Note: The GLN uses the same structure as EAN/UCC-13 Identification Numbers for Trade Items, but must be treated as a separate series of numbers.

1.3.4 Global Returnable Asset Identifier (GRAI)

The GRAI is used to identify a reusable entity that is normally used for transport and storage of goods.

Figure 1.3.4 – 1

EAN/UCC-13 Data Structure														
GS1 Company Prefix						Asset Type						Check Digit	Serial Number (Optional)	
0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	X ₁ ← variable → X ₁₆

N_i represents a digit and 'X_i' represents any character contained in [Figure 3.A.3 – 1](#).

1.3.5 Global Individual Asset Identifier (GIAI)

The GIAI is used to identify uniquely an entity that is part of the inventory of a given company.

Figure 1.3.5 – 1

GS1 Company Prefix					Individual Asset Reference				
N ₁	...	N _i	X _{i+1}	...	variable length	X _j	(j ≤ 30)		

N_i represents a digit and 'X_i' represents any character contained in [Figure 3.A.3 – 1](#).

1.3.6 Global Service Relation Number (GSRN)

The GSRN is used to identify the recipient of services in the context of a service relationship.

Figure 1.3.6 – 1

GS1 Company Prefix																	Check Digit
N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄	N ₁₅	N ₁₆	N ₁₇	N ₁₈

N_i represents a digit

1.3.7 Global Document Type Identifier (GDTI)

The GDTI is used to uniquely identify a document type or an individual document.

Figure 1.3.7 – 1

EAN/UCC-13 Data Structure																		
GS1 Company Prefix					Document Type					Check Digit			Serial Number (Optional)					
N ₁ N ₂ N ₃ N ₄ N ₅ N ₆ N ₇ N ₈ N ₉ N ₁₀ N ₁₁ N ₁₂													N ₁₃			N ₁ variable N ₁₇		

N_i represents a digit

1.3.8 Components of the Data Structures

The GS1 Prefix is a number with two or more digits, administered by the GS1 Global Office that denotes the format and meaning of a particular Element String. The main purpose of the GS1 Prefix is to allow decentralisation of the administration of identification numbers.

GS1 Prefixes are shown in Figures 1.3.7 – 1 and 1.3.7 – 2

Figure 1.3.7 – 1

Synopsis of GS1 Prefixes	
GS1 Prefixes	Significance
000 - 019	UCC™ data structure*
02	GS1 Variable Measure Trade Item identification for restricted distribution
030 - 039	UCC data structure
04	GS1 item numbering for restricted distribution within a company
05	GS1 US coupon identification
060 - 099	UCC data structure
100 - 139	GS1 data structure
140 - 199	Reserve
20 - 29	GS1 numbering for restricted distribution within a geographic region
300 - 969	GS1 data structure
970 - 976	Reserve
977	ISSN standard numbering (serial publications)
978	ISBN standard numbering (books)
979	ISBN or ISMN standard numbering
980	GS1 identification of Refund Receipts
981-982	GS1 coupon identification for common currency areas
983 - 989	Reserved for further GS1 coupon identification
99	GS1 coupon identification

* Starting from GS1 Company Prefix 00 00100 to avoid collision with EAN/UCC-8 Identification Numbers. Note: GS1 Company Prefixes 00 00000 and 00 01000 to 00 07999 have specific application for Locally Assigned Codes (LACs) or Retailer Zero-Suppressed Codes (RZSCs). For details, see [Section 3.A.2](#).

Note: These prefixes all assume an EAN/UCC-13 Data Structure. When UCC identification numbers are carried by UCC-12 (UPC) Bar Code Symbols, the prefixes 00 to 09 will appear as the single figures 0 to 9.

1.3.7 – 2

Synopsis of GS1-8 Prefixes	
GS1-8 Prefixes	Significance
0	Velocity Codes
100 - 139	GS1 data structure
140 - 199	Reserve
2	GS1 numbering for use within a company
300 - 969	GS1 data structure
97 - 99	Reserve

The GS1 Prefix and the Company Number jointly form the GS1 Company Prefix, which is assigned to each system user by a GS1 Member Organisation.

GS1 Company Prefixes are assigned to entities that administer the allocation of the GS1 System identification numbers. These entities may be, for example, commercial companies, non-profit organisations, governmental agencies, and business units within organisations. The criteria to qualify for the assignment of a GS1 Company Prefix are established by the GS1 Member Organisations.

The Item Reference, Serial Reference, Location Reference, Individual Asset Reference, Service Reference, and Asset Type are assigned by system users. Rules for their allocation depend on the particular application. EAN/UCC-8 Identification Numbers are available from GS1 Member Organisations.

The Indicator in an EAN/UCC-14 Identification Number allows each user to increase the numbering capacity when identifying similar trade units in different packaging configurations.

The Extension digit is used to increase the capacity of the SSCC. It has the value 0 to 9 and has no meaning.

The Check Digit is calculated as explained in [Section 3.A.1](#). It is used to verify that the identification number is correctly composed.

Note: The data structures guarantee unique identification within a particular area of application. Although, for example, trade items may use the same number as locations, each system user must be able to control how data is used according to the GS1 rules.

1.4 The Data Carriers

Bar code symbols are the data carriers used in the GS1 System. Other data carriers may be introduced in the future.

The data that comprises each identification number and any extra information that can be provided using the GS1 System Application Identifiers can be regarded as an Element String, and they can all be represented in the bar code symbols endorsed by GS1. The GS1 System uses the bar code symbologies described below.

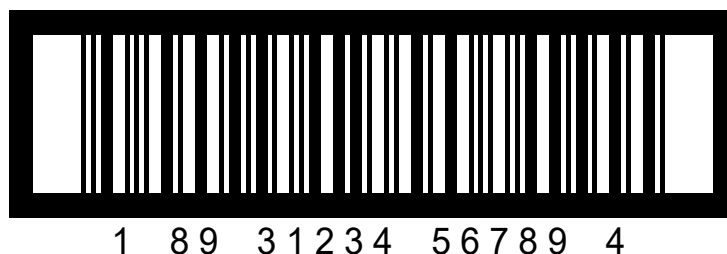
The EAN/UPC Symbology (which includes the UPC-A, UPC-E, EAN-13, and EAN-8 Bar Code Symbols as well as the two- and five-digit Add-On Symbols) is a bar code symbology family that can be read omnidirectionally. It must be used for all items that are scanned at the Point-of-Sale and may be used on other trade items.

Figure 1.4 – 1



The ITF-14 Bar Code Symbol (Interleaved 2-of-5) is restricted to use on trade items not passing through the Point-of-Sale. This symbology is better suited for direct printing on corrugated fibreboard.

Figure 1.4 – 2



GS1-128 is a variant of Code 128. Its use is exclusively licensed by GS1. This extremely flexible symbology is used for the representation of Element Strings using GS1 System Application Identifiers. It is not intended to be read on items passing through the Point-of-Sale.

Figure 1.4 – 3



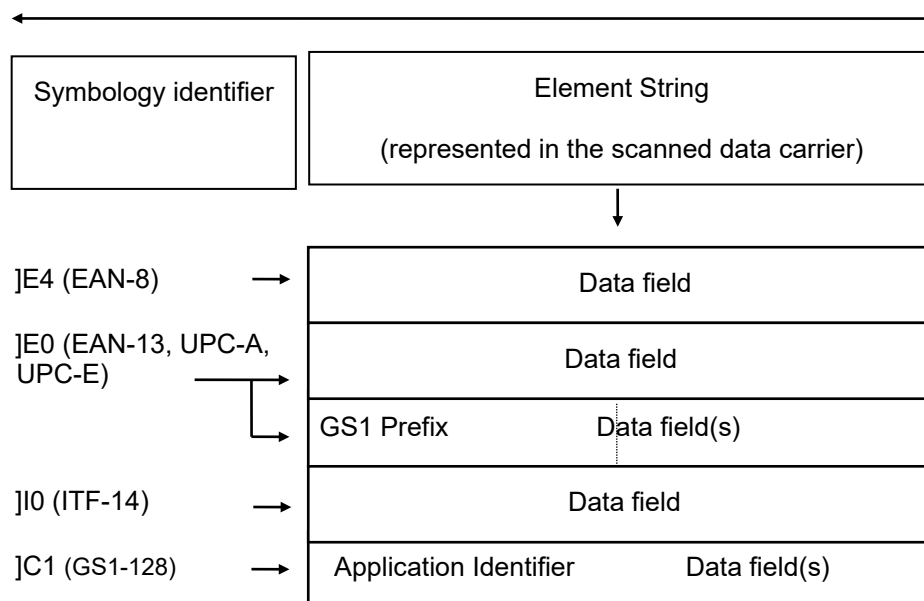
1.5 The Data Standard

The GS1 System provides various types of standardised data in the form of Element Strings. An Element String is data of a particular structure and meaning that is represented in a GS1 System endorsed data carrier. It may be:

- An EAN/UCC-8, UCC-12, EAN/UCC-13, or EAN/UCC-14 Identification Number
- A GS1 Prefix and data field(s) for special use with the EAN-13 or UPC-A Bar Code Symbol in a particular environment
- An Application Identifier and data field(s)

A full string consists of the symbology identifier (see [Section 5.0.3](#)) followed by one or more Element Strings. The symbology identifier is generated by the reading device and transmitted together with the Element String(s). The symbology identifier ensures that systems distinguish between GS1 System data structures and other non-EAN/UCC System data structures. Figure 1.5 – 1 shows how Element Strings are incorporated in the full string transmitted from a bar code reader to the appropriate software.

Figure 1.5 – 1
Transmitted Full String



Note: The full string may contain several Element Strings.

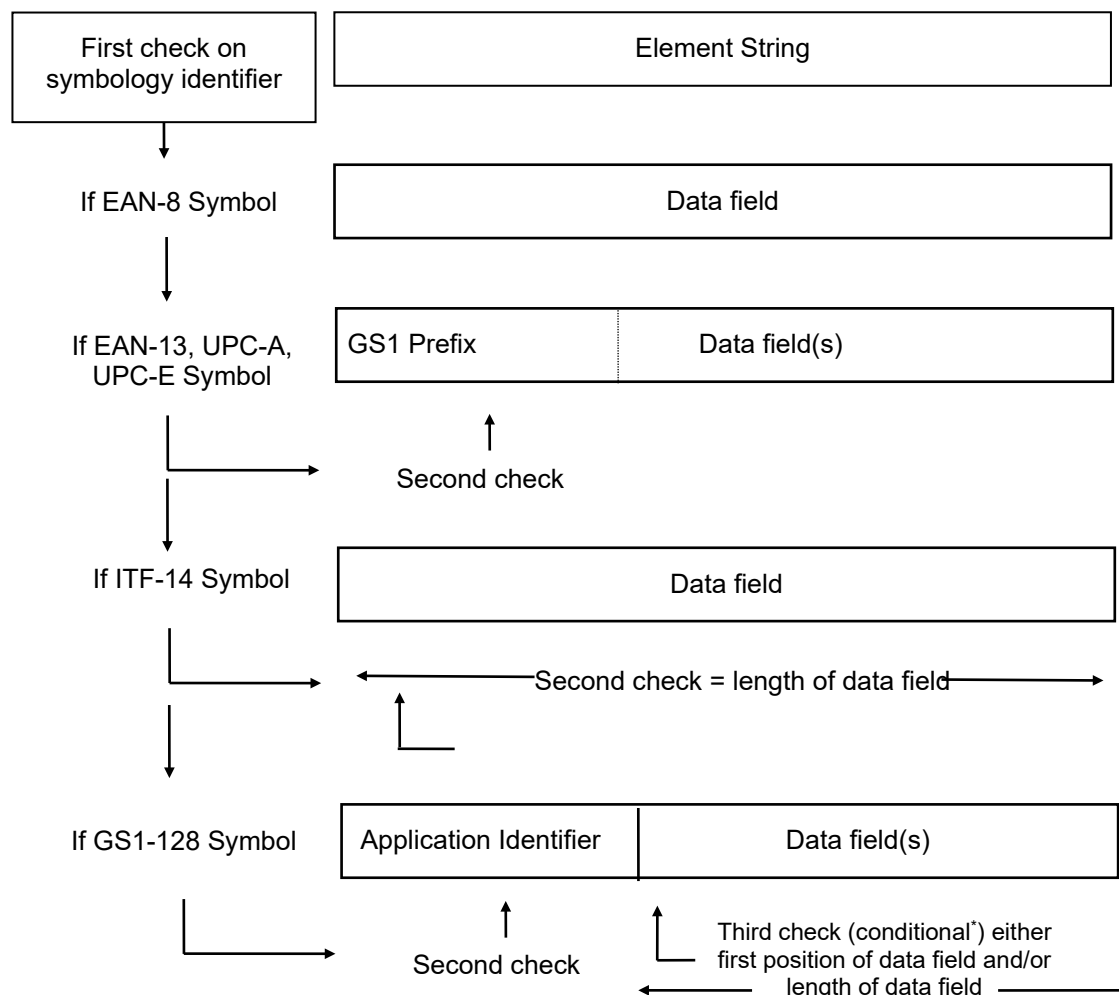
Each Element String, whether consisting of one or several data fields, will have unique meaning, because it is unambiguous and does not depend on other read or stored data, or human intervention. Element Strings must not be used for purposes other than those assigned to them, or this uniqueness will be lost.

The Element Strings of the GS1 System will be used mainly for recording transactions in goods handling and business applications. Some Element Strings will be applied for administrative purposes in specific environments (e.g., hospitals). The use of specific Element Strings in system applications is subject to standards and recommendations. Their logical association is described in Sections 4.0 and 7.0.

The Element Strings are composed of an Application Identifier and one or more data fields. The Application Identifier denotes the content and structure of the respective data fields. Full details are contained in Section 3.0. The meaning of the Element Strings is determined by a sequence of checks carried out on the information in the transmitted full string (see Figure 1.5 – 2). See Section 5.0 for details on symbology identifiers.

Figure 1.5 – 2

Analysis of the Significance of an Element String Represented in a Data Carrier



* For Application Identifiers (01) and (02), the digit 9 in the first position indicates a Variable Measure Trade Item (see Section 2.1).

1.6 The Areas of System Application

To ensure that Element Strings are used and interpreted correctly together, they must only be used in the appropriate areas of application. In this way, each Element String will always have the same meaning, enabling automatic processing.

Element Strings containing identification numbers provide unique identification within a particular area of application. Each area of application must be distinguished within a database using qualifiers, different fields, or even different files.

1.6.1 Area 1: Identification of Trade Items

A trade item is any item (product or service) upon which there is a need to retrieve pre-defined information and that may be priced, or ordered, or invoiced at any point in any supply chain (see [Section 2.1](#)). This definition covers services and products, from raw materials through to end user products, all of which have pre-defined characteristics.

EAN/UCC-8, UCC-12, EAN/UCC-13, and EAN/UCC-14 Identification Numbers are all used to identify trade items. These data structures provide unique identification when they are right-justified in a 14-digit reference field, called the GTIN Format (see Figure 1.3.1 – 5). If the item is of variable measure, its identity will need to be completed by measure information, or in some instances, price information. Other variable information about trade items (e.g., production, packaging, expiration dates, lot numbers, serial numbers) is also available as standardised Element Strings.

Each trade item is allocated a unique identification number, which remains the same as long as it is being traded. The same identification number is used for all of these same items. The numbers must be used in their entirety within computer systems and must not be used in parts.

1.6.2 Area 2: Identification of Logistic Units

Logistic units are units which store or transport any combination of trade items and which need to be identified and managed through the supply chain (see [Section 2.2](#)). Each individual unit is allocated a unique serial number, the SSCC (Serial Shipping Container Code), which must be different for every logistic unit. Even if the logistic units contain identical trade items, they still require different SSCCs.

Attributes relating to logistic units (e.g., gross weight, outside dimensions) are also standardised Element Strings. Standardised Element Strings are available to identify the contents of logistic units that contain a single type of trade item.

1.6.3 Area 3: Identification of Assets

The Global Returnable Asset Identifier (GRAI) or Global Individual Asset Identifier (GIAI) can be used to identify specific assets or types of assets within an asset register (see [Section 2.3](#)).

1.6.4 Area 4: Identification of locations

The EAN/UCC-13 Data Structure is used to identify locations, and each location is given a unique Global Location Number (GLN) (see [Section 2.4](#)).

The identification of physical locations or legal entities is required:

- For EDI messages
- When providing transport information on logistic units
- To enable bar code symbol identification of actual locations (e.g., goods inward, warehouse shelving)

1.6.5 Area 5: Identification of Service Relationships

The Global Service Relation Number (GSRN) is used to uniquely identify a receiver of agreed upon services from a particular service provider (See [Section 2.5](#)). The GSRN can identify the user as a participant (or member) in a programme or scheme. However, it never constitutes a person's personal identification number because it is always related to a given service arrangement.

1.6.6 Area 6: Special System Applications

Special system applications are standardised Element Strings that may be used for company internal and special applications that are not covered by the main application areas (see [Section 2.6](#)).

1.6.7 Area 7: Very Small Healthcare Items

RSS, Composite Symbology, and Data Matrix symbologies may be used in healthcare applications with limited space marking requirements.

1.6.8 Area 8: Direct Part Marking

Data Matrix symbology may be used in direct part marking applications that require permanent marking for cradle-to-grave history of the part's lifecycle.

1.7 Automatic Processing of Decoded Data

The purpose of entering data from a bar code scanner into a system is to record a transaction. Transaction data are electronic messages that will be processed according to the meaning of the data transferred. This is possible without any manual intervention.

Although each Element String has only one meaning, correct interpretation of the electronic message depends on the type of transaction. This implies that the transaction type, although not part of the GS1 System standards, should be considered an integral part of GS1 System data processing. Consequently, the electronic message will be derived from:

- The transaction type
- The identification of the bar code symbol
- The data decoded from a bar code symbol, including the Application Identifier(s) or other data identifier(s)

An Electronic Data Interchange (EDI) message has clearly defined components to enable automatic processing, and in the same way, data from a bar code scanner forms a message with a pre-defined structure. Such messages may simply identify an item, but some will also contain data that supplements the identification.

In order to provide unambiguous and complete messages, it is necessary to define which Element Strings are required to form a valid electronic message. Valid electronic messages are determined by the systems components and by business practices (system user applications), which together generate the system's logic. System users assembling these electronic messages need an unambiguous way of characterising the Element Strings, which do not have explicit Application Identifiers.

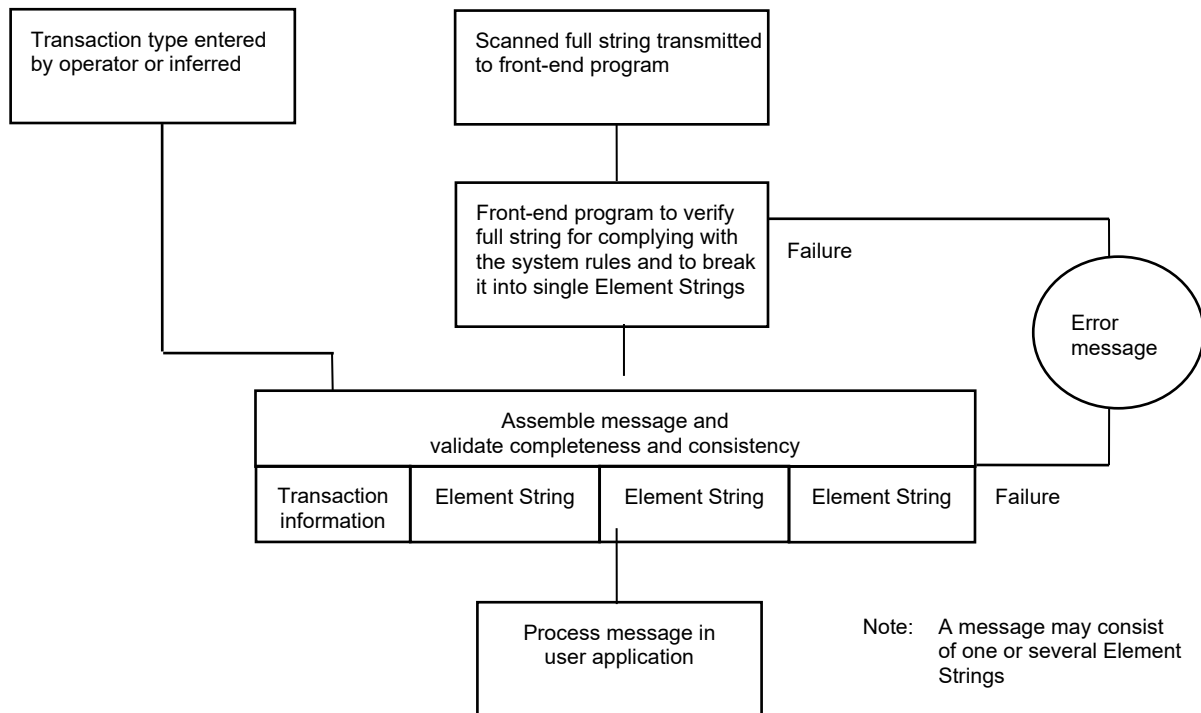
The GS1 System provides standardised data, which, when carried by GS1 System bar code symbols, can be captured, correctly analysed, and processed automatically. The steps in this procedure are:

- The bar code reader reads the bar code symbol and transmits the full string of data to the front-end processing program.
- The front-end program breaks the full string into Element Strings and transmits them to the analysing program.
- The analysing program assembles the Element Strings from one or more full strings, any manually entered data, and the transaction information collected from the operator or inferred, then validates the correctness of the set and transmits the set of data to the application for processing.
- The application uses the transaction information, the Element Strings, and a database to process the information correctly.

The above steps will be repeated as needed at each point in the supply chain.

This process is represented in Figure 1.7 – 1.

Figure 1.7 – 1



Note: In principle, all Element Strings provide their information independent of context. When the Element Strings are shown in a bar code symbol applied to an item, the information in the Element Strings is about the item itself. In this way, transactions about items can be recorded as the items are scanned. When printed in a document (e.g., in a product catalogue), the information enables the automatic entry of data for a business transaction, such as an order. For example, the Element String AI (01) will be shown in the same bar code symbol whether physically marked on an item or printed in a catalogue.

Section 2.0:

Areas of System Application

Table of Contents

Eight Areas of System Application	1

2.0.1 Eight Areas of System Application

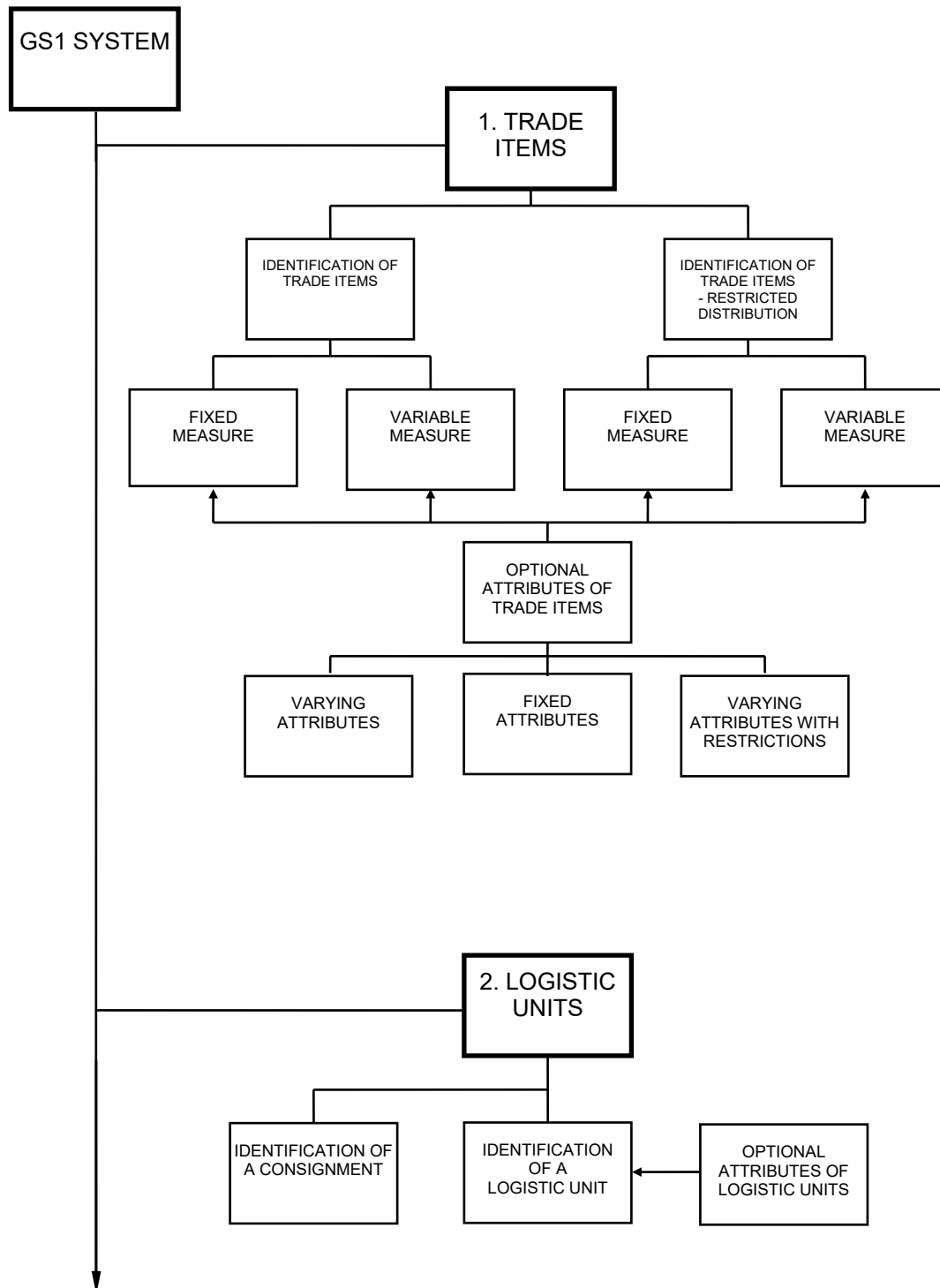
The GS1 System is a method of identification comprising a standard numbering system and standardised identification data for unambiguous worldwide use. Represented in data carriers (currently bar code symbols), the identification system is used for Automatic Data Capture and electronic data processing of such things as goods, documents, and physical locations.

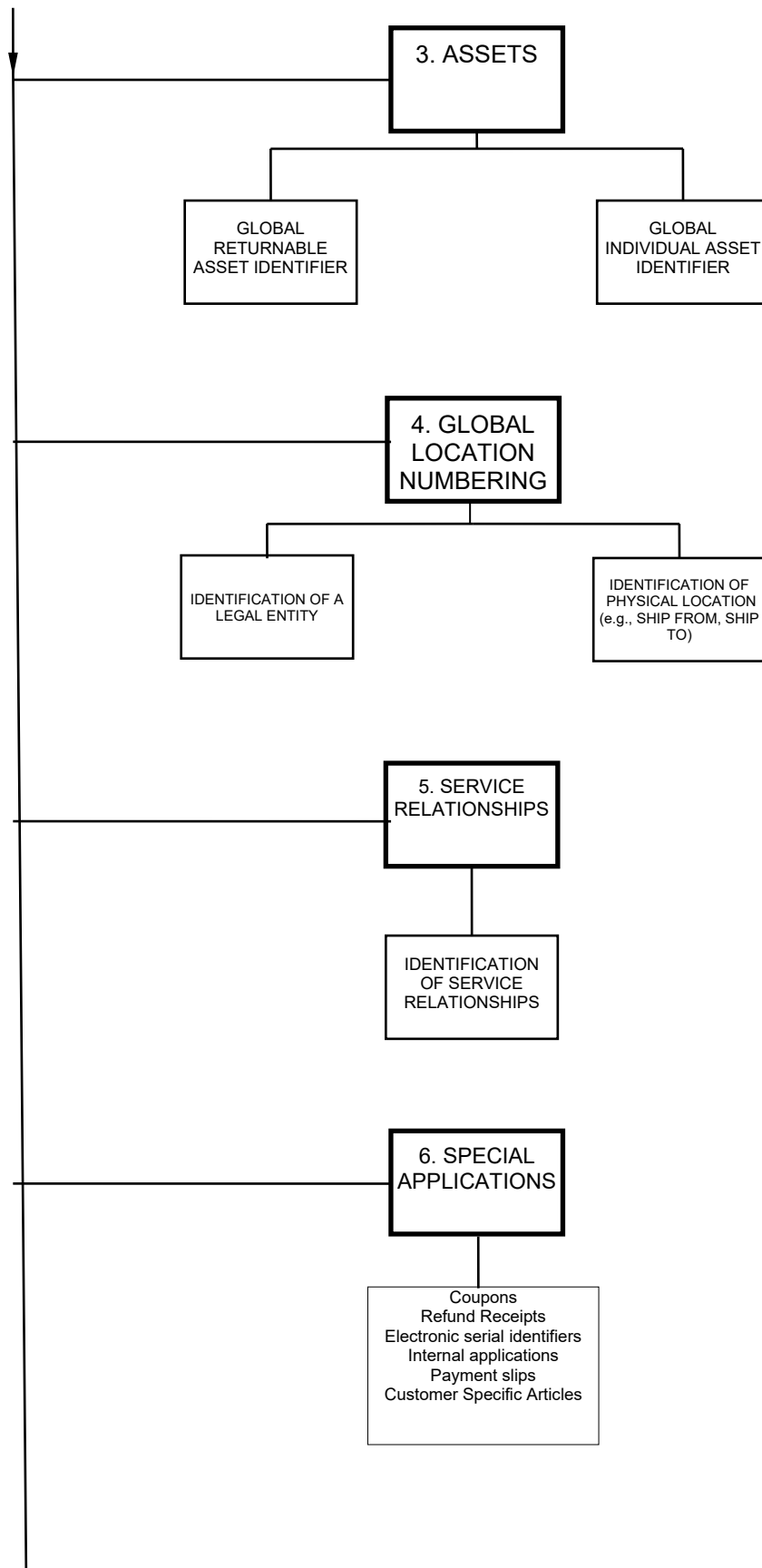
The rules and regulations for proper use of the numbering system and its Element Strings apply to eight areas of system application, which are outlined in Figure 2.0.1 – 1. These rules and regulations must be observed by all system users to ensure the integrity of the GS1 System.

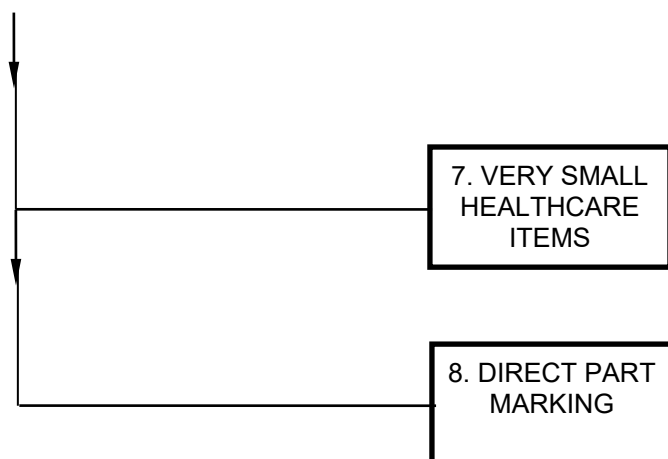
System users are continually developing real business applications for the GS1 System. It is neither possible nor desirable to outline all the real world solutions that are based upon the use of GS1 System standards. However, all elements of the GS1 System have been developed to meet user requests while keeping in mind the objective to improve the efficiency of integrated logistics and contribute added value to partners and consumers.

Unique and unambiguous identification is guaranteed only within each area of application. The six areas of application supported by these standards should only be applied in instances that fit the application as defined. In the future, when new requirements arise, system application areas will be developed to meet those requirements.

Figure 2.0.1 – 1

Areas of System Application





Section 2.1:

Numbering and Symbol Marking of Trade Items

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2.1.1 Introduction

2.1.1.1 Definitions and Principles

A trade item is any item (product or service) upon which there is a need to retrieve pre-defined information and that may be priced, or ordered, or invoiced at any point in any supply chain. This definition covers services and products, from raw materials through to end user products, all of which may have pre-defined characteristics.

The identification and bar code symbol marking of trade items enables the automation of the Point-of-Sale (through Price Look Up (PLU) files), of goods receiving, inventory management, automatic re-ordering, sales analysis, and a wide range of other business applications.

The EAN/UCC-8, UCC-12, EAN/UCC-13, and EAN/UCC-14 Identification Numbers are used to identify trade items. Each can be considered a Global Trade Item Number™ (GTIN™) when stored in the GTIN Format, a 14-digit reference field.

Figure 2.1.1.1 – 1

Data Structures	Storage in the GTIN Format													
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	T ₁₁	T ₁₂	T ₁₃	T ₁₄
EAN/UCC-14	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄
EAN/UCC-13	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃
UCC-12	0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂
EAN/UCC-8	0	0	0	0	0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈

If the item is of variable measure, the respective measure or price information will often be of critical importance to business applications. Attributes relating to trade items (e.g., dates, lot number) are also available as standardised Element Strings.

Each trade item that is different from another in design and/or content is allocated a unique identification number, which remains the same as long as it is traded. The same identification number is given to all trade items sharing key characteristics. Such numbers must be treated in their entirety throughout the supply chain.

Basic principles for the identification of trade items include:

- Each trade item that is different from another must be allocated a separate, unique GTIN.
- The GTIN does not carry any information related to the trade item. The brand owner responsible for assigning the GTIN must communicate this information by Electronic Data Interchange (EDI) or other means to all business partners.
- An assigned GTIN must never be changed as long as the item is not modified so that it needs to be discriminated from the initial trade item for ordering, stocking, or billing. Exceptions to this rule may occur only when regulatory or legal requirements mandate a change.
- The serialised identification of trade items, which enables total connectivity of information and communication systems, is achieved through the use of AI (01) GTIN and AI (21) Serial Number (See Section 3.6 for full details).

2.1.1.2 Types of Trade Items

Trade items cover a broad variety of things that may carry a bar code symbol and a GTIN™. Different standard solutions apply depending on the nature of the item and the scope of the users' applications. The following sections determine the identification and symbol marking rules applicable to a particular trade item.

2.1.1.2.1 Physical or Non-Physical Trade Items

Non-physical trade items are usually called services. Services may be identified with standard numbers for open trade applications or in restricted distribution environments.

2.1.1.2.2 Open or Restricted Distribution

The main benefit of the GS1 System for trade items is that it provides a unique and unambiguous identification number for every trade item, which is applicable worldwide in open environments. In addition, the system provides for other number series that may be exclusively used for restricted distribution (e.g., national use, company internal use). Restricted distribution identification numbers are available to GS1 Member Organisations members to help them develop solutions applicable within their territory.

2.1.1.2.3 Fixed or Variable Measure

Fixed Measure Trade Items are those that are always produced in the same version and composition (e.g., type, size, weight, contents, design). Like a Fixed Measure Trade Item, a Variable Measure Trade Item is an entity with pre-defined characteristics, such as the nature of the product or its contents. Unlike a Fixed Measure Trade Item, a Variable Measure Trade Item has at least one characteristic that varies whilst other characteristics of the trade item remain the same. The variable characteristic may be weight, dimension, number of items contained, or volume information. The complete identification of a Variable Measure Trade Item consists of both an identification number and information about the variable data.

2.1.1.2.4 Retail or Non-Retail

Scanning at the Point-of-Sale is a major application of the GS1 System, and trade items that are intended to cross a Point-of-Sale are subject to specific rules.

2.1.1.2.5 Books and Serial Publications

Published material (newspapers, magazines, and books) requires special consideration due to the following factors:

- A solution for published material should address the requirement to process returns (sorting and counting) to wholesalers and publishers. This implies the reading of a supplementary number that is not required for item identification.
- The international systems, ISSN and ISBN, already handle the numbering of publications and books.
- Because of the large number of titles involved and the problems of creating and updating Price Look Up (PLU) files, price may be encoded within the Global Trade Item Number™ (GTIN™).

2.1.1.2.6 Single Item or Grouping of Items

A trade item may be a single, non-breakable unit or a standard and stable grouping of a series of single items. Such groupings of items may be present in a wide variety of physical forms, such as a fibreboard case, a covered or banded pallet, a film wrapped tray, or a crate with bottles. Trade items consisting of a single unit are identified with a Global Trade Item Number™ (GTIN™). Standard groupings of identical or different units, each identified with a GTIN, are identified with a separate GTIN.

2.1.1.2.7 Single Trade Items Composed of Several Physical Parts

Because of its physical nature, a trade item may be packed in separate physical parcels. For example, furniture equipment may be composed of several pieces (e.g., a sofa and two armchairs, which cannot be ordered or sold separately). A specific standard solution is available to identify and symbol mark each component of a trade item composed of several physical parts.

2.1.1.2.8 Quality of Substrate

The choice of the data carrier (bar code symbology) used to symbol mark a trade item depends on the nature of the item and on the environment in which the bar code symbol will be scanned. It also depends on the quality of the substrate on which the bar code symbol will be marked.

2.1.1.2.9 Size of the Package

The space available on a package to symbol mark a trade item may be limited. Standard solutions that emphasise strictly defined rules are available to handle these situations.

2.1.2 Identification of Trade Items

2.1.2.1 Fixed Measure Trade Items

2.1.2.1.1 General Numbering and Symbol Marking Rules

Fixed Measure Trade Items are those that are always produced in the same version and composition (e.g., type, size, weight, contents, design). The identification number identifies the item unambiguously. Every trade item that is different from another in any respect is assigned a separate Global Trade Item Number™ (GTIN™). The GS1 Prefixes 000 to 019, 030 to 039, 060 to 099, 100 to 139, 300 to 969, and 977 to 979 are used for all GTINs described in this section.

Figure 2.1.2.1.1 – 1 shows the options available when numbering and symbol marking Fixed Measure Trade Items.

Figure 2.1.2.1.1 – 1

Data Structure	Bar Code Symbol	Reference to Element Strings in Section 3.0	Comments
EAN/UCC-8	EAN-8	Section 3.3.1	Only for small items
UCC-12	UPC-E	Section 3.2.1	Only for small items
UCC-12	UPC-A	Section 3.2.1	For all items
EAN/UCC-13	EAN-13	Section 3.2.1	For all items
UCC-12	ITF-14	Section 3.5.1	Not for Point-of-Sale
EAN/UCC-13	ITF-14	Section 3.5.1	Not for Point-of-Sale
EAN/UCC-14	ITF-14	Section 3.5.2	Not for Point-of-Sale
UCC-12	GS1-128 (AI 01)	Section 3.6.2	Not for Point-of-Sale
EAN/UCC-13	GS1-128 (AI 01)	Section 3.6.2	Not for Point-of-Sale
EAN/UCC-14	GS1-128 (AI 01)	Section 3.6.2	Not for Point-of-Sale

Any bar code symbol that is intended for General Distribution Scanning (including unattended, fixed mount scanning environments, where items are scanned automatically as they pass by on a conveyor) should be a minimum of 32 mm (1.25 in.) in height and be printed at the higher end of the permissible X-dimension range.

2.1.2.1.2 Trade Items Scanned at the Point-of-Sale

A trade item that is intended to cross the Point-of-Sale in a retail outlet must carry a bar code symbol of the EAN/UPC Symbology family. Therefore, these trade items support only EAN/UCC-8, UCC-12, or EAN/UCC-13 Identification Numbers.

Some Point-of-Sale scanning systems may be able to handle symbologies other than the EAN/UPC Symbology. However in an open environment, it is not possible to predict the type of scanner that will be used. Therefore, items intended for scanning at a Point-of-Sale in a retail outlet must be marked with a bar code symbol of the EAN/UPC Symbology family.

2.1.2.1.3 When is an EAN/UCC-8 Identification Number Appropriate?

The EAN/UCC-8 Identification Number is available for items whose packaging does not include enough available space to permit the use of an EAN-13 or UPC-A Symbol. EAN/UCC-8 Identification Numbers are individually assigned by GS1 Member Organisations on request (see Figure 2.1.2.1.3 – 1).

Figure 2.1.2.1.3 – 1

EAN/UCC-8 Data Structure

GS1-8 Prefix				Item Reference			Check Digit
N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈

The following guidelines should be observed:

Before deciding to use an EAN/UCC-8 Identification Number as opposed to an EAN/UCC-13 ID Number or UCC-12 ID Number, companies, working jointly with their printer, should consider options such as:

- Whether the bar code can be reduced in size (e.g., printed at a lower X-dimension, taking into account the minimum bar code symbol print quality requirements (See Section 5.4))
- Whether the label or artwork can reasonably be changed to enable the printer's recommended size of a EAN-13 or UPC-A Bar Code Symbol to be included (e.g., redesigning the label increasing the label size, especially when the existing label is small in comparison with the pack area, or using an additional label). The label includes the total printed design surface, whether or not it is separately affixed.
- Whether a truncated bar code symbol can be used. A truncated bar code symbol (normal length, but reduced in height) may only be used if there is absolutely no possibility of printing a full size bar code symbol. Truncation removes the omni-directional scanning capability. A bar code symbol with excessive truncation will not be of any practical use. Users considering this option should consult their customers to see if an acceptable compromise can be reached.

Pack size constraints allow several possible options:

- The use of an EAN/UCC-8 Identification Number is authorised when the EAN-13 or UPC-A Bar Code Symbol in the size required as a result of print quality studies exceeds either 25% of the printed label area or 12.5% of the total printable area.
- The use of an EAN/UCC-8 Identification Number is authorised when either the largest side of the printed label is less than 40 cm² or the total printable area is less than 80 cm².
- The use of an EAN/UCC-8 Identification Number is authorised on cylindrical products with a diameter less than 3 cm.

2.1.2.1.4 When is a UPC-E Bar Code Symbol Appropriate?

Only UCC Company Prefixes beginning with zero can be used to construct UPC-E Bar Code Symbols. Distribution of UCC Company Prefixes in this range is restricted to proven need only (e.g., for items whose packaging does not include enough available space to permit the use of any other bar code symbol). Companies with these prefixes are encouraged to manage their finite resource carefully.

Technical details for the UPC-E Bar Code Symbol and UCC-12 Identification Numbers are described in [Section 3.A.2](#).

2.1.2.1.5 Books, Paperbacks, Serials, and Printed Sheet Music

2.1.2.1.5.1 General Principles Adopted in the Solutions Provided

When identifying books, paperbacks, serials, and printed sheet music, companies can choose between an existing international numbering system, such as ISBN, ISMN, or ISSN, and the EAN/UCC-13 Data Structure GS1 makes available, through these specifications, a general framework of solutions for books, paperbacks, serials, and printed sheet music, which should be considered by GS1 Member Organisations working in liaison with publishers and trade associations.

The numbering and symbol marking rules for books, paperbacks, serials, and printed sheet music sold in the United States and Canada are available from GS1 US.

2.1.2.1.5.2 Identification of Books, Paperbacks, and Printed Sheet Music

When identifying books, paperbacks, and printed sheet music, a company should first attempt to identify them in the same manner as any other trade item: by use of the EAN/UCC-13 or UCC-12 Data Structure.

The second option is to use the ISBN or ISMN numbering systems. The GS1 Prefix 978 is used to encode the ISBN number assigned to a particular item without its Check Digit. The GS1 Prefix 979 is used for encoding either the ISBN or the ISMN of a particular item without its Check Digit.

Figure 2.1.2.1.5.2 – 1

GS1 Prefix	ISBN (Without its Check Digit)	Check Digit
9 7 8	N ₄ N ₅ N ₆ N ₇ N ₈ N ₉ N ₁₀ N ₁₁ N ₁₂	N ₁₃

GS1 Prefix	ISBN or ISMN (Without its Check Digit)	Check Digit
9 7 9	N ₄ N ₅ N ₆ N ₇ N ₈ N ₉ N ₁₀ N ₁₁ N ₁₂	N ₁₃

Note: For ISMN the N₄ (which is represented by "M" in the ISMN) takes the value 0 (zero). N₅ to N₁₂ are the first eight digits of the ISMN number.

2.1.2.1.5.3 Symbol Marking of Books, Paperbacks, and Printed Sheet Music

Books, paperbacks, and printed sheet music should be marked with an EAN-13, UPC-A, or UPC-E Bar Code Symbol that complies with the print quality specifications applicable to all GS1 System bar code symbols. In addition, the main bar code symbols on books, paperbacks, and printed sheet music are subject to the following constraints:

- They must not be reduced in height.
- They must appear on the outside cover of the book (to facilitate payment) and inside the cover for books that are subject to return.

2.1.2.1.5.4 Supplementary Information for Books, Paperbacks, and Printed Sheet Music

Some publishers may wish to communicate additional information in a bar code symbol in order to meet their internal requirements. For example, publishers may wish to include an edition variant (e.g., unchanged reprint, price increase), which is not distinguished by the ISBN, ISMN, EAN/UCC-13 ID Number, or UCC-12 ID Number. The GS1 System provides an additional two- or five-digit symbol, called an Add-On Symbol, can be included on the item just to the right of the main bar code symbol.

Add-On Symbols involve the following constraints:

- They should not contain information that must appear in the item's EAN/UCC-13 ID Number (or UCC-12 ID Number).
- The reading of the Add-On Symbol by the retailer's Point-of-Sale system is optional.
- The use of the Add-On Symbol is the responsibility of each publisher.

2.1.2.1.5.5 Identification of Serial Publications

When identifying serial publications, companies should first attempt to identify them in the same manner as any other trade item: using the EAN/UCC-13 or UCC-12 Data Structure.

The second option involves using a special GS1 Company Prefix (assigned by a GS1Member Organisation within its territory), the publication number, and the price of the publication (provided that the national legislation allows this). With this option, the price is placed in clearly defined positions and is directly usable in the country of publication. However, as soon as the item leaves the country, the price has no direct significance and the GTIN must be interpreted in a general way, without being broken down internally.

The third option is to make use of the ISSN numbering system. The GS1 Prefix 977 is used for encoding the ISSN number assigned to a particular item without its Check Digit.

Figure 2.1.2.1.5.5 – 1

GS1 Prefix	ISSN (Without its Check Digit)	Variant	Check Digit
9 7 7	N ₄ N ₅ N ₆ N ₇ N ₈ N ₉ N ₁₀	N ₁₁ N ₁₂	N ₁₃

The variant digits, N₁₁ and N₁₂ may be used to express variants of the same title for issues with a different price or to identify different issues of a daily within one week. Normal title takes value 00

2.1.2.1.5.6 Two-Digit Add-On Symbol

Serial publications are identified using one of the three solutions previously described. A two-digit serial number encoded in a two-digit Add-On Symbol is also available. The system for assigning the serial number is at the discretion of each GS1 Member.

GS1 Global Office recommend the use of the following number assignment:

- Dailies (or more generally publications with several issues a week): The publications of each day of the week are considered separate trade items that must be identified with a separate identification number represented in an Add-On Symbol. The two-digit serial number should only be used to represent the applicable week, which, together with the EAN/UCC-13 or UCC-12 ID Number, establishes the day within the year.
- Weeklies: Number of the week (01 – 53)
- Bi-weeklies: Number of the first week of the respective period (01 – 53)
- Monthlies: Number of the month (01 – 12)
- Bi-monthlies: Number of the first month of the respective period (01 – 12)
- Quarterlies: Number of the first month of the respective period (01 – 12)
- Seasonal period: First digit = last digit of the year; second digit = 1 spring, 2 summer, 3 autumn, 4 winter
- Bi-annual period: First digit = last digit of the year; second digit = number of the first season of the respective period
- Annuals: First digit = last digit of the year; second digit = 5
- Special intervals: Consecutively numbered from 01 to 99

The serial number is carried by a two-digit Add-On Symbol that is placed to the right of the symbol and parallel to it. The Add-On Symbol must comply with the print quality specifications applicable to all GS1 System bar code symbols. For example, the X-dimension applied to the main bar code symbol must also be applied to the Add-On Symbol.

2.1.2.1.5.7 Five-Digit Serial Number

Serial publications can also use a five-digit serial number carried by a five-digit Add-On Symbol. The reading of the Add-On Symbol at a Point-of-Sale is optional. The Add-On Symbol must not be used to encode information that should be contained within the Global Trade Item Number™ (GTIN™). The Add-On Symbol provides additional information about a particular publication of a printed item, and it is the publisher's responsibility to define the numbering scheme. When using a five-digit Add-On Symbol, a two-digit Add-On Symbol cannot also be used.

Information that can be encoded in the five-digit Add-On Symbol includes the actual date of issue, in order to differentiate between successive issues.

The five-digit Add-On Symbol is placed to the right of the main bar code symbol and parallel to it. The Add-On Symbol must comply with the print quality specifications applicable to all GS1 System bar code symbols. For example, the X-dimension applied to the main symbol also must be applied to the Add-On Symbol.

2.1.2.1.6 Groupings of Trade Items Not Crossing a Point-of-Sale

2.1.2.1.6.1 General Identification Rules for Groupings of Trade Items

Every trade item that is different from another in any respect is assigned a unique Global Trade Item Number™ (GTIN™). This includes groupings of trade items which are also trade items.

For example each of the packaging types in Figure 2.1.2.1.6.1 – 1, if traded, is assigned a separate GTIN.

Figure 2.1.2.1.6.1 – 1

Trade Item	GTIN Numbering Options			
	EAN/UCC-8	UCC-12	EAN/UCC-13	EAN/UCC-14
Single Product A	X	X	X	
50 x Product A (standard case)		X	X	X
50 x Product A (display case)		X	X	X
100 x Product A (standard case)		X	X	X
Single Product B	X	X	X	
50 x Product A 50 x Product B		X	X	

2.1.2.1.6.2 Identification of Uniform Groupings of Trade Items

A uniform grouping of trade items is a standard and stable grouping of identical trade items. If the grouping is itself a trade item, it must be identified with a UCC-12, EAN/UCC-13, or EAN/UCC-14 Global Trade Item Number.

2.1.2.1.6.3 EAN/UCC-14 Global Trade Item Number for Trade Item Groupings

The manufacturer or supplier has the option of either assigning a unique EAN/UCC-13 or UCC-12 GTIN to each grouping, or assigning a unique EAN/UCC-14 GTIN with an indicator digit value of 1 to 8. These 14-digit GTINs incorporate the GTIN (less its check digit) of the trade item contained in each grouping, as explained below. The check digit for each EAN/UCC-14 GTIN is then recalculated.

The indicator digit has no meaning. The digits do not have to be used in sequential order and some may not be used at all. The EAN/UCC-14 GTIN structure for standard trade item groupings creates extra numbering capacity. The indicator digits can be re-used according to section 2.1.4.4.

For example

- Different uniform groupings of the same trade item.

Figure 2.1.2.6.3 - 1

Indicator digit	GTIN of trade item contained in the grouping, less its check digit	New Check Digit	Description	Quantity
	061414112345	2	Trade item	Single
1	061414112345	9	Standard Trade Item Grouping	A grouping
...	...	...	...	...
8	061414112345	8	Standard Trade Item Grouping	Another grouping
The indicator digits 2 to 7 may also be used to create new EAN/UCC-14 GTINs. When all these eight indicator digits have been used, further groupings must be identified with either EAN/UCC-13 or UCC-12 GTINs. (Indicator digit 9 is reserved for variable measure product. See Section 2.2.2.2.)				

2.1.2.1.6.4 Identification of Mixed Groupings of Trade Items

A mixed grouping of trade items is a standard and stable grouping of two or more different trade items.

The EAN/UCC-14 Identification Number is valid for mixed groupings only when the trade item contained is an assortment of two or more different trade items as shown below.

For example:

- Product C is a mixed grouping of Product A (GTIN 'A') and Product B (GTIN 'B'), and is identified with either an EAN/UCC-8, UCC-12 or EAN/UCC-13 Global Trade Item Number, GTIN 'C'.
- GTIN 'C' could then be used to construct an EAN/UCC-14 Global Trade Item Number for a standard trade item grouping comprised of Product C.

As shown below, the UCC-12 GTINs 614141234561 and 614141345670 identify the two trade items in the assortment identified by the GTIN 614141456789.

Figure 2.1.2.1.6.4 – 1

Indicator digit	GTIN of trade item less its check digit	Check digit	Description	Quantity
	061414123456	1	Retail consumer trade item (Product A)	Single
	061414134567	0	Retail consumer trade item (Product B)	Single
	061414145678	9	Retail consumer trade item (Product C)	Assortment
1	061414145678	6	Standard Trade Item Grouping	A grouping of the assortment
...	...	...	...	...
8	061414145678	5	Standard Trade Item Grouping	Another grouping of the assortment
The indicator digits 2 to 7 may also be used to create new EAN/UCC-14 GTINs. When all these eight indicator digits have been used, further groupings must be identified with either EAN/UCC-13 or UCC-12 GTINs. (Indicator digit 9 is reserved for variable measure product. See Section 2.2.2.2.)				

2.1.2.1.6.5 Symbol Marking Groupings of Trade Items

Symbols from the EAN/UPC Symbology family (UPC-A, UPC-E, and EAN-13 Bar Code Symbols) may be used to encode the UCC-12 or EAN/UCC-13 Identification Number of the trade item grouping.

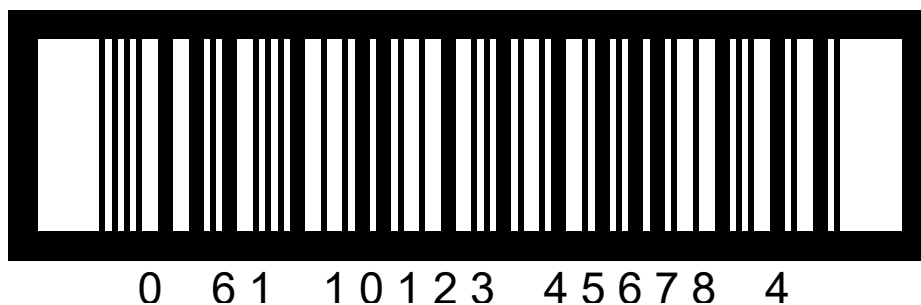
ITF-14 Symbols may be used on groupings of trade items where printing conditions require the application of a less demanding symbology. ITF-14 Symbols can encode the UCC-12, EAN/UCC-13, or EAN/UCC-14 Identification Number of the item.

The GS1-128 Symbology with Application Identifier (01) may be used to encode a UCC-12, EAN/UCC-13, or EAN/UCC-14 Identification Number that identifies the trade item if the printing conditions allow. The choice of this symbology is particularly relevant if there is a need to encode attribute information in addition to the identification number.

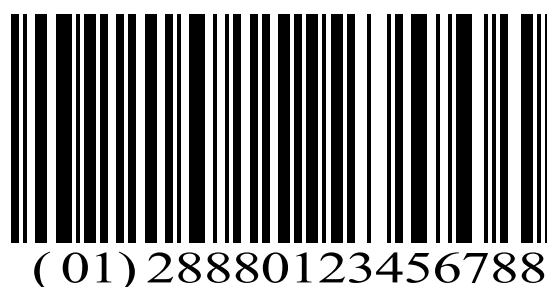
Figure 2.1.2.1.6.4 – 1



ITF-14



GS1-128 - AI (01)



2.1.2.1.7 Identification of a Trade Item Composed of Several Parts

The GS1 System provides for an Element String using Application Identifier (8006) (described in [Section 3.6.52](#)) to identify a trade item that does not cross a Point-of-Sale and which, due to its nature, is packed in several physical units. Each individual component is marked with a GS1-128 Bar Code Symbol carrying the Element String, which consists of the Global Trade Item Number™ (GTIN™) of the trade item, the sequence number of the particular component, and the total number of components of the trade item. If an attribute appears on more than one component, its value must be the same.

The use of the Element String AI (8006) to identify a trade item excludes the application of the Element String AI (01) on the same unit.

This solution is not applicable for trade items crossing a Point-of-Sale using slot scanners.

2.1.2.2 Variable Measure Trade Items Not Crossing a Point-of-Sale

2.1.2.2.1 General Numbering and Symbol Marking Rules

This section concerns trade items not intended to be scanned at the Point-of-Sale.

Trade items may be of variable measure either because the production process does not guarantee consistency in weight, size, or length (e.g., carcasses of meat, whole cheeses) or because the items are created to meet a special order that states a quantity (e.g., textiles ordered by the metre, glass ordered by the square metre).

Only trade items that are sold, ordered, or produced in quantities, which can vary continuously, are covered by the rules outlined in this section. Trade items that are sold in discrete and pre-defined bands (e.g., as a nominal weight) are treated as Fixed Measure Trade Items.

A trade item must be considered to be variable measure if its measure is variable at any point in the supply chain. For example, a supplier may sell and invoice chickens in standardised cases of 15 kg each; therefore the quantity of contained chickens will vary. The customer, a retailer in this example, may need to know the exact number of chickens contained in each case in order to organise the distribution to his stores. In this example, the supplier should source mark the trade item by using a variable measure Global Trade Item Number™ (GTIN™) (see Figure 2.1.2.2.1 – 1) and the variable count Element String (see [Section 3.6.20](#)).

The options shown in Figure 2.1.2.2.1 – 1 are available to number and symbol mark Variable Measure Trade Items.

Figure 2.1.2.2.1 – 1

Data Structure	Bar Code Symbol	Reference to Element Strings in Section 3.0	Comments
EAN/UCC-14	ITF-14	Section 3.5.3	Not for Point-of-Sale
EAN/UCC-14	GS1-128 - AI (01)	Section 3.6.3	Not for Point-of-Sale

The EAN/UCC-14 Identification Number with the Indicator 9 is used to identify a Variable Measure Trade Item. The presence of the variable measure information is mandatory for the complete identification of a particular Variable Measure Trade Item. The digit 9 in the first position is an integral part of the GTIN.

The EAN/UCC-14 data structure beginning with the indicator 9 is not used on an item intended to cross the Point of Sale. Numbering of these items is defined in [Section 2.1.2.4](#).

2.1.2.2.2 Trade Measures Required to Complete the Identification of Variable Measure Trade Items

The EAN/UCC-14 Identification Number identifies a Variable Measure Trade Item with respect to its fixed attributes or characteristics. To complete the identification of a Variable Measure Trade Item, the presence of an Element String representing a trade measure is mandatory. Applicable trade measures depend on the nature of the product. They may be a quantity, a weight, or any dimension.

For details on Element Strings for trade measures, see [Sections 3.6.20](#) and [3.6.21](#).

2.1.2.2.2.1 Variable Count: AI (30)

This Element String is used if the variable measure of the trade item is the number of items contained. In order to generate a short bar code symbol, always enter an even number of digits in the data field count of items by inserting a leading zero. Concatenation of this Element String with the EAN/UCC-14 Identification Number of the item enhances the accuracy of the application.

Note: This Element String should never be used to indicate the quantity contained in a Fixed Measure Trade Item. However, if it appears on a Fixed Measure Trade Item, it should not invalidate the trade item identification.

2.1.2.2.2.2 Trade Measures: AI (31nn), (32nn), (35nn), (36nn)

These Element Strings are used if the variable measure of the respective trade item is weight, dimension, area, or volume. Only one Element String of a given unit of measure may be applied on a particular item. Several Element Strings containing trade measures are possible on a particular item if the item is available in either unit of measure and if the applicable unit of measure is not distinguished for ordering and billing. This might apply if weight must be expressed in kilograms and pounds.

Note: The fourth (and last) digit of the AI indicates the implied decimal point position. The value 0 means that the measurement is expressed in the basic unit of measure associated with the AI (e.g., kilograms). A value of 1 decreases the measurement by a factor of 10, a value of 2 by a factor of 100, and so on. For example, this enables metric weights to be represented from 999 kilograms to 1/1000 of a milligram.

2.1.2.2.2.3 Roll Products - Width, Length, Core Diameter, Direction, Splices: AI (8001)

The EAN/UCC-14 Identification Number can denote a basic roll product. The Element String AI (8001) contains the pre-defined variable fields of a roll product. It may be used for those variable roll products where the standard trade measures (AI (31nn), (32nn), (35nn), (36nn)) are not sufficient.

This Element String must never be used together with other Element Strings representing standard trade measures.

2.1.2.2.3 Types of Variable Measure Items

Any trade item of a given composition where the quantity/measure information cannot be pre-determined for any reason is a Variable Measure Trade Item. The most frequent types are shown in Figure 2.1.2.2.3 – 1.

Figure 2.1.2.2.3 – 1

Type	Item Description
A	Items traded in bulk, neither portioned nor pre-packed for retail sale, ordered in any quantity, and that are delivered as non-standardised trade items (e.g., fish, fruit, vegetables, cables, carpets, timber, fabrics) The identification number denotes the item as a trade entity containing any quantity of the given product and, if applicable, the form of packaging. Weight or dimensions complete the identification of the individual unit.
B	Trade items ordered and delivered by piece (wrapped or unwrapped) and invoiced by weight or measure because weight or measure varies due to the nature of the product or due to the manufacturing process (e.g., whole cheese, sides of bacon, beef carcasses, fish, sausages, ham, chicken, cauliflower, motion picture films) The identification number denotes the item as a particular pre-defined entity and, if applicable, denotes the form of packaging. Price or weight or dimensions complete the identification of the individual item.
C	Portioned trade items, pre-packed for sale by weight to the consumer, not standardised in quantity. (e.g., meat, cheese, vegetables, fruit, fillets of fish, sliced poultry, cold cuts) The identification number denotes the item type according to business practice and the form in which it is packed. Price or weight completes the identification of the individual unit.
D	Standardised trade items with selectable dimensions where GS1 System standard numbering does not make sense to cover the multiplicity of all variations (e.g., wooden planks, carpeting) The identification number denotes the pre-defined basic trade item. The applicable dimension(s) completes the identification of the individual unit.
E	Standardised composition of a fixed number of trade items that are Type B or Type C (e.g., a trade item containing 10 chickens (Type B)) The identification number denotes the standardised trade item as an entity and, if applicable, its form of packaging. The total weight of all items contained completes the identification of the particular trade item.

2.1.2.2.4 Examples of Numbering and Symbol Marking of Variable Measure Trade Items

In the examples in the subsections that follow, the following factors apply:

- In order to be illustrative, all examples show the same presentation (e.g., price list, order, delivery, invoice, and recording in a data file).
- GS1-128 Bar Code Symbols are used.
- The examples are given to demonstrate the correct use of a given Application Identifier when used. When AI (02) is not used, information about the shipment must be received using Electronic Data Interchange (EDI) or other means prior to its physical receipt.

2.1.2.2.4.1 Example 1: Traded by Piece

The following example shows the order and delivery of an item traded by piece and invoiced by weight.

- The supplier's catalogue contains one entry: one salami weighing ~ 500 g
- The order for 100 units is delivered in three boxes. Each box is marked with an SSCC and, optionally, with information on the content of the box, expressed as follows:
 - AI (02) indicates the variable measure Global Trade Item Number™ (GTIN™) of the units contained within the box.
 - AI (3101) indicates the total weight of the items contained within the box.
 - AI (37) indicates the count of items contained within the box
- The three boxes may be stored on a pallet that may itself be marked with an SSCC and, optionally, with information on the contents of the pallet, expressed as follows:
 - AI (02) indicates the variable measure GTIN of the units contained within the pallet.
 - AI (3101) indicates the total weight of the items contained within the pallet.
 - AI (37) indicates the count of items contained within the pallet

The invoice refers to the GTIN and quantity delivered and shows the total weight and the price per kilogram. The GTIN and quantity of the invoice match the GTIN and quantity of the order.

Figure 2.1.2.2.4.1 – 1

Process	Description	Element Strings Used / Symbol Marking of the Items
Supplier's catalogue	one Salami ~ 500 g	GTIN 97612345000018
Order	100 salamis	100 x 97612345000018
Delivery	three logistic units Unit 1 = 33 salamis, 16.7 kg Unit 2 = 33 salamis, 16.9 kg Unit 3 = 34 salamis, 17.1 kg	Unit 1: 00 376123450000010008 02 97612345000018 3101 000167 37 33 Unit 2: 00 376123450000010015 02 97612345000018 3101 000169 37 33 Unit 3: 00 376123450000010022 02 97612345000018 3101 000171 37 34
	If delivery is made on a pallet	Pallet: 00 376123450000010039 02 97612345000018 3101 000507 37 0100
Invoice	GTIN of items and the total weight (50.7 kg) + the price per kg	100 x 97612345000018; 50.7 kg x price per kg

Data File Logistic Units	Identification of Logistic Unit (SSCC)	GTIN of Contained Trade Items	Total Trade Weight of Content (grams.)	Number of Units Contained
Either pallet or individual units	376123450000010039	97612345000018	50700	100
	376123450000010008	97612345000018	16700	33
	376123450000010015	97612345000018	16900	33
	376123450000010022	97612345000018	17100	34

Data File Trade Items	GTIN of Trade Item	Total Trade Weight (grams)	Number of Trade Items
One record per identification number	97612345000018	50700	100

2.1.2.2.4.2 Example 2: Traded by Standard Grouping

The following example shows the order and delivery of an item traded by standard grouping and invoiced by weight.

- The supplier's catalogue contains one entry: one case of 20 steaks weighing ~ 200 g each.
- The order is for three cases. Each case delivered is marked with the Global Trade Item Number™ (GTIN™) of a single case followed by the actual weight of the items contained.
- The three cases may be stored on a pallet that may itself be marked with an SSCC and, optionally, with information on the contents of the pallet, expressed as follows:
 - AI (02) indicates the variable measure GTIN of the units contained within the pallet.
 - AI (3102) indicates the total weight of the items contained within the pallet.
 - AI (37) indicates the count of cases contained within the pallet
- The invoice refers to the GTIN and quantity delivered and shows the total weight and the price per kilogram. The GTIN and quantity of the invoice match the GTIN and quantity of the order.

Figure 2.1.2.2.4.2 – 1

Process	Description	Element Strings Used / Symbol Marking of the Items
Supplier's catalogue	One case of 20 steaks ~ 200 g, vacuum packed	GTIN 97612345000117
Order	Three cases	3 x 97612345000117
Delivery	Three trade items Unit 1: weight = 4.150 kg Unit 2: weight = 4.070 kg Unit 3: weight = 3.980 kg	Unit 1: 01 97612345000117 3102 000415 Unit 2: 01 97612345000117 3102 000407 Unit 3: 01 97612345000117 3102 000398
	If delivery is made on a pallet	Pallet: 00 376123450000010091 02 97612345000117 3102 001220 37 03
Invoice	GTIN of items and the total weight (12.20 kg) + the price per kg	3 x 97612345000117; 12.2 kg x price per kg

Data File Logistic Units	Identification of Logistic Unit (SSCC)	GTIN of Contained Trade Items	Total Trade Weight of Content (grams.)	Number of Units Contained
Pallet	376123450000010091	97612345000117	12200	3

Data File Trade Items	GTIN of Trade Item	Total Trade Weight	Number of Trade Items
One Record	97612345000018	12200	3

2.1.2.2.4.3 Example 3: Traded in Bulk

The following example shows an order and delivery of an item traded in bulk.

- The supplier's catalogue contains one entry: cabbage unwrapped sold in bulk by kilogram.
- The order is for 100 kg. It is delivered in two cases. Each case is marked with the Global Trade Item Number™ (GTIN™) of the cabbage followed by the actual weight of the items contained.
- The two cases may be stored on a pallet that may itself be marked with an SSCC.
- The invoice refers to the GTIN as ordered and shows the total weight and the price per kilogram. The delivered weight may be verified as being close to the ordered quantity.

Figure 2.1.2.2.4.3 – 1

Process	Description	Element Strings Used / Symbol Marking of the Items
Supplier's catalogue	Cabbage unwrapped sold in bulk by kilogram	GTIN 97612345000049
Order	100 kg of cabbage	100 kg x 97612345000049
Delivery	Two trade items Unit 1: weight = 42.7 kg Unit 2: weight = 57.6 kg	Unit 1: 01 97612345000049 3101 000427 Unit 2: 01 97612345000049 3101 000576
	If delivery is made on a pallet	Pallet: 00 376123450000010107
Invoice	GTIN of item and the total weight (100.3 kg) + the price per kg	97612345000049 100.3 kg x price per kg

Data File Logistic Units	Identification of Logistic Unit (SSCC)	GTIN of Contained Trade Items	Total Trade Weight of Content (grams)	Number of Units Contained
Pallet	376123450000010107	97612345000049	42700	1
		97612345000049	57600	1

Data File Trade Items	GTIN of Trade Item	Total Trade Weight (grams)	Number of Trade Items
One record per trade item	97612345000049	42700	1
	97612345000049	57600	1

2.1.2.2.4.4 Example 4: Traded by Standard Grouping

The following example shows an order of standardised Variable Measure Trade Items by case that are invoiced by the number of pieces delivered.

- The supplier's catalogue contains one entry: one case of ~ 10 cabbages sold by piece.
- The order is for two cases. Each case delivered is marked with the Global Trade Item Number™ (GTIN™) of a single case followed by the actual count of the items contained.
- The two cases may be stored on a pallet that may itself be marked with an SSCC and, optionally, with information on the contents of the pallet, expressed as follows:
 - AI (02) indicates the variable measure GTIN of the units contained within the pallet.
 - AI (30) indicates the total count of the items contained within the pallet.
 - AI (37) indicates the count of cases contained within the pallet
- The invoice refers to the GTIN as ordered and delivered and the total count of items.

Figure 2.1.2.2.4.4 – 1

Process	Description	Element Strings Used / Symbol Marking of the Items
Supplier's catalogue	Case containing ~10 cabbages sold by pieces	GTIN 97612345000285
Order	Two cases	2 x 97612345000285
Delivery	Unit 1: 11 pieces Unit 2: 12 pieces	Unit 1: 01 97612345000285 30 11 Unit 2: 01 97612345000285 30 12
	If delivery is made on a pallet	Pallet: 00 376123450000010138 02 97612345000285 30 23 37 02
Invoice	GTIN of the trade item and the total quantity	2 x 97612345000285 23 pieces x price per piece

Data File Logistic Units	Identification of Logistic Unit (SSCC)	GTIN of Contained Trade Items	Total Number of Pieces Contained in the Trade Item	Number of Units Contained
Pallet	376123450000010138	97612345000285	23	2

Data File Trade Items	GTIN of Trade Item	Total Number of Pieces	Number of Trade Items
One Record	97612345000285	23	2

2.1.2.2.4.5 Example 5: Traded in Bulk

The following example shows a product that can be purchased from a supplier or sold to a customer by any length in metres.

- The supplier's catalogue contains one entry: cable T49 sold in metres.
- The order is for one length of cable of 150 metres. The delivered package is marked with the Global Trade Item Number™ (GTIN™) of the cable followed by the actual length of cable contained.
- The invoice refers to the GTIN as ordered and delivered and the total length.

Figure 2.1.2.2.4.5 – 1

Process	Description	Element Strings Used / Symbol Marking of the Items
Supplier's catalogue	Cable T49 sold in any length in metres	GTIN 97612345000063
Order	One trade item of 150 metres	97612345000063 x 150 metres
Delivery	One trade item, 150 metres	01 97612345000063 3110 000150
Invoice	GTIN of the trade item and the total quantity	1 x 97612345000063 150 x price per metre

Data File Trade Items	GTIN of Trade Item	Total Trade Length (meters)
One record	97612345000063	150

2.1.2.3 Fixed Measure Trade Items - Restricted Distribution

2.1.2.3.1 Definition

This section describes applications where the item identification is defined only in a closed environment. Therefore, the distribution of trade items marked in this way is restricted to a given geographic region or for use within a company. However, within their closed environment these items may be processed along with trade items identified with Global Trade Item Numbers™ (GTINs™) defined for open trade.

Some regulations established by GS1 Member Organisations for their country or assigned area should be observed for the allocation of identification numbers for restricted distribution.

When assigned to company internal use, the structure and management of the numbers represented in the Element Strings of this section are the responsibility of the user. Number changes and re-use of expired numbers must be managed by the user based on his requirements.

When centrally administrated within a geographic area, the relevant administration body determines the structure and manages number allocation based on user requirements.

2.1.2.3.2 Company Internal Numbering – GS1-8 Prefix 0 or 2

This Element String, described in [Section 3.3.2](#), uses a GS1-8 Prefix of 0 or 2. It provides two million identification numbers, which can be assigned for internal use in a company. When the GS1-8 Prefix is 0, the Element String is sometimes called a Velocity Code because it is quicker to key enter.

Note 1: In addition to trade item identification, this Element String may be used for any purpose that is supported by the company's equipment supplier (see [Section 2.6.4](#)).

Note 2: In some environments where numbers may have to be key entered, the EAN-8 Bar Code Symbol carrying EAN/UCC-8 Identification Numbers (and the GS1-8 Prefix 0) may be confused with the numbers carried by a UPC-E Bar Code Symbol. If such a risk exists, it is preferable to use the GS1-8 Prefix 2 capacity for internal use.

2.1.2.3.3 Numbering in a Geographic Area Defined by the GS1 Member Organisation – GS1 Prefixes 20 to 29

The GS1 Prefixes 20 to 29 are reserved for identification purposes within a restricted geographic area. Each GS1 Member Organisation is entitled to assign the prefixes to be used for these Element Strings in its country or assigned area (see [Section 3.2.2](#)):

- For the central administration of the identification of Fixed Measure Trade Items within the country or assigned area of the GS1 Member Organisation.
- For internal numbering of Fixed Measure Trade Items by a particular company within the country or assigned area of the GS1 Member Organisation.

Note 1: Under the control of an individual GS1 Member Organisation, GS1 Prefixes 20 to 29 may also be used for the identification of Variable Measure Trade Items for restricted geographic distribution and for any other company internal purpose.

Note 2: In addition to trade item identification, a company may use this data element for any other internal purpose (see [Section 2.6.4](#)).

Note 3: Suppliers manufacturing their own label products for several different customers should use unique GS1 System numbering to distinguish their customers. If this is not done, the supplier will not be able to use Electronic Data Interchange (EDI) or electronic catalogues.

2.1.2.3.4 Company Internal Numbering - GS1 Prefix 04

Any company in the world may use this Element String for company internal trade item numbering. If the GS1 Prefix 04 is being applied, the user company may structure the trade item number.

Note: In addition to trade item identification, a company may use this data element for any other internal purpose (see [Section 2.6.4](#)).

2.1.2.3.5 Company Internal Numbering - GS1 Prefix 00 (LAC and RZSC)

The GS1 Prefix 00 provides for company internal numbering, using Locally Assigned Codes (LACs) or Retailer Zero-Suppressed Codes (RZSCs), which are carried by a UPC-E Bar Code Symbol. GS1 Company Prefixes 00 00000 and 00 01000 to 00 07999 are used in this feature. For details, see [Section 3.A.2](#).

2.1.2.4 Variable Measure Trade Items - Restricted Circulation

2.1.2.4.1 Definition

Variable Measure Trade Items – Restricted Circulation, are those sold in random quantity against a fixed price per unit quantity and intended to cross a Point-of-Sale (e.g., apples sold at a fixed price per kilogram).

These items are either marked in the store by the retailer or are marked at the source by the supplier. National solutions are available for this purpose.

GS1 Prefixes 02 and 20 to 29 are available to GS1 Member Organisations to devise rules for the marking of Variable Measure Trade Items in their territory. GS1 Member Organisations should make part of this capacity available to user companies for company internal applications.

The data fields available after the relevant GS1 Prefix (defined by the GS1 Member Organisation for their territory) can be structured in a variety of ways to represent the product type, net weight, calculated price, or number of units. Equipment is commercially available for automatically weighing items, calculating an item price from the unit price, and printing the information as a bar code label. The scanning equipment and applications can then be programmed to use the prefix as an instruction to decode the ensuing data fields according to the particular structure adopted.

2.1.2.4.2 Identification of Variable Measure Trade Items

GS1 Member Organisations should assign one or several of the GS1 Prefixes 02 and 20 through 29 for the identification of Variable Measure Trade Items.

Although each GS1 Member Organisation and/or user is perfectly free to develop its solution for numbering Variable Measure Trade Items, the GS1 System provides recommended structures aiming at some degree of equipment standardisation. These formats may include an Item Reference, the retail price of the item, and a price verifier-digit. The recommended structures are shown in Figure 2.1.2.4.2 – 1.

Figure 2.1.2.4.2 – 1

GS1 Prefix*	Recommended Data Structures (Exact Structure Determined by GS1 Member Organisation)	Check Digit
0 2	I I I I I V P P P P	C
or	I I I I V P P P P P	C
2 0 - 29	I I I I I I P P P P	C
	I I I I I P P P P P	C

* The GS1 Prefix is administered by GS1 Global Office and denotes the format and meaning of a particular Element String.

Where: I..I = Item Reference
V = Price verifier-digit calculated according to the algorithm specified in [Section 3.A.1](#)
P..P = Price in local currency
C = Check Digit calculated according to the standard algorithm in [Section 3.A.1](#)

Note: The price field may contain 0, 1, or 2 implied decimal places depending on the monetary unit used. The decimal point, which is not included in the bar code symbol, must nevertheless be taken into account by the marking equipment when printing the Human Readable Interpretation on the label.

GS1 Member Organisations may choose to implement a national solution for Variable Measure Trade Items branded by the supplier for retail. Any national branded variable measure solution requires GS1 Member Organisations to manage the allocation of the item number at a national level.

2.1.3 Attributes of Trade Items

2.1.3.1 General Considerations

2.1.3.1.1 Types of Trade Item Attributes

Trade item attributes are classified into three categories:

- Varying attributes, the use of which is determined by business practices
- Fixed attributes or characteristics of trade items are generally communicated between trading partners by Electronic Data Interchange (EDI) or other means and should thus not be marked on the goods. However, some fixed attributes have been made available for transitional use in order to provide temporary help for particular business applications.
- Varying attributes with restrictions have been established to fulfil special functions in particular applications. Their use makes sense for the issuing company or a within a specific user sector.

2.1.3.1.2 Symbol Marking of Trade Item Attributes

Attributes of trade items shall be symbol marked using a GS1-128 Bar Code Symbol. The only exceptions are the two- and five-digit Add-On Symbols, which are supplementary to the primary symbol.

2.1.3.2 Varying Trade Item Attributes

2.1.3.2.1 Batch or Lot Number: AI (10)

This Element String provides the batch or lot number of the trade item on which the Element String is applied. The Element String is used for tracking trade items with particular manufacturing characteristics wherever required. Complete tracking of the trade item must include the Global Trade Item Number™ (GTIN™).

Note: This Element String must not be used to express characteristics of a trade item that should be included in the GTIN. Use non-significant (shorter) data for batch or lot numbers leading to shorter Element Strings.

2.1.3.2.2 Dates

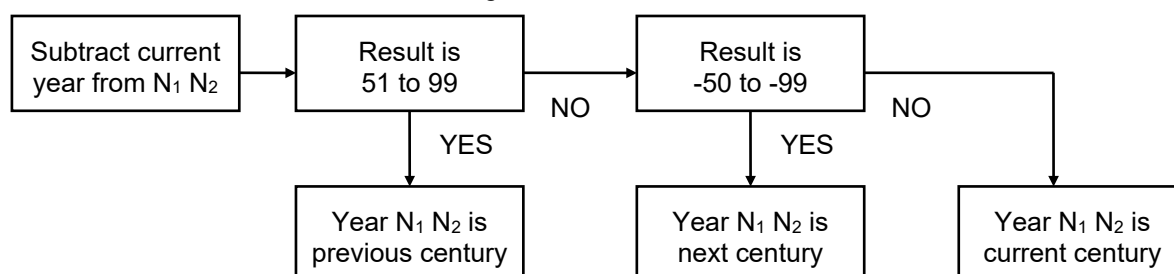
These Element Strings are used to differentiate identical trade items by date information where this is required for business practices. The following types of dates are available:

- Production date - AI (11)
- Packaging date - AI (13)
- Best Before Date - AI (15)
- Expiration Date - AI (17)
- Date and time of production - AI (8008)

It is left to the discretion of the user to interpret a particular date type most useful for his business practices. Such interpretation may change according to the product range for which a date is being applied

Since the data field year consists of two positions, the century is established by the procedure shown in Figure 2.1.3.2.2 – 1.

Figure 2.1.3.2.2 – 1



Note: The Element String can only specify a date in the range from 49 years in the past to 50 years in the future of the current year.

2.1.3.2.3 Serial Number: AI (21)

This Element String represents the serial number of a trade item. It is used for tracking a trade item with a particular serial number. Proper tracking must include the Global Trade Item Number™ (GTIN™).

2.1.3.2.4 Secondary Data for Specific Health Industry Products: AI (22)

This Element String is mainly used in the United States. It contains a special arrangement of supplementary data required for health industry products. AI (22) should not be taken as substitute for AI (21) Serial Number. For details, see [Section 7.8](#).

2.1.3.2.5 Secondary Serial Number: AI (250)

This Element String is used for tracking a particular component contained in a trade item and when used, Element String AI (21) must also appear on the trade item. The secondary serial number may refer to any of the components contained. It is an attribute of the Global Trade Item Number™ (GTIN™). For example, the secondary serial number may be placed on the chassis of a television set to mark its serial number. The company using this Element String should make clear to all business partners which component of a given trade item a secondary serial number relates.

2.1.3.2.6 Reference to Source Entity: AI (251)

Reference to source entity is an attribute of a trade item that refers back to the original item from which the trade item was derived. The issuer of the trade item must indicate through other means the source entity to which the data refers.

2.1.3.2.7 Logistic Measures for Variable Measure Trade Items: AI (33nn), (34nn), (35nn), (36nn)

Logistic measures for Fixed Measure Trade Items remain unchanged for each item. Consequently, they are considered as fixed characteristics and should not be symbol marked on the trade item. Logistic measures for Variable Measure Trade Items, however, can change according to the varying size or weight of the items. This Element String may be used to represent the logistic measure of a particular Variable Measure Trade Item.

2.1.3.2.8 Kilograms Per Square Metre: AI (337n)

This Element String is used to differentiate identical trade items by the effective weight per square metre. It is a varying attribute of the trade item and it is not a variable measure of the trade item concerned.

For example, depending upon the production conditions, the actual weight of standard paper expressed in grams per square metre may vary slightly. The Global Trade Item Number™ (GTIN™) remains unchanged, but it may be useful to mark the actual weight per square metre on the trade item.

2.1.3.2.9 Country of Origin of a Trade Item: AI (422)

This Element String may be used on a physical unit to denote the country of origin of the trade item, the identification number of which is represented in either AI (01) or AI (02).

2.1.3.2.10 Country of Initial Processing: AI (423)

This Element String may be used on a physical unit to denote the country of initial processing of the trade item, the identification number of which is represented in either AI (01) or AI (02).

2.1.3.2.11 Country of Processing: AI (424)

This Element String may be used on a physical unit to denote the country of processing of the trade item, the identification number of which is represented in either AI (01) or AI (02).

2.1.3.2.12 Country of Disassembly: AI (425)

This Element String may be used on a physical unit to denote the country of disassembly of the trade item, the identification number of which is represented in either AI (01) or AI (02).

2.1.3.2.13 Country Covering Full Process Chain: AI (426)

This Element String may be used on a physical unit to denote the country covering full process chain of the trade item, the identification number of which is represented in either AI (01) or AI (02).

2.1.3.2.14 Approval Number of Processor: AI (703s)

In some countries, some products are required by law to be marked with an approval number allocated by a national authority. Where required the Application Identifiers in the series 703(s) are used to give the identification of approved location in supply chain. This identification could be a Global Location Number (GLN) or another scheme endorsed by the national authority. This Element String may be used on a physical unit to denote the country and approval number of a trade item, the identification number of which is represented by a Global Trade Item Number™ (GTIN™).

As multiple approval numbers may be required, the fourth digit of the AI(s) indicates the sequence of the processors. An example from a meat supply chain would be:

A bovine animal has been slaughtered in a German slaughterhouse (approval number GLN: 4012345000009), and the deboning was done by a Dutch deboning hall (approval number EGNL410).

The country and approval number for slaughtering is shown in Figure 2.1.3.2.14 – 1.

Figure 2.1.3.2.14 – 1

AI	ISO Country Code for Germany	Approval Number
7030	276	4012345000009

The country and approval number of the first processor (Dutch deboning hall) is shown in Figure 2.1.3.2.14 – 2.

Figure 2.1.3.2.14 – 2

AI	ISO Country Code for the Netherlands	Approval Number
7031	528	EGNL410

2.1.3.3 Fixed Trade Item Attributes

2.1.3.3.1 Additional Product Identification Assigned by the Manufacturer: AI (240)

This Element String has been created to represent a company's existing (non-GS1 System) trade item identification number.

The ID number may be marked on the same item together with the GS1 Identification Number (AI (01)) in order to facilitate migration to the GS1 System. There must be a one-to-one relationship between the contents of AI (240) and AI (01).

Note: The use of this Element String must be based on an agreement between the users concerned for a limited period. In no way should a company supply internal item identification of any other kind via AI (240), which would violate the GS1 System's principles. It is not a substitute for the Global Trade Item Number™ (GTIN™).

2.1.3.3.2 Customer Part Number: AI (241)

This Element String has been created to facilitate the conversion from the business use of a customer assigned part number to a manufacturer's Global Trade Item Number™ (GTIN™).

2.1.3.4 Varying Trade Item Attributes with Restrictions

2.1.3.4.1 Serial Number for Serial Publications - Two-Digit Add-On Symbol

The two-digit Add-On Symbol identifies each title of a serial publication. This bar code symbol, used to provide supplementary identification on serial publications, is not designed to be scanned at the Point-of-Sale. The Global Trade Item Number™ (GTIN™) provides the necessary data for correct price capture.

This bar code symbol is applied for the processing of returns of serial publications requiring additional identification beyond the level provided by the item identification number. When the two-digit Add-On Symbol is scanned, it is always processed together with the GTIN.

2.1.3.4.2 Supplementary Information for Books, Paperbacks, and Printed Sheet Music - Two-Digit and Five-Digit Add-On Symbol

The two-digit and five-digit Add-On Symbols can identify a title of a book or paperback. These bar code symbols are used to track a particular edition of a book, but not to carry information otherwise included in the Global Trade Item Number™ (GTIN™).

Note: The two-digit and five-digit Add-On Symbols must not be used to represent the price of the book for several reasons. First, the bar code symbol does not ensure the reading reliability needed for price capture. Secondly, there is no currency indicator available to prohibit price misinterpretation for imported or exported books. Thirdly, the system logic does not provide a means to distinguish whether the five-digit Add-On Symbol represents the price or the supplementary information of the particular book.

2.1.3.4.3 Product Variant: AI (20)

GS1 System application rules clearly state that each trade item that is different from another must be assigned a unique Global Trade Item Number™ (GTIN™). However, there are cases where a difference is not significant outside the manufacturing company and, therefore, no separate identification number is required.

Element String AI (20) is a means to handle variations of trade items that are significant only for the producer of the item.

2.1.3.4.4 Price Per Unit of Measure: AI (8005)

This Element String is used to discriminate groupings of price marked Variable Measure Trade Items and to inform about the price per unit of measure marked on the individual units contained in the trade item. It should in no way be used for price marked Fixed Measure Trade Items, in which groupings of trade items not to be scanned at the Point-of-Sale require a unique GS1 System identification number for each separate price or a product variant (AI (20)).

2.1.4 Allocating the Numbers

2.1.4.1 General rule

A Global Trade Item Number™ (GTIN™) is used to identify any item (trade item or service) upon which there is a need to retrieve pre-defined information and that may be priced or ordered or invoiced at any point in any supply chain. A separate unique GTIN is required whenever any of the pre-defined characteristics of an item are different in any way that is relevant to the trading process. The guiding principle is if the customer is expected to distinguish a new trade item from an old trade item and purchase accordingly, a new GTIN should be assigned to the new trade item. (This will ensure the product package and shelf edge label declarations should appear the same to the consumer). However, any law or regulation that contradicts these rules shall supersede these rules.

Specific rules that apply to prevalent industry practices have been endorsed by the Global Commerce Initiative Board, for the Fast Moving Consumer Goods (FMCG) industry. These rules covering many common business cases can be found in Appendix 2.1.A. While all GS1 standards are voluntary, the rules are intended to drive normative practice within the FMCG sector.

Specific rules that apply to packaging and raw material trade items supplied to manufacturing companies can be found in Appendix 2.1.A.2.

2.1.4.2 Responsibility

2.1.4.2.1 Branded items

The Brand Owner, the organisation that owns the specifications of the trade item regardless of where and by whom it is manufactured, is normally responsible for the allocation of the Global Trade Item Number™ (GTIN™). On joining a GS1 Member Organisation the Brand Owner receives a GS1 Company Prefix which is for the sole use of the company to which it is assigned. The company prefix may not be sold, leased or given, in whole or in part, for use by any other company.

The Brand Owner is the organisation that owns the trade item specifications and may be:

The manufacturer or supplier - the company manufactures the trade item or has it manufactured, in any country, and sells it under its own brand name

The importer or wholesaler - the importer or wholesaler has the trade item manufactured, in any country, and sells it under its own brand name or the importer or wholesaler changes the trade item (for example by modifying the packaging of the trade item).

The retailer - the retailer has the trade item manufactured, in any country, and sells it under its own brand.

2.1.4.2.2 Exceptions and non branded items

There are some exceptions as follows:

Non-Branded Items - Items without a brand name and generic items – not private labels – are still assigned Global Trade Item Numbers™ (GTIN™) by their manufacturer. As different manufacturers and/or suppliers may supply items that appear identical to the buyer (this could be a consumer as well as a retailer or manufacturer), it is possible that items that are apparently the same have different GTINs. Companies that trade in these items need to organise their computer applications (replenishment programs for example) to cope with this eventuality. Examples of items that sometimes have no brand are apples, plasterboard, candles, drinking glasses etc. Examples for trade items that sometimes have no brand and are not intended for retail include salt, fragrances, food cans, etc.

Customer Specific Items - If a trade item is made specifically for one trade customer (buyer) and is orderable only by this customer, then the buyer assigns the GTIN. In this case the GTIN should be

formed from the customer's GS1 Company Prefix (see Section 2.6.6). If the supplier (seller) sells a trade item to more than one buyer or intends to sell to more than one buyer, then the seller assigns the GTIN.

Other Exceptions - If the Brand Owner does not assign a GTIN, the importer or another intermediary can assign an item a *temporary* GTIN. This would imply that the importer takes on the role of the Brand Owner and could, for example, register the product upon a Data Catalogue. This temporary GTIN may be used until a GTIN is assigned in the normal way. Alternatively a retail organisation can assign an *internal* number, for use within its own stores only, to an item that does not yet have a GTIN assigned to it.

2.1.4.3 Guidelines for Allocating Global Trade Item Number™ (GTIN™)

2.1.4.3.1 Management of Uniqueness

The Global Trade Item Numbers™ (GTIN™) must be allocated uniquely. It is recommended that the GTIN does not contain any intelligence or parsable strings. The embedding of internal codes is discouraged because it is often found that the rules for changing them differ from the rules for changing a GTIN.

2.1.4.3.2 Pre-defined characteristics

Although this list is not exhaustive, the basic pre-defined characteristics of a trade item are:

- The Product Name, Product Brand, and Product Description
- The trade item type and variety
- The net quantity of trade item (weight, volume, or other dimension impacting trade)
- If the trade item is a grouping, the number of elementary items contained, and their subdivision in sub-packaging units, the nature of the grouping (carton, pallet, box-pallet, flat-pallet...)

A modification to any of the basic elements that characterise a trade item will usually lead to a change in the GTIN.

Note: Price is not a relevant criteria for changing a GTIN except when the price is printed directly on the trade item.

Note: National, federal or local regulations may apply and take precedence over this rule. For example, in some industries such as healthcare, regulations or other requirements may dictate that any trade item changes require a new GTIN.

Typically the gross dimensions of a trade item communicated via the Item File that do not affect net trade item quantity or measure do not impact the GTIN assignment. However, as a general rule if any gross dimension (e.g. length, depth, weight, etc) changes by more than 20% a new GTIN is required. Changes below 20% may require a new GTIN at the discretion of the brand owner.

In all cases, a change to a GTIN for the trade item at a lower level of packaging will always lead to a change of any GTIN used for associated packaging at higher grouping levels.

2.1.4.3.3 Prepriced merchandise

Prepricing is discouraged as a trade practice as it introduces complexity for trade item file maintenance through the supply chain. If however, the price that the consumer will pay is marked on the item, the Global Trade Item Number™ (GTIN™) should be changed when the price marked on the item changes.

Note: National, federal or local regulations may apply and take precedence over this guideline.

2.1.4.3.4 Promotional variants

A promotion is a temporary change to a trade item, which modifies the presentation of the trade item. It usually coexists with the standard trade item.

- Promotional variants of trade items that affect the net weight or volume of the trade item must be allocated a separate unique Global Trade Item Number™ (GTIN™). Examples: Attached free additional item, 10% extra free.
- Promotional variants of trade items may impact the logistic weight or dimension of the trade item by more than 20%. In this case, the promotional variants must be allocated a separate unique Global Trade Item Number™ (GTIN™).
- Promotional variants of trade items where a price reduction is explicitly specified on the pack (flash packs) must be allocated a separate unique GTIN unless local trade practices or price marking legislation dictate otherwise. Examples: 10 cents off.
- Each seasonal promotion of a trade item should be allocated a separate unique GTIN. Example: chocolate especially over-wrapped for Easter.
- Other promotional variants should not be allocated a separate unique GTIN. Examples: Money off coupon, free gift inside (unless this causes an increase in gross weight by more than 20%), "send for" offer, competition offer, or samples sent directly to consumer bypassing retail Point-of-sale.

2.1.4.3.5 Trade item changes

Trade item changes are any change or improvement during the life of a trade item. The "new" trade item replaces the old one. Should the Brand Owner decide to create a variant (e.g., with different ingredients) in parallel with the standard trade item, then a separate unique Global Trade Item Number™ (GTIN™) has to be allocated.

- Minor trade item changes or improvements do not require the allocation of a different GTIN. Examples: label artwork redesign, minor trade item description changes that do not impact the supply chain, gross dimension change in any axis of less than 20% with content quantity or measure unchanged. This rule applies to retail consumer trade items (retail POS unit) and standard trade item groupings (orderable cases or pallets).
- If a trade item's quantity or measure changes or if the consumer will be expected to distinguish between an old and new brand name or product description, then a new GTIN must be allocated.

2.1.4.3.6 Variants for groupings

- Trade items which are a standard and stable grouping of smaller units identified by a Global Trade Item Number™ (GTIN™) must be allocated a separate GTIN whenever there is a change to the GTIN of any of the units contained.
- For trade items containing units which are themselves promotional variants or minor trade item variants of trade items whose GTINs remain unchanged, the rule is the following:
 - If the trade item has to be distinguished for effective ordering, handling and tracking, a separate GTIN must be allocated to the trade item. Examples: Promotions that are limited to certain geographical areas or date specific promotions.
 - If the identification of minor trade item variants is only relevant to the manufacturer, they should distinguish these variants by using the element string Product Variant (AI 20). Examples: Minor package design changes, side loading as opposed to top loading cases.

2.1.4.4 Lead time in re-using a GTIN

A Global Trade Item Number™ (GTIN™) allocated to a trade item, which has become obsolete must not be re-used for another trade item until at least 48 months have elapsed from the date the original trade item was last supplied to the customer. In the case of clothing the minimum retention period is reduced to 30 months. If a GTIN has been assigned to a item, which was then never actually produced, the GTIN may be deleted from any catalogue immediately without first being marked as discontinued. In this exceptional case the GTIN may be re-used 12 months after deletion from the seller's catalogue.

A longer period may be needed depending upon the type of goods. For example steel beams may be stored for many years before entering the supply chain. Brand owners should consider what would be a reasonable period of time for the trade item to remain in the supply chain cycle before re-using GTINs.

In addition, when contemplating the re-use of a GTIN, consideration should be given to the use of data associated with the original GTIN by trading partners for statistical analysis or service records, which may continue long after the original trade item was last supplied.

2.1.4.5 Data alignment

When a new Global Trade Item Number™ (GTIN™) is assigned to a trade item, it is essential that the Brand Owner provide the detailed information to trading partners about the item's characteristics. This information should be provided at as soon as possible before the trade item is actually traded.

Expediting GTIN information to buyers reduces order exception handling and reduces the lead-time in getting goods to the selling floor.

2.1.4.5.1 Data Alignment Best Practice

A number of actions are vital to ensure that GTINs are accurately communicated within the Supply Chain. These ensure that the data associated with any scanned bar code can be associated with accurate, up to date, data. This is particularly essential for items scanned at the Point of Sale where the absence of accurate data may have legal implications.

The GTIN provides a Supply Chain solution for the identification of any item that is traded (priced or invoiced or ordered). Overall Supply Chain costs are minimised by all partners in the Supply Chain adhering to identical allocation rules (see Section 2.1.A.1.).

The following 'Best Practices' guideline is proposed for all items. It has been developed by manufacturers, distributors and retailers to help eliminate any confusion between product identification and product listing in the Retailers Database in the Supply Chain.

1. GTIN allocation, and the bar coding of the GTIN, is a technical process the rules for which are laid down elsewhere in these GS1 General Specifications. Product listing is the act of adopting a new product in an assortment by a commercial organisation. Product listing is the result of commercial negotiations between purchaser and seller.

Example: GTIN Allocation should be independent from Product Listing.

2. For management reasons, or to ensure that correct information is communicated to the final consumer, changes to an item may require a new GTIN. A new GTIN does not automatically imply a new listing.

Example: If a change requiring a new GTIN is made to a listed product, this should not be an automatic trigger for a new Product Listing.

3. GTIN allocation and database listing are to be considered as two entirely autonomous decisions: GTIN allocation is not an object of negotiation.

4. The Brand Owner makes available to their client all information regarding the listed items, ideally with an EDI message or in an e-product catalogue no later than at the time of item listing. In case of time limited promotions or a product evolution, this information will be communicated largely beforehand, thus allowing the retailer to validate this information and to circulate it internally.

2.1.A.1 GTIN Allocation Rules - Endorsed by the Board of the Global Commerce Initiative (GCI) as a Normative Reference

The following terms have been included in this appendix, as they were found useful in explaining the column B and C headers.

trade item - Any item (product or service) upon which there is a need to retrieve pre-defined information and that may be priced, or ordered, or invoiced at any point in any supply chain.

retail consumer trade item - The trade item intended to be sold to the end consumer at retail Point-of-Sale. They are identified with a unique EAN/UCC-13, UCC-12, or EAN/UCC-8 GTIN. (see Section 2.1. Sub-Section on Retail Items).

standard trade item grouping – A grouping of retail consumer trade items that is not intended for Point-of-Sale scanning. It is identified with a unique EAN/UCC-14, EAN/UCC-13, or UCC-12 GTIN.

Non-GTIN Pack – A packaging level for trade items where there is no trading partner requirement for GTIN identification. If a GTIN is required, then this item becomes a retail consumer trade item or standard trade item grouping.

logistic unit - An item of any composition established for transport and/or storage that needs to be managed through the supply chain. It is identified with SSCC.

dynamic assortment - a standard trade item grouping that comprises a fixed count of a changing assortment of two or more different retail consumer trade items, each identified with a unique GTIN. All of the retail consumer trade items and their GTINs will have been communicated to the retailer before trading takes place. The retailer has accepted that the supplier may change the assortment without any prior notice.

An example is a trade item grouping of ten toy cars which may contain any mix of possibly more than ten different toy cars that have been individually identified and notified to the retailer.

pre-defined assortment: - a standard trade item grouping that comprises a fixed configuration of two or more different retail consumer items, each identified with a GTIN. Any change in the configuration of the assortment is considered a new trade item.

Note: These rules are intended for global use. Exceptions may occur only when local regulatory or legal requirements mandate otherwise.

Note: To access a standards based implementation tool see <http://www.gs1.org/gtinrules/>.

Type of Change to Trade item	GTIN for Retail Consumer Trade Item	GTIN for Standard Trade Item Grouping	Rationale	Consequence if rule not applied
2.1.A.1 - 1 Market Variants (languages and traded quantities)				
1.1 New Language on a package sold in one Market/Country (single language label)	New GTIN (Brand Owner may use the same GTIN for different language packs if tracking movement occurs at grouping level)	New GTIN	Efficient shipping (at Retailer's Distribution Centre) requires distinction between non-substitutable trade items at the grouping level (Note: Differing languages on other wise identical trade items are non-substitutable). The release of a new language market/country pack requires compliance with local labelling laws (hence a new trade item and GTIN)	NOTE: The language change does not apply to the Brand Name. If the language change causes the Brand Name to change, then the GTIN at all levels must change. NOTE: In certain industries, such as apparel and home fashion environment, the human readable is added as part of the distribution process. In this case there is no need to change a GTIN when the language is added.
1.2 Add additional language on a package sold in several Markets (multi language label)	Same GTIN	Same GTIN (a separate GTIN is required for each language cluster)	A re-cluster (adding an additional language at the retail level) does not impact existing markets. For example, if languages A, B and C appear on one pack, the addition of another language (D) has no impact on existing trading partners.	Unnecessary introduction of new GTINs.
1.3 Language Group Cluster Substitution	New GTIN (Brand Owner may use the same GTIN for different language packs if tracking movement occurs at Grouping level)	New GTIN	If languages A, B and C appear on one pack, and languages A, D and E on another, units cannot be substituted in all target markets and therefore must be identified uniquely.	Unable to identify trade item in supply chain.
1.4 Sample or Test Trade items	Retail consumer trade Item has a unique GTIN (if ever sold at retail)	Standard trade item grouping has a unique GTIN (if ever traded in supply chain)	If the trade item is released to market for POS use in any form it requires a GTIN. The GTIN used on the test/sample trade item can be maintained if	Unable to identify trade item in supply chain.

Type of Change to Trade item	GTIN for Retail Consumer Trade Item	GTIN for Standard Trade Item Grouping	Rationale	Consequence if rule not applied
			the trade item test is successful and becomes orderable.	
1.5 Groupings of retail consumer trade items containing different counts	GTIN of retail consumer trade Item not impacted	Each standard trade item grouping has a unique GTIN	Different GTIN necessary to distinguish between the different pack sizes.	The GTIN identifies all aspects of the standard trade item grouping for ordering, stocking or billing systems. Using the same GTIN for the standard trade item grouping containing different quantities invalidates these systems.
2.1.A.1 - 2 Replacement of Trade Items				
2.1 Minor Changes	<i>Minor changes are those which are not relevant to trading partners (e.g. neither the consumer declaration nor the ordering, billing or stocking information is impacted).</i> <i>Manufacturers may need to distinguish these minor changes in trade items variant (e.g. for tracking price impact).</i>			
2.1.1 Minor formulation or characteristic change that will replace the existing trade item and does not involve any change in the Declaration to the consumer (e.g., is not covered by legislation). Examples include: changes for cost reduction reasons without changing the trade item characteristics (e.g., taste, viscosity, minor ingredients change, etc.) changes to the button colour used on fashion items, etc.	No change	No change	The change has no impact on supply chain partners. Minor ingredient changes do not change the trade item description.	An explosion in the number of GTIN changes within the supply chain as any change relevant only to the manufacturer will have to be signalled by a new GTIN. This imposes unnecessary cost.

Type of Change to Trade item	GTIN for Retail Consumer Trade Item	GTIN for Standard Trade Item Grouping	Rationale	Consequence if rule not applied
2.1.2 Minor artwork changes	No change	No change	Minor artwork changes, possibly associated with a trade item re-vamping or seasonal/ promotional flow through, that do not impact other GTIN Rules, should not cause a new GTIN to be assigned	GTIN assignment would be impractical to manage.
2.1.3 Minor (not declared) change in net weight / count / volume (e.g. changes in manufacturing tolerances do not impact the declaration to the consumer).	No change	No change	The changes possibly associated with an improved product manufacturing or processing tolerance that do not impact other GTIN Rules, should not cause a new GTIN to be assigned.	GTIN assignment would be impractical to manage.
2.1.4 A minor change in the packaging, at the standard trade item grouping level, is made (e.g. optimisation of packaging material or changing supplier of the packaging material).	No change	No change	The change has no impact on supply chain partners. Manufacturer assigned Batch Numbers can be used to track changes not related to "trade".	An explosion in the number of GTIN changes within the supply chain as any change relevant only to the manufacturer will have to be signalled by a new GTIN. This imposes unnecessary cost.
2.1.5 Minor packaging material changes on the retail consumer trade item level (e.g. PET to HDPE) that do not affect trade item "facings" dimensions when on the retail shelf. As a general guideline the change should be considered "major" (and therefore require a new GTIN) if any logistic measure increase or decreases by more than 20%.	No change	No change	Trade item dimensions for both retail consumer and standard trade item grouping should be part of the Item File Master Data, which is best communicated between trading partners via electronic catalogues (e.g., SINFOS)	(Unnecessary) changes to the GTIN at the retail consumer trade item level increase supply chain cost. Historic sales data from the point of sale can be used to assess the impact of the change by keeping a track of the date. If a new GTIN is not assigned at the retail consumer trade item level, the required logistics information is not communicated to supply chain partners. The 20% rule meets

Type of Change to Trade item	GTIN for Retail Consumer Trade Item	GTIN for Standard Trade Item Grouping	Rationale	Consequence if rule not applied
Note: Any change in Net Declared Weight requires a new GTIN.				the "reasonability" test- e.g., 0% is unacceptable to manufacturers, and 100% is unacceptable to retailers. In depth canvassing of GCI companies led to 20% being selected.
2.1.6 Random Packs When a retail consumer trade item or standard trade item grouping contains a random mix of trade item (e.g. different colours/flavours of jellies) and the random mix is modified	No change	No change	If the mix is random the change to a new random mix has no impact on the consumer declaration or supply chain partners	An explosion in the number of GTIN changes - imposing unnecessary cost.
2.1.7 Seasonal recipe (new line proposal) For example "Yoghurt with seasonal fruit": fruit can change from one season to the next.	No change	No change	The consumer declaration remains the same whatever the season.	An explosion in the number of GTIN changes - imposing unnecessary cost.
2.1.8 Change in Brand graphics (e.g. graphic colour, size, font, etc.)	No change	No change	The change has no impact on supply chain partners. A Brand may be printed on packaging, but not used to describe and/or identify the product to the consumer (e.g. printed on a back panel in small text). In this circumstance, a change in text does not require a change in the shelf edge label, therefore no GTIN	An explosion in the number of GTIN changes within the Supply Chain that imposes unnecessary cost.

Type of Change to Trade item	GTIN for Retail Consumer Trade Item	GTIN for Standard Trade Item Grouping	Rationale	Consequence if rule not applied
			change required.	
2.1.9 Brand addition (e.g. a corporate brand name is added to the existing product brand on the package)	No change	No change	The change has no impact on supply chain partners.	An explosion in the number of GTIN changes within the Supply Chain that imposes unnecessary cost.
2.1.10 A change in the content of a dynamic assortment (see definition at the beginning of the annex).	No change	No change, even if a retail consumer trade item is introduced to or removed from the assortment.	The retailer has accepted that the assortment may be changed without notice.	An explosion in the number of GTIN changes and an unnecessary increase in cost.
2.2 Major change	<i>Major changes are those which require trading partners to distinguish, within their systems, between the "old" and "new" trade item (e.g., the consumer declaration has changed or the ordering, billing or stocking information is impacted).</i>			
2.2.1 Declared net weight, count: number of consumer usage items in the package changes. Examples include: number of tablets in an aspirin bottle or number of diapers in a pack of disposable diapers or net volume to the consumer or a retail item of 400 grams in 4 helpings of 100 grams changed to 400 grams in 8 helpings of 50 grams or colour and size code for a fashion item.	New GTIN	New GTIN	The change leads to a change in the shelf edge label (consumer declaration). Failure to distinguish between "old" and "new" retail consumer trade item could lead to inaccurate unit pricing at the shelf leading to legal penalties	Failure to provide the consumer with accurate retail consumer trade item information (e.g., via the shelf edge label) may lead to legal penalties. All supply chain partners need to "phase in" and "phase out" the new and old trade item. Using separate GTINs does this most efficiently.
2.2.2 Formulation change - If the consumer is	New GTIN	New GTIN	The change leads to a change in the shelf edge label (consumer	Failure to provide the consumer with accurate retail

Type of Change to Trade item	GTIN for Retail Consumer Trade Item	GTIN for Standard Trade Item Grouping	Rationale	Consequence if rule not applied
expected to distinguish the new from the old trade item and order accordingly / if regulations or other requirements dictate so (e.g., healthcare) / if changes alter the fundamental consumer benefit (e.g., new flavour, aroma)			declaration).	consumer trade item information (e.g., via the shelf edge label) may be against the law. Without a "new" GTIN it would not be possible to uniquely distinguish the trade item (e.g., determine if Lemon or Lime flavour was selling best).
2.2.3 Packaging changes with major impact - any dimensional change of more than 20% in any axis or any gross weight change of more than 20% requires a new GTIN	New GTIN	New GTIN	Shelf management software and logistic systems need to be updated to ensure optimal shelf space allocation.	The 20% rule meets the "reasonability" test (e.g., 0% is unacceptable to manufacturers, and 100% is unacceptable to retailers. In depth canvassing of GCI companies led to 20% being selected).
2.2.4 Changes to a pre-defined assortment (see definition at beginning of the annex). For example, a pre-defined assortment contains 200 retail items of four different flavours (configuration: 30/50/80/40). The configuration is changed (e.g. new configuration: 40/60/40/60) but the total quantity remains the same (200 retail items).	No change (changes to configuration of the grouping are not applicable to the GTIN of lower packaging levels)	New GTIN	The standard trade item grouping is a new trade item which must be uniquely identified throughout the supply chain.	Unable to identify the content and count of retail consumer trade items within the trade item grouping.

Type of Change to Trade item	GTIN for Retail Consumer Trade Item	GTIN for Standard Trade Item Grouping	Rationale	Consequence if rule not applied
2.2.5 Major change in functionality - If the change introduces new features or functionality (e.g., new software Version, New features on electronic trade items, etc.)	New GTIN	New GTIN	It is recommended to assign a new GTIN at both the retail consumer and standard trade item grouping levels to ensure all supply chain partners are able to distinguish the "old" from the "new".	Unable to Phase In, Phase Out old stock.
2.2.6 Changes to the wording of existing product name, product brand, or product description that appear on the product and that will impact Supply Chain applications (this includes removal of existing branding used to describe the product in the Supply Chain and to the consumer).	New GTIN	New GTIN	The change leads to a change in the shelf edge label (consumer declaration). Brand, or product, name changes must be clearly communicated and old stock phased out.	Brand or product name changes could not be registered effectively. This potentially could lead to the failure to provide the consumer with accurate retail consumer trade item information (e.g. via the shelf edge label).
2.2.7 Graduated change of the product brand or name (when old brand coexists with new one during a period with several stages)	New GTIN (the brand owner decides exactly when the new GTIN is assigned. This should take place when the old brand disappears from the product.)	New GTIN (timing identical to the GTIN change of the consumer Trade Item)	The change triggers a change in the supply chain (e.g. in the shelf edge label (consumer declaration))	Brand or product name changes could not be registered effectively. This potentially could lead to the failure to provide the consumer with accurate retail consumer trade item information (e.g. via the shelf edge label).
2.1.A.1 - 3 Parallel Trade Items				
3.1 Promotions				
3.1.1 Promotions that do not impact GTIN	<i>Promotions are (normally) short-term modifications to the way a trade item is presented to the customer. This section highlights examples of promotions where GTIN at retail consumer trade item level stays the same.</i>			

Type of Change to Trade item	GTIN for Retail Consumer Trade Item	GTIN for Standard Trade Item Grouping	Rationale	Consequence if rule not applied
3.1.1.1 Two or more retail consumer trade items near each other (not attached or banded together) both of which can be purchased separately. For example a gift-with-purchase or buy-two, get one free offers - These items are offered at no additional cost when the primary (regular) retail consumer trade item is purchased. The promotion is sold at the same price.	No change	No change unless the two retail consumer trade items are shipped together in one physical package when originally they were shipped individually	The change has no impact on supply chain partners. Promotions data can only be captured by knowing the date of the offer. The shelf management software is not impacted The consumer declaration is not impacted	An explosion in the number of GTIN changes within the supply chain as any change relevant only to the manufacturer will have to be signalled by a new GTIN. This imposes unnecessary cost.
3.1.1.2 Two (or more) retail consumer trade items bound together, i.e. designed to promote the trial of the attachment (One-Order Trial Packs) where the geometry of the base package and the item net weight, count or volume is not impacted and the item is not intended to be reordered because the promotion period is limited.	No change	No change	The change has no impact on supply chain partners (e.g., diapers packaged with insert pouch of 5 baby wipes) Promotions data can only be captured by knowing the date of the offer. The shelf management software is not impacted and the consumer declaration is not impacted	An explosion in the number of GTIN changes within the supply chain as any change relevant only to the manufacturer will have to be signalled by a new GTIN. This imposes unnecessary cost.
3.1.1.3 Free Item Two retail consumer trade items, not attached or banded together where one item, which cannot be purchased, is free when the other is purchased (e.g. gift-with-purchase or	No change (as all the items have a GTIN for sales or inventory tracking)	No change (However, if the free item is shipped in the same physical container with the primary item, a separate GTIN should be assigned to identify the new standard trade	The change has no impact on original item.	An explosion in the number of GTIN changes within the supply chain as any change relevant only to the manufacturer will have to be signalled by a new GTIN. This imposes unnecessary cost.

Type of Change to Trade item	GTIN for Retail Consumer Trade Item	GTIN for Standard Trade Item Grouping	Rationale	Consequence if rule not applied
purchase-with purchase items).		item grouping.)		
3.1.1.4 Free Item in Retail Consumer Trade Item - A free item packed inside the primary retail consumer trade item package with no change in quantity of trade item and the promotion package is sold at the same price as the regular package.	No change	No change	The change has no impact on supply chain partners.	An explosion in the number of GTIN changes - imposing unnecessary cost.
3.1.1.5 Reconfiguration of Consumer Pack - A consumer package reconfigured for promotional purposes (e.g. memorial edition coffee can), which contains the same quantity of trade item as the regular package and is sold at the same price.	No change (Where the retail consumer trade item footprint does not change more than 20% in any dimension)	No change	The change has no impact on supply chain partners. The consumer declaration is not changed The net weight is not affected.	An explosion in the number of GTIN changes - imposing unnecessary cost.
3.1.1.6 Price-Off Coupon - A retail consumer trade item may have a price-off coupon on or in the package. The price-off coupon could be for the same or any other retail item.	No change	No change (However, if the coupon is time critical it should be treated as 3.1.1.9)	The change has no impact on for pricing or ordering or invoicing If the retail consumer is given the choice between purchasing the trade item with or without consumer price-off coupons a separate GTIN is required.	Additional complexity (cost) in the management of trade item with or without coupon.

Type of Change to Trade item	GTIN for Retail Consumer Trade Item	GTIN for Standard Trade Item Grouping	Rationale	Consequence if rule not applied
3.1.1.7 Mail in with Proof of Purchase - A retail consumer trade item may have a coupon or other identifiable printed matter that would offer proof of having purchased that item. The coupon would be returned by mail by the consumer for refund, for other items or for purchase of other items at a reduced price.	No change	No change (However, if the coupon is time critical it should be treated as 3.1.1.9)	The change has no impact on supply chain partners.	An explosion in the number of GTIN changes - imposing unnecessary cost.
3.1.1.8 Merchandise Sold with Allowance - When items are purchased by the retailer at the regular price, additional items are furnished free of charge. When the quantity of retail consumer trade items in the case can be increased.	No change	New GTIN	New reference due to increased quantity contained. NOTE: If the quantity of regular cases is increased (e.g. buy ten cases and get one case free), there is no change in the standard trade item grouping GTIN. Replenishment is based on shipped cases (which are the correct and really delivered quantity) not on the ordered quantity, which would be too low. Therefore in this case, there is not a need to change the standard trade item grouping GTIN.	The physical flow of the goods needs to be managed throughout the supply chain - even if supplied for free.

Type of Change to Trade item	GTIN for Retail Consumer Trade Item	GTIN for Standard Trade Item Grouping	Rationale	Consequence if rule not applied
3.1.1.9 Push promotion for a (time critical) event	No change	New GTIN (where First In First Out (FIFO) is inappropriate)	Certain time critical promotion (e.g., World Animal Day) where the promotion item has to be on display on a given day. In this instance normal FIFO rules cannot be effectively applied. Other, longer term, critical promotions (e.g., seasonal soft drink package versus shipment that may not arrive on the shelf until a movie is launched) require no change as normal FIFO rules can be applied Standard trade item grouping distinction required for efficient Phase In – Phase Out	Different retailers impose different rules on the same supplier causing unnecessary supply chain cost. Keeping the retail consumer trade item level GTIN allows historic data file referral.
3.1.2 Promotions that do impact GTIN.	<i>Promotions are (normally) short-term modifications to way a trade item is presented to the customer. This section highlights examples of promotions where a new GTIN is required at the one level.</i>			
3.1.2.1 If a retail consumer trade item, (not normally prepriced with a special price statement incorporated into the label) is changed to a retail consumer trade item that has a pricing statement on the label.	New GTIN	New GTIN	The change requires supply chain partners to distinguish old and new stock.	Danger that the price declaration to the consumer (on the pack) is different to the price charged (price in the Item File look up table).
3.1.2.2 Price reduction is explicitly specified on the pack (flash packs), (e.g., 10 cents off)	New GTIN	New GTIN	The change requires supply chain partners to distinguish old and new stock.	Danger that the price declaration to the consumer (on the pack) is different to the price charged (price in the file look up table).

Type of Change to Trade item	GTIN for Retail Consumer Trade Item	GTIN for Standard Trade Item Grouping	Rationale	Consequence if rule not applied
3.1.2.3 Bonus Pack: A bonus pack is an item that has increased quantity (net weight, count, volume) and is sold at the same price as the regular item.	New GTIN	New GTIN (standard trade item grouping net weight and case cube can change)	Quantity increase affect unit pricing and information found on shelf labels	Danger that the price declaration to the consumer (on the pack) is different to the price charged (price in the file look up table).
3.1.2.4 Combination Pack - Items, composed of two or more retail trade items normally sold separately, that are bound together	New GTIN - Obscure the symbol (GTIN) on all individual trade items	New GTIN	A new GTIN is required for the retail consumer trade item because it is a new and unique product. For all combination packs it is important to obscure any bar code symbol on a lower packaging level.	If more than one bar code symbol (carrying a GTIN) is visible, the operator is unsure which one to scan.
3.2 Prepriced Merchandise	<i>Prepricing, where the supplier of an item physically marks a retail price on the item that is imposed on all trading partners, is discouraged as a trade practice as it introduces complexity for retail consumer trade item and standard trade item grouping price file maintenance through the supply chain. The definition does not include the practice, which is common in some industries like home furnishing and fashion, where the retail price is printed on the item as part of the distribution chain and at the request of the retailer.</i>			
3.2.1 Retail Consumer Trade Item with price label attached per specific retailer(s) requirements	No change	No change	Retail consumer trade item where multiple retailers require specific price labelling does not require individual GTIN assignment per each price label.	An explosion in the number of GTIN changes - imposing unnecessary cost.
3.2.2 When the manufacturer includes prepricing as part of the package graphics, such as is normally done with a Manufacturer's Suggested Retail Price (MSRP), and the buyer has not requested the price to be marked on the item (in other words, the selling price of the buyer may or may not	New GTIN	New GTIN	The change requires supply chain partners to distinguish old and new stock.	Danger that the price declaration to the consumer (on the pack) is different to the price charged (price in the file look up table).

Type of Change to Trade item	GTIN for Retail Consumer Trade Item	GTIN for Standard Trade Item Grouping	Rationale	Consequence if rule not applied
have anything to do with the selling price marked on the item). Event: change of MSRP.				
3.2.3 Any other marked price as part of the packaging. Selling price is the price marked on the packaging. Event: marked price change.	New GTIN	New GTIN	Newspapers, magazines and some books tend to be price marked. If the cover price changes, the GTIN should change. Prepricing needs to comply to the law	Pricing legislation normally means that the price shown must equal (or be greater than) the price charged to the consumer. If the price is shown on the trade item (not recommended) this must be communicated to supply chain partners.
3.3 - 3.8 Other parallel trade items	<i>Other changes which could impact GTIN allocation.</i>			
3.3 Different Manufacturer for an (apparently) identical trade item made for a specific retailer.	No change (the retailer is the Brand Owner)	No change	The Retail Price is not relevant to the GTIN.	GTIN assignment would be impossible to manage.
3.4 Different Retail Price (e.g., for different regions in one country) and the price is not marked on the packaging	No change (exception if the trade item is prepriced)	No change	The retail price is not relevant to the GTIN unless it is prepriced by the supplier on the package.	GTIN assignment would be impossible to manage if linked to retailers price files.
3.5 Trade item produced in different locations	No change	No change	Different GTIN for the same trade item could cause serious problems for retailer (e.g. price lookup file, replenishment)	Global players supplying the same trade item, from factories in different countries, would have to use different GTINs even though no change to the consumer.

Type of Change to Trade item	GTIN for Retail Consumer Trade Item	GTIN for Standard Trade Item Grouping	Rationale	Consequence if rule not applied
3.6 Trade Item sold in different locations	No Change	No Change	Different GTIN for the same trade item could cause serious problems for the supplier (e.g., inventory management)	Global players supplying the same trade item to different locations would have to assign different GTINs even though no change was declared to the consumer
3.7 New / additional pallet layout to co-exist permanently with the original layout	No change	No change at the case level but (If pallet layout is important to the retailer, then retailer should order by the pallet. This would require a GTIN at the pallet level.)	The pallet pattern / layout does not impact the quantity of retail consumer trade items or cases contained. If two pallet layout configurations are supplied to a market in parallel, and can be ordered separately, a different GTIN is required for each pallet configuration. In effect the pallet then becomes the ordering unit.	Robotic picking requires a known (predetermined) pallet layout and stacking order. Efficient Logistics applications require pre-determined pallet configurations.
3.8 EAS (Electronic Article Surveillance) system (theft protection) Should the Retail Item be orderable with - no anti-theft device - an electromagnetic anti-theft system - a radio based system - etc	No change (same GTIN independent of anti-theft properties)	New GTIN (a different GTIN dependent upon the anti-theft properties of the retail unit and trading partner agreement)	Facilitate reorder within the retailer organisation and timely inventory rotation	Retailer Distribution Centre unable to distinguish between shipping to stores with theft protection systems.

Type of Change to Trade item	GTIN for Retail Consumer Trade Item	GTIN for Standard Trade Item Grouping	Rationale	Consequence if rule not applied
3.9 The addition of an EPC Tag. NOTE: Where an item has an EPC Tag and Bar Code, the encoded GTIN must be identical.	No change	No change	The requirement to use EPC Tags is driven by trading partner agreement. Otherwise identical items, with and without an EPC Tag, must have the same GTIN to enable the smooth operation of the Supply Chain.	The introduction of EPC Tags to existing product lines would require reallocation of GTIN. This would add significant cost to the global supply chain and avoids the additional costs associated with an explosion of new GTINs.
2.1.A.1 - 4 Seasonals				
4.1 Trade items modified for seasonal reason (e.g. holiday pack, candy over-wrapped for Easter)	New GTIN Note Recurring Seasonals (e.g., White T-shirt sold each summertime or a cake supplied only during the Christmas period) should use the same GTIN each season.	New GTIN	Facilitates efficient pricing, invoicing, reordering and stock-management at the standard trade item grouping level and seamless trade item substitution at the retail consumer trade item level.	Additional complexity (cost) in the phase-in phase-out of seasonal trade items. Rate sale, re-order and (seasonal) promotions management more complex.
4.2 Same Brand - Trade item Vintage (e.g. Wine)	New GTIN (vintage impacts pricing or ordering or invoicing at any point in the supply chain) Same GTIN (vintage has no impact on pricing or ordering or invoicing at any point in the supply chain)	Same as for Retail Unit.	<i>An assigned GTIN must never be changed as long as the item is not modified so that it needs to be discriminated from the initial trade item for ordering, stocking or billing. The example of "wine" clearly highlights the grey area within this definition. For exactly the same "brand" of wine, the price of top quality vintage varies enormously by year. For other "brands" of wine, the year is of no consequence. Therefore it is ultimately for the Brand Owner (whoever markets the wine) to decide GTIN allocation rules.</i>	The Brand Owner is ultimately responsible for the correct GTIN assignment to their trade items. The GTIN assignment impacts how their trade items are traded. Failure to use the Brand Owners identification scheme means that all benefit of source numbering is lost.

2.1.A.2 GTIN Allocation Rules For Upstream Suppliers

Upstream suppliers are those companies that typically supply or manufacture trade items that are supplied to other companies for further processing. Examples of these trade items include raw ingredient and packaging materials.

A GTIN must be assigned to each pre-defined trade item, and any unit of measure used in the price, order, or invoice process.

Note: These rules are intended for global use. Exceptions may occur only when local regulatory or legal requirements mandate otherwise.

Type of Change to Trade item	GTIN for Trade Item		Rationale	Consequence if rule not applied
2.1.A.2 - 1 Different logistical size				
1.1 Trade item sold in variable measure varies in total weight.	Same GTIN.		All identification includes the measure as an attribute of the GTIN, so no new GTIN is required. See section 2.1.2.2 for further guidance.	Unnecessary introduction of new GTINs.
1.2 Trade item supplied in new size	New GTIN		Different sized trade items must have different GTINs.	Impossible to distinguish between different sizes of trade item.
1.3 Major packaging change – any dimensional change of more than 20%, but net weight remains unchanged.	New GTIN		Inventory and logistics systems need to be updated to ensure optimal space allocation.	20% rule meets reasonability test (e.g. 0% is unacceptable to suppliers, and 100% is unacceptable to customers.) Note: Any change in Net Declared Weight requires a new GTIN.

Type of Change to Trade item	GTIN for Trade Item		Rationale	Consequence if rule not applied
1.4 Same trade item but different handling parameters, e.g. change of container or packaging.	Same GTIN		The trade item is unaffected by how it is delivered.	Unnecessary introduction of new GTINs.
2.1.A.2 - 2 Different substance				
2.1 The party that assigns the GTIN has issued a new specification for the trade item.	New GTIN		Trade item must be distinguished from previous trade item.	Old and new trade items are confused with each other.
2.2 Variations in the grade of the trade item	New GTIN		Different grades of a trade item must be distinguished from one another.	Different grades are confused with one another.
2.3 Trade item specification varies within the parameters of the party assigning the GTIN.	Same GTIN		The trade item still falls within the specification defined for trading purposes so no new GTIN is required. The supplier could use the GTIN Variant AI 20 to distinguish the technical improvement.	Unnecessary introduction of new GTINs.
2.4 The trade item is printed packaging material, and the print design has changed.	New GTIN		The change in print design will affect where and how the trade item can be used in the manufacturing process.	Unable to ensure that correct packaging is used for the appropriate production process and batch.

Type of Change to Trade item	GTIN for Trade Item		Rationale	Consequence if rule not applied
2.5 Different finishing e.g. a trade item is finished or converted to order	New GTIN		The final conversion produces different trade item which must be separately identified.	Unable to distinguish between different trade items.
2.1.A.2 - 3 Different trading partners				
3.1 Change of supplier and the GTIN is assigned by the supplier.	New GTIN		Each supplier's trade items need to be identified separately from those of another supplier.	Impossible to track and trace trade items manufactured or supplied by different companies.
3.2 Change of supplier and the GTIN is assigned by the customer.	Same GTIN		The trade item is specified by the customer who allocates the GTIN to the trade item.	Unnecessary introduction of new GTINs.
3.3 Change of customer and the GTIN is assigned by the supplier.	Same GTIN		The trade item is unaffected by the change in customer.	Unnecessary introduction of new GTINs.

2.1.A.3 GTIN Allocation Considerations for Home Apparel & Home Fashion

The GSMP General Merchandise Work Team validated the existing GTIN Allocation rules and concluded that they are applicable to the apparel and home fashions product category. The content of this appendix extends the content in Appendix 2.1.A.1 to cover scenarios specific to apparel and home fashions and may be different than in other sectors. This appendix is the result of the review of the Trade Item Identification and Communication Guidelines (VICS EDI) TIIC, May 2001 by the GSMP Work Team.

Pre-pack/Multi-pack/Set-pack: For a pre-pack or standard assortment of trade items, each different item within the pre-pack will be assigned a GTIN maintaining the one-to-one relationship between trade item/colour ID/size ID and GTIN. Each GTIN must be marked so as to enable scanning at the Point-of-Sale. A separate, unique GTIN is assigned to each orderable pre-pack. This GTIN is not intended to be scanned at the retail Point-of-Sale. Different pre-packs of trade items are assigned different GTINs when either the component item or quantity contents of the pre-packs are different.

A multi-pack is a group of trade items (the same or different) that are intended to be sold as a single consumer unit at the Point-of-Sale (e.g., a three-pack of men's white T-shirts or a 12-piece set of glassware). A multi-pack is not intended to be broken apart and sold as individual trade items. A multi-pack is assigned a GTIN that is different from the GTIN that may be assigned to the individual trade items. Generally components of a multi-pack are not marked with individual trade item GTINs. Each different multi-pack of the same trade items (e.g., three-pack socks versus six-pack socks) must have a different GTIN assigned. Each different multi-pack GTIN must also have its own trade item/colour ID/size ID.

For a set-pack, each different trade item within the set-pack will be assigned a GTIN, maintaining the one-to-one relationship between trade item/colour ID/size ID and the GTIN. The individual trade item GTIN must be marked to enable retail Point-of-Sale scanning and may or may not be orderable separately outside the set-pack(s). A separate unique GTIN is assigned to each set-pack.. Different set-packs are assigned different GTINs when either the trade item or quantity contents are different.

The figure below provides a summary of the requirements:

	PACK			INDIVIDUAL ITEMS OF THE PACK		
	Orderable by Retailer	Sell to Consumer	GTIN Marked	Orderable by Retailer	Sellable to Consumer	GTIN Marked
Pre-pack	Yes	No	Yes	Maybe	Yes	Yes
Multi-pack	Yes	Yes	Yes	No	No	No
Set-pack	Yes	Yes	Yes	Maybe	Yes	Yes

Notes:

- GTINs on individual trade items in a multi-pack are optional
- GTINs in a **set-pack** are required because the individual pieces are available for sale to the consumer
- Individual components of pre-packs and set-packs may be ordered separately based on individual partnership agreement.

Gift with Purchase/Purchase with Purchase/Collateral Item: A **Gift with Purchase** is a trade item given to a consumer as part of a promotional event, contingent on the consumer making a purchase of another item or items. A Gift with Purchase is considered inventory and has no retail value.

A **Purchase with Purchase** is a trade item sold to a consumer at a special price as part of a promotional event, contingent on the consumer purchasing another item or items. A Purchase with Purchase is considered inventory and has a retail value. When assigning and tracking GTINs for Gift With Purchase and Purchase With Purchase trade items, GTINs should be assigned to all Gift With Purchase and Purchase With Purchase items and be marked with a GTIN to enable Point-of-Sale scanning.

A **Collateral item** is a trade item delivered from a manufacturer to the retail selling floor that is not considered inventory and has no retail value (e.g., A display case that needs to be identified but is has no retail value). GTINs should be assigned to all collateral items.

Section 2.2:

Numbering and Symbol Marking of Logistic Units

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2.2.1 Introduction

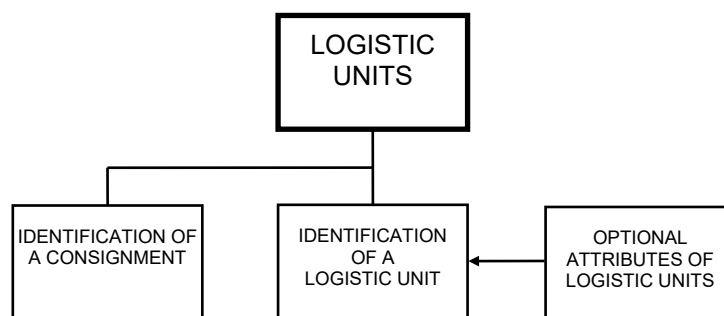
A logistic unit is an item of any composition established for transport and/or storage that needs to be managed through the supply chain.

Tracking and tracing logistic units in the supply chain is a major application of the GS1 System. Scanning the standard identification number, marked on each logistic unit, allows the physical movement of units to be individually tracked and traced by providing a link between the physical movement of items and the associated information flow. It also opens up the opportunity to implement a wide range of applications, such as cross docking, shipment routing, and automated receiving.

Logistic units are identified with a GS1 Identification number called the SSCC. The SSCC ensures that logistic units are identified with a number that is unique worldwide.

Attribute information, such as a Consignment Number, AI (401), may be optionally encoded using internationally agreed data structures and a bar code symbology that allow unambiguous interpretation.

Figure 2.2.1 – 1



2.2.2 Definition and Identification of Logistic Units

A logistic unit is an item of any composition established for transport and/or storage which needs to be managed through the supply chain. The identification and symbol marking of logistic units enables a large number of user applications. In particular, the SSCC provides a link between the physical logistic unit and information pertaining to the logistic unit that is communicated between trading partners using Electronic Data Interchange (EDI).

The SSCC Element String AI (00) is used for the identification of logistic units (see [Section 3.6.1](#)). Each individual logistic unit is allocated a unique number, which remains the same for the life of the logistic unit. When assigning an SSCC, the rule is that an individual SSCC number must not be reallocated within one year of the shipment date from the SSCC assignor to a trading partner. However, prevailing regulatory or industry organization specific requirements may extend this period.

In principle, the SSCC provides a unique reference number that can be used as the key to access information regarding the logistic unit in computer files. However, attributes relating to the logistic unit (e.g., ship to information, logistic weights) are also available as standardised Element Strings.

2.2.2.1 Element Strings Used on Logistic Units

The use of attribute information on logistic units is optional. However, when used, attribute information should be processed with the SSCC that identifies the logistic unit.

2.2.2.1.1 Identification of Trade Items Contained in a Logistic Unit: AIs (02) and (37)

When a logistic unit is a grouping of trade items, it is sometimes useful to indicate the Global Trade Item Number™ (GTIN™) of the contained items in association with the SSCC. The Element String AI (02), which has a mandatory association with AI (37), may be used only on a unit that is not itself a trade item and only if all trade items that are contained within the unit have the same GTIN.

2.2.2.1.2 Logistic Measures: AI (33nn), (34nn), (35nn), (36nn)

The GS1 System provides standard Element Strings for representing logistic weights and measures in metric and other units of measure. In principle a particular logistic measure should be applied in only one unit of measure on a given logistic unit. However, application of the same attribute in several units of measure does not impede the correct processing of the transmitted data.

2.2.2.1.3 Consignment Number: AI (401)

The Consignment Number, AI (401), identifies a logical grouping of goods (one or more physical entities) that has been consigned to a freight forwarder and is intended to be transported as a whole. The Consignment Number, AI (401), must be allocated by a freight forwarder, carriers acting as a freight forwarder, or a consignor, but only if the prior agreement of the freight forwarder is given. Typically AI (401) encodes a House Way Bill Number (HWB).

2.2.2.1.4 Shipment Identification Number: AI (402)

The Shipment Identification Number (Bill of Lading) is assigned by a consignor. It is a globally unique number that identifies a logical grouping of physical units in a transport shipment. It may be used as a communication reference by all parties in the transport chain, such as in (Electronic Data Interchange) (EDI) messages where it can be used as a shipment reference and/or a consignor's loading list.

2.2.2.1.5 Routing Code: AI (403)

The Routing Code, AI (403), is assigned by a parcel carrier. It is intended to provide a migration path to the adoption of a yet to be defined international, multi-modal solution. The routing code, AI (403), must not be used to encode information that could be encoded in a separate AI (such as AI (420), ship to postal code).

2.2.2.1.6 Ship to - Deliver to Global Location Number: AI (410)

This Element String has been designed to allow the automatic sortation of logistic units using the Global Location Number (GLN).

2.2.2.1.7 Ship for - Deliver for - Forward to Global Location Number: AI (413)

This Element String has been designed to allow the cross docking of logistic units using the Global Location Number (GLN). It is used in conjunction with the Element String AI (410) to indicate the cross docking station and the final destination of the logistic unit.

2.2.2.1.8 Ship to - Deliver to Postal Code Within a Single Postal Authority: AI (420)

This Element String has been designed to allow the automatic sortation of logistic units using the postal code in a single postal area.

2.2.2.1.9 Ship to - Deliver to Postal Code with Three-Digit ISO Country Code: AI (421)

This Element String has been designed to allow the automatic sortation of logistic units using the postal code. As the postal code is prefixed by the ISO country code, it may be used internationally.

2.2.3 Special Considerations

By their nature, units that need to be tracked and traced individually in a supply chain require unique identification numbers. The SSCC provides this identification number.

Because each logistic unit must be assigned its own unique SSCC, it is not practical to preprint the bar code symbol containing the SSCC on the logistic unit packaging. A more logical approach is to create a label that can be affixed to the logistic unit when the unit is constructed.

Further, a logistic unit may also be a trade item and hence be subject to the GS1 System specifications for trade items (See Section 2.1). If this is the case, it is logical to generate a single label containing all of the information required.

GS1 along with representatives from manufacturers, retailers, transporters, and GS1 Member Organisations, have developed a voluntary standard for bar code symbol label applications: the GS1Logistics Label. The SSCC and its application on logistic units are the central focus of the GS1 Logistics Label.

2.2.4 GS1 Logistics Label Design

These specifications constitute the basis for all GS1 Logistics Labels. Other sections, most notably Section 3.0, Definitions of the Element Strings, and Section 5.3, GS1-128 Symbology Specifications, should be read in conjunction with the following sub-sections.

2.2.4.1 Scope

These specifications detail the structure and layout of GS1 Logistics Labels. Emphasis is given to the basic requirements for practical application in an open trade environment. Primary topics include:

- The unambiguous identification of logistic units
- The efficient presentation of text and machine readable data
- The information requirements of the key partners in the supply chain: suppliers, customers, and carriers
- Technical parameters to ensure systematic and stable interpretation of labels

2.2.4.2 Concepts

2.2.4.2.1 Logistics Information Flow

As a logistic unit moves through the supply chain, a series of events occur that defines the information related to the unit. The whole supply chain process of manufacturing, finished goods distribution, transportation, and deployment into the marketplace adds layers of information related to the logistic unit.

For example, the physical content of the unit is typically defined at finished goods distribution. At that point in time the identification of the logistic unit as an entity is possible. Other elements of information, such as final destination or the composition of a multi-unit shipment, are not typically known until later in the supply chain process. In a trading relationship, different elements of information are generally known and applied by the supplier, carrier, and customer.

Figure 2.2.4.2.1 – 1



2.2.4.2.2 Representation of Information

The information included on a GS1 Logistics Label comes in two basic forms. Human Readable Interpretation is used by people and is comprised of text and graphics. Machine readable information is designed for data capture by a machine. Bar code symbols are machine readable and are a secure and efficient method for conveying structured data, while Human Readable Interpretation allows people general access to basic information at any point in the supply chain. Both methods add value to GS1 Logistics Labels, and often co-exist on the same label.

The GS1 Logistics Label has three sections. The top section of the label contains free format information. The middle section contains text information and the Human Readable Interpretation of the bar code symbol(s). The lowest section contains the bar code symbol(s).

2.2.4.2.3 Specific Bar Code Symbol Structures

The GS1-128 Symbology is used for GS1 Logistics Labels. This symbology, which is used exclusively for GS1 System defined data structures, is a subset of Code 128, a highly refined, secure, and space efficient alphanumeric symbology. The data formats carried include the Element Strings and their Application Identifiers (AIs) (see [Section 3.0](#)). Each AI is a two-, three-, or four-digit prefix that defines the meaning of the data that follows. AIs allow data to be represented in bar code symbols in a form that is unambiguously and securely interpreted when scanned.

2.2.4.2.4 Identification of a Logistic Unit

The one mandatory field for all GS1 Logistics Labels is the SSCC. The SSCC is an identification number that is unique to each logistic unit. The SSCC is represented by AI (00) and in principle is sufficient for all logistics applications.

In an environment where Electronic Data Interchange (EDI) is used to transmit detailed information about a logistic unit, or where that information is already resident in a database, the SSCC acts as a reference pointer to information.

However, when EDI is not available at each point in the supply chain, or when replicated data is desired, certain additional elements of information are desirable in bar code form. Each of these is also represented through the use of AIs.

2.2.4.3 Label Design

The layout of the GS1 Logistics Label groups information into three logical sections for the supplier, customer, and carrier. Each label section may be applied at a different point in time as relevant information becomes known. Additionally, within each section, bar code symbols are segregated from text information to facilitate interpretation by both machines and people.

The labeller, the organisation responsible for printing and applying the label, determines the content, format, and dimensions of the label. The SSCC is the single mandatory element for all GS1 Logistics Labels. Other information, when required, should comply with the specifications of this document and with the proper use of Application Identifiers.

2.2.4.3.1 Supplier, Customer, Carrier Sections

A section is a logical grouping of information that is generally known at a particular time. There are three label sections on a GS1 Logistics Label, each representing a group of information. Generally, the order of the sections, from top to bottom, is: carrier, customer, and supplier. However, this order and top/down alignment may vary depending on the size of the logistic unit and the business process being served.

2.2.4.3.1.1 Supplier Section

The supplier section of the label contains information that is generally known at the time of packaging by the supplier. The SSCC is applied here as the unit identifier, along with the Global Trade Item Number™ (GTIN™) if used.

Other information that may be of interest to the supplier but might also be useful for customers and carriers, can be applied. This includes product-related information such as product variant; dates such as production, packaging, expiration, and best-before dates; and lot, batch and serial numbers.

2.2.4.3.1.2 Customer Section

The customer section of the label contains information that is generally known at the time of order and order processing by the supplier. Typical information includes the ship to location, purchase order number, and customer-specific routing and handling information.

2.2.4.3.1.3 Carrier Section

The carrier section of the label contains information that is generally known at the time of shipment and is typically related to transport. Typical information includes ship to postal codes, AI (420), Consignment Numbers, AI (401), and carrier-specific routing and handling information.

2.2.4.3.2 Bar Code Symbol and Human Readable Interpretation Layout

Bar code symbols are represented in the lower part of each section, while Human Readable Interpretation is shown in the upper part of the section. This facilitates access to each component.

Figure 2.2.4.3.2 – 1



2.2.4.3.3 Label Dimensions

The physical dimensions of the label are determined by the labeller, but the size of the label should be consistent with the data requirements for all sections of the label. Factors influencing label dimensions include the amount of data required, the content and X-dimension of the bar code symbols used, and the dimensions of the logistic unit to be labelled.

The size of the label is determined by the amount of bar coded data required. The standard A6 (105 mm x 148 mm) or 4 x 6 inch formats are ideal when only the SSCC is coded. Other dimensions are typically variations driven by data requirements or logistic unit size. As a guideline to users, the width of the label is best held constant at 105 mm (4 in.), while the height of the label varies depending on data requirements.

2.2.4.4 Technical Specifications

2.2.4.4.1 Bar Code Symbols

GS1-128 Bar Code Symbols shall be used on the GS1 Logistics Label.

2.2.4.4.1.1 Concatenation

Concatenation is an effective means for presenting multiple Element Strings in a single bar code symbol and should be used to conserve label space and optimise scanning operations. However, concatenation shall not be used with the GS1-128 bar code symbol containing the SSCC on cartons or outer-cases due to the scanning environment. SSCC concatenation is not recommended on standard A6 (105 mm x 148 mm) or 4 x 6 inch formats when SSCC concatenation is used on pallets. This helps to maintain the required symbol height and X-dimension of the bar code containing the SSCC, which is the identifier for the logistics unit and the most fundamental element on the label.

2.2.4.4.1.2 X-Dimension (Symbol Magnification)

In the past, the term symbol magnification was extensively used to specify the size of a bar code symbol. This technique relied upon setting a nominal size (100%) that was directly related to a given X-dimension. Since January 2000, the more precise X-dimension has been used to specify permissible symbol sizes (see [Section 5.4](#)).

The recommended X-dimension range is between 0.495 mm (0.0195 in.) and 0.94 mm (0.037 in.) The target X-dimension recommended for the GS1-128 Bar Code Symbol encoding the SSCC is 0.495 mm (0.0195 in.).

The reliability of scanning will always be enhanced by selecting the same X-dimension for all the bar codes on the label. However, if the information required cannot be accommodated in the space available, a lower X-dimension may be used. In any case, the minimum X-dimension is 0.250 mm (0.00984 in.) Using smaller symbols reduces reading distance and makes the production of quality symbols more difficult to maintain.

2.2.4.4.1.3 Bar Code Symbol Height

Taller symbols present a better target for readers. The recommended bar code symbol height of at least 32 mm (1.25 in.) applies to all of the bar codes on the label, especially the GS1-128 Bar Code encoding the SSCC (see [Section 5.4](#)). January 1, 2004 is the end of the migration from the previous minimum height of 27 mm (1.1 in.). Space constraints may not allow a bar code to be printed at the recommended height, but in no case shall a bar code symbol be less than 13 mm (0.5 in.) high.

2.2.4.4.1.4 Quiet Zones

Bar codes should be printed with leading and trailing Quiet Zones that are at least 10 modules wide.

2.2.4.4.1.5 Orientation and Placement

Picket Fence Orientation Bar Code Symbols should be used on logistic units. In other words, the bars and spaces shall be perpendicular to the base on which the logistic unit stands. In all cases, the GS1-128 Bar Code Symbol encoding the SSCC shall be placed in the lowest portion of the label.

2.2.4.4.1.6 Human Readable Interpretation

As a back up key entry and diagnostic aid, a Human Readable Interpretation of each bar code symbol shall be provided above or below the symbol. It includes Application Identifiers, data content, and a Check Digit, but no representation of special symbol characters or the Symbol Check Character.

To facilitate key entry, AIs should be set apart from the data by parentheses.

This Human Readable Interpretation characters shall be no less than 3 mm high and clearly legible and preferably below the symbol.

2.2.4.4.2 Text**2.2.4.4.2.1 Plain Text**

Text that has no bar code symbol equivalent is often required on a label. The name and address of the sender and receiver are typical examples. In many instances companies may also wish to add specific text to a label (e.g., company logos). All text shall be clearly legible and no less than 3 mm high.

2.2.4.4.2.2 Human Readable Interpretation

Human Readable Interpretation is text designed to support manual operations and to facilitate key entry in menu driven systems. It is the equivalent of data elements represented in bar code symbols and is comprised of data titles and data content. The data content should be at least 7 mm in height. If there is no language agreed between trading partners, data titles must be printed in English. As an option left at the discretion of the labeller, a second language can be added. Application Identifiers are not included in Human Readable Interpretation.

2.2.4.4.2.3 Data Titles

Data titles are the standard abbreviated descriptions of data fields used to denote the Human Readable Interpretation of encoded data. They are prefixes of the Human Readable Interpretation to support manual interpretation of data fields. They can also be used adjacent to other text or bar code symbols to clarify content, such as the word "from" adjacent to a sender's address.

All data titles are shown in Section 3.A.4.

2.2.4.4.3 Label Location

Label placement specifications are maintained in Section 6.7.

2.2.4.5 Label Examples

Figure 2.2.4.5 – 1

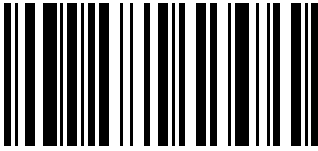
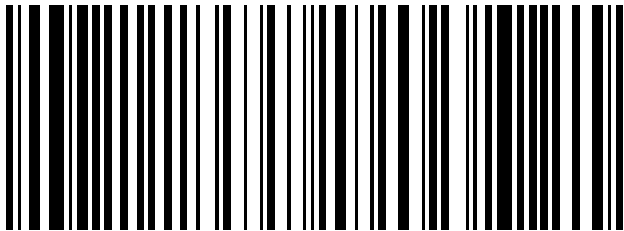
The Basic Label: An SSCC



Figure 2.2.4.5 – 2

Label with Supplier and Carrier Sections

Figure 2.2.4.5 – 3

FROM	TO
BIG SUPPLIER 5 th AVENUE NEW YORK USA	GREAT VALUE 8163 NEW CAJUN DAYTON, OHIO USA
 (420) 45458	SHIP TO POST 45458 B/L 853930 PRO 2895769860
SSCC 0 0614141 123456789 0  (00) 006141411234567890	

Label with Supplier Section with Concatenated Data

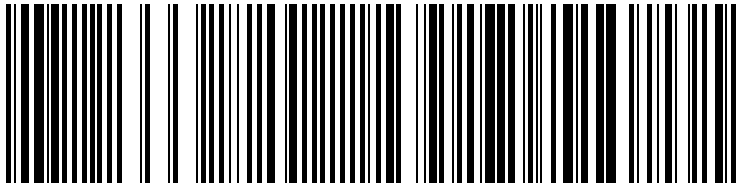
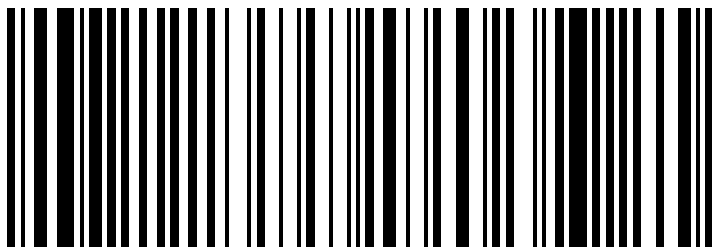
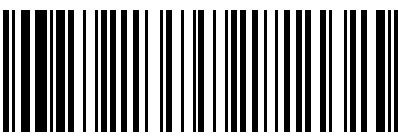
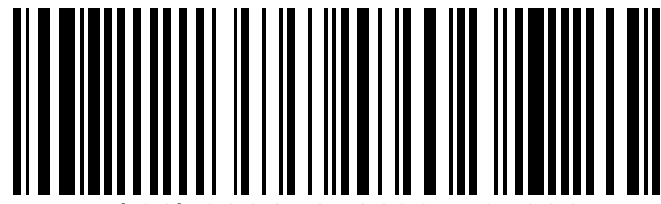
GRAND SUPPLIER COFFEE	
SSCC	
0 0614141 1234567890	
CONTENT	COUNT
00614141000418	20
BEST BEFORE (ddmmyy)	BATCH
14.02.00	4512XA
	
(02)00614141000418(15)000214(10)4512XA(37)20	
	
(0 0) 0 0 6 1 4 1 4 1 1 2 3 4 5 6 7 8 9 0	

Figure 2.2.4.5 – 4

Label with Supplier, Customer, and Carrier Sections

FROM	TO
BIG SUPPLIER 92 ROYAL ST. NEW YORK USA	GREAT VALUE 8163 NEW CAJUN DAYTON, OHIO USA
SHIP TO POST 45458 B/L 853930 CONSIGNMENT 541234550127501	
 (420) 45458(401) 541234550127501	
PO: 345-896779-0 DWCP: 9684584-23 Zone: 4 STORE # 49	
 (410) 0614141000531	SHIP TO LOC 0614141000531
SSCC 0 0614141 123456789 0	
 (00) 006141411234567890	

2.2.4.6 2005 EPCglobal Seal Application Guidelines

(Refer to 2.2.4.6.1 Label examples)

1. EPCglobal Seal location placement should be as close to the human readable / bar code symbol as possible.
 - a) If the EPC Tag is a part of the Shipping Label, place the EPCglobal Seal on the label itself.
 - b) EPC Tag placement for best-read rates takes precedence over being close to the barcode symbol. (Especially on product containing liquids and metal).
 - c) If the EPC Tag and Shipping Label are separate, the EPCglobal Seal should appear on the shipping label, not on the EPC Tag.
 - d) Do not increase the width of the printed label (4 inches or ISO A6).
 - e) If necessary increase the label height.
 - f) Cartons using direct print should locate the EPCglobal Seal as close to the direct print human readable / bar code symbol as possible.
2. Incorporate only an EPCglobal approved and trademarked seal.
 - a) Approved EPCglobal Seals are described in the document *EPCglobal Tag Notification Brand Guidelines*. Utilise the current version found at www.epcglobalinc.org.
 - b) Note: **The examples in Section 2.2.4.6.1 are for illustration only.** The examples use the EPCglobal seals found in *EPCglobal Tag Notification Brand Guidelines* Version 3, November 17, 2004.
 - c) No text included: text needs met by signage and education. No Human Readable text explaining the presence of an EPC Tag is required. The use of the EPCglobal Seal itself is sufficient
 - d) Not a warning label
3. Used for consumer and supply chain benefit
 - a) On tagged consumer items
 - b) Single/Shipping Consumer Trade Item (ship unit is selling unit, carton quantity one)
 - c) On trade item groupings and logistics units containing tagged items

4. The supplier may use EPC Tags and the EPCglobal seal on product delivered to their retail customer whether or not the retail customer is reading the EPC tag. The supplier should not have to manage the handling of distribution where some retailers (or individual stores) have EPC RFID installed and those that do not. This is a matter of education. It is the choice of the manufacturer how to manage its tagged products. The manufacturer will not need to develop separate inventories for products dependent on whether or not EPC RFID is in use at a customer site.

2.2.4.6.1 2005 EPCglobal Seal Application Guideline Label Examples

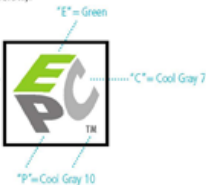
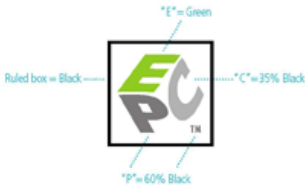
The EPCglobal Seals used in the following label examples are for illustration only. They are found in the EPCglobal Tag Notification Guidelines Version 3 dated November 17, 2004 as shown below.

EPCglobal will provide EPCglobalSeal(s) and EPCglobal Seal Use Guidelines for EPC Tagged Logistics units and Trade Items.

GSMP will revise Section 2.2, Marking and Labelling Guidelines in the *GS1 General Specifications*, Version 7.0 using feedback from initial installations and consumer input via the EPCglobal Public Policy Steering Committee.

EPCglobal Tag Notification Guidelines

Version: 3.0 / Prepared: 17 November 2004

HIGHEST QUALITY COLOR REPRODUCTION (4 colors)	ACCEPTABLE COLOR REPRODUCTION (2 colors)	ONE COLOR REPRODUCTION (positive & reverse)																
For the highest quality color reproduction it is recommended that four spot colors be used to reproduce the EPC seal. Alternatively, four-color process tint equivalents may also be used (see color reproduction formulas below). 	In situations where fewer colors are available due to production limitations, two spot colors may be used. 	In single color applications, all components reproduce at 100% Black. Positive Reverse																
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Specified below are the suggested color reproduction formulas. In order to maintain color consistency for different reproduction methods, always visually match the chosen colors to the Pantone Matching System (PMS) designations. <table><tr><th>Green</th><th>Cool Gray 7</th><th>Cool Gray 10</th><th>Black</th></tr><tr><td>PANTONE PMS 376 coated PMS 368 uncoated</td><td>PANTONE PMS Cool Gray 7 coated PMS Cool Gray 7 uncoated</td><td>PANTONE PMS Cool Gray 10 coated PMS Cool Gray 10 uncoated</td><td>PANTONE PMS Black coated PMS Black uncoated</td></tr><tr><td>CMYK C: 50 M: 0 Y: 100 K: 0</td><td>CMYK C: 0 M: 0 Y: 0 K: 35</td><td>CMYK C: 0 M: 0 Y: 0 K: 60</td><td>CMYK C: 0 M: 0 Y: 0 K: 100</td></tr><tr><td>RGB R: 102 G: 204 B: 51</td><td>RGB R: 153 G: 153 B: 153</td><td>RGB R: 102 G: 102 B: 102</td><td>RGB R: 0 G: 0 B: 0</td></tr></table>	Green	Cool Gray 7	Cool Gray 10	Black	PANTONE PMS 376 coated PMS 368 uncoated	PANTONE PMS Cool Gray 7 coated PMS Cool Gray 7 uncoated	PANTONE PMS Cool Gray 10 coated PMS Cool Gray 10 uncoated	PANTONE PMS Black coated PMS Black uncoated	CMYK C: 50 M: 0 Y: 100 K: 0	CMYK C: 0 M: 0 Y: 0 K: 35	CMYK C: 0 M: 0 Y: 0 K: 60	CMYK C: 0 M: 0 Y: 0 K: 100	RGB R: 102 G: 204 B: 51	RGB R: 153 G: 153 B: 153	RGB R: 102 G: 102 B: 102	RGB R: 0 G: 0 B: 0	Maintaining the minimum clear space around the EPC seal ensures maximum visibility. The measurements below indicate the minimum space required around the EPC seal that must be free from imagery, text, other graphic elements, or the edge of a given format. The isolation area is based on one half (1/2 X) the cap height of "E."  Respecting the minimum-size regulation ensures that the EPC seal appears at a readable size and is reproduced clearly through most production methods. The smallest acceptable size permitted for the seal is based on a 1P (1 pica) width for consumer packaging and a 1" (1 inch) width for pallet applications.  1P (approx. 5/32 inch) width minimum size for packaging  1 inch width minimum size for pallet (note, not to scale)	1. Pallets Minimum size of 1" x 1" Because of wide size variations, tag notification size should be consistent with other notification language already contained on the pallet or the label on the pallet 2. Cases Minimum 1 pica Because of wide size variations, tag notification size should be consistent with other notification language already contained on the case 3. Items Minimum 1 pica It is recommended that the EPC seal be placed near bar codes and/or ingredient information on consumer packaging CONTACT To obtain a copy of the EPC seal please submit a request to: epcinfo@epcglobalinc.org
Green	Cool Gray 7	Cool Gray 10	Black															
PANTONE PMS 376 coated PMS 368 uncoated	PANTONE PMS Cool Gray 7 coated PMS Cool Gray 7 uncoated	PANTONE PMS Cool Gray 10 coated PMS Cool Gray 10 uncoated	PANTONE PMS Black coated PMS Black uncoated															
CMYK C: 50 M: 0 Y: 100 K: 0	CMYK C: 0 M: 0 Y: 0 K: 35	CMYK C: 0 M: 0 Y: 0 K: 60	CMYK C: 0 M: 0 Y: 0 K: 100															
RGB R: 102 G: 204 B: 51	RGB R: 153 G: 153 B: 153	RGB R: 102 G: 102 B: 102	RGB R: 0 G: 0 B: 0															
Note: Any use of the EPC seal beyond what is provided for in these guidelines is prohibited without the written consent of EPCglobal Inc.																		

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Figure 2.2.4.6.1 – 1

Pallet Level A6 Label

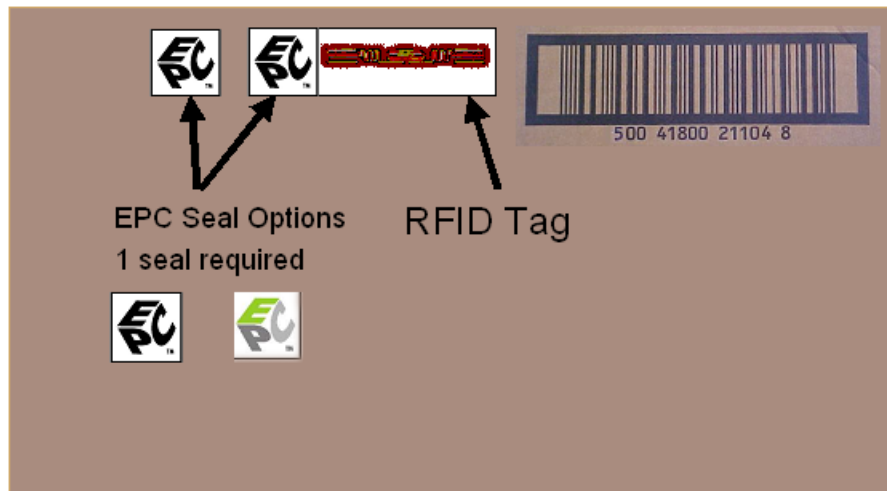
From: Vendor Name Address City, State, Zip		To: Retailer Address City, State, Zip	
Ship to Postal Code: (420) ZIPCODE 			
PO#:			
EPC Seal Area 1 seal required		RFID Tag Area	
			
SSCC  (00) 0042273 0000000113 1			

Figure 2.2.4.6.1 – 2

Carton Level A6 Label

From: Vendor Name Address City, State, Zip		To: Retailer Address City, State, Zip	
Ship to Postal Code: (420) ZIPCODE 			
PO#: UPC #: Case qty:			
EPC Seal Area 1 seal required		RFID Tag Area	
		 Style: Color: Size:	
SSCC  (00) 0042273 0000000113 1			

Figure 2.2.4.6.1 – 3

Proposed Alternative for Corrugate

Section 2.3:

Numbering and Symbol Marking of Assets

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2.3.1 Introduction

The GS1 System provides a method for the identification of assets. The object of asset identification is to identify a physical entity as an inventory item.

Each company holding a GS1 Company Prefix may assign asset identifiers to the assets or trade items supplied to their customers. Best practices may dictate that the trade item manufacturer apply the asset identifier during the manufacturing process. This number may then be used for ordering new assets of an identical type. The GS1 System asset identifiers act as keys to access the characteristics of an asset stored in a computer file and/or to record movements of assets.

Asset identifiers may be used for simple applications, such as the location and usership of a given fixed asset (e.g., a personal computer) or for complex applications, such as recording the characteristics of a Returnable Asset (e.g., a reusable beer keg), its movements, its life-cycle history, and any relevant data for accounting purposes.

2.3.2 Data Carrier

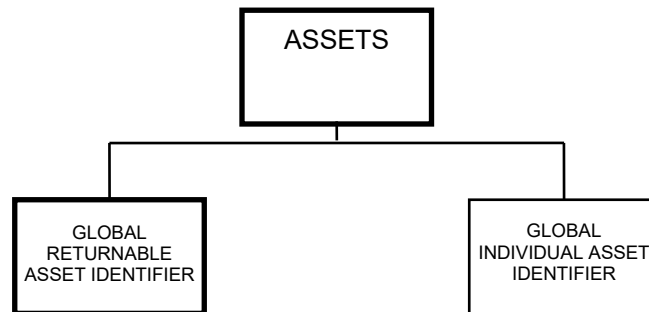
The only data carrier used to represent GS1 System asset identifiers is the GS1-128 Bar Code Symbol. When encoding an asset identifier, GS1-128 Bar Code Symbols should be printed at an X-dimension between 0.25 mm (0.00984 in.) and 1.016 mm (0.040 in.).

2.3.3 Application Overview

2.3.3.1 Identification of an Asset

2.3.3.1.1 Global Returnable Asset Identifier (GRAI): AI (8003)

Figure 2.3.3.1.1 – 1



A Returnable Asset is a reusable package or transport equipment of a certain value, such as a beer keg, a gas cylinder, a plastic pallet, or a crate. The GS1 System identification of a Returnable Asset, the Global Returnable Asset Identifier (GRAI), enables tracking as well as recording of all relevant data.

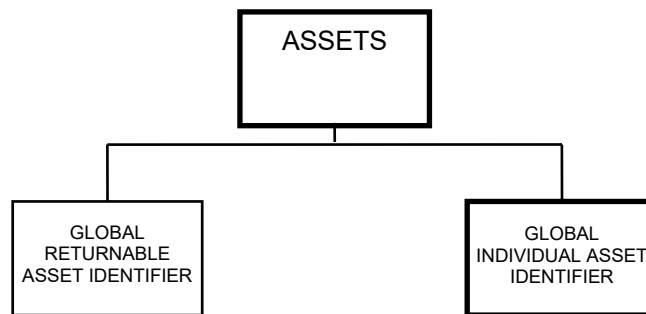
The Element String is comprised of the GRAI and an optional serial number (see [Section 3.6.49](#)). The GRAI is composed of the GS1 Company Prefix of the company assigning the asset identifier and of the Asset Type. The latter is assigned to uniquely identify, together with the GS1 Company Prefix, a particular kind of asset. The GRAI remains the same for all identical Returnable Assets. Although consecutive numbering is recommended, the structure is left to the discretion of the assigning company. An optional serial number may be used to distinguish Individual Assets within a given asset type.

A typical application using this Element String is in tracking returnable beer kegs. The owner of the beer keg applies a bar code symbol carrying a GRAI to the keg using a permanent marking technique. This bar code symbol is scanned whenever the keg is supplied full to a customer and scanned again when it is returned. This scanning operation allows the beer keg owner to automatically capture the life-cycle history of a given keg and to operate a deposit system, if desired.

Note: This Element String identifies a physical entity as a Returnable Asset. When such a physical entity is used to transport or to contain a trade item, the Element String AI (8003) must never be used to identify the transported or contained trade item.

2.3.3.1.2 Global Individual Asset Identifier (GIAI): AI (8004)

Figure 2.3.3.1.2 – 1



In the GS1 System, an Individual Asset is considered a physical entity made up of any characteristics.

This Element String identifies a particular physical entity as an asset. It must not be used for other purposes and must be unique for a period well beyond the lifetime of the relevant asset records. Whether or not the assigned Global Individual Asset Identifier (GIAI) may remain with the physical item when changing hands depends on the particular business application. If it remains with the physical item, then it must never be re-used.

The GIAI comprises the GS1 Company Prefix of the company assigning the asset identifier and an Individual Asset Reference (see [Section 3.6.50](#)). The Individual Asset Reference is alphanumeric. Its structure is left to the discretion of the company applying the Element String.

This Element String might, for example, be used to record the life-cycle history of aircraft parts. By symbol marking the GIAI, AI (8004), on a given part, aircraft operators are able to automatically update their inventory database and track assets from acquisition until retirement.

2.3.4 Allocating GS1 System Asset Identifiers

2.3.4.1 General Rule

GS1 System asset identifiers can be used to identify any fixed assets of a company. It is left to the discretion of the issuer to determine whether the Global Returnable Asset Identifier (GRAI), AI (8003), or Global Individual Asset Identifier (GIAI), AI (8004), is more suitable for the application concerned.

Asset identifiers must not be used for any other purpose and must remain unique for a period well beyond the lifetime of the relevant records.

If a company assigns asset identifiers to trade items supplied to its customers, the company must ensure that the asset identifiers are never re-used.

2.3.4.1.1 Allocating Global Returnable Asset Identifiers (GRAIs): AI (8003)

The structure of the Element String for a Global Returnable Asset Identifier (GRAI) can include two parts: the mandatory GRAI and an optional serial number (see [Section 3.6.49](#)).

Figure 2.3.4.1.1 – 1

	Format of the Element String															
	Application Identifier	Global Returnable Asset Identifier													Serial Number (optional)	
		GS1 Company Prefix											Asset Type			Check Digit
																
(UCC-12)	8 0 0 3	0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	X ₁  variable  X ₁₆
(EAN/UCC-13)	8 0 0 3	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	X ₁  variable  X ₁₆

The exact method used to allocate the GRAI is left to the discretion of the issuing organisation. However, a unique number, the Asset Type, must be assigned for each type of asset being identified, and for ease of administration, the GS1 System recommends that numbers be allocated sequentially and not contain classifying elements.

When it is not possible to assign an Asset Type (e.g., for museum exhibits), or when the type of asset is not required by the application (e.g., when the item is only used for a single type of asset), then the GS1 Global Individual Asset Identifier (GIAI), AI (8004), should be used.

2.3.4.1.1.1 Identical Assets and the Global Returnable Asset Identifier

A single Global Returnable Asset Identifier (GRAI) should be assigned to a series of identical assets (see Figure 2.3.4.1.1.1. – 1).

Figure 2.3.4.1.1.1 – 1

Asset Type	GRAI
50 litre aluminium beer keg	0 12345 6789 000 5
10 litre aluminium beer keg	0 12345 6789 001 2
10 litre wooden beer keg	0 12345 6789 002 9

2.3.4.1.1.2 Serial Number (Optional)

The owner of the asset assigns the optional serial number. It denotes an Individual Asset within a given Asset Type. The field is alphanumeric and is used to distinguish individual assets with the same Asset Types.

2.3.4.1.2 Allocating Global Individual Asset Identifiers (GIAIs): AI (8004)

The Global Individual Asset Identifier (GIAI) is structured according to Figure 2.3.4.1.2 - 1 (see [Section 3.6.50](#)).

Figure 2.3.4.1.2 – 1

Format of the Element String					
Application Identifier	Global Individual Asset Identifier				
	GS1 Company Prefix		Individual Asset Reference		
					
8 0 0 4	N ₁ ...	N _i	X _{i+1} ...	variable length	X _j (j<=30)

The exact method used to allocate the GIAI is left to the discretion of the issuing organisation. However, each GIAI must be unique for each individual asset being identified and, for ease of administration, the GS1 System recommends that GIAIs be allocated sequentially and not contain classifying elements.

2.3.4.2 Change of Asset Ownership

Asset Identification Numbers are used in a diverse range of business applications ranging from tracking the movements of re-usable packaging trays to recording the life-cycle history of aircraft parts. If a company sells an asset to another company then the asset identifier should ideally be replaced by another GIAI [Global Individual Asset Identifier] or GRAI [Global Returnable Asset Identifier] or be removed. It is permissible for the asset identifier to remain on the item when the ownership changes if the new owner takes responsibility for GS1 Company Prefix associated with the asset identifier.

For further information regarding changes of ownership, please refer to Section 1.2.

2.3.4.3 Information Associated with Asset Identifiers

The attributes of the asset should be established on a computer file using the GS1 System asset identifier as the key to the information. Examples of the type of information held include the full name and address of the party who owns the asset, the value of the asset, the location of the asset, and the life-cycle history of the asset.

Section 2.4:

Numbering and Symbol Marking of Locations

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2.4.1 Introduction

A global location number is used to identify any location (physical or legal) that needs to be uniquely identified for use in the supply chain.

The Global Location Number (GLN) makes possible the unique and unambiguous identification of physical locations and legal entities. This is a prerequisite for efficient Electronic Commerce between trading partners (e.g., Electronic Data Interchange (EDI), electronic catalogues). The EAN/UCC-13 Data Structure is used for the GLN. Note that when a UCC Prefix is used to generate the GLN, the UCC Prefix should be considered as having a leading zero (see Section 1.2 for a full definition of the GS1 Company Prefix).

Within the GS1 System the GLN and the GTIN (Global Trade Item Number) are two distinct data identifiers. There is no conflict when a GTIN and a GLN have the same digits, the data carrier (electronic data interchange, machine readable symbol, or radio frequency) will distinguish between the two identifiers. For example, when GLNs are used in Automatic Identification and Data Capture (AIDC) and EDI, the context (Application Identifiers and qualifiers) will prevent any misinterpretation. Each company or organisation that is a member of a GS1 Member Organisation may use GLNs to identify locations under the terms of its membership. For full contact details of the GS1 Member Organisations worldwide visit www.gs1.org.

Although in some countries the national GLN database is administered by the GS1 Member Organisation, it remains the responsibility of the company issuing the numbers to keep business partners informed of all relevant GLNs related to the trading relationship. Special care is needed if ownership of the company changes (see Section 1.2.1).

In business operations, location numbers are of no value if they are not associated with business attributes. All Element Strings described in this section indicate the particular usage of the GLN represented in the bar code symbol.

The GLN is designed to improve the efficiency of communication with trading partners and add value to the trading partners involved, as well as to consumers. The types of locations that can be identified with GLNs are:

- **Physical location** – a single point of access with a physical address, such as a particular room in a building, warehouse, warehouse gate, loading dock, delivery point, cabinet, cabinet shelf, or a room within a building, as well as operational locations such as EDI mailboxes
- **Legal entity** – the legal organisation that is subscribed to the GS1 System, such as whole companies or subsidiaries, including suppliers, customers, financial services companies, and freight forwarders

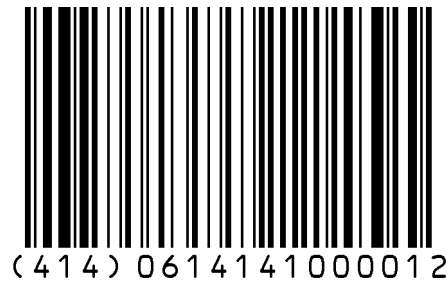
Each GLN points to a unique record that has distinctions created by fields of data that answer three questions: who, what and where. The “who” is the organisation controlling or owning the GLN. The “what” qualifies or states the context of the relationship of the associated data. The “where” is the physical address of the location.

2.4.2 Data Carrier

The Global Location Number (GLN) is used to identify a physical location and, when required, may be bar coded using the appropriate Application Identifier as described in Section 2.4.4.

The data carrier used to represent the GLN is the GS1-128 Bar Code Symbol. When encoding the GLN, GS1-128 Bar Code Symbols should be printed at an X-dimension between 0.25 mm (0.00984 in.) and 1.016 mm (0.040 in.). However, if the GLN is carried by a bar code symbol on a GS1 logistics label, the recommendations contained in Section 2.2 apply.

Figure 2.4.2 – 1: GS1-128 Symbol encoding a GLN using AI (414) Identification of a Physical Location



2.4.3 EDI and Global Data Synchronisation (GDS)

Electronic Data Interchange (EDI) ideally uses Global Location Numbers (GLNs) to identify all trading partners and locations involved. The mailbox or network address for companies have traditionally been identified with a GLN to support EDI applications. The EDI standards promoted by the GS1 System (EANCOM®, GS1 Business Messaging Standards ((XML)) make full use of GLNs to simplify the automation of business messaging. Any GLN related Application Identifier should have an equivalent field (data element) in EDI messages.

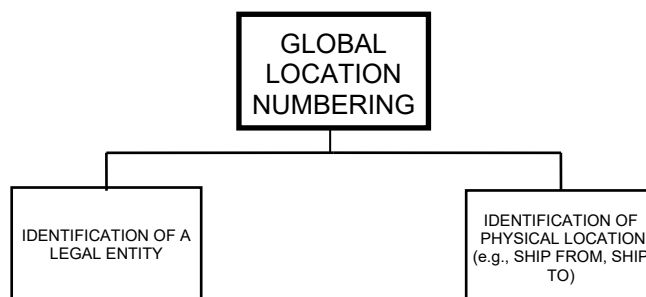
GLNs and associated information of trading partners are communicated at the start of the relation through the Party Information message (PARTIN). GLNs are then used during the trading relationship in any other business message, such as invoice, order, pay, or deliver.

National data pools and the global registry that links them for the purpose of Global Data Synchronisation mandate the use of GLNs to identify each party that provides information to any data pool or who requires information about products and locations.

Please note that the *GS1 General GS1 Specifications* do not provide details on business messages or the Global Data Synchronisation Network (GDSN). For further information please consult the relevant GS1 standard.

2.4.4 Application Overview

Figure 2.4.4 – 1



2.4.4.1 Identification of a Legal Entity

Legal entities require identification within Electronic Business Networks (e.g., Electronic Data Interchange (EDI) networks, electronic catalogues). The use of Global Location Numbers (GLNs) in these areas is driven by the exact party role within a given business process requirement. The GLN can be used as a GS1 identification key to access master data associated with a given business transaction.

Figure 2.4.4.1 – 1: High-Level Example of a Trading Partner Scenario



The use of a GLN, as a unique key to master data and used within these transactional messages, makes such applications more efficient and provides greater accuracy of data; in EANCOM® its use is

mandatory in the 'header' of any message. Using GLNs for such business processes requires an appropriate qualifier.

2.4.4.2 Identification of a Physical Location

2.4.4.2.1 Global Location Number to Identify a Physical Location: AI (414)

An Element String with an Application Identifier (AI) (414) identifies a physical location. This implies that this Element String is represented in a data carrier on the location itself. Physical locations may, for example, be a room, a door of a warehouse, an x-ray room in a hospital, or a control point.

This Element String may be used to record and confirm presence at a given location for any purpose. An equivalent field will hold this information in electronic messages.

A typical application using this Element String is the identification of a warehouse dock as a delivery point. The driver is directed to a given warehouse dock and the Global Location Number (GLN) identifying the warehouse dock, and the Global Trade Item Number® (GTIN®) or SSCC identifying the goods are scanned whenever a delivery is made to the location. The electronic message from the scanner is then used to automatically update the warehouse's stock management system of the delivery.

2.4.4.2.2 Global Location Number Extension for Relationship Definition

The use of GLN Extension is restricted for internal purposes. For communication between trading partners a GLN will be used following the rules defined in Section 2.4 Appendix A.1 "Scenarios of GLN Allocation Rules." The GLN Extension will not be communicated with trading partners except by mutual agreement.

The ability to provide GLN Extensions is expected to be an important business requirement with the EPC Network. Locations that currently have a GLN may also use an optional GLN Extension component to distinguish unique locations (storage slots, door locations, bin storage, shelves, peg holes, rack, cabinet, computer/communication bays, etc.). However, a company may choose to assign a unique GLN, without an Extension component, as a way to identify these locations.

The extension component is used to identify internal physical locations within a location previously identified with a GLN (stores, factories, buildings, etc.).

The GLN plus extension component must not be used to identify more than one site.

With experience of using the EPC Network, it is likely that additional rules will be defined. Initial EPCglobal Installations through June 2006 will be monitored to define new rules for use of the GLN extension as required. The new Extension AI 254 is a variable length alphanumeric field up to 20 characters in length. Implementation using EPC Generation 1 tags will limit the extension to a maximum of 12 numeric digits. A/N functionality will be resolved during Generation 2 development.

2.4.4.3 Location Numbering by Business Operation

2.4.4.3.1 Ship to – Deliver to Global Location Number: AI (410)

An Element String with an Application Identifier (AI) (410) represents the Global Location Number (GLN) of the recipient of a logistic unit. The GLN refers to the address where a particular consignment is to be delivered. This Element String is used in single leg transport operations. A logistic unit may include a bar code symbol carrying the GLN of the unit's intended destination. When scanning this Element String, the data transmitted may be used to retrieve the related address and/or to sort the item by destination.

2.4.4.3.2 Bill to - Invoice to Global Location Number: AI (411)

An Element String with Application Identifier (AI) (411) represents the Global Location Number (GLN) of the addressee of an invoice. The GLN refers to the name and address of the business partner to which an entity shall be invoiced and includes accounting-related information that may be used wherever required.

2.4.4.3.3 Purchased from Global Location Number: AI (412)

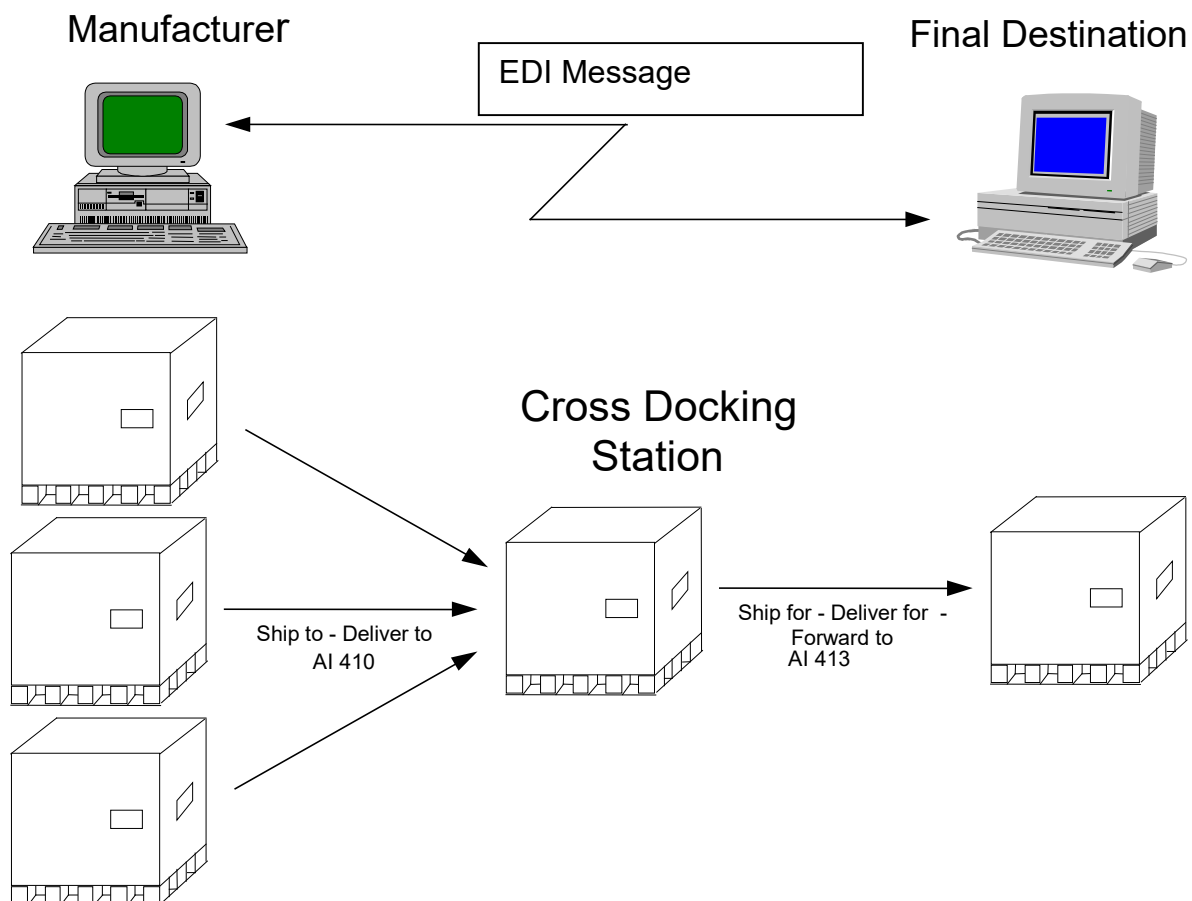
In business it is sometimes important to know from where a particular item was purchased. Applied on a trade item, an Element String with Application Identifier (AI) (412) provides the Global Location Number (GLN) of the company from which the respective trade item has been purchased.

2.4.4.3.4 Ship for - Deliver for - Forward to Global Location Number: AI (413)

An Element String with Application Identifier (AI) (413) is used by the consignee for determining the internal or subsequent final destination of a physical unit.

Cross docking is a typical application using this Element String. Here, a bar code symbol carrying the Element String AI (410) is placed on a logistic unit at the point of creation to direct the goods to the intermediate destination (e.g., a distribution centre). The Element String AI (413) is also carried by the bar code symbol to direct the goods to their final destination (e.g., a retail store served by the distribution centre).

Figure 2.4.4.3.4 – 1: Example of a Cross Docking Application



2.4.4.3.5 Global Location Number of the Invoicing Party: AI (415)

An Element String with Application Identifier (AI) (415) is used to indicate the Global Location Number (GLN) of the invoicing party. The GLN is mandatory information for the payment slip application (see Section 2.6.5).

2.4.5 Allocating Global Location Numbers

2.4.5.1 General Rule

Global Location Numbers (GLNs) can be used to identify any physical location or legal entity that has meaning within a business scenario. The general rule is that a separate GLN is required to identify each different location (e.g., each store of a retail group is required to have a separate GLN to enable efficient delivery to the individual store).

The exact method used to allocate the GLN is at the discretion of the issuing organisation. In line with best practice, GS1 recommend that the GLN be assigned at source, usually by the party owning the location. When a new GLN is issued it is recommended that:

- The GLN is associated with the master data for the identified location.
- This master data is communicated to trading partners in a timely manner.
- GLNs are allocated sequentially without classifying elements.

Once assigned at the source, usually by the party owning the location, the GLN becomes a global reference that can be used by all. See Section 2.4.5.6 for guidance on trading with organisations that do not use GLNs.

The GLN allocated to an entity should be communicated from the owner of the location through the supply chain in advance of a transaction/delivery so that all systems can be prepared for interaction. GLNs are reference keys for retrieving the indicated information from databases.

From time to time, the details (associated data) related to a GLN might change. The following are general cases or examples on the allocation of GLNs due to a change in the circumstances or business conditions in which the number was originally established. See Appendix 2.4.A.1 for GLN allocation rules and scenarios regarding when GLNs should remain the same or should be changed. These rules are based on business practices.

Note: National, federal, or local regulations may apply and take precedence over this guideline. Examples include regulations affecting a company's registration, taxation, or fiscal obligations, as well as its industry requirements.

2.4.5.2 Company Liquidation, Acquisition, and Mergers: Change of Ownership

If a company sells a location to another party who may or may not be using Global Location Numbers (GLNs), the GLN for the address that is associated with the previous owner should be closed. If the new owner of the address wishes to identify the location with a GLN, a new number should be assigned using the new owner's GS1 Company Prefix. In this scenario, the new owner should assign a new GLN within one year of purchase.

- If a company sells a location to another party, the GLN that was assigned should not be reassigned per the provisions of Section 2.4.5.7.
- If the purchase of the whole company by another has included assignment of the GS1 Company Prefix with the consent of the Member Organisation, then the existing GLNs already allocated can continue to be used.
- If a company is split as a result of the purchase, the new owner must assign new GLNs.

In addition, if two activities within a company merge and have separate GLNs before the merger, then transition to one of the existing GLNs should be made by updating records and retiring one of the GLNs.

2.4.5.3 Relocations

Relocations within the same building (e.g., a department moves from the second to the seventh floor of a building), or other changes in address that have little or no impact on such things as deliveries and payments, do not require assignment of a new GLN. The changed information may be updated and communicated to trading partners. However, whenever the point of access changes, a new GLN should be assigned.

When a given operation is closed in one location and replaced by a similar operation at a new location, a new GLN should be assigned.

2.4.5.4 Physical Location and Ownership Remain Unchanged and Associated Data for a Particular Global Location Number Change

If an attribute associated with a Global Location Number (GLN) changes (e.g., a cross-docking station changes within a warehouse or a small enterprise starts electronic invoicing), the details associated with the GLN should be communicated to trading partners by the party responsible for the location. The GLN itself remains the same.

2.4.5.5 Grouping of Global Location Numbers

Within business applications, a series of Global Location Numbers (GLNs) may be organised into logical groupings. For example, a series of GLNs could be prepared for all retail stores of a given group in a given area, all retail stores with an in-store pharmacy, and all retail stores larger than a certain size. The exact business process determines these logical groupings. Any additions or deletions from the group do not impact individual GLN assignments.

2.4.5.6 Trading Partners Without Global Location Numbers

The party responsible for a given location assigns the Global Location Number (GLN). This ensures supply chain efficiency by having the GLN assigned at source and used by all trading partners.

Although GLNs cannot be bought or sold, they can be used for third party trading partners who, for whatever reason, do not assign GLNs. This arrangement is analogous to private label for Global Trade Item Numbers® (GTINs®). For example, in a long-term lease of storage space, the company leasing the space (the leaseholder) can use its own GLN or acquire the GLN for that space from the leasing company. As long as it leases that space from the leasing company, the leaseholder can use the GLN for that specific location. Using the leasing company's GLNs for any other location type or trading partner is prohibited.

2.4.5.7 Reassignment of Global Location Numbers

A Global Location Number (GLN) that has been used previously or has become obsolete must not be reused for another location until at least 48 months have elapsed. A longer period may be needed in accordance with government requirements, such as invoicing and taxation, or requirements related to the nature of the location (e.g., a bonded warehouse). This period must allow time for all references of the old GLN to be removed from trading partners' files.

2.4.6 Information Associated with a Global Location Number

Master data for a location should be established on a computer file and the Global Location Number (GLN) may then be used to facilitate efficient communication of this information. There are a number of Solution Providers who provide services for the efficient communication of master data information associated with a GLN on a global or regional level.

An example of the type of information held includes the full name and address of the party, bank details and account number, sales department that deals with the party, and profile of a company.

Information associated with each GLN is held internally by trading partners or on central databases. If the location changes and the details are not changed, communications or deliveries will go to the address held on file. It is, therefore, essential for organisations to keep trading partners informed of any change of information associated with a GLN. See Appendix 2.4.A.1 for GLN allocation rules and scenarios where changes to a location or attributes relating to a GLN may require a new GLN.

Within the GS1 System the GLN and the GTIN (Global Trade Item Number) are two distinct data identifiers. There is no conflict when a GTIN and a GLN have the same digits, the data carrier (electronic data interchange, machine readable symbol, or radio frequency) will distinguish between the two identifiers. For example, when GLNs are used in Automatic Identification and Data Capture (AIDC) and EDI, the context (Application Identifiers and qualifiers) will prevent any misinterpretation.

Appendix 2.4.A.1 Scenarios of GLN Allocation Rules

The following scenarios have been developed by the Global Location Number (GLN) Allocation Rules Work Group established under Global Standards Management Process (GSMP). The starting point for each of the scenarios is a correctly assigned GLN according to the general rules described in Section 2.4.5.

GLNs are assigned to physical and legal locations to provide a key to access master data in a business process (e.g., Order, Invoice, Deliver). For each of these assigned GLNs, master data will be assigned to the GLN to support the business process. The following scenarios illustrate a change in the business process or attribute data associated with a given GLN and indicate whether a new GLN should be assigned to signify the change or whether alternative business processes (e.g., change to the PARTIN (Party Information) message in business messaging or updating information in a Party Data Catalogue) can be used to communicate the GLN change.

GLNs are intended to support business processes and are used to identify entities and organisations. Individual businesses will need to determine whether to use the same GLN for more than one business process (e.g., a small business may use a single GLN for order, delivery, and invoice, because each of these processes are undertaken in a single location, while a multinational organisation could chose to assign a distinct GLN to each location within its organisation).

Note: These rules are intended for global use. Exceptions may occur only when local regulatory or legal requirements mandate otherwise.

Type of Change to Location	GLN for Location	Rationale	Consequence if Rule Not Applied
2.4.A.1 – 1 – General Rules			
1.1 Whenever the point of access changes, where a location needs to be distinguished from another location for communication with a trading partner	New GLN	GLNs provide a key to master data associated with a given location. Whenever locations need to be distinguished by trading partners, a different GLN is required.	It is not possible for trading partners to distinguish one location from another.
1.2 Legal status change following a partial merger or acquisition	New GLN using the GS1 Company Prefix of the purchasing company (when the purchasing company does not assume responsibility for the entire organisation purchased)	See Section 1.2.1 (Acquisitions and Mergers). When an organisation makes a partial purchase of another, the GLNs must be changed within one year.	Following a partial purchase of a company, the GLNs and all other GS1 System identification numbers have to be changed to reflect the purchasing organisation's GS1 Company Prefix.
1.3. Legal status change following a total merger or acquisition	Same GLN may be kept	See Section 1.2.1 (Acquisitions and Mergers). When an organisation makes a total purchase of another, it may assume responsibility for the GS1 Company Prefix and may continue to use existing GLNs.	When a complete purchase of an organisation is concluded, the responsibility for the GS1 Company Prefix of the purchased organisation is also transferred. The purchasing party may then use the existing GLNs or make changes in line with the integration of the business.
1.4. A new trading partner starts communication/shipment to an existing location	Same GLN	The change has no impact on existing supply chain partners. New trading partners may use the existing GLN	An explosion in the number of GLN changes within the supply chain as any change to a trading partner relationship will have to be signalled by a new GLN. This imposes unnecessary cost.
2.4.A.1 – 2 – Creation of New Locations			

Type of Change to Location	GLN for Location	Rationale	Consequence if Rule Not Applied
2.1 Purchase/creation/use of a new location	New GLN	New physical address that needs to be identified separately for operational processes	Unable to communicate information efficiently to trading partners
2.2. Addition of a new operation or building within an existing site that is not key to the operational activities (e.g., a new office block, a new customer relations department, an SME that has all its operations within the same building)	Same GLN	Does not impact trading partner relationship or internal operations and communications	An explosion in the number of GLN changes within the supply chain as any change to a trading partner relationship will have to be signalled by a new GLN. This imposes unnecessary cost.
2.4.A.1 – 3 – Minor Change to Existing Location			
<i>Minor Change</i>	<i>An update to attribute information associated with a given GLN is not directly relevant to trading partners in that it is in addition to (not a replacement for) existing information. Existing business processes may be enhanced but not rendered obsolete by the updated information.</i> <i>These minor additions to the attributes associated with a given GLN must be communicated to trading partners.</i>		
3.1. Minor change to company name (e.g., from John Smith Ltd to J Smith Ltd)	Same GLN	The change has no impact on supply chain partners or national legal authorities with whom the company is registered.	Unnecessary change of GLN
3.2. Minor changes to the address of a physical location (move to a different floor within a building, move to a different building within the same site)	Same GLN (If the suite number/floor number has been communicated to trading partners, then the company may consider changing the GLN.)	Minor impact on trading partners. Change of address can be communicated through business messaging to trading partners. A new GLN is not required.	Unnecessary time and cost for both parties in changing the GLN and amending systems

Type of Change to Location	GLN for Location	Rationale	Consequence if Rule Not Applied
3.2.1. Change of post code, city/ town name, or street name, but the physical address remains unchanged	Same GLN	The physical address has not changed, therefore, there is no impact on trading partners' use of the new/old postal code. The new postal code should be communicated as a changed attribute.	Unnecessary change of GLN
3.2.2. Change to a legal location (e.g., post code, street address, city)	Same GLN	As the location is used virtually the changes would not immediately impact the trading partner.	Unnecessary change of GLN
3.2.3. Change to a legal location that is also a physical location	New GLN depending on the nature of the change to the address (See physical location address changes for more information)	Any change to the physical location would impact the trading partners (See physical GLNs for more information).	Trading partners not informed of new information
3.3. Relocation of legal entity to a new country	New GLN	Impacts on the registration of the company, tax and legal requirements	Trading partners not informed of new information
3.4. Delivery routing does not need to be handled separately.	Same GLN	No impact on trading partners	Unnecessary change of GLN
3.5. New/change to contact person information (department, e-mail, telephone, fax)	Same GLN	The change has a minor impact on existing supply chain partners. The change to details can be communicated as a changed attribute to the GLN.	Unnecessary change of GLN
3.6. Amendment to terms of delivery or transport	Same GLN	No immediate impact on trading partners; however, this will need to be communicated as a changed attribute.	Impact on efficiency of the trading relationship
3.7 Change to the facility specification (e.g., start/end period of party availability, operating hours and days)	Same GLN	No immediate impact on trading partners; however, this will need to be communicated as a changed attribute.	Impact on efficiency of the trading relationship
3.8. Change to delivery scheduling conditions (delivery plan, frequency and timing)	Same GLN	No immediate impact on trading partners; however, this will need to be communicated as a changed attribute.	Impact on efficiency of the trading relationship

Type of Change to Location	GLN for Location	Rationale	Consequence if Rule Not Applied
3.9. Change to planning management profile (transport strategy, safety stock rules)	Same GLN	No immediate impact on trading partners; however, this will need to be communicated as a changed attribute	Impact on efficiency of the trading relationship
3.10. Change to financial information	Same GLN	No immediate impact on trading partners	The frequency of change to financial information would be impossible to manage if the GLN is changed each time.
3.10.1. Change to payment terms (e.g., discount, fixed date, instant, payment by specified date, payment time period)	Same GLN	Information can be communicated to trading partners using business messaging.	Unnecessary change of GLN
3.10.2. Change to allowance charge (e.g., monetary amount (minimum due, currency), settlement type, allowance charge (flat rate, consolidated), free goods, packing charges)	Same GLN	Information can be communicated to trading partners using business messaging.	Unnecessary change of GLN
3.10.3. Change to financial institution information (e.g., account number, institution name and number)	Same GLN	Information can be communicated to trading partners using business messaging.	Unnecessary change of GLN
2.4.A.1 – 4 – Major Change to Existing Location			
<i>Major change</i>	<i>Major changes are those that require trading partners to distinguish, within their systems, between the "old" and "new" location identified by the GLN.</i>		

Type of Change to Location	GLN for Location	Rationale	Consequence if Rule Not Applied
4.1. Major change to the point of access to the location (e.g., moving to a new location outside the existing building and site)	New GLN	The change has a major impact on supply chain partners who supply and trade to that location. The new location will need to be identified separately in order to trade effectively with that company.	Unable to identify separate locations in the supply chain
4.1.1 Change of physical address (e.g., new city, new town, new country)	New GLN	The physical location is completely different and needs to be identified differently for routing and operations purposes.	Unable to identify separate locations in the supply chain. Incorrect deliveries, reduced timeliness and efficiency
4.1.2. Change to a legal location that is also a physical location	New GLN depending on the nature of the change to the address (See physical location address changes for more information)	Any change to the physical location would impact the trading partners (See physical GLNs for more information).	Trading partners not informed of new information
4.2. Delivery routing process –different routes to or from the buyer/seller need to be identified separately for legal, industry, operational, or internal purposes (e.g., chilled and frozen goods are delivered to the same Goods In delivery point but need to be routed immediately to the appropriate area (chilled or frozen) within. A legal example, from the USA, tobacco, confectionery and beverage products need to be separated in distribution.	New GLN (allocated at the trading partners' discretion)	Separate identification is vital to the operations of the GLN brand owner. Please note that if only one party (e.g., the buyer) requires routing separation, then the other party (e.g., the seller) is not mandated to separate their internal process accordingly. Instead they can separate deliveries using the receiver GLN(s) provided in advance. Whilst a company can have multiple GLNs for internal purposes, it is recommended that communication of multiple GLNs for the same location/purpose is used sparingly to avoid sellers having to manage multiple third party GLNs.	Unable to track and log movement of product lines within their operations; potentially failure to meet legal requirements

Type of Change to Location	GLN for Location	Rationale	Consequence if Rule Not Applied
4.3. Location is split and part of the location is leased or franchised to a different legal entity (e.g., a retail outlet may also contain a franchised pharmacy, therefore, two different legal entities operate within the same location).	New GLN (for the part leased to a different legal entity) Same GLN (for the part of the location used by the GLN brand owner)	No impact on trading partners of the GLN brand owner; however, a separate GLN is required for the leased location for management purposes and to avoid confusion for trading partners of both companies. A GLN cannot be sold or loaned to a separate legal entity.	Confusion within trading partners, unclear trading boundaries, and no clear legal separation
4.4. Change to legal entity leasing (franchising) a third party premises	New GLN (GLN assigned by the legal entity taking on the lease)	Person taking the lease should assign own GLN to identify it as their location and a separate entity to the company owning the physical property. The GLN assigned is at the discretion of the two parties concerned and should be agreed in the lease contract. A GLN cannot be sold, leased, or loaned to a separate legal entity.	If the 'tenant' uses the owner assigned GLN, it will be difficult for the owner to track the historical leasing of the location. In addition, if an external organisation attempted to track the 'tenant' company, the search would relate back to the incorrect organisation(s).
4.5. Major Change to company name (e.g., from John Smith to Bitter Ltd)	Same GLN	Although this will have an impact on their trading partners and company registration authority, this will not impact the trading relationship and the changes can be communicated electronic to all parties concerned.	Unnecessary change of GLN
4.6. Major change to party/location that impacts trading partners and/or traceability requirements (e.g., frozen warehouse/depot changes to accept dry products only or a food store changes to a pharmacy store.)	New GLN	The nature of the relationship and use of the GLN within the trading partner scenario is impacted by the change. If there were no impact to the trading partners relationship, then a new GLN would not be required.	Unable to track and log movement of product efficiently; potentially failure to meet legal requirements

Type of Change to Location	GLN for Location	Rationale	Consequence if Rule Not Applied
4.7. Minor change to party/location that does not impact trading partners or traceability requirements (e.g., for internal use only and is not communicated externally, such as conversion from warehouse space to a retail outlet or change of use of a shelf in a depot)	Same GLN	No impact to trading partner relationship	Unnecessary change of GLN

Section 2.5:

Numbering and Symbol Marking of Service Relationships

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2.5.1 Introduction

The Global Service Relation Number (GSRN) is used to identify the recipient of services in the context of a service relationship. It provides a unique and unambiguous identification number for the service provider to store data relevant to service(s) provided to the recipient. The GSRN is the key to access information stored on computer systems or reference information transferred via Electronic Data Interchange (EDI).

The GSRN can be used to identify the service relationships in:

- A hospital admission, where it could be used to record a patient's room charges, medical tests, and patient charges
- A membership in a frequent flyer programme, where it could be used to record awards, claims, and preferences
- A membership in a loyalty scheme, where it could be used to record visits, purchase value, and awards
- A membership in a club, where it could be used for recording entitlements, use of facilities, and subscriptions
- A service agreement, where it could be used to manage agreed upon services, such as maintenance services for a television or computer

2.5.2 Data Carrier

The data carrier for the Global Service Relation Number (GSRN) is the GS1-128 Bar Code Symbol. When encoding the GSRN, the GS1-128 Bar Code Symbol should be printed at an X-dimension between 0.25 mm (0.00984 in.) and 1.016 mm (0.040in.).

2.5.3 Application Overview

2.5.3.1 Global Service Relation Number (GSRN): AI (8018)

The Global Service Relation Number (GSRN) is a non-significant number used to identify a database entry for recording recurring services. These services are activities carried out by a service provider for a service user, based upon a bilateral agreement. Consequently, the GSRN identifies a particular service arrangement with reference to a particular service provider and to a particular user. It may in some instances identify the user as a participant (or member) in a programme or scheme. However, it never constitutes a person's personal identification number because it is always related to a given service arrangement.

A typical application using this Element String is the identification of membership in a student library. The library would issue all members a card that includes a unique GSRN identifying the relationship between the library and a student. The library would then scan the GSRN whenever a book was lent or returned. The electronic message from the scanner would then be used to automatically update the library's stock management database. See Figure 2.5.3.1 – 1 for an example of how the GSRN would appear on this membership card.

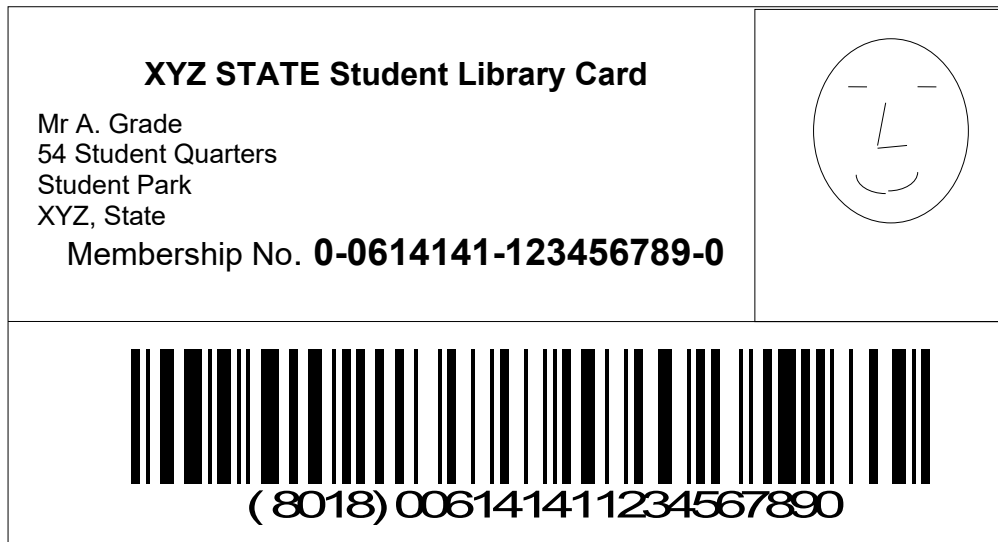
The worldwide, unique GSRN may also be used in other applications. For example, it could be used to give students access to other libraries that have formed a cooperative lending agreement.

GSRNs also can be used to identify hospital patients. In this case, the service provider is the hospital and the service recipient is the patient. The GS1 Company Prefix used is the one allocated to the hospital. The hospital generates a GSRN for each of its patients and encodes it in a GS1-128 Bar Code Symbol on the patient's wristband as well as his or her corresponding medical record.

When a product or service is administered (e.g., a particular treatment is given) it can easily be associated with the patient by scanning the patient's GSRN and the Global Trade Item Number™ (GTIN™) of the product or service.

It should be noted that the GSRN is not meant to identify a single service as a trade item. Neither is it used to identify a physical unit as a trade item. It may identify a physical unit for service purposes (e.g., a computer with a service agreement).

Figure 2.5.3.1 – 1



2.5.4 Allocating Global Service Relation Numbers

2.5.4.1 General Rule

The Global Service Relation Number (GSRN) can be used to identify any service relationship. A separate, unique number can be issued, normally by the service provider, to identify any given service relationship. Once assigned, the GSRN becomes a unique and universal reference that can be used by all parties involved in the service relationship.

2.5.4.2 Changes in a Service Relationship

From time to time the details related to a Global Service Relation Number (GSRN) may change. The following are general cases that may occur if the circumstances under which the GSRN was originally set up change:

- If a service provider ceases trading (possibly because of liquidation), any GSRNs allocated by that organisation should be phased out. If the activity covered by the GSRN is transferred, the new service provider may continue to use existing GSRNs, but should allocate further GSRNs using the new provider's GS1 Company Prefix.
- If the range of services identified by a GSRN changes, the service provider should change the details associated with the GSRN on the related computer file record. The assignment of a new GSRN is not required in this case.
- A GSRN used to identify a particular service relationship that has terminated should not be reallocated for a period well beyond the lifetime of the relevant records.

2.5.4.3 Recommendation for Allocating Global Service Relation Numbers

The exact method used to allocate the Global Service Relation Number (GSRN) is left to the discretion of the issuing organisation. However, the GSRN must be unique for each individual service recipient and remain unique for a period well beyond the lifetime of the records relevant to the service relationship.

For ease of administration, GS1 recommend that GSRNs be allocated sequentially and do not contain classifying elements.

2.5.4.4 Information Associated with a Global Service Relation Number

The Global Service Relation Number (GSRN) is a standalone Element String. All information required by the service provider should be established on a computer file using the GSRN as the key to access the information. The type of information stored is determined by the nature of the service relationship. Typical information includes the service recipient's full name, address, and details on services rendered.

Section 2.6:

Numbering and Symbol Marking for Special Applications

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2.6.1 Coupons

2.6.1.1 Introduction

A coupon is a voucher that can be redeemed at the Point-of-Sale for a cash value or free item. Coupon identification is organised at the local level. Determining the data structure of a coupon is, therefore, the responsibility of the GS1 Member Organisations for their area of jurisdiction.

The purpose of coupon numbering and symbol marking is to automate and speed up coupon handling procedures at the Point-of-Sale. Moreover, coupon issuers and retailers may be able to reduce the costs involved in sorting coupons, administering manufacturers' payments, and producing reports on redemption.

All GS1 System coupon standards presented here allow for coupon validation" (e.g., to check whether the item(s) covered by the coupon are within the customer's order).

If either validation or value look up is performed, manufacturers must advise their distributors and retailers of the impending issue of a coupon so that retailers' files can be updated to process the information at the Point-of-Sale.

2.6.1.2 Application Overview

A GS1 System coupon number is used for numbering promotional coupons for manufacturers and retailers as well as tokens with monetary value, such as gift tokens, book tokens, food stamps, record vouchers, luncheon vouchers, and social security tokens.

The structure of GS1 System coupon numbers ensures uniqueness against all other GS1 System numbers only when used within the monetary area of the appropriate GS1 Member Organisation(s).

2.6.1.3 Coupon Identification for Restricted Geographic Distribution

2.6.1.3.1 Coupon Identification for Restricted Geographic Distribution (GS1 Prefix 99)

The prefix 99 has been released for use with coupon numbers.

The internationally agreed standard for GS1 System coupon numbers is shown in Figure 2.6.1.3.1 – 1.

Figure 2.6.1.3.1 – 1

GS1 Prefix	Coupon Data (Structure Determined by GS1 Member Organisation)	Check Digit
9 9	N ₃ N ₄ N ₅ N ₆ N ₇ N ₈ N ₉ N ₁₀ N ₁₁ N ₁₂	N ₁₃

Within this structure each GS1 Member Organisation is free to develop a national coupon solution. Four recommended structures provide a degree of equipment standardisation.

These recommended structures are shown in Figure 2.6.1.3.1 – 2.

Figure 2.6.1.3.1 – 2

GS1 Prefix	Recommended Coupon Data Structures (Exact Structure Determined by GS1 Member Organisation)	Check Digit
9 9	Y Y Y Y R R R V V V	C
9 9	Y Y Y R R R V V V V	C
9 9	Y Y Y Y Y R R R T T	C
9 9	Y Y Y Y Y R R R R R	C

Where:

- Y = Coupon issuer number (issued by the GS1 Member Organisation)
- R = Coupon reference number (allocated by a coupon issuer)
- V = Redemption value
- T = Value Code (standardised by the GS1 Member Organisation)
- C = Check Digit calculated according to the standard algorithm

The GS1 Member Organisations, or retailers may require that the third digit of the coupon numbers (990 to 999) be programmable in order to cope with specific demands such as:

- Taxable or non-taxable coupons
- Different currencies
- Indication of the decimal position

2.6.1.3.2 GS1 Common Currency Coupon Identification (GS1 Prefixes 981 and 982)

The GS1 Prefixes 981 and 982 have been released for use with coupons expressing a value in a common currency.

The internationally agreed standard for GS1 Common Currency Coupon Codes is shown in Figure 2.6.1.3.2 – 1.

Figure 2.6.1.3.2 – 1

GS1 Prefix	Coupon Data (Structure Determined in Agreement with GS1 Global Office)	Check Digit
9 8 1 or 9 8 2	N ₄ N ₅ N ₆ N ₇ N ₈ N ₉ N ₁₀ N ₁₁ N ₁₂	N ₁₃

Within this structure, GS1 Member Organisations in a common currency area should develop a common coupon solution that is valid throughout the common currency area.

2.6.1.3.2.1 Use of GS1 Common Currency Coupon Code for the Euro

At present the only application of GS1 Prefixes 981 and 982 is for the euro. The euro is a new currency that began to replace the national currencies of some countries on 1 January 1999. A migration period of several years is planned, with notes and coins being introduced in 2002.

Within the euro area, coupon issuer numbers are administered by:

GS1 BELGIUM•LUXEMBOURG

Rue Royale 29

1000 Brussels

Belgium

Tel: + 32.2.229.18.80, Fax: + 32.2.217.43.47, Web: www.gs1belu.org

See Figure 2.6.1.3.2.1 – 1 for the coupon data structure in the euro area.

Figure 2.6.1.3.2.1 – 1

GS1 Prefix	Coupon Data			Check Digit
9 8 1	Y ₁ Y ₂ Y ₃ Y ₄	R ₁ R ₂	E E , E	C
9 8 2	Y ₁ Y ₂ Y ₃ Y ₄	R ₁ R ₂	E , E E	C

Where:

- Y = Coupon issuer number (issued by a GS1 Member Organisation)
- R = Coupon reference number (allocated by a coupon issuer)
- E = Redemption value (expressed in euro); value 000 indicates free gift
- C = Check Digit calculated according to the standard algorithm

Note: The only difference between the two structures is the position of the implied decimal point.

2.6.1.3.3 GS1 US Coupon Code Identification for use in North America (GS1 Prefix 05)

Prefix 05 is reserved for use in North America only. The structure is given in [Section 3.2.6](#).

Coupons using the GS1 Prefix 05 are constructed using the GS1 US Company Prefix assigned to a given organisation. For GS1 US Company Prefixes beginning with a digit other than zero, the presence of one of the Element Strings AI (8100), (8101), or (8102) is required.

See the [Application Standard for GS1 US Coupon Codes](#) for detailed information on GS1 US Coupon Code data content and applied numbers.

2.6.1.3.3.1 GS1 US Coupon Extended Code: AI (8100 – 8102)

Element Strings AI (8100) to AI (8102) represent supplementary data related to a particular GS1 US Coupon Code using the GS1 Prefix 05. They are never used as a stand-alone Element String.

The Element String AI (8100) enables the representation of an Offer Code and the extension of the use of GS1 US Coupon Codes to companies whose GS1 US Company Prefix does not begin with the UCC Prefix 0.

The Element String AI (8101) enables the representation of an Offer Code and expiration data, and extends the use of GS1 US Coupon Codes to companies whose GS1 US Company Prefix does not begin with the GS1 US Prefix 0.

The Element String AI (8102) enables the extension of the use of GS1 US Coupon Codes to companies whose GS1 US Company Prefix does not begin with the UCC Prefix 0.

See the [Application Standard for GS1 US Coupon Codes](#) for detailed information on data content and applied numbers.

2.6.1.4 Symbol Marking of Coupons

A coupon with the GS1 Prefix 99, 981, or 982 is carried by the EAN-13 Bar Code Symbol.

A coupon with the GS1 Prefix 05 is carried by the UPC-A Bar Code Symbol.

The GS1 US Coupon Extended Code, AIs (8101 to 8103), is carried by the GS1-128 Bar Code Symbol.

2.6.1.5 Allocating GS1 System Coupon Data

2.6.1.5.1 General Rule

GS1 System coupon identification specifications are flexible and have been designed to cater for current and future requirements.

Due to the nature of coupon numbering, a range of national solutions is offered, each of which is defined by the respective GS1 Member Organisation. National coupon solutions are not unique worldwide and must be operated in the restricted area defined by the GS1 Member Organisation.

In the interest of consistency and to avoid misinterpretation by equipment vendors, when defining national specifications, GS1 Member Organisations should include appropriate mention of all GS1 System coupon data structures.

Coupon reference numbers must not be re-used for a period of three years.

2.6.1.5.2 Recommendation on Allocating Coupon Reference Numbers

The exact method used to allocate GS1 System coupon reference numbers is left to the discretion of the issuing organisation. However, the GS1 US Coupon Code must be unique for each individual promotion.

For ease of administration, coupon reference numbers should be allocated sequentially.

2.6.2 Refund Receipts

2.6.2.1 Introduction

Refund Receipts are vouchers produced to automate payment for returned empty containers.

Refund Receipts automate and expedite the handling of empty containers (e.g., bottles, crates) that have a refund value in a retail store.

When customers return empty containers (which have a refund value), the containers have to be checked and valued. This process can be done manually or by automated equipment capable of handling empty containers. When the returned containers have been valued, a Refund Receipt is printed and given to the customer. The customer presents the Refund Receipt at the store checkout, and the corresponding amount is refunded in cash or deducted from the customer's bill.

An EAN-13 Bar Code Symbol can be printed on the Refund Receipt to encode the required data including a security number and the monetary value.

2.6.2.2 Application Overview

The structure of Refund Receipts ensures uniqueness against all other GS1 System ID numbers only when used within the restricted environment defined by the appropriate GS1 Member Organisation.

2.6.2.2.1 GS1 System Identification of Refund Receipts - Restricted Geographic Distribution (GS1 Prefix 980)

The GS1 Prefix 980 has been released for use with Refund Receipt data.

The internationally agreed standard for GS1 System Refund Receipt data is shown in Figure 2.6.2.2.1 – 1.

Figure 2.6.2.2.1 – 1

GS1 Prefix	Refund Receipt Data (Structure Determined by GS1 Member Organisation)	Check Digit
9 8 0	N ₄ N ₅ N ₆ N ₇ N ₈ N ₉ N ₁₀ N ₁₁ N ₁₂	N ₁₃

Within this structure each GS1 Member Organisation develops its own national Refund Receipt solution. The recommended structure shown in Figure 2.6.2.2.1 – 2 aims at some degree of equipment standardisation.

Figure 2.6.2.2.1 – 2

Prefix	Recommended Structure	Check Digit
9 8 0	S S S S S V V V V	C

Where: S = Security number

This number is used to provide some security in the handling of the Refund Receipt. For example, it consists of a sequential number, which is incremented by 1, for each ticket generated. In this case, the Point-of-Sale system will be able to recognise a Refund Receipt that had already been refunded. The security number can also include a two-digit machine number and a three-digit sequential number, in the case where several machines are available to the customers at the same location.

V = Monetary value of the refund

The scale factor (decimal places) will depend on the currency used.

C = Check Digit

Calculated according to the standard algorithm

2.6.2.3 Symbol Marking of Refund Receipts

EAN-13 Bar Code Symbols are used with Refund Receipts.

2.6.2.4 Allocating Refund Receipts

2.6.2.4.1 General Rule

Refund Receipt specifications are flexible and have been designed to cater for current and future requirements.

Due to the nature of Refund Receipt identification, several national solutions are offered, each of which is defined by the respective GS1 Member Organisation. National Refund Receipt solutions are not unique worldwide and must be operated in the restricted circulation defined by the GS1 Member Organisation.

2.6.3 Electronic Serial Identifier for Cellular Mobile Telephones (CMTI): AI (8002)

2.6.3.1 Introduction

The purpose of an Electronic Serial Identifier, AI (8002), for cellular mobile telephones (CMTI) is to uniquely identify a cellular phone within a given jurisdiction.

The information from the bar code symbol can be used to automate and speed up the capture of CMTIs.

2.6.3.2 Application Overview

The Cellular Mobile Telephone (CMTI) is usually assigned by a national or pluri-national authority. Issuing authorities must ensure that the Electronic Serial Identifier is unique for each cellular phone. However, because Electronic Serial Identifiers are assigned by different issuing authorities, they are not unique worldwide.

Figure 2.6.3.2 – 1 illustrates Electronic Serial Identifier, AI (8002), 123456789 carried by a GS1-128 Bar Code Symbol.

Figure 2.6.3.2 – 1



2.6.3.3 Allocating Electronic Serial Identifiers: AI (8002)

An Electronic Serial Identifier, AI (8002) is assigned by the appropriate national or pluri-national body and can be carried by a bar code symbol placed directly on the cellular phone. The Electronic Serial Identifier, AI (8002), is unique for each cellular telephone within the jurisdiction of the issuing body.

2.6.4 Internal Applications

2.6.4.1 Introduction

The GS1 System has been established as an open standard. The primary benefits derived from the GS1 System are that the same bar code symbols and unique identification numbers are used by all participants in the supply chain. This significantly reduces supply chain costs by standardising the data exchanged between trading partners and allowing “label once, scan many” operations.

However, organisations that have the capability to process GS1 System data may have the requirement to encode, in machine readable form, data for a company's internal purposes. The GS1 System makes available the following guidelines to meet purely internal applications. The guidelines are compatible with the overall GS1 System, but to avoid the possibility of causing ambiguity elsewhere in the supply chain. It is strongly recommended that any bar codes containing data for internal-use are destroyed before items carrying them leave the organisation.

2.6.4.2 Application Overview

2.6.4.2.1 Definition

An internal application is broadly defined as any numbering and symbol marking system that is restricted to within the operations of a company.

Facilities are available within the GS1 System to identify items only within the operations of a company. In these cases, the identified units have a restricted distribution, as the identification numbers they bear are not unique worldwide.

2.6.4.2.2 Data Carrier

Internal application ID numbers are carried by UPC-A, EAN-13, EAN-8 or UPC-E Bar Code Symbols (using certain GS1 Prefixes) or the GS1-128 Bar Code Symbol (using certain AIs).

2.6.4.3 Allocating Internal Application Numbers

Specifications for internal ID numbers are flexible and leave the choice of data structure, following the appropriate GS1 Prefix or Application Identifier, completely at the discretion of the issuing organisation.

2.6.4.4 Company Internal Applications Using EAN/UPC Symbology

2.6.4.4.1 Company Internal Applications Using GS1 Prefixes

Full details related to the use of GS1 Prefixes 02 and 20 to 29, for internal applications, can be found in [Section 3.0](#).

Organisations wishing to use these GS1 Prefixes for purely internal applications should contact their GS1 Member Organisation for the guidelines prevailing in their area.

2.6.4.5 Internal Applications Using GS1-128 Symbology

In addition to the GS1 Prefixes noted above, the GS1 System makes available Application Identifiers for internal applications. Like all other data structures using Application Identifiers, internal application AIs may only be carried by GS1-128 Bar Code Symbols.

2.6.4.5.1 Information Mutually Agreed Between Trading Partners (Including FACT Data Identifiers: AI (90))

Element String AI (90) may be used to represent any information that has been mutually agreed between two trading partners. The agreement may include the use of FACT DIs (Data Identifiers). If a FACT DI is used, it should appear immediately after the AI (90), followed by the appropriate data. The use of FACT DIs gives little security to users.

The bar code symbol carrying this Element String should be removed from any item that leaves the jurisdiction of the trading partners. Failure to remove the symbol may cause problems if another trading partner using the same AI for a separate internal application scans the item.

2.6.4.5.2 Company Internal Information: AIs (91 to 99)

Element Strings AI (91) to (99) may contain any internal information relevant to a company's internal applications.

The bar code symbol containing these Element Strings should be removed from any item that leaves the jurisdiction of the company. Failure to remove the symbol may cause problems if a trading partner using the same AI for a separate internal application scans the item.

2.6.5 Numbering and Symbol Marking for Payment Slips

GS1, in conjunction with representatives of banks, utility service providers, and retailers, has developed this voluntary standard for applications of bar code symbols on payment slips.

This standard is based on the use of GS1 System Application Identifiers and utilises GS1-128 Bar Code Symbols. It is a complement to, and should be read in conjunction with:

- Other sections of these specifications
- *EANCOM*[®], the Electronic Data Interchange (EDI) standard providing implementation guidelines for UN/EDIFACT messages.

Organisations wishing to automate the payment process should use this standard as a basis to produce specific implementation guidelines pertinent to their application. The implementation guidelines in the following subsections consider issues such as domestic versus international payments and local banking laws.

2.6.5.1 Introduction

2.6.5.1.1 Business Demand for the Application

The use of GS1 System standards has led to major innovations in the retail sector. The GS1 System family of bar code symbols has enabled automation at the Point-of-Sale (POS). Studies have shown that identifying goods with GS1 System bar code symbols and ID numbers reduces the amount of time required to process a transaction, increases the accuracy of data, and enables efficient Electronic Data Interchange (EDI).

This success has led other industries to introduce the GS1 System into their business processes. One such application of the GS1 System is the automation of payment for billable services.

Utility companies (e.g., electricity, gas, water) and other service providers (e.g., insurance, government agencies) have sought to improve their customer service through automating the payment system. This requires that the information needed by all partners in the payment process be in a form that can be automatically captured. Bar code symbols are one of the most cost-effective means of capturing data.

The information flow that accompanies the physical payment demand is communicated between trading partners in a variety of ways; however, EDI is the most optimal means. In practice, fully automated communication channels that make it possible to rely exclusively on electronic files for retrieving information are not always available.

For this reason, there may be a need to indicate relevant information on the payment slip, in addition to an identification number of the invoicing party and a reference number for the payment slip. The various fields of information that must be communicated need to be organised in a standard way in order to facilitate their interpretation and processing by the partners involved.

2.6.5.2 Potential Benefits

The potential benefits of payment slips carrying bar code symbols include:

- For the customer (invoicee):
 - Provides flexible payment facilities. Payment can be made, for example, at banks, post offices, automatic teller machines, supermarkets, and on the Internet.
 - Increases quality in the capture of payment reference information for use in international banking
- For the issuer of the invoice (invoicing party):
 - Using bar code symbols to represent critical payment data greatly reduces the possibility of key entry error.
 - By offering customers more payment locations, the issuer of the invoice provides an increased level of service to customers.
- For the payment receiving agency:
 - The agency can use its investment in scanning technology to provide a payment collection service to customers while being able to charge the invoicing party a collection fee.
 - For retailers, the provision of such a service could provide a commercial advantage, because customers may choose to use a retailer who provides such a service over one that does not.
- For the bank:
 - Provides an opportunity to use symbol and scanning technology at the cashier's desk to process payments quickly and accurately. In addition this technology could be extended to ATM machines in bank lobbies, allowing customers to pay their bills 24 hours a day.
 - Provides an opportunity in some countries to offer new services to batch payments issued by the payment receiving agency on behalf of large invoice issuers (e.g., utility suppliers)

2.6.5.3 Application Rules

2.6.5.3.1 Definition of a Payment Slip

A payment slip is that part of a paper invoice used to facilitate payment. The payment slip covers a wide range of payment demands, such as telephone bills, electricity bills, and insurance renewals. The payment slip is normally issued by a service provider (the invoicing party) to a final customer (the invoicee) and represents a payment demand. Normally the payment slip would outline in Human Readable Interpretation:

- Details of the customer
- Details of the service provider
- A detailed invoice for the service(s) provided
- A reference number
- The amount payable
- The payment conditions (e.g., pay before date, where to pay)

2.6.5.3.2 Bar Code Symbolology

The GS1-128 Bar Code Symbol is used with payment slips. They in no way replace the need for Human Readable information.

2.6.5.3.3 Bar Code Symbol Information

2.6.5.3.3.1 Global Location Number of the Invoicing Party

The Application Identifier to indicate the Global Location Number (GLN) of the invoicing party is AI (415).

The GLN of the invoicing party identifies the issuer of the payment slip. It is used as a key to access database information about the invoicing party (normally held by the payment receiving agency). The same GLN is used for all payment slips issued by the invoicing party under identical payment conditions. The GLN of the invoicing party is used by the payment receiving agency to reference the characteristics of the contract with the invoicing party, such as:

- Whether the payment can be accepted
- Contact details of the invoicing party
- Action to take if the due date has expired
- Transfer arrangement of funds to the invoicing party's bank

A different GLN shall be used whenever the payment conditions are different. For more information, see [Section 2.6.A.2](#).

2.6.5.3.3.2 International Bank Account Number (IBAN): AI (8007)

The Application Identifier to indicate the International Bank Account Number (IBAN) is AI (8007).

The bank account identifier of the invoicing party is defined in ISO 13616. It is used to identify where to send the payment and, in the receiving country, which bank holds the account for international bank payment.

2.6.5.3.3.3 Payment Slip Reference Number: AI (8020)

The Application Identifier to indicate a Payment Slip Reference Number is AI (8020).

By their nature, payment slips need to be individually tailored for the invoicee and therefore require a unique reference number the Payment Slip Reference Number, AI (8020). Reminder notices should use the same number as the original notice. The Payment Slip Reference Number, (AI (8020), is issued by the invoicing party and is a unique number in the system. Payment Slip Reference Numbers, AI (8020), should be sequentially allocated.

The Payment Slip Reference Number, AI (8020), uniquely identifies the payment slip when used in conjunction with the Global Location Number (GLN) of the invoicing party. It is used to communicate details of payment between all the partners involved: invoicing party, invoicee, payment receiving agency, and bank(s). It is also used to access locally held information.

2.6.5.3.3.4 Amount Payable

There are two Application Identifiers to indicate the amount payable:

- AI (390n) = amount payable for a single monetary area
 - AI (391n) = amount payable with ISO three-digit currency code
- n = indicates the implied decimal point position

If the amount payable is expressed in a bar code symbol, AI (391n) should be used, as this ensures the currency of the payment can be automatically processed and verified by the system. However, if the currency is unambiguously implied by the system, AI (390n) may be used. To avoid ambiguity, only one AI encoding the amount payable shall be used, and the currency must be clearly indicated in human readable form.

Scanning systems should have the facility to override the amount payable. This functionality is required should the invoicee wish to make the minimum required payment, which could be less than the total amount due. The amount due is attribute information and, when used, must be processed with the Global Location Number (GLN) of the invoicing party.

2.6.5.3.3.5 Due Date

The Application Identifier to indicate the due date is AI (12).

The due date indicates the date by which the invoice should be paid (by the invoicee). It is attribute information and, when used, must be processed with the Global Location Number (GLN) of the invoicing party.

Note: The due date must be represented in the YYMMDD format in the bar code symbol; however the human readable data can be presented in whatever form is appropriate.

2.6.5.4 Application Overview

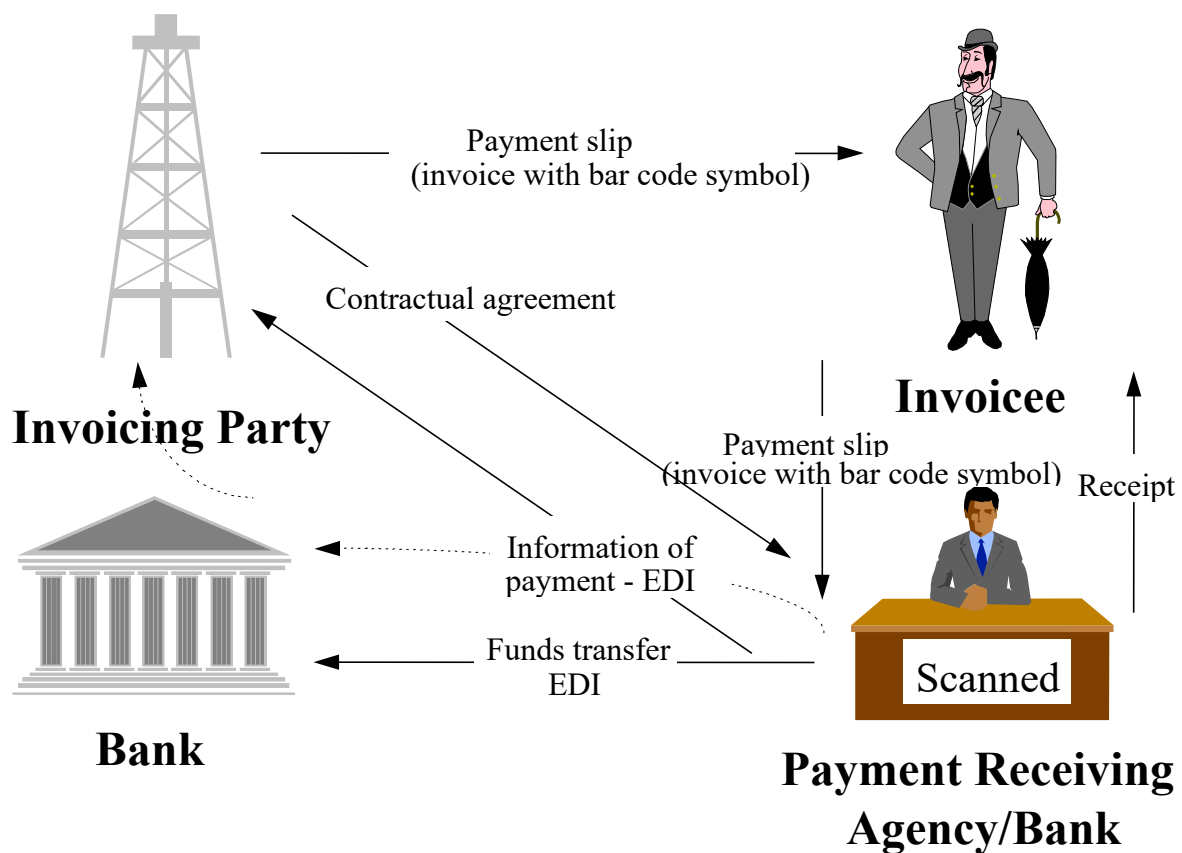
2.6.5.4.1 Application Requirements

These international guidelines outline the GS1 System standards for payment slips used in an open environment. The guidelines provide information on how to use bar code symbols on payment slips and how they can help automate the payment process.

Note: Legislation in certain countries may require that the payment receiving agency be a bank.

2.6.5.4.2 Overview of the Key Steps When Using Bar Code Symbols with Payment Slips

Figure 2.6.5.4.2 – 1



Step 1: The invoicing party and payment receiving agency must conclude a working agreement, under the appropriate legal framework, regarding the system for receiving payment on an agency basis.

Step 2: The payment receiving agency informs and trains all receiving points on the processing of payment slips. The Global Location Number (GLN) of the invoicing party is used to discriminate between payment slips that can and cannot be accepted.

Step 3: The invoicing party issues payment slips with bar code symbols to the customer (invoicee)

Step 4: The invoicee takes the payment slip to the payment receiving agency. The payment slip is scanned, the payment is made, and a receipt is issued.

Note: The working agreement between the invoicing party and payment receiving agency should cover the appropriate action if the due date has expired.

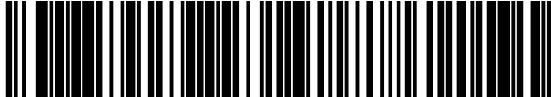
Step 5: The payment receiving agency logs all payment slips received using the Payment Slip Reference Number (8020). This information is centrally collated and transmitted to the relevant invoice issuing party directly or via the banking system after an agreed time frame. The funds are then transferred to the designated bank account.

Step 6: The invoicing party updates its database information using the Payment Slip Reference Number, AI (8020).

Note: This is a simplified model and may not be applicable in all countries or for international payments.

2.6.5.A.1 Appendix 1: Example of a Payment Slip

Figure 2.6.5.A.1 – 1

ABC-Electric Company	Mr A.N. Customer	PAY TO: 5412345678908
Electricity consumption for	45 Sunrise Drive	REF NO.: ABC123
period:	Cape Town, TX	
1 January 2001	765444	
to		
31 March 2001		
Amount Payable South African Rand		
12.50		
DUE DATE 25 April 2001		
		 (415) 5412345678908 (3911) 710125
		 (12) 010425 (8020) ABC123

GS1-128 Symbols

To facilitate efficient scanning, all bar code symbols shall be printed at an X-dimension between 0.25 mm (0.00984 in.) and 0.495 mm (0.0195 in.) and be a minimum of 13 mm (0.5 in.) in height.

Payment slips should be carried by GS1-128 Bar Code Symbols.

Example: (415) 5412345678908

AI (415) indicates the Global Location Number (GLN) of the invoicing party.

The GLN is a fixed length 13-digit number terminated by a standard Check Digit. The rules for allocating GLNs ensure that this number is unique worldwide. GLNs are used by the payment receiving agent to distinguish between payment slips that can and cannot be accepted.

Example: (12) 010425

AI (12) indicates the due date by which the payment should made.

The due date is always encoded YYMMDD; however, other formats may be used for the Human Readable Interpretation equivalent. The use of the due date is optional, but if used, the payment receiving agent and the invoicing party should agree about what action will be taken if the due date has expired.

Example: (3911) 710125

AI (3911) indicates the amount payable with ISO currency number. From ISO 4217, "710" indicates South African Rand.

It is strongly recommended to use the ISO currency number when encoding this optional data element. The fourth digit of this AI is the decimal point indicator. For example, the digit 1 in this position would indicate one digit after the decimal point; a 2 would indicate two digits after the decimal point.

Example: (8020) ABC123

AI (8020) indicates the Payment Slip Reference Number.

The Payment Slip Reference Number, AI (8020) is a mandatory data element for this application. It is processed with the GLN of the invoicing party and provides a unique reference for all communications between the payment agent and the invoicing party.

2.6.5.A.2 Appendix 2: Guideline on the Use of Global Location Numbers

2.6.5.A.2.1 Introduction

On a daily basis information related to parties and locations is generated and communicated throughout the business world in vast quantities. For example, names and addresses are put on envelopes, the delivery destination is noted on transport documentation, and the bank account number of the payee is identified on an invoice. These are just a few examples of the many applications in existence that identify parties in everyday business communications.

With the advent of electronic communication, and particularly Automatic Data Capture (ADC) and Electronic Data Interchange (EDI), the need for unambiguous and globally unique identification of parties and locations has become more acute. Using bar code symbol identification rather than exclusively using alphanumeric information is key to successfully implementing an automated payment project. Global Location Numbers (GLNs) offer an internationally recognised standard solution to the identification of parties and locations.

Full information on GLNs is available from the local GS1 Member Organisation. This appendix presents an overview of their use with payment slips.

2.6.5.A.2.2 What is a Global Location Number?

Global Location Numbers (GLNs) are reference keys to computer files. When scanned or received in an EDI transmission, the GLN is used as the key to look up all relevant information in a computer database.

GLNs are unique, non-significant, international in their application, and have strictly defined rules assigned to them. In short, a GLN must always be numeric and have a fixed length of 13 digits. Each location number contains, in the thirteenth position, a Check Digit, which ensures the correctness of the number. Once assigned, usually the invoicing party, the GLN becomes a unique and universal reference.

2.6.5.A.2.3 What Information is Associated with a Global Location Number?

The attributes of a Global Location Number (GLN) should be established on a computer file using the GLN as the key to the information. The type of attribute information held by the payment agent might be the invoicing party's full name and address, bank details and account number, contractual payment conditions, and the action to be taken if the due date has expired. Whenever any of the attribute information changes, the invoicing party should assign a new GLN.

The use of the GLN is based on the assumption that the payment agent maintains a computer database to reference information related to the invoicing party. Where the payment agent is a bank, the invoicing parties International Bank Account Number (IBAN), AI (8007), and Payment Slip Reference Number, AI (8020), may be sufficient to process the payment.

2.6.5.A.2.4 Are Global Location Numbers Used in EDI?

The EDIFACT Interchange Header segment (UNB) is used in all EDI interchanges complying with the EDIFACT syntax rules. The identity of the sender and receiver of the interchange must be specified in this segment. The use of Global Location Numbers (GLNs) is mandatory in *EANCOM*® for the identification of EDI parties at this level.

2.6.5.A.2.5 How to Obtain a Global Location Number

Global Location Numbers (GLNs) are available through any GS1 Member Organisation.

2.6.5.A.3 Appendix 3: Introduction to the International Bank Account Number (IBAN): AI (8007)

The International Bank Account Number (IBAN), AI (8007), is defined by *ISO 13616*. The standard specifies the elements of an IBAN that are used to facilitate international processing of data in financial environments and other industries.

The IBAN is constructed using the Basic Bank Account Number (BBAN). The BBAN is the identifier used by financial institutions in individual countries as part of the national account numbers scheme. This ensures the unique identification of a customer's bank account within a country. The BBAN is used to construct the IBAN as follows:

- The first two positions (a2) shall always be filled by the two-character country code (alpha version), as defined in *ISO 3166*, of the country in which the bank branch servicing/maintaining the IBAN resides.
- The third and fourth positions (n2) shall be filled by the Check Digits as calculated from the defined scheme (see *ISO 13616*).
- In electronic transmission of the IBAN (including in bar code symbol form), the remaining positions shall be filled by the BBAN without separators or special characters (see *ISO 13616*).

Examples:

Country: Canada (ISO 3166 two-character country code = CA)

BBAN : 012323456-123 123456789012

IBAN : CA95012323456123123456789012

Country: Belgium (ISO 3166 two-character country code = BE)

BBAN : 320-0347134-41

IBAN : BE88320034713441

Note that only the financial institution that services (maintains) the account is allowed to generate its IBAN (including the Check Digit).

2.6.6 Customer Specific Articles

2.6.6.1 Introduction

The GS1 System guidelines for trade items (see [Section 2.1](#)) state that each item of trade is assigned a non-significant number that uniquely identifies the item in an unrestricted environment. The same number is used to identify a series of identical items, with every variant being allocated a separate unique identification number whenever the variation is apparent and significant between partners in the supply chain or to the final user.

This system enables the use of Automatic Data Capture (ADC) and Electronic Data Interchange (EDI) in an open environment, globally. However, in a number of business sectors, because of the vast number of possible different manifestations of certain made-to-order articles, pre-allocation of Global Trade Item Numbers™ (GTINs™) at the lowest level is not feasible.

For organisations that trade in such made-to-order products, GS1 in association with trade representatives, has developed the following guideline. This guideline has been designed to improve supply chain efficiency by enabling ADC and, in particular, efficient ordering via EDI.

This guideline is fully compatible with, and should be treated as a special case of, the GS1 System recommendations for the numbering and symbol marking of trade items.

2.6.6.2 Application Overview

2.6.6.2.1 Definition

A Customer Specific Article (CSA) is broadly defined as any item where the supplier defines all possible manifestations of the article from which the customer may choose, and pre-allocation of article numbers at the lowest level is not feasible. CSAs are never made for stock, and hence are always made to order. However, made-to-order articles are not necessarily customer specific, but could be standard.

A typical example of a CSA is a chair that is available in 300 different types of upholstery for the seat, back, and armrest. This list of available upholstery could also be used for other types of furniture the supplier offers. There are 27,000,000 ordering possibilities for this chair (300 x 300 x 300). Typically the supplier's catalogue lists a generic style of chair as well as the 300 different upholstery options. The customer chooses the style of chair and selects upholstery for the seat, back, and armrest.

On receipt of order, the supplier produces the customer specific chair and makes it available to the customer. Because the supplier defines the customer's options, and because the customer must specify his or her choices based on those options, the order contains all the information the supplier requires to manufacture the chair.

This example highlights four separate process steps:

- The supplier makes available all the possible manifestations of an article.
- The customer specifies the actual article required using the supplier catalogue.
- The supplier manufactures the article in accordance with the customer's specifications.
- The CSA is delivered.

The GS1 System has formalized this process, enabling efficient Automatic Data Capture (ADC) and Electronic Data Interchange (EDI) throughout the supply chain. The CSA data model is based on the assumption that the supplier defines the possible components (either in a paper or electronic catalogue) and the customer specifies the actual article required.

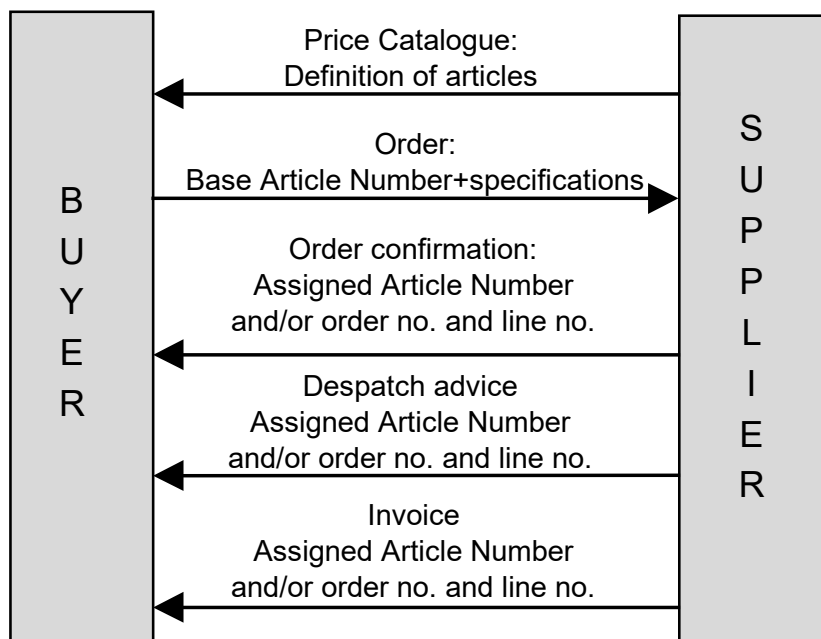
The processes for identifying and ordering the article are dealt with separately. Although these processes are closely related, each requires separate consideration in an open system.

2.6.6.2.2 Customer Specific Articles Data Flow

The data flow model is organised on a series of assumptions designed to ensure that the model is independent of the type of article and the sector: It is a generic model. Because many different procedures may be applied by various manufacturers, the generic model is meant to be a general guide. By using this model, companies can communicate in a standard way and (re)organise the automated handling of Customer Specific Article (CSA) specification according to this guideline.

The model assumes that the supplier informs the customer of all available ordering options and specifications. This is achieved by means of an electronic catalogue (see Figure 2.6.6.2.2 - 1). From this catalogue the customer can determine which article(s) to order. In the order message the Base Article Number and the chosen specifications are communicated.

Figure 2.6.6.2.2 – 1



In the order confirmation the supplier may confirm that the article ordered can be manufactured (that is, that the buyer has made a correct combination of specifications). This should be the case assuming the customer has up-to-date database information. The order confirmation may also be used to notify the customer of the assigned article number. The assigned article number may be used in all subsequent communications. For example, the despatch advice and invoice messages use the assigned article number and, if required, the order number plus the order line number to establish an unambiguous link with the CSA.

The article produced may not be numbered with a string of numbers representing the Base Article Number plus the applicable specifications (see [Section 2.6.6.3.3](#)).

2.6.6.3 Allocating System Numbers for Customer Specific Articles

2.6.6.3.1 General Rule

Each different product must be identified by a unique number. This implies that each variant of a product is assigned a different number. For example, each different size or colour of a garment has its own individual identification number. Article numbers should be sequentially allocated for this purpose.

2.6.6.3.2 Ordering of Customer Specific Articles

The ordering process of Customer Specific Articles (CSAs), the customer specification process, is based on a supplier's catalogue definitions. Internal identification systems are often manual and become increasingly complex and prone to error as the number of trading partners increases. In addition, the use of internal codes can be cumbersome, inflexible, and prone to duplication between different suppliers. These recommendations, which are based on the open systems principle, seek to avoid internally-based systems. Catalogue products using GS1 System identification numbers are guaranteed to be uniquely identifiable worldwide.

A Customer Specific Articles *EANCOM*[®] User Profile for the price catalogue (PRICAT), orders (ORDERS), and the response to order (ORDRSP) messages has been published that utilises the numbering system outlined below.

2.6.6.3.2.1 Base Article Number

A supplier assigned Base Article Number is given to each generic product type for ordering purposes. An EAN/UCC-13 Identification Number is used for this functionality. The EAN/UCC-13 ID Number is defined by the supplier and must be unique with respect to all other GS1 System identification numbers. Because it does not identify an item, the Base Article Number will never be carried by a bar code symbol on an article. It is solely used for ordering purposes.

The Base Article Number indicates to the customer that a number of supplier defined questions have to be answered by the customer. These specifications (questions and associated answers), which are relevant to a Base Article Number, are communicated via an electronic catalogue. The specifications available for each different article are defined by the supplier.

2.6.6.3.2.2 Specifications

Specifications are linked to the different Base Article Numbers for the purposes of ordering. The same specifications may be used with different Base Article Numbers. Specifications fall into one of the categories described in the following subsections.

2.6.6.3.2.2.1 Option

An option is a specification with a discrete value that is pre-defined by the supplier and associated with a Base Article Number.

Each option may be identified with an EAN/UCC-13 Identification Number. The EAN/UCC-13 Identification Number is defined by the supplier and must be unique with respect to all other GS1 System identification numbers. An ID number of an option will never be carried by a bar code symbol on an article. It solely is used for communication purposes.

Options, such as red leather seat cover, may be valid for different base articles.

2.6.6.3.2.2.2 Parameter

A parameter is a specification within a range of values (e.g., dimensions) ranging from a minimum to a maximum and including a step size.

Each parameter may be identified with an EAN/UCC-13 Identification Number. The EAN/UCC-13 Identification Number is defined by the supplier and must be unique with respect to all other GS1 System identification numbers. The parameter identification will never be carried by a bar code symbol on an article. It is solely used for ordering purposes.

Parameters should be communicated using the standard EANCOM[®] syntax and should be related to a Base Article Number.

2.6.6.3.2.2.3 Part

A part is a physical article that may also be ordered separately.

Parts are identified within Global Trade Item Identification Numbers[™] (GTINs[™]). The EAN/UCC-13 Identification Number for the part may be used in association with a Base Article Number to create a composite, an article made up of one or more individual parts.

A part may be associated with a number of different base articles.

2.6.6.3.2.2.4 External References

An external reference is often required for a customer-designed or custom-made item. External references are specified through a separate, non-EDI communication channel, such as a fax or CAD/CAM drawing. A secondary source can be used to communicate a set of customer-defined specifications (not pre-defined by the supplier).

2.6.6.3.2.3 Data Carrier

GS1 System identification numbers used to identify Customer Specific Articles (CSAs) for ordering purposes may never be carried by a bar code symbol on the physical article. However, suppliers may wish to utilise bar code scanning as part of the order process. This may be achieved by representing base articles and identification numbers in machine readable form in a paper catalogue. GS1-128 Bar Code Symbols, utilising an Application Identifier for internal applications, should be used for this purpose.

2.6.6.3.3 Identification of the Physical Article Actually Produced

In environments with automated systems the physical article needs to be identified and the identification of the produced article is required in machine readable form (as a bar code symbol). The identification of the physical article must be communicated from the supplier to the customer. Both supplier and customer should be able to use the same identification number and each needs to keep a record of this number.

For open systems, the most appropriate identification number is the EAN/UCC-13 Identification Number. Identifying a physical article with an EAN/UCC-13 ID Number and a bar code symbol allows Customer Specific Articles (CSAs) to be integrated within a system that manages all other items identified using the GS1 System. During order confirmation, the supplier assigns an EAN/UCC-13 Identification Number to the product. It is not necessary to pre-assign numbers to all possible articles, only to those that are actually produced.

2.6.6.3.3.1 Data Carrier

The bar code symbol requirements for Customer Specific Articles (CSAs) are the same as those for trade items. The data carrier used to carry the GS1 System identification number of a physical article shall be one of the following:

- EAN-13 or UPC-A Bar Code Symbol
- ITF-14 Bar Code Symbol
- GS1-128 Bar Code Symbol (attribute information always uses GS1-128 Bar Code Symbols)

With CSAs, the choice of data carrier is left to the discretion of the organisation responsible for issuing the GS1 System identification number. Trade items that will be scanned at a Point-of-Sale always should be marked using the EAN/UPC Symbology.

2.6.7 Numbering and Symbol Marking for Document Control

GS1, in conjunction with representatives of user organisations, has developed this voluntary standard for applications of bar code symbols on documents and pre-defined forms.

This standard is based on the use of GS1 System Application Identifiers and utilises GS1-128 Bar Code Symbols. It is a complement to, and should be read in conjunction with:

- Other sections of these specifications
- *EANCOM*[®], the Electronic Data Interchange (EDI) standard providing implementation guidelines for UN/EDIFACT messages.
- XML (eXtensible Mark-up Language), a GS1 supported application for data exchange.

Organisations wishing to automate the processing of documents to ensure correct control procedures may use this standard as a basis to produce specific implementation guidelines pertinent to their exact application. The implementation guidelines in the following subsections consider issues such as domestic versus international requirements and local legal requirements.

2.6.7.1 Introduction

2.6.7.1.1 Business Demand for the Application

The use of GS1 System standards has led to major innovations in the retail sector. The GS1 System family of bar code symbols has enabled automation at the Point-of-Sale (POS). Studies have shown that identifying goods with GS1 System bar code symbols and ID numbers reduces the amount of time required to process a transaction, increases the accuracy of data, and enables efficient Electronic Data Interchange (EDI).

This success has led other industries to introduce the GS1 System into their business processes. One such application of the GS1 System is the automation of the control of documents.

Official organisations, like Government Ministries, Local Authorities, Insurance Organisations, Real Estate Registration Authorities, Freight Forwarders Associations, etc. are required to identify their documents and ensure internal controls are in place to provide full processes visibility. The information flow that accompanies the physical document is often communicated and/or stored in a variety of ways including the use of EDI (*EANCOM* or XML) communications. In practice, however, fully automated communication channels and data storage, that make it possible to rely exclusively on electronic files for retrieving information, are not always available.

For this reason, there may be a need to indicate relevant information on the document itself to help automate processing and provide a secure basis for control procedures. The various fields of information that must be communicated need to be organised in a standard way in order to facilitate their interpretation and processing by all the partners involved. The GS1 System standards, based upon the use of GS1-128 Bar Code Symbols and the Application Identifiers may be used to provide this standard solution as outlined in the guideline below.

2.6.7.2 Potential Benefits

The potential benefits for using bar code symbols on documents include:

- Greater control of documents within each organisation.
- Traceability of documents through the process
- Reduced complexity by having a standard system that can be easily implemented by any interested party.
- Using bar code symbols to represent critical control data greatly reduces the possibility of key entry error.
- Ensure the world-wide unique identification of documents as an indispensable base for electronic documents.
- To help prevent misuse and fraud of official documents and improve acceptance.
- To ensure a consistent approach on both electronic and printed documents
- Provides an opportunity in some countries to offer new services

2.6.7.3 Application Rules

2.6.7.3.1 Definition of a Document requiring Internal Control

The term *document* is applied broadly to cover any official or private papers that infer a right (e.g. proof of ownership) or obligation (e.g. notification a call for military service) upon the bearer. The issuer of the document is normally responsible for all the information contained upon the document - both bar coded and human readable. Such documents typically require storage of the appropriate information contained on the document. Examples include:

- Land registration papers
- Tax demands
- Proof of shipment / receipt forms
- Custom's clearance forms
- Insurance policies
- Internal invoices.
- National press documents
- Educational papers
- Transporting company documents
- Mail companies documents
- Among others

2.6.7.3.2 Bar Code Symbolology

The GS1-128 Bar Code Symbol is used for Documents that require control. The bar code in no way replaces the need for Human Readable information.

2.6.7.3.3 Bar Code Information

2.6.7.3.3.1 GS1-128 Symbol Requirements

To facilitate efficient scanning, all bar code symbols shall be printed at an X-dimension between 0.25 mm (0.00984 in.) and 0.495 mm (0.0195 in.) and be a minimum of 13 mm (0.5 in.) in height.

The information required for the internal Control of Documents should be carried by GS1-128 Bar Code Symbols.

2.6.7.3.3.2 Global Document Type Identifier

The Application Identifier to indicate the Global Document Type Identifier is AI (253).

The Global Document Type Identifier is assigned by the document issuer. The Global Document Type is used as a key to access database information that is required for document control purposes (normally held by issuing organisation). The same Document Type is used for all document classes which are issued with an identical purpose. This can then be used to reference the characteristics of the document, such as:

- The issuer of the document
- The exact right or obligation the document imposes
- The document type (insurance policy, governmental paper, etc.)
-

A different Document Type shall be used whenever characteristics of the document are different.

By their nature, each document needs to be individually tailored for the intended recipient and therefore requires a unique reference number in addition to the Document Type. Any duplicates of a document should use the same number as the original. The Serial Component is optional and assigned by the document issuer and is a unique number in a series of documents issued under the same Document Type. Ideally the Serial Component should be sequentially allocated for each new document generated.

The serial component is used to communicate exact details pertinent to the individual document such as:

- The name and address of the recipient
- The cross-reference to individual details
-

2.6.7.4 Application Overview

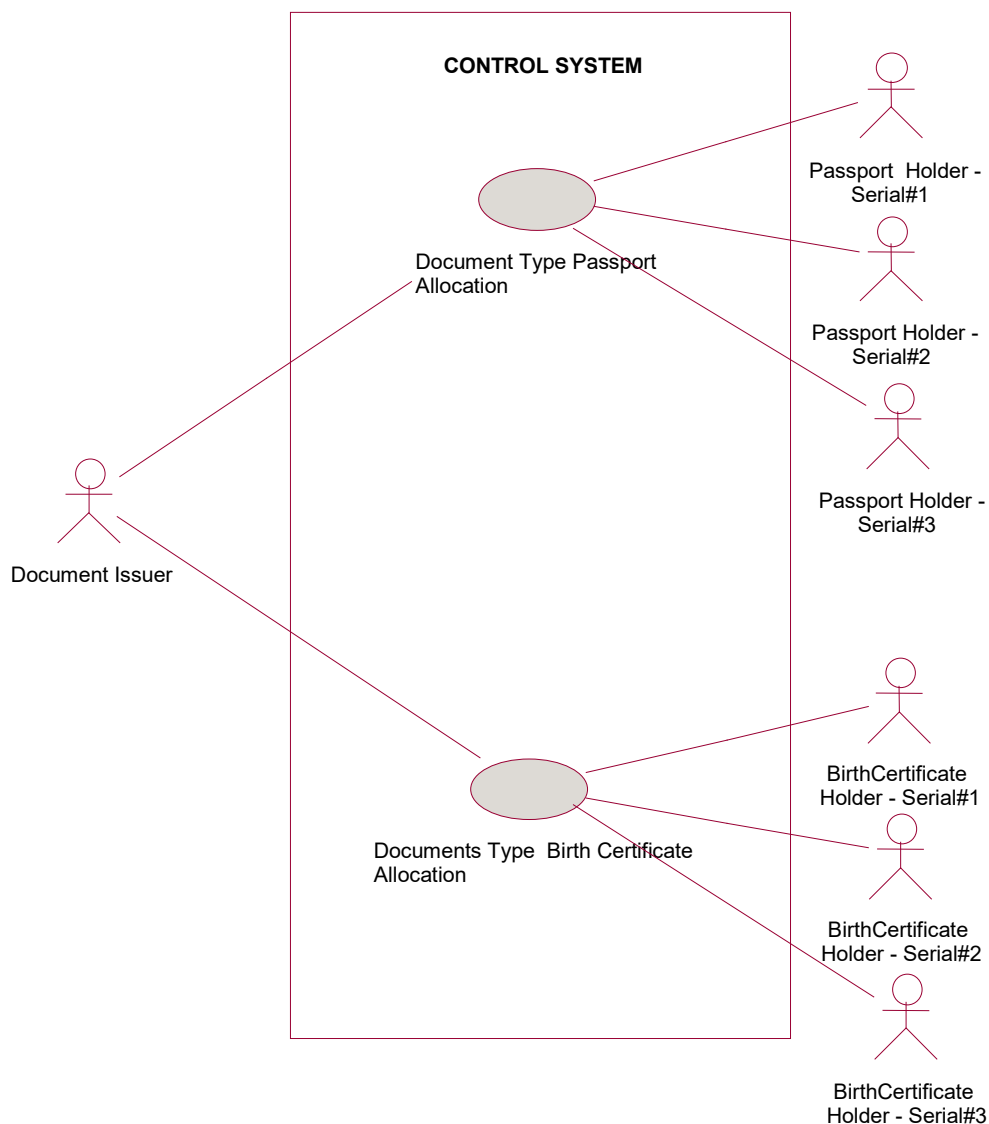
2.6.7.4.1 Application Requirements

These international guidelines outline the GS1 System standards for documents used in an open environment. The guidelines provide information on how to use bar code symbols on documents and how they can help to provide internal controls.

Note: Legislation in certain countries may require additional controls.

2.6.7.4.2 Overview of Using Bar Code Symbols for Document Control

Figure 2.6.7.4.2 – 1



- Step 1: The document issuer assigns a unique Document Type for each of its document types that require control.
- Step 2: For each document that is issued, a unique serial component is allocated if required.
- Step 3: The document issuer provides a bar code symbol on the document. The Global Document Type Identifier, the combination of document type and serial component, provide a globally unique reference number that can be used for document control.
- Step 4: The bar code containing the Global Document Type Identifier may be scanned to access the required information for a database whenever a query is required.

2.6.7.A.1 Appendix 1: Examples of Documents using GS1-128 Symbols for Internal Control

Example 1: Legally required declaration prior to travel

This example shows how GS1-128 Bar Codes can be used to automate the capture of information for traveller who enters or leaves the country.

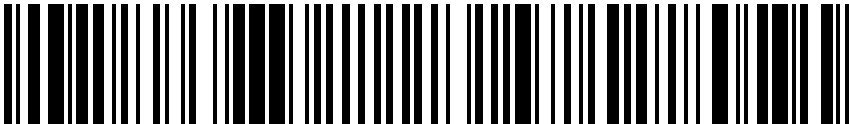
Figure 2.6.7.A.1 - 1 Legally required travel declaration

Declaration of Luggage and Money of Travellers			
(253) 770721248998412345678901			
Name:			
Address:			
Date of Entrance:			
Items to Declare:			
Amount	Description	Value	Customs Value
I have read the instructions and declare the truth:			
Date and Signature:			
Doc Type: 12345678901			

Example 2: Insurance Policy

This example shows how GS1-128 Bar Codes can be used to automate the capture of information on Insurance Policies. This standard solution provides benefit for both the insurer, the insured, any potential beneficiaries as well as facilitating the automation of any monitoring and inspection of the requirement to fulfill the legal norms.

Figure 2.6.7.A.1 - 2 Insurance Policy

Policy Number: 67890543210987		Insurance Company	
Branch: Bogota		Date of Policy: March 23, 2005	
Name: Name of Insured			
Age: 24		Valid From: March 23, 2005	
		Valid To: March 22, 2007	
Contract Cover: Life		Value: 10,000	
Date and Signature:			
 (253) 770999800010067890543210987			

Example 3: Application Form

This example shows how GS1-128 Bar Codes can be used to automate the capture of information on application forms. There are many organisations that require their clients to complete an application form: social clubs, unions, associations, universities, schools, etc.

Figure 2.6.7.A.1 - 3 Membership Application Form

Request Number:
7654321

IAC
COLOMBIA

Este formulario es para solicitar directamente en IAC, un código de barras.

Mira una muestra de cómo se verá en Internet, así son en nuestra página más fácil de usar.



Solicitud de Servicios

TIPOS DE SERVICIOS

Para que su empresa pueda identificar productos, servicios o localizaciones, el Instituto Colombiano de Codificación y Automatización Comercial IAC Colombia le ofrece varias opciones. Escija la que más le convenga según sus necesidades.

1. SER MIEMBRO DE IAC
Al ser miembro del Instituto, su empresa podrá obtener los siguientes beneficios:

- » Asignación de Código único para su empresa, con el cual podrá identificar entre 1 y 100.000 productos, servicios o localizaciones (los códigos asignados como localizaciones sirven para identificar ubicaciones o buzones para EDI).
- » Voz y voto en la Asamblea Anual de Miembros de IAC Colombia.
- » Uso gratuito de CABASet: El primer Catálogo Electrónico de Productos.
- » Tarifas especiales en los cursos, seminarios y consultorías que realiza el Instituto.
- » Recordatorios básicos por TemoEAN, el único modelo real y didáctico de una Cadena de Abastecimiento en Colombia.
- » Navegar en el área privada de nuestra página Web www.iaccolombia.org, en la cual puede acceder a la información especializada que le ofrece el Instituto.
- » Tarifas preferenciales para pasar en el Directorio de Soluciones Logísticas para la Cadena de Abastecimiento.

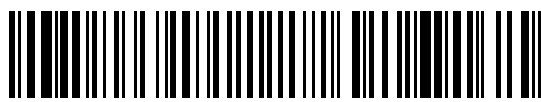
2. SER CLIENTE DE IAC
Al escoger esta opción Usted puede elegir entre cuatro opciones dependiendo de sus necesidades:

2a. Cliente Código de empresa: Con este tipo de vinculación su empresa adquirirá el código EAN+UCC mediante el cual podrá identificar entre 1 y 100.000 productos, servicios o localizaciones. Renovación anual.

2b. Cliente pago por 10 años: Con este tipo de vinculación su empresa adquirirá el código EAN+UCC mediante el cual podrá identificar entre 1 y 100.000 productos, servicios o localizaciones. Renovación cada 10 años. Válido solo para empresas con activos inferiores a 99.9 millones de pesos.

2c. Cliente Código GTIN: Con este tipo de vinculación su empresa adquirirá UN código para UN solo producto o UN solo servicio. Si más adelante usted desea identificar UNO adicional, debe diligenciar un formato que IAC le suministrará y cancelar el valor vigente. Código de carácter vitalicio.

2d. Cliente Código Identificación de Documentos: Con este tipo de vinculación su empresa



(253) 77012340000117654321

Example 4: Freight-Forwarding Authorisation

This example shows how GS1-128 Bar Codes can be used to automate the capture of information on Freight-Forwarding forms. There are many organisations that require documentary evidence that goods have been dispatched prior to making payment.

Figure 2.6.7.A.1 - 4 Freight-Forwarding Authorisation

Suppliers or Forwarders Principals ID-Number barcoded (automated access to database)		2.6.1 FIATA FCT Emblem <table border="1" style="border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">No. 123 456</td> <td style="padding: 2px 5px;">CH</td> </tr> </table>  (253)761234500008123456 ID-Number human readable (manual access to database)		No. 123 456	CH
No. 123 456	CH				
Consigned to order of Human readable information (no meaning for access to database)		Notify address Conveyance from / via Destination			
Marks and numbers					
Number and kind of packages					
Description of goods					
Gross weight		Measurement			

specimen

according to the declaration of the consignor

The goods and instructions are accepted and dealt with subject to the General Conditions printed overleaf.
 Acceptance of this document or the invocation of rights arising therefrom acknowledges the validity of the following conditions, regulations and exceptions also of the trading conditions printed overleaf, except where the latter conflict with conditions 1-6 below.

1. The undersigned are authorized to enter into contracts with carriers and others involved in the execution of the transport subject to the latter's usual terms and conditions.
2. The undersigned do not act as Carriers but as Forwarders. In consequence they are only responsible for the careful selection of third parties, instructed by them, subject to the conditions of Clause 3 hereunder.
3. The undersigned are responsible for delivery of the goods to the holder of this document through the intermediary of a delivery agent of their choice. They are not responsible for acts or omissions of Carriers involved in the execution of the transport or of other third parties. The undersigned Forwarders will, on request, assign their rights and claims against Carriers and other parties.
4. Insurance of the goods will only be effected upon express instructions in writing.
5. Unforeseen and/or unforeseeable circumstances entitle the undersigned to arrange for deviation from the envisaged route and/or method of transport.
6. Unforeseen and/or unforeseeable disbursements and charges are for the account of the goods.

Insurance through the intermediary or the undersigned Forwarders

☐ Not covered

☐ Covered according to the attached Insurance Policy / Certificate

All disputes shall be governed by the law and within the exclusive jurisdiction of the courts at the place of issue.

For delivery of the goods please apply to:

Freight and charges prepaid to:

thence for account of goods, lost or not lost.

We, the Undersigned Forwarders in accordance with the instructions of our Principals, have taken charge of the abovementioned goods in good external condition at:

for despatch and delivery as stated above or order against surrender of this document properly endorsed.

In witness thereof the Undersigned Forwarders have signed originals of this FCT document, all of this tenor and date. When one of these has been accomplished, the other(s) will lose their validity.

Place and date of issue

Stamp and signature

Text authorized by FIATA. COPYRIGHT FIATA / Zurich - Switzerland 5.96

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Section 2.7:

Numbering and Symbol Marking for Very Small Healthcare Items

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2.7.1 Introduction

The Reduced Space Symbolology® (RSS), System Composite Symbolology®, and Data Matrix (see Section 5.5 and Section 5.6) were specially developed for applications where traditional bar codes symbols were limited or not available. The GS1 System currently limits use of these symbologies to very small healthcare items. This application guideline has been globally agreed.

Very small healthcare items are an application for which there exists no encoding method with traditional GS1 bar code standards. Product identification for unit-of-use items and unit dose items dispensed at bedside is extremely important. The lack of automatic identification of pharmaceuticals and medical-surgical items leads to high manual effort and errors during administration, documentation, and stocking or inventory.

The following guidelines provide the current best practice for use and application of RSS, Composite Symbolology, and Data Matrix symbologies in healthcare applications with limited space marking requirements.

2.7.2 Scope

2.7.2.1 Purpose

These guidelines provide a foundation for the implementation of RSS-14® Stacked, RSS Limited®, RSS-14® Stacked Omnidirectional, Composite, and Data Matrix Symbologies in healthcare. They provide:

- Application requirements for RSS-14 Stacked, RSS Limited, RSS-14 Stacked Omnidirectional, Composite Component®, and Data Matrix Symbologies.
- Methods for evaluating RSS-14 Stacked, RSS Limited, RSS-14 Stacked Omnidirectional, Composite Component, and Data Matrix readability and scannability.

2.7.2.2 Applicability

These guidelines are only for healthcare items. They apply to the appropriate use of RSS-14® Stacked, RSS Limited™, RSS-14 Stacked Omnidirectional, Composite Component®, and Data Matrix on healthcare items that are too small for other GS1 System linear symbologies. The majority of uses for Reduced Space Symbolology® (RSS) will be on very small items, such as vials, ampoules, very small bottles, and blister packs. The majority of uses for Data Matrix will be on very small items with limited printing area and medical-surgical items that lack a traditionally printable surface or area.

2.7.2.3 Who Should Use These Guidelines

These guidelines are written for the entire healthcare supply chain, from the label printer to the healthcare provider and everyone in between. They provide sufficient information to implement this technology, assuming that the hardware and software being used supports the RSS, Composite Symbolology, and Data Matrix Symbologies according to *ITS/99-001:1999*, *ITS/99-002:1999*, and *ISO/IEC 16022*.

2.7.3 References

The standards listed below are referenced in these guidelines. The relevant provisions contained in the referenced specifications constitute provisions of these guidelines.

ITS/99-001:1999	International Symbology Specification Reduced Space Symbology® (RSS)
ITS/99-002:1999	International Symbology Specification Composite Symbology®
ISO/IEC 16022	Information Technology – International Symbology Specification – Data Matrix
ISO/IEC 15416	Information technology – Automatic identification and data capture techniques – Bar code print quality test specification – Linear symbols
ISO/IEC 15415	Information Technology – Automatic identification and data capture techniques – Bar code print quality test specification – 2D symbols
ISO 1073-2	Alphanumeric character sets for optical recognition – Part 2: Character set OCR-B – Shapes and dimensions of the printed image

2.7.4 Definitions

Terms and definitions

The terms and definitions provided here and those from the Glossary (see [Section 8](#)) apply to these guidelines:

bar height	The dimension of a bar (line) measured from its top to its bottom.
bar width	The thickness of a bar (line) measured from one of its edges to the other.
Bar Width Reduction/Increase	The uniform reduction/increase of each bar code symbol in the Film Master or digital image file to correct for anticipated bar growth/shrinkage in the imaging or printing process.
very small healthcare items	All kinds of very small pharmaceutical and medical products, mainly unit-of-use items and unit dose items, but also very small packages.
selective Bar Height Reduction	The uniform Bar Height Reduction of a bar code symbol in the Film Master or digital bar code file to correct for anticipated bar growth in the imaging or printing process.
direct part marking	Any method of directly marking (as opposed to applying) the part or surface. Sometimes abbreviated as DPM.

Abbreviations

2D	Two-dimensional
CC	Composite Component®
RSS	Reduced Space Symbology®
GTIN™	Global Trade Item Number™
YYMMDD	Expression of date – Year Year/Month Month/Date Date

2.7.5 Marking Requirements

RSS-14® Stacked, RSS Limited® and RSS-14 Stacked Omnidirectional have been developed for small unit healthcare packages and are designed to encode the Global Trade Item Number™ (GTIN™). The optional Composite Component® can contain additional data elements that refer to that particular item. Data Matrix shall encode GTINs and can contain additional elements that refer to that particular item.

RSS-14 Stacked has the first priority to be used for identification of very small healthcare items. RSS Limited, RSS-14 Stacked Omnidirectional, or Data Matrix shall be used in exceptional cases for certain application requirements. The RSS Limited can be used if the item needs a relatively long but limited height symbol. RSS-14 Stacked Omnidirectional is designed for omnidirectional scanning environments.

In general, all participants of the healthcare supply chain shall be able to read and process all of these variants of RSS symbols.

Data Matrix should be used where printing area is .375 in. (9.525mm) square or smaller or where the marking area will preclude the application of ink (et al) thus requiring the symbol to be applied by means of direct part marking.

Marking & Reading (Scanning Requirements)

Symbology	Print Area Available	Print Density	Scanner Technology Required
RSS Stacked	12.7 mm x 6.35 mm (0.5 in. x 0.25 in.)	≥ 6.7 mil	Laser or Imaging Scanner
RSS Limited	12.7 mm x 6.35 mm (0.5 in. x 0.25 in.)	≥ 6.7 mil	Laser or Imaging Scanner
RSS Stacked Omnidirectional	12.7 mm x 25.4 mm (0.5 in. x 1.0 in.)	≥ 8.0 mil	Retail Style Slot Scanner
Data Matrix	9.525 mm (.375 in.) square	≥10.05 mil	Imaging Scanner

Note: Data Matrix is not intended for general retail scanning.

2.7.5.1 Mandatory Data Elements

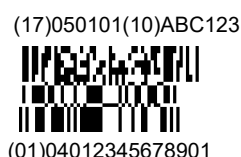
Item level marking shall contain the Global Trade Item Number™ (GTIN™) in the RSS-14® Stacked Symbol (or in the RSS Limited™, RSS-14 Stacked Omnidirectional, or Data Matrix Symbol depending on the application requirements previously described).

2.7.5.2 Optional Data Elements

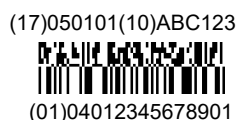
An item may also contain a symbol encoding secondary attribute data. It is recommended to adopt the expiry date and the lot number in the encoded data. Expiry date and lot number must, legally, be expressed minimally in Human Readable Interpretation on the label or package. Automatic handling (scanning and electronic delivery) of this data facilitates many maintenance and documentation duties. Within the Composite Component® and Data Matrix, the secondary information is structured according to the rules of the GS1-128 Bar Code Symbol Application Identifier (AI) concept.

Neither Composite Component nor Data Matrix is omnidirectionally scannable using a retail style slot scanner and, therefore, neither is suitable for retail applications. Nevertheless, the automatic handling of secondary data offers several possibilities and benefits that may become important even in retail applications (e.g., scanning of best before or expiry dates, lot numbers in case of recalls).

Example¹: RSS-14® Stacked Composite Symbol, Global Trade Item Number™ (GTIN™) in RSS-14 Stacked, Als (17) expiry date, and (10) lot number in Composite Component A



Example: RSS Limited™ Composite Symbol, GTIN in RSS Limited, Als (17) expiry date, and (10) lot number in Composite Component A



Example: RSS-14 Stacked Omnidirectional Composite Symbol, GTIN in RSS-14 Stacked Omnidirectional, Als (17) expiry date, and (10) lot number in Composite Component A



Example: Data Matrix Symbol, GTIN, Als (17) expiry date, and (10) lot number



¹ Please note that all symbol examples shown in these guidelines are for illustration purposes and do not correspond to the metrics described elsewhere.

2.7.6 Data Representation

2.7.6.1 Syntax

2.7.6.1.1 Mandatory GTIN™

The data syntax for the mandatory Global Trade Item Number™ (GTIN™) is:

- A two-digit Application Identifier (AI) (01) indicating a GTIN
- A GTIN

As the RSS-14® Stacked, RSS Limited™ and RSS-14 Stacked Omnidirectional always exclusively contain a GTIN, the AI (01) indicating a GTIN is not encoded in these RSS symbols. It must be noted that for Data Matrix, FNC1 (Function Code 1) must be encoded first to indicate a symbol within the GS1 System.

The 14-digit GTIN is structured as follows:

- A one-digit Indicator (value from 0 to 9). However, only 0 to 8 can be used as 9 is the variable measure prefix. The RSS Limited is restricted to the GTIN with Indicator value 0 or 1.
- The GS1 Company Prefix
- The Item Reference (designated by the holder of the GS1 Company Prefix)
- A Check Digit (calculated from the first 13 digits of the GTIN)

2.7.6.1.2 Optional Data

Any optional data shall be contained in the 2D Composite Component® or following the Global Trade Item Number™ (GTIN™) in a Data Matrix Symbol. The data syntax for each of the optional data fields is:

- A two- to four-digit Application Identifier (AI) to indicate data type and field size
- The data indicated by the AI. This may be a fixed or variable length field, depending on the AI.

Multiple AI data elements may be concatenated in a single 2D Composite Component message or in a Data Matrix Symbol. Note that if a Data Matrix Symbol is used, the optional data must follow the GTIN information.

All AIs of pre-defined length² should precede the variable field AIs for the most efficient encoding. The FNC1 (Function Code 1) separator character shall separate variable length AI fields.

In healthcare applications, the following AI elements should be used because this data is legally required and implies certain liabilities:

² See [Section 7.9.2](#)

Expiry (Expiration) Date:

The data syntax for the expiry date is n2 + n6:

- A two-digit AI (17) indicating the maximum durability date
- A fixed length field of six digits indicating expiry date as YYMMDD

Lot/Batch Number:

The data syntax for the lot number is n2 + an..20:

- A two-digit AI (10) indicating lot number
- A variable length field of up to 20 alphanumeric characters of lot number data

2.7.6.2 Symbol Metrics**2.7.6.2.1 RSS & Data Matrix****2.7.6.2.1.1 X-Dimension (Module Size) and Symbol Height (Y Dimension)**

Symbol(s) Specified	X-Dimension mm (inches)			Minimum Symbol Height for Given X mm (inches)			Quiet Zone		*Minimum Quality Specification
	Minimum	Target	Maximum	For Minimum X-dimension	For Target X-dimension	For Maximum X-dimension	Left	Right	
RSS-14® Stacked	0.170 (0.0067 in.)	0.20 (0.008 in.)	0.41 (0.016 in.)	2.21 (0.087 in.)	2.64 (0.104 in.)	5.28 (0.208 in.)	Not Applicable	Not Applicable	1.5/06/670
RSS Limited™	0.170 (0.0067 in.)	0.20 (0.008 in.)	0.41 (0.016 in.)	1.70 (0.067 in.)	2.03 (0.080 in.)	4.07 (0.160 in.)	Not Applicable	Not Applicable	1.5/06/670
RSS-14 Stacked Omnidirectional	0.170 (0.0067 in.)	0.20 (0.008 in.)	0.41 (0.016 in.)	11.73 (0.4623 in.)	13.8 (0.552 in.)	28.51 (1.104 in.)	Not Applicable	Not Applicable	1.5/06/670
Data Matrix	0.255 (0.01005 in.)	0.3 (0.012 in.)	0.615 (0.024 in.)	Entirely dependent on quantity of data encoded			Symbol must be surrounded by a 1X Quiet Zone		1.5/06/670

* See [Section 2.7.7](#) for full details on minimum quality specifications.

2.7.6.2.1.2 Symbol Size**2.7.6.2.1.2.1 RSS-14® Stacked**

This symbol is, at minimum, 50X (50 modules) wide by 13X (13 modules) high. The top row is 5X (5 modules) high and the bottom row is 7X (7 modules) high. The separator pattern between rows is, at minimum, 1X (1 module) high. No Quiet Zones are required. The adjacent background colour can be the same as the guard bar, light on the left and dark on the right side of the symbol respectively.

2.7.6.2.1.2.2 RSS Limited™

This symbol is 74X (74 modules) wide by a minimum of 10X (10 modules) high. No Quiet Zones are required. The adjacent background colour can be the same as the guard bar, light on the left and dark on the right side of the symbol respectively.

2.7.6.2.1.2.3 RSS-14® Stacked Omnidirectional

This symbol is, at minimum, 50X (50 modules) wide by 69X (69 modules) high. Each is 33X (33 modules) high minimum, with a 3X (3 modules) high separator pattern between the two rows. No Quiet Zones are required. The adjacent background colour can be the same as the guard bar, light on the left and dark on the right side of the symbol respectively.

2.7.6.2.1.2.4 Composite Component®

The X-dimension shall be nominally the same as the X-dimension of the associated primary Reduced Space Symbolology® (RSS) linear symbol. The overall dimensions of the Composite Component® depend on the data content. See *International Symbolology Specification Composite Symbolology* for details on calculating the dimension of a specific Composite Component Symbol and the allowed tolerances between the linear and the Composite Component.

2.7.6.2.1.2.5 Data Matrix

The X-dimension shall be nominally 1.5X as the X-dimension of a like Reduced Space Symbolology® (RSS) linear symbol. The overall dimensions of the Data Matrix Symbol depend on the data content. See *ISO/IEC 16022 Information Technology - International Symbolology Specification - Data Matrix* for details on calculating the dimensions of a specific Data Matrix Symbol.

2.7.6.3 Human Readable Interpretation

2.7.6.3.1 RSS

2.7.6.3.1.1 Location

The Global Trade Item Number™ (GTIN™) shall be printed in human-readable form underneath the symbol.

Example: RSS-14® Stacked Symbol containing the GTIN

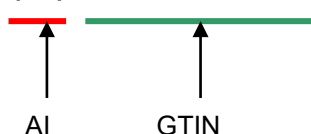


2.7.6.3.1.2 Font

A clearly legible font shall be used for the human-readable digits (e.g., OCR-B as defined in *ISO 1073-2*). Reasonable alternative type fonts and character sizes are acceptable provided the interpretation is clearly legible. The font should be suitable and compatible with other printed materials. When necessary, the font used shall be in accordance with applicable government laws and regulations.

2.7.6.3.1.3 Format

The Global Trade Item Number™ (GTIN™) shall be printed as a single 14-digit number preceded by the corresponding Application Identifier (AI) (01) enclosed in parentheses. Although the AI (01) is not encoded in the Reduced Space Symbolology® (RSS), it shall be printed to ensure the consistent and unambiguous interpretation of data in the case of a Composite Component® Symbol. The parentheses are not part of the data and are not encoded in the bar code symbol.

(01)04012345678901

2.7.6.3.1.4 Data Overflow

There will be instances where there is insufficient space on the very small healthcare item for the Reduced Space Symbolology® (RSS) Symbol and the human readable Global Trade Item Number™ (GTIN™). When this situation occurs and this information is already printed on the label because of government mandates or by trade practice, then, at the supplier's discretion and in accordance with applicable government regulations, the identification number's Human Readable Interpretation requirement can be waived.

For a consistent representation of the GTIN printed independently from the symbology, the GS1 System data title should be used. For example:

AI	Full Title	Data Title
01	Global Trade Item Number	GTIN

2.7.6.3.2 Composite Component®

2.7.6.3.2.1 Location

If there is sufficient space to print the Human Readable Interpretation of the Composite Component®, it shall be printed above the symbol in proper sequence of the Application Identifiers (AIs) (the Reduced Space Symbolology® (RSS) Human Readable Interpretation is printed below). The data shall be printed from top to bottom and left to right. A single AI with accompanying data shall be displayed on one line and not broken into two lines.

Example: RSS-14® Stacked Composite Symbol - Global Trade Item Number™ (GTIN™) printed below RSS-14 Stacked, AIs (17) expiry date and (10) lot number printed above the Composite Component in one single line.

(17)050103(10)ABC123

 (01)04012345678901

Example: RSS-14 Stacked Composite Symbol – GTIN printed below RSS-14 Stacked, AIs (17) expiry date and (10) lot number printed above the Composite Component from top to bottom and left to right.

(17)050103
 (10)ABC123

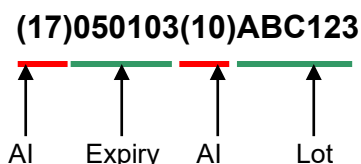
 (01)04012345678901

2.7.6.3.2.2 Font

The font should be suitable and compatible with other printed materials and the Reduced Space Symbology® (RSS) Human Readable Interpretation. The font size should be scaled for easy legibility. The font used shall be in accordance with applicable government laws and regulations.

2.7.6.3.2.3 Format

The data should be printed with the proceeding Application Identifiers (AIs) enclosed in parentheses. The order of the data should be the same as encoded in the Composite Component® according to the rules in these *GS1 General Specifications*. The parentheses are not part of the data and are not encoded in the bar code symbol, though the AIs are.

**2.7.6.3.2.4 Data Overflow**

On many packages there will be insufficient space to print both the Human Readable Interpretation for Reduced Space Symbology® (RSS) (Global Trade Item Number™ (GTIN™)) and the Composite Component® information. Printing the RSS (GTIN) or Data Matrix information shall take precedence over the Human Readable Interpretation for the Composite Component or the remainder of data encoded in the Data Matrix Symbol.

The GTIN, expiry date, and lot number are already routinely printed on the label because of government mandates or by trade practice. If there is no space for printing the encoded data above or below the symbol, the data not belonging directly to the symbology should be consistently represented using the GS1 System data titles. For example:

AI	Full Title	Data Title
01	Global Trade Item Number	GTIN
17	Expiration Date	USE BY or EXPIRY
10	Batch or Lot Number	BATCH/LOT

Note: If the RSS Composite Symbol fails to scan, manual input of the data is necessary. As expiry date and lot number should always be part of the information stored in the Composite Symbol and as this information is already printed on the label because of legal requirements, a software solution can be implemented to prompt the user for this data after keying in the GTIN.

2.7.6.3.3 Data Matrix**2.7.6.3.3.1 Location**

The Global Trade Item Number™ (GTIN™) shall be printed in human-readable form underneath the symbol.

If there is sufficient space to print the Human Readable Interpretation of the optional attribute data it shall be printed above the symbol in proper sequence of the Application Identifiers (AIs). The data shall be printed from top to bottom and left to right. A single AI with accompanying data shall be displayed on one line and not broken into two lines.

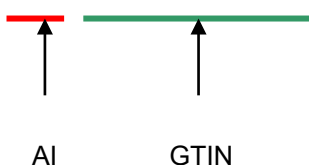
2.7.6.3.3.2 Font

A clearly legible font shall be used for the human-readable digits (e.g., OCR-B as defined in *ISO 1073-2*). Reasonable alternative type fonts and character sizes are acceptable provided the interpretation is clearly legible. The font should be suitable and compatible with other printed materials. When necessary, the font used shall be in accordance with applicable government laws and regulations.

2.7.6.3.3.3 Format

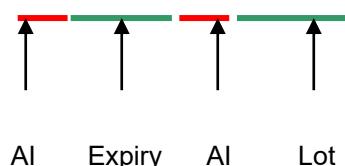
The Global Trade Item Number™ (GTIN™) shall be printed as a single 14-digit number preceded by the corresponding Application Identifier (AI) (01) enclosed in parentheses.

(01)04012345678901



The optional attribute data should be printed with the proceeding AIs enclosed in parentheses. The order of the data should be the same as encoded in the Composite Component® according to the rules in these *GS1 General Specifications*. The parentheses are not part of the data and are not encoded in the bar code symbol, though the AIs are.

(17)050103(10)ABC123



2.7.7 Print Quality

The minimum print quality grade for RSS-14® Stacked, RSS Limited™ and RSS-14 Stacked Omnidirectional Symbols in healthcare applications shall be a 1.5/6/670 overall symbol grade when measured in accordance with *ISO/IEC 15416*. The measurement of the quality parameters shall be made by a verifier conforming to *ISO/IEC 15416*, using a 0.15 mm (0.006 in.) aperture at a nominal illumination wavelength of 670 nanometres. According to this standard, minimum print quality requirements are shown in the form:

1.5 / 6 / 670

where 1.5 is the overall symbol quality grade (sometimes expressed as letter grade “C”)
 6 is the measuring aperture reference number (corresponding to an 0.15 mm or 0.006 in. diameter aperture)
 670 is the peak response wavelength in nanometres.

For the 2D Composite Component®, ink spread in the direction of the bar y-axis (perpendicular to the bar width or x direction) requires a compensating Bar Width Reduction in the y direction.

2.7.8 Label Location

General principles on placement of bar code labels are described in Section 6 and apply to the label location of Reduced Space Symbology® (RSS)/Composite Symbols.

The majority of uses for RSS will be on very small items with curved surfaces, such as vials, ampoules, and very small bottles. For guidance in locating the RSS/Composite Symbol on curved surfaces, refer to Section 6.2.3.2.

Section 2.8:

Numbering and Direct Part Marking Using Data Matrix (ECC 200)

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2.8.1 Introduction

These guidelines provide the generic requirements for applying Data Matrix symbols to items using direct part marking (DPM). Direct part marking refers to the process of marking a symbol on an item using an intrusive or non-intrusive method.

Guidelines for specific application guidelines that may have additional requirements are listed in the reference section. In lieu of specific industrial or retail applications, these guidelines will provide the minimum requirements.

The use of Data Matrix in direct part marking applications is endorsed by GS1 for those applications that require permanent marking for cradle-to-grave history of the part's lifecycle.

2.8.1.1 Criteria for Direct Part Marking

- Traceability at the component level is required to ensure product integrity.
- The component identification number is required to be tracked through the manufacturing process and throughout the lifecycle of the product.
- The component or product is in harsh operational and overhaul environments.
- Adherent materials (e. g., labels) are prohibited on the component or product.
- The area allotted for the bar code symbol is limited and poses a problem for other methods.
- Permanent marking is required.

2.8.1.2 Guidance for Symbology Selection with Direct Part Marking Process

Use Data Matrix if:

- The use of Data Matrix is allowed in the application specification.
- The marking method will not produce an acceptable linear symbol but will produce an acceptable Data Matrix, e.g., dot peen marking and high-speed ink jet.
- A GS1 Identification key plus attribute element string are to be encoded
- Data Matrix is the only symbology that will fit on the item at the application specified X-dimension.
- Low contrast signal is expected from the application.
- The use of 2D (two-dimensional) array scanners and/or vision systems are specified exclusively for the application and can read Data Matrix.

2.8.2 References

The standards listed below are referenced in these guidelines. The relevant provisions contained in the referenced specifications constitute provisions of these guidelines.

ISO/IEC 16022	Information Technology- International Symbology Specification – Data Matrix
ISO/IEC 15415	Information technology – Automatic identification and data capture techniques – Bar code print quality test specification – 2D symbols
ISO/IEC 15416	Information technology – Automatic identification and data capture techniques – Bar code print quality test specification – linear symbols
ISO 1073-2	Alphanumeric character sets for optical recognition – Part 2: Character set OCR-B – Shapes and dimensions of the printed image

2.8.3 Definitions

2.8.3.1 Terms and Definitions

The terms and definitions provided here and those from the glossary (see Section 8) apply to these guidelines:

Dot	A localized region with a reflectance, which differs from that of the surrounding surface.
Cell	The area within a Data Matrix symbol where a mark may be placed to indicate a binary value
Intrusive marking	Marking by removing or altering substrate material
Non-Intrusive marking	Does not alter the substrate material, and usually adds to that surface.
Peen	Hemispherical or wedged shaped instrument that is mechanically driven to produce a dot on the surface

2.8.3.2 Abbreviations

2D	Two-dimensional
DPM	Direct Part Marking
GALE	Gas Assisted Laser Etching
LISI	Laser Inductive Surface Improvement
LIVD	Laser Induced Vapor Deposition

2.8.4 Data Requirements

In general, all participants in the supply chain shall be able to read and process all of variants of symbols based on ECC 200 that include mandatory and agreed to optional data elements.

2.8.4.1 Mandatory Data Elements

Data Matrix must minimally encode a Function Code One (FNC1) and a GS1 Identification Key with its associated Application Identifier (AI). Some common examples for GS1 Identification keys that can be directly marked with Data Matrix include:

- (01) GTIN (Global Trade Item Number)
- (8003) GRAI (Global Returnable Asset Identifier)
- (8004) GIAI (Global Individual Asset Identifier)

2.8.4.2 Optional Data Elements

Using Application Identifiers, additional elements that refer to the particular key can be encoded using similar rules to concatenate AI's as documented in section 4.0.

Refer to Section 7 of these *GS1 General Specifications* for a complete description of Element Strings.

For Example:

- Healthcare: Using AI's (17) and (10) with GTIN
- Parts Identification: Using AI (21) with GTIN

Figure 2.8.4.2-1

Example of Data Matrix Symbol Encoded with GTIN and AI's (17) and (10) per Section 2.7

(17) 050101 (10) ABC123



(01) 04012345678901

Figure 2.8.4.2-2

Example of Data Matrix Symbol Encoded with GTIN and Serial Number AI (21)

(21) ABCDEFG123456789



(01) 04012345678901

2.8.5 Marking Methods

It is important to analyse the selected method of marking in relation to several considerations:

- Finishes that cause an excess of shadowing or glare
- Surfaces that do not provide sufficient contrast - less than 20% difference in surface reflectance.
- Safety critical parts that can not be marked with intrusive methods
- Marking method must comply with the users requirements
- Location of the symbol should not be:
 - In direct air/water etc. streams
 - On sealing surfaces
 - On surfaces subject to wear or exposure to heavy contact

2.8.5.1 Intrusive (Subtractive Methods)

Intrusive marking refers to methods that remove or alter the material of the host.

- Abrasive blast
- Dot peen
- Electro-chemical marking, colouring or etching
- Engraving/milling
- Fabric embroidery/weaving
- Direct laser marking
- Laser shot peening
- Laser Inducted Surface Improvement (LISI)
- Gas Assisted Laser Etch (GALE)
- Laser Induced Vapor Deposition (LIVD)

2.8.5.2 Non-Intrusive (Additive Methods)

Non-Intrusive marking does not affect the host material; it usually involves the addition of material.

- Cast, forge, mold
- Inkjet
- Laser bonding
- Liquid metal jet
- Silk screen
- Stencil

2.8.5.3 Host (Substrate) Surface

Direct part marking of Data Matrix should be reserved for surfaces no rougher than 250 micro-inches (millionths of an inch) and for surfaces that are no smoother than 8 micro-inches. Surfaces that fall outside these parameters need to be re-surfaced or marked using an alternative method.

Consideration of the surface colour must be taken. A minimum 20% difference in contrast between the host and the symbol is required.

Altering the cell size in relation to the surface roughness should provide adequate contrast on cast surfaces.

$$(\text{Cell size} = (0.00006 \times \text{Roughness}) + 0.0067) \text{ (See Table 2.8.5.3-1)}$$

Table 2.8.5.3-1

Average Roughness	Cell Size Minimum
.508 micrometers (20 micro inches)	.1905mm (.0075")
1.524 micrometers (60 micro inches)	.2286mm (.009")
3.048 micrometers (120 micro inches)	.381mm (.015")
5.08 micrometers (200 micro inches)	.508mm (.020")
7.62 micrometers (300 micro inches)	.635mm (.025")
10.668 micrometers (420 Micro inches)	.762mm (.030")

2.8.5.4 Substrate Surface Thickness

A minimum host surface thickness is recommended as is a maximum marking depth. Both are outlined in the table below.

Table 2.8.5.4-1

Method	Min. Thickness	Max Marking Depth
Dot Peen	1.016 mm (.04")	.102 mm (.004")
Laser Shot peening	.508mm (.020")	.051 mm (.002")
Laser Bonding	.025 mm (.001")	Surface Mark
Abrasive Blast	.076 mm (.003")	.008 mm (.0003")
Electro-Chemical Colouring	.508 mm (.02")	.051 mm (.002")
Laser Etch	.762 mm (.03")	.076 mm (.003")
LISI	1.016 mm (.04")	.102 mm (.004")
Laser Engraving	1.27 mm (.05")	.127 mm (.005")
Electro-Chemical Etch	2.54 mm (.100")	.254 mm (.01")
Micro-Milling	31.75 mm (1.250")	3.175 mm (.125")

2.8.6 Symbol Metrics

2.8.6.1 X and Y Dimensions

Some sources express the height of the 2D cell in terms of a Y dimension. For Data Matrix the cells are considered the same size under optimal print conditions so that $X = Y$. Consult System Symbol Specification Table 7: 2D Symbols Using Data Matrix, Figure 5.4.2.8-8, for minimum and maximum printing densities and other sizing requirements. Symbol size is determined by the amount of data and the number of rows and columns required to encode the data for the printing density selected. Consult Section 5.6 and Tables 5.6.3.2-1 and 5.6.3.2-2

2.8.6.2 Human Readable Interpretation

2.8.6.2.1 Location

If printed, the GTIN shall be printed in human-readable form underneath the symbol.

If there is sufficient space to print the human readable interpretation of the optional attribute data, it shall be printed above the symbol in proper sequence of the Application Identifiers. The data shall be printed from top to bottom and left to right. A single Application Identifier with accompanying data shall be displayed on one line and not broken into two lines.

2.8.6.2.2 Font

A clearly legible font shall be used for the human-readable digits, e.g. OCR-B as defined in *ISO 1073-2*. Reasonable alternative type fonts and character sizes are acceptable provided the interpretation is clearly legible. The font should be one that is considered suitable and compatible with other printed materials. When necessary, the font used shall be in accordance with applicable government laws and regulations.

2.8.6.2.3 Format

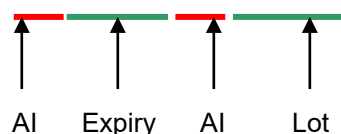
The GTIN shall be printed as a single 14-digit number preceded by the corresponding Application Identifier (01) enclosed in a parenthesis.

(01)04012345678901



The data should be printed with the preceding AI's enclosed in parenthesis. The order of the data should be the same as encoded in the Data Matrix symbol according to the rules in these *GS1 General Specifications*. The parentheses are not part of the data and are not encoded in the bar code symbol, though the AI's are.

(17)050103(10)ABC123



2.8.6.3 Symbol Quality

The minimum Symbol quality grade for Data Matrix Symbols shall be specified by the application specification. The measurement of the quality parameters shall be made by a verifier conforming to *ISO/IEC 15415*. According to this standard an overall grade is shown in the form:

Grade/Aperture/Light/Angle

Where:

- "grade" is the overall symbol grade as defined in *ISO/IEC 15415 Information technology - Automatic identification and data capture techniques - Bar code symbol print quality test specification - Two-dimensional symbols* (e.g., the arithmetic mean to one decimal place of the Scan Reflectance Profile or scan grades). For Data Matrix, the grade number may be followed by an asterisk, *, which indicates that the surroundings of the symbol contain extremes of reflectance that may interfere with reading. For most applications, this should be specified as causing the symbol to fail.
- "aperture" is the diameter in thousandths of an inch (to the nearest thousandth) of the synthetic aperture defined in *ISO/IEC 15415 Information technology - Automatic identification and data capture techniques - Bar code symbol print quality test specification - Two-dimensional symbols*.
- "Light" defines the illumination: a numeric value indicates the peak light wavelength in nanometers (for narrow band illumination); the alphabetic character W indicates that the symbol has been measured with broadband illumination ("white light") the spectral response characteristics of which must imperatively be defined or have their source specification clearly referenced.
- "Angle" is an additional parameter defining the angle of incidence (relative to the plane of the symbol) of the illumination. It shall be included in the reporting of the overall symbol grade when the angle of incidence is other than 45°. Its absence indicates that the angle of incidence is 45°.

Note: This international standard provides for 30 degrees and 90 degrees illumination in addition to the default 45 degrees.

The aperture is normally specified as being 80% of the minimum X-dimension allowed for the application. The printing method must produce the Data Matrix "L" pattern with gaps between the dots less than 25% of the specified aperture. If symbols with greater than the minimum X dimension are allowed by the application, the same absolute maximum gap dimension must be maintained.

2.8.6.4 Location

General principles on placement of bar codes are described in Section 6 and apply to the location of Data Matrix Symbols.

The majority of uses for these symbols will be on very small items with curved surfaces such as vials, ampoules, and very small bottles. For guidance in locating these symbols on curved surfaces, refer to Section 6.2.3.2.

2.8.7 Scanning Requirements

Data Matrix requires a two-dimensional imaging scanner or vision system to read the Data Matrix symbol. Data Matrix is not omni-directionally scannable using a retail style slot scanner. Handheld laser scanners or linear array imagers cannot scan Data Matrix.

Section 3.0:

Definitions of the Element Strings

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3.1 Introduction

This section describes the meaning, structure, and function of the GS1 System Element Strings so they can be correctly processed in users' application programmes.

Automatic processing of Element Strings in business applications requires information about the type of transaction to which the transferred data refers. See [Section 7.0](#) for an explanation of this process. [Section 4.0](#) provides details on associations between Element Strings. Element Strings are grouped according to their symbology identifier (see Section 5.0 for details on symbology identifiers)

3.2 UPC-A, UPC-E, and EAN-13 Bar Code Symbols

This section describes Element Strings that begin with symbology identifier JE0.

3.2.1 Identification of a Fixed Measure Trade Item (GTIN)

This Element String is based on the UCC-12 or EAN/UCC-13 Data Structure (see [Section 1.3](#)).

Figure 3.2.1 – 1

Format of the Element String													
GS1 Company Prefix ← ← Item Reference												Check Digit	
(EAN/UCC-13)	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃
(UCC-12)	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂

The GS1 Company Prefix is allocated a GS1 Member Organisation to a system user. It makes the ID number unique worldwide but does not identify the origin of the item. GS1 Company Prefixes starting with GS1 Prefixes* 000 to 019, 030 to 039, 060 to 099, 100 to 139, 300 to 969, or 977 to 979 in the first three digits are used in this Element String.

The Item Reference is assigned by the system user, who must observe the rules in [Section 2.1](#).

The Check Digit is explained in [Section 3.A.1](#). Its verification, carried out automatically by the bar code reader, ensures that the number is correctly composed.

The data carriers for this Element String are:

- UPC-A Bar Code Symbol (carrying a UCC-12 ID Number)
- UPC-E Bar Code Symbol** (carrying a UCC-12 ID Number)
- EAN-13 Bar Code Symbol (carrying an EAN/UCC-13 ID Number)

The system recognises this Element String by the symbology identifier JE0 and the GS1 Prefixes starting with 000 to 019, 030 to 039, 060 to 099, 100 to 139, 300 to 969, or 977 to 979.

The data transmitted from the bar code reader means that one Fixed Measure Trade Item with an EAN/UCC-13 ID Number has been captured.

	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	T ₁₁	T ₁₂	T ₁₃	T ₁₄
GTIN format*** of this number for	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃
processing in a 14-digit field	0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂

* Some GS1 Prefixes require Element Strings be constructed according to particular rules, which can be found in [Sections 3.2.4](#) and [2.1.2.1.3](#).

**For information on representing an ID number in a UPC-E Bar Code Symbol, see [Section 3.A.2](#).

*** T represents the position of each individual digit in a computer file format, N represents the position of each individual digit in a given data structure, and 0 represents a filler digit.

3.2.2 Identification of a Trade Item for Restricted Distribution - Fixed Measure

Although this Element String is mainly used for the identification of trade items, it may be used for any purpose as long as it is kept within a restricted environment (see [Section 2.6.4.4](#)).

This Element String is for use within a GS1 Member Organisation's geographic region. The GS1 Member Organisation may assign a company a GS1 Prefix for use externally throughout a region or may assign the prefix for use internally within a region. The numbers are never unique if they leave the region and, if assigned for a company's internal use, are not unique if they leave the company or region.

Figure 3.2.2 – 1

Format of the Element String												
GS1 Prefix		Item Reference										Check Digit
2	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃

The GS1 Prefix must be in the series 20 to 29. A particular prefix may be assigned either for use on Fixed Measure Trade Items for restricted distribution, Variable Measure Trade Items (see [Section 3.2.4](#)), or for special applications (see [Section 2.6.4.4](#)).

The Item Reference is assigned by the company that uses the Element String. Positions N₃ to N₁₂ may contain any digit.

The Check Digit is explained in [Section 3.A.1](#). Its verification, carried out automatically by the bar code reader, ensures that the number is correctly composed.

The data carrier for this Element String is an EAN-13 Bar Code Symbol.

The system recognises this Element String by the symbology identifier JEO and the GS1 Prefix assigned by the relevant GS1 Member Organisation.

The data transmitted from the bar code reader means that one Fixed Measure Trade Item with an EAN/UCC-13 ID Number has been captured.

The format* of this number for

processing in a 14-digit field

T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	T ₁₁	T ₁₂	T ₁₃	T ₁₄
0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃

* T represents the position of each individual digit in a computer file format, N represents the position of each individual digit in a given data structure, and 0 represents a filler digit.

3.2.3 Identification of a Trade Item Within a Company - Fixed Measure

Although this Element String is mainly used for the identification of trade items, it may be used for any purpose as long as it is kept within a restricted environment (see [Section 2.6.4.4](#)).

This Element String is for a company's internal use. Because any company may use this Element String, it does not provide unique identification of a trade item if it leaves the company's premises.

Figure 3.2.3 – 1

Format of the Element String												
GS1 Prefix		Item Reference										Check Digit
0	4	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃
0	0	0	I ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃

The GS1 Prefix 04 is a system identifier showing that the identification number is under the sole control of the assigning company and that it is for internal trade item distribution. The same applies to GS1 Prefix 00 when I₄ has any value from 1 to 7.

The Item Reference is assigned by the company that uses the Element String. Positions N₃ to N₁₂ may contain any digit.

The Check Digit is explained in [Section 3.A.1](#). Its verification, carried out automatically by the bar code reader, ensures that the number is correctly composed.

The data carrier for this Element String is the UPC-A Bar Code Symbol.

The system recognises this Element String by the symbology identifier JEO and GS1 Prefix 04 or 00 with the digits 01 to 07 in the next two positions.

The data transmitted from the bar code reader means that one Fixed Measure Trade Item with an EAN/UCC-13 ID Number has been captured.

The formats* of these numbers for

processing in a 14-digit field

T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	T ₁₁	T ₁₂	T ₁₃	T ₁₄
0	0	4	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃
0	0	0	0	I ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃

* T represents the position of each individual digit in a computer file format, N represents the position of each individual digit in a given data structure, and 0 represents a filler digit.

3.2.4 Short Identification Number with Price or Measure of a Trade Item for Restricted Distribution

The first row in Figure 3.2.4 – 1 shows the structure specified by GS1 US for North America. The same structure is used by many other GS1 Member Organisations. The next two rows do not show predetermined structures. Examples of recommended structures are given in Figure 3.2.4 – 2. GS1 Member Organisations choose appropriate structures for use within their geographic area.

Figure 3.2.4 – 1

Format of the Element String

GS1 Prefix	Item Reference	Price Verifier-Digit	Item Price	Check Digit
0 2	N ₃ N ₄ N ₅ N ₆ N ₇	N ₈	N ₉ N ₁₀ N ₁₁ N ₁₂	N ₁₃
0 2	N ₃ N ₄ N ₅ N ₆ N ₇ N ₈ N ₉ N ₁₀ N ₁₁ N ₁₂			N ₁₃
2 N ₂	N ₃ N ₄ N ₅ N ₆ N ₇ N ₈ N ₉ N ₁₀ N ₁₁ N ₁₂			N ₁₃

The GS1 Prefix must be 02 or 20 to 29. GS1 Prefixes 20 to 29 may be assigned for use on restricted distribution Variable Measure Trade Items with price or measure (see [Section 2.6.4](#)).

The Item Reference is usually assigned by the company that scans the Element String at its Point-of-Sale. However, some countries may specify their own standard numbering systems for variable measure products administered by their GS1 Member Organisation or by a trade association.

The price verifier-digit is the result of a special calculation, and its verification ensures correct reading of the price. For details, see [Section 3.A.1](#). Security of reading this Element String without a price verifier-digit depends on the Element String's Check Digit (see [Section 3.A.1](#)).

The item price is the price of the trade item in the relevant currency with an implied decimal point defined by the trading partners or the relevant GS1 Member Organisation. A different format is required for each position of the implied decimal point. Multiple formats require an unambiguous way to differentiate each format, and separate GS1 Prefixes may be assigned to accomplish this.

The Check Digit is explained in [Section 3.A.1](#). Its verification, carried out automatically by the bar code reader, ensures that the data corresponds with the verification rules.

Figure 3.2.4 – 2

Examples of Alternative Data Structures		
Item Reference	Price verifier-digit	Item price
Item Reference		Item price
Item Reference	Measure verifier-digit	Item measure
Item Reference		Item measure

When the price (or weight) of an item is encoded using this Element String, a price verifier-digit or a measure verifier-digit should be used. The measure verifier-digit is calculated from the digits in the item measure field in the same way that the price verifier-digit is calculated from the item price digits (see [Section 3.A.1](#)).

The item measure is a measurement of the trade item with a defined unit of measure and an implied decimal point position. The unit of measure and decimal point position are defined within the relevant geographic area for each GS1 Prefix and/or format code. The item measure may be weight only if local weights and measures regulations permit.

The data carriers for this Element String are:

- UPC-A Bar Code Symbols
- EAN-13 Bar Code Symbols

The system recognises this Element String by the symbology identifier JE0, the GS1 Prefix 02 or 20 to 29, and the structure defined by the GS1 Member Organisation in which it is operating. Note that some of the prefixes 20 to 29 may have been assigned by GS1 Member Organisations to the Element String as described in [Section 3.2.2](#).

The data transmitted from the bar code reader means that data about a Variable Measure Trade Item has been captured. The bar code reader normally performs the price verifier-digit and the measure verifier-digit calculation. Failing this, the calculation must take place in the application software.

	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	T ₁₁	T ₁₂	T ₁₃	T ₁₄
The formats** of these numbers for	0	0	2	N ₃	N ₄	N ₅	N ₆	N ₇	0	0	0	0	0	C *
processing in a 14-digit field	0	0	2	Item Reference → ← Zeros										C *
	0	2	N ₂	Item Reference → ← Zeros										C *

* The Check Digit is to be recalculated.

** T represents the position of each individual digit in a computer file format, N represents the position of each individual digit in a given data structure, and 0 represents a filler digit.

3.2.5 Coupon Identification for Restricted Distribution

A coupon is a voucher with a cash value that is deducted at the Point-of-Sale. It is sometimes associated with a specific trade item. Coupon identification is organised on a national level and is therefore not unique worldwide. The specification of the coupon data structure in the Element String is the responsibility of each GS1 Member Organisation.

Figure 3.2.5 – 1

Format of the Element String												
GS1 Prefix		Coupon Data										Check Digit
9	9	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃

The GS1 Prefix 99 denotes the Element String for GS1 coupon identification.

The structure of the coupon data field is determined according to the needs of a particular country. Mandatory components are the coupon issuer number and the coupon reference number. Other useful data are the redemption value in real or encoded format and codes for the decimal point or tax rates.

The Check Digit is explained in [Section 3.A.1](#). Its verification, carried out automatically by the bar code reader, ensures that the data corresponds with the verification rules.

The data carrier for this Element String is the EAN-13 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]E0 and the GS1 Prefix.

The data transmitted from the bar code reader means that the data of a coupon has been captured. Processing of coupons at a Point-of-Sale usually consists of validity checks and deduction of its value.

3.2.6 GS1 US Coupon Identification for Restricted Geographic Distribution

GS1 US coupon identification consists of the actual coupon identification data and supplementary information represented in a GS1-128 Coupon Extended Code. The *Application Standard for UCC Coupon Codes* provides detailed information on data contents and applied codes.

Note: GS1 US coupon identification is used in the United States and Canada and cannot be used beyond their boundaries.

Figure 3.2.6 – 1

Format of the Element String											
UCC Prefix	Company Number					Family Code			Value Code		Check Digit
5	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂

The UCC Prefix 5 denotes the Element String for GS1 US coupon identification.

The Company Number is that of the company issuing the coupon for redemption if a product symbol marked with the same Company Number in the item identification number has been purchased.

The Family Code is used to validate the coupon.

The Value Code is the redemption value of the coupon in encoded format.

The Check Digit is explained in [Section 3.A.1](#). Its verification, carried out automatically by the bar code reader, ensures that the data corresponds with the verification rules.

The data carrier for this Element String is the UPC-A Bar Code Symbol.

The system recognises this Element String by the symbology identifier JE0 and the UCC Prefix 5.

Note: The Company Number N₂ to N₆ uses the implied UCC Prefix 0 (zero). If the coupon is applicable to a Global Trade Item Number™ (GTIN™) beginning with a UCC Prefix other than zero, an AI (8100) to (8102) (GS1-128 Coupon Extended Code) must be present.

3.2.7 Common Currency Coupon Code Identification for Restricted Distribution

A coupon is a voucher with a cash value that is deducted at the Point-of-Sale. It is sometimes associated with a specific trade item. Coupon identification is normally organised on a national level using the GS1 Prefix 99. However, for a common currency area, coupon identification is organised between participating countries. Determining the coupon data structure in the Element String is the responsibility of all the GS1 Member Organisations in the common currency area.

Figure 3.2.7 – 1

Format of the Element String												
GS1 Prefix			Coupon Data									Check Digit
9	8	1	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃
9	8	2	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃

The GS1 Prefixes 981 and 982 denote the Element String for GS1 Common Currency Coupon Numbers.

The structure of the coupon data positions is determined according to the needs of a particular set of countries. Mandatory components are the coupon issuer number and the coupon reference number. Further useful data is the redemption value in real or encoded format and numbers for the decimal point or tax rates.

The Check Digit is explained in [Section 3.A.1](#). Its verification, carried out automatically by the bar code reader, ensures that the data corresponds with the verification rules.

The data carrier for this Element String is the EAN-13 Bar Code Symbol.

The system recognises this Element String by the symbology identifier JE0 and the GS1 Prefix. The data transmitted from the bar code reader means that the data of a common currency coupon has been captured. Processing of coupons at a Point-of-Sale usually consists of validity checks and deduction of its value.

The only application of GS1 Prefixes 981 and 982 are for the euro. The euro is a currency that began to replace the national currencies of some countries on 1 January 1999. A migration period of several years is planned, with notes and coins being introduced in 2002. Within the euro-areas, coupon issuer numbers are administered by:

EAN BELGIUM•LUXEMBOURG
 Rue Royale 29, B-1000 Brussels, BELGIUM
 Tel: + 32.2.229.18.80, Fax: + 32.2.217.43.47,
 Email: info@eanbelgilux.be

3.2.8 Identification of Refund Receipts - Restricted Distribution

Refund Receipts are vouchers produced by equipment handling empty containers (bottles and crates), automatically. These receipts have a cash value that is refunded when the receipt is scanned at the Point-of-Sale.

Figure 3.2.8 – 1

Format of the Element String												
GS1 Prefix			Identification →						← Value			Check Digit
9	8	0	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃

The GS1 Prefix 980 denotes the Element String for the identification of Refund Receipts.

The identification and value positions contain an identification number and the value of the voucher. It may be structured by a particular system user to meet his needs or by the GS1 Member Organisation as a standard for its sphere of jurisdiction. The identification number may be of any structure and shall provide a certain protection against invalid redemption.

The Check Digit is explained in [Section 3.A.1](#). Its verification, carried out automatically by the bar code reader, ensures that the data corresponds with the verification rules.

The data carrier for this Element String is the EAN-13 Bar Code Symbol.

The system recognises this Element String by the symbology identifier JE0 and the GS1 Prefix 980.

The data transmitted from the bar code reader means that the data of a Refund Receipt has been captured.

3.3 EAN-8 Bar Code Symbols

This section describes the full strings beginning with symbology identifier]E4 (EAN-8 Bar Code Symbol).

3.3.1 Identification of a Fixed Measure Trade Item (GTIN)

This Element String is based on the EAN/UCC-8 Data Structure (see [Section 1.3](#)).

Figure 3.3.1 – 1

Format of the Element String							
EAN/UCC-8 Prefix →				← Item Reference			Check Digit
N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈

The EAN/UCC-8 Prefix is a one-, two-, or three-digit index number, administered by GS1 Global Office. It does not identify the origin of the item. GS1 Prefixes 100 to 139 and 300 to 969 in positions N₁ to N₃ are used in this Element String. Others may be added in the future.

The Item Reference is assigned by the GS1 Member Organisation. The GS1 Member Organisations provide procedures for obtaining EAN/UCC-8 Identification Numbers.

The Check Digit is explained in [Section 3.A.1](#). Its verification, carried out automatically by the bar code reader, ensures that the number is correctly composed.

The data carrier for this Element String is the EAN-8 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]E4 and by N₁ not being 0 or 2.

The data transmitted from the bar code reader means that one Fixed Measure Trade Item with an EAN/UCC-8 ID Number has been captured.

GTIN format* of this number for

processing in a 14-digit field

T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	T ₁₁	T ₁₂	T ₁₃	T ₁₄
0	0	0	0	0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈

* T represents the position of each individual digit in a computer file format, N represents the position of each individual digit in a given data structure, and 0 represents a filler digit.

3.3.2 Identification of a Trade Item Within a Company - Fixed Measure

Although this Element String is mainly used for identifying trade items, it may be used for any purpose as long as it is kept within a restricted environment (see [Section 2.6.4.4](#)).

This Element String is for internal use in a company. The numbers are assigned by individual companies and do not provide unique identification if they leave the company premises.

Figure 3.3.2 – 1

Format of the Element String							
EAN/UCC-8 Prefix	Item Reference						Check Digit
N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈

The EAN/UCC-8 Prefixes 0 or 2 are system identifiers that show that the item identification number is under the sole control of the assigning company and that it is for internal item distribution.

The Item Reference is allocated by the company that uses the Element String. The positions N₂ to N₇ may contain any digit.

The Check Digit is explained in [Section 3.A.1](#). Its verification, carried out automatically by the bar code reader, ensures that the number is correctly composed.

The data carrier for this Element String is the EAN-8 Bar Code Symbol.

The system recognises this Element String by the symbology identifier JE4 and by N₁ being 0 or 2.

The data transmitted from the bar code reader means that one Fixed Measure Trade Item with an EAN/UCC-8 ID Number has been captured.

The format* of this number for processing in a 14-digit field

T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	T ₁₁	T ₁₂	T ₁₃	T ₁₄
0	0	0	0	0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈

* T represents the position of each individual digit in a computer file format, N represents the position of each individual digit in a given data structure, and 0 represents a filler digit.

3.4 Two-Digit and Five-Digit Add-On Symbols

This section describes the full strings beginning with symbology identifier JE1 (two-digit Add-On Symbol) and JE2 (five-digit Add-On Symbol).

These Element Strings may be transmitted with the data normally following the symbology identifier JE0, in which case the symbology identifier JE1 (two-digit Add-On Symbol) or JE2 (five-digit Add-On Symbol) is required. A single full string with the symbology identifier JE3 is followed by the data from the main symbol and the Add-On Symbol (see [Section 5.0](#)).

3.4.1 Serial Number for Serial Publications

A serial publication is identified by a trade item number as described in [Section 2.1.2.1.5.5](#). Together the item identification number and serial number identify a particular issue of a particular serial publication.

Figure 3.4.1 – 1

Format of the Element String	
Serial Number for Serial Publications	
N ₁	N ₂

The serial number for serial publications always refers to the corresponding item identification number and has meaning as described in Figure 3.4.1 – 2.

Figure 3.4.1 – 2

Appearance	Applied Serial Numbers
Daily	Number of the week (01 - 53)
Weekly	Number of the week (01 - 53)
Bi-weekly	Number of the first week of the covered period (01 - 53)
Monthly	Number of the month (01 - 12)
Bi-monthly	Number of the first month of the covered period (01 - 12)
Quarterly	Number of the first month of the covered period (01 - 12)
Seasonally	N ₁ = last digit of the year N ₂ = 1 summer, 2 autumn, 3 winter, 4 spring
Bi-annually	N ₁ = last digit of the year N ₂ = number of the first season of the covered period
Annually	N ₁ = last digit of the year N ₂ = digit 5
Special intervals	Consecutively numbered from 01 - 99

The data carrier for this Element String is the two-digit Add-On Symbol.

The system recognises this Element String by the symbology identifier JE1. The two-digit Add-On Symbol must be jointly used with a UPC-A, UPC-E, or EAN-13 Bar Code Symbol. It is never scanned alone, and the data from both bar code symbols can be used together for processing.

3.4.2 Supplementary Information for Books, Paperbacks, and Serials

Books, paperbacks, and serial publications are identified by a Global Trade Item Number™ (GTIN™) as described in Section 2.1.2.1.5. This Element String provides more information about a particular publication of the printed item, but it is not required for the identification of the title itself.

Figure 3.4.2 – 1

Format of the Element String				
Supplementary Information				
N ₁	N ₂	N ₃	N ₄	N ₅

The supplementary information consists of numeric data of any structure and meaning. It is the publisher's responsibility to define the numbering scheme.

The data carrier for this Element String is the five-digit Add-On Symbol.

The system recognises this Element String by the symbology identifier JE2. The five-digit Add-On Symbol must be jointly used with a UPC-A, UPC-E or EAN-13 Bar Code Symbol. It is never scanned alone, and the data from both bar code symbols can be used together for processing.

3.5 ITF-14 Symbols

This section describes the full strings beginning with symbology identifier]I1.

The]I1 symbology identifier not only indicates that an ITF-14 Symbol has been scanned but that the bar code reader has verified the Check Digit. If the bar code reader has not been set to verify the Check Digit, the symbology identifier will be]I0. If this is the case, Check Digit verification must be carried out in the application programme.

3.5.1 EAN/UCC-13 Identification Number: Identification of a Fixed Measure Trade Item (GTIN)

This Element String is based on the UCC-12 or EAN/UCC-13 Data Structure (see [Section 1.3](#)).

Figure 3.5.1 – 1

	Format of the Element String														
	GS1 Company Prefix and Item Reference													Check Digit	
	(EAN/UCC-13)	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃
	(UCC-12)	0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂

The GS1 Company Prefix is allocated by GS1 Member Organisations to a system user. The Item Reference is assigned by the system user, who must observe the rules in [Section 2.1](#). Leading zeros are used to create a 14-digit number, which is required by the data carrier.

The Check Digit is explained in [Section 3.A.1](#). Its verification, usually carried out automatically by the bar code reader, ensures that the number is correctly composed. The symbology identifier shows whether or not the Check Digit has been validated. If it has not, the Check Digit verification must be programmed in the application software.

The data carrier for this Element String is the ITF-14 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]I1 and the number of the decoded digits (14). This Element String might not be supported at the Point-of-Sale.

The data transmitted from the bar code reader means that one Fixed Measure Trade Item with either an EAN/UCC-13 ID Number or a UCC-12 ID Number has been captured.

GTIN format* of this number for

processing in a 14-digit field

T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	T ₁₁	T ₁₂	T ₁₃	T ₁₄
0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃
0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂

* T represents the position of each individual digit in a computer file format, N represents the position of each individual digit in a given data structure, and 0 represents a filler digit.

3.5.2 EAN/UCC-14 Identification Number: Identification of a Fixed Measure Trade Item (GTIN)

This Element String is based on the EAN/UCC-14 Data Structure (see [Section 1.3](#)). It may only be used for the identification of trade items that contain two or more trade items that share the same identification number.

Figure 3.5.2 – 1

Format of the Element String														
Global Trade Item Number™ (GTIN™)														
	Indicator	GTIN of Contained Trade Items (Without Check Digit)												Check Digit
(EAN/UCC-8)	N ₁	0	0	0	0	0	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄
(UCC-12)	N ₁	0	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄
(EAN/UCC-13)	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄

The Indicator is a digit with a value of 1 to 8. It is assigned as required by the company that constructs the identification number. It can provide up to eight separate EAN/UCC-14 Identification Numbers to identify groupings of trade items.

The GTIN of the trade items contained must always be the EAN/UCC-13, UCC-12, or EAN/UCC-8 Identification Number of the relevant level of packaging contained, usually the lowest level. GTINs for restricted distribution must not be used in this Element String.

The Check Digit is explained in [Section 3.A.1](#). Its verification, usually carried out automatically by the bar code reader, ensures that the number is correctly composed. The symbology identifier shows whether or not the Check Digit has been validated. If it has not, the Check Digit calculation must be programmed in the application software.

The data carrier for this Element String is the ITF-14 Bar Code Symbol.

The system recognises this Element String by the symbology identifier J11 and the number of digits decoded (14). This Element String might not be supported at the Point-of-Sale.

The data transmitted from the bar code reader means that one Fixed Measure Trade Item with a GTIN has been captured. It is important that the EAN/UCC-14 Identification Number is always processed in its entirety.

GTIN format* of this number for

processing in a 14-digit field

T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	T ₁₁	T ₁₂	T ₁₃	T ₁₄
N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄

* T represents the position of each individual digit in a computer file format, N represents the position of each individual digit in a given data structure.

3.5.3 EAN/UCC-14 Identification of a Variable Measure Trade Item (GTIN)

The identification of a Variable Measure Trade Item is usually represented in Element Strings using Application Identifiers as described in Sections 3.6.3, 3.6.20, and 3.6.21.

The Element String described in this section is an alternative that may be adequate in circumstances where an ITF-14 Symbol must be used to represent the identification number of the trade item.

Figure 3.5.3 – 1

	Format of the Element String														
	Global Trade Item Number™ (GTIN™)														
	Indicator	GS1 Company Prefix →							← Item Reference					Check digit	
	(UCC-12)	9	0	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄
	(EAN/UCC-13)	9	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄

The digit 9 in the Indicator position indicates that the identification number is for a Variable Measure Trade Item.

The GS1 Company Prefix and the Item Reference are applied as described in Section 3.2.1. When the trade item contained is identified by an EAN/UCC-8 Identification Number and this product is sold in bulk, these two fields may be replaced by the EAN/UCC-8 Identification Number padded with five leading zeros without the Check Digit.

The Check Digit is explained in Section 3.A.1. Its verification, usually carried out automatically by the bar code reader, ensures that the number is correctly composed. The symbology identifier shows whether or not the Check Digit has been validated. If it has not, the Check Digit verification must be programmed in the application software.

The data carrier for this Element String is the ITF-14 Bar Code Symbol.

The system recognises this Element String by the symbology identifier J11, the number of digits decoded (14), and the digit 9 in the Indicator position. This Element String might not be supported at the Point-of-Sale.

The data transmitted from the bar code reader means that the EAN/UCC-14 Identification Number of a Variable Measure Trade Item has been captured. To complete the item identification, the corresponding variable information must be present at the same time (see Sections 3.6.20 and 3.6.21).

GTIN format* of this number for
processing in a 14-digit field

T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	T ₁₁	T ₁₂	T ₁₃	T ₁₄
9	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄

* T represents the position of each individual digit in a computer file format, N represents the position of each individual digit in a given data structure.

3.6 GS1-128 Bar Code Symbols

This section describes the full strings beginning with symbology identifier]C1

The sub-sections for the Element Strings are in order of Application Identifier. When the full string is made up from concatenated Element Strings, each Element String must be processed separately in association with the symbology identifier]C1 from the full string.

3.6.1 Identification of a Logistic Unit: AI (00)

Figure 3.6.1 – 1

(UCC)	Format of the Element String																			
		SSCC (Serial Shipping Container Code)																		
	Application Identifier	Extension Digit	GS1 Company Prefix										Serial Reference							Check Digit
0 0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄	N ₁₅	N ₁₆	N ₁₇	N ₁₈		
0 0	N ₁	0	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄	N ₁₅	N ₁₆	N ₁₇	N ₁₈		

The Application Identifier (00) indicates that the data field contains an SSCC.

The Extension digit is used to increase the capacity of the Serial Reference within the SSCC. It is assigned by the company that constructs the SSCC.

The GS1 Company Prefix is allocated by GS1 Member Organisations to a system user (see [Section 1.2](#)). It makes the SSCC unique worldwide but does not identify the origin of the unit.

The structure and content of the Serial Reference is at the discretion of the system user responsible for its assignment.

The Check Digit is explained in [Section 3.A.1](#). Its verification, which must be carried out in the application software, ensures that the number is correctly composed.

The data carrier for this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]C1 and the Application Identifier.

The data transmitted from the bar code reader means that the identification number of a logistic unit has been captured.

3.6.2 Identification of a Fixed Measure Trade Item (GTIN): AI (01)

This Element String is based on the UCC-12, EAN/UCC-8, EAN/UCC-13, or EAN/UCC-14 Data Structure (see [Section 1.3](#)).

Figure 3.6.2 – 1

	Format of the Element String														
	Application Identifier	Global Trade Item Number™ (GTIN™)													Check Digit
(EAN/UCC-8)	0 1	0	0	0	0	0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈
(UCC-12)	0 1	0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂
(EAN/UCC-13)	0 1	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃
(EAN/UCC-14)	0 1	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄

The Application Identifier (01) indicates that the data field contains a GTIN.

The GTIN can include an EAN/UCC-8, UCC-12, or EAN/UCC-13 Identification Number (described in [Sections 3.2.1](#) and [3.3.1](#)) or an EAN/UCC-14 Identification Number (described in [Section 3.5.2](#)).

The Check Digit is explained in [Section 3.A.1](#). Its verification, which must be carried out in the application software, ensures that the number is correctly composed.

The data carrier for this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]C1 and the Application Identifier.

The data transmitted from the bar code reader means that the identification number of a Fixed Measure Trade Item has been captured

	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	T ₁₁	T ₁₂	T ₁₃	T ₁₄
GTIN format* of these numbers for	0	0	0	0	0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈
processing in a 14-digit field	0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂
	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃
	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄

* T represents the position of each individual digit in a computer file format, N represents the position of each individual digit in a given data structure, and 0 represents a filler digit.

3.6.3 Identification of a Variable Measure Trade Item (GTIN): AI (01)

This Element String is a special application of the EAN/UCC-14 Data Structure.

Figure 3.6.3 – 1

Format of the Element String													
	Application Identifier		Global Trade Item Number™ (GTIN™)										
			Indicator	GS1 Company Prefix					Item Reference				
(UCC-12)	0	1	9	0	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₄
(EAN/UCC-13)	0	1	9	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₄

The Application Identifier (01) indicates that the data field contains a GTIN.

The digit 9 in the Indicator position indicates that the item identified is a Variable Measure Trade Item.

The GS1 Company Prefix and the Item Reference are described in [Section 3.2.1](#). When the trade item contained is identified by an EAN/UCC-8 Identification Number and this product is sold in bulk, these two fields may be replaced by the EAN/UCC-8 Identification Number padded with five leading zeros without the Check Digit.

The Check Digit is explained in [Section 3.A.1](#). Its verification, which must be carried out in the application software, ensures that the number is correctly composed.

The data carrier for this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier JC1, the Application Identifier, and the digit 9 in the Indicator position.

The data transmitted from the bar code reader means that the EAN/UCC-14 Identification Number of a Variable Measure Trade Item has been captured. To complete the item identification, the variable information must be present at the same time (see [Sections 3.6.20](#) and [3.6.21](#)).

GTIN format* of this number for

processing in a 14-digit field

T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	T ₁₁	T ₁₂	T ₁₃	T ₁₄
9	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄

* T represents the position of each individual digit in a computer file format, N represents the position of each individual digit in a given data structure.

3.6.4 Identification of Trade Items Contained in a Logistic Unit - Fixed Measure: AI (02)

Note: This Element String may be used only on a logistic unit that is not itself a trade item and if all trade items that are contained at the same level have the same Global Trade Item Number™ (GTIN™).

Figure 3.6.4 – 1

Format of the Element String														
Application Identifier	GTIN of the Contained Trade Items													Check Digit
0 2	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄

The Application Identifier (02) indicates that the data field includes the GTIN of the contained trade items.

The GTIN of the trade items contained represents the identification number of the highest level of trade item contained in the logistic unit.

The Check Digit is explained in [Section 3.A.1](#). Its verification, which must be carried out in the application software, ensures that the number is correctly composed.

The data carrier of this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]C1 and the Application Identifier.

The data transmitted from the bar code reader means that the identification number of Fixed Measure Trade Items contained in a logistic unit has been captured. It must be processed together with Element String AI (37) that must appear on the same unit (see [Section 3.6.24](#)).

3.6.5 Identification of Trade Items Contained in a Logistic Unit - Variable Measure: AI (02)

Note: This Element String may be used only on a logistic unit that is not itself a trade item and if all trade items that are contained at the same level have the same Global Trade Item Number™ (GTIN™). If the trade items are variable measure retail items, then this GTIN will be the implied item number that does not appear on the items contained.

Figure 3.6.5 – 1

Format of the Element String														
Application Identifier	GTIN of the Contained Trade Item													Check Digit
0 2	9	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄

The Application Identifier (02) indicates that the data field includes the GTIN of the contained trade items.

The GTIN of the trade items contained represents the identification number of the highest level of items contained in the logistic unit.

The Check Digit is explained in [Section 3.A.1](#). Its verification, which must be carried out in the application software, ensures that the number is correctly composed.

The data carrier for this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]C1 and the Application Identifier.

The data transmitted from the bar code reader means that the EAN/UCC-14 Identification Number of a Variable Measure Trade Item contained in a logistic unit has been captured. It must be processed with Element String AI (37) and a valid trade measure that must appear on the same unit (see [Sections 3.6.20](#), [3.6.21](#), and [3.6.24](#)).

3.6.6 Batch or Lot Number: AI (10)

Figure 3.6.6 – 1

Format of the Element String	
Application Identifier	Batch or Lot Number
1 0	X ₁ ————— variable length —————> X ₂₀

The Application Identifier (10) indicates that the data field contains a batch or lot number.

The batch or lot number gives whatever information the manufacturer (the party with responsibility for traceability of the trade item) considers relevant to the trade item to which the Element String is applied. The data may refer to the trade item itself or to items contained. The number may be, for example, a production lot number, a shift number, a machine number, a time, or an internal production code. The data is alphanumeric and may include all characters contained in [Figure 3.A.3 – 1](#).

The data carrier for this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]C1 and the Application Identifier.

The data transmitted by the bar code reader means that the Element String denoting a batch or lot number has been captured. As it is an attribute of a particular item, the batch or lot number should not be processed on its own, but together with the Global Trade Item Number™ (GTIN™) of the trade item to which it relates.

Note: The batch or lot number is not part of the unique identification of a trade item.

3.6.7 Production Date: AI (11)

Figure 3.6.7 – 1

Format of the Element String			
Application Identifier	Production Date		
	Year	Month	Day
1 1	N ₁ N ₂	N ₃ N ₄	N ₅ N ₆

The Application Identifier (11) indicates that the data fields contain a production date.

The production date is the production or assembly date determined by the manufacturer. The date may refer to the trade item itself or to items contained.

The structure is:

Year: the tens and units of the year (e.g., 2003 = 03), which is mandatory.

Month: the number of the month (e.g., January = 01), which is mandatory.

Day: the number of the day of the relevant month (e.g., second day = 02); if it is not necessary to specify the day, the field must be filled with two zeros

The data carrier for this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]C1 and the Application Identifier.

The data transmitted from the bar code reader means that the Element String denoting a production date has been captured. As it is an attribute of a trade item, the production date should not be processed on its own, but together with the Global Trade Item Number™ (GTIN™) of the trade item to which it relates.

Note: This Element String can only specify dates ranging from 49 years in the past to 50 years in the future. Determination of the correct century is explained in [Section 3.A.5](#).

3.6.8 Due Date for Amount on Payment Slip: AI (12)

Figure 3.6.8 – 1

Format of the Element String			
Application Identifier	Due Date		
	Year	Month	Day
1 2	N ₁ N ₂	N ₃ N ₄	N ₅ N ₆

The Application Identifier (12) indicates that the data fields contain the date by which an invoice should be paid.

The structure is:

Year: the tens and units of the year (e.g., 1998 = 98), which is mandatory.

Month: the number of the month (e.g., January = 01), which is mandatory.

Day: the number of the day of the relevant month (e.g., second day = 02); if it is not necessary to specify the day, the field must be filled with two zeros

The data carrier for this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that a due date has been captured. Since this data element represents an attribute of a Payment Slip Reference Number, AI (8020), and a Global Location Number (GLN) of the invoicing party, it should not be processed on its own.

Note: This Element String can only specify dates ranging from 49 years in the past to 50 years in the future. Determination of the correct century is explained in [Section 3.A.5](#).

3.6.9 Packaging Date: AI (13)

Figure 3.6.9 – 1

Format of the Element String			
Application Identifier	Packaging Date		
	Year	Month	Day
1 3	N ₁ N ₂	N ₃ N ₄	N ₅ N ₆

The Application Identifier (13) indicates that the data fields contain a packaging date.

The packaging date is the date when the goods were packed as determined by the packager. The date may refer to the trade item itself or to items contained.

The structure is:

Year: the tens and units of the year (e.g., 2003 = 03), which is mandatory.

Month: the number of the month (e.g., January = 01), which is mandatory.

Day: the number of the day of the relevant month (e.g., second day = 02); if it is not necessary to specify the day, the field must be filled with two zeros

The data carrier of this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]C1 and the Application Identifier.

The data transmitted from the bar code reader means that the Element String denoting a packaging date has been captured. As it is an attribute of a trade item, the packaging date should not be processed on its own, but together with the Global Trade Item Number™ (GTIN™) of the trade item to which it relates.

Note: This Element String can only specify dates ranging from 49 years in the past to 50 years in the future. Determination of the correct century is explained in [Section 3.A.5](#).

3.6.10 Best Before Date: AI (15)

Figure 3.6.10 – 1

Format of the Element String			
Application Identifier	Best Before Date		
	Year	Month	Day
1 5	N ₁ N ₂	N ₃ N ₄	N ₅ N ₆

The Application Identifier (15) indicates that the data fields contain a best before date.

The best before date indicates the ideal consumption or best effective use date of a product. It is a statement about quality. It is often referred to as a sell by date or a minimum durability date.

The structure is:

Year: the tens and units of the year (e.g., 2003 = 03), which is mandatory.

Month: the number of the month (e.g., January = 01), which is mandatory.

Day: the number of the day of the relevant month (e.g., second day = 02); if it is not necessary to specify the day, the field must be filled with two zeros

The data carrier for this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]C1 and the Application Identifier.

The data transmitted from the bar code reader means that the Element String denoting best before date has been captured. As it is an attribute of a trade item, the best before date should not be processed on its own, but together with the Global Trade Item Number™ (GTIN™) of the trade item to which it relates.

Note: This Element String can only specify dates ranging from 49 years in the past to 50 years in the future. Determination of the correct century is explained in [Section 3.A.5](#).

3.6.11 Expiration Date : AI (17)

Figure 3.6.11 – 1

Format of the Element String			
Application Identifier	Expiration Date		
	Year	Month	Day
1 7	N ₁ N ₂	N ₃ N ₄	N ₅ N ₆

The Application Identifier (17) indicates that the data fields contain an expiration date.

The expiration date is the date that determines the limit of consumption or use of a product. Its meaning is determined based on the trade item context (e.g., for food the date will indicate the possibility of a direct health risk resulting from use of the product after the date, for pharmaceutical products it will indicate the possibility of an indirect health risk resulting from the ineffectiveness of the product after the date). It is often referred to as "use by date" or "maximum durability date."

The structure is:

Year: the tens and units of the year (e.g., 2003 = 03), which is mandatory.

Month: the number of the month (e.g., January = 01), which is mandatory.

Day: the number of the day of the relevant month (e.g., second day = 02); if it is not necessary to specify the day, the field must be filled with two zeros

The data carrier of the Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the Element String denoting expiration date has been captured. Since the Element String represents an attribute of a trade item, the expiration date should not be processed on its own, but together with the Global Trade Item Number™ (GTIN™) of the trade item to which it relates.

Note: This Element String can only specify dates ranging from 49 years in the past to 50 years in the future. Determination of the correct century is explained in [Section 3.A.5](#).

3.6.12 Product Variant: AI (20)

This Element String is used to distinguish a variant from the standard item if the variation is not sufficiently significant to require a separate Global Trade Item Number™ (GTIN™) and if the difference is relevant only to the manufacturer.

The product variant is only for use by the manufacturer, and not for the dealings with business partners.. Although the Element String will not have meaning outside the company who issued it, the Element String may remain on the item throughout distribution.

Figure 3.6.12 – 1

Format of the Element String	
Application Identifier	Variant Number
2 0	N ₁ N ₂

The Application Identifier (20) indicates that the data field contains a variant number.

The variant number is assigned by the user of the Element String. It forms a subsidiary numbering facility that can be used in addition to the item's identification number and allows the creation of 100 variants of a particular item.

The data carrier for this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]C1 and the Application Identifier.

The data transmitted from the bar code reader means that the Element String denoting a product variant has been captured. The product variant must always be decoded and processed together with the GTIN from the same item. Outside of the applying company, it is decoded and ignored.

3.6.13 Serial Number: AI (21)

Figure 3.6.13 – 1

Format of the Element String	
Application Identifier	Serial Number
2 1	X ₁ ————— variable length —————> X ₂₀

The Application Identifier (21) indicates that the data field contains a serial number.

A serial number is assigned to an entity for its lifetime. When combined with a Global Trade Item Number™ (GTIN™), a serial number uniquely identifies an individual item. The serial number field is alphanumeric and may include all characters contained in [Figure 3.A.3 – 1](#). The manufacturer determines the serial number.

The data carrier of this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]C1 and the Application Identifier.

The data transmitted from the bar code reader means that the Element String denoting a serial number has been captured. The Element String represents an attribute of a trade item and, therefore, the serial number should not be processed on its own, but together with the identification number of the trade item to which it relates.

3.6.14 Secondary Data for Specific Health Industry Products: AI (22)

Figure 3.6.14 – 1

Format of the Element String	
Application Identifier	Secondary Data Fields
2 2	X ₁ ————— variable length —————> X ₂₉

The Application Identifier (22) indicates that the data field contains the secondary data for specific health industry products (quantity, expiration date, and lot number). The secondary data fields are described in [Section 7.8](#).

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

Note: This Element String was developed to accommodate an existing, non-GS1 System, standard used for specific healthcare products. The Element String is not recommended for new applications or other industries. The use of the Element Strings denoting expiration date and lot number are recommended instead.

3.6.15 Additional Product Identification Assigned by the Manufacturer: AI (240)

The purpose of this Element String is to enable identification data other than the Global Trade Item Number™ (GTIN™) to be represented in a GS1 System data carrier. It is a cross-reference to previously used catalogue numbers. The additional item identification is considered an attribute of the GTIN (e.g., it facilitates migration to the GS1 System during a transitional period). However, it must not be used to replace the GTIN.

Figure 3.6.15 – 1

Format of the Element String	
Application Identifier	Additional Item Identification
2 4 0	X ₁ ————— variable length —————> X ₃₀

The Application Identifier (240) indicates that the data field contains additional item identification.

The additional item identification field is alphanumeric and may include all characters contained in [Figure 3.A.3 – 1](#). Its content and structure are at the discretion of the company applying the Element String.

The data carrier for this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]C1 and the Application Identifier.

The data transmitted from the bar code reader means that the Element String denoting an additional item identification has been captured.

3.6.16 Customer Part Number: AI (241)

The purpose of this Element String is to enable identification data other than the Global Trade Item Number™ (GTIN™) to be represented in a GS1 System data carrier. The Element String should only be used between trading partners that are currently using the customer part number for ordering and who have agreed on a timetable to convert to the GTIN for their business purposes. Therefore, the use of the GTIN and the AI (241) on trade items is for transitional use during the conversion. The customer part number must not be used in place of the GTIN.

Figure 3.6.16 – 1

Format of the Element String	
Application Identifier	Customer Part Number
2 4 1	X ₁ ————— variable length —————> X ₃₀

The Application Identifier (241) indicates that the data field contains a customer part number.

The customer part number field is alphanumeric and may include all characters contained in [Figure 3.A.3 – 1](#).

The data carrier for this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]C1 and the Application Identifier.

The data transmitted from the bar code reader means that the Element String denoting a customer part number has been captured.

3.6.17 Secondary Serial Number: AI (250)

While the Element String using AI (21) (see [Section 3.6.13](#)) contains the serial number of the trade item, the Element String denoting a secondary serial number represents the serial number of a component of that item. The company applying the Element String determines which component the Element String refers to for a given trade item. The recognition of the meaning of the secondary serial number is accomplished via the Global Trade Item Number™ (GTIN™) and information provided by the issuer regarding the component to which the secondary serial number refers.

If this Element String is being used, the trade item must be symbol marked with the following Element Strings:

AI (01): representing the GTIN of the trade item

AI (21): representing the serial number of the trade item

AI (250): representing the serial number of a component of the trade item

Only one Element String with AI (250) may be associated with a particular GTIN.

Figure 3.6.17 – 1

Format of the Element String	
Application Identifier	Secondary Serial Number
2 5 0	X ₁ ————— variable length —————> X ₃₀

The Application Identifier (250) indicates that the data field contains a secondary serial number.

The secondary serial number field is alphanumeric and may include all characters contained in [Figure 3.A.3 – 1](#). The number and to what component it relates is determined by the issuer.

The data carrier for this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]C1 and the Application Identifier.

The data transmitted from the bar code reader means that the Element String denoting a secondary serial number has been captured.

3.6.18 Reference to Source Entity: AI (251)

Reference to source entity is an attribute of a trade item used to refer to the original item from which the trade item was derived. The issuer of the trade item must indicate through other means the source entity to which the data refers.

For example, the original item could be an animal from which a carcass of beef is derived. This Element String would enable reference to the original animal, so that, if the animal was found to be contaminated, all derived products could be isolated. In addition, it could also be used for regulatory compliance when recycling parts from various white goods, such as refrigerators, where it is necessary to refer to the original appliance.

Figure 3.6.18 – 1

Format of the Element String	
Application Identifier	Reference to Source Entity
2 5 1	X ₁ ————— variable length —————> X ₃₀

The Application Identifier (251) indicates that the data field consists of a reference to the original item.

The reference to the source entity field is alphanumeric and may include all characters contained in [Figure 3.A.3 – 1](#).

The data carrier for this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by symbology identifier JC1 and the Application Identifier.

The data transmitted by the bar code reader means that the Element String denoting a reference to source entity has been captured. Since this Element String represents an attribute of a Global Trade Item Number™ (GTIN™), the reference to the source entity should not be processed on its own.

3.6.19 Global Document Type Identifier (GDTI): AI (253)

This Element String is based on the EAN/UCC-13 or UCC-12 Data Structure (see [Section 1.3](#)).

Figure 3.6.19 – 1

Format of the Element String				
	Application Identifier	Global Document Type Identifier (GDTI)		
		GS1 Company Prefix →	Document Type ←	Check Digit
(UCC-12)	2 5 3	0 N ₁ N ₂ N ₃ N ₄ N ₅ N ₆ N ₇ N ₈ N ₉ N ₁₀ N ₁₁		N ₁₂
(EAN/UCC-13)	2 5 3	N ₁ N ₂ N ₃ N ₄ N ₅ N ₆ N ₇ N ₈ N ₉ N ₁₀ N ₁₁ N ₁₂		N ₁₃
		Serial Component (Optional)		
		N ₁ — variable → N ₁₇		

The Application Identifier (253) indicates that the data field contains the Global Document Type Identifier.

The GS1 Company Prefix is the GS1 Company Prefix of the document issuer (see [Section 1.2](#)). It makes the number unique worldwide.

The Document Type Reference is assigned by the document issuer.

The Check Digit is explained in [Section 3.A.1](#). Its verification, which must be carried out in the application software, ensures that the number is correctly composed.

The optional serial component is assigned to a single document for its lifetime. When combined with a Global Document Type Identifier it uniquely identifies an individual document. The serial component field is numeric and may contain up to seventeen digits. The issuer of the document determines the serial component.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the Global Document Type Identifier has been captured. It may be processed according to the particular application requirements.

3.6.19.1 GLN Extension Component: AI (254)

Figure 3.6.19.1 – 1

Format of the Element String	
Application Identifier	GLN Extension component
254	A/N ₁ — variable length —→ A/N ₂₀

The Application Identifier (254) indicates that the data field contains an extension component of a Global Location Number (GLN). The use of AI (254) is optional, but when used it must be in conjunction with AI (414) Identification of a physical location.

The GS1 Company Prefix owner determines the extension component. Once determined, it is unchanged for the life of the associated GLN.

The data carrier of this Element String is the EPC Tag, a GS1-128 or an RSS Bar Code Symbol.

The data transmitted from the reader means that the Element String denoting an extension component of a GLN has been captured. The Element String represents an attribute of a GLN and therefore, the extension component should not be processed alone, but with the identification number of the GLN to which it relates.

3.6.20 Variable Count: AI (30)

This Element String is used to complete the identification of a Variable Measure Trade Item. It contains the number of items contained in such a unit and, therefore, should never be applied in isolation.

Figure 3.6.20 – 1

Format of the Element String	
Application Identifier	Count of Items
3 0	N ₁ — variable length —→ N ₈

The Application Identifier (30) indicates that the data field contains the number of items contained in a Variable Measure Trade Item.

The count of items field represents the quantity contained in the respective trade item. It is of variable length and may have up to eight digits.

The data carrier for this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]C1 and the Application Identifier. The data transmitted from the bar code reader means that the quantity (count of items), which can be considered part of the identification of a Variable Measure Trade Item, has been captured. The variable count must be processed with the Global Trade Item Number™ (GTIN™) of the trade item to which it relates.

Note: This Element String must not be used to indicate the contained quantity of a Fixed Measure Trade Item. However, if this Element String appears on a Fixed Measure Trade Item (in error) it should not invalidate the item identification but should be treated as redundant data.

3.6.21 Trade Measures: Als (31nn, 32nn, 35nn, 36nn)

These Element Strings are used to complete the identification of a Variable Measure Trade Item. They contain information such as the weight, size, volume, or dimension of a variable measure trade item and, therefore, should never be applied alone. Several Element Strings are possible if the variables required are dimensions or weights expressed in kilograms and pounds.

Figure 3.6.21 – 1

Format of the Element String									
Application Identifier				Applicable Value					
A ₁	A ₂	A ₃	A ₄	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆

The Application Identifier digits (A₁ to A₃) (see [Figure 3.6.21 – 2](#)) indicate that the data field contains the quantity or dimension of a Variable Measure Trade Item. It also denotes the unit of measure.

The Application Identifier digit A₄ indicates the implied decimal point position, where, for example, the digit 0 means that there is no decimal point, and the digit 1 means that the decimal point is between N₅ and N₆.

The Application Identifiers used with this Element String are shown in [Figure 3.6.21 – 2](#).

Figure 3.6.21 – 2

A ₁	A ₂	A ₃	Trade Measure	Unit of Measure
3	1	0	Net weight	Kilograms
3	1	1	Length or first dimension	Metres
3	1	2	Width, diameter, or second dimension	Metres
3	1	3	Depth, thickness, height, or third dimension	Metres
3	1	4	Area	Square metres
3	1	5	Net volume	Litres
3	1	6	Net volume	Cubic metres
3	2	0	Net weight	Pounds
3	2	1	Length or first dimension	Inches
3	2	2	Length or first dimension	Feet
3	2	3	Length or first dimension	Yards
3	2	4	Width, diameter, or second dimension	Inches
3	2	5	Width, diameter, or second dimension	Feet
3	2	6	Width, diameter, or second dimension	Yards
3	2	7	Depth, thickness, height, or third dimension	Inches
3	2	8	Depth, thickness, height, or third dimension	Feet
3	2	9	Depth, thickness, height, or third dimension	Yards
3	5	0	Area	Square inches
3	5	1	Area	Square feet
3	5	2	Area	Square yards
3	5	6	Net weight	Troy ounces
3	5	7	Net weight (or volume)	Ounces
3	6	0	Net volume	Quarts
3	6	1	Net volume	Gallons (U.S.)
3	6	4	Net volume	Cubic inches
3	6	5	Net volume	Cubic feet
3	6	6	Net volume	Cubic yards

The applicable value field contains the variable measure that applies to the respective trade item.

The data carrier for this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]C1 and the Application Identifier.

The data transmitted from the bar code reader means that the quantity, which can be considered part of the identification of a Variable Measure Trade Item, has been captured. It must be processed with the Global Trade Item Number™ (GTIN™) of the trade item to which it relates.

Note: Other values of AI (3nnn) specify gross measures and logistic measures.

Note: The approval number of processor is usually assigned by a national or pluri-national authority.

3.6.22 Logistic Measures: Als (33nn, 34nn, 35nn, 36nn)

Note: The GS1 System provides standards for logistic weights and measures in metric and other units of measure. In principle, a particular logistic measure should be applied in only one unit of measure on a given logistic unit. However, application of the same attribute in several units of measure does not impede the correct processing of the transmitted data.

Figure 3.6.22 – 1

Format of the Element String									
Application Identifier				Applicable Value					
A ₁	A ₂	A ₃	A ₄	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆

The Application Identifier digits (A₁ to A₃) (see Figure 3.6.22 – 2) indicate that the data field contains the logistic quantity or dimension of a Logistic Unit or a Variable Measure Trade Item. It also denotes the unit of measure.

The Application Identifier digit A₄ indicates the implied decimal point position, where, for example, the digit 0 means that there is no decimal point, and the digit 1 means that the decimal point is between N₅ and N₆.

The Application Identifiers used with this Element String are shown in Figure 3.6.22 – 2.

Figure 3.6.22 – 2

A ₁	A ₂	A ₃	Definition of Logistic Measures	Unit of Measure
3	3	0	Logistic weight	Kilograms
3	3	1	Length or first dimension	Metres
3	3	2	Width, diameter, or second dimension	Metres
3	3	3	Depth, thickness, height, or third dimension	Metres
3	3	4	Area	Square metres
3	3	5	Logistic volume	Litres
3	3	6	Logistic volume	Cubic metres
3	4	0	Logistic weight	Pounds
3	4	1	Length or first dimension	Inches
3	4	2	Length or first dimension	Feet
3	4	3	Length or first dimension	Yards
3	4	4	Width, diameter, or second dimension	Inches
3	4	5	Width, diameter, or second dimension	Feet
3	4	6	Width, diameter, or second dimension	Yards
3	4	7	Depth, thickness, height, or third dimension	Inches
3	4	8	Depth, thickness, height, or third dimension	Feet
3	4	9	Depth, thickness, height, or third dimension	Yards
3	5	3	Area	Square inches
3	5	4	Area	Square feet
3	5	5	Area	Square yards
3	6	2	Logistic volume	Quarts
3	6	3	Logistic volume	Gallons (U.S.)
3	6	7	Logistic volume	Cubic inches
3	6	8	Logistic volume	Cubic feet
3	6	9	Logistic volume	Cubic yards

The applicable value field represents the measures of the respective unit.

The data carrier for this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]C1 and the Application Identifier.

The data transmitted from the bar code reader means that a logistic measure has been captured. It must be processed with the SSCC or the Global Trade Item Number™ (GTIN™) of the Variable Measure Trade Item appearing on the same unit.

3.6.23 Kilograms Per Square Metre: AI (337n)

This Element String is used to indicate the exact weight per square metre of a particular trade item.

Figure 3.6.23 – 1

Format of the Element String						
Application Identifier	Kilograms Per Square Metre					
3 3 7 n	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆

The Application Identifier digits (337) indicate that the data field contains kilograms per square metre.

The Application Identifier digit shown as “n” indicates the implied decimal point position, where, for example, the digit 0 means that there is no decimal point, and the digit 1 means that the decimal point is between N₅ and N₆.

The kilograms per square metre field contains the weight per area of the respective trade item. The unit of measure is kilograms.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the Element String denoting kilograms per square metre has been captured. Since the Element String represents an attribute of a trade item, it should not be processed on its own, but together with the Global Trade Item Number™ (GTIN™) of the trade item to which it relates.

3.6.24 Count of Trade Items Contained in a Logistic Unit: AI (37)

This Element String is a mandatory completion of the identification described in Sections [3.6.4](#) and [3.6.5](#).

Figure 3.6.24 – 1

Format of the Element String	
Application Identifier	Count of Trade Items
3 7	N ₁ ——— variable length ———> N ₈

The Application Identifier (37) indicates that the data field contains the number of trade items contained in a logistic unit.

The count of trade items field contains the number of trade items contained in the respective logistic unit. This information refers to the identification number of the contained trade items.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the number of trade items contained in a logistic unit has been captured. This number must be processed with the identification number represented in AI (02) (see Sections [3.6.4](#) and [3.6.5](#)) appearing on the same logistic unit.

3.6.25 Amount Payable - Single Monetary Area: AI (390n)

Note: To aid unambiguous processing AI (391n), described in [Section 3.6.26](#), should be used to indicate the currency in which the amount is expressed.

Figure 3.6.25 – 1

Format of the Element String	
Application Identifier	Applicable Amount Payable
3 9 0 n	N ₁ ——— variable length ———> N ₁₅

The Application Identifier digits(390) indicate that the data field contains the amount payable of a payment slip.

The Application Identifier digit shown as “n” indicates the implied decimal point position, where the digit 0 means that there is no decimal point, and the digit 1 means that the decimal point is before the last position of the amount payable. See examples in [Figure 3.6.25 – 2](#).

The applicable amount payable contains the sum to be paid with the respective payment slip.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data string transmitted from the bar code reader means that the amount payable of a payment slip has been captured. Since this Element String represents an attribute of a Payment Slip Reference Number and a Global Location Number (GLN) of the invoicing party, the amount payable should not be processed on its own.

See [Figure 3.6.25 – 2](#) for an example of the decimal point indication.

Figure 3.6.25 – 2

Application Identifier	Encoded Value	Actual Value
3 9 0 2	1 2 3 4 5 6 7	1 2 3 4 5 . 6 7
3 9 0 1	1 2 3 4 5 6 7	1 2 3 4 5 6 . 7 0
3 9 0 0	1 2 3 4 5	1 2 3 4 5 . 0 0

3.6.26 Amount Payable and ISO Currency Code: AI (391n)

Figure 3.6.26 – 1

Format of the Element String		
Application Identifier	ISO Currency Code	Applicable Amount Payable
3 9 1 n	N ₁ N ₂ N ₃	N ₄ ——— variable length ———> N ₁₈

The Application Identifier digits (391) indicate that the data fields consist of an ISO currency code and an applicable amount payable.

The Application Identifier digit shown as “n” indicates the implied decimal point position in the applicable amount payable field, where the digit 0 means that there is no decimal point, and the digit 1 means that the decimal point is before the last position of the amount payable. See examples in [Figure 3.6.26 – 2](#).

The ISO country code field contains the three-digit currency number of the numerical international standard ISO 4217 (data readily available on the Internet) and indicates the currency in which the amount payable is expressed.

The applicable amount payable contains the sum to be paid with the respective payment slip.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data string transmitted from the bar code reader means that the amount payable has been captured. Since this Element String represents an attribute of a Payment Slip Reference Number and a Global Location Number (GLN) of the invoicing party, it should not be processed on its own.

See [Figure 3.6.26 – 2](#) for an example of the decimal point indication. [Figure 3.6.26 – 2](#)

Application Identifier	ISO Currency Code	Encoded Value	Actual Value
3 9 1 2	7 1 0*	1 2 3 0	1 2 . 3 0
3 9 1 1	7 1 0*	1 2 3 0	1 2 3 . 0 0
3 9 1 0	9 7 8**	1 2 3	1 2 3 . 0 0

*South African rand

**Euro

3.6.27 Amount Payable for a Variable Measure Trade Item – Single Monetary Area: AI (392n)

The amount payable refers to an item identified by the Global Trade Item Number™ (GTIN™) of a Variable Measure Trade Item and is expressed in local currency. This AI is an attribute of the GTIN and is always used in conjunction with it.

Figure 3.6.27 – 1

Format of the Element String	
Application Identifier	Applicable Amount Payable
3 9 2 n	N ₁ ————— variable length —————> N ₁₅

The Application Identifier digits (392) indicate that the data field contains the amount payable for a Variable Measure Trade Item.

The Application Identifier digit shown as “n” indicates the implied decimal point position, where the digit 0 means that there is no decimal point, and the digit 1 means that the decimal point is before the last position of the amount payable.

The applicable amount payable contains the total to be paid for the Variable Measure Trade Item.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted by the bar code reader means that the Element String denoting amount payable of a Variable Measure Trade Item has been captured. Since this Element String represents an attribute of a GTIN, the amount payable should not be processed on its own.

See Figure 3.6.27 – 2 for an example of the decimal point indication.

Figure 3.6.27 – 2

Application Identifier	Encoded Value	Actual Value
3 9 2 2	1 2 3 4 5 6 7	1 2 3 4 5 . 6 7
3 9 2 1	1 2 3 4 5 6 7	1 2 3 4 5 6 . 7 0
3 9 2 0	1 2 3 4 5	1 2 3 4 5 . 0 0

3.6.28 Amount Payable for a Variable Measure Trade Item and ISO Currency Code: AI (393n)

The amount payable refers to an item identified with the Global Trade Item Number™ (GTIN™) of a Variable Measure Trade Item and is expressed in the indicated currency. This AI is an attribute of the GTIN and is always expressed in conjunction with it.

Figure 3.6.28 – 1

Format of the Element String		
Application Identifier	ISO Currency Code	Applicable Amount Payable
3 9 3 n	N ₁ N ₂ N ₃	N ₄ ——— variable length ———→ N ₁₈

The Application Identifier (393) indicates that the data field consists of an ISO currency code and an applicable amount payable.

The Application Identifier digit shown as “n” indicates the implied decimal point in the applicable amount payable field, where the digit 0 means that there is no decimal point, and the digit 1 means that the decimal point is before the last position of the amount payable.

The ISO currency code field contains the three-digit currency number of the numerical international standard ISO/IEC 4217 (data readily available on the Internet) and indicates the currency in which the amount payable is expressed.

The applicable amount payable field contains the sum to be paid for the Variable Measure Trade Item.

The data carrier of this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted by the bar code reader means that the Element String denoting amount payable of a Variable Measure Trade Item has been captured. Since this Element String represents an attribute of a GTIN, the amount payable should not be processed on its own.

See Figure 3.6.28 – 2 for an example of the decimal point indication.

Figure 3.6.28 – 2

Application Identifier	ISO Currency Code	Encoded Value	Actual Value
3 9 3 2	7 1 0*	1 2 3 0	1 2 . 3 0
3 9 3 1	7 1 0*	1 2 3 0	1 2 3 . 0 0
3 9 3 0	9 7 8**	1 2 3	1 2 3 . 0 0

*South African rand

**Euro

3.6.29 Customer's Purchase Order Number: AI (400)

Figure 3.6.29 – 1

Format of the Element String	
Application Identifier	Customer's Purchase Order Number
4 0 0	X ₁ ← variable length → X ₃₀

The Application Identifier (400) indicates that the data field contains the customer's purchase order number, restricted for use between two trading partners.

The customer's purchase order number field is alphanumeric and may include all characters contained in [Figure 3.A.3 – 1](#). It contains the number of the purchase order assigned by the company that issued the order. The composition and content of the order number is left to the discretion of the customer. For example, the purchase order number may include release and line numbers.

The data carrier of this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted by the bar code reader means that the Element String denoting a customer's purchase order number has been captured. It may be processed as stand-alone information where applicable or processed with the identification data of the same unit.

Warning: This Element String must be removed from the unit before the unit leaves the premises of the customer.

3.6.30 Consignment Number: AI (401)

The consignment number identifies a logical grouping of goods (one or more physical entities) that has been consigned to a freight forwarder and is intended to be transported as a whole. The consignment number must be allocated by a freight forwarder (or carriers acting as a freight forwarder) or a consignor, but only if the prior agreement of the freight forwarder is given. Typically AI (401) encodes a House Way Bill (HWB) number.

A freight forwarder (as per *Multi Industry Scenario for Transport – MIST*) is a party that arranges the carriage of goods including connected services and/or associated formalities on behalf of a shipper or consignee.

A carrier (as per *MIST*) is a party that undertakes the transportation of goods from one point to another.

A consignor (as per *MIST*) is the party that sends the goods.

Figure 3.6.30 – 1

Format of the Element String	
Application Identifier	Consignment Number
	GS1 Company Prefix Consignment Information
4 0 1	$N_1 \dots N_i$ $X_{i+1} \dots$ variable length $X_j (j \leq 30)$

The Application Identifier (401) indicates that the data field contains a consignment number.

The consignment number is composed of the GS1 Company Prefix of the carrier and the actual consignment information. The structure of the consignment information following the GS1 Company Prefix is left to the discretion of the user of the Element String. It may contain all characters contained in [Figure 3.A.3 – 1](#).

The data carrier of this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted by the bar code reader means that the Element String denoting a consignment number has been captured. The consignment number may be processed as stand-alone information where applicable or with other identification data appearing on the same unit.

Note: If a new consignment is created, previously bar coded consignment number Element Strings must be removed from the physical units.

3.6.31 Shipment Identification Number: AI (402)

The Shipment Identification Number (Bill of Lading) is a number assigned by a consignor. It provides a globally unique number that identifies a logical grouping of physical units for the purpose of a transport shipment. It may be used by all parties in the transport chain as a communication reference, for example, in Electronic Data Interchange (EDI) messages where it can be used as a shipment reference and/or a consignor's loading list.

Figure 3.6.31 – 1

Format of the Element String		
Application Identifier	Shipment Identification Number	
	GS1 Company Prefix →	Shipper Reference ← Check Digit
4 0 2	N ₁ N ₂ N ₃ N ₄ N ₅ N ₆ N ₇ N ₈ N ₉ N ₁₀ N ₁₁ N ₁₂ N ₁₃ N ₁₄ N ₁₅ N ₁₆	N ₁₇

The Application Identifier (402) indicates that the data field contains a Shipment Identification Number.

The GS1 Company Prefix in this Element String is the GS1 Company Prefix of the consigner (see [Section 1.2](#))

The shipper reference is assigned by the consigner.

The Check Digit is explained in [Section 3.A.1](#). Its verification, which must be carried out in the application software, ensures that the number is correctly composed.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted by the bar code reader means that the Element String denoting a Shipment Identification Number has been captured. The Shipment Identification Number may be processed as stand-alone information where applicable or with other identification data appearing on the same unit.

Note: Numbers should be sequentially allocated.

3.6.32 Routing Code: AI (403)

The routing code is assigned by the parcel carrier and is an attribute of the SSCC (Serial Shipping Container Code). It is intended to provide a migration path to the adoption of a yet-to-be-defined international, multi-modal solution. The routing code must not be used to encode information for which other Element Strings have been created (such as a ship to postal code).

Figure 3.6.32 – 1

Format of the Element String	
Application Identifier	Routing Code
4 0 3	X ₁ ————— variable length —————> X ₃₀

The Application Identifier (403) indicates that the data field contains a routing code.

The routing code field is alphanumeric and may include all characters contained in [Figure 3.A.3 – 1](#). Its content and structure are at the discretion of the parcel carrier issuing the code. If parcel carriers wish to enter co-operative agreements with other parcel carriers, then a mutually agreed indicator is required to designate the structure of the routing code.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the Element String denoting a routing code has been captured. The routing code must be processed with the SSCC appearing on the same unit.

3.6.33 Ship to - Deliver to Global Location Number: AI (410)

This Element String is based on the EAN/UCC-13 Data Structure (see [Section 1.3](#)).

Figure 3.6.33 – 1

Format of the Element String													
Application Identifier	GS1 Company Prefix →						← Location Reference						Check Digit
4 1 0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃

The Application Identifier (410) indicates that the data field contains the Global Location Number (GLN) of the consignee.

The GS1 Company Prefix is the GS1 Company Prefix of the addressee (see [Section 1.2](#)). It makes the number unique worldwide.

The Location Reference is assigned by the addressee's company.

The Check Digit is explained in [Section 3.A.1](#). Its verification, which must be carried out in the application software, ensures that the number is correctly composed.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the GLN of the consignee of a physical item has been captured. The GLN may be processed independently or together with related identifications.

3.6.34 Bill to - Invoice to Global Location Number: AI (411)

This Element String is based on the EAN/UCC-13 Data Structure (see [Section 1.3](#)).

Figure 3.6.34 – 1

Format of the Element String														
Application Identifier	GS1 Company Prefix →						←	Location Reference						Check Digit
4 1 1	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	

The Application Identifier (411) indicates that the data field contains the Global Location Number (GLN) of the addressee of an invoice.

The GS1 Company Prefix is the GS1 Company Prefix of the addressee (see [Section 1.2](#)). It makes the number unique worldwide.

The Location Reference is assigned by the addressee's company.

The Check Digit is explained in [Section 3.A.1](#). Its verification, which must be carried out in the application software, ensures that the number is correctly composed.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the GLN of the addressee of an invoice has been captured.

3.6.35 Purchased from Global Location Number: AI (412)

This Element String is based on the EAN/UCC-13 Data Structure (see [Section 1.3](#)).

Figure 3.6.35 – 1

Format of the Element String														
Application Identifier	GS1 Company Prefix →						←	Location Reference						Check Digit
4 1 2	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	

The Application Identifier (412) indicates that the data field contains the Global Location Number (GLN) of the company from which the respective trade item has been purchased.

The GS1 Company Prefix is the GS1 Company Prefix of the supplier (see [Section 1.2](#)). It makes the number unique worldwide.

The Location Reference is assigned by the company supplying the trade item.

The Check Digit is explained in [Section 3.A.1](#). Its verification, which must be carried out in the application software, ensures that the number is correctly composed.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the GLN of the company that supplied the trade item has been captured. The GLN may be processed independently or together with related identifications.

3.6.36 Ship for - Deliver for - Forward to Global Location Number: AI (413)

This Element String is based on the EAN/UCC-13 Data Structure (see [Section 1.3](#)).

Figure 3.6.36 – 1

Format of the Element String														
Application Identifier	GS1 Company Prefix →						←	Location Reference						Check Digit
4 1 3	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	

The Application Identifier (413) indicates that the data field contains the Global Location Number (GLN) of the internal or subsequent final destination.

The GS1 Company Prefix is the GS1 Company Prefix of the final recipient (see [Section 1.2](#)). It makes the number unique worldwide.

The Location Reference is assigned by the final recipient's company.

The Check Digit is explained in [Section 3.A.1](#). Its verification, which must be carried out in the application software, ensures that the number is correctly composed.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the GLN of the final recipient of a physical item has been captured. The GLN may be processed independently or together with related identifications.

Note: This Element String is for the internal use of the consignee and is not to be used by the carrier.

3.6.37 Identification of a Physical Location - Global Location Number: AI (414)

This Element String is based on the EAN/UCC-13 Data Structure (see [Section 1.3](#)).

Figure 3.6.37 – 1

Format of the Element String													
Application Identifier	GS1 Company Prefix →						← Location Reference						Check Digit
4 1 4	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃

The Application Identifier (414) indicates that the data field contains the Global Location Number (GLN) of a physical location.

The GS1 Company Prefix is the prefix of the holder of the location (see [Section 1.2](#)). It makes the number unique worldwide.

The Location Reference is assigned by the owner or user of the physical location.

The Check Digit is explained in [Section 3.A.1](#). Its verification, which must be carried out in the application software, ensures that the number is correctly composed.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the GLN of a physical location has been captured from the location itself. The GLN may be processed according to the particular application requirements.

3.6.38 Global Location Number of the Invoicing Party: AI (415)

This Element String is based on the EAN/UCC-13 Data Structure (see [Section 1.3](#)).

Note: This Element String is mandatory on a payment slip. Together with the Payment Slip Reference Number, AI (8020), it uniquely identifies a payment slip.

Figure 3.6.38 – 1

Format of the Element String													
Application Identifier	GS1 Company Prefix						Location Reference						Check Digit
4 1 5	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃

The Application Identifier (415) indicates that the data field contains the Global Location Number (GLN) of the invoicing party.

The GS1 Company Prefix is the GS1 Company Prefix of the invoicing party (see [Section 1.2](#)). It makes the number unique worldwide.

The Location Reference is assigned by the invoicing party.

The Check Digit is explained in [Section 3.A.1](#). Its verification, which must be carried out in the application software, ensures that the number is correctly composed.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the GLN of the invoicing party has been captured. The GLN must be processed together with the Payment Slip Reference Number, AI (8020), on the same payment slip.

3.6.39 Ship to - Deliver to Postal Code Within a Single Postal Authority: AI (420)

Figure 3.6.39 – 1

Format of the Element String	
Application Identifier	Postal Code
4 2 0	X ₁ — variable length → X ₂₀

The Application Identifier (420) indicates that the data field contains the postal code of the addressee (national format).

The postal code field contains the postal code of the addressee as defined by the appropriate postal authority. It is left justified and must not contain any fill characters.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the national version of a postal code of the addressee of the consignment has been captured. The postal code is normally processed independently.

3.6.40 Ship to - Deliver to Postal Code with Three-Digit ISO Country Code: AI (421)

Figure 3.6.40 – 1

Format of the Element String		
Application Identifier	ISO Country Code	Postal Code
4 2 1	N ₁ N ₂ N ₃	X ₄ — variable length → X ₁₂

The Application Identifier (421) indicates that the data fields contain the postal code of the addressee (international format).

The ISO country code field contains the three-digit country number of the numerical international standard ISO 3166 (data readily available on the Internet) that relates to the national postal code that follows.

The national postal code field contains the postal code of the addressee as defined by the appropriate postal authority. It is left justified and must not contain any fill characters.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the international version of a postal code of the addressee of the consignment has been captured. The postal code is normally processed independently.

3.6.41 Country of Origin of a Trade Item: AI (422)

Figure 3.6.41 – 1

Format of the Element String			
Application Identifier	ISO Country Code		
4 2 2	N ₁	N ₂	N ₃

The Application Identifier (422) indicates that the data field contains the ISO country code of the country of origin of the trade item.

The ISO country code field contains the three-digit country number of the numerical international standard ISO 3166 that is the country of origin (data readily available on the Internet).

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the ISO country code denoting the country of origin of the respective trade item has been captured.

Note: The country of origin is normally the country in which the trade item has been produced or manufactured. However, due to a wide range of definitions for country of origin, which were created for different purposes, it is the manufacturer's responsibility to assign the correct country of origin.

3.6.42 Country of Initial Processing: AI (423)

Figure 3.6.42 – 1

Format of the Element String	
Application Identifier	ISO Country Code(s)
4 2 3	N ₁ N ₂ N ₃ ... N ₁₅

The Application Identifier (423) indicates that the data field contains the ISO country code(s) of the country or countries of initial processing of the trade item.

The ISO country code field contains the three-digit country code(s) from the numerical international standard ISO 3166 that indicates the country or countries of initial processing (data readily available on the Internet).

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the ISO country code(s) denoting the country or countries of initial processing of the respective trade item has been captured.

Note: The country of initial processing is normally the country in which the trade item has been produced or manufactured. However, in certain applications, such as livestock fattening, the country of initial processing may include up to five different countries, all of which should be indicated. It is the responsibility of the supplier to allocate the correct country code(s).

3.6.43 Country of Processing: AI (424)

Figure 3.6.43 – 1

Format of the Element String			
Application Identifier	ISO Country Code		
4 2 4	N ₁	N ₂	N ₃

The Application Identifier (424) indicates that the data field contains the ISO country code of the country of processing of the trade item.

The ISO country code field contains the three-digit country code of the numerical international standard ISO 3166 that is the country of processing (data readily available on the Internet).

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the ISO country code denoting the country of processing of the respective trade item has been captured.

Note: It is the responsibility of the processor of the trade item to allocate the correct country code.

3.6.44 Country of Disassembly: AI (425)

Figure 3.6.44 – 1

Format of the Element String			
Application Identifier	ISO Country Code		
4 2 5	N ₁	N ₂	N ₃

The Application Identifier (425) indicates that the data field contains the ISO country code of the country of disassembly of the trade item.

The ISO country code field contains the three-digit country code of the numerical international standard ISO 3166 that is the country of disassembly (data readily available on the Internet).

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the ISO country code denoting the country of disassembly of the respective trade item has been captured.

Note: It is the responsibility of the party doing the disassembly of the trade item to allocate the correct country code.

3.6.45 Country Covering full Process Chain: AI (426)

Figure 3.6.45 – 1

Format of the Element String			
Application Identifier	ISO Country Code		
4 2 6	N ₁	N ₂	N ₃

The Application Identifier (426) indicates that the data field contains the ISO country code of the country where all the processing of the trade item took place.

The ISO country code field contains the three-digit country code of the numerical international standard ISO 3166 that is the country of full processing (data readily available on the Internet).

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the ISO country code denoting the country of full processing of the trade item has been captured.

Note: If this AI is used, the full processing of a trade item must have taken place in a single country. This is particularly important in certain applications, such as livestock (where it would cover things such as the animal's birth, fattening, and slaughter), where processing could take place in different countries. In situations like this, AI (426) may not be used. It is the responsibility of the supplier to allocate the correct country code.

3.6.46 Seventy Series AIs - Cautionary Note

Application Identifiers issued under the 70 series are assigned when an Application Identifier request meets all the normal criteria except one of the following:

- The application is not multi-sectoral.
- The application is restricted to a country or a region (e.g., is not global).

3.6.46.1 NATO Stock Number (NSN): AI (7001)

Figure 3.6.46.1 – 1

	Format of the Element String		
Application Identifier	NATO Supply Classification	Assigning Country	Sequential Number
7001	N ₁ N ₂ N ₃ N ₄	N ₅ N ₆	N ₇ N ₈ N ₉ N ₁₀ N ₁₁ N ₁₂ N ₁₃

The Application Identifier (7001) indicates that the data field contains a NATO stock number.

The NATO stock number is the number allocated to any item of supply in the NATO Alliance. It is the responsibility of the country that manufactures or controls the design of the item to allocate the number.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier. As it is an attribute of a trade item, the NATO stock number should not be processed on its own, but together with the Global Trade Item Number™ (GTIN™) of the trade item to which it relates.

The data transmitted from the bar code reader means that the Element String denoting a NATO stock number has been captured

Note: This Element String is only for use within the context of the supply within the NATO Alliance. Use of it is subject to the rules and regulations of the Allied Committee 135 (AC/135), the NATO Group of National Directors on Codification.

3.6.46.2 UN/ECE Meat Carcasses and Cuts Classification: AI (7002)

Figure 3.6.46.2 – 1

Format of the Element String	
Application Identifier	UN/ECE Product Classification
7 0 0 2	X ₁ ————— variable length —————> X ₃₀

The Application Identifier (7002) indicates that the data field contains a UN/ECE meat carcasses and cuts classification code.

The UN/ECE meat carcasses and cuts code is an attribute of a Global Trade Item Number™ (GTIN™) that denotes the trade description of the product. It is an alphanumeric, variable length code up to 30 characters.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier. As it is an attribute of a trade item, the UN/ECE meat carcasses and cuts code should not be processed on its own, but together with the Global Trade Item Number™ (GTIN™) of the trade item to which it relates.

The data transmitted from the bar code reader means that the Element String denoting a UN/ECE meat carcasses and cuts code has been captured.

Note: This Element String is only for use within the context of UN/ECE standards for the quality of meat carcasses and cuts (bovine, porcine, ovine, and caprine).

3.6.46.3 Approval Number of Processor with Three-Digit ISO Country Code: AI (703s)

Figure 3.6.46.3 – 1

Format of the Element String		
Application Identifier	ISO Country Code	Approval Number of Processor
7 0 3 s	N ₁ N ₂ N ₃	AN ₄ ——— variable length —————> X ₃₀

The Application Identifier (703s) indicates that the data field contains the ISO country code and approval number of the processor of a trade item. As many processors may be involved, each with an individual approval number, the fourth digit of the AI (s in Figure 3.6.46.3 – 1) indicates the sequence of the processors. For a typical meat supply chain, the following sequence would be used:

- 7030: slaughterhouse
- 7031: first deboning/cutting hall
- 7032 to 7039: second through ninth processing location (cutting hall)

The ISO country code contains the three-digit country number of the numerical international standard ISO 3166 that relates to the following approval number of processor (data readily available on the Internet).

The approval number of processor is an attribute to a Global Trade Item Number™ (GTIN™). It designates the approval number of the company who did the processing.

The data carrier for this Element String is the GS1-128 Bar Code Symbol.

The system recognises this element string by the symbology identifier]C1 and the Application Identifier.

The data transmitted from the bar code reader means that the Element String for ISO country code and approval number of processor has been captured. As it is an attribute of a trade item, the ISO country code and approval number of processor should not be processed on its own, but together with the Global Trade Item Number™ (GTIN™) of the trade item to which it relates.

Note: The approval number is usually assigned by a national or pluri-national authority to processors in the food-supply chain. These authorities may use Global Location Number (see Section 1.3) for this purpose. The approval number (GLN) then remains with the item regardless of whether or not it changes ownership or function.

3.6.47 Roll Products - Width, Length, Core Diameter, Direction, Splices: AI (8001)

Owing to the method of production, some roll products cannot be numbered according to standard criteria which have been determined in advance. They are, therefore, classified as variable items. For those products where the standard trade measures are not sufficient, the following guidelines should be used.

The identification of a roll product consists of the Global Trade Item Number™ (GTIN™) and the variable attributes. The basic product (e.g., a certain type of paper) is included as data in the EAN/UCC-14 ID Number (see [Section 3.6.3](#)), and the variables contain information about the special features of the particular item that has been produced.

Figure 3.6.47 – 1

Format of the Element String					
Application Identifier	Variable Values of a Roll Product				
8 0 0 1	N ₁ N ₂ N ₃ N ₄	N ₅ N ₆ N ₇ N ₈ N ₉	N ₁₀ N ₁₁ N ₁₂	N ₁₃	N ₁₄

The Application Identifier (8001) indicates that the data fields contain the variable attributes of a roll product.

The variable values of a roll product, N₁ to N₁₄, consist of the following data:

- N₁ to N₄: slit width in millimetres (width of the roll)
- N₅ to N₉: actual length in metres
- N₁₀ to N₁₂: internal core diameter in millimetres
- N₁₃: winding direction (face out 0, face in 1, undefined 9)
- N₁₄: number of splices (0 to 8 = actual number, 9 = number unknown)

The data carrier for this Element String is the GS1-128 Bar Code Symbol.

The system recognises this Element String by the symbology identifier]C1 and the Application Identifier.

The data transmitted from the bar code reader means that the variable attributes of the identification of a roll product trade item have been captured. The variable attributes may be processed together with the simultaneously required GTIN of that trade item (see [Section 3.6.3](#)).

3.6.48 Cellular Mobile Telephone Identifier: AI (8002)

Figure 3.6.48 – 1

Format of the Element String	
Application Identifier	Serial Number
8 0 0 2	X ₁ ————— variable —————> X ₂₀

The Application Identifier (8002) indicates that the data field contains the serial number of a cellular mobile telephone.

The serial number field is alphanumeric and may contain all characters contained in [Figure 3.A.3 – 1](#). A national or pluri-national authority usually assigns the number. It uniquely identifies each mobile telephone within a given authority for special control purposes. It is not considered as an attribute of the identification of the telephone as a trade item.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the Element String denoting an electronic serial identifier of a cellular mobile telephone has been captured. The electronic serial identifier may be processed according to the particular application requirements.

3.6.49 Global Returnable Asset Identifier (GRAI): AI (8003)

The Global Returnable Asset Identifier (GRAI) is based on the EAN/UCC-13 or UCC-12 Data Structure (see [Section 1.3](#)).

Figure 3.6.49 – 1

	Format of the Element String															
	Application Identifier	Global Returnable Asset Identifier (GRAI)												Serial Number (Optional)		
		GS1 Company Prefix →						← Asset Type				Check Digit				
	(UCC-12)	8 0 0 3	0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂
(EAN/UCC-13)	8 0 0 3	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	X ₁ — variable → X ₁₆

The Application Identifier (8003) indicates that the data fields contain the GRAI.

The GS1 Company Prefix is the one allocated to the owner of the asset (see [Section 1.2](#)). It makes the number unique worldwide. The zero in the leftmost position is added to generate 14 digits in the asset identification number field.

The Asset Type is a number assigned by the owner of the asset to uniquely identify each type of asset.

The Check Digit is explained in [Section 3.A.1](#). Its verification, which must be carried out in the application software, ensures that the number is correctly composed.

The optional serial number is assigned by the owner of the asset. It identifies an Individual Asset within a given Asset Type. The field is alphanumeric and may contain all characters contained in [Figure 3.A.3 – 1](#).

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1, by the Application Identifier and by the length of the transmitted data.

The data transmitted from the bar code reader means that the GRAI has been captured. It may be processed according to the particular application requirements.

3.6.50 Global Individual Asset Identifier (GIAI): AI (8004)

This Element String may be used for the unique identification of assets to provide a means to store relevant data.

Note: This Element String must never be used to identify the entity as a trade item or logistic unit. If an asset is transferred between parties, the Global Individual Asset Identifier (GIAI) cannot be used for ordering the asset. However, asset identification may be exchanged between parties for the purpose of traceability.

Figure 3.6.50 – 1

Format of the Element String	
Application Identifier	Global Individual Asset Identifier (GIAI)
	GS1 Company Prefix Individual Asset Reference
8 0 0 4	$N_1 \dots N_i$ $X_{i+1} \dots$ variable length $X_j (j \leq 30)$

The Application Identifier (8004) indicates that the data field contains a GIAI.

The GIAI uses the GS1 Company Prefix of the company assigning the Individual Asset Reference. The structure and numbering of the individual asset reference is determined by the holder of the GS1 Company Prefix. It may contain all characters contained in [Figure 3.A.3 – 1](#).

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the Element String of a GIAI has been captured. It may be processed according to the particular application requirements.

3.6.51 Price Per Unit of Measure: AI (8005)

This Element String is used to indicate the price per unit of measure of price marked goods on a Variable Measure Trade Item to discriminate price variants of the same item. It is considered as an attribute of the respective trade item and not as part of its identification.

Figure 3.6.51 – 1

Format of the Element String						
Application Identifier	Price Per Unit of Measure					
8 0 0 5	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆

The Application Identifier (8005) indicates that the data field contains a price per unit of measure.

Content and structure of the price per unit of measure field are left to the discretion of the trading partners.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the Element String denoting the price per unit of measure has been captured. This Element String must always be decoded and processed together with the Global Trade Item Number™ (GTIN™) from the same item.

3.6.52 Identification of the Components of a Trade Item: AI (8006)

Figure 3.6.52 – 1

Format of the Element String			
Application Identifier	Global Trade Item Number™ (GTIN™)	Relative Number of the Component Within the Assembly	Total Number of Components in the Assembly
8 0 0 6	N ₁ N ₂ N ₃ N ₁₁ N ₁₃ N ₁₄	N ₁₅ N ₁₆	N ₁₇ N ₁₈

The Application Identifier (8006) indicates that the data fields contain the identification of the trade item and the enumeration of its components.

The GTIN is the item number under which the whole item is traded. For the structures of the GTIN, see [Section 1.3](#).

The relative number field shows the consecutive number of a particular component within the assembly. A component of a given trade item must always be identical for the respective trade item.

The total number field shows the total number of components of the trade item.

The Check Digit is explained in [Section 3.A.1](#). Its verification, which must be carried out in the application software, ensures that the number is correctly composed.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the identification of a component of a trade item has been captured. Components may be processed according to the particular application requirements.

3.6.53 International Bank Account Number (IBAN): AI (8007)

Figure 3.6.53 – 1

Format of the Element String	
Application Identifier	International Bank Account Number
8 0 0 7	X ₁ ————— variable —————> X ₃₀

The Application Identifier (8007) indicates that the data field contains the international bank account identifier.

The International Bank Account Number (IBAN), AI (8007), defined as *ISO 13616*, indicates to which account the amount of the respective payment slip is to be transferred. The invoicing party determines the applicable bank account number. The data field is alphanumeric and may contain all characters contained in [Figure 3.A.3 – 1](#).

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data string transmitted by the bar code reader means that an IBAN has been captured. The IBAN must be processed together with the Payment Slip Reference Number, AI (8020), and the Global Location Number (GLN) of the invoicing party that is captured from the same payment slip.

3.6.54 Date and Time of Production: AI (8008)

Figure 3.6.54 – 1

Format of the Data Element						
Application Identifier	Date and Time of Production					
	YY	MM	DD	HH	MM	SS
8008	N ₁ N ₂	N ₃ N ₄	N ₅ N ₆	N ₇ N ₈	N ₉ N ₁₀	N ₁₁ N ₁₂

The Application Identifier (8008) indicates that the data fields contain a date and time of production.

The date and time of production is the date and time of production or assembly determined by the manufacturer. The date and time may refer to the trade item itself or to the items contained.

The structure is:

Year: the tens and units of the year (e.g., 2000 = 00), which is mandatory

Month: the number of the month (e.g., January = 01), which is mandatory

Day: the number of the day of the relevant month (e.g., second day = 02), which is mandatory.

Hour: the number of the hour based on local time (e.g., 2 p.m. = 14), which is mandatory

Minutes: may be dropped if not required

Seconds: may be dropped if not required

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

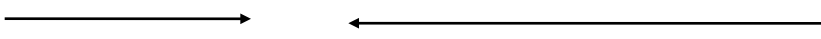
The data transmitted from the bar code reader means that the Element String denoting date and time of production has been captured. As it is an attribute of a trade item, the date and time of production should not be processed on its own, but together with the Global Trade Item Number™ (GTIN™) of the trade item to which it relates.

Note: This Element String can only specify dates in the range from 49 years in the past to 50 years in the future. Determination of the correct century is explained in [Section 3.A.5](#).

3.6.55 Global Service Relation Number (GSRN): AI (8018)

This Element String may be used to identify the recipient of services in the context of a service relationship. It provides a means for the service provider to store data relevant to services provided to the recipient.

Figure 3.6.55 – 1

Format of the Element String		
Application Identifier	Global Service Relation Number (GSRN)	
	GS1 Company Prefix 	Check Digit
8 0 1 8	N ₁ N ₂ N ₃ N ₄ N ₅ N ₆ N ₇ N ₈ N ₉ N ₁₀ N ₁₁ N ₁₂ N ₁₃ N ₁₄ N ₁₅ N ₁₆ N ₁₇	N ₁₈

The Application Identifier (8018) indicates that the data field contains a GSRN.

The GS1 Company Prefix is the one allocated to the service provider (see [Section 1.2](#)). It makes the number unique worldwide.

The Service Reference is assigned by the service provider. The structure and content of the Service Reference is at the discretion of the particular service provider.

The Check Digit is explained in [Section 3.A.1](#). Its verification, which must be carried out in the application software, ensures that the number is correctly composed.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the Element String for a GSRN has been captured. It may be processed according to the particular application requirements.

3.6.56 Payment Slip Reference Number: AI (8020)

Figure 3.6.56 – 1

Format of the Element String	
Application Identifier	Payment Slip Reference Number
8 0 2 0	X ₁ ————— variable —————> X ₂₅

The Application Identifier (8020) indicates that the data field contains a Payment Slip Reference Number.

The Payment Slip Reference Number, assigned by the invoicing party, identifies a payment slip within a given Global Location Number (GLN) of an invoicing party. Together with the GLN of the invoicing party, the Payment Slip Reference Number uniquely identifies a payment slip. The data field is alphanumeric and may contain all characters contained in [Figure 3.A.3 – 1](#).

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data string transmitted from the bar code reader means that a Payment Slip Reference Number has been captured. It must be processed together with the GLN of the invoicing party that is captured from the same payment slip.

3.6.57 GS1-128 Coupon Extended Code: AIs (8100 - 8102)

Figure 3.6.57 – 1

Formats of the Element Strings				
Application Identifier	Filler Digit	UCC Prefix	Offer Code	Expiration Date (Month + Year)
8 1 0 0		N ₁	N ₂ N ₃ N ₄ N ₅ N ₆	
8 1 0 1		N ₁	N ₂ N ₃ N ₄ N ₅ N ₆	N ₇ N ₈ N ₉ N ₁₀
8 1 0 2	0	N ₂		

The Application Identifiers (8100) to (8102) indicate that the data fields contain data supplementary to a GS1 US coupon identification.

The filler digit 0 is used in AI (8102) to generate an even number of digits in the Element String.

The UCC Prefix is the digit that is preceded by a zero and followed by a Company Number to form the GS1 Company Prefix. The Offer Code is assigned by the issuer and identifies a particular promotion.

The expiration date indicates the end of the redemption period of the coupon.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the respective Application Identifier.

3.6.58 Information Mutually Agreed Between Trading Partners (Including FACT Data Identifiers): AI (90)

Figure 3.6.58 – 1

Format of the Element String	
Application Identifier	Data Field
9 0	X ₁ ————— variable length —————> X ₃₀

The Application Identifier (90) indicates that the data field contains any information mutually agreed between trading partners.

The data field shows the information agreed between the two trading partners. The field is alphanumeric and may contain all characters contained in [Figure 3.A.3 – 1](#). It may also be used to incorporate data preceded by FACT Data Identifiers.

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the Element String AI (90) has been captured. As the data field may contain any information, processing is subject to prior agreement between trading partners.

Warning: The bar code symbol carrying this Element String should be removed from any item that leaves the jurisdiction of the trading partners.

3.6.59 Company Internal Information: AIs (91 - 99)

Figure 3.6.59 – 1

Format of the Element String	
Application Identifier	Data Field
A ₁ A ₂	X ₁ ————— variable length —————> X ₃₀

The Application Identifier (A₁ A₂) assigned to this Element String is AI (91 to 99).

The data field may contain any company internal information. The field is alphanumeric and may show all characters contained in [Figure 3.A.3 – 1](#).

The data carrier for this Element String is the GS1-128 Bar Code Symbol. The system recognises this Element String by the symbology identifier JC1 and the Application Identifier.

The data transmitted from the bar code reader means that the Element String containing company internal information has been captured. Processing is to be organised by the using company.

Warning: This Element String should be removed from any item that leaves the jurisdiction of the company.

3.7 Compatibility of EPCglobal Tag Data Standard and GS1 General Specifications

This section describes how GS1 is linked to EPCglobal Inc® and how the GS1 System can be used in the EPCglobal Tag Data Standard and vice versa.

EPCglobal Inc®, a subsidiary of GS1, is a not-for-profit organisation entrusted by industry to establish and support the EPCglobal Network™ as the global standard for real-time, automatic identification of information in the supply chain of any company, anywhere in the world. EPCglobal is a neutral, consensus-based, not-for-profit standards organisation.

The EPCglobal Network combines radio frequency identification (RFID) technology, existing communications network infrastructure, and the Electronic Product Code™ (a number for uniquely identifying an item) to enable accurate, cost-efficient visibility of information in the supply chain. The end result helps organisations be more efficient, flexible, and responsive to customer needs.

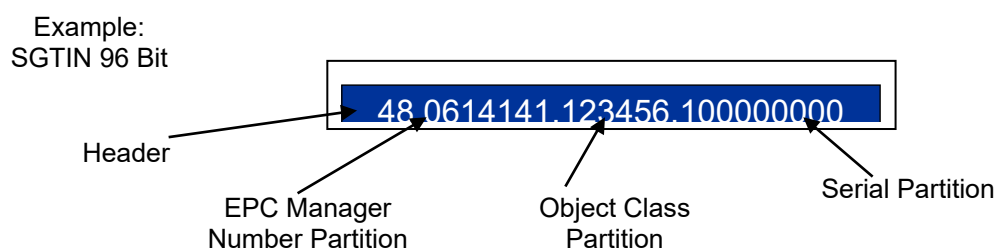
For more information contact: EPCglobal Inc®
www.EPCglobalinc.org

The mission is to make organisations more efficient by enabling true visibility of information about items in the supply chain.

The **EPCglobal Network** is a framework that enables immediate, automatic identification and sharing of information on items in the supply chain. In that way, the EPCglobal Network will make organisations more effective by enabling true visibility of information about items in the supply chain. Using a combination of technologies and harnessing the power of current information systems, the EPCglobal Network will provide for immediate, automatic, and accurate identification and location of any item in the supply chain of any company, in any industry, anywhere in the world.

The **Electronic Product Code™ (EPC™)** is an identification scheme for universally identifying physical objects via Radio Frequency Identification (RFID) tags and other means. The standardised EPC data consists of an EPC that uniquely identifies an individual object. In addition to this standardised data, certain Classes of EPC tags will allow user-defined data. The EPC Tag Data Standards will define the length and position of this data, without defining its content.

An EPC has the following structure:



Because of the structure of EPC, there are some restrictions for the implementation of the Identification Numbers of the GS1 System and also for the implementation of an EPC in the data structures of the GS1 System. Companies should use the GS1 specifications to define the applicable fields in databases and other ICT-systems.

This section provides GS1 approval of the version of the EPCglobal® Tag Data Standard with the following GS1 Application Identifier definition restrictions:

For GS1 use of EPC 64-bit tags, the following applies:

In the 64-bit EPC, the limited number of bits prohibits a literal embedding of the GS1 Company Prefix. As a partial solution, a Company Prefix Index is used. This Index, which can accommodate up to 16,384 codes, is assigned to companies that need to use the 64 bit tags, in addition to their existing Company Prefixes. The Index is encoded on the tag instead of the Company Prefix, and is subsequently translated to the Company Prefix at low levels of the EPC system components (i.e. the Reader or Middleware). While this means a limited number of Company Prefixes can be represented in the 64-bit tag, this is a transitional step to full accommodation in 96-bit and additional encoding schemes.

- **AI (00) SSCC:** No restrictions for using the GS1 System in the SSCC-64. To avoid out-of-specification serial references, the Serial Reference field in the EPC SSCC-64 Tag must not exceed the capacity specified in the *GS1 General Specifications*, which are (inclusive of the extension digit) 9,999 for Company Prefixes of 12 digits up to 9,999,999,999 for Company Prefixes of 6 digits.

The Physical Technical Requirement Group has approved the following Filter Values for use with the SSCC as defined in the EPC Tag Data Standard (refer to Section 3.5, EPC Tag Data Standards, Version 1.1, Rev. 1.27).

- 001 = undefined
- 010 = logistical / shipping unit (E.G. 48 unit case of tissues)
- 011 = reserved
- 100 = reserved
- 101 = reserved
- 110 = reserved
- 111 = reserved
- 000 = all other (default value, always used by readers)

- **AI (01) GTIN + AI (21) Serial Number:** If the Serial Number of an EPC defined in the EPC Tag Data Standard will be used in the GS1 System, the Serial Number in AI (21), defined in Section 3.6.13 of this *GS1 General Specification*, can be used with the restriction to permit assignment of 33.554.431 numeric-only serial numbers for the serial part in the EPC.

The Physical Technical Requirement Group has approved the following Filter Values for use with the SGTIN as defined in the EPC Tag Data Standard (refer to Section 3.4, EPC Tag Data Standards, Version 1.1, Rev. 1.27).

- 001 = Retail Consumer Trade Item (E.G. Single package of tissues)
- 010 = Standard Trade Item Grouping (E.G. 48 unit case of tissues)
- 011 = Single Shipping/Consumer Trade Item (E.G. TV, Bike)
- 100 = reserved
- 101 = reserved
- 110 = reserved

- 111 = reserved
- 000 = all other (default value, always used by readers)
- **AI (414) GLN + AI (XX) Serial Number:** The EPC Tag Data Standard is approved from the EPCglobal Board, but has a complete restriction on GLN with a Serial Number in the GS1 System. At the moment there is no serialisation of a GLN in the GS1 System, so it is not defined and not possible to use.

The Physical Technical Requirement Group has approved the following Filter Values for use with the SGLN as defined in the EPC Tag Data Standard (refer to Section 3.6, EPC Tag Data Standards, Version 1.1, Rev. 1.27).

- 001 = reserved
- 010 = reserved
- 011 = reserved
- 100 = reserved
- 101 = reserved
- 110 = reserved
- 111 = reserved
- 000 = all other (default value, always used by readers)
- **AI (8003) GRAI:** The *GS1 General Specifications* definition of Global Returnable Asset Identifier in Section 3.6.49 has an integrated optional Serial Number defined as alphanumeric. For the use of the GRAI in the EPC Tag Data Standard, the Serial Component is restricted to permit assignment of 524,288 numeric-only serial numbers and is mandatory.

The Physical Technical Requirement Group has approved the following Filter Values for use with the GRAI as defined in the EPC Tag Data Standard (refer to Section 3.7, EPC Tag Data Standards, Version 1.1, Rev. 1.27).

- 001 = reserved
- 010 = reserved
- 011 = reserved
- 100 = reserved
- 101 = reserved
- 110 = reserved
- 111 = reserved
- 000 = all other (default value, always used by readers)

- **AI (8004) GIAI:** The *GS1 General Specifications* definition of Global Individual Asset Identifier in Section 3.6.50 has a required integrated Individual Asset Reference number defined as alphanumeric. In the EPC Tag Data Standard, the Global Individual Asset Identifier is restricted to permit assignment of 549.755.813.888 numeric-only serial numbers.

The Physical Technical Requirement Group has approved the following Filter Values for use with the GIAI as defined in the EPC Tag Data Standard (refer to Section 3.8, EPC Tag Data Standards, Version 1.1, Rev. 1.27).

- 001 = reserved
- 010 = reserved
- 011 = reserved
- 100 = reserved
- 101 = reserved
- 110 = reserved
- 111 = reserved
- 000 = all other (default value, always used by readers)

For GS1 use of EPC 96-bit tags, the following applies:

- **AI (00) SSCC** No restrictions for using the GS1 System in the SSCC-96. To avoid out-of-specification serial references, the Serial Reference field must not exceed the capacity specified in the *GS1 General Specifications*, which are (inclusive of the extension digit) 9,999 for Company Prefixes of 12 digits up to 9,999,999,999 for Company Prefixes of 6 digits.

The Physical Technical Requirement Group has approved the following Filter Values for use with the SSCC as defined in the EPC Tag Data Standard (refer to Section 3.5, EPC Tag Data Standards, Version 1.1, Rev. 1.27).

- 001 = undefined
- 010 = logistical / shipping unit (E.G. 48 unit case of tissues)
- 011 = reserved
- 100 = reserved
- 101 = reserved
- 110 = reserved
- 111 = reserved
- 000 = all other (default value, always used by readers)

- **AI (01) GTIN + AI (21) Serial Number:** If the Serial Number of an EPC defined in the EPC Tag Data Standard will be used in the GS1 System, the Serial Number in AI (21) defined in Section 3.6.13 of this *GS1 General Specification* can be used with the restriction to permit assignment of 274.877.906.943 numeric-only serial numbers for the serial part in the EPC.

The Physical Technical Requirement Group has approved the following Filter Values for use with the SGTIN as defined in the EPC Tag Data Standard (refer to Section 3.4, EPC Tag Data Standards, Version 1.1, Rev. 1.27).

- 001 = Retail Consumer Trade Item (E.G. Single package of tissues)
- 010 = Standard Trade Item Grouping (E.G. 48 unit case of tissues)
- 011 = Single Shipping/Consumer Trade Item (E.G. TV, Bike)
- 100 = reserved
- 101 = reserved
- 110 = reserved
- 111 = reserved
- 000 = all other (default value, always used by readers)

- **AI (414 GLN) + AI (254) GLN Extension Component:** The Tag Data Standard V1.1 R1.27 is approved for the use of GLN Extension with the restrictions specified in Section 2.4.4.2.2 of the GS1 General Specifications.

The Physical Technical Requirement Group has approved the following Filter Values for use with the SGLN as defined in the EPC Tag Data Standard (refer to Section 3.6, EPC Tag Data Standards, Version 1.1, Rev. 1.27).

- 001 = reserved
- 010 = reserved
- 011 = reserved
- 100 = reserved
- 101 = reserved
- 110 = reserved
- 111 = reserved
- 000 = all other (default value, always used by readers)

- **AI (8003) GRAI:** The *GS1 General Specifications* definition of Global Returnable Asset Identifier in Section 3.6.49 has an integrated optional Serial Number defined as alphanumeric. For the use of the GRAI in the EPC Tag Data Standard, the Serial Component is restricted to permit assignment of 274,877,906,943 numeric-only serial numbers and is mandatory.

The Physical Technical Requirement Group has approved the following Filter Values for use with the GRAI as defined in the EPC Tag Data Standard (refer to Section 3.7, EPC Tag Data Standards, Version 1.1, Rev. 1.27).

- 001 = reserved
 - 010 = reserved
 - 011 = reserved
 - 100 = reserved
 - 101 = reserved
 - 110 = reserved
 - 111 = reserved
 - 000 = all other (default value, always used by readers)
- **AI (8004) GIAI:** The *GS1 General Specifications* definition of Global Individual Asset Identifier in Section 3.6.50 has a required integrated Individual Asset Reference number defined as alphanumeric. In the EPC Tag Data Standard, the Individual Asset Identifier is restricted to permit assignment of 4,611,686,018,427,387,904 numeric-only serial numbers.

The Physical Technical Requirement Group has approved the following Filter Values for use with the GIAI as defined in the EPC Tag Data Standard (refer to Section 3.8, EPC Tag Data Standards, Version 1.1, Rev. 1.27).

- 001 = reserved
- 010 = reserved
- 011 = reserved
- 100 = reserved
- 101 = reserved
- 110 = reserved
- 111 = reserved
- 000 = all other (default value, always used by readers)

For further details or more information for the use of the GS1 System in the EPC Tag Data Standard, read the latest version of the EPC Data Standard. To get the latest version, ask your national GS1 Organisation or directly at EPCglobal Inc.®.

3.A.1 Appendix 1: Check Digit Calculations

3.A.1.1 Standard Check Digit Calculations for GS1 Data Structures

This algorithm is identical for all fixed length numeric GS1 Data Structures that require a Check Digit.

Figure 3.A.1.1 – 1

	Digit Positions																		
EAN/ UCC-8											N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	
UCC-12						N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂		
EAN/ UCC-13						N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	
EAN/ UCC-14					N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄	
17 digits		N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄	N ₁₅	N ₁₆	N ₁₇	
18 digits	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄	N ₁₅	N ₁₆	N ₁₇	N ₁₈	
	Multiply value of each position by																		
	x3	X1	x3	x1	x3	x1	x3	x1	x3	x1	x3	x1	x3	x1	x3	x1	x3		
	Accumulated results = sum																		
	Subtract sum from nearest equal or higher multiple of ten = Check Digit																		→

Figure 3.A.1.1 – 2

Example of a Check Digit Calculation for the 18-Digit Field																		
Positions	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄	N ₁₅	N ₁₆	N ₁₇	N ₁₈
Number without Check Digit	3	7	6	1	0	4	2	5	0	0	2	1	2	3	4	5	6	
Step 1: multiply by	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3	
Step 2: add up	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	
results to sum	9	7	18	1	0	4	6	5	0	0	6	1	6	3	12	5	18	= 101
Step 3: Subtract sum from nearest equal or higher multiple of ten (110) = Check Digit (9)																		
Number with Check Digit	3	7	6	1	0	4	2	5	0	0	2	1	2	3	4	5	6	9

3.A.1.2 Check Digit Calculation for Price/Weight Fields

To increase the security of reading a price or weight from a bar code symbol, the Check Digit for these fields is not only calculated according to the methods described in the previous section, but also according to the procedure described in this section.

The basic principle of the Check Digit calculation is that each digit position in a price/weight field is assigned a weighting factor. Weighting factors are 2-, 3, 5+, and 5-. Each weighting factor affects the particular calculation for the position concerned. The result of such a calculation is called a weighted product.

The figures below show the weighted products of the various weighting factors.

Figure 3.A.1.2 – 1

Weighting Factor 2-										
Calculation rule: The digit is multiplied by 2. If the result has two digits, the tens digit is subtracted from the units digit. The units digit resulting is the weighted product.										
Digit	0	1	2	3	4	5	6	7	8	9
Weighted product	0	2	4	6	8	9	1	3	5	7

Figure 3.A.1.2 – 2

Weighting Factor 3										
Calculation rule: The digit is multiplied by 3. The units digit of the result is the weighted product.										
Digit	0	1	2	3	4	5	6	7	8	9
Weighted product	0	3	6	9	2	5	8	1	4	7

Figure 3.A.1.2 – 3

Weighting Factor 5+										
Calculation rule: The digit is multiplied by 5. The units digit and the tens digit of the result are added together. The result of this sum is the weighted product.										
Digit	0	1	2	3	4	5	6	7	8	9
Weighted product	0	5	1	6	2	7	3	8	4	9

Figure 3.A.1.2 – 4

Weighting Factor 5-										
Calculation rule: The digit is multiplied by 5. The tens digit of the result is subtracted from the result. The units digit of the result of this subtraction is the weighted product.										
Digit	0	1	2	3	4	5	6	7	8	9
Weighted product	0	5	9	4	8	3	7	2	6	1

3.A.1.3 Check Digit Calculation for the Four-Digit Price Field

Figure 3.A.1.3 – 1

Assigned Weighting Factors				
Digit position	1	2	3	4
Weighting factor	2-	2-	3	5-

Calculation step 1: Determine the weighted product for each number in Positions one to four according to the assigned weighting factors.

Calculation step 2: Add the products of step 1.

Calculation step 3: Multiply the result of step 2 by the factor 3. The units digit of the result is the Check Digit.

Figure 3.A.1.3 – 2

Example of a Check Digit Calculation				
Position of price field	1	2	3	4
Assigned weighting factor	2-	2-	3	5-
Amount	2	8	7	5
Step 1: weighted product according to figure	4	5	1	3
Step 2: sum	+	+	+	+
Step 3: multiply by 3				

Unit position is the Check Digit

3.A.1.4 Check Digit Calculation for the Five-Digit Price Field

Figure 3.A.1.4 – 1

Assigned Weighting Factors					
Digit positions	1	2	3	4	5
Weighting factor	5+	2-	5-	5+	2-

Calculation step 1: Determine the weighted product for each number in Positions one to five according to the assigned weighting factors.

Calculation step 2: Add the products of step 1.

Calculation step 3: Subtract the result from the nearest equal or higher multiple of 10.

Calculation step 4: Take the result and search for the same number in the weighted product row of [Figure 3.A.1.2 – 4](#). The Check Digit is the number in the digit row of the same column.

Figure 3.A.1.4 – 2

Example of a Check Digit Calculation					
Price field positions	1	2	3	4	5
Assigned weighting factor	5+	2-	5-	5+	2-
Amount	1	4	6	8	5
Step 1: weighted product according to figure	5	8	7	4	9
Step 2: sum	+	+	+	+	+
Step 3: result of subtraction (40 - 33)					
Step 4: weighted product 7 in the figure weighting factor 5- shows number 6 to be the Check Digit.					

3.A.2 Appendix 2: UCC-12 Identification Numbers in a UPC-E Bar Code Symbol

Some UCC-12 Identification Numbers beginning with the UCC Prefix 0 may be represented in a small symbol called the UPC-E Bar Code Symbol. The UCC-12 ID Number is condensed into a bar code symbol consisting of six symbol character positions. For application processing, the UCC-12 ID Number must be transformed into its full length by the bar code reader software or by the application software. There is no six-digit UPC-E Bar Code Symbol.

Figure 3.A.2 – 1

UPC-E Bar Code Symbol Option for the Identification of Global Trade Item Numbers™ (GTINs™)

UCC-12 Identification Number of Trade Item												Represented in UPC-E Symbol Positions						
UCC Company Prefix						Item Reference					Check Digit							
N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂		1	2	3	4	5	6
(0)	0	0	0	0	0	1	0	0	0	0	5	4	0	0	0	0	1	'5'
(0)	0	9	9	9	9	9	0	0	0	0	9	2	9	9	9	9	9	'9'
= 5 UPC-E Bar Code Symbol Applications																		
(0)	0	0	0	0	1	0	0	0	0	0	0	7	0	0	0	1	0	'4'
(0)	0	9	9	9	9	0	0	0	0	0	9	1	9	9	9	9	9	'4'
= 10 UPC-E Bar Code Symbol Applications																		
(0)	0	0	0	3	0	0	0	0	0	0	0	7	0	0	3	0	0	'3'
(0)	0	9	9	9	0	0	0	0	0	9	9	5	9	9	9	9	9	'3'
= 100 UPC-E Bar Code Symbol Applications																		
(0)	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	'0'
(0)	0	9	9	2	0	0	0	0	9	9	9	9	9	9	9	9	9	'2'
= 1000 UPC-E Bar Code Symbol Applications																		

Company Prefixes showing 000000 and 001000 to 007999 in positions N₁ to N₆ are not available in the UPC-E Bar Code Symbol option (see [Figure 3.A.2 – 2](#)).

Figure 3.A.2 – 2

UPC-E Bar Code Symbol Option

for the Identification of GTINs for Company Internal Distribution

UCC-12 Identification Number of Trade Item												Check Digit	Represented in UPC-E Symbol Positions						
N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁		N ₁₂		1	2	3	4	5	6
(0)	0	0	1	0	0	0	0	0	0	0	5	2		0	1	0	0	0	'5'
(0)	0	<u>0</u>	<u>7</u>	<u>9</u>	<u>9</u>	<u>9</u>	0	0	0	0	<u>9</u>	7		<u>0</u>	<u>7</u>	<u>9</u>	<u>9</u>	<u>9</u>	'9'
LAC version = 35000 UPC-E Bar Code Symbol Applications																			
(0)	0	0	1	0	0	0	0	0	1	0	0	4		0	1	1	0	0	'0'
(0)	0	<u>0</u>	<u>5</u>	<u>0</u>	0	0	0	0	<u>9</u>	<u>9</u>	<u>9</u>	2		<u>0</u>	<u>5</u>	<u>9</u>	<u>9</u>	<u>9</u>	'0'
RZSC version = 4500 UPC-E Bar Code Symbol Applications																			
(0)	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	'0'
(0)	0	<u>0</u>	<u>0</u>	<u>0</u>	0	0	0	0	<u>9</u>	<u>9</u>	<u>9</u>	7		<u>0</u>	<u>0</u>	<u>9</u>	<u>9</u>	<u>9</u>	'0'
Velocity version = 1000 UPC-E Bar Code Symbol Applications																			

Figure 3.A.2 – 2 shows the construction principle of the UPC-E Bar Code Symbol for trade item numbering for restricted distribution (company internal). These UCC-12 Identification Numbers are not unambiguous when leaving the applying company.

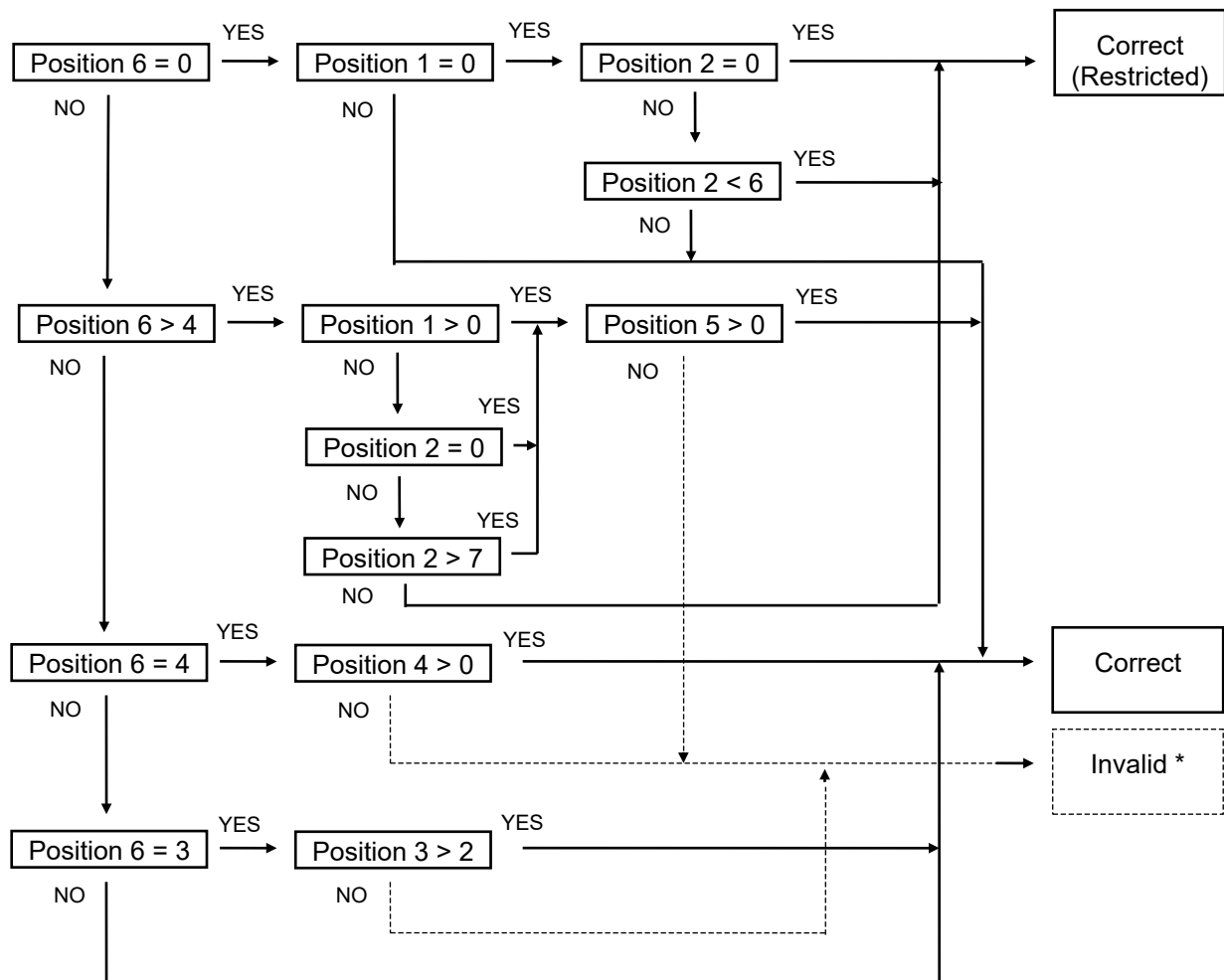
In Figures 3.A.2 – 1 and 3.A.2 – 2, each number position must only contain the digits shown in the upper and lower lines of each section and those in-between. On decoding, the extension to full length is determined by the value of the number in single quotes in the column represented in UPC-E Bar Code Symbol positions.

The Check Digit, calculated as described in [Section 3.A.1](#), applies to the entire length of the UCC-12 Identification Number. In the UPC-E Bar Code Symbol, it is implicitly represented by the parity combination of the six symbol characters that are actually encoded.

It is possible to create false UPC-E Bar Code Symbols if the encodation rules are not properly observed. Whether the digits represented in a UPC-E Bar Code Symbol can be expanded correctly to a UCC-12 Identification Number may be verified by the following tests.

Test 1: Verify the digits encoded in Positions 1 to 6 of the UPC-E Bar Code Symbol according to the diagram in Figure 3.A.2 – 3.

Figure 3.A.2 – 3



Note: These UPC-E Bar Code Symbols were valid in previous specifications. Provision for accepting them must be made during decoding only.

Test 2: Expand the digits encoded in the UPC-E Bar Code Symbol to the first 11 digits of the full length UCC-12 Identification Number, calculate the Check Digit, and compare it with the Check Digit decoded from the UPC-E Bar Code Symbol. If they do not match, it signifies an invalid symbol.

3.A.3 Appendix 3: The International Standard ISO/IEC 646

Figure 3.A.3 – 1

Unique Graphic Character Allocations

Graphic Symbol	Name	Coded Representation	Graphic Symbol	Name	Coded Representation
!	Exclamation mark	2/1	M	Capital letter M	4/13
"	Quotation mark	2/2	N	Capital letter N	4/14
%	Percent sign	2/5	O	Capital letter O	4/15
&	Ampersand	2/6	P	Capital letter P	5/0
'	Apostrophe	2/7	Q	Capital letter Q	5/1
(	Left parenthesis	2/8	R	Capital letter R	5/2
)	Right parenthesis	2/9	S	Capital letter S	5/3
*	Asterisk	2/10	T	Capital letter T	5/4
+	Plus sign	2/11	U	Capital letter U	5/5
,	Comma	2/12	V	Capital letter V	5/6
-	Hyphen/Minus	2/13	W	Capital letter W	5/7
.	Full stop	2/14	X	Capital letter X	5/8
/	Solidus	2/15	Y	Capital letter Y	5/9
0	Digit zero	3/0	Z	Capital letter Z	5/10
1	Digit one	3/1	—	Low line	5/15
2	Digit two	3/2	a	Small letter a	6/1
3	Digit three	3/3	b	Small letter b	6/2
4	Digit four	3/4	c	Small letter c	6/3
5	Digit five	3/5	d	Small letter d	6/4
6	Digit six	3/6	e	Small letter e	6/5
7	Digit seven	3/7	f	Small letter f	6/6
8	Digit eight	3/8	g	Small letter g	6/7
9	Digit nine	3/9	h	Small letter h	6/8
:	Colon	3/10	i	Small letter i	6/9
;	Semicolon	3/11	j	Small letter j	6/10
<	Less-than sign	3/12	k	Small letter k	6/11
=	Equals sign	3/13	l	Small letter l	6/12
>	Greater-than sign	3/14	m	Small letter m	6/13
?	Question mark	3/15	n	Small letter n	6/14
A	Capital letter A	4/1	o	Small letter o	6/15
B	Capital letter B	4/2	p	Small letter p	7/0
C	Capital letter C	4/3	q	Small letter q	7/1
D	Capital letter D	4/4	r	Small letter r	7/2
E	Capital letter E	4/5	s	Small letter s	7/3
F	Capital letter F	4/6	t	Small letter t	7/4
G	Capital letter G	4/7	u	Small letter u	7/5
H	Capital letter H	4/8	v	Small letter v	7/6
I	Capital letter I	4/9	w	Small letter w	7/7
J	Capital letter J	4/10	x	Small letter x	7/8
K	Capital letter K	4/11	y	Small letter y	7/9
L	Capital letter L	4/12	z	Small letter z	7/10

3.A.4 Appendix 4: GS1 Data Titles

3.A.4.1 All Application Identifiers

Figure 3.A.4.1 – 1

AI	Full Title	Format	Data Title
00	SSCC (Serial Shipping Container Code)	n2+n18	SSCC
01	Global Trade Item Number™	n2+n14	GTIN™
02	GTIN of Trade Items Contained in a logistic unit	n2+n14	CONTENT
10	Batch or lot number	n2+an..20	BATCH/LOT
11*	Production date (YYMMDD)	n2+n6	PROD DATE
12*	Due date (YYMMDD)	n2+n6	DUE DATE
13*	Packaging date (YYMMDD)	n2+n6	PACK DATE
15*	Best before date (YYMMDD)	n2+n6	BEST BEFORE or SELL BY
17*	Expiration date (YYMMDD)	n2+n6	USE BY OR EXPIRY
20	Product variant	n2+n2	VARIANT
21	Serial number	n2+an..20	SERIAL
22	Secondary data for specific health industry products	n2+an..29	QTY/DATE/BATCH
240	Additional product identification assigned by the manufacturer	n3+an..30	ADDITIONAL ID
241	Customer part number	n3+an..30	CUST. PART NO.
250**	Secondary serial number	n3+an..30	SECONDARY SERIAL
251**	Reference to source entity	n3+an..30	REF. TO SOURCE
253	Global Document Type Identifier	n3+n13+n..17	DOC. ID
254	GLN Extension component	n3+an..20	GLN EXTENSION
30	Variable count	n2+n..8	VAR. COUNT

* When only year and month are required, DD must be filled with "00".

** The actual data title may be specified by the issuer of the data.

All Application Identifiers (*continued*)

AI	Full Title	Format	Data Title
310n-369n	(Trade and logistic measurements)	n4+n6	
337n	Kilograms per square metre	n4+n6	KG PER m ²
37	Count of trade items contained in a logistic unit	n2+n..8	COUNT
390(n)	Amount payable – single monetary area	n4+n..15	AMOUNT
391(n)	Amount payable – with ISO currency code	n4+n3+n..15	AMOUNT
392(n)	Amount payable for a Variable Measure Trade Item – single monetary unit	n4+n..15	PRICE
393(n)	Amount payable for a Variable Measure Trade Item – with ISO currency code	n4+n3+n..15	PRICE
400	Customer's purchase order number	n3+an..30	ORDER NUMBER
401	Consignment number	n3+an..30	CONSIGNMENT
402	Shipment Identification Number	n3+n17	SHIPMENT NO.
403	Routing code	n3+an..30	ROUTE
410	Ship to - deliver to Global Location Number	n3+n13	SHIP TO LOC
411	Bill to - invoice to Global Location Number	n3+n13	BILL TO
412	Purchased from Global Location Number	n3+n13	PURCHASE FROM
413	Ship for - deliver for - forward to Global Location Number	n3+n13	SHIP FOR LOC
414	Identification of a physical location Global Location Number	n3+n13	LOC No
415	Global Location Number of the Invoicing Party	n3+n13	PAY TO

All Application Identifiers (*continued*)

AI	Full Title	Format	Data Title
420	Ship to - deliver to postal code within a single postal authority	n3+an..20	SHIP TO POST
421	Ship to - deliver to postal code with Three-Digit ISO country code	n3+n3+an..9	SHIP TO POST
422	Country of origin of a trade item	n3+n3	ORIGIN
423	Country of initial processing	n3+n3+n..12	COUNTRY - INITIAL PROCESS.
424	Country of processing	n3+n3	COUNTRY - PROCESS.
425	Country of disassembly	n3+n3	COUNTRY - DISASSEMBLY
426	Country covering full process chain	n3+n3	COUNTRY – FULL PROCESS
7001	NATO stock number	n4+n13	NSN
7002	UN/ECE meat carcasses and cuts classification	n4+an..30	MEAT CUT
703(s)***	Approval number of processor with ISO country code	n4+n3+an..27	PROCESSOR # s ⁴
8001	Roll products - width, length, core diameter, direction, and splices	n4+n14	DIMENSIONS
8002	Electronic serial identifier for cellular mobile telephones	n4+an..20	CMT No
8003	Global Returnable Asset Identifier	n4+n14+an..16	GRAI
8004	Global Individual Asset Identifier	n4+an..30	GIAI
8005	Price per unit of measure	n4+n6	PRICE PER UNIT
8006	Identification of the component of a trade item	n4+n14+n2+n2	GCTIN
8007	International Bank Account Number	n4+an..30	IBAN
8008	Date and time of production	n4+n8+n..4	PROD TIME
8018	Global Service Relation Number	n4+n18	GSRN
8020	Payment Slip Reference Number	n4+an..25	REF No
8100	GS1-128 Coupon Extended Code - NSC + Offer Code	n4+n1+n5	-
8101	GS1-128 Coupon Extended code - NSC + Offer Code + end of offer code	n4+n1+n5+n4	-
8102	GS1-128 Coupon Extended Code – NSC	n4+n1+n1	-
90**	Information mutually agreed between trading partners (including FACT DIs)	n2+an..30	INTERNAL
91-99**	Company internal information	n2+an..30	INTERNAL

* When only year and month are required, DD must be filled with "00".

** The actual data title may be specified by the issuer of the data.

*** The fourth digit of this AI, "s," indicates the sequence of the processors in the supply chain (see Section 3.6.46).

3.A.4.2 Metric Trade Measures

Figure 3.A.4.2 – 1

AI	Full Title	Unit of Measure	Data Title
	Data Format n6		
310 (n)*	Net weight	Kilograms	NET WEIGHT (kg)
311 (n)	Length or first dimension, trade	Metres	LENGTH (m)
312 (n)	Width, diameter, or second dimension, trade	Metres	WIDTH (m)
313 (n)	Depth, thickness, height, or third dimension, trade	Metres	HEIGHT (m)
314 (n)	Area, trade	Square metres	AREA (m ²)
315 (n)	Net volume	Litres	NET VOLUME (l)
316 (n)	Net volume	Cubic metres	NET VOLUME (m ³)

*(n) indicates the decimal point position outlined in [Section 7.5](#).

3.A.4.3 Non-Metric Trade Measures

Figure 3.A.4.3 – 1

AI	Full Title	Unit of Measure	Data Title
	Data Format n6		
320 (n)*	Net weight	Pounds	NET WEIGHT (lb)
321 (n)	Length or first dimension, trade	Inches	LENGTH (i)
322 (n)	Length or first dimension, trade	Feet	LENGTH (f)
323 (n)	Length or first dimension, trade	Yards	LENGTH (y)
324 (n)	Width, diameter, or second dimension, trade	Inches	WIDTH (i)
325 (n)	Width, diameter, or second dimension, trade	Feet	WIDTH (f)
326 (n)	Width, diameter, or second dimension, trade	Yards	WIDTH (y)
327 (n)	Depth, thickness, height, or third dimension, trade	Inches	HEIGHT (i)
328 (n)	Depth, thickness, height, or third dimension, trade	Feet	HEIGHT (f)
329 (n)	Depth, thickness, height, or third dimension, trade	Yards	HEIGHT (y)
350 (n)	Area, trade	Square inches	AREA (i ²)
351 (n)	Area, trade	Square feet	AREA (f ²)
352 (n)	Area, trade	Square yards	AREA (y ²)
356 (n)	Net weight	Troy ounces	NET WEIGHT (t)
357 (n)	Net volume (or weight)	Ounces (U.S.)	NET VOLUME (oz)
360 (n)	Net volume	Quarts	NET VOLUME (q)
361 (n)	Net volume	Gallons (U.S.)	NET VOLUME (g)
364 (n)	Net volume	Cubic inches	NET VOLUME (i ³)
365 (n)	Net volume	Cubic feet	NET VOLUME (f ³)
366 (n)	Net volume	Cubic yards	NET VOLUME (y ³)

*(n) indicates the decimal point position outlined in [Section 7.5](#).

3.A.4.4 Metric Logistic Measures

Figure 3.A.4.4 – 1

AI	Full Title	Unit of Measure	Data Title
	Data Format n6		
330 (n)*	Gross weight	Kilograms	GROSS WEIGHT (kg)
331 (n)	Length or first dimension, logistics	Metres	LENGTH (m), log
332 (n)	Width, diameter, or second dimension, logistics	Metres	WIDTH (m), log
333 (n)	Depth, thickness, height, or third dimension, logistics	Metres	HEIGHT (m), log
334 (n)	Area, logistics	Square metres	AREA (m ²), log
335 (n)	Gross volume	Litres	VOLUME (l), log
336 (n)	Gross volume	Cubic metres	VOLUME (m ³), log

*(n) indicates the decimal point position outlined in [Section 7.5](#).

3.A.4.5 Non-Metric Logistic Measures

Figure 3.A.4.5 – 1

AI	Full Title	Unit of Measure	Data Title
	Data Format n6		
340 (n)*	Gross weight	Pounds	GROSS WEIGHT (lb)
341 (n)	Length or first dimension, logistics	Inches	LENGTH (i), log
342 (n)	Length or first dimension, logistics	Feet	LENGTH (f), log
343 (n)	Length or first dimension, logistics	Yards	LENGTH (y), log
344 (n)	Width, diameter, or second dimension, logistics	Inches	WIDTH (i), log
345 (n)	Width, diameter, or second dimension, logistics	Feet	WIDTH (f), log
346 (n)	Width, diameter, or second dimension, logistics	Yards	WIDTH (y), log
347 (n)	Depth, thickness, height, or third dimension, logistics	Inches	HEIGHT (i), log
348 (n)	Depth, thickness, height, or third dimension, logistics	Feet	HEIGHT (f), log
349 (n)	Depth, thickness, height, or third dimension, logistics	Yards	HEIGHT (y), log
353 (n)	Area, logistics	Square inches	AREA (i ²), log
354 (n)	Area, logistics	Square feet	AREA (f ²), log
355 (n)	Area, logistics	Square yards	AREA (y ²), log
362 (n)	Gross volume	Quarts	VOLUME (q), log
363 (n)	Gross volume	Gallons (U.S.)	VOLUME (g), log
367 (n)	Gross volume	Cubic inches	VOLUME (i ³), log
368 (n)	Gross volume	Cubic feet	VOLUME (f ³), log
369 (n)	Gross volume	Cubic yards	VOLUME (y ³), log

*(n) indicates the decimal point position outlined in [Section 7.5](#).

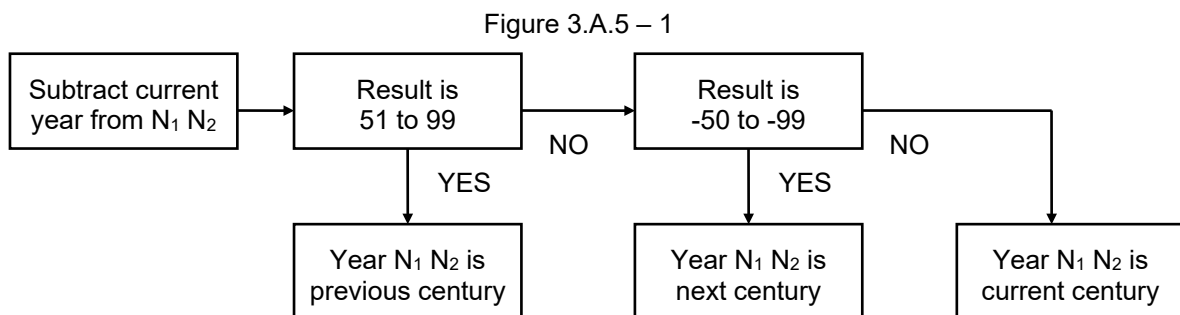
3.A.5 Appendix 5: Determination of Century in Dates

Element Strings are available for the following types of dates:

- Production date: AI (11)
- Due date: AI (12)
- Packaging date: AI (13)
- Best before date (quality): AI (15)
- Expiration date (safety): AI (17)
- Date and time of production: AI (8008)

It is left to the discretion of the user to interpret a particular date type in the sense of his business practices. Such interpretation may change according to the product range for which a date is being applied

Since the year data field consists of two positions, the century is established by following the procedure in Figure 3.A.5 – 1.



Note: The Element String can only specify a date in the range from 49 years in the past to 50 years in the future of the current year.

Section 4.0:

Association of Element Strings to Form Valid Messages

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4.1 Introduction

The main purpose of automatic data capture (ADC) is to replace manual entry of visually captured information. This implies that an ADC message has to provide all information required for a transaction without human intervention. GS1 System data may be used, for example, to record entities in computer files, to sort goods on conveyor belts, to check completeness of a consignment, to verify dates, and to record physical stock taking.

Element Strings may be applied directly on physical goods or printed in catalogues or documents. The scanning source and the type of transaction determine the required information in a given business application. Since all ADC data is being used in Electronic Data Processing (EDP) applications, strict validation of data to be processed is an absolute prerequisite.

For correct processing of scanned data, certain business applications may require the association of Element Strings representing a particular combination of identification data. The GS1 System enables users to achieve the needed level of data accuracy through the use of adequate Element Strings.

The logical set up of the data standard of the GS1 System enables system users to validate scanned data messages (see [Section 7.0, System Processing in EDP Applications](#)).

Validation is effected on two levels. The first is validation of the data for conformity with system rules (e.g., to provide a message that contains all information to be processed logically without human intervention). The second level is validation of the data for conformity with the requirements of a particular business application.

Figures [4.3 – 1](#) and [4.4 - 1](#) show the rules for the first verification level (e.g., validate data to conform with the system logic). [Figure 4.3 - 1](#) defines the pairs of Element Strings that cannot appear on the same physical entity. [Figure 4.4 – 1](#) defines the Element Strings that mandate the appearance of another Element String on the same physical entity. All other combinations of Element Strings are possible at the first level of verification, although they may not make sense at the second, the application level.

4.2 Basic Considerations

The Element Strings that require specialised software and/or scanner set up are not covered by these rules. These are the Element Strings with GS1 Prefixes 0001 to 0007, 02, 04, 05, 20 to 29, 980, and 99; EAN/UCC-8 Prefixes 0 and 2; two-digit and five-digit Add-On Symbols; and AIs (8100) to (8102).

Duplicate Element Strings appearing on the same physical entity must have the same value.

In [Figures 4.3–1](#) and [4.4–1](#), the Application Identifiers (AIs) are used to indicate the Element String. The AI (01) is used to indicate Global Trade Item Number™ (GTIN™), however the Element Strings that encode GTINs are defined in [Sections 3.2.1, 3.3.1, 3.5.1, 3.5.2, 3.5.3, 3.6.2, 3.6.3, and 3.6.52](#). GTINs may be encoded in bar code symbols from the EAN/UPC Symbol family, ITF-14 Bar Code Symbols, RSS Symbol family, and GS1-128 Bar Code Symbols using AI (01) or AI (8006).

4.3 Invalid Pairs of Element Strings

Figure 4.3 – 1 defines the pairs of Element Strings that cannot appear on the same physical entity.

Figure 4.3 – 1

Pair of Element Strings				Comment
AI	Designation	AI	Designation	
01	Identification of a trade item	01	Identification of a trade item	Duplicate Global Trade Item Numbers™ (GTINs™) with different values
01	Identification of a trade item	02	Identification of logistic unit contents	AI (02) must not be used for the identification of trade items contained in a trade item.
01	Identification of a trade item	37	Count of units contained	The count of units contained would duplicate the master data of the GTIN™. AI (37) may only be used with AI (02).
22	Secondary data for the health industry	30	Count	Duplicate counts with different values
22	"	10	Batch/lot number	Duplicate lot numbers with different values
22	"	17	Expiration date	Duplicate expiration date with different values
22	"	21	Serial number	Duplicate serial numbers with different values
420	Ship to postal code, single postal authority	421	Ship to postal code with ISO country code	Only one ship to postal code may be applied on an item.
422	Country of origin of a trade item	426	Country of full processing	Duplication of country of origin of a trade item (covered by country of full processing)
423	Country of initial processing	426	Country of full processing	Duplication of country of initial processing (covered by country of full processing)
424	Country of processing	426	Country of full processing	Duplication of country of processing (covered by country of full processing)
425	Country of disassembly	426	Country of full processing	Duplication of country of disassembly (covered by country of full processing)
390n	Amount payable – single monetary area	391n	Amount payable – with ISO currency code	Only one amount payable Element String may be applied on a payment slip.
8006	Component identification	01	Identification of a trade item	Other GTINs cannot be used with AI (8006). The trade item is identified by a GTIN

Pair of Element Strings				Comment
AI	Designation	AI	Designation	
				contained in the AI (8006).

4.4 Mandatory Association of Element Strings

Figure 4.4 – 1 defines the Element Strings that mandate the appearance of another Element String on the same physical entity.

Figure 4.4 – 1

If Element String		Then	Comment
AI	Designation	Mandatory Associated Element String	
01 or 02 with N ₁ = 9	Identification of a Variable Measure Trade Item	30, 3nnn ¹ or 3nnn ² or 8001	Mandatory association with variable measure information Only GS1-128, ITF-14, and RSS Expanded Bar Code Symbols can encode a GTIN with N ₁ = 9.
02	Identification of logistic unit contents	00	Mandatory association with a Serial Shipping Container Code (SSCC)
02	Identification of logistic unit contents	37	Mandatory count of the contained trade items
10	Batch/lot number	01 or 02	Mandatory association with a Global Trade Item Number™ (GTIN) or with the identification of logistic unit contents
11, 13, 15, 17	Dates	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
12	Due date	8020 and 415	Mandatory association with the Payment Slip Reference Number (AI (8020)) and the Global Location Number (GLN) of the invoicing party
20	Product variant	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
21	Serial number	01	Mandatory association with a GTIN of a single trade item (a serial number cannot apply to a grouping of trade items)
22	Secondary data health industry	01	Mandatory association with a GTIN

If Element String		Then	Comment
AI	Designation	Mandatory Associated Element String	
240	Additional product identification	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
241	Customer part number	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
250	Secondary serial number	01	Mandatory association with a GTIN (a secondary serial number cannot apply to a grouping of trade items)
251	Reference to source entity	01	Mandatory association with GTIN of the trade item
254	Extension Component of a GLN	414	Mandatory association with AI 414. Only GS1-128, and RSS Expanded symbologies, and EPC RFID tags are valid. This is used with GLN and not GTIN.
30	Variable count	01 or 02	Mandatory association with a variable measure GTIN (e.g., an EAN/UCC-14 Identification Number starting with the digit 9) or the identification of variable measure content of a logistic unit
3nnn*	Trade measures which cannot be summed	01	Mandatory association with a variable measure GTIN (e.g., an EAN/UCC-14 Identification Number starting with the digit 9)
3nnn**	Trade measures which can be summed	01 or 02	Mandatory association with a variable measure GTIN (e.g., an EAN/UCC-14 Identification Number starting with the digit 9) or the identification of variable measure content of a logistic unit
3nnn***	Logistic measures	00 or 01	Mandatory association with an SSCC or a variable measure GTIN (e.g., an EAN/UCC-14 Identification Number starting with the digit 9)
337n	Kilograms per square metre	01	Mandatory association with a GTIN
37	Count of units contained	02	Mandatory association with the identification of logistic unit contents
390n	Amount payable – single monetary area	8020 and 415	Mandatory association with the Payment Slip Reference Number, AI (8020), and the GLN of the invoicing party
391n	Amount payable – with ISO currency code	8020 and 415	Mandatory association with the Payment Slip Reference Number, AI (8020), and the GLN of the invoicing party

If Element String		Then	Comment
AI	Designation	Mandatory Associated Element String	
392n	Amount payable – single monetary unit	01	Mandatory association with variable measure GTIN (e.g., an EAN/UCC-14 Identification Number starting with the digit 9)
393n	Amount payable – with ISO currency code	01	Mandatory association with variable measure GTIN (e.g., an EAN/UCC-14 Identification Number starting with the digit 9)
403	Routing code	00	Mandatory association with an SSCC
415	GLN of the invoicing party	8020	Mandatory association with Payment Slip Reference Number, AI (8020)
422	Country of origin	01 or 02	Mandatory association with a GTIN
423	Country of initial processing	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
424	Country of processing	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
425	Country of disassembly	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
426	Country of full processing	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
7001	NATO Stock Number	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
7002	UN/ECE Meat Carcasses and Cuts Classification	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
703(s)	Approval number of processor	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
8001	Variables of roll products	01	Mandatory association with a variable measure GTIN (e.g., an EAN/UCC-14 Identification Number starting with the digit 9)
8005	Price per unit of measure	01 or 02 with N ₁ = 9	Mandatory association with a variable measure GTIN or the identification of variable measure content of a logistic unit
8007	International Bank Account Number, AI	8020 and 415	Mandatory association with the Payment Slip Reference Number, AI (8020), and the GLN of the invoicing party

If Element String AI Designation		Then Mandatory Associated Element String	Comment
	(8007)		
8008	Date and time of production	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
8020	Payment Slip Reference Number, AI (8020)	415	Mandatory association with the GLN of the invoicing party

*Als (3nnn) where the first three digits are 312, 313, 324, 325, 326, 327, 328, and 329.

**Als (3nnn) where the first three digits are 310, 311, 314, 315, 316, 320, 321, 322, 323, 350, 351, 352, 356, 357, 360, 361, 364, 365, and 366.

***Als (3nnn) where the first three digits are 330, 331, 332, 333, 334, 335, 336, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 353, 354, 355, 362, 363, 367, 368, and 369.

Section 5.0:

Data Carriers

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5.0.1 Introduction

A data carrier is a means of representing data in machine readable form. Data carriers that are endorsed by GS1 are described in Sections [5.1](#), [5.2](#), and [5.3](#), and bar code production and quality assessment are covered in [Section 5.4](#).

The GS1 System specifies the data carrier used to represent any given Element String. [Section 2.0](#) covers rules indicating which data carrier should be used to represent which Element Strings in particular applications.

The GS1 System uses the following data carriers:

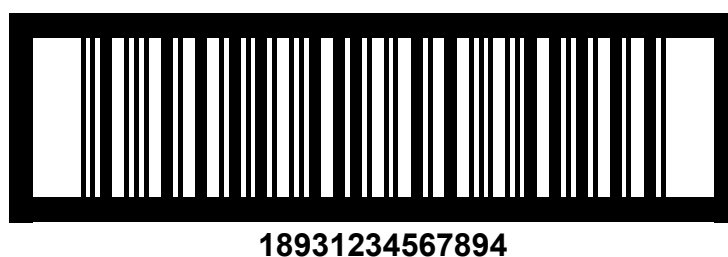
The EAN/UPC Symbology family of bar code symbols (UPC-A, UPC-E, EAN-13, and EAN-8 Bar Code Symbols and the two- and five-digit Add-On Symbols) can be read omnidirectionally. These symbols must be used for all items that are scanned at the Point-of-Sale and may be used on other trade items.

Figure 5.0.1 - 1



ITF-14 (Interleaved 2-of-5) Bar Code Symbols carry ID numbers only on trade items that are not expected to pass through the Point-of-Sale. ITF-14s are better suited for direct printing onto corrugated fibreboard.

Figure 5.0.1 – 2



The GS1-128 is a subset of the Code 128 Bar Code Symbology. Its use is exclusively licensed to GS1. This extremely flexible symbology encodes Element Strings using Application Identifiers.

Figure 5.0.1 – 3



Reduced Space Symbology® (RSS) is a family of linear symbologies used within the GS1 System. This family of linear symbologies in most cases implicitly encodes Application Identifier (01) and in the case of RSS Expanded explicitly encodes Element Strings using Application Identifiers.

Figure 5.0.1 – 4



Composite Component™ Symbols do not exist in isolation. The primary identification number is always encoded in the linear symbol and supplementary AI Element Strings may be encoded in the two-dimensional (2D) component where they take up less space.

Figure 5.0.1 – 5



Data Matrix ISO version ECC 200 is the only version that supports GS1 System data structures, including Function Code 1. Implementation of Data Matrix shall be done per approved GS1 System application guidelines such as very small healthcare items.

Figure 5.0.1 – 6



5.0.2 International Standards

A number of national and regional standardisation bodies have developed bar code symbol technical standards. The International Standards Organisation (ISO) has published standard bar code symbology specifications via a subcommittee of ISO/IEC JTC1 (International Standards Organisation/International Electronics Committee Joint Technical Committee 1).

GS1 is actively involved in developing these standards. The objective is that GS1 System standards remain fully compatible with relevant published national, regional, and international symbology standards. The pertinent documents for Section 5 include:

Section 5.0: ISO/IEC 15424 information technology; automatic identification and data capture techniques; Data carrier/Symbology Identifiers

Section 5.1: ISO/IEC 15420 information technology; automatic identification and data capture techniques; bar code symbology specifications; EAN/UPC

Section 5.2: ISO/IEC 16390 information technology; automatic identification and data capture techniques; bar code symbology specifications; ITF-14 (Interleaved 2-of-5)

Section 5.3: ISO/IEC 15417 information technology; automatic identification and data capture techniques; bar code symbology specifications; Code 128

Section 5.5: ISO/IEC 15438 – Automatic identification and data capture techniques - Symbology specification - PDF417.

Section 5.6: ISO/IEC 16022 Information technology - International Symbology Specification - Data Matrix.

5.0.3 Symbology Identifiers

The symbology identifier is not encoded in the bar code symbol, but is generated by the decoder after decoding and is transmitted as a preamble to the data message.

All scanning equipment has the ability to recognise the symbology that has been scanned. Some scanners have the optional feature of being able to transmit a symbology identifier. The symbology identifier is a three-character data string comprising a flag character, code character, and a modifier character.

] is the flag character (which has an ASCII value of 93). This denotes that the two characters following are symbol identifier characters.

c is the code character. This denotes the type of symbology.

m is the modifier character. This indicates the mode in which the symbology is used.

Note: If used, the symbology identifier is transmitted as a prefix to the data message.

The symbology identifiers used in the GS1 System are as follows:

Figure 5.0.3 – 1

Symbology Identifier*	Symbology Format	Content
] E 0	EAN-13, UPC-A, or UPC-E	13 digits
] E 1	Two-digit Add-On Symbol	2 digits
] E 2	Five-digit Add-On Symbol	5 digits
] E 3	EAN-13, UPC-A, or UPC-E with Add-On Symbol**	15 or 18 digits
] E 4	EAN-8	8 digits
] I 1	ITF-14	14 digits
] C 1	GS1-128	Standard AI Element Strings
] e 0	RSS***	Standard AI Element Strings
] d 2	Data Matrix	Standard AI Element Strings

Notes:

* Symbology identifiers are case sensitive.

** Bar code symbols with Add-On Symbols may be considered either as two separate symbols, each of which is transmitted separately with its own symbology identifier, or as a single data packet. The system designer shall select one of these methods, but the method using symbology identifier]E3 is preferable for data security.

*** The RSS symbology has several symbol types and the full list of modifier characters is found in Section 5.5.

Section 5.1:

EAN/UPC Symbology Specifications

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5.1.1 Symbology Characteristics

Characteristics of bar code symbols in the EAN/UPC Symbology family include:

- Numeric encodable character set (0 to 9) (e.g., ASCII characters 48 to 57 inclusive, in accordance with ISO 646)
- Symbology type: continuous
- Symbol character density: seven modules per symbol character
- Four elements per symbol character comprising two bars (dark bars) and two spaces (light bars), each of one, two, three, or four modules in width (auxiliary guard patterns have differing numbers of elements)
- Character self-checking
- Fixed data string length encodable: 8, 12, or 13 characters including Check Digit, depending on specific symbol type
- Omni-directionally decodable
- One mandatory Check Digit (described in [Section 3.A.1](#))
- Non-data overhead not including the Check Digit or Quiet Zones:
 - 11 modules for EAN-13, EAN-8, and UPC-A Bar Code Symbols (left Guard Bar Pattern/centre Guard Bar Pattern/right Guard Bar Pattern)
 - Nine modules for UPC-E Bar Code Symbols (left Guard Bar Pattern/right Guard Bar Pattern)

5.1.1.1 Symbol Types

The bar code symbols in the EAN/UPC Symbology family are:

- EAN-13, UPC-A, and UPC-E Bar Code Symbols, all of which may be accompanied by an Add-On Symbol
- EAN-8 Bar Code Symbols

The four symbol types are described in Sections [5.1.1.3.1](#), [5.1.1.3.2](#), [5.1.1.3.3](#), and [5.1.1.3.4](#), and the optional Add-On Symbols are described in [Section 5.1.1.3.5](#).

5.1.1.2 Symbol Encodation

5.1.1.2.1 Symbol Character Encodation

Symbol characters shall encode digit values in seven module characters selected from different number sets known as A, B, and C, as shown in Figure 5.1.1.2.1 – 1.

Figure 5.1.1.2.1 – 1

Number Sets A, B, and C

Digit Value	Set A Element Widths				Set B Element Widths				Set C Element Widths			
	S	B	S	B	S	B	S	B	B	S	B	S
0	3	2	1	1	1	1	2	3	3	2	1	1
1	2	2	2	1	1	2	2	2	2	2	2	1
2	2	1	2	2	2	2	1	2	2	1	2	2
3	1	4	1	1	1	1	4	1	1	4	1	1
4	1	1	3	2	2	3	1	1	1	1	3	2
5	1	2	3	1	1	3	2	1	1	2	3	1
6	1	1	1	4	4	1	1	1	1	1	1	4
7	1	3	1	2	2	1	3	1	1	3	1	2
8	1	2	1	3	3	1	2	1	1	2	1	3
9	3	1	1	2	2	1	1	3	3	1	1	2
Note: S denotes a space (light bar), B denotes a bar (dark bar), and the element widths are in modules.												

Figure 5.1.A.1 – 1 graphically illustrates Figure 5.1.1.2.1 – 1. The sum of the bar (dark bar) modules in any symbol character determines its parity. Symbol characters in number set A are odd parity characters. Symbol characters in number sets B and C are even parity characters. Number set C characters are mirror images of number set B characters.

Symbol characters in number sets A and B always begin on the left with a space module and end on the right with a dark module. Symbol characters in number set C begin on the left with a dark module and end on the right with a light module.

A data character shall normally be represented by a symbol character. However, in certain specific instances defined in Sections 5.1.1.3.1, 5.1.1.3.4, and 5.1.1.3.5, the combination of number sets in a symbol may itself represent either data or a Check Digit value. This technique is referred to as variable parity encodation.

5.1.1.2.2 Auxiliary Pattern Encodation

Auxiliary patterns shall be composed as shown in Figure 5.1.1.2.2 – 1.

Figure 5.1.1.2.2 – 1
Auxiliary Patterns

Auxiliary Pattern	Number of Modules	Element Widths in Modules					
		S	B	S	B	S	B
Normal Guard Bar Pattern	3		1	1	1		
Centre Guard Bar Pattern	5	1	1	1	1	1	
Special Guard Bar Pattern	6	1	1	1	1	1	1
Add-on Guard Bar Pattern	4		1	1	2		
Add-On delineator	2	1	1				
Note: S denotes a space (light) element and B denotes a bar (dark) element.							

Section 5.1.A.2 graphically illustrates these patterns.

The normal Guard Bar Pattern corresponds to the start and stop patterns in other symbolologies, and the special Guard Bar Pattern is used as a stop pattern in UPC-E Bar Code Symbols.

5.1.1.3 Symbol Formats

5.1.1.3.1 EAN-13 Bar Code Symbols

The EAN-13 Bar Code Symbol shall be made up as follows, reading from left to right:

- A left Quiet Zone
- A normal Guard Bar Pattern

- Six symbol characters from number sets A and B
- A centre Guard Bar Pattern
- Six symbol characters from number set C
- A normal Guard Bar Pattern
- A right Quiet Zone

The rightmost symbol character shall encode the Check Digit calculated in accordance with [Section 3.A.1](#).

Since the EAN-13 Bar Code Symbol comprises only 12 symbol characters but encodes 13 digits of data (including the Check Digit), the value of the additional digit, which is the character in the leftmost position in the data string, shall be encoded by the variable parity mix of number sets A and B for the six symbol characters in the left half of the symbol. The numbering system for values of the leading digit is specified in Figure 5.1.1.3.1 – 1. Figure 5.1.1.3.1 – 2 is an example of an EAN-13 Bar Code Symbol.

Figure 5.1.1.3.1 – 1

Left Half of an EAN-13 Bar Code Symbol

Leading Digit, Implicitly Encoded	Number Sets Used for Numbering Left Half of an EAN-13 Bar Code Symbol					
	Symbol Character Position					
	1	2	3	4	5	6
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

*Note: The leading digit value “0” is reserved for symbols encoding UCC-12

Identification Number Element Strings.

Figure 5.1.1.3.1 – 2

EAN-13 Bar Code Symbol



5.1.1.3.2 EAN-8 Bar Code Symbols

The EAN-8 Bar Code Symbol shall be made up as follows, reading from left to right:

- A left Quiet Zone
- A normal Guard Bar Pattern
- Four symbol characters from number set A
- A centre Guard Bar Pattern
- Four symbol characters from number set C
- A normal Guard Bar Pattern
- A right Quiet Zone

The rightmost symbol character shall encode the Check Digit calculated in accordance with [Section 3.A.1](#). Figure 5.1.1.3.2 – 1 is an example of an EAN-8 Bar Code Symbol.

Figure 5.1.1.3.2 – 1

EAN-8 Bar Code Symbol



5.1.1.3.3 UPC-A Bar Code Symbols

The UPC-A Bar Code Symbol shall be made up as follows, reading from left to right:

- A left Quiet Zone
- A normal Guard Bar Pattern
- Six symbol characters from number set A
- A centre Guard Bar Pattern
- Six symbol characters from number set C
- A normal Guard Bar Pattern
- A right Quiet Zone

The rightmost symbol character shall encode the Check Digit calculated in accordance with [Section 3.A.1](#). A UPC-A Bar Code Symbol may be decoded as a 13-digit number by adding an implied leading zero to the UCC-12 Identification Number. Figure 5.1.1.3.3 – 1 is an example of a UPC-A Bar Code Symbol.

Figure 5.1.1.3.3 – 1
UPC-A Bar Code Symbol



5.1.1.3.4 UPC-E Bar Code Symbols

The UPC-E Bar Code Symbol shall be made up as follows, reading from left to right:

- A left Quiet Zone
- A normal Guard Bar Pattern
- Six symbol characters from number sets A and B
- A special Guard Bar Pattern
- A right Quiet Zone

The UPC-E Bar Code Symbol may only be used to encode UCC-12 Identification Number Element Strings which commence with a zero and contain a sequence of four or five zeroes in defined positions, as shown in [Figure 5.1.1.3.4.2 – 1](#). These zeros are removed from the data during encoding by the zero-suppression process described in [Section 5.1.1.3.4.1](#). Figure 5.1.1.3.4 – 1 is an example of a UPC-E Bar Code Symbol.

Figure 5.1.1.3.4 – 1

UPC-E Bar Code Symbol (Encoding 001234000057 by Zero-Suppression)



5.1.1.3.4.1 Encodation of a UPC-E Bar Code Symbol

The following algorithm describes the encodation of a data string suitable for zero-suppression:

1. Let D1, D2, and D3 through D12 denote the UCC-12 Identification Number data characters (including Check Digit). D1 shall always be zero. D12 shall be the Check Digit calculated according to the algorithm in Section 3.A.1. Let X1 and X2 through X6 denote the six symbol characters in the final UPC-E Bar Code Symbol.
2. Convert D2 through D11 into a symbol character string by removing zeroes according to the following rules:

- If D11 equals 5, 6, 7, 8, or 9
and D7 to D10 inclusive are all 0
and D6 is not 0

then D7 to D10 are not encoded.

Symbol character:	X1	X2	X3	X4	X5	X6
Data character:	D2	D3	D4	D5	D6	D11

- If D6 to D10 inclusive are all 0
and D5 is not 0

then D6 to D10 are not encoded and X6 = 4.

Symbol character:	X1	X2	X3	X4	X5	X6
Data character:	D2	D3	D4	D5	D11	4

- If D4 is 0, 1, or 2
and D5 to D8 inclusive are all 0

then D5 to D8 are not encoded.

Symbol character:	X1	X2	X3	X4	X5	X6
Data character:	D2	D3	D9	D10	D11	D4

- If D4 is 3, 4, 5, 6, 7, 8, or 9
and D5 to D9 inclusive are all 0

then D5 to D9 are not encoded and X6 = 3.

Symbol character:	X1	X2	X3	X4	X5	X6

Data character: D2 D3 D4 D10 D11 3

3. Determine the number sets for the implicit encodation of D12 from Figure 5.1.1.3.4.1 – 1.
4. Encode symbol characters X1 to X6 using number sets A and B as determined in Step 3.

Figure 5.1.1.3.4.1 – 1

Value of Check Digit D12	Number Sets Used for Numbering a UPC-E Bar Code Symbol					
	Symbol Character Position					
	1	2	3	4	5	6
0	B	B	B	A	A	A
1	B	B	A	B	A	A
2	B	B	A	A	B	A
3	B	B	A	A	A	B
4	B	A	B	B	A	A
5	B	A	A	B	B	A
6	B	A	A	A	B	B
7	B	A	B	A	B	A
8	B	A	B	A	A	B
9	B	A	A	B	A	B

Figure 5.1.1.3.4.1 – 2

Example 1:	Original Data	Zero-Suppressed	Rule
	0 1 2 3 4 5 0 0 0 0 5 8	1 2 3 4 5 5	2a
		B A B A A B	

Figure 5.1.1.3.4.1 – 3

Example 2:	Original Data	Zero-Suppressed	Rule
	0 4 5 6 7 0 0 0 0 0 8 0	4 5 6 7 8 4	2b
		B B B A A A	

Figure 5.1.1.3.4.1 – 4

Example 3:	Original Data	Zero-Suppressed	Rule
	0 3 4 0 0 0 0 0 5 6 7 3	3 4 5 6 7 0	2c
		B B A A A B	

Figure 5.1.1.3.4.1 – 5

Example 4:	Original Data	Zero-Suppressed	Rule
	0 9 8 4 0 0 0 0 0 7 5 1	9 8 4 7 5 3	2d
		B B A B A A	

Note: The number sets used to implicitly encode the Check Digit are shown in the zero-suppressed column.

5.1.1.3.4.2 Decoding a UPC-E Bar Code Symbol

Derivation of the 12-digit data string from the characters encoded in the UPC-E Bar Code Symbol can be performed according to Figure 5.1.1.3.4.2 – 1.

Figure 5.1.1.3.4.2 - 1
Decoding a UPC-E Bar Code Symbol

Encoded UPC-E Bar Code Symbol Digits									Decoded Number											
	P1	P2	P3	P4	P5	P6			D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12
(0)	X1	X2	X3	X4	X5	0	(C)		(0)	X1	X2	0	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	X3	X4	X5	(C)
(0)	X1	X2	X3	X4	X5	1	(C)		(0)	X1	X2	1	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	X3	X4	X5	(C)
(0)	X1	X2	X3	X4	X5	2	(C)		(0)	X1	X2	2	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	X3	X4	X5	(C)
(0)	X1	X2	X3	X4	X5	3	(C)		(0)	X1	X2	X3	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	X4	X5	(C)
(0)	X1	X2	X3	X4	X5	4	(C)		(0)	X1	X2	X3	X4	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	X5	(C)
(0)	X1	X2	X3	X4	X5	5	(C)		(0)	X1	X2	X3	X4	X5	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	5	(C)
(0)	X1	X2	X3	X4	X5	6	(C)		(0)	X1	X2	X3	X4	X5	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	6	(C)
(0)	X1	X2	X3	X4	X5	7	(C)		(0)	X1	X2	X3	X4	X5	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	7	(C)
(0)	X1	X2	X3	X4	X5	8	(C)		(0)	X1	X2	X3	X4	X5	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	8	(C)
(0)	X1	X2	X3	X4	X5	9	(C)		(0)	X1	X2	X3	X4	X5	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	9	(C)

Notes:

- The symbol characters at positions P1 and P2 through P5 of the UPC-E Bar Code Symbol are represented by X1 and X2 through X5.
- Re-inserted zeroes are indicated by underlining.
- The leading digit for UPC-E Bar Code Symbols, which is not encoded, is indicated by “0”.
- The Check Digit implicitly encoded in UPC-E Bar Code Symbols is indicated by “C”.

5.1.1.3.5 Add-On Symbols

The Add-On Symbols were designed to encode information supplementary to that in the main bar code symbol on periodicals and paperback books. Because they provide reduced security, use of Add-On Symbols shall be limited to applications where rules in the application specification governing data format and content provide appropriate safeguards.

5.1.1.3.5.1 Two-Digit Add-On Symbol

A two-digit Add-On Symbol may be used in specific applications to accompany an EAN-13, UPC-A, or UPC-E Bar Code Symbol. The two-digit Add-On Symbol is positioned following the right Quiet Zone of the main symbol and consists of the following:

- Add-on Guard Bar Pattern
- First digit of the additional number from number sets A or B
- Add-on delineator
- Second digit of the additional number from number sets A or B
- A right Quiet Zone

The Add-On Symbol has no right Guard Bar Pattern. It does not have an explicit Check Digit. Checking is done through the mix of the number sets (A or B) used for the two digits. The choice of number sets is linked to the value of the additional number as shown by Figure 5.1.1.3.5.1 – 1.

Figure 5.1.1.3.5.1 – 1

Number Sets for Two-Digit Add-On Symbols

Value of the digits carried by the Add-On Symbol	Left-Hand Digit	Right-Hand Digit
Multiple of 4 (00,04,08,..96)	A	A
Multiple of 4+1 (01,05,..97)	A	B
Multiple of 4+2 (02,06,..98)	B	A
Multiple of 4+3 (03,07,..99)	B	B

Figure 5.1.1.3.5.1 – 2 is an example of an EAN-13 Bar Code Symbol with a two-digit Add-On Symbol.

Figure 5.1.1.3.5.1 - 2

EAN-13 Bar Code Symbol with Two-Digit Add-On Symbol



5.1.1.3.5.2 Five-Digit Add-On Symbol

A five-digit Add-On Symbol may be used in specific applications to accompany an EAN-13, UPC-A, or UPC-E Bar Code Symbol. The five-digit Add-On Symbol is positioned following the right Quiet Zone of the main symbol and consists of the following:

- Add-on Guard Bar Pattern
- First digit of the add-on number from number sets A or B
- Add-on delineator
- Second digit of the add-on number from number sets A or B
- Add-on delineator
- Third digit of the add-on number from number sets A or B
- Add-on delineator
- Fourth digit of the add-on number from number sets A or B
- Add-on delineator
- Fifth digit of the add-on number from number sets A or B
- A right Quiet Zone

The Add-On Symbol has no right Guard Bar Pattern. It does not have an explicit Check Digit. Checking is done through the mix of the number sets (A or B) used for the five digits. A value V is determined by the following procedure:

1. Sum the digits in Positions one, three, and five.
2. Multiply the result of step 1 by 3.
3. Sum the remaining digits (Positions two and four).
4. Multiply the result of step 3 by 9.
5. Sum the results of steps 2 and 4.
6. The value of V is the unit's position (lowest-order digit) of the result of step 5.

Example: To calculate the value of V for an Add-On Symbol carrying the number 86104, follow these steps:

1. $8 + 1 + 4 = 13$
2. $13 \times 3 = 39$
3. $6 + 0 = 6$
4. $6 \times 9 = 54$
5. $39 + 54 = 93$
6. $V = 3$

The number sets can then be determined by using Figure 5.1.1.3.5.2 – 1.

Figure 5.1.1.3.5.2 - 1

Number Sets for Five-Digit Add-On Symbol

Value of V	Number Sets Used for Symbol Characters				
	1	2	3	4	5
0	B	B	A	A	A
1	B	A	B	A	A
2	B	A	A	B	A
3	B	A	A	A	B
4	A	B	B	A	A
5	A	A	B	B	A
6	A	A	A	B	B
7	A	B	A	B	A
8	A	B	A	A	B
9	A	A	B	A	B

Since $V = 3$ in Figure 5.1.1.3.5.2 - 1, the sequence of number sets used to encode the value 86104 is BAAAB.

Figure 5.1.1.3.5.2 – 2 shows an example of an EAN-13 Bar Code Symbol with a five-digit Add-On Symbol.

Figure 5.1.1.3.5.2 - 2
EAN-13 Bar Code Symbol with Five-Digit Add-On Symbol



5.1.1.4 Dimensions and Tolerances

5.1.1.4.1 Nominal Dimensions of Characters

Bar code symbols can be printed at various densities to accommodate a variety of printing and scanning processes. The significant dimensional parameter is X, the ideal width of a single module element. The X-dimension must be constant throughout a given symbol.

The dimensions of EAN-13, UPC-A, EAN-8 and UPC-E Bar Code Symbols may be referenced to a defined set of dimensions referred to as the nominal size symbol. Refer to [Section 5.1.A.6](#) for dimensioned drawings of nominal size symbols.

The X-dimension at nominal size is 0.33 mm (0.013 in.).

The width of each bar (dark bar) and space (light bar) is determined by multiplying the X-dimension by the module width of each bar (dark bar) and space (light bar) (1, 2, 3, or 4). There is an exception for characters 1, 2, 7, and 8. For these characters, the bars (dark bars) and spaces (light bars) are reduced or enlarged by one-thirteenth of a module to provide a uniform distribution of bar width tolerances and thus improve scanning reliability.

The reduction or enlargement in millimetres at nominal size of the bars (dark bars) and spaces (light bars) for the characters 1, 2, 7, and 8 in the number sets A, B, and C is shown in Figure 5.1.1.4.1 – 1:

Figure 5.1.1.4.1 –1

Reduction/Enlargement for Characters 1, 2, 7, and 8

Character Value	Number Set A		Number Sets B and C	
	Bar (Dark Bar) mm	Space (Light Bar) mm	Bar (Dark Bar) mm	Space (Light Bar) mm
1	- 0.025	+0.025	+0.025	- 0.025
2	- 0.025	+0.025	+0.025	- 0.025
7	+0.025	- 0.025	- 0.025	+0.025
8	+0.025	- 0.025	- 0.025	+0.025

Note: The existing symbol generation equipment that uses a value of 0.030 mm for the reduction/enlargement factor at nominal size may continue to be used for the foreseeable future.

5.1.1.4.2 Symbol Height

For EAN-13, UPC-A, and UPC-E Bar Code Symbols the approximate height of the symbol, including the human readable information, at the nominal size is 25.9mm (1.0 in.).

For EAN-8 Bar Code Symbols the approximate height of the symbol, including the human readable information, at the nominal size is 21.3mm (0.8 in.).

The height of any two-digit or five-digit Add-On Symbol used, including the human readable information, must not extend outside the symbol height dimensions of the primary symbol.

In EAN-13, EAN-8, UPC-A, and UPC-E Bar Code Symbols, the bars (dark bars) forming the left, centre, and right Guard Bar Patterns shall be extended downward by 5x (e.g., 1.65 mm (0.065 in.)). This shall also apply to the bars (dark bars) of the first and last symbol characters of the UPC-A Bar Code Symbol.

Symbol height is not modular.

5.1.1.4.3 Quiet Zone (Light Margin)

The minimum Quiet Zone width required by the main bar code symbol is 7x. However, other minimum Quiet Zone dimensions are specified for some symbol types due to the size and location of their Human Readable Interpretation. These dimensions are noted in Figure 5.1.1.4.3 – 1.

Figure 5.1.1.4.3 – 1

Quiet Zone Lengths by Version

Symbol Version	Left Quiet Zone (Light Margin)		Right Quiet Zone (Light Margin)	
	Modules	mm*	Modules	mm
EAN-13	11	3.63	7	2.31
EAN-8	7	2.31	7	2.31
UPC-A	9	2.97	9	2.97
UPC-E	9	2.97	7	2.31
Add-Ons (EAN)	7-10	2.31-3.30	5	1.65
Add-Ons (U.P.C.)	9-12	2.97-3.96	5	1.65

*This is an example using an X-dimension of 0.33 mm.

Note: A useful device to help maintain the Quiet Zone in some production processes is to include a less than (<) and/or greater than (>) character in the Human Readable Interpretation field, with its apex aligned with the edge of the Quiet Zone. If this device is used, the character(s) shall be positioned in accordance with the appropriate drawings in [Section 5.1.A.6](#).

5.1.1.4.4 X-Dimension (Magnification Factor)

In the past the term "magnification factor" was extensively used to specify the size of a bar code symbol. This technique relied upon setting a nominal size (100%) that was directly related to a given X-dimension. Since January 2000, the more precise term "X-dimension" has been used to specify permissible symbol sizes (see [Section 5.4](#)).

The X-dimension of an Add-On Symbol shall be the same as the X-dimension of its associated main symbol.

5.1.1.4.5 Symbol Length

The symbol length in modules, including the minimum Quiet Zones, shall be as indicated in Figure 5.1.1.4.5 – 1.

Figure 5.1.1.4.5 - 1

Symbol Length in Modules

Symbol Type	Length
EAN-13	113
UPC-A	113
EAN-8	81
UPC-E	67
Two-digit Add-On	25
Five-digit Add-On	52
EAN-13 or UPC-A and two-digit Add-On	138
UPC-E and two-digit Add-On	92
EAN-13 or UPC-A and five-digit Add-On	165
UPC-E and five-digit Add-On	119

5.1.1.4.6 Positioning of the Add-On Symbol

The Add-On Symbol shall not encroach on the right Quiet Zone of the main symbol. The maximum separation shall be 12x.

The bottom edge of the bars (dark bars) in the Add-On Symbol shall be horizontally aligned with the bottom edge of the guard bars of the main symbol.

5.1.2 Reference Decode Algorithm

Decode algorithms are used by scanning equipment to convert the bar and space patterns of the bar code into data characters. As a matter of policy, GS1 make no attempt to specify or standardise equipment beyond stating that it should be capable of reading symbols produced in accordance with the specifications laid out in this manual.

Bar code reader systems are designed to read imperfect symbols to the extent that practical algorithms permit. This section describes the reference decode algorithm

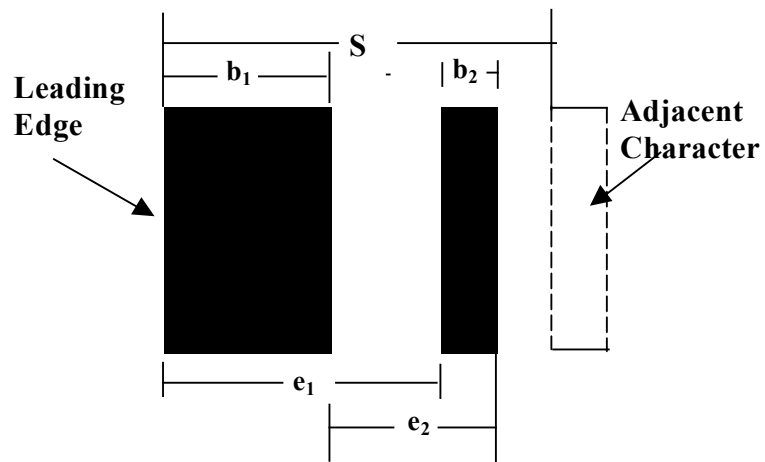
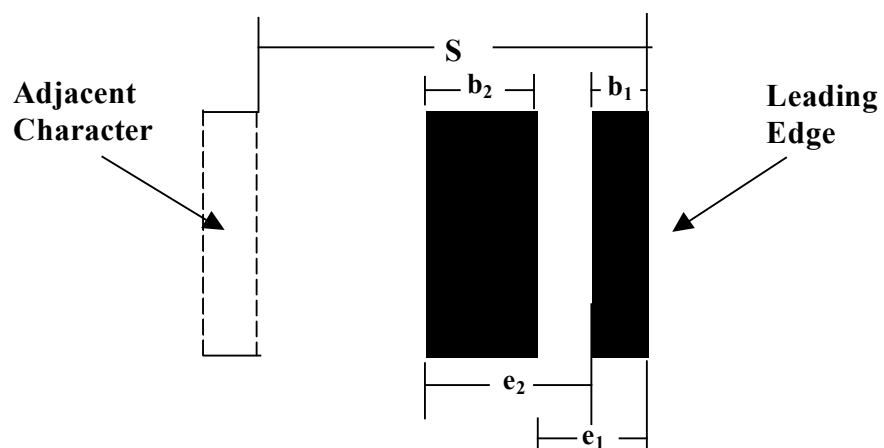
used to determine decode and decodability in symbol verification in accordance with *ISO 15416*.

For each symbol character, let S equal the total measured width of the character. The value S is used to determine reference threshold (RT) values. Individual edge to similar edge measurements (e) are then compared to the reference threshold to determine E values. Character values are determined from E values.

Value e_1 is defined as the measurement from the leading edge of a bar (dark bar) to the leading edge of the adjacent bar (dark bar). Value e_2 is defined as the measurement from the trailing edge of a bar (dark bar) to the trailing edge of the adjacent bar (dark bar). For number sets A and B, the right edge of each of the two bars (dark bars) is considered to be leading, while for number set C, the left edge of each bar (dark bar) is considered to be leading. These relationships are illustrated in Figure 5.1.2 – 1.

Figure 5.1.2 - 1

Symbol Character Decode Measurements

Number Set C**Number Sets A and B**

Reference thresholds RT1, RT2, RT3, RT4, and RT5 are given by:

- $RT1 = (1.5/7)S$
- $RT2 = (2.5/7)S$
- $RT3 = (3.5/7)S$
- $RT4 = (4.5/7)S$
- $RT5 = (5.5/7)S$

Within each character, the measurements $e1$ and $e2$ are compared with the reference thresholds. The corresponding integer values $E1$ and $E2$ are considered to be equal to 2, 3, 4, or 5 as follows:

- If $RT1 \leq e_i < RT2$, $E_i = 2$
- If $RT2 \leq e_i < RT3$, $E_i = 3$
- If $RT3 \leq e_i < RT4$, $E_i = 4$
- If $RT4 \leq e_i < RT5$, $E_i = 5$

Otherwise the character is in error.

In Figure 5.1.2 – 2, use the values of $E1$ and $E2$ as the primary determinant for the symbol character value.

Figure 5.1.2 – 2
Bar Code Symbol Decoding

Character	Number Set	Primary Determinant		Secondary Determinant $7(b_1 + b_2)/S$
		E1	E2	
0	A	2	3	
1	A	3	4	≤ 4
2	A	4	3	≤ 4
3	A	2	5	
4	A	5	4	
5	A	4	5	
6	A	5	2	
7	A	3	4	>4
8	A	4	3	>4
9	A	3	2	
0	B and C	5	3	
1	B and C	4	4	>3
2	B and C	3	3	>3
3	B and C	5	5	
4	B and C	2	4	
5	B and C	3	5	
6	B and C	2	2	
7	B and C	4	4	≤ 3
8	B and C	3	3	≤ 3
9	B and C	4	2	

Note: b_1 and b_2 are the widths of the two bar (dark bar) elements

The character is uniquely determined for all combinations of E1 and E2 except for the following four cases:

- E1 = 3 and E2 = 4 (characters 1 and 7 in number set A)

- E1 = 4 and E2 = 3 (characters 2 and 8 in number set A)
- E1 = 4 and E2 = 4 (characters 1 and 7 in number sets B and C)
- E1 = 3 and E2 = 3 (characters 2 and 8 in number sets B and C)

These cases require that the combined width of the two bars (dark bars) be tested as follows:

- For $E1 = 3$ and $E2 = 4$:
 - Character is 1 if $7 \times (b_1 + b_2) / S \leq 4$
 - Character is 7 if $7 \times (b_1 + b_2) / S > 4$
- For $E1 = 4$ and $E2 = 3$:
 - Character is 2 if $7 \times (b_1 + b_2) / S \leq 4$
 - Character is 8 if $7 \times (b_1 + b_2) / S > 4$
- For $E1 = 4$ and $E2 = 4$:
 - Character is 1 if $7 \times (b_1 + b_2) / S > 3$
 - Character is 7 if $7 \times (b_1 + b_2) / S \leq 3$
- For $E1 = 3$ and $E2 = 3$:
 - Character is 2 if $7 \times (b_1 + b_2) / S > 3$
 - Character is 8 if $7 \times (b_1 + b_2) / S \leq 3$

The requirements on $(b_1 + b_2)$ are shown in Figure 5.1.2 – 2.

The same procedures shall be used to decode the symbol characters in any Add-On Symbol.

Use Figure 5.1.2 – 3 to determine the appropriate S measurement for calculating the reference threshold values $RT1$ and $RT2$ applicable to the auxiliary patterns of the main symbol. For each symbol or half symbol the measurements of the appropriate auxiliary pattern e_i values are then compared to the reference thresholds to establish the integer E_i values. The determined values of $E1$, $E2$, $E3$, and $E4$ shall match those of valid auxiliary patterns as shown in Figure 5.1.2 – 4. Otherwise the symbol is in error.

Figure 5.1.2 – 3
Auxiliary Pattern Measurements

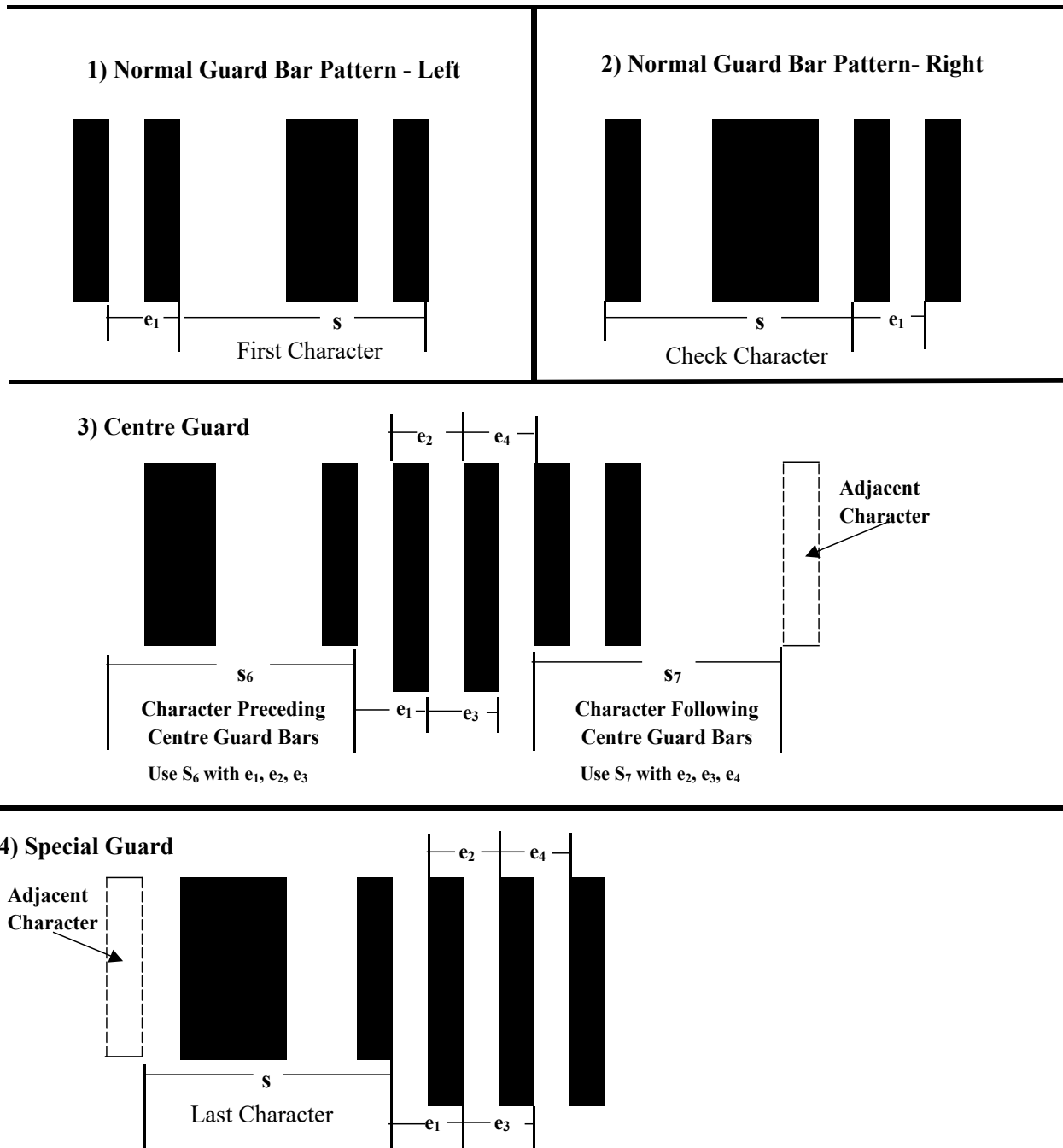


Figure 5.1.2 - 4

Main Symbol Auxiliary Pattern E Values

Auxiliary Guard Patterns	E1	E2	E3	E4
Normal Guard Bar Pattern	2			
Centre Guard Bar Pattern (left half)	2	2	2	
Centre Guard Bar Pattern (right half)		2	2	2
Special Guard Bar Pattern	2	2	2	2

5.1.3 Human Readable Interpretation

The human readable digits shall be printed underneath the main symbol and above the Add-On Symbol. A clearly legible font shall be used for these digits, and OCR-B as defined in ISO 1073-2 is recommended. This font is referenced only as a convenient standard typeface, and it is not intended that these characters be machine read or verified. Reasonable alternative type fonts and character sizes are acceptable provided the Human Readable Interpretation is clearly legible.

All the encoded digits for EAN-13, UPC-A, and EAN-8 Bar Code Symbols, and the Add-On Symbols shall be shown in Human Readable Interpretation form. For UPC-E Bar Code Symbols, the six digits directly encoded together with the leading zero and the implicitly encoded Check Digit shall be shown in Human Readable Interpretation form. Figures [5.1.1.3.1 – 2](#), [5.1.1.3.2 – 1](#), [5.1.1.3.3 – 1](#), [5.1.1.3.4 – 1](#), [5.1.1.3.5.1 – 2](#), and [5.1.1.3.5.2 – 2](#) illustrate each type of symbol and its Human Readable Interpretation.

The height of the digits in the nominal size symbol is 2.75 mm. The minimum space between the top of the digits and the bottom of the bars (dark bars) shall be 0.5X. Normally the minimum is one module, which is close enough to keep the Human Readable Interpretation associated with the symbol.

In the EAN-13 Bar Code Symbol, the leftmost digit, which is encoded by variable parity, is printed to the left of the Start Character in line with the other digits.

For UPC-A and UPC-E Bar Code Symbols, the size of the first and last digits should be reduced to a maximum width equivalent to four modules. The height is reduced proportionally. The right-hand side of the first digit is positioned five module widths to

the left of the leftmost guard bar. The left-hand side of the last digit is positioned five module widths to the right of the rightmost guard bar for UPC-A Bar Code Symbols and three module widths for UPC-E Bar Code Symbols. The bottom edge of the first and last digit shall be aligned with the bottom edge of the remaining full size digits.

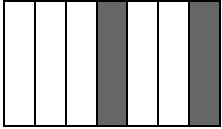
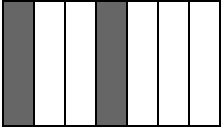
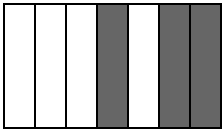
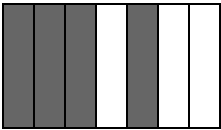
The Human Readable Interpretation of the Add-On Symbol shall be above it. The digits shall be the same height as those of the main symbol. The upper edges of the digits are aligned with the upper edges of the bars (dark bars) of the main symbol. The minimum space between the bottom of the digits and the top of the bars (dark bars) shall be 0.5X.

Some industries use specific variations of the recommended Human Readable Interpretation, such as inserted hyphens to segment the number field. An example of this is shown in Section 5.1.A.6.

5.1.A.1 Appendix 1 Character Values in the EAN/UPC Symbology Family

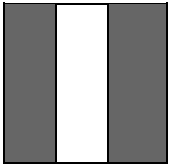
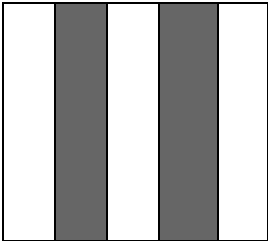
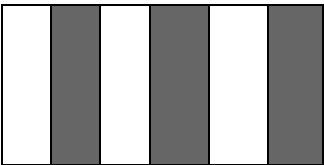
Figure 5.1.A.1 – 1

Value of Character	Number Set A (Odd)	Number Set B (Even)	Number Set C (Even)
0			
1			
2			
3			
4			
5			
6			
7			

8			
9			

5.1.A.2 Appendix 2: Auxiliary Characters in the EAN/UPC Symbology Family

Figure 5.1.A.2 – 1

Auxiliary Character	
Normal Guard Bar Pattern (right and left)	
Centre Guard Bar Pattern	
UPC-E Right Guard Bar Pattern	

5.1.A.3 Appendix 3: Logical Structure of an EAN-13 and UPC-A Bar Code Symbol Excluding Quiet Zones

Figure 5.1.A.3 – 1

Logical Structure of an EAN-13 or UPC-A Bar Code Symbol (Excluding Quiet Zones)				
Left Guard Bar Pattern	Characters 12 Through 7 (Left Half)	Centre Guard Bar Pattern	Characters 6 Through 1 (Right Half)	Right Guard Bar Pattern
3 modules	42 modules (6x7)	5 modules	42 modules (6x7)	3 modules
Total number of modules = 95				

Figure 5.1.A.3 – 2

Character Position												
Value of the Thirteenth Character	Number Set Used for Representing Characters 12 Through 7						Number Set Used for Representing Characters 6 Through 1					
	12	11	10	9	8	7	6	5	4	3	2	1
0	A	A	A	A	A	A	ALWAYS USE NUMBER SET C					
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	

5.1.A.4 Appendix 4: Logical Structure of an EAN-8 Bar Code Symbol Excluding Quiet Zones

Figure 5.1.A.4 – 1

Logical Structure of an EAN-8 Bar Code Symbol (Excluding Quiet Zones)				
Left Guard Bar Pattern	Characters 8 Through 5 (Left Half)	Centre Guard Bar Pattern	Characters 4 Through 1 (Right Half)	Right Guard Bar Pattern
3 modules	28 modules (4x7)	5 modules	28 modules (4x7)	3 modules
Total number of modules = 67				

Figure 5.1.A.4 – 2

Character Position							
Number Set Used for Representing Characters 8 Through 5				Number Set Used for Representing Characters 4 Through 1			
8	7	6	5	4	3	2	1
ALWAYS USE NUMBER SET A				ALWAYS USE NUMBER SET C			

5.1.A.5 Appendix 5: Logical Structure of a UPC-E Bar Code Symbol Excluding Quiet Zones

Figure 5.1.A.5 – 1

Logical Structure of a UPC-E Bar Code Symbol (Excluding Quiet Zones)		
Normal Guard Bar Pattern	Six Symbol Characters (Note the Use of Variable Parity)	Special Guard Bar Pattern (UPC-E)
3 modules	42 modules (6x7)	6 modules
Total number of modules = 51		

Figure 5.1.A.5 – 2

Value of Prefix Digit	Value of Check Digit	Number Sets Used for Numbering a UPC-E Bar Code Symbol					
		1	2	3	4	5	6
0	0	B	B	B	A	A	A
0	1	B	B	A	B	A	A
0	2	B	B	A	A	B	A
0	3	B	B	A	A	A	B
0	4	B	A	B	B	A	A
0	5	B	A	A	B	B	A
0	6	B	A	A	A	B	B
0	7	B	A	B	A	B	A
0	8	B	A	B	A	A	B
0	9	B	A	A	B	A	B

5.1.A.6 Appendix 6: Symbol Formats at Nominal Dimensions (Not to Scale)

Figure 5.1.A.6 - 1

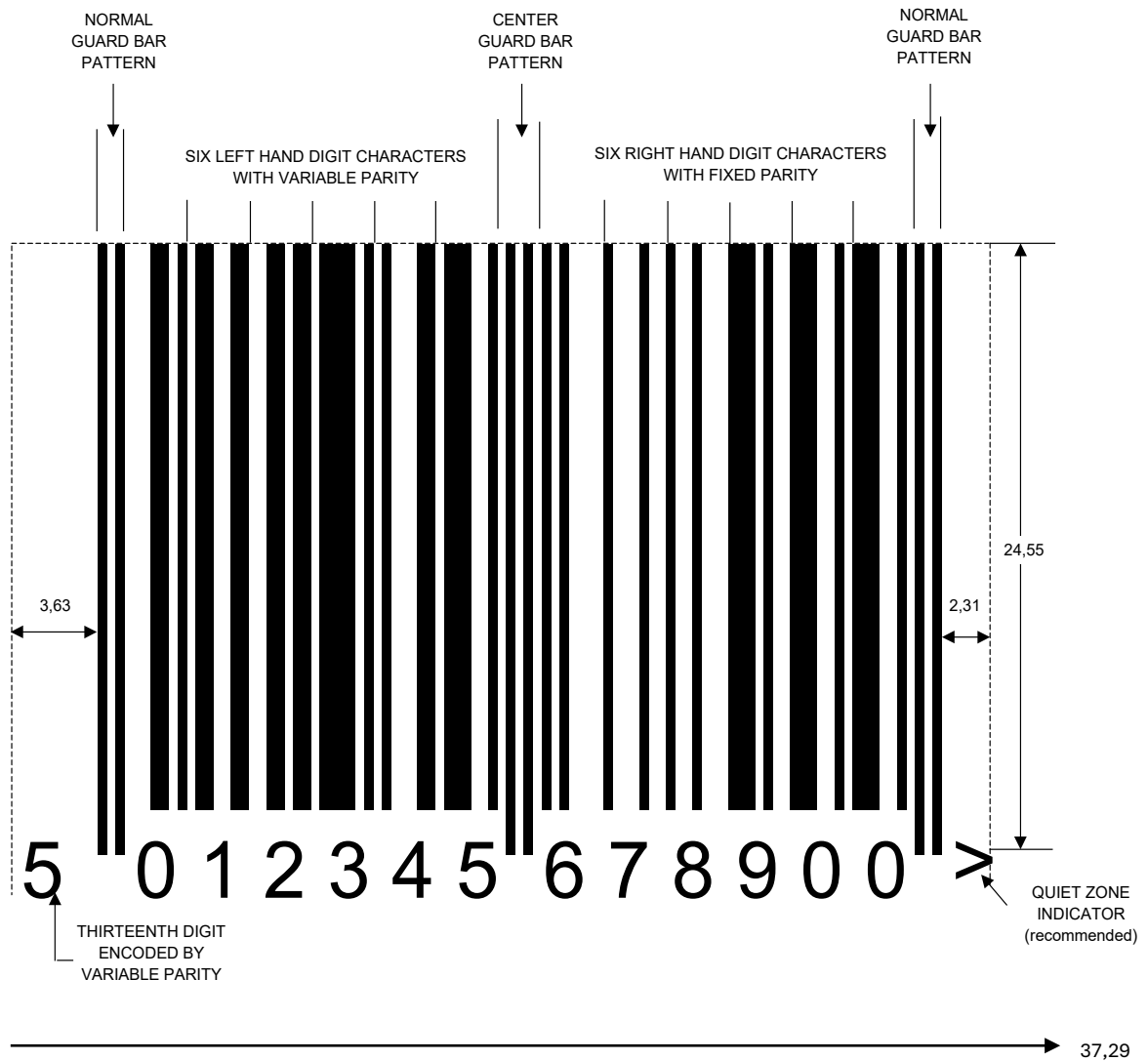
EAN-13 Bar Code Symbol

Figure 5.1.A.6 - 2
UPC-A Bar Code Symbol



Figure 5.1.A.6 – 3

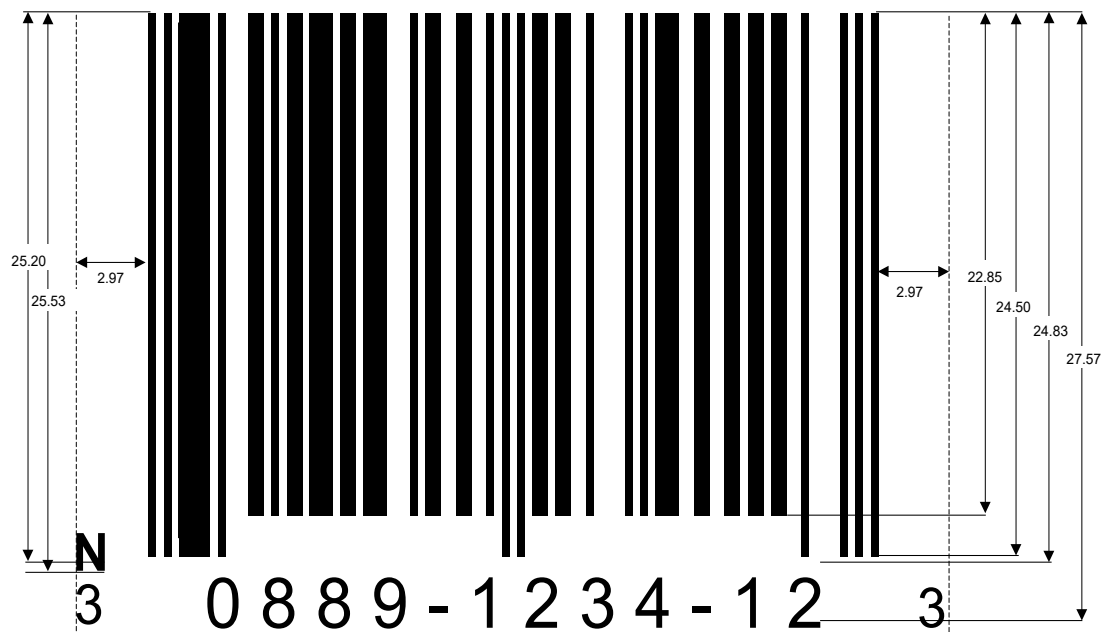


Figure 5.1.A.6 – 4

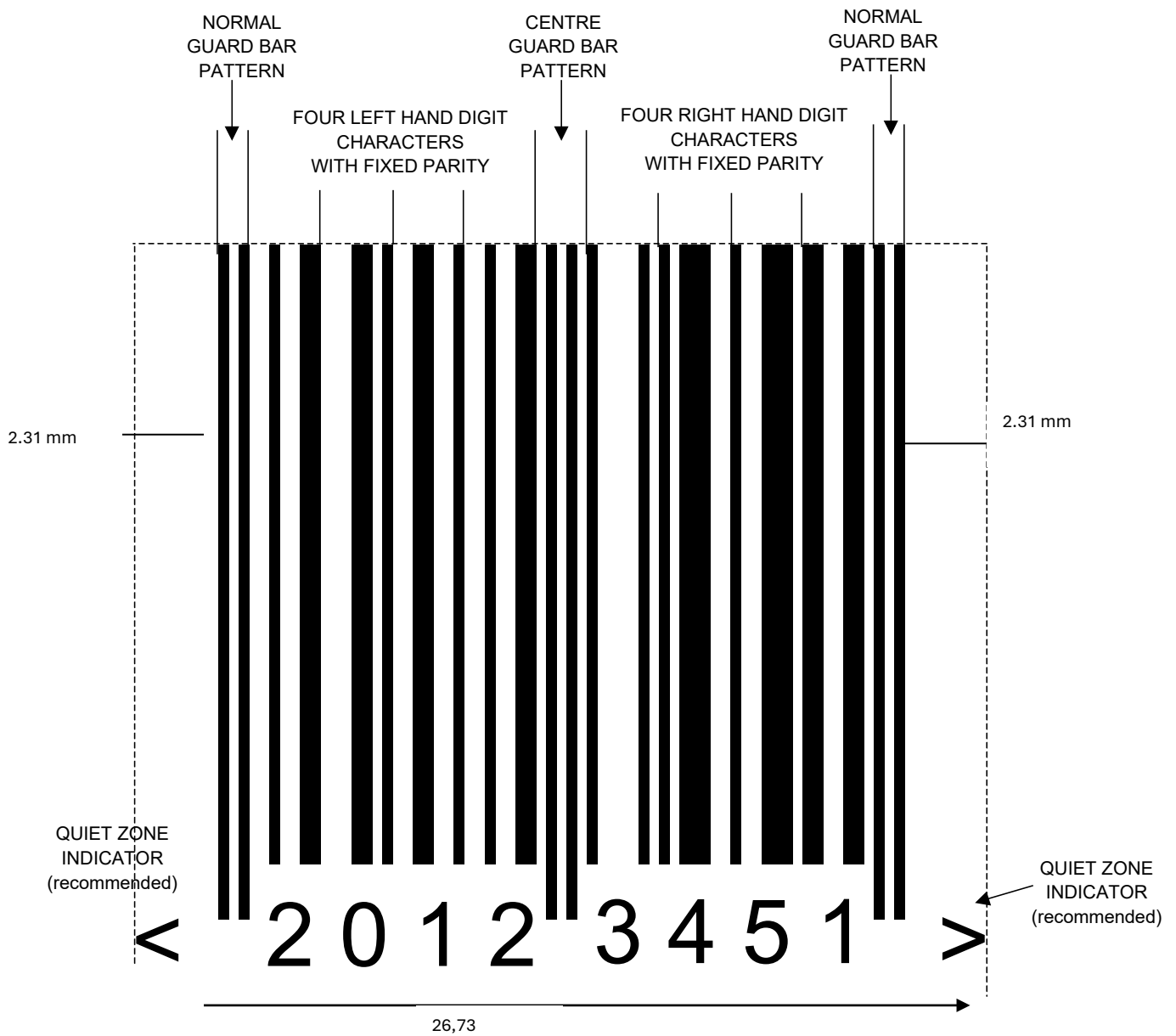


Figure 5.1.A.6 - 5

UPC-E Bar Code Symbol

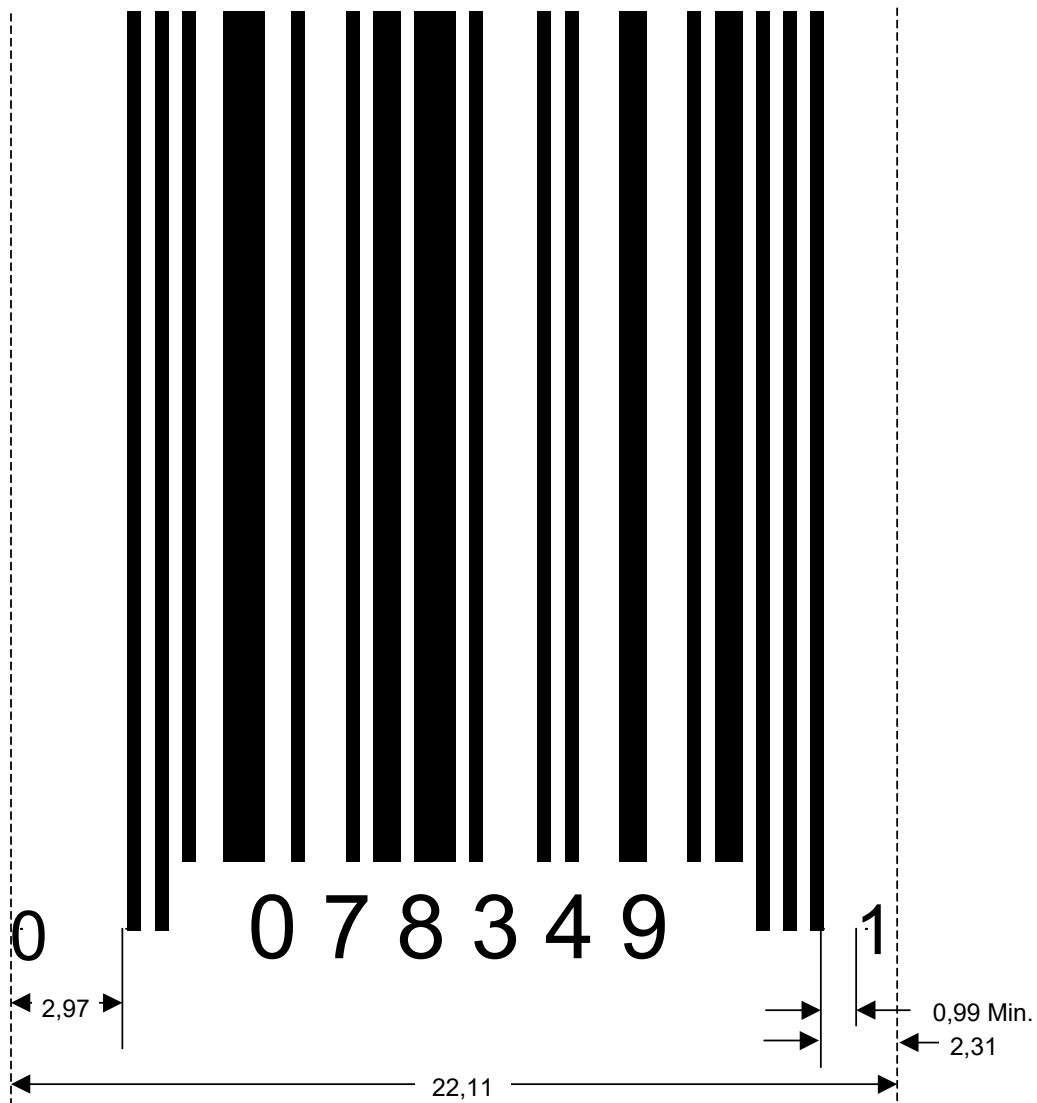


Figure 5.1.A.6 – 6

UPC-A Bar Code Symbol with Two-Digit Add-On Symbol

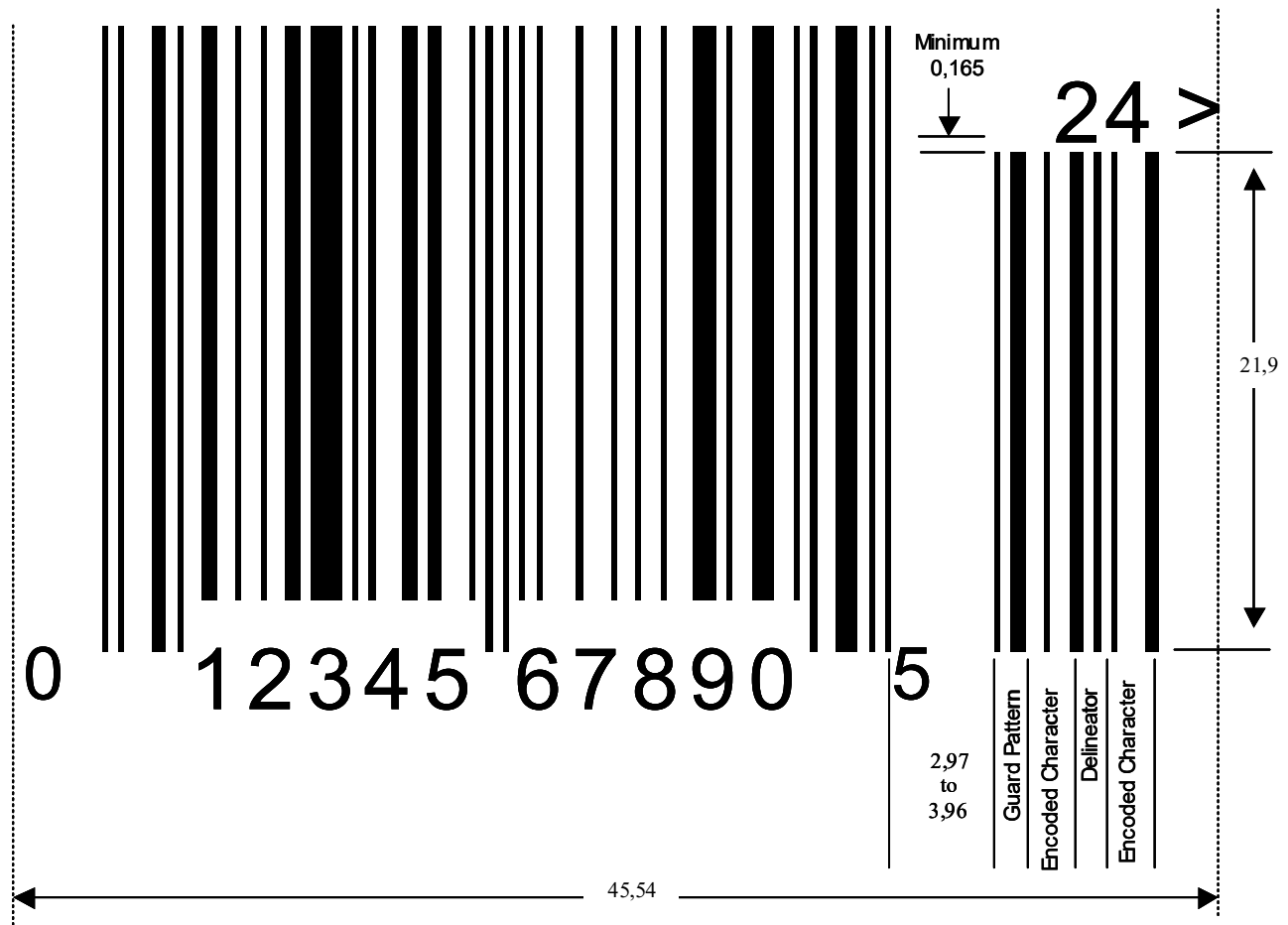
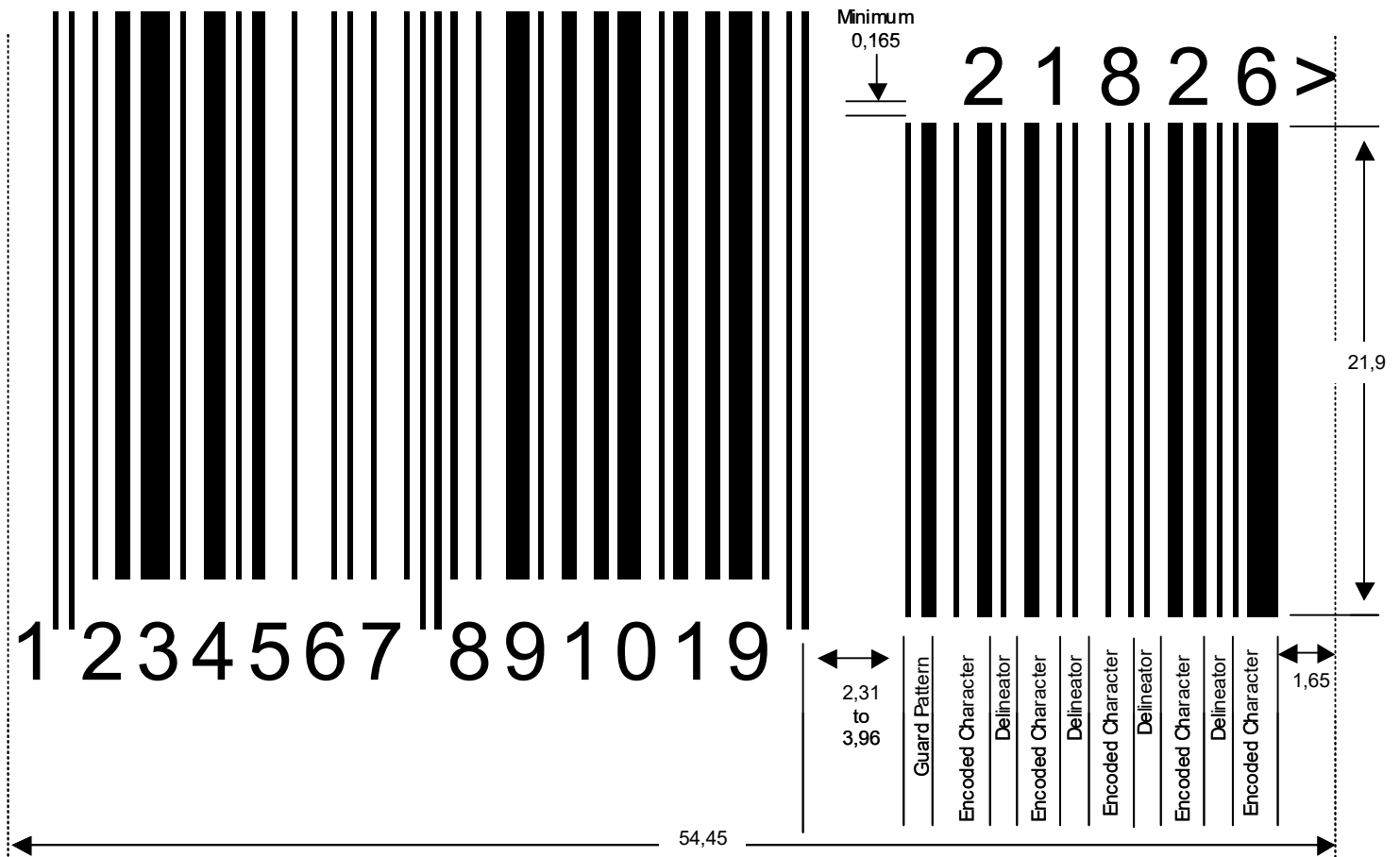


Figure 5.1.A.6 – 7

EAN-13 Bar Code Symbol with Five-Digit Add-On Symbol



5.1.A.7 Appendix 7: Dimensions of Modules and Symbols at Different Levels of Magnification

Figure 5.1.A.7 – 1

Magnification Factor	Ideal Module Width [mm]	EAN-13/UPC-A Dimensions [mm]		EAN-8 Dimensions [mm]	
		Width	Height	Width	Height
0.80	0.264	29.83	20.73	21.38	17.05
0.85	0.281	31.70	22.02	22.72	18.11
0.90	0.297	33.56	23.32	24.06	19.18
0.95	0.313	35.43	24.61	25.39	20.24
1.00	0.330	37.29	25.91	26.73	21.31
1.05	0.346	39.15	27.21	28.07	22.38
1.10	0.363	41.02	28.50	29.40	23.44
1.15	0.379	42.88	29.80	30.74	24.51
1.20	0.396	44.75	31.09	32.08	25.57
1.25	0.412	46.61	32.39	33.41	26.64
1.30	0.429	48.48	33.68	34.75	27.70
1.35	0.445	50.34	34.98	36.09	28.77
1.40	0.462	52.21	36.27	37.42	29.83
1.45	0.478	54.07	37.57	38.76	30.90
1.50	0.495	55.94	38.87	40.10	31.97
1.55	0.511	57.80	40.16	41.43	33.03
1.60	0.528	59.66	41.46	42.77	34.10
1.65	0.544	61.53	42.75	44.10	35.16
1.70	0.561	63.39	44.05	45.44	36.23
1.75	0.577	65.26	45.34	46.78	37.29
1.80	0.594	67.12	46.64	48.11	38.36

1.85	0.610	68.99	47.93	49.45	39.42
1.90	0.627	70.85	49.23	50.79	40.49
1.95	0.643	72.72	50.52	52.12	41.55
2.00	0.660	74.58	51.82	53.46	42.62
Note: Refer to <u>Section 5.4</u> for the minimum, nominal, and maximum X-dimensions, and symbol heights for bar code symbols.					

Section 5.2:

ITF-14 Symbology Specifications

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5.2.1 Symbology Characteristics

In the GS1 System, the characteristics of ITF-14 Symbol are:

- Encodable character set: numeric 0 to 9 (ASCII characters 48 to 57 inclusive, in accordance with ISO 646)
- Code type: continuous
- Elements per symbol character: five (two wide and three narrow) encoded as either five bars (dark bars) or five spaces (light bars)
- Self-checking symbol character
- Data string length encodable: fixed length at 14 digits
- Bidirectionally decodable
- One Check Digit is required (see [Section 3.A.1](#))
- The symbol character density for ITF-14 is 16 to 18 modules per symbol character pair, depending on the wide-to-narrow ratio. The value is 16, based on the target ratio of 2.5 to 1.
- The non-data overhead is eight to nine modules, depending on the wide-to-narrow ratio. The value is 8.5, based on the target ratio of 2.5 to 1.

5.2.1.1 Symbol Structure

An ITF-14 Symbol includes:

- A leading Quiet Zone
- A start pattern
- Seven pairs of symbol characters representing data
- A stop pattern
- A trailing Quiet Zone

5.2.1.2 Character Encodation

5.2.1.2.1 Data Character Encodation

Figure 5.2.1.3.1 – 1 defines the ITF-14 Symbol's character encodation. In the binary representation column, the character 1 represents a wide element and 0 represents a narrow element.

Figure 5.2.1.3.1 – 1
Binary Representation of Character Encodation

Data Character	Binary Representation				
0	0	0	1	1	0
1	1	0	0	0	1
2	0	1	0	0	1
3	1	1	0	0	0
4	0	0	1	0	1
5	1	0	1	0	0
6	0	1	1	0	0
7	0	0	0	1	1
8	1	0	0	1	0
9	0	1	0	1	0

Figure 5.2.1.3.1 – 1 uses a modified binary coded decimal encoding scheme. The four leftmost bit positions for each character are assigned weights of 1, 2, 4, and 7, from left to right; the fifth position is used for an even parity bit. The sum of the positional weights of the 1 bits is equivalent to the data character value, except in the case of data character 0, where the weights 4 and 7 are applied. The parity bit ensures that there are always two 1 bits per character.

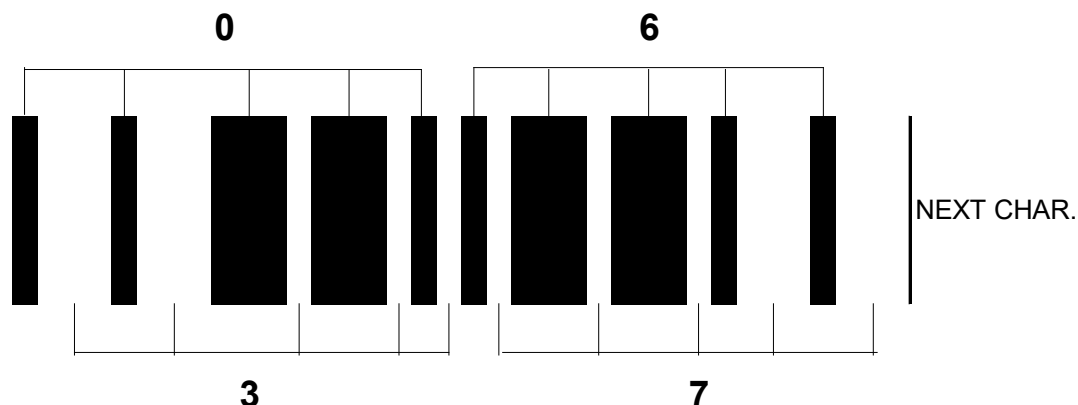
The algorithm shown in Figure 5.2.1.3.1 – 2 defines the rules for converting numeric data into the symbol characters of an ITF-14 Symbol (numeric data equals the Global Trade Item Number™ (GTIN™) and, therefore, already contains the Check Digit).

Figure 5.2.1.3.1 - 2

Step in Algorithm	Example
1. Calculate Check Digit for 0367123456789	367
2. With ITF-14 Symbols, the data string, including the Check Digit, will always be a 14-digit number. The leftmost four digits of this number are 0367.	0367
3. Subdivide the numeric string into digit pairs. The leftmost four digits of the number are 0367.	0367 03 and 67
4. Encode the digit pairs as follows:	
-- Encode the leading digit of each pair into bar patterns, as shown in Figure 5.2.1.3.1 – 1.	0 and 6
-- Encode the second digit of each pair into space patterns, as shown in Figure 5.2.1.3.1 – 1.	3 and 7
5. Form each symbol character pair by taking the bar (dark bar) and space (light bar) elements alternately from the patterns derived from the two steps in 4, commencing with the first bar (dark bar) of the pattern for the first digit, followed by the first space (light bar) of the pattern for the second digit.	

Figure 5.2.1.3.1 – 3 illustrates the sequence of bar (dark bar) and space (light bar) elements corresponding to the data character pairs 03 and 67.

Figure 5.2.1.3.1 – 3
ITF-14 Symbol Character Pairs Encoding 03 and 67



5.2.1.2.2 Start and Stop Patterns

The start pattern shall consist of four narrow elements in the sequence “bar (dark bar) - space (light bar) - bar (dark bar) - space (light bar).” The stop pattern shall consist of a “wide bar (dark bar) - narrow space (light bar) - narrow bar (dark bar)” sequence.

The start pattern shall be positioned at the normal left end of the symbol characters adjacent to the first bar (dark bar) of the most significant digit. The stop pattern shall be positioned at the normal right end of the symbol characters adjacent to the final space (light bar) of the least significant digit.

There is no assigned Human Readable Interpretation of the start and stop patterns, and they shall not be transmitted by the decoder.

Figure 5.2.1.3.2 – 1 illustrates the start and stop patterns and their relationship to the symbol characters.

Figure 5.2.1.3.2 – 1
Start and Stop Patterns

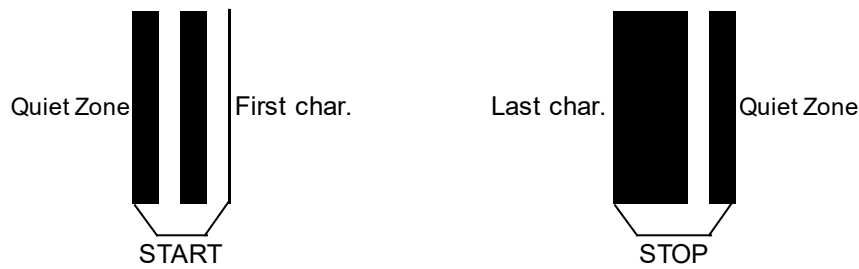
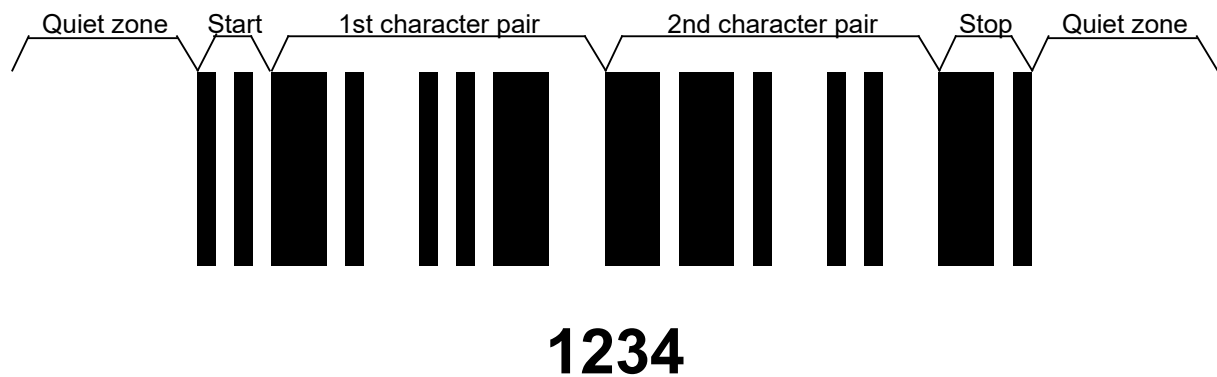


Figure 5.2.1.3.2 – 2 illustrates a complete bar code for the number 1234, showing the necessary Quiet Zones.

Figure 5.2.1.3.2 – 2
ITF-14 Symbol Inclusive of Quiet Zones



5.2.1.2.3 Check Digit

A Check Digit is required in the ITF-14 Symbology. [Section 3.A.1](#) defines the Check Digit position and calculation.

5.2.1.3 Dimensions and Tolerances

ITF-14 Symbols shall use the following target dimensions:

The X-dimension of ITF-14 Symbols is defined by the application specification based on the needs of the application. Refer to Section 5.4.2.6 for specifications by application area.

In the ITF-14 Symbol target size, the theoretical widths of the bars (light or dark) are:

Narrow bar = 1.016 mm (0.04 in.)

Wide bar = 2.540 mm (0.10 in.). The target width of the wide bars (dark bars) is 2.5 times the width of the narrow bars (dark bars).

The target width of an ITF-14 Symbol ten element character pair is 16.256 mm (0.64 in.), and the corresponding widths of auxiliary characters are:

Start Character = 4.064 mm (0.16 in.)

Stop Character = 4.572 mm (0.18 in.)

The Quiet Zones to the right and left of the symbol are compulsory. The minimum width of the Quiet Zone is 10X. Both Quiet Zones in an ITF-14 Symbol have target widths of 10.2 mm (0.40 in.).

A minimum Quiet Zone of 1 mm (0.04 in.) between the bottom line of the Bearer Bar and the top of the human readable characters is required.

For ITF-14 Symbols, the height of the bars (dark bars) in the target size symbol is 32 mm (1.25 in.).

Note: All dimensions given are ideal, theoretical values corresponding to the target size of symbols as used in the general distribution operating environment. These dimensions are not intended to be used directly in the preparation of bar codes.

The length of an ITF-14 Symbol, including Quiet Zones, can be calculated from the following expression:

$$W = (P(4N+6)+N+6)X+2Q$$

Where:

W is the length in millimetres

P is the number of character pairs

N is the wide-to-narrow ratio

X is the width of a narrow element in millimetres

Q is the width of the Quiet Zone in millimetres

An ITF-14 Symbol has seven character pairs, a target wide-to-narrow ratio of 2.5:1, a target X width of 1.016 mm (0.04 in.), and Quiet Zone widths of 10.2 mm (0.40 in.). This corresponds to a total symbol width of 142.748 mm (5.8 in.).

5.2.1.4 Reference Decode Algorithm

Bar code reading systems are designed to read imperfect symbols to the extent that practical algorithms permit. This section describes the reference decode algorithm used in the computation of the Decodability value described in *ISO/IEC 15416*.

Decodability shall be determined as follows:

- Within each ITF-14 Symbol character (representing two digits), sort the bars (b_i) and spaces (s_i) such that:

$$b_1 < b_2 < b_3 < b_4 < b_5$$

$$s_1 < s_2 < s_3 < s_4 < s_5$$

- The determined X-dimension (Z) is given by:

$$Z = b_1 + b_2 + b_3 + s_1 + s_2 + s_3 / 6$$

- Separation value (V_1) is:

$$V_1 = (d/Z) - 0.5$$

where d = the smaller of $(b_4 - b_3)$ or $(s_4 - s_3)$

- Uniformity value (V_2) is:

$$V_2 = 1 - u/Z$$

where u = the largest of:

$$b_5 - b_4$$

$$b_3 - b_1$$

$$s_5 - s_4$$

$$s_3 - s_1$$

- Narrowest element value (V_3) is:

$$V_3 = [(n/Z) - 0.25] / 0.75$$

where n = the smaller of s_1 or b_1

- For each symbol character, determine the Decodability value V . V is the smallest of V_1 , V_2 , or V_3 .
- The scan profile Decodability value is the smallest value of V measured in a Scan Reflectance Profile (SRP). The reference decode algorithm fails when V exhibits a negative value.
- The Decodability grade for each profile is determined from the Decodability value according to [ANSI X3.182, Table 3](#).

5.2.1.5 ITF-14 Symbols

5.2.1.5.1 Bearer Bar

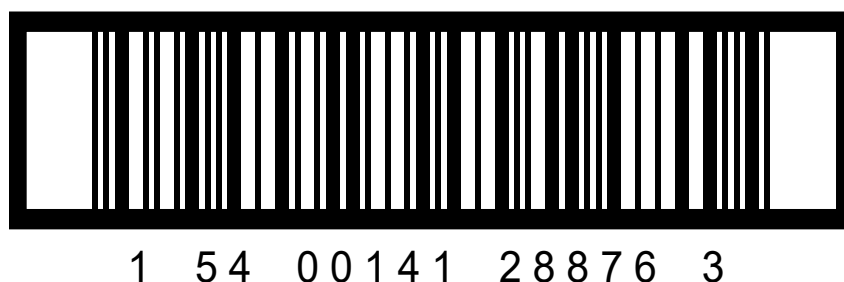
The purpose of a Bearer Bar is to equalise the pressure exerted by the printing plate over the entire surface of the symbol, and to enhance reading reliability by helping to reduce the probability of misreads or short scans that may occur when a skewed scanning beam enters or exits the bar code symbol through its top or bottom edge.

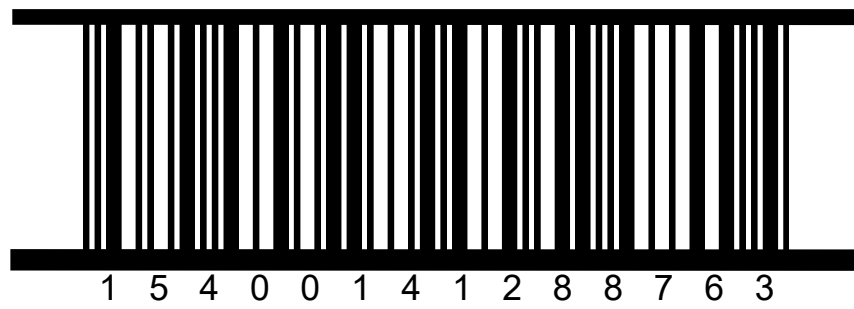
The Bearer Bar is mandatory unless it is not technically feasible to apply it (in which case reading reliability will be reduced).

For printing methods requiring printing plates, the nominal Bearer Bar has a constant thickness of 4.8 mm (0.19 in.) and must completely surround the symbol, including its Quiet Zones, and butt directly against the top and bottom of the bars (dark bars) of the symbol.

For printing methods that do not require printing plates, the Bearer Bar should be a minimum of twice the width of a narrow bar (dark bar) and need only appear at the top and bottom of the symbol, butting directly against the top and bottom of the symbol bars (dark bars). The Bearer Bar may extend above and below the Quiet Zones. However, it is not mandatory to print the vertical sections of the Bearer Bar. See Figure 5.2.1.6.1 – 1.

Figure 5.2.1.6.1 – 1





5.2.1.6 Human Readable Interpretation

A clearly legible Human Readable Interpretation of the data characters (proportional to the size of the symbol) including a Check Digit should normally be printed with the symbol encoding the data characters. Start and stop patterns do not have Human Readable Interpretation. Character size and font are not specified, and the Human Readable Interpretation may be printed anywhere in the area surrounding the symbol as long as the Quiet Zones are not encroached upon.

5.2.A.1 Appendix 1: (Informative) Additional Features

5.2.A.1.1 Protection Against Short Scans

In ITF-14 Symbols, the bar (dark bar) patterns of the start and stop patterns may be found at the respective end and beginning of certain encoded symbol characters within the code. There is, therefore, no guarantee that a partial scan of the symbol will not produce a valid read for an embedded symbol having fewer characters.

In the GS1 System, short scans are very unlikely to happen, as the symbol must always contain 14 digits. However, a symbol containing more than 14 digits may cause a short scan of 14 digits. In this instance, the Check Digit offers a certain security to detect this error.

These are the measures that should be taken to minimise the risk of partial read.

5.2.A.1.2 Fixed Length Symbols

In any application standard, the number of characters encoded in an ITF-14 Symbol should be fixed for that application, and reading or data processing equipment should be programmed to only accept messages of that defined length. An ITF-14 Symbol must always carry a 14-digit number.

5.2.A.1.3 Bearer Bars

For information regarding Bearer Bars, refer to Section 5.2.1.5.1.

5.2.A.2 Appendix 2: (Informative) Guidelines for the Use of ITF-14

5.2.A.2.1 Autodiscrimination Compatibility

ITF-14 Symbols may be read by suitably programmed bar code readers that are designed to autodiscriminate the ITF Symbology from other symbologies. The ITF Symbology is, in particular, fully distinguishable from, and thus compatible with, many symbologies including the ISO standard symbologies.

The decoder's valid set of symbologies should be limited to those needed by a given application to maximize reading security.

5.2.A.2.2 System Considerations

It is important that the various components making up a bar code installation system (e.g., printers, labels, readers) operate in concert. A failure in any component, or a mismatch between components, can compromise the performance of the overall system.

5.2.A.3 Appendix 3: (Informative) Symbology Identifier

The symbology identifier allocated to the ITF-14 Symbol in *ISO/IEC 15424*, which may be added as a preamble to the decoded data by a suitably programmed bar code reader, is

]Im

where:

] is ASCII character 93

I (upper case I) is the code character for the ITF-14 Symbology

m is a modifier character

Note: The symbology identifier]I1 is the only symbology identifier used by GS1 with the ITF-14 Symbol. This information shall not be encoded in the bar code symbol, but should be generated by the decoder after decoding and transmitting as a preamble to the data message. The value of “m” in the symbology identifier is equal to 1, which indicates the Check Digit has been validated and transmitted by the scanner.

5.2.A.4 Appendix 4: (Informative) Test Specifications

To verify whether a symbol meets the specifications in the GS1 System, it shall be tested using the specification defined in ISO/IEC 15416, which details the conditions under which measurements should be made. The specification defines methods of determining an overall quality grade based on the attributes of the bar code symbol and determining its conformity with the system. For ITF-14 Symbols, the reference decode algorithm shall be the algorithm specified in [Section 5.2.1.4](#).

Full details on bar code production and quality assessment can be found in [Section 5.4](#).

The verifier shall determine the average wide-to-narrow ratio (N) for each profile. The value N should be computed character by character, then averaged over all characters in the symbol. The range indicated below is passing:

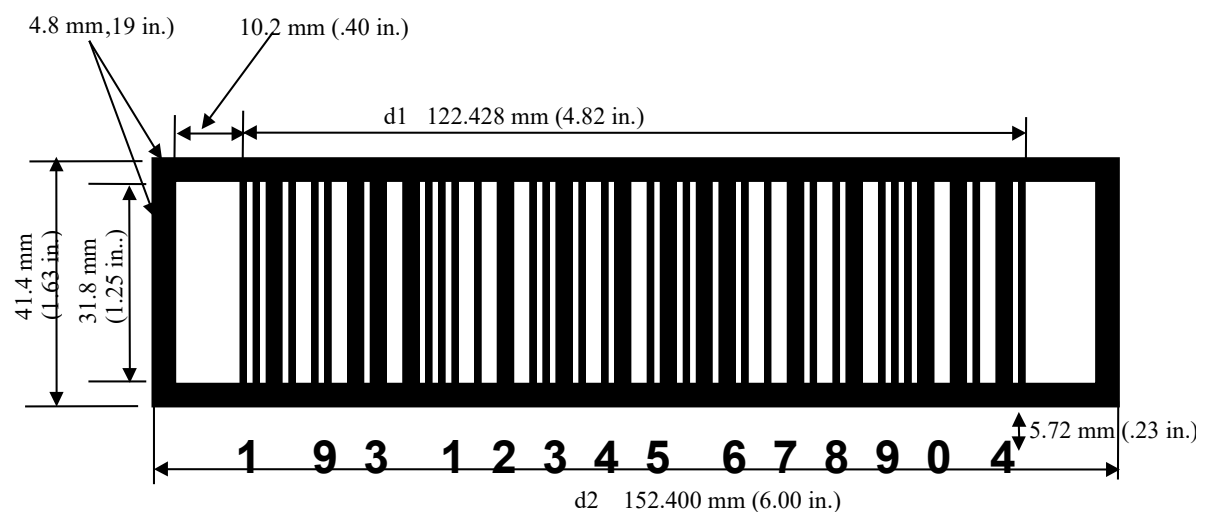
$$2.25 < N < 3.00$$

N is calculated for each symbol character (pair of data digits) according to the following rule:

$$N_i = 1.5 * [(b_4 + b_5 + s_4 + s_5) / (b_1 + b_2 + b_3 + s_1 + s_2 + s_3)]$$

The value N for the profile is then obtained by averaging the N_i for all characters in the symbol.

Figure 5.2.A.4 – 1

ITF-14 Symbol: Main Dimensions at X-Dimension 1.016 mm (0.040 in.)

This diagram is not intended to be used as a basis for measurement.

Section 5.3:

GS1-128 Symbology Specifications

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5.3.1 Symbology Characteristics

The GS1-128 Bar Code Symbol has been carefully designed through joint co-operation between GS1 and Automatic Identification Manufacturers, Inc. (AIM). Use of GS1-128 Bar Code Symbols provides a high degree of security and distinguishes GS1 System Element Strings from extraneous non-standard bar code symbols.

The GS1-128 Symbology is a subset of the more general Code 128 Symbology. By agreement between AIM, Inc and GS1, use of the Function Code 1 (FNC1) in Code 128 Symbols in the first symbol character position following the Start Character has been reserved exclusively for the GS1 System.

Code 128 is fully described in *“ISO/IEC 15417, Information Technology - Automatic Identification and Data Capture Techniques - Bar code Symbology Specification - Code 128.*

The information covered in Section 5.3 includes:

- Sections 5.3.1 – 5.3.6: GS1-128 Symbology subset (using *“ISO/IEC 15417”* for reference)
- Section 5.3.7: GS1 System application-defined parameters
- Section 5.3.8: GS1 System rules for encoding/decoding Element Strings in GS1-128 Bar Code Symbols

5.3.1.1 GS1-128 Symbology Characteristics

The characteristics of the GS1-128 Symbology are:

- Encodable character set:
 - The Code 128 ASCII characters are in accordance with *ISO 646*. Refer to Figure 3.A.3 – 1 for more details. Spaces are not encoded in GS1-128 Bar Code Symbols).
 - Characters with ASCII values 128 to 255 may also be encoded in Code 128 Symbols. Characters with ASCII values 128 -to 255 accessed by Function 4 Character (FNC4) are reserved for future use and are not used in GS1-128 Bar Code Symbols.
 - Four non-data function characters. FNC2 and FNC4 are not used in GS1-128 Bar Code Symbols.

- Four code set selection characters (including single character code set shift)
- Three Start Characters
- One Stop Character
- Continuous code type
- Six elements per symbol character comprising three bars (dark bars) and three spaces (light bars), each one, two, three, or four modules in width. The Stop Character is made up of seven elements comprising four bars (dark bars) and three spaces (light bars).
- Character self-checking
- Variable symbol length
- Bi-directionally decodable
- One mandatory Symbol Check Character (see [Section 5.3.A.1](#)).
- Data character density is 11 modules per symbol character (5.5 modules per numeric character in code set C, 13 modules per Stop Character)
- Non-data overhead:
 - GS1-128 Bar Code Symbols have a special double character start pattern consisting of the appropriate Start Character and immediately followed by a Function Code 1 (FNC1). The FNC1 adds to the symbol's non-data overhead. The total symbol overhead is 46 modules.
 - The FNC1 character may also be used as a separator character between Element Strings not contained in the pre-defined table shown in [Figure 5.3.8.2.1 – 1](#).
- GS1-128 Bar Code Symbol size characteristics:
 - The maximum physical length is 165 mm (6.5 in.) including Quiet Zones.
 - The maximum number of data characters in a single symbol is 48.
 - For a given length of data, the symbol size is variable between limits in X-dimension to accommodate the ranges in quality achievable by the various printing processes.

5.3.2 GS1-128 Bar Code Symbol Structure

The GS1-128 Bar Code Symbol is made up as follows, reading from left to right:

- * Leading Quiet Zone

* A Start Character (A, B, or C)	The double character Start pattern
* The Function Code 1 (FNC1)	

- * Data (including the Application Identifier represented in character set A, B, or C)

- * A Symbol Check Character

- * The Stop Character

- * Trailing Quiet Zone

The data characters represented in the symbol are shown in Human Readable Interpretation underneath or above the symbol.

Figure 5.3.2 – 1

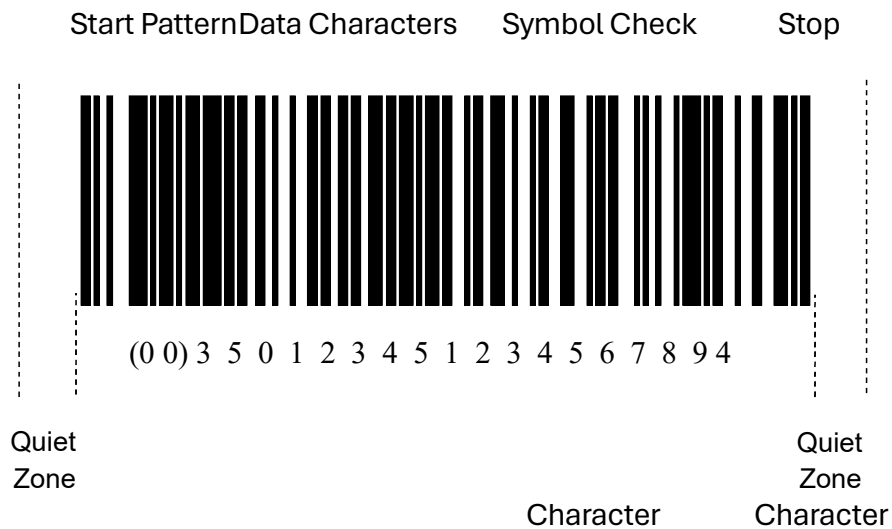
General Format of a GS1-128 Bar Code Symbol**5.3.3 GS1-128 Symbology Character Assignments**

Figure 5.3.3.2 – 1 defines all the Code 128 character assignments. In the element width column, the numeric values represent the widths of the elements in modules or multiples of the X-dimension.

GS1-128 Bar Code Symbol character assignments are identical to Code 128 Symbol character assignments.

5.3.3.1 Symbol Character Structure

The sum of the bar modules in any symbol character is always even (even parity) and the sum of the space modules is, therefore, always odd. This parity feature enables character self-checking.

Figure 5.3.3.1 – 1

GS1-128 Bar Code Symbol Start Character A

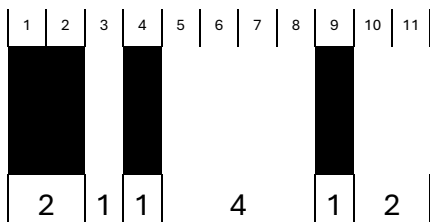


Figure 5.3.3.1 – 2 illustrates the encodation of the symbol character value 35, which represents data character C in code sets A or B or the digits 35 in code set C.

Figure 5.3.3.1 – 2

Symbol Character Value 35

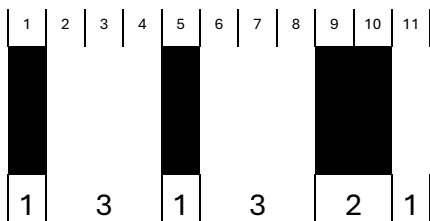
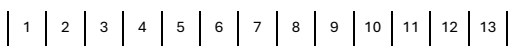
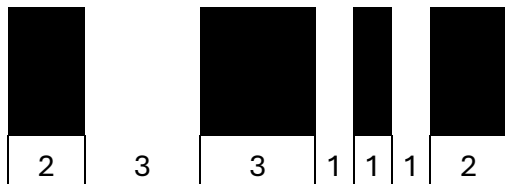


Figure 5.3.3.1 – 3

GS1-128 Bar Code Symbol Stop Character





5.3.3.2 Data Character Encodation

Code 128 has three character sets, which are shown in Figure 5.3.3.2 – 1 as code sets A, B, and C.

GS1-128 Symbology specifies the identical character set, as defined by the International *ISO/IEC 646* Standard, to ensure international compatibility. For more information see [Figure 3.A.3 – 1](#).

The symbol character bar (dark bar) and space (light bar) patterns shown in Figure 5.3.3.2 – 1 represent the data characters listed under the columns for code set A, B, or C. The choice of code set depends on the Start Character, the use of code A, code B, or code C characters, or the shift character. If the symbol begins with Start Character A, then code set A is defined initially. Code set B and code set C are similarly defined by beginning the symbol with Start Character B or C, respectively. The code set can be redefined within the symbol by using code A, code B, and code C characters or the shift character (see [Section 5.3.3](#) for the use of special characters).

The same data may be represented by different Code 128 Symbols through the use of different combinations of Start, code set, and shift characters. The individual applications do not specify code sets A, B, or C. [Section 5.3.A.3](#) contains rules to minimise the length of the symbol for any given data.

Each symbol character is assigned a numeric value listed in Figure 5.3.3.2 – 1. This value is used in calculating the Symbol Check Character value. It may also be used to provide a conversion to and from ASCII values (see [Section 5.3.A.2](#)).

Figure 5.3.3.2 – 1

Code 128 Character Encodation

Symbol Character Value	Code Set A	ASCII Value for Code Set A	Code Set B	ASCII Value for Code Set B	Code Set C	Element Widths (Modules)						Element Pattern										
						B	S	B	S	B	S	1	2	3	4	5	6	7	8	9	10	11
0	space	32	space	32	00	2	1	2	2	2	2	■	■	■	■	■	■	■	■	■	■	■
1	!	33	!	33	01	2	2	2	1	2	2	■	■	■	■	■	■	■	■	■	■	■
2	"	34	"	34	02	2	2	2	2	2	1	■	■	■	■	■	■	■	■	■	■	■
3	#	35	#	35	03	1	2	1	2	2	3	■	■	■	■	■	■	■	■	■	■	■
4	\$	36	\$	36	04	1	2	1	3	2	2	■	■	■	■	■	■	■	■	■	■	■
5	%	37	%	37	05	1	3	1	2	2	2	■	■	■	■	■	■	■	■	■	■	■
6	&	38	&	38	06	1	2	2	2	1	3	■	■	■	■	■	■	■	■	■	■	■
7	apostrophe	39	apostrophe	39	07	1	2	2	3	1	2	■	■	■	■	■	■	■	■	■	■	■
8	(	40	(	40	08	1	3	2	2	1	2	■	■	■	■	■	■	■	■	■	■	■
9	)	41	)	41	09	2	2	1	2	1	3	■	■	■	■	■	■	■	■	■	■	■
10	*	42	*	42	10	2	2	1	3	1	2	■	■	■	■	■	■	■	■	■	■	■
11	+	43	+	43	11	2	3	1	2	1	2	■	■	■	■	■	■	■	■	■	■	■
12	comma	44	comma	44	12	1	1	2	2	3	2	■	■	■	■	■	■	■	■	■	■	■
13	-	45	-	45	13	1	2	2	1	3	2	■	■	■	■	■	■	■	■	■	■	■
14	full stop	46	full stop	46	14	1	2	2	2	3	1	■	■	■	■	■	■	■	■	■	■	■
15	/	47	/	47	15	1	1	3	2	2	2	■	■	■	■	■	■	■	■	■	■	■
16	0	48	0	48	16	1	2	3	1	2	2	■	■	■	■	■	■	■	■	■	■	■
17	1	49	1	49	17	1	2	3	2	2	1	■	■	■	■	■	■	■	■	■	■	■

Symbol Character Value	Cod e Set A	ASCII Value for Code Set A	Code Set B	ASCII Value for Code Set B	Code Set C	Element Widths (Modules)						Element Pattern										
						B	S	B	S	B	S	1	2	3	4	5	6	7	8	9	10	11
18	2	50	2	50	18	2	2	3	2	1	1											
19	3	51	3	51	19	2	2	1	1	3	2											
20	4	52	4	52	20	2	2	1	2	3	1											
21	5	53	5	53	21	2	1	3	2	1	2											
22	6	54	6	54	22	2	2	3	1	1	2											
23	7	55	7	55	23	3	1	2	1	3	1											
24	8	56	8	56	24	3	1	1	2	2	2											
25	9	57	9	57	25	3	2	1	1	2	2											
26	colo n	58	colon	58	26	3	2	1	2	2	1											
27	semi - colo n	59	semi- colon	59	27	3	1	2	2	1	2											
28	<	60	<	60	28	3	2	2	1	1	2											
29	=	61	=	61	29	3	2	2	2	1	1											
30	>	62	>	62	30	2	1	2	1	2	3											
31	?	63	?	63	31	2	1	2	3	2	1											
32	@	64	@	64	32	2	3	2	1	2	1											
33	A	65	A	65	33	1	1	1	3	2	3											
34	B	66	B	66	34	1	3	1	1	2	3											
35	C	67	C	67	35	1	3	1	3	2	1											
36	D	68	D	68	36	1	1	2	3	1	3											
37	E	69	E	69	37	1	3	2	1	1	3											

Symbol Character Value	Cod e Set A	ASCII Value for Code Set A	Code Set B	ASCII Value for Code Set B	Code Set C	Element Widths (Modules)						Element Pattern										
						B	S	B	S	B	S	1	2	3	4	5	6	7	8	9	10	11
38	F	70	F	70	38	1	3	2	3	1	1											
39	G	71	G	71	39	2	1	1	3	1	3											
40	H	72	H	72	40	2	3	1	1	1	3											
41	I	73	I	73	41	2	3	1	3	1	1											
43	J	74	J	74	42	1	1	2	1	3	3											
43	K	75	K	75	43	1	1	2	3	3	1											
44	L	76	L	76	44	1	3	2	1	3	1											
45	M	77	M	77	45	1	1	3	1	2	3											
46	N	78	N	78	46	1	1	3	3	2	1											
47	O	79	O	79	47	1	3	3	1	2	1											
48	P	80	P	80	48	3	1	3	1	2	1											
49	Q	81	Q	81	49	2	1	1	3	3	1											
50	R	82	R	82	50	2	3	1	1	3	1											
51	S	83	S	83	51	2	1	3	1	1	3											
52	T	84	T	84	52	2	1	3	3	1	1											
53	U	85	U	85	53	2	1	3	1	3	1											
54	V	86	V	86	54	3	1	1	1	2	3											
55	W	87	W	87	55	3	1	1	3	2	1											
56	X	88	X	88	56	3	3	1	1	2	1											
57	Y	89	Y	89	57	3	1	2	1	1	3											
58	Z	90	Z	90	58	3	1	2	3	1	1											
59	[	91	[	91	59	3	3	2	1	1	1											

Symbol Character Value	Cod e Set A	ASCII Value for Code Set A	Code Set B	ASCII Value for Code Set B	Code Set C	Element Widths (Modules)						Element Pattern										
						B	S	B	S	B	S	1	2	3	4	5	6	7	8	9	10	11
60	\	92	\	92	60	3	1	4	1	1	1											
61	]	93	]	93	61	2	2	1	4	1	1											
62	^	94	^	94	62	4	3	1	1	1	1											
63	_	95	_	95	63	1	1	1	2	2	4											
64	NUL	00	grave accent	96	64	1	1	1	4	2	2											
65	SOH	01	a	97	65	1	2	1	1	2	4											
66	STX	02	b	98	66	1	2	1	4	2	1											
67	ETX	03	c	99	67	1	4	1	1	2	2											
68	EOT	04	d	100	68	1	4	1	2	2	1											
69	ENQ	05	e	101	69	1	1	2	2	1	4											
70	ACK	06	f	102	70	1	1	2	4	1	2											
71	BEL	07	g	103	71	1	2	2	1	1	4											
72	BS	08	h	104	72	1	2	2	4	1	1											
73	HT	09	i	105	73	1	4	2	1	1	2											
74	LF	10	j	106	74	1	4	2	2	1	1											
75	VT	11	k	107	75	2	4	1	2	1	1											
76	FF	12	l	108	76	2	2	1	1	1	4											
77	CR	13	m	109	77	4	1	3	1	1	1											
78	SO	14	n	110	78	2	4	1	1	1	2											
79	SI	15	o	111	79	1	3	4	1	1	1											
80	DLE	16	p	112	80	1	1	1	2	4	2											
81	DC1	17	q	113	81	1	2	1	1	4	2											

Symbol Character Value	Cod e Set A	ASCII Value for Code Set A	Code Set B	ASCII Value for Code Set B	Code Set C	Element Widths (Modules)						Element Pattern										
						B	S	B	S	B	S	1	2	3	4	5	6	7	8	9	10	11
82	DC2	18	r	114	82	1	2	1	2	4	1	■			■			■	■	■	■	
83	DC3	19	s	115	83	1	1	4	2	1	2	■		■	■	■	■			■		
84	DC4	20	t	116	84	1	2	4	1	1	2	■			■	■	■			■		
85	NAK	21	u	117	85	1	2	4	2	1	1	■			■	■	■			■		
86	SYN	22	v	118	86	4	1	1	2	1	2	■	■	■			■			■		
87	ETB	23	w	119	87	4	2	1	1	1	2	■	■	■			■			■		
88	CAN	24	x	120	88	4	2	1	2	1	1	■	■	■			■			■		
89	EM	25	y	121	89	2	1	2	1	4	1	■	■		■	■		■	■	■	■	
90	SUB	26	z	122	90	2	1	4	1	2	1	■	■		■	■			■	■	■	
91	ESC	27	{	123	91	4	1	2	1	2	1	■	■	■			■			■	■	
92	FS	28		124	92	1	1	1	1	4	3	■		■	■		■	■	■	■		
93	GS	29	}	125	93	1	1	1	3	4	1	■		■	■			■	■	■	■	
94	RS	30	~	126	94	1	3	1	1	4	1	■				■		■	■	■	■	
95	US	31	DEL	127	95	1	1	4	1	1	3	■		■	■	■			■			
96	FNC 3		FNC3		96	1	1	4	3	1	1	■		■	■	■			■	■	■	
97	FNC 2		FNC2		97	4	1	1	1	1	3	■	■	■			■		■			
98	SHIFT		SHIF T		98	4	1	1	3	1	1	■	■	■			■			■	■	
99	CODE C		CODE C		99	1	1	3	1	4	1	■		■	■	■		■	■	■	■	
100	CODE B		FNC4		CODE B	1	1	4	1	3	1	■		■	■	■			■	■	■	
101	FNC		CODE		CODE	3	1	1	1	4	1	■	■	■			■	■	■	■	■	

Symbol Character Value	Code Set A	ASCII Value for Code Set A	Code Set B	ASCII Value for Code Set B	Code Set C	Element Widths (Modules)						Element Pattern										
						B	S	B	S	B	S	1	2	3	4	5	6	7	8	9	10	11
	4		A		A																	
102	FNC 1		FNC1		FNC1	4	1	1	1	3	1											
103	Start A					2	1	1	4	1	2											
104	Start B					2	1	1	2	1	4											
105	Start C					2	1	1	2	3	2											

Symbol Character r Values	Code Set A	Code Set B	Code Set C	Element Widths (Modules)						Element Pattern													
	Stop			B	S	B	S	B	S	B	1	2	3	4	5	6	7	8	9	10	11	12	13
				2	3	3	1	1	1	2													

Note: The Stop Character comprises 13 modules in four bars (dark bars) and three spaces (light bars). Every other character comprises 11 modules, starts with a bar (dark bar), ends with a space (light bar), and comprises six elements, each of which varies from one to four modules in width. The numeric values in the B and S columns represent the number of modules in each bar (dark bar) or space (light bar) element respectively in the symbol characters.

5.3.3.3 Code Sets

5.3.3.3.1 Code Set A

Code set A includes all of the standard upper case alphanumeric characters and punctuation characters together with the symbology elements (e.g., characters with ASCII values from 00 to 95) and seven special characters.

5.3.3.3.2 Code Set B

Code set B includes all of the standard upper case alphanumeric characters and punctuation characters together with the lowercase alphabetic characters (e.g., ASCII characters 32 to 127 inclusive) and seven special characters.

5.3.3.3.3 Code Set C

Code set C includes the set of 100 digit pairs from 00 to 99 inclusive, as well as three special characters. This allows numeric data to be encoded as two data digits per symbol character.

5.3.3.4 Special Characters

The last seven characters of code sets A and B (character values 96 to 102) and the last three characters of code set C (character values 100 to 102) are special non-data characters that, though they have particular significance to the bar code reader, have no ASCII character equivalents.

5.3.3.4.1 Code Set and Shift Characters

Code set and shift characters shall be used to change from one code set to another within a symbol. The decoder shall not transmit them.

- Code set characters: Code A, B, or C characters change the symbol code set from the code set previously defined to the new code set, which is defined by the code character. This change applies to all characters following the code set character until either the end of the symbol, another code set character, or the shift character is encountered.
- Shift character: The shift character changes the code set from A to B or B to A for the single character following the shift character. Characters following the affected character shall revert to the code set A or B defined prior to the shift character.

5.3.3.4.2 Function Characters

Function Characters (FNC) provide special operations and application instructions to the bar code reading device.

- The Function Code 1 (FNC1) shall be subject to the special considerations defined in [Section 5.3.A.2](#). An FNC1 in the first position following the Start Character of a Code-128 Symbol is at all times a reserved use, which identifies the GS1 System.
- The Function 2 Character (FNC2) (Message Append) is not used in the GS1 System. It instructs the bar code reader to temporarily store the data from the symbol containing the FNC2 and transmit it as a prefix to the data of the next symbol. This may be used to concatenate several symbols before transmission. This character may occur anywhere in the symbol. Where the sequence of data is significant, provision should be made to ensure reading of the symbols in the correct sequence.
- The Function 3 Character (FNC3) (Initialise) instructs the bar code reader to interpret the data from the symbol containing the FNC3 as instructions for initialisation or reprogramming of the bar code reader. The data from the symbol shall not be transmitted by the bar code reader. This character may occur anywhere in the symbol.
- The Function 4 Character (FNC4) is not used in the GS1 System. In Code 128 Symbols, FNC4 is used to represent an extended ASCII character set (byte values 128 to 255) as specified in ISO 8859-1 or otherwise in an application specification. If a single FNC4 is used, the value 128 is added to the ASCII value

of the following data character in the symbol. A shift character may follow the FNC4 if it is necessary to change the code set for the following data character. Subsequent data characters revert to the standard ASCII set. If two consecutive FNC4s are used, the value 128 is added to the ASCII value of the following data characters until two further consecutive FNC4s are encountered or the end of the symbol is reached. If, during this sequence of extended ASCII encodation, a single FNC4 is encountered, it is used to revert to standard ASCII encodation for the next data character only. Shift and code set characters shall have their normal effect during such a sequence. The default reference character set for extended ASCII values 128 to 255 is the corresponding half of ISO 8859-1, Latin alphabet 1, but application specifications may define or reference alternative sets corresponding to byte values 128 to 255.

5.3.3.5 Start and Stop Characters

- Start Characters A, B, and C define the corresponding code set to be used initially in the symbol.
- The Stop Character is common to all code sets.
- The decoder shall not transmit Start and Stop Characters.

5.3.3.6 Symbol Check Character

The Symbol Check Character shall be included as the last symbol character before the Stop Character. [Section 5.3.A.1](#) defines the algorithm for its calculation. The Symbol Check Character shall not be represented in the Human Readable Interpretation, nor shall it be transmitted by the decoder.

5.3.3.7 GS1-128 Symbology Start Pattern

The GS1-128 Symbology has special double character start patterns consisting of Start (A, B, or C) FNC1. These special Start Characters differentiate GS1-128 Bar Code Symbols from the more generalised Code 128 Symbols.

In other words, a Code 128 Symbol, which begins with one of the GS1-128 Symbology double character start patterns, is always a GS1-128 Bar Code Symbol; a Code 128 Symbol, which does not begin with this start pattern, is never a GS1-128 Bar Code Symbol.

A Function Code 1 (FNC1) may be the Symbol Check Character (in less than 1 percent of cases). It is also used as a Separator Character, when appropriate, if Application Identifiers (AIs) and their data fields are concatenated into a single bar code.

- Start A begins the GS1-128 Symbol data encodation according to character set A.
- Start B begins the GS1-128 Symbol data encodation according to character set B.
- Start C begins the GS1-128 Symbol data encodation according to character set C. Start Character C should always be used when the data inclusive of the AI begins with four or more numeric characters.

5.3.4 Dimensional Requirements

GS1-128 Bar Code Symbols shall conform to the dimensions in the subsections that follow.

5.3.4.1 Minimum Width of a Module (X-Dimension)

The minimum X-dimension is defined by the application specification and requirements (see [Section 5.4](#)), while considering the equipment available for symbol production and scanning. For GS1-128 Bar Code Symbols, the absolute minimum X-dimension is 0.250 mm (0.00984 in.). The maximum X-dimension is 1.016 mm (0.040 in.). Application specifications stipulate a target and range of the X-dimension.

The X-dimension shall be constant throughout a given symbol.

5.3.4.2 Quiet Zone (Light Margin)

The minimum width of the Quiet Zone to the left and right of the GS1-128 Bar Code Symbol is 10x.

5.3.4.3 Maximum Symbol Length

The maximum length of any GS1-128 Bar Code Symbol must be within the following limits:

- The physical length, including Quiet Zones, cannot exceed 165 mm (6.5 in.).
- The maximum number of encoded data characters is 48, including the Application Identifier(s) and Function Code 1 (FNC1) when used as a Separator, but excluding the auxiliary characters and the Symbol Check Character.

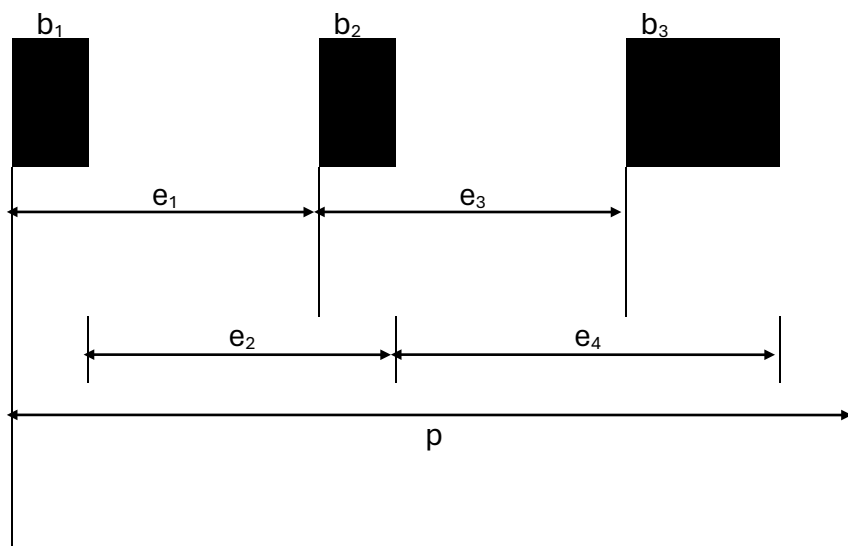
5.3.5 Reference Decode Algorithm

Bar code reading systems are designed to read imperfect symbols to the extent that practical algorithms permit. This section describes the reference decode algorithm used in the computation of the Decodability value described in *ISO/IEC 15416*.

The algorithm contains the following steps to decode each character:

1. Calculate eight width measurements p, e1, e2, e3, e4, b1, b2, and b3 (see Figure 5.3.5 – 1).

Figure 5.3.5 – 1

Decode Measurements

2. Convert measurements e_1 , e_2 , e_3 , and e_4 to normalised values e_1 , e_2 , e_3 , and e_4 , which will represent the integral module width (e_i) of these measurements. The following method is used for the i -th value:

If $1,5p/11 \leq e_i < 2,5p/11$, then $E_i = 2$

If $2,5p/11 \leq e_i < 3,5p/11$, then $E_i = 3$

If $3,5p/11 \leq e_i < 4,5p/11$, then $E_i = 4$

If $4,5p/11 \leq e_i < 5,5p/11$, then $E_i = 5$

If $5,5p/11 \leq e_i < 6,5p/11$, then $E_i = 6$

If $6,5p/11 \leq e_i < 7,5p/11$, then $E_i = 7$

Otherwise the character is in error.

3. Look up the character in the decode table using the four values E_1 , E_2 , E_3 , and E_4 as the key (see Figure 5.3.5 – 2).
4. Retrieve the self-checking symbol character value V , which is stored in the table with the character. The value V is equal to the sum of the modules for the bars (dark bars) as defined for that character.
5. Verify that:

$$(V-1, 75)p / 11 < (b_1 + b_2 + b_3) < (V + 1, 75)p / 11$$

Otherwise the character is in error.

The calculation indirectly uses character parity to detect all decode errors caused by single non-systematic one-module edge errors.

Using these five steps, decode the first character. If it is a Start Character, continue decoding the symbol in the normal forward direction. If it is not a Start Character but decodes as a Stop Character, attempt to decode all subsequent characters in the reverse direction.

After all characters have been decoded, make sure there was a valid Start Character, a valid Stop Character, and that the Symbol Check Character is correct.

Translate the symbol characters into the appropriate data characters from code set A, B, or C according to the Start Character, code characters, and shift characters used in the symbol.

In addition, perform other secondary checks on Quiet Zones, beam acceleration, absolute timing, and dimensions that are appropriate considering the specific reading device and intended application environment.

Note: In this algorithm the symbol is decoded using edge to similar edge measurements (e) and an additional measurement of the sum of the three bar (dark bar) widths.

Figure 5.3.5 – 2

Edge Differences for Decoding Code 128 Symbols

Char. Value	E1	E2	E3	E4	V	Char. Value	E1	E2	E3	E4	V
00	3	3	4	4	6	54	4	2	2	3	6
01	4	4	3	3	6	55	4	2	4	5	6
02	4	4	4	4	6	56	6	4	2	3	6
03	3	3	3	4	4	57	4	3	3	2	6
04	3	3	4	5	4	58	4	3	5	4	6
05	4	4	3	4	4	59	6	5	3	2	6
06	3	4	4	3	4	60	4	5	5	2	8
07	3	4	5	4	4	61	4	3	5	5	4
08	4	5	4	3	4	62	7	4	2	2	6
09	4	3	3	3	4	63	2	2	3	4	4
10	4	3	4	4	4	64	2	2	5	6	4
11	5	4	3	3	4	65	3	3	2	3	4
12	2	3	4	5	6	66	3	3	5	6	4
13	3	4	3	4	6	67	5	5	2	3	4
14	3	4	4	5	6	68	5	5	3	4	4
15	2	4	5	4	6	69	2	3	4	3	4
16	3	5	4	3	6	70	2	3	6	5	4
17	3	5	5	4	6	71	3	4	3	2	4
18	4	5	5	3	6	72	3	4	6	5	4
19	4	3	2	4	6	73	5	6	3	2	4
20	4	3	3	5	6	74	5	6	4	3	4
21	3	4	5	3	6	75	6	5	3	3	4
22	4	5	4	2	6	76	4	3	2	2	4
23	4	3	3	4	8	77	5	4	4	2	8
24	4	2	3	4	6	78	6	5	2	2	4
25	5	3	2	3	6	79	4	7	5	2	6
26	5	3	3	4	6	80	2	2	3	6	6
27	4	3	4	3	6	81	3	3	2	5	6
28	5	4	3	2	6	82	3	3	3	6	6
29	5	4	4	3	6	83	2	5	6	3	6
30	3	3	3	3	6	84	3	6	5	2	6
31	3	3	5	5	6	85	3	6	6	3	6
32	5	5	3	3	6	86	5	2	3	3	6
33	2	2	4	5	4	87	6	3	2	2	6
34	4	4	2	3	4	88	6	3	3	3	6
35	4	4	4	5	4	89	3	3	3	5	8
36	2	3	5	4	4	90	3	5	5	3	8
37	4	5	3	2	4	91	5	3	3	3	8
38	4	5	5	4	4	92	2	2	2	5	6
39	3	2	4	4	4	93	2	2	4	7	6
40	5	4	2	2	4	94	4	4	2	5	6
41	5	4	4	4	4	95	2	5	5	2	6
42	2	3	3	4	6	96	2	5	7	4	6
43	2	3	5	6	6	97	5	2	2	2	6
44	4	5	3	4	6	98	5	2	4	4	6
45	2	4	4	3	6	99	2	4	4	5	8
46	2	4	6	5	6	100	2	5	5	4	8
47	4	6	4	3	6	101	4	2	2	5	8
48	4	4	4	3	8	102	5	2	2	4	8
49	3	2	4	6	6	103	3	2	5	5	4
50	5	4	2	4	6	104	3	2	3	3	4
51	3	4	4	2	6	105	3	2	3	5	6
52	3	4	6	4	6	Stop _A	5	6	4	2	6
53	3	4	4	4	8	Stop _B	3	2	2	4	6

Note: Stop_A values are for decoding in a forward direction. Stop_B values apply to the first six elements of the Stop Character starting at the rightmost side when scanned in a reverse direction.

5.3.6 Symbol Quality

5.3.6.1 General

ISO/IEC 15416 defines a standardised methodology for measuring and grading bar code symbols. Code 128 Symbols shall be evaluated according to that standard. The reference decode algorithm defined in [Section 5.3.5](#) shall be used for the assessment of the decode and Decodability parameters under *ISO/IEC 15416*.

For GS1-128 Bar Code Symbol minimum quality levels, refer to [Section 5.3.7](#).

5.3.6.2 Decodability

Decodability is a measure of how closely the decode algorithm measurement values approach those in a theoretically perfect symbol. Thus, Decodability is a parameter that measures how closely the Scan Reflectance Profile is to approaching decode failure for a given printed symbol.

For the calculation of the Decodability value V , the following provisions apply, which supplement those described in *ISO/IEC 15416* for edge to similar edge decodable symbologies:

Substitute V_1 for V_C in the formula $V_C = K / (S / 2n)$.

Where: K = the smallest difference between a measurement and a reference threshold

$N = 11$ (number of modules in a symbol character)

S = total width of the character

Calculate V_2 :

$$V_2 = \frac{1,75 - (\text{ABS}((W_b \times 11/S) - M))}{1,75}$$

Where: M = number of dark modules in the character

S = total width of the character

W_b = sum of the bar (dark bar) widths in the character

ABS = mathematical term for taking the absolute of the calculation that follows it

V_C is the lesser of V_1 and V_2 .

The Stop Character includes an additional terminating bar (dark bar). For the purpose of measuring Decodability, the Stop Character should be checked twice: first using the six leftmost elements and then using the six rightmost elements from right to left. Both sets of six elements are equivalent in width to a standard character.

5.3.6.3 Quiet Zones (Light Margins)

The Quiet Zones to the right and left of the GS1-128 Bar Code Symbol are compulsory. Both Quiet Zones have a minimum width of 10x.

ISO/IEC 15416 allows for additional pass/fail criteria to be stipulated by a symbology specification. In the case of a GS1-128 Bar Code Symbol, a minimum Quiet Zone of 10Z is specified. Both left and right Quiet Zones on each Scan Reflectance Profile (SRP) under ISO/IEC 15416 shall be measured and graded as follows:

Quiet Zone $\geq 10Z$: Grade 4 (A)

Quiet Zone $< 10Z$: Grade 0 (F)

Where Z = the average measured width of the narrow bars (dark bars) and spaces (light bars) (one module) in the symbol

5.3.6.4 Transmitted Data

Transmitted data from a decoded GS1-128 Bar Code Symbol shall comprise the byte values of the data characters. It is prefixed by the symbology identifier JC1, if used. The Start and Stop Characters, function characters, code set and shift characters, and Symbol Check Character shall not be included in the transmitted data.

For GS1-128 Symbology implementation, see [Section 5.3.7](#).

5.3.7 GS1-128 Symbology Application Parameters

5.3.7.1 Symbol Height

For GS1-128 Bar Code Symbols used in general distribution, the minimum height of the bars (dark bars) in the symbol is 32 mm (1.25 in.). The actual symbol height used depends on the specific application requirements.

5.3.7.2 Symbol Length

The dimensions of the GS1-128 Bar Code Symbol depend on the number of characters encoded:

1 Start Character	x 11 modules =	11
Function Code 1 (FNC1)	x 11 modules =	11
1 Symbol Check Character	x 11 modules =	11

1 Stop Character	x 13 modules =	13
N symbol characters	x 11 modules =	11N

$$(11N + 46) \text{ modules}$$

Where N is the number of symbol characters, any auxiliary characters (shift and code characters) embedded in the data are included.

A module is equal to the X-dimension of the symbol.

Character set C allows two digits to be encoded in one symbol character. Thus, numeric data can be encoded with twice the density of other data when using character set C.

In addition, Quiet Zones to the right and left of the bar code are compulsory and both have widths of 10 modules.

Thus total symbol length, including Quiet Zones, is:

$$(11N + 66) \text{ modules} = (11N + 66) \times$$

5.3.7.3 Maximum Symbol Length

Two parameters have to be taken into consideration for defining the maximum length of a GS1-128 Bar Code Symbol: the physical length, which depends on the number of characters encoded and the module width (or X-dimension) used, and the number of data characters encoded excluding the auxiliary characters.

The maximum length of any GS1-128 Bar Code Symbol must be within the following limits:

- The physical length, including Quiet Zones, cannot exceed 165 mm (6.5 in.).
- The maximum number of encoded data characters is 48, including the Application Identifier(s) and Function Code 1 (FNC1) when used as a Separator, but excluding the auxiliary characters and the Symbol Check Character.

5.3.7.4 Human Readable Interpretation

The Human Readable Interpretation of the data in the bar code symbol must be shown below the symbol. Start, Stop, shift, and function characters, as well as the Symbol Check Character, are not shown in the human readable format.

The precise location of the Human Readable Interpretation and the font used to represent the characters are not specified for GS1-128 Bar Code Symbols. However, the characters should be clearly legible (such as OCR-B) and must be obviously associated with the symbol. The Quiet Zones must not be violated.

Application Identifiers should be clearly recognisable to facilitate key entry. This is achieved by putting parentheses around Application Identifiers in the Human Readable Interpretation.

Note: The parentheses are not part of the data and are not encoded in the bar code symbol.

5.3.7.5 Transmitted Data (FNC1)

The following GS1-128 Symbology implementation specifications are in accordance with *ISO/IEC 15417 Appendix 2* for transmitted data:

- The Function Code 1 (FNC1) may validly occur as the Symbol Check Character.
- FNC1 in the third or subsequent character position is transmitted as the ASCII character 29 (GS).
- Symbols using FNC1 in the first data position should have symbology identifiers enabled.
- When FNC1 is used in the first position it shall not be represented in the transmitted message, although its presence is indicated by the use of modifier value 1 in the symbology identifier.

5.3.8 Rules for Encoding/Decoding Element Strings in GS1-128 Symbology

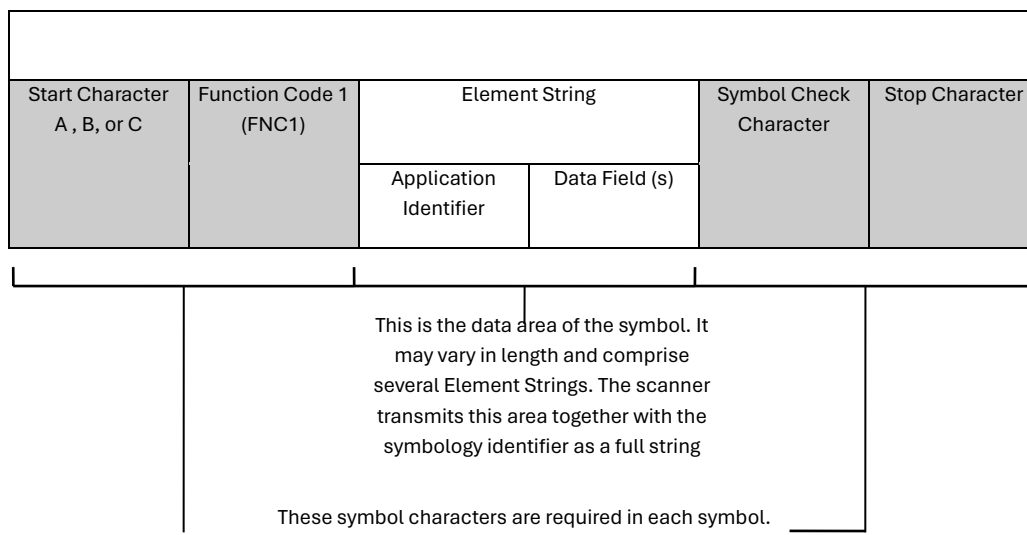
5.3.8.1 The Basic Structure of GS1-128 Bar Code Symbols

All bar code symbologies use particular symbol characters to mark the beginning and the end of the bar code symbol. A GS1-128 Bar Code Symbol may begin with the Start Character A, B, or C, which determines the interpretation of the subsequent symbol characters. GS1-128 Symbology uses the Function Code 1 (FNC1) in the position following the Start Character. This double start pattern is reserved for GS1 System applications worldwide. This makes it possible to distinguish GS1-128 Bar Code Symbols from extraneous non-standard bar code symbols.

5.3.8.2 The Basic Structure of Each GS1-128 Bar Code Symbol

Figure 5.3.8.2 – 1

GS1-128 Bar Code Symbol Structure



Since GS1-128 Bar Code Symbols vary in length, it is important to ensure that:

- Not more than 48 data characters are encoded (see the data area of Figure 5.3.8.2 – 1)
- The physical length does not exceed 165 mm (6.5 in.) including Quiet Zones

The maximum length allows several Element Strings to be encoded in one bar code symbol, a process called concatenation. Concatenation is advantageous because it means that the symbology elements are only needed once, and the space required for the symbol is smaller than when separate bar code symbols are used to encode each Element String. It also improves scanning accuracy, allowing for single scanning rather than multiple scanning. The various Element Strings can be transmitted from the bar code reader as a single full string.

The various Element Strings, which are transmitted from concatenated bar code symbols, have to be analysed and processed. To simplify this procedure and reduce the symbol size, the lengths of some Element Strings are pre-defined (see [Figure 5.3.8.2.1 – 1](#)). Element Strings that are not contained in [Figure 5.3.8.2.1 – 1](#) and that do not appear at the end of the symbol (encoded immediately before the Symbol Check Character)

must immediately be followed by an FNC1 to separate it from the Element String that follows.

5.3.8.2.1 Pre-Defined Length Application Identifiers

Figure 5.3.8.2.1 – 1 contains all Application Identifiers that have a predefined length and, therefore, do not require a Function Code 1 (FNC1) separator.

Figure 5.3.8.2.1 – 1

Element Strings with Pre-Defined Length Using Application Identifiers			
First Two Digits of the Application Identifier	Number of Characters (Application Identifier and Data Field)	First Two Digits of the Application Identifier	Number of Characters (Application Identifier and Data Field)
00	20	17	8
01	16	(18)	8
02	16	(19)	8
(03)	16	20	4
(04)	18	31	10
11	8	32	10
12	8	33	10
13	8	34	10
(14)	8	35	10
15	8	36	10
(16)	8	41	16

Figure 5.3.8.2.1 – 1 is limited to the listed numbers and will remain unchanged. Those numbers in parentheses are not yet assigned.

5.3.8.2.2 Application Identifier Digits 23

The first two digits of the Application Identifier (23n) presented a special case. The first digit following AI (23n) indicates the length of the Element String. No Separator Character was required when AI (23n) is used in a concatenated Element String. Application Identifier (23n) is no longer supported.

5.3.8.3 Concatenation

Using the GS1-128 Bar Code Symbol, it is possible to concatenate (chain together) discrete Element Strings. [Figure 5.3.8.2.1 – 1](#) specifies the total Element String length (including the Application Identifier) associated with the first two digits of an Application Identifier. Application Identifiers starting with two digits that are not included in [Figure 5.3.8.2.1 – 1](#) have a variable length even if the definition of the Application Identifier specifies a fixed length data field.

5.3.8.3.1 Concatenation of the Pre-Defined Length Element Strings

Concatenated Element Strings constructed from Application Identifiers with a pre-defined length do not require a Separator Character. Each Element String is immediately followed by either the next Application Identifier or the Symbol Check Character and Stop Character.

For example, concatenation of net weight (4 kg) with the associated Global Trade Item Number™ (GTIN™) 95012345678903 does not require the use of a Separator Character. From [Figure 5.3.8.2.1 – 1](#), Element Strings with Pre-Defined Length Using Application Identifiers:

- 01 has a pre-defined Element String length of 16 digits.
- 31 has a pre-defined Element String length of 10 digits.

Figure 5.3.8.3.1 – 1

GTIN 95012345678903

Net weight 4.00 kg

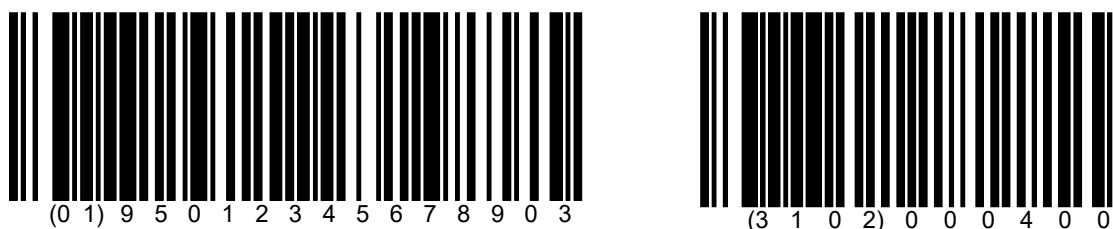
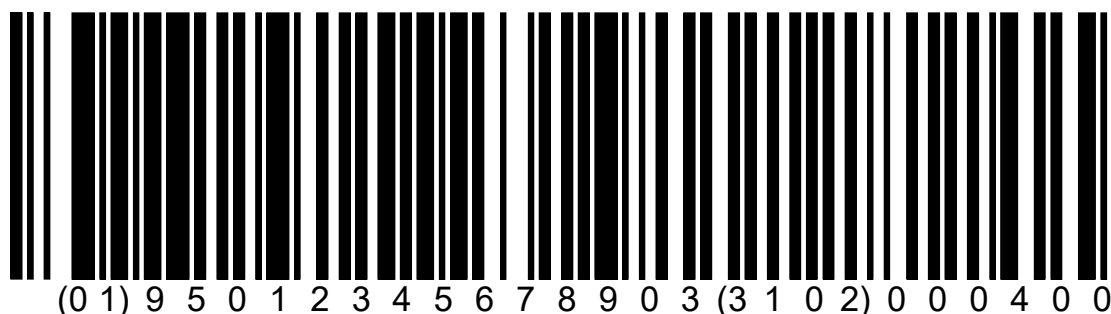


Figure 5.3.8.3.1 – 2

GTIN 95012345678903 + Net weight 4.00 kg



5.3.8.3.2 Variable Length Data Strings

Concatenating Element Strings of variable length, which includes all Application Identifiers that do not start with two characters contained in [Figure 5.3.8.2.1 – 1](#), involves the use of a Separator Character. The Separator Character used is the Function Code 1 (FNC1). It is placed immediately after the last symbol character of a variable length data string and is followed by the Application Identifier of the next Element String. If the Element String is the last to be encoded, it is followed by the Symbol Check and Stop Characters and not the FNC1 Separator Character.

For example, concatenation of price per unit of measure (365 currency units) and batch number (123456) requires the use of a Separator Character immediately after the price per unit of measure.



Figure 5.3.8.3.2 – 1

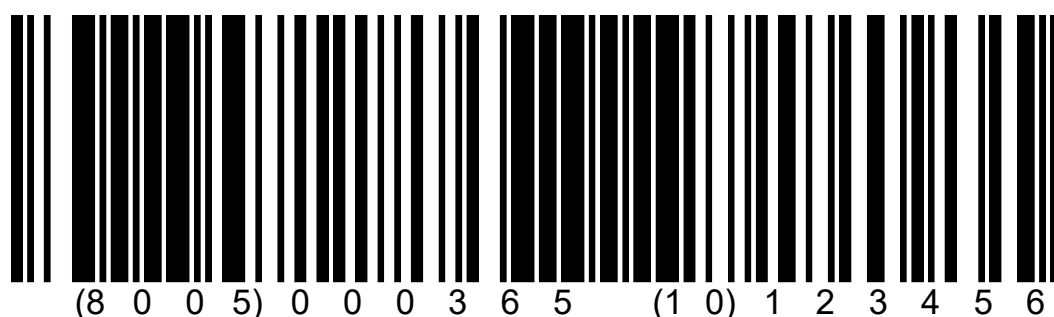
Price per unit of measure 365

Batch number 123456

Figure 5.3.8.3.2 – 2

Price per unit of measure 365

Batch number 123456



Note: The FNC1 is not shown in Human Readable Interpretation.

5.3.8.3.3 Pre-Defined and Variable Length Element Strings

When concatenating a mixture of pre-defined and other Element Strings, place the pre-defined Element Strings before the variable length Element Strings. The Separator Character is not used to terminate pre-defined Element Strings, and hence, fewer symbol characters are required in the concatenated bar code.

5.3.8.4 The Separator Character (FNC1)

The Separator Character appears in the decoded data string as <GS> (ASCII character 29, 7-bit character set ISO 646). All Element Strings not of pre-defined length must be followed by a Function Code 1 (FNC1) separator when followed by another Element String in a single bar code symbol. An FNC1 is not required at the end of the last Element String represented in a GS1-128 Bar Code Symbol. The processing routine shown on the next page allows for a FNC1 entered by error after an Element String contained in [Figure 5.3.8.3.2 – 1](#).

Refer to [Section 5.3.7](#) for additional information on encoding/decoding FNC1.

5.3.8.5 Mixing GS1-128 Symbology with Other Symbologies

Global Trade Item Numbers™ (GTINs™) may be carried in any of the GS1 System endorsed symbologies. When additional data is required beyond the GTIN, GS1-128 Bar Code Symbols are used. The GS1-128 Symbology specification does not eliminate other GS1 Symbologies. In these cases, the GTIN is printed using an ITF-14 Symbol or other GS1 System symbologies and additional data using a GS1-128 Bar Code Symbol.

5.3.8.6 Symbol Placement

The preferred placement for a supplementary GS1-128 Symbol is on the same horizontal plane as the bar code symbol containing the Global Trade Item Number™ (GTIN™), SSCC, or other stand-alone GS1 System identification number. The supplementary symbol(s) should be as close as possible to the main symbol and must not interfere with the Quiet Zones.

- Orient the supplementary symbols in the same direction as the main symbol. Main symbol placement guidelines are given in [Section 6.0](#).
- Concatenated symbols must follow the symbol placement guidelines given in [Section 6.0](#), based upon the GS1 System ID number they encode (GTIN, SSCC).

5.3.8.7 Processing GS1-128 Bar Code Symbols - Basic Required Logic

See [Figure 7.9 – 1](#) for a flow chart of the logic required to accurately parse GS1-128 Bar Code Symbols from the full data strings output from a scanner.

5.3.A.1 Appendix 1: (Normative) Additional Features of Code 128

5.3.A.1.1 Symbol Check Character

The Code 128 Symbol Check Character shall be calculated according to the following rules.

1. Retrieve the symbol character value from [Figure 5.3.3.2 – 1](#).
2. Each symbol character position is given a weight. The Start Character is weighted 1. Then, beginning on the left with the first symbol character following the Start Character, the weights are 1, 2, 3, and 4 to...n for all following symbol characters up to, but not including, the Symbol Check Character itself; n denotes the number of symbol characters representing data or special information in the symbol, exclusive of the Start and Stop Characters and Symbol Check Character.

Note: Both the Start Character and the first symbol character following the Start Character (the Function Code 1 (FNC1) for all GS1-128 Bar Code Symbols) are weighted by one.

3. Each symbol character value is multiplied by its weight.
4. The products of the calculations in step 3 are totalled.
5. The sum of the products is divided by 103.
6. The remainder derived from the calculation in step 5 is the symbol character value of the Symbol Check Character.

Figure 5.3.A.1 –1 shows how to calculate the Symbol Check Character value for the batch number 2503X using the GS1-128 Bar Code Symbol.

Figure 5.3.A.1 – 1

	Start C	FNC1	10 ^Y	25	03	Code B	X	[Symbol Check Character]	Stop
Characters									
Character values (Step 1)	105	102	10	25	3	100	56		
Weights (Step 2)	1	1	2	3	4	5	6		
Products (Step 3)	105	102	20	75	12	500	336		
Sum of products (Step		115							

^Y Application Identifier (10) is defined as batch or lot number.

4)	0
Divide by 103 (Step 5)	$1150 / 103 = 11$
Remainder = Symbol	17
Check Character value	

The Symbol Check Character shall be positioned immediately following the final data or special character and before the Stop Character.

Note: The Symbol Check Character shall not be shown in the Human Readable Interpretation.

5.3.A.2 Appendix 2: (Informative) Relationship of Symbol Character Value to ASCII Value

In order to convert symbol character value (S) to ASCII decimal value or vice versa, the following relationships are applicable for code set A and code set B.

- Code set A

If $S \leq 63$,

ASCII value = $S + 32$

If $64 \leq S \leq 95$,

ASCII value = $S - 64$

- Code set B

If $S \leq 95$,

ASCII value = $S + 32$

The resulting values are shown in [Figure 5.3.3.2 – 1](#).

Note: As described in [Section 5.3.3](#), the Function 4 Character (FNC4) is not used in the GS1 System. However, the presence of FNC4 in Code 128 Symbols has the effect of adding 128 to the ASCII value of the following data character or characters derived from the rules given above.

5.3.A.3 Appendix 3: (Informative) Use of Start, Code Set, and Shift Characters to Minimise Symbol Length

The same data may be represented by different GS1-128 Bar Code Symbols through the use of different combinations of Start, code set, and shift characters.

The following rules should normally be implemented in printer control software to minimise the number of symbol characters needed to represent a given data string (and, therefore, reduce the overall symbol length).

1. Determine the Start Character:

- a. If the data consists of two digits, use Start Character C.
- b. If the data begins with four or more numeric data characters, use Start Character C.
- c. If an ASCII symbology element (e.g., NUL) occurs in the data before any lowercase character, use Start Character A.
- d. Otherwise, use Start Character B

2. If Start Character C is used and the data begins with an odd number of numeric data characters, insert a code set A or code set B character before the last digit, following rules 1c and 1d above to determine between code sets A and B.

3. If four or more numeric data characters occur together when in code sets A or B and:

- a. If there is an even number of numeric data characters, then insert a code set C character before the first numeric digit to change to code set C.
- b. If there is an odd number of numeric data characters, then insert a code set C character immediately after the first numeric digit to change to code set C.

4. When in code set B and an ASCII symbology element occurs in the data:

- a. If following that character, a lowercase character occurs in the data before the occurrence of another symbology element, then insert a shift character before the symbology element.
- b. Otherwise, insert a code set A character before the symbology element to change to code set A

5. When in code set A and a lowercase character occurs in the data:

- a. If following that character, a symbology element occurs in the data before the occurrence of another lowercase character, then insert a shift character before the lowercase character.
 - b. Otherwise, insert a code set B character before the lowercase character to change to code set B
6. When in code set C and a non-numeric character occurs in the data, insert a code set A or code set B character before that character, and follow rules 1c and 1d to determine between code sets A and B.

Note 1: In these rules, the term “lowercase” is used for convenience to mean any code set B character with Code 128 Symbol character values 64 to 95 (ASCII values 96 to 127) (e.g., all lowercase alphanumeric characters plus `{ } ~ DEL). The term “symbology element” means any code set A character with Code 128 Symbol character values 64 to 95 (ASCII values 00 to 31).

Note 2: If the Function Code 1 (FNC1) occurs in the first position following the Start Character, or in an odd-numbered position in a numeric field, it should be treated as two digits for the purpose of determining the appropriate code set.

5.3.A.4 Appendix 4: (Informative) Guidelines for the Use of Code 128**5.3.A.4.1 Autodiscrimination Compatibility**

Code 128 Symbols may be read by suitably programmed bar code readers that have been designed to autodiscriminate these symbols from other symbologies. Code 128 Symbology is fully distinguishable from, and thus compatible with, the following linear symbologies:

- ITF (Interleaved 2-of-5)
- Codabar
- Code 39
- Code 93
- EAN/UPC
- Telepen
- Reduced Space

Section 5.4:

Bar Code Production and Quality Assessment

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5.4.1 Introduction

This section of the *GS1 General Specifications* has been evolving to meet the changes to data carriers and their use within the GS1 System. Some of those changes are, for example, dimension requirement, the introduction of new symbols (e.g., Reduced Space Symbology® and Composite Component®), and the shift from the use of analogue Film Masters to digital bar code files.

In this atmosphere of change, due consideration must be given to how this change affects bar code symbol production and the maintenance of quality in the production process.

5.4.2 GS1 System Symbol Specification Tables

Over the years, operational requirements of GS1 System users have influenced the dimensional specifications of GS1 System symbols, and these dimensional specifications have in turn influenced the development of scanning system optics and printing processes. The GS1 System Symbol Specification Tables (SSTs) relate to the application areas defined in [Section 2](#). Each Symbol Specification Table provides the following bar code symbol specification detail:

- The bar code symbol(s) specified by the GS1 System for each application area
- The minimum, target, and maximum X-dimension (narrow element width) for the symbol, based on the scanning environment
- The minimum and target bar code symbol height, based on the scanning environment
- The Quiet Zone width and, for primary/secondary symbols, the minimum and maximum separation between the two symbols

Note: These measurements are expressed as multiples of the X-dimension in the form nX .

- The minimum ISO quality specification

Note: Expressed as $g.g/aa/www$, where $g.g$ is the minimum overall symbol grade to one decimal place (on a 4.0 scale), aa is the effective measuring aperture in thousandths of an inch, and www is the wavelength of the light source in nanometres.

Note: Please refer to [Section 2](#) for any specific application guidelines (such as [Section 2.7, Global Application Guideline for Coding Very Small Healthcare Items](#) and [Section 2.8, Direct Part Marking Using Data Matrix](#)) that may supplement or supersede these symbol specification table for specific application areas.

Before determining the exact symbol specification required, additional factors, such as scanning environment, should be considered. These are summarised in [Section 5.4.2.1](#).

5.4.2.1 Role of the Symbol's Dimensional Specifications

The three major dimensional specifications are the symbol's nominal (target) X-dimension, the symbol's allowable X-dimension range, and the symbol's minimum bar height. These dimensional characteristics are always specified based on the operating environment. The X-dimension target and range determine the scanner's operating range (field of view). The bar code symbol's height along with its X-dimension target and range help determine the ergonomic aspects of product handling when using a scanner. These dimensional specifications are critical components of the efficient use of all scanners.

5.4.2.2 Omnidirectional Scanning and the Term Magnification (X-Dimension)

The EAN/UPC Symbology was originally designed for omnidirectional scanners. Based on this type of scanner, the specifications include a fixed relationship between the symbol's nominal (target) width and height. The term "symbol magnification" has been used extensively to refer to this fixed relationship. For example, EAN-13 Symbols have a fixed relationship between the symbol target width and height (100 percent magnification) based on the symbol height (including text) of 25.93 mm (1.02 in.) and a target X-dimension of 0.33 mm (.013 in.). The term magnification has been used to refer to a range of magnification percentages below and/or above a target value that are specified based on the omnidirectional scanning environment. The Symbol Specification Tables (SSTs) do not use magnification values and instead list the target, minimum, and maximum values for the symbol's X-dimension and height.

5.4.2.3 Laser Versus Image Based Scanning

Most scanners based on laser technology can scan all linear symbologies in the GS1 System. New laser and linear array scanners are even capable of scanning Reduced Space Symbology® (RSS) and Composite Component® Symbols. 2D Imaging technology, such as array scanners and vision systems, are capable of scanning all symbols in the GS1 System, including Data Matrix. Note that linear imagers, like laser scanners, cannot scan Data Matrix; only 2D or array imaging scanners can scan Data Matrix, as well as camera based or vision systems. For this reason, Data Matrix applications shall be limited to niche markets and direct part marking where the business case is justified for using this technology exclusively to read Data Matrix Symbols. Read the section on Operative Scanning Environments for GS1 System symbols.

5.4.2.4 Printing Considerations

The functional and operative bands provide printers and labellers with the flexibility needed to produce quality symbols over a wide range of processes. Once a scanning operational environment is determined and the allowable specification range is known, the printer should be consulted for guidance on:

- The minimum recommended symbol size based on printing press or print characterisation tests
- Colour/substrate considerations (e.g., separate print station for symbol or double ink layer)
- The optimum orientation of the symbol on the printed web (the direction of movement of the media in relation to a printing plate on a printing press)
- Direct part marking, such as is done by dot peening on items, requires special considerations for material properties.
- Laser or chemically etched parts with low contrast or light marked elements on a dark background (e.g., circuit boards and electronic components, medical instruments, and surgical implants)
- High-speed ink jet printed parts and components where the marked dots cannot form a scannable linear symbol
- Very small items that require a symbology with a square aspect ratio and/or cannot be marked within the allocated packaging space by existing Reduced Space Symbology® (RSS) and Composite symbols.

5.4.2.5 Packaging Considerations

Once a scanning operational environment is determined and the allowable symbol characteristics is known, the package designer should be consulted to:

- Ensure the symbol will not be obstructed by other graphics or package design parameters (e.g., folds, creases, corner wraps, flaps, laminates, embossed logos/patterns, text)
- Ensure that only the symbol intended for scanning will be scanned (e.g., obscure all symbols on the individual units within larger trade items so that the individual units' symbols do not scan instead of the larger unit's symbol)

Section 6 contains complete information on symbol placement criteria to meet quality and ergonomic needs.

5.4.2.6 GS1 System Application Area Considerations

The application where the bar code symbol will be used should be determined prior to locating the correct Symbol Specification Table (SST) entry. Figure 5.4.2.6 – 1 provides a cross-reference for all system applications defined in [Section 2](#). Use the “See Symbol Specification Table(s) #” column to find the SST appropriate for the application area. Because most application areas provide a reference to two Symbol Specification Tables based on the operative scanning environment, a decision must be made between the two. See the decision tree in [Figure 5.4.2.7.1 – 2](#) to determine the correct Symbol Specification Table.

Figure 5.4.2.6 – 1: Areas of GS1 System Application

Application Areas	See Section	See SST(s) #	Read Before Reviewing Symbol Specification Table
Fixed Measure Trade Items – Packages/Containers Scanned at POS	2.1.2.1.2	1 or 3	EAN-13, UPC-A, EAN-8, and UPC-E Symbols only
Fixed Measure Trade Items – Books and Serials	2.1.2.1.5	1 or 3	EAN-13, UPC-A, EAN-8, and UPC-E Symbols only
Fixed Measure Trade Items – Packages/Containers NOT Scanned at POS	2.1.2.1	2 or 4	
Fixed Measure Trade Items – Trade Item Packed in Several Physical Units NOT Scanned at POS	2.1.2.1	2 or 4	GS1-128 Symbols only
Fixed Measure Trade Items – Restricted Distribution	2.1.2.3	1 or 3	
Variable Measure Trade Items – Restricted Circulation	2.1.2.4	1	EAN-13 and UPC-A Symbols only
Variable Measure Trade Items – Packages/Containers NOT Scanned at POS	2.1.2.2	2 or 4	GS1-128 Symbols only
POS Trade Item Attributes – Using Secondary EAN/UPC-2 or EAN/UPC-5 Add-On Symbols	2.1.3.4.1 and 2.1.3.4.2	1	Use the X-dimension specified for the primary EAN/UPC Symbol
Trade Item Attributes – Using Secondary GS1-128 Symbols	2.1.3.1 , 2.1.3.2 , 2.1.3.3 , 2.1.3.4.3 , and 2.1.3.4.4	2 or 4	Use the X-dimension specified for the primary symbol
Logistics – Mandatory SSCC	2.2.2	5	GS1-128 Symbols only
Logistics – Logistic Unit Element Strings	2.2.2.1	5	GS1-128 Symbols only
Assets – Global Returnable Asset Identifier	2.3.3.1.1	2, 4, or	GS1-128
Assets – Global Individual Asset Identifier	2.3.3.1.2	2, 4, or	GS1-128
Locations or Postal Codes	2.4	2 or 4	GS1-128 Symbols only

Application Areas	See Section	See SST(s) #	Read Before Reviewing Symbol Specification Table
Global Service Relation Numbers	<u>2.5</u>	4	GS1-128 Symbols only
Coupons – Restricted Geographic Distribution Outside USA or Common Currency Area identification	<u>2.6.1.3.1</u> and <u>2.6.1.3.2</u>	1	EAN-13 Symbols only
Coupons – Restricted Geographic Distribution Inside USA - UPC-A plus GS1-128 Symbols	<u>2.6.1.3.3</u>	4	<i>See Guidelines for Supply Chain Identification</i>
Refund Receipts – Restricted Geographic Distribution	<u>2.6.2</u>	1	EAN-13 Symbols only
Electronic Serial Identifier for Cellular Mobile Telephones	<u>2.6.3</u>	4	GS1-128 Symbols only
Company Internal Application Using EAN/UPC Symbols	<u>2.6.4.4</u>	1	EAN-13, UPC-A, and UPC-E Symbols only
Internal Application Using GS1-128 Symbols	<u>2.6.4.5</u>	2 or 4	GS1-128 Symbols only
Payment Slips	<u>2.6.5</u>	4	GS1-128 Symbols only
Customer Specific Articles	<u>2.6.6</u>	4	
Very Small Healthcare Items	<u>2.7</u>	6 or 7	RSS and Composite Component or Data Matrix Symbols only*
Direct Part Marking	<u>2.8</u>	7	Data Matrix

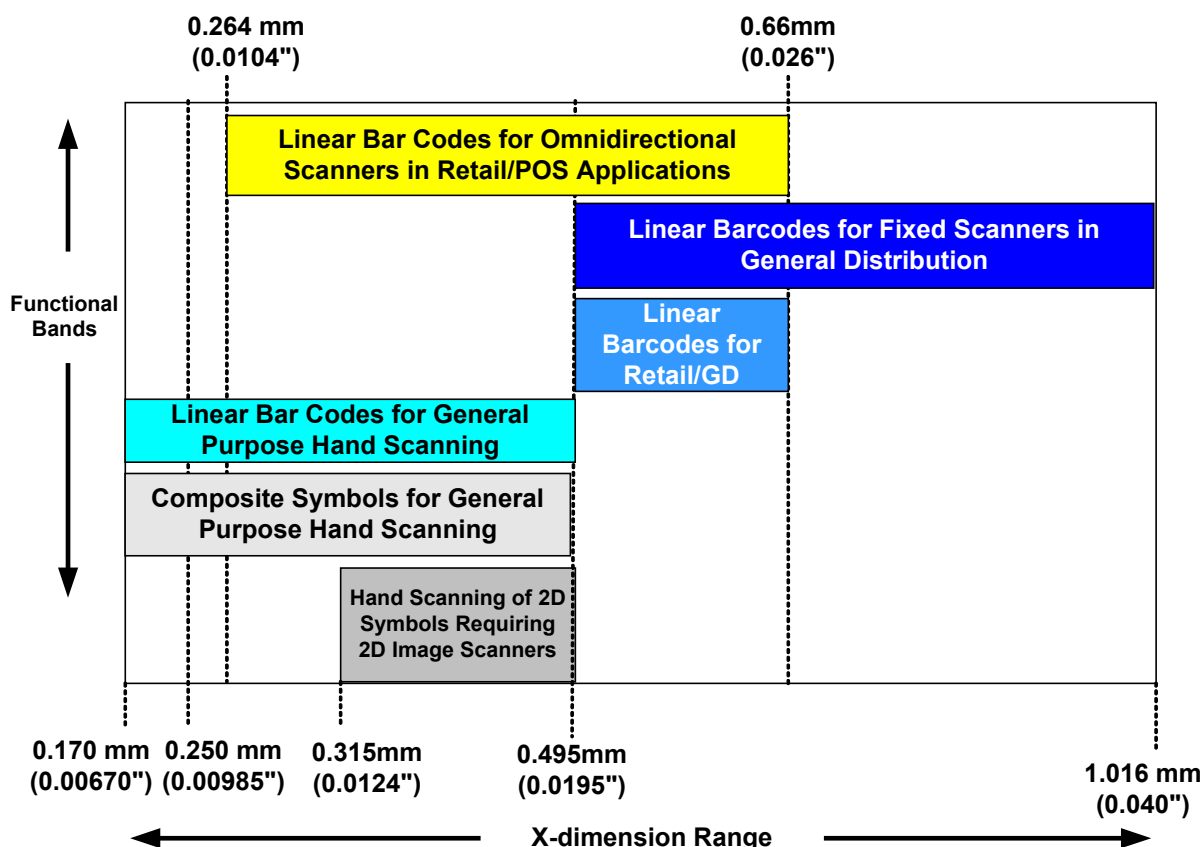
* See Section 2.7. Data Matrix has limited use in healthcare until application standards are fully developed.

5.4.2.7 Operative Scanning Environments for GS1 System Symbols

5.4.2.7.1 GS1 System Scanner Functional Operative Bands

GS1 System symbol specifications are based on six scanner functional bands because scanner technology cannot universally support the entire operating range using a single scanner and different application requirements. The six scanner functional bands that have evolved to meet user needs are illustrated in Figure 5.4.2.7.1 – 1.

Figure 5.4.2.7.1 – 1: GS1 Scanner Functional Operative Bands



Note: Figure not to scale and target size for each functional band can be found in the Symbol Specification Tables (see [Section 5.4.2.8](#))

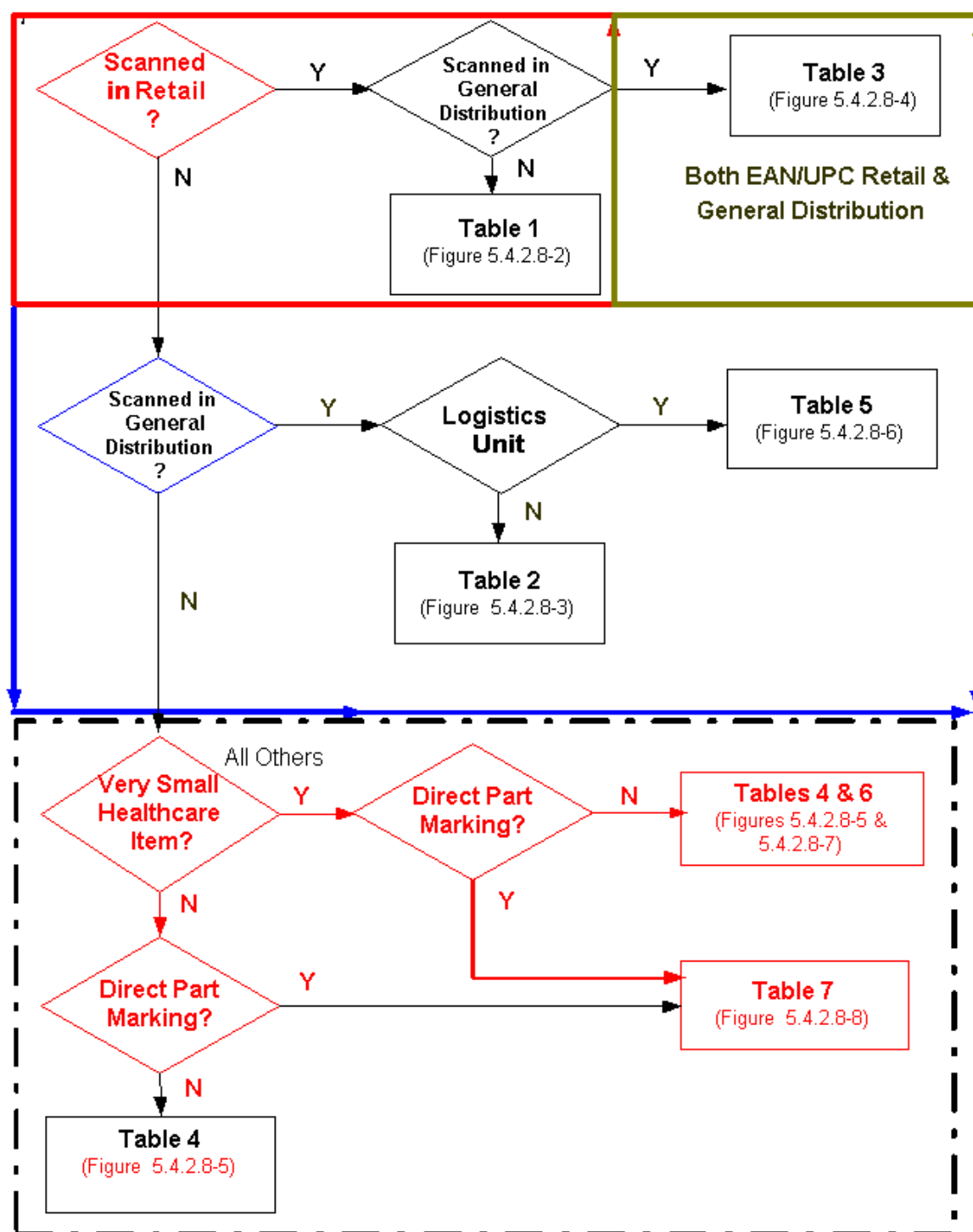
In the future, there will be more integration of the operative bands and an extension of the bands to support small symbols.

The Scanner Functional Bands

- The *Omnidirectional Scanners for Retail POS* band is primarily intended for retail operations to provide orientation-free scanning. Scanners are designed to read EAN/UPC over-square symbols. The approximate average distance between scanner and symbol is 100 mm (4 in.).
- The *Fixed Scanners in General Distribution* band is primarily intended to facilitate automated scanning of trade items packaged for transport and logistic units using fixed mount scanners. In this environment it is essential to maintain symbol height and location to achieve acceptable scan rates.
- Linear bar codes for both *Retail* and *General Distribution* band covers trade items in specific packaging suitable for transport purposes in General Distribution Scanning, but that are also scanned at the retail Point-of-Sale. See the overlap area between EAN/UPC Retail and General Distribution (Retail/GD) in Figure 5.4.2.7.1 – 1.

- The *General Purpose* scanner bands cover a broad range of applications. Symbol size must be within the maximum and minimum boundaries for the symbology, but the target size is directly related to the exact usage as specified by the application guidelines. It has been divided into three bands: One for linear general purpose hand scanning and two bands for two-dimensional bar codes: Composite Component® and Data Matrix. In general, the rule is that Composite Components shall be printed at the same X-dimension as their linear host. Data Matrix Symbols shall be printed at X-dimensions that are 50 percent greater than corresponding linear symbols with Composite Components. Therefore, the bands for linear symbols and Composite Components are very similar in X-dimension and if the same scanner types are chosen, as in the case of Composite Symbols, the bands become one.

Figure 5.4.2.7.1 – 2: GS1 Symbology Operational Environment Decision Tree



5.4.2.8 GS1 System Symbol Specification Tables

In order to find the correct bar code specification, you must:

- Find the appropriate GS1 System application area using [Figure 5.4.2.6 – 1](#).
- If the application area references two Symbol Specification Tables, use the decision tree in [Figure 5.4.2.7.1 – 2](#) to determine which one to use.

Figure 5.4.2.8 – 1 provides a quick reference list of the symbol quality parameters depending on their type and their application.

Figure 5.4.2.8 – 1 Quick Reference on Symbol Quality

Symbology	Application or ID Code	ISO (ANSI) Symbol Grade	Aperture	Wavelength
EAN/UPC	EAN/UCC-8	1.5 (C)	6 mils	670 nm +/-10
EAN/UPC	UCC-12	1.5 (C)	6 mils	670 nm +/-10
EAN/UPC	EAN/UCC-13	1.5 (C)	6 mils	670 nm +/-10
GS1-128	Extended Coupon Code	1.5 (C)	6 mils	670 nm +/-10
GS1-128	EAN/UCC-14	1.5 (C)	10 mils	670 nm +/-10
GS1-128	SSCC	1.5 (C)	10 mils	670 nm +/-10
GS1-128	Small Shipping Packages	1.5 (C)	10 mils	670 nm +/-10
ITF-14 (<0.635 mm (0.025 in.) X)	EAN/UCC-14	1.5 (C)	10 mils	670 nm +/-10
ITF-14 (≥0.635 mm (0.025 in.) X)	EAN/UCC-14	0.5 (D)	20 mils	670 nm +/-10
RSS and Composite	EAN/UCC-14, Other Als	1.5 (C)	6 mils	670 nm +/-10
Data Matrix	Direct Part Marking, Very Small Healthcare Items	1.5 (C)	See Guidelines (Sections 2.7 and 2.8)	670 nm +/-10

Note: An EAN/UPC based symbol should always be verified using a 6 mil (0.006 in.) aperture, a 670 nm +/-10 nm wavelength of light, and requires a minimum symbol grade of 1.5 (overall symbol grade on a 4.0 scale) equivalent to a “C” under the ANSI X3.182 standard. In the Symbol Specification Tables that follow, as well as on a typical bar code purchase order, this is expressed as 1.5/06/670.

Figure 5.4.2.8 – 2: GS1 System Symbol Specification Table 1

* Primary Symbol(s) Specified	X-Dimension mm (inches)			*** Minimum Symbol Height for Given X mm (inches)			Quiet Zone		Minimum Quality Specification	
	**Minimum	Target	Maximum	For Minimum dimension	X- For Target dimension	For Maximum X-dimension	Left	Right		
EAN-13	0.264 (0.0104")	0.33 (0.013")	0.66 (0.026")	20.73 (0.82")	25.91 (1.02")	51.82 (2.04")	11X	7X	1.5/06/670	
EAN-8	0.264 (0.0104")	0.33 (0.013")	0.66 (0.026")	17.03 (0.67")	21.29 (0.84")	42.58 (1.68")	7X	7X	1.5/06/670	
UPC-A	0.264 (0.0104")	0.33 (0.013")	0.66 (0.026")	20.73 (0.82")	25.91 (1.02")	51.82 (2.04")	9X	9X	1.5/06/670	
UPC-E	0.264 (0.0104")	0.33 (0.013")	0.66 (0.026")	20.73 (0.82")	25.91 (1.02")	51.82 (2.04")	9X	7X	1.5/06/670	
* Primary Symbol(s) Specified Plus Add-on 2 or 5	X-Dimension mm (inches)			** Minimum Symbol Height for Given X mm (inches)			Quiet Zone	Minimum Separation Between Symbols	Maximum Separation Between Symbols	Minimum Quality Specification
	**Minimum	Target	Maximum	For Minimum X-dimension	For Target X-dimension	For Maximum X-dimension	Left			
EAN-13 + 2	0.264 (0.0104")	0.33 (0.013")	0.66 (0.026")	20.73 (0.82")	25.91 (1.02")	51.82 (2.04")	11X	7X	12X	1.5/06/670
EAN-13 + 5	0.264 (0.0104")	0.33 (0.013")	0.66 (0.026")	20.73 (0.82")	25.91 (1.02")	51.82 (2.04")	11X	7X	12X	1.5/06/670
UPC-A + 2	0.264 (0.0104")	0.33 (0.013")	0.66 (0.026")	20.73 (0.82")	25.91 (1.02")	51.82 (2.04")	9X	9X	12X	1.5/06/670
UPC-A + 5	0.264 (0.0104")	0.33 (0.013")	0.66 (0.026")	20.73 (0.82")	25.91 (1.02")	51.82 (2.04")	9X	9X	12X	1.5/06/670
UPC-E + 2	0.264 (0.0104")	0.33 (0.013")	0.66 (0.026")	20.73 (0.82")	25.91 (1.02")	51.82 (2.04")	9X	7X	12X	1.5/06/670
UPC-E + 5	0.264 (0.0104")	0.33 (0.013")	0.66 (0.026")	20.73 (0.82")	25.91 (1.02")	51.82 (2.04")	9X	7X	12X	1.5/06/670

See [Section 5.4.2.7](#) to ensure the correct Symbol Specification Table is used.

*Special considerations exist for North American retail Point-of-Sale (POS) until a migration to international standards is completed. Until January 1, 2005, only UPC-A or UPC-E Symbols are acceptable in North America. After that date, EAN-8 and EAN-13 Symbols will also be accepted using the size specifications in Figure 5.4.2.8 – 2.

** [Appendix 5.4.A.1](#) gives full details on when bar code symbols can be printed at less than the minimum X-dimension. In general, bar code symbols may only be printed using an X-dimension below 0.264 mm (0.0104 in.) or 80 percent magnification under the following conditions:

- The allowance for X-dimensions between 0.2475 mm (0.00975 in.) or 75 percent magnification and 0.264 (0.014 in.) or 80 percent magnification is only applicable to on demand (e.g., thermal, laser) print processes. For all other printing processes, an X-dimension of 0.264 mm (0.0104 in.) is attainable and is the minimum allowable size.
- When printing a minimum symbol with any method of printing, the area provided for printing the symbol and the required Quiet Zone should never be less than the area required for an X-dimension of 0.264 mm (0.0104 in.).

- When printing a minimum symbol with any method of printing, the symbol height should never be truncated below the minimum 20.73 mm (0.82 in.).

***The minimum symbol height dimensions listed for EAN/UPC Symbols include the Human Readable Interpretation. Because of the operative scanning environment for EAN/UPC Symbols, there is a direct relationship between the symbol's height and width. This means the minimum symbol height listed is tied to the minimum, target, and maximum X-dimension listed. There is no maximum for the height, but if the maximum X-dimension is used, the symbol height must be equal to or greater than those listed in the Minimum Symbol Height column.

Figure 5.4.2.8 – 3: GS1 System Symbol Specification Table 2

Symbol(s) Specified	*X-Dimension mm (inches)			** Minimum Symbol Height for Given X mm (inches)			Quiet Zone		***Minimum Quality Specification
	Minimum	Target	Maximum	For Minimum X: dimension	For Target dimension	X For Maximum X-dimension	Left	Right	
EAN-13	0.495 (0.0195")	0.66 (0.026")	0.66 (0.026")	38.87 (1.53")	51.82 (2.04")	51.82 (2.04")	11X	7X	1.5/06/670
EAN-8	0.495 (0.0195")	0.66 (0.026")	0.66 (0.026")	31.94 (1.26")	42.58 (1.68")	42.58 (1.68")	7X	7X	1.5/06/670
UPC-A	0.495 (0.0195")	0.66 (0.026")	0.66 (0.026")	38.87 (1.53")	51.82 (2.04")	51.82 (2.04")	9X	9X	1.5/06/670
UPC-E	0.495 (0.0195")	0.66 (0.026")	0.66 (0.026")	38.87 (1.53")	51.82 (2.04")	51.82 (2.04")	9X	7X	1.5/06/670
ITF-14	0.495 (0.0195")	0.495 (0.0195")	1.016 (0.040")	32.00 (1.25")	32.00 (1.25")	32.00 (1.25")	10X	10X	1.5/10/670
GS1-128	0.495 (0.0195")	0.495 (0.0195")	1.016 (0.040")	32.00 (1.25")	32.00 (1.25")	32.00 (1.25")	10X	10X	1.5/10/670

See [Section 5.4.2.7](#) to ensure the correct Symbol Specification Table is used.

*UPC-E and EAN-8 Symbols are designed for use on small packages. Whenever space permits, UPC-A, EAN-13, ITF-14, or GS1-128 Symbols should be used in the General Distribution Scanning environment.

The minimum symbol height dimensions listed for EAN/UPC Symbols include the Human Readable Interpretation. Because of the operative scanning environment for EAN/UPC Symbols, there is a direct relationship between the symbol's height and width. This means the minimum symbol height is tied to the minimum, target, and maximum X-dimension listed.

ITF-14 Symbols with X-dimensions below 0.635 mm (0.025 in.) should not be printed directly on corrugate with conventional (plate-based) processes. Packages and/or containers marked with ITF-14 Symbols with X-dimensions between 1.016 mm (0.040 in.) and 1.219 mm (0.048 in.) are acceptable based on historical specifications, but a migration to the 1.016 mm (0.040 in.) maximum X-dimension should be made on new artwork. The ITF-14 Symbol's bar width ratio target is 2.5:1, and the acceptable range is 2.25:1 to 3:1.

GS1-128 Symbols have a maximum symbol length of 165 mm (6.5 in.) which may impact the maximum achievable X-dimension. For example a GS1-128 Symbol containing an SSCC has a maximum achievable X-dimension for 0.94 mm (0.037 in.)

**The minimum symbol height for General Distribution Scanning is always 32 mm (1.25 in.). The minimum symbol height dimensions for ITF-14 and GS1-128 Symbols relate to the bar heights only (do not include Human Readable Interpretation text or ITF-14 Symbol Bearer Bars). There is no maximum for the height, but if the maximum X-dimension is used, the symbol height must be equal to or greater than those listed in the Minimum Symbol Height column.

***For ITF-14 Symbols printed on labels with off-set, thermal, or laser print with an X-dimension 0.495 mm (0.0195 in), the minimum quality specification is 1.5/10/670. For ITF-14 Symbols printed directly on corrugate or labels with an X-dimension greater than or equal to 0.635 mm (0.025 in.), the minimum quality specification is 0.5/20/670.

Figure 5.4.2.8 – 4: GS1 System Symbol Specification Table 3

Symbol(s) Specified	*X-Dimension mm (inches)			** Minimum Symbol Height for Given X mm (inches)			Quiet Zone		Minimum Quality Specification
	Minimum	Target	Maximum	For Minimum X- dimension	For Target dimension	X- For Maximum X-dimension	Left	Right	
EAN-13	0.495 (0.0195")	0.66 (0.026")	0.66 (0.026")	38.87 (1.53")	51.82 (2.04")	51.82 (2.04")	11X	7X	1.5/06/670
EAN-8	0.495 (0.0195")	0.66 (0.026")	0.66 (0.026")	31.94 (1.26")	42.58 (1.68")	42.58 (1.68")	7X	7X	1.5/06/670
UPC-A	0.495 (0.0195")	0.66 (0.026")	0.66 (0.026")	38.87 (1.53")	51.82 (2.04")	51.82 (2.04")	9X	9X	1.5/06/670
UPC-E	0.495 (0.0195")	0.66 (0.026")	0.66 (0.026")	38.87 (1.53")	51.82 (2.04")	51.82 (2.04")	9X	7X	1.5/06/670

See [Section 5.4.2.7](#) to ensure the correct Symbol Specification Table is used.

*Special considerations exist for North American retail POS until a migration to international standards is completed. Until January 1, 2005, only UPC-A or UPC-E Symbols are acceptable in North America. After that date, EAN-8 and EAN-13 Symbols will also be accepted using the size specifications in Figure 5.4.2.8 – 4.

UPC-E and EAN-8 Symbols are designed for use on small packages. Whenever space permits, UPC-A and EAN-13 Symbols should be used.

**The minimum symbol height dimensions listed for EAN/UPC Symbols include the Human Readable Interpretation. Because of the operative scanning environment for EAN/UPC Symbols, there is a direct relationship between the symbol's height and width. This means the minimum symbol height listed is tied to the minimum, target, and maximum X-dimension listed.

There is no maximum for the height, but if the maximum X-dimension is used, the symbol height must be equal to or greater than those listed in the Minimum Symbol Height column.

Figure 5.4.2.8 – 5: GS1 System Symbol Specification Table 4

Symbol(s) Specified	*X-Dimension mm (inches)			** Minimum Symbol Height for Given X mm (inches)			Quiet Zone		Minimum Quality Specification
	Minimum	Target	Maximum	For Minimum X- dimension	For Target X-dimension	For Maximum X-dimension	Left	Right	
EAN-13	0.264 (0.0104")	0.33 (0.013")	0.66 (0.026")	20.73 (0.82")	25.91 (1.02")	51.82 (2.04")	11X	7X	1.5/06/670
EAN-8	0.264 (0.0104")	0.33 (0.013")	0.66 (0.026")	17.03 (0.67")	21.29 (0.84")	42.58 (1.68")	7X	7X	1.5/06/670
UPC-A	0.264 (0.0104")	0.33 (0.013")	0.66 (0.026")	20.73 (0.82")	25.91 (1.02")	51.82 (2.04")	9X	9X	1.5/06/670
UPC-E	0.264 (0.0104")	0.33 (0.013")	0.66 (0.026")	20.73 (0.82")	25.91 (1.02")	51.82 (2.04")	9X	7X	1.5/06/670
ITF-14	0.250 (0.00984")	0.495 (0.0195")	0.495 (0.0195")	12.70 (0.50")	12.70 (0.50")	12.70 (0.50")	10X	10X	1.5/10/670
GS1- 128	0.250 (0.00984")	0.495 (0.0195")	0.495 (0.0195")	12.70 (0.50")	12.70 (0.50")	12.70 (0.50")	10X	10X	1.5/10/670

See [Section 5.4.2.7](#) to ensure the correct Symbol Specification Table is used.

*ITF-14 Symbols with X-dimensions below 0.635 mm (0.025 in.) should not be printed directly on corrugate with conventional (plate based) processes. Packages and/or containers marked with ITF-14 Symbols with X-dimensions between 1.016 mm (0.040 in.) and 1.219 mm (0.048 in.) are acceptable based on historical specifications, but a migration to the 1.016 mm (0.040 in.) maximum X-dimension should be made on new artwork. The ITF-14 Symbol's bar width ratio target is 2.5:1, and the acceptable range is 2.25:1 to 3:1.

[Appendix 5.4.A.1](#) gives full details on when bar code symbols can be printed at less than the minimum X-dimension. In general, bar code symbols may only be printed using an X-dimension below 0.264 mm (0.0104 in.) or 80 percent magnification under the following conditions:

- The allowance for X-dimensions between 0.2475 mm (0.00975 in.) or 75 percent magnification and 0.264 (0.014 in.) or 80 percent magnification is only applicable to on demand (e.g., thermal, laser) print processes. For all other printing processes, an X-dimension of 0.264 mm (0.0104 in.) is attainable and is the minimum allowable size.
- When printing a minimum symbol with any method of printing, the area provided for printing the symbol and the required Quiet Zone should never be less than the area required for an X-dimension of 0.264 mm (0.0104 in.).
- When printing a minimum symbol with any method of printing, the symbol height should never be truncated below the minimum 20.73 mm (0.82 in.).

**The minimum symbol height dimensions listed for EAN/UPC Symbols include the Human Readable Interpretation, but the minimum symbol height dimensions for ITF-14

and GS1-128 Symbols relate to the bar heights only (do not include Human Readable Interpretation text or ITF-14 Bearer Bars).

Because of the operative scanning environment for EAN/UPC Symbols, there is a direct relationship between the symbol's height and width. This means the minimum symbol height listed is tied to the minimum, target, and maximum X-dimension listed.

The minimum bar height for ITF-14 and GS1-128 Symbols in this operative scanning environment is 12.7 mm (0.50 in.), but if the package is physically too small to accommodate this rule, further truncation is permitted. In no case shall the bar height be less than 5.08 mm (0.20 in.).

There is no maximum for the symbol height, but if the maximum X-dimension is used, the symbol height must be equal to or greater than those listed in the Minimum Symbol Height column.

Whereas, linear symbol heights are set at a fixed dimension, Composite Components[®] are printed at the same density as the linear portion of the Composite Symbology[®], and the bar code height varies depending on the amount of data, the printing density, and which linear symbol is used in conjunction with the Composite Component. Note that Composite Components have to be printed with a linear symbol such as Reduced Space Symbology[®] (RSS), GS1-128, UPC-A, or EAN-13. ITF cannot be used with Composite Components.

Figure 5.4.2.8 – 6: GS1 System Symbol Specification Table 5

Symbol(s) Specified	*X-Dimensions mm (inches)			** Minimum Symbol Height for Given X mm (inches)			Quiet Zone
	Minimum	Target	Maximum	For Minimum X- dimension	For Target dimension	X For Maximum X-dimension	Left
GS1-128	0.495 (0.0195")	0.495 (0.0195")	0.940 (0.037")	32.00 (1.25")	32.00 (1.25")	32.00 (1.25")	10X

See [Section 5.4.2.7](#) to ensure the correct Symbol Specification Table is used.

*If the item is too small to accommodate the minimum X-dimension, the minimum X-dimension is 0.250 mm (0.00984 in.).

**The minimum symbol height indicated is for bar height only and does not include the Human Readable Interpretation. If the item is too small to accommodate the minimum, the minimum bar height is the greater of 15 percent of the symbol width including Quiet Zones or 12.7 mm (0.50 in.). If the package is physically too small to accommodate this rule, further truncation is permitted, but in no case shall the bar height be less than 5.08 mm (0.20 in.).

There is no maximum for the height, but if the maximum X-dimension is used, the symbol height must be equal to or greater than those listed in the Minimum Symbol Height column.

Figure 5.4.2.8 – 7: GS1 System Symbol Specification Table 6 - 2D Symbols Using Composite Component® (CC)

Symbol(s) Specified	X-Dimensions mm (inches)			Minimum Symbol Height for Given X mm (inches)			Quiet Zone Left	Quiet Zone Right	Minimum Quality Specification
	Minimum	Target	Maximum	Minimum	Target	Maximum			
CC-A	Consult Table 4, since all CCs need to be printed at the same printing densities as their linear components			Height is determined by X-Dimension for data that is encoded			1X	1X	1.5/06/670
CC-B				Height is determined by X-Dimension for data that is encoded			1X	1X	1.5/06/670
CC-C				Height is determined by X-Dimension for data that is encoded			2X	2X	1.5/06/670

**Figure 5.4.2.8 – 8: GS1 System Symbol Specification Table 7 - 2D Symbols
Using Data Matrix**

Symbol(s) Specified Data Matrix (ECC 200)	**X-Dimensions mm (inches)			Minimum Symbol Height for Given X mm (inches)			*Quiet Zone	*Quiet Zone	Minimum Quality Specification
	Minimum	Target	Maximum	Minimum	Target	Maximum	Left	Right	
Direct Part Marking	0.380*** (0.0150)	0.380 (0.0150)	0.495 (0.0195)	Height is determined by X-Dimension for data that is encoded			1X	1X	1.5/**/670
Healthcare Printing	Refer to Section 2.7 for Data Matrix Applications for small items in healthcare								

*Quiet zones for Data Matrix are 1X on all four sides.

**Because of the physics of optics, Data Matrix needs to be printed at 1.5 times the equivalent printing density allowed for linear or Composite Symbols.

***The effective aperture for Data Matrix quality measurements should be taken at 80 percent of the printing density. For Direct Part Marking this would equate to an aperture of 12; for Healthcare printing, an aperture of 8.

****Minimum has been set close to Target value until specifications and testing can justify changing this to a lower value.

5.4.3 Bar Code Production

The following subsections will:

- Provide background on major bar code printing methods and materials
- Provide general printing and packaging background for major application groups

The various definitions and specialist terms used throughout this section can be found in *ISO/IEC 15419*, Information Technology, Automatic Identification and Data Capture Techniques, Bar Code Digital Imaging and Printing Performance Testing.

5.4.3.1 Digital Imaging

5.4.3.1.1 General Requirements

General requirements consisting of the following topics can be found in Section 4 of *ISO/IEC 15419*.

- Data input
- Quiet Zones
- Classification of imaging device categories, from informative reference Annex E of *ISO/IEC 15419*
- Programmer's examples, from informative reference Annex F of *ISO/IEC 15419*
 - Programmer's example for general-purpose printers
 - Programmer's example for indirect bar code imaging devices
 - Programmer's example for symbols distorted for plate roll circumference
- Direct bar code imaging devices
- Dedicated bar code printers
- Adjustment of target element dimensions
- Record of design elements
- General purpose printers
- Adjusted bar width compensation (BWC) (including the General Purpose Printer Dot/Pixel Comparison figure)
- Record of design attributes
- Indirect bar code imaging devices
- Adjustments for planned distortion (disproportioning)
- Adjustments for special EAN/UPC Symbol characters

- Test requirements
 - System configuration
 - Test procedure
- Conformance
- Test report, including sample test layout, from normative reference Annex A of *ISO/IEC 15419*
- Certification
- Software specification, including classification of software categories, from informative reference Annex D of *ISO/IEC 15419* and functions of bar code production software from informative reference Annex G of *ISO/IEC 15419*
- Maintenance and supplies, from informative reference Annex C of *ISO/IEC 15419*

5.4.3.1.2 Dedicated Bar Code Printers

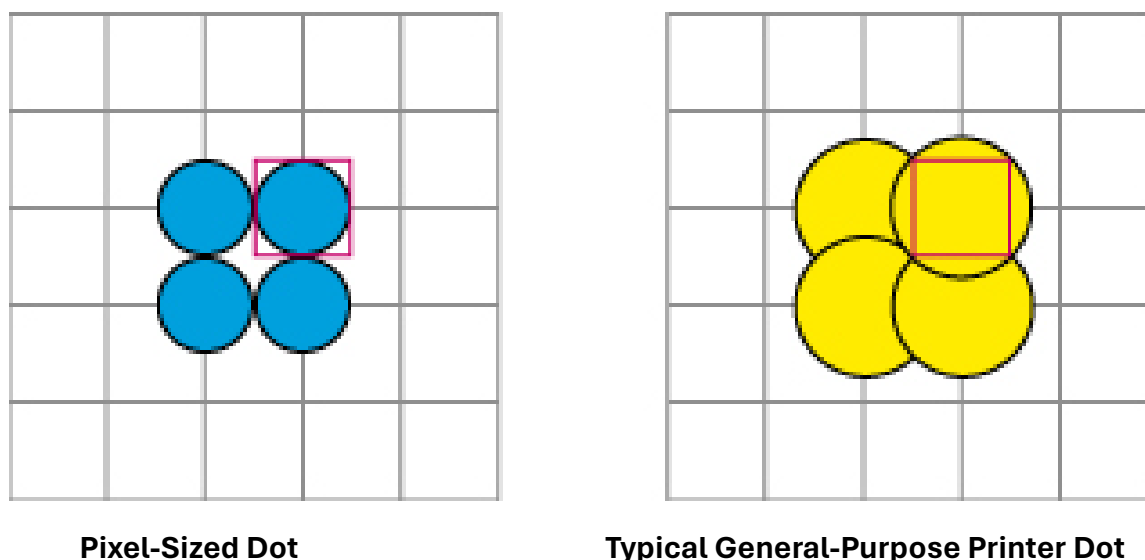
Section 5 of *ISO/IEC 15419* contains information on dedicated bar code symbol printers and includes the following topics:

- Data input requirements
- Test requirements
- Selection of equipment for testing
- Test conditions; environment, equipment configuration
- Test procedure
- Conformance
- Test report
- Certification and labelling
- Equipment specification

5.4.3.1.3 EAN/UPC On-Demand Printed Symbols at Minimum Size

It is more difficult for the user to create high quality bar code symbols with general-purpose printers than it is with direct thermal transfer label printers. There are two reasons for this difficulty. First, the printed dot size for general-purpose printers is appreciably larger than the pixel dimension, as shown in Figure 5.4.3.1.3 – 1. This causes the bars (dark bars) to be printed wider and the spaces (light bars) to be narrower than nominal, unless the software driving the printer corrects for this distortion. Second, the software that constructs the bar code may itself introduce dimensional errors.

Figure 5.4.3.1.3 – 1 Example of Digital Printing



The most common printing densities used by on-demand, bar code symbol printers are 200 and 300 dpi. However, due to the constraints of the dot pitch, these printers cannot print a minimum X-dimension of 0.264 (0.0104 in.) or 80 percent magnification symbol correctly. The closest to 80 percent that these printers can print is 75.7 percent or 76.9 percent depending on the exact dot geometry (see Figure 5.4.3.1.3 – 2).

Even though a minimum X-dimension of 0.264 (0.0104 in. or 80 percent magnification) is the minimum value specified, users of on-demand printers have used magnifications between 75 percent and 80 percent in Point-of-Sale (POS) scanning environments for years. They have done so with no significant reduction in scan rate, as compared to symbols printed precisely at 80 percent. Because larger in-specification symbols are always easier to scan, 80 percent symbols and larger are preferred. However, when an on-demand printer is required, the 75 to 80 percent symbols are an acceptable alternative given the following qualifications for printing:

- The allowance for symbols from the EAN/UPC Symbology family of magnifications from 75 to 80 percent is only applicable to on-demand (e.g.,

thermal, laser) print processes. For all other printing processes, 80 percent is attainable and is the minimum allowable size.

- When printing a minimum symbol with any method of printing, the area provided for printing the symbol, including the required Quiet Zones, should never be less than the area required for an 80 percent symbol. This area can be derived from the total width of an 80 percent symbol times its height.
- When printing a minimum symbol with any method of printing, the symbol height should never be truncated below the 80 percent value (20.7 mm or 0.816 in.).
- The minimum print quality grade is the same for all symbols in the EAN/UPC Symbology family: 1.5/06/670.

Figure 5.4.3.1.3 – 2 Achievable X-Dimensions for Thermal Printed EAN/UPC Symbols

Reference DPI	Actual DPI	Dots Per Millimetre	Actual Dot Width (Centre Point to Centre Point)		Dots Per Module Width	Module Width (X-Dimension)		*Corrected Magnification
			Inch	mm		Mils	mm	
200	203.2	8	0.0049	0.1250	2	9.84	0.250	**75.76%
200	203.2	8	0.0049	0.1250	3	14.7	0.375	113.64%
200	203.2	8	0.0049	0.1250	4	19.6	0.500	151.52%
200	203.2	8	0.0049	0.1250	5	24.6	0.625	189.39%
300	304.8	12	0.0032	0.0833	3	9.84	0.250	**75.76%
300	304.8	12	0.0032	0.0833	4	13.1	0.333	100.01%
300	304.8	12	0.0032	0.0833	5	16.4	0.416	126.26%
300	304.8	12	0.0032	0.0833	6	19.6	0.500	151.52%
300	304.8	12	0.0032	0.0833	7	22.9	0.583	176.77%
400	406.4	16	0.0024	0.0625	4	9.84	0.250	**75.76%
400	406.4	16	0.0024	0.0625	5	12.3	0.312	94.70%
400	406.4	16	0.0024	0.0625	6	14.7	0.375	113.64%
400	406.4	16	0.0024	0.0625	7	17.2	0.437	132.58%
400	406.4	16	0.0024	0.0625	8	19.6	0.500	151.52%
400	406.4	16	0.0024	0.0625	9	22.1	0.562	170.45%
400	406.4	16	0.0024	0.0625	10	24.6	0.625	189.39%
600	609.6	24	0.0016	0.0416	6	9.84	0.250	**75.76%
600	609.6	24	0.0016	0.0416	7	11.4	0.291	88.38%
600	609.6	24	0.0016	0.0416	8	13.1	0.333	101.01%
600	609.6	24	0.0016	0.0416	9	14.7	0.375	113.64%
600	609.6	24	0.0016	0.0416	10	16.4	0.416	126.26%
600	609.6	24	0.0016	0.0416	11	18.0	0.458	138.89%
600	609.6	24	0.0016	0.0416	12	19.6	0.500	151.52%
600	609.6	24	0.0016	0.0416	13	21.3	0.541	164.14%
600	609.6	24	0.0016	0.0416	14	22.9	0.583	176.77%
600	609.6	24	0.0016	0.0416	15	24.6	0.625	189.39%

*Note: The nominal EAN/UPC Symbol can be based on a module width (X-dimension) of either 0.013 inch or 0.33 mm. In North America, long-standing GS1 US specifications set the nominal module size (X-dimension) at 0.013 inch or 13 mils. The ISO/IEC specification for EAN/UPC Symbols set the nominal module size (X-dimension) at 0.33 mm. The international metric nominal is 0.0606 percent smaller than the original inch-

based nominal. The data in the right-most column labelled “Corrected Magnification” are based on a nominal module width (X-dimension) of 0.33 mm.

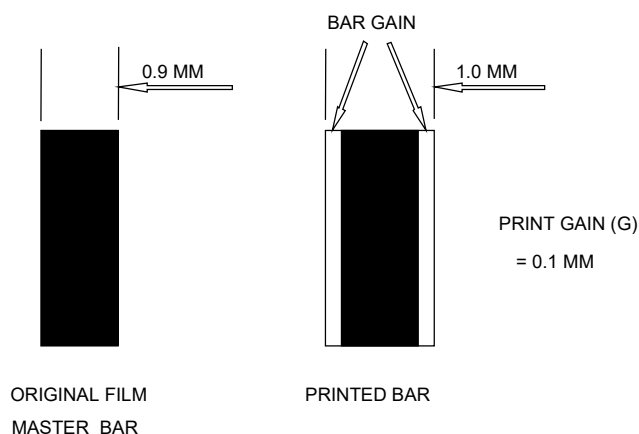
5.4.3.2 Film Master Production

5.4.3.2.1 Introduction

For symbols in the EAN/UPC Symbology family, the biggest usage of verification has always been in conjunction with printing and production of packaging and labels by means of the conventional or "wet ink" printing processes, such as offset lithography, flexography, and photogravure. These printing processes use a Film Master as the initial artwork of the symbol, although some form of electronic origination of the symbol is increasingly replacing this high-precision article.

The first point at which one might use verification is the printability test stage prior to actual production of "real-life" symbols, where a printing run of a test symbol is carried out under normal conditions and measured in order to characterise the printing process for a particular press and printing substrate. It is necessary to assess how much bar gain (or loss) has occurred and over what range of variation, to decide how much Bar Width Adjustment (BWA) is required. BWA can be in the form of Bar Width Reduction (BWR), where there is print gain, or the less common Bar Width Increase (BWI). The required BWA is associated with the X-dimension used. These details are required in order to specify the Film Master correctly, or as input parameters for the bar code symbol origination software.

Figure 5.4.3.2.1 – 1 Example of Bar Width Adjustment



Verifying the Film Master on receipt confirms that the correct BWA has been applied and that it is otherwise as specified. Note that a special type of verifier using traditional measurement and capable of more precise measurement is necessary at this point, since Film Master requirements are specified in terms of element widths and are

subject to tolerances of only plus or minus five microns for EAN/UPC Symbols. In addition, the verifier needs to be capable of measuring the intensity of light transmitted through, rather than that reflected by, the film material. Also, Film Masters may be either photographic positives or negatives, and in the latter case, the light and dark characteristics of the background and bars are reversed. In the absence of such a verifier, reliance may be placed on the verification report normally provided by the Film Master supplier with the master.

If a proof of the print job is produced, the bar code symbol should be verified as part of the approval process. Note, however, that since proofing presses are not the same as production printing presses, there may be a slight difference in the quality of the proof and the production job.

While the presses are being made ready, a check of bar widths on the first few printed sheets can help to ensure that the press is correctly set to produce near-ideal bar widths. Once the presses have started to roll, periodic sampling should be carried out, at intervals based on experience or dictated by the company's quality control procedures, to monitor both bar widths and other aspects of symbol quality (in particular Symbol Contrast), since these are the attributes most easily adjusted during the run.

Finally, a further sample should be verified following completion of the print job. The Scan Reflectance Profile (SRP) analysis should be used as the basis for decision making, to ensure that the job has achieved at least the minimum quality grade specified by the customer or based on the application.

The following items are recommended to appear on or with a Film Master:

- X-dimension (magnification factor)
- Selected Bar (line) Width Reduction
- Product identification, including company name
- A test square (outside the symbol area) for emulsion studies (this should be incorporated in the film, not affixed on a separate label)
- Printing process for which the Film Master is intended
- Identification of the Film Master supplier
- Date of Film Master manufacture

5.4.3.2.2 Terms and Definitions

Definitions for the following terms can be found in *ISO/IEC15421: 2000(E)*, Section 4:

- Achieved bar width difference
- Bar edge
- Bar edge conformance
- Bar edge contour
- Bar edge gradient
- Bar width adjustment (BWA)
- Bar width increase (BWI)
- Bar Width Reduction (BWR)
- Bar width tolerance
- Base density
- Negative image
- Nominal bar width (EAN/UPC Family)
- Optical density profile
- Polarity

- Positive image
- Specified bar width
- Target element width

5.4.3.2.3 Physical Requirements

Physical requirements consisting of the following topics can be found in Section 6 of *ISO/IEC15421: 2000(E)*, Information Technology, Automatic Identification and Data Capture Techniques, Bar Code Master Test Specifications:

- Material
 - Dimensional stability
 - Archival properties
- Physical requirements controlled by the manufacturing process
 - Target bar width
 - Bar width adjustment (BWA)
- Tolerances
 - Tolerance A – all symbologies
 - Tolerance B – two-width symbologies
 - Tolerance C – (n,k) symbologies
 - Tolerance D – all symbologies
- Bar edge characteristics
 - Bar edge conformance
 - Bar edge gradient
- Defects
- Quiet Zones
- Corner marks
- Optical densities (including table “Reference Density Values,” and, from informative reference Annex A of *ISO/IEC15421: 2000(E)*, Optical Density Profiles, the following figures: Minimum and Maximum Values of Optical Density, Measurement of Slope, Threshold Point for Bar Edge Determination, Measurements for Ratio-Based Symbologies, Measurements for (n,k) Symbologies, and Symbol Character Pitch Measurement)
 - Minimum density ($D_{\min}$)
 - Maximum density ($D_{\max}$)
- Orientation

- Polarity
- Encodation
- Human Readable Interpretation
- Test Methods
 - Bar and space width measurement
 - Conditions for dimensional measurements
 - Calculation of the achieved BWA
 - Test report and traceability

5.4.3.3 Quality Assessment

5.4.3.3.1 Verification

Verification is the technical process by which a bar code symbol is measured to determine its conformance with the specification for that symbol. Verification is not intended to be used alone as a method for downstream rejection. For example, GS1's advice is to use the *ISO/IEC 15416* methodology as a tool to improve overall scanning performance. For problem GS1 System Symbols, an ISO-based verifier can be of enormous assistance in diagnosing the problem and providing a standard means of reporting among printing companies and their trading partners.

It is also important to note the difference between a scanner and a verifier. A verifier is a measuring tool by which one can make certain determinations concerning the ability of the symbol to do its job, namely, to carry and deliver data on demand. Because traditional verification measurement is typically made in a single scan across the symbol, it is uncertain whether this "snapshot" is truly representative of the symbol's characteristics through the height of the bars.

When interpreting the results from verification it is also important to remember that:

- Most verifiers do not measure bar height.
- Without additional software linking the decoded data to a database, the quality and accuracy of the data content of a symbol cannot be confirmed.
- The verifier cannot confirm that the symbol dimensions are those intended and are as indicated in Symbol Specification Tables (SSTs). For example, many of the simpler verifiers cannot measure in dimensional terms (X-dimension), though they can be remarkably accurate in measuring the relationships of element widths to each other. The amount that bar widths differ from nominal width on average in a symbol is called the average bar error. This number is expressed as a fraction of X-dimension. A positive value indicates average bar growth and a negative value indicates bar shrinkage.
- The verifier does not check that the Human Readable Interpretation matches the bar code data (and it may be necessary to check that the two correspond,

particularly where the bar code generating software does not include Human Readable Interpretation data).

- Because only a sample of the symbols produced are actually verified, the quality of all the symbols in a production batch cannot be guaranteed beyond the statistical confidence limits associated with the sampling rate used.
- Even a perfect symbol at the time of production can be damaged or otherwise affected in its passage through the supply chain (e.g., scratched, frozen, dampened).
- Operator error can cause inconsistent results. Operators should be properly trained and visual checks should be made to confirm verifier results (e.g., where the bar code is expected to get a good result and fails the verifier test, recheck the operation of using the verifier).
- The correct bar code symbol has been printed for the scanning environment of the item (e.g., an ITF-14 Symbol used on an item intended for retail Point-of-Sale).

5.4.3.3.1.1 Traditional Verification

Traditional verification methods were introduced in the early to mid-1970s and were based on the measurement of two symbol parameters: print contrast signal (PCS) and the bar width deviation. If the bar (or space) widths were within a defined (but somewhat arbitrary) tolerance, and if PCS was above a defined minimum value, the symbol was regarded as being "in spec."

Initially, none of these measurements were automated, and human factors affected the accuracy and consistency of measurements. Also, checking that the symbol was correctly encoded was a laborious task. However, within a few years, instruments were developed that performed these measurements automatically. These were the first true verifiers that enabled the printer to take steps to produce the symbols as nearly perfectly as this process allowed.

Traditional verification does not necessarily give results that correlate very closely with the actual scanning performance of the symbols. One reason is that the assessment of the symbol gives only a single threshold for acceptability – "Pass" or "Fail." In addition if the assessment is based on a single scan across the symbol, which might be through an exceptionally good or bad section of the symbol, it cannot be guaranteed to be truly representative of its condition.

Measurements of bar gain or loss are less meaningful in the case of certain symbologies, like the EAN/UPC Symbology and the GS1 128 Bar Code Symbol, where

decoding relies primarily on edge-to-similar-edge distances, which are relatively immune to even substantial amounts of consistent gain or loss across the symbol. These distances are measured from the leading edge of one bar to the leading edge of the next (or from one trailing edge to the next), which tends to move in the same direction if there is bar gain or loss. A more subtle factor is that the method is not standardised, either as to where the dark and light reflectance (or density) measurements are made for the calculation of PCS, or as to how the exact position of an element edge is defined, so that some models of verifier could assess a given symbol as "Pass" whereas others could "Fail" it – a source of potential and, indeed, actual disagreements among suppliers and customers.

5.4.3.3.1.2 ISO Verification

During the 1980s, two factors led to attempts to improve the traditional verification technique. One was the disparity between traditional verification results and the real life performance of symbols, and the other was the increasing number of product rejections by customers based on differing verification results between the supplier's instrument and his customer's.

A wide-ranging programme by a group of experts from bar code and user industries working on all types of scanning systems determined the factors that most directly affect symbol-scanning performance and resulted in the analysis of the Scan Reflectance Profile (SRP). This methodology was originally known as ANSI verification because it was first described in the United States' standard *ANSI X3.182*, published in 1990 under the title *Bar Code Print Quality Guidelines*. The method was then defined in a European standard (*EN 1635*), published in 1995, and an international standard (*ISO/IEC 15416*), published in 2000. *ISO/IEC 15416* is the definitive international specification of the ISO bar code verification methodology, and the numeric grading system is used.

The method, as described in the *ISO/IEC 15416* standard, is technically fully compatible with the *ANSI X3.182* and *EN 1635* method, so verifiers based on these standards are not obsolete.

In simple terms, an ISO verifier looks at the symbol in exactly the same way a scanner sees it. The ISO verifier reports its assessment of the symbol quality not as a single "Pass" or "Fail" decision, but as one of a range of four passing grades (from 4 to 1, in order of decreasing quality) or one failing grade (0). This enables an application to set the most appropriate minimum grade for acceptability. It may be noted that the ANSI standard uses the alphabetic scale A to D for passing grades and F for failing symbols, but the grade thresholds are identical.

The relationship between symbol grades measured in this way and the way the symbols behaved when they were scanned was so close that users rapidly came to accept the SRP assessment method for verifying symbols received from their trading partners. Users knew that as long as a symbol achieved grade 1.5 or better it would give them acceptable performance when they had to scan it to capture the encoded data.

Note: The GS1 System requires that the Quiet Zone be a measured parameter for EAN/UPC Symbology, GS1-128 Symbols, and ITF-14 Symbols per the values expressed in *ISO/IEC 15416*, Section 5.

5.4.3.3.1.3 Types of Verifiers

There are many types of verifiers and almost as many ways of classifying them, but for practical purposes, it is convenient to group them into two classes related to where they are used and the extent to which all their possible functions are required. This grouping corresponds reasonably closely to the Class A and Class B classification respectively (as used in the European pre-standard *ENV 12647*).

The first group (broadly equivalent to the Class A category) contains the full-function type of verifier, which is mainly found in a quality control laboratory. It performs a full range of measuring functions and provides comprehensive analytical reports on the symbol, enabling the cause of problems to be diagnosed. Its use requires a good degree of knowledge of the technology, and the operator must, therefore, be specially trained. Its measurement accuracy may be substantially higher than the average; its cost almost certainly is, and the time taken to perform the necessary scans and output the results may be relatively long; however, in the expected conditions for which such an instrument is purchased, this is not likely to be a problem. This type of verifier may have motorised optical heads to improve the evenness of movement and achieve the multiple scanning requirements, and to enable accurate dimensional measurements. In addition, this verifier may have interchangeable measuring apertures and light sources to enable measurement of symbols with a wide range of X-dimensions and to meet the illumination needs of differing application standards. Some of these instruments are used in conjunction with a personal computer with special verification

software for the symbol analysis and display/printing of results, while others are integrated stand-alone units.

The second group (corresponding to the Class B category) contains all the simpler, easy-to-use devices intended for use in the pressroom or on the receiving dock by relatively less trained operators. At their simplest, these devices are used to rapidly check that symbols are of the desired grade or better and, particularly in the pressroom, to obtain an indication of bar gain or loss and of contrast to help the press operator fine-tune his machine. Typically they have a single light source and measuring aperture, though by using plug-in wands or mice, a degree of interchange functionality may be achieved. Some instruments use laser beam illumination, which facilitates multiple scans of the symbol, though the effective measuring aperture may not be circular in shape, and its size may not be precisely known. They also may be more limited in their reflectance measurements.

A group of specialised verifiers is designed for mounting on printing equipment. They monitor the bar code symbols produced by the equipment and provide continuous analysis of key parameters, notably element widths, to enable the operator to control the printing process very quickly. Some are designed for high-speed presses and others for on-demand printers. Some are even able to automatically feed back control instructions to improve symbol quality and reprint defective labels.

A particular verifier may be hard to fit neatly into either class, as it may resemble the simpler class of unit in its physical construction, but its functions and the amount of information that it can give on the symbol may correspond more closely to those of the laboratory unit. Partly for this reason and partly because the Class A and Class B reporting requirements did not necessarily correspond precisely to what a verifier manufacturer might wish to offer for commercial reasons, the international standard *ISO/IEC 15426-1*, which replaces *ENV 12647*, has eliminated the classification scheme in favour of a minimum set of reporting requirements for all verifiers, to which manufacturers are at liberty to add in accordance with their view of the market needs.

5.4.3.3.2 Measurement Methodology

The symbol should be verified in its final configuration wherever possible (e.g., including over-laminate, package material, contents), but if this is not feasible, the following procedure is recommended to allow for the effects of show-through.

Place the symbol to be verified on a flat surface. If the substrate is not opaque (allows light through), perform the verification procedure with the symbol on a dark surface, and then repeat it on a light surface. Take the poorer set of results, unless it is known what type of material is likely to back the symbol in practice, in which case attempt to match it.

5.4.3.3.3 Symbol Grading

Symbol Grading consisting of the following topics can be found in Section 6 of *ISO/IEC 15416: 2000(E)*:

- Scan Reflectance Profile (SRP) grading (further explained in normative reference Annex B of *ISO/IEC 15416: 2000(E)*)
- Decode
- Reflectance parameter grading (including the Reflectance Parameter Grading figure)
- Decodability (including the Decodability Grades figure; also covered in normative reference Annex A of *ISO/IEC 15416: 2000(E)*)
- Expression of symbol grade
- Symbol grading process flowchart is available from normative reference Annex C of *ISO/IEC 15416: 2000(E)*
- Example of verification report is available from informative reference Annex H of *ISO/IEC 15416: 2000(E)*

5.4.3.3.4 Substrate Characteristics

Substrate characteristics consisting of the following topics can be found in the informative reference Annex D of *ISO/IEC 15416: 2000(E)*:

- Substrate opacity
- Gloss
- Over-laminate
- Static reflectance measurements
- Prediction of Symbol Contrast
- Prediction of Minimum Edge Contrast (EC_{min}) and Modulation (MOD)
- Acceptability of measured and derived values

5.4.3.3.5 Interpretation of the Scan Reflectance Profile and Profile Grades

Interpretation of the Scan Reflectance Profile (SRP) and profile grades consisting of the following topics can be found in the informative reference Annex E of *ISO/IEC 15416: 2000(E)*:

- Significance of SRPs
- Interpretation of results
- Matching grades to applications
- Alphabetic grading

5.4.3.3.6 Comparison with Traditional Methodologies

Comparison with traditional methodologies consisting of the following topics can be found in the informative reference Annex I of *ISO/IEC 15416: 2000(E)*:

- Traditional methodologies
- Correlation of print contrast signal with Symbol Contrast measurements
- Guidance on grading for applications also specifying print contrast signal (PCS)

5.4.3.3.7 Process Control Requirements

Process control requirement methodologies consisting of the following topics can be found in the informative reference Annex J of *ISO/IEC 15416: 2000(E)*:

- Process control for repetitive printing
- Number of scans
- Bar width deviation
- Two-width symbologies
- (n,k) symbologies
- Average bar gain/loss

Average bar error is not graded directly, but is used to calculate what fraction of a defined bar tolerance is consumed by the printing process. This traditional bar tolerance calculation differs by symbology and, in the case of the EAN/UPC Symbology, it also differs by the X-dimension at which the symbol is printed. Generally a smaller X-dimension yields a smaller tolerance.

5.4.3.3.8 Compliance Statement

Verifiers that are suitable for use with the recommendations contained in these *GS1 General Specifications* will often be supplied with a statement that associates the instrument with the following calibration standards:

“Applied Image certified EAN/UPC Symbology calibration standards are manufactured to specifications set by Applied Image and the collaboration of GS1 using *ISO/IEC 15416* methodology and are calibrated using standards traceable to the National Institute of Standards and Technology.”

5.4.3.3.9 Calibrated Conformance Standard Test Cards

The verifier operator may use a variety of tools and procedures to periodically ensure maintenance of the verifier's calibration. For example, the operator may follow the manufacturer's recommended procedure for set-up, programming (if necessary), normal operational calibration, and use of the verifier prior to performing any tests. Indeed such procedures are considered essential to ensure the consistency of verification results over time.

Some verifier manufacturers may require the operator to utilise a calibration patch designed for use in maintaining instrument calibration. A common form of patch is often referred to as a "reflectance patch," which may be provided with the instrument. It is very important that the manufacturer's instructions are followed carefully and conscientiously to properly calibrate the instrument. An indication of "calibration complete" normally signals successful recalibration of the device.

Other manufacturers may require periodic factory calibration of their verifier to maintain proper calibration.

With the increasing use of verifiers as communication tools, all verifiers must be periodically checked for their calibration conformance to a traceable standard (within accuracy and repeatability limits stated by the manufacturer). For this reason, the

Calibrated Conformance Standard Test Cards are available for the verifier user (see Figure 5.4.3.3.9 – 1).

Calibrated Conformance Standard Test Cards have been designed for verifiers with 6, 10, and 20 mil apertures, and the following are currently available from GS1:

- EAN/UPC Calibrated Conformance Standard Test Card
- ITF Calibrated Conformance Standard Test Card
- GS1-128 Calibrated Conformance Standard Test Card
- RSS Calibrated Conformance Standard Test Card

Use of these test cards provide a number of benefits including:

- Validates verifiers for UPC-A, EAN-13, ITF, GS1-128, and Reduced Space Symbology® (RSS) linear symbols. Covers all GS1 symbologies except Composite Component® and Data Matrix (two-dimensional bar code).
- Training tool for operators of verifiers
- Validates that the verifier is working within its specified tolerances for the symbology selected

Each test card is designed to test particular characteristics of *ISO/IEC 15416*-based verification equipment. The standards are manufactured on special materials and are made traceable to the National Institute of Standards and Technology (NIST). This traceability is facilitated through a custom designed piece of hardware (nicknamed “the Judge”) and has been engineered to measure the various attributes outlined in *ISO/IEC 15416*. The Judge has also been made traceable to NIST in Washington, D.C.

The idea behind the standard is to regularly test the verification equipment to ensure it is operating within ISO tolerance levels as published by the verifier manufacturer. This is especially important in heavy use applications where various operators may be involved or where a new user is learning to properly verify. The operator should routinely scan each of the symbols on the test card to determine if the verifier device provides the values listed. These specifications stipulate an aperture and 670 nm +/-10 nm wavelength be used, and the exact scanning method should be determined by following all of the verifier manufacturer recommendations. This may require some practice to obtain the right touch, but it will inform the operator when the correct method has been used. If the verifier reports values that agree with the values listed on the test card (within the verifier manufacturer’s stated accuracy and repeatability limits), then the operator can assume the verifier is calibrated. If, after repeated attempts, the device

does not provide the value as printed on the standard (within the verifier manufacturer's stated accuracy and repeatability limits), then the device or the operator's scanning technique must be considered suspect. In this event, the operator should refer to his or her operator's manual as to the proper remedies specified by the verifier manufacturer.

Test cards are sensitive and should be handled with care. If the symbols show dirty areas, one can safely clean these by using a soft cotton pad and photographic grade film cleaner. If visible scratches develop on a symbol, that area of the symbol should not be used. If sufficient visible scratches develop so that a clean scan path is not available, then the test card is no longer useable and should be replaced.

The test card serves as a device for, or means of, confirming that an ISO-based verifier has been properly calibrated and that users are obtaining results within the accuracy limits stated by the manufacturer of their instruments.

It is possible that a defective verifier, use of a damaged or incorrect reflectance patch, or, in some cases, a careless user performing the calibration to the patch, might provide a false indication of successful calibration. The proper use of the Calibrated Conformance Standard Test Cards is the only way multiple trading partners can be assured of reliable quality measurements for the printed GS1 endorsed symbol.

As a general rule, any ISO-based verifier (NIST or non-NIST traceable) should be periodically tested using a Calibrated Conformance Standard Test Card. This procedure will confirm both the accuracy of the instrument and the skill of the user.

5.4.3.3.10 Special Considerations for Verification of GS1 System Symbolologies

5.4.3.3.10.1 General

Since ISO verification does not measure dimensions, it is part of the additional visual checking that has to be carried out to ensure that, for example, the symbol height meets the application requirements.

With better digital imaging software, element dimensions can only be adjusted automatically to the nearest integer number of pixels in the output device, be it imagesetter or printer, enabling element width ratios to be maintained with allowance duly made, for example, for print gain/loss and adjustment of element widths for digits 1, 2, 7, and 8 in EAN/UPC Symbols. This means that symbol sizes may not match those input as target dimensions, but will vary in discrete steps within the permitted range, which will result in a more accurate symbol overall.

5.4.3.3.10.2 EAN/UPC Symbology

The main characteristic of the EAN/UPC Symbology that affects verification is the different treatment of the three sets of symbol characters for digits 1, 2, 7, and 8 from the remaining digits (0, 3, 4, 5, 6, and 9). The reference decode algorithm uses the combined width of both bars in these characters to discriminate between a 1 and a 7, and between a 2 and an 8, which are ambiguously decodable since they share the same set of edge-to-similar-edge modular dimensions. The addition to or subtraction from the element widths of 1/13 module is intended to increase the differences between the sums of the bar widths for each pair of ambiguous characters. The Decodability parameter for these characters takes account of bar gain and loss whereas it does not for the remaining symbol characters. Consequently, a symbol not containing any of these four symbol characters may suffer substantial bar gain or loss without degrading its Decodability, whereas a symbol that does contain one or more of them is likely to have a lower Decodability grade, with the same amount of bar gain or loss. However, the laws of probability suggest that only some 6.9 percent of symbols would not be affected by this, so it is wise to be cautious and assume that bar gain or loss is a possible cause of a poor Decodability grade for EAN/UPC Symbols. It is also wise (for process control purposes) not to assume that the Decodability grade correlates with bar width deviation, but it is far safer and easier to rely on the traditional measurement of bar width deviation for adjusting the production process.

The measuring aperture for EAN/UPC Symbols, irrespective of X-dimension, is 6 mils (which is equivalent to 0.15 mm (0.006in.)). This is not one of the four ISO-recommended standard default aperture sizes, which are 3, 5, 10, and 20 mils, but is usually available from verifier manufacturers. This diameter was based on measurement of symbols with various apertures and much test scanning in order to determine which aperture gave results correlating best with scanning performance.

5.4.3.3.10.3 GS1-128 Symbology

The important aspects to verify for a GS1-128 Symbol are its print quality, which is assessed in the standard way, and its formatting, which may need to be visually checked from the information output by the verifier. The Code 128 Symbology is an edge-to-similar-edge decodable symbology, but its reference decode algorithm also requires a check of the sum of the widths of the three bars in each character as part of its parity checking process. Consequently, its Decodability is affected by bar gain or loss.

Measuring apertures for GS1-128 Symbols varies according to the application. For all applications except the GS1-128 Coupon Extended Code, an aperture of 10 mils is

specified, giving a minimum acceptable grade of 1.5/10/670. The GS1 US Coupon Code requires an aperture of 6 mils and a minimum grade of 1.5/06/670.

Data contained in GS1-128 Symbols must be formatted according to these specifications for the use of Application Identifiers (AIs). Specific features to check are:

- Presence of Function Code 1 (FNC1) as a flag for the GS1 System subset of the Code 128 Symbol, in the first position after the Start Character
- Use of FNC1 as a field separator following non-predefined length AIs
- Sequencing of AIs, with pre-defined length AIs preceding non pre-defined length ones
- Length of data fields with fixed length AIs
- Correct formatting of data in all AI fields
- Absence of encoded parentheses around AIs

The extent to which a verifier can do this automatically will vary greatly among devices, even those that have GS1-128 Symbols as a specific symbology option.

5.4.3.3.10.4 ITF-14 Symbology

ITF-14 Bar Code Symbols are, unlike the others used in the GS1 System, two-width (narrow/wide) symbols that cannot be decoded by the edge-to-similar-edge technique, but all element widths must be measured. They are, therefore, more subject to the problems caused by bar gain or loss.

The standard ISO verification technique is fully applicable to these symbols. However, in the GS1 System application, additional checks must be made to ensure that the X-dimension (magnification factor) is within the permitted range.

Measuring apertures for the ITF-14 Symbol are 10 mil for symbols with an X-dimension less than 0.635 mm and 20 mil for symbols with an X-dimension equal to or greater than 0.635 mm.

The minimum acceptable grade for symbols printed with the higher range of X-dimension (above 0.635 mm) is 0.5/20/670. This is because the brown corrugated substrates on which such symbols are often printed typically have a reflectance value below 40 percent, and sometimes below 30 percent, and cannot, therefore, ever achieve a Symbol Contrast better than 40 percent (the lower threshold for a grade 2 Symbol Contrast) no matter how dense the ink or how well the other attributes of the symbol are graded. As a result, the Scan Reflectance Profile (SRP) grade will most often be dictated by Symbol Contrast, so it cannot be higher than 1 for symbols on these materials, giving a maximum achievable overall symbol grade of 1.0.

Such symbols may also be affected by the inherent interference in the background reflectance caused by the substrate's composition, which may well lead to reduced Defect grades and possibly low edge contrast and Modulation values. It is, therefore, desirable to ensure that symbols printed on these corrugated materials are of as high a quality as possible in respect of the other parameters.

5.4.3.3.11 Possible Causes of Less-Than-Perfect Verification Grades

5.4.3.3.11.1 Reflectance Parameters

Symbol Contrast is governed by the reflectance of the substrate and ink. A symbol printed in black ink on a white paper will almost certainly achieve the top grade 4 for Symbol Contrast, as white papers typically have reflectance in excess of 75 percent, and black ink will usually have about 3 to 8 percent reflectance. Coloured backgrounds or coloured inks will affect the result. Highly glossy materials may also appear to have a lower background reflectance than expected. The worst case may be when printing on a corrugated brown fibre-board material, which may have a reflectance in a range between 27 and 40 percent, so even with a very dense, low reflectance ink it can never achieve better than the minimum passing grade 1 for Symbol Contrast (grade 1 includes Symbol Contrast values from 20 to 39 percent).

The causes of low Symbol Contrast and the solutions are:

- Background too dark: Use lighter or less glossy material, or change background colour (if printed) to one with higher reflectance
- Bars too light: Change bar colour for one with lower reflectance, and increase ink weight or print head temperature (thermal printing) (Note: watch for consequential increase in bar widths)
- Show-through of contents: Use more opaque material for package, or print opaque white underlay prior to printing symbol
- Show-through of imprint: use more opaque labels

Minimum reflectance, or $R_{\min}$, must always be equal to or less than half the highest reflectance value, $R_{\max}$. In practice, this means that the reflectance of at least one bar must meet this criterion. For example, if $R_{\max}$ is 70 percent, at least one bar must have a reflectance of 35 percent or less. A symbol that fails on this parameter will almost certainly have a low Symbol Contrast grade also.

The cause of and solution for $R_{\min}$ being too high include:

- Bars too light: Change bar colour to one with lower reflectance, and increase ink weight or print head temperature (thermal printing) (watch for consequential increase in bar widths)

Minimum Edge Contrast ($EC_{\min}$) will always be lower than Symbol Contrast, but will only be a problem in itself if it approaches or drops below 15 percent (the pass/fail

threshold). However, low edge contrast (EC) values, acceptable under this criterion, may still cause low Modulation (MOD) grades.

The causes of a low value of EC_{min} and the possible remedies are:

- Local variations in background reflectance (e.g., fragments of darker material in a recycled material): Use a more consistent substrate or one with higher reflectance
- Local variations in inking of the bars: Adjust press settings to ensure even inking
- Show-through of contents: Use more opaque material for package, or print opaque white underlay prior to printing symbol

- Elements adjoining the edge in question are excessively narrow relative to the measuring aperture used: Increase X-dimension; ensure correct measuring aperture is used; ensure correct bar width adjustment (BWA) applied to Film Master/original symbol; print bars marginally narrower than spaces of same modular dimension

Modulation, being calculated as the percentage of Symbol Contrast represented by the EC_{min} , will be reduced for the same reasons as when EC_{min} is low in the symbol. A scanner will tend to see spaces as narrower than bars and also to see narrow elements as less distinct than wider ones. Consequently, if there is significant bar loss, Modulation will be reduced. Measuring with an aperture that is too large for the X-dimension will also reduce Modulation.

The causes of a low value of Modulation (often listed as “MOD” on verification reports) and the possible remedies are:

- Local variations in background reflectance (e.g., fragments of darker material in a recycled material): Use a more consistent substrate or one with higher reflectance
- Local variations in inking of the bars: Adjust press settings to ensure even or darker inking
- Show-through of contents: Use more opaque material for package, or print opaque white underlay prior to printing symbol
- Element(s) adjoining the edge in question appear excessively narrow relative to the measuring aperture used: Increase X-dimension; ensure correct measuring aperture is used; apply correct BWA when originating symbol; print bars marginally narrower than spaces of same modular dimension

5.4.3.3.12 Other Parameters

Decode is graded on a pass/fail basis by applying the reference decode algorithm to the edge positions and element widths determined for the symbol. A failure to decode may be evidence of the symbol being incorrectly encoded, which may include an incorrect Check Digit. It also may indicate either that the bars and spaces initially identified by the global threshold are too many or too few for a valid symbol or that one or more edge positions are ambiguous.

The possible causes of decode failure and possible remedies are:

- Symbol incorrectly encoded: Re-originate symbol; over-label with correctly encoded symbol
- Check Digit incorrectly calculated: Correct software error in origination system; re-originate symbol; over-label with correctly calculated symbol
- Gross element width errors due to excessive print gain or loss, or to defects: Apply correct bar width adjustment (BWA) when originating symbol; adjust press or printer settings
- Too many elements detected due to defects: Correct cause of defects; adjust press (relief printing processes) to reduce haloing; replace print head (thermal/ink-jet printing)

- Too few elements detected (failure to cross global threshold): Refer to solutions for edge contrast (EC)

In the ISO standard, a decode failure occurs because an incorrect number of elements has been perceived to be present, either because the profile of one or more elements has failed to cross the global threshold or because a gross defect has caused one element to be seen as three or more, corresponding to the separately graded Edge Determination failure in the ANSI standard, which may also be reported by some verifiers following the ANSI methodology.

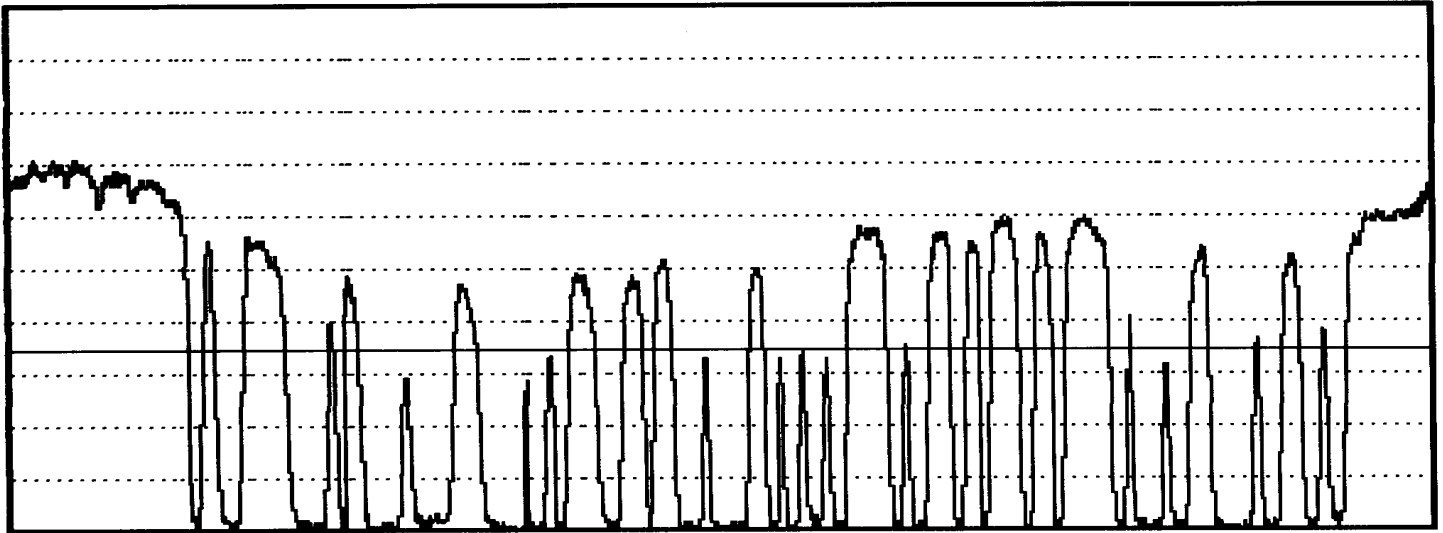
Figure 5.4.3.3.12 – 1 shows a symbol in which the narrow spaces have been partly filled in, reducing their contrast below the global threshold and causing an Edge Determination or decode failure. This could also be interpreted as an extreme example of Modulation (MOD).

Figure 5.4.3.3.12 – 1: Symbol with Edge Determination Problem



Figure 5.4.3.3.12 – 2 illustrates a Scan Reflectance Profile (SRP) showing narrow space profiles failing to reach the global threshold, giving an (ISO) decode failure or (ANSI) Edge Determination failure.

Figure 5.4.3.3.12 – 2: Scan Reflectance Profile with Narrow Space Profiles



Decodability grades are influenced by bar gain or loss in most symbologies and by distortion of the symbol. Distortion can occur with relief printing processes, such as flexography, when the printing plate is stretched around the press cylinder with the bars parallel to the cylinder axis (e.g., at right angles to the print direction). A common reason for distortion with digitally-originated images is that they have been rescaled in graphics software, resulting in uneven addition or removal of pixels to or from the element widths. Print processes that tend to produce irregular bar edges, such as ink-jet and photogravure, will also be likely to give lower Decodability grades.

The causes of a low value of Decodability and the possible remedies are:

- Bar gain/loss (systematic): Apply correct Bar Width Adjustment (BWA) when originating symbol; adjust press settings
- Element width gain/loss (non-systematic): Correct missing pixels (burnt-out print head elements, blocked ink-jet nozzles); rectify cause of defects
- Distortion of symbol (uneven stretching of flexographic plate; non-linear disproportioning in plate-making process): Print symbol with height of bars parallel to direction of printing; do not disproportion bar code image in plate-making
- Rescaling of digitally-originated images: Ensure symbol is created in correct size; ensure software matches module widths to integer number of pixels after all adjustments
- Irregular element edges (ink-jet, photogravure, screen process printing): Change print technology; increase X-dimension/magnification factor; re-orient symbol relative to cylinder engraving angle/screen mesh

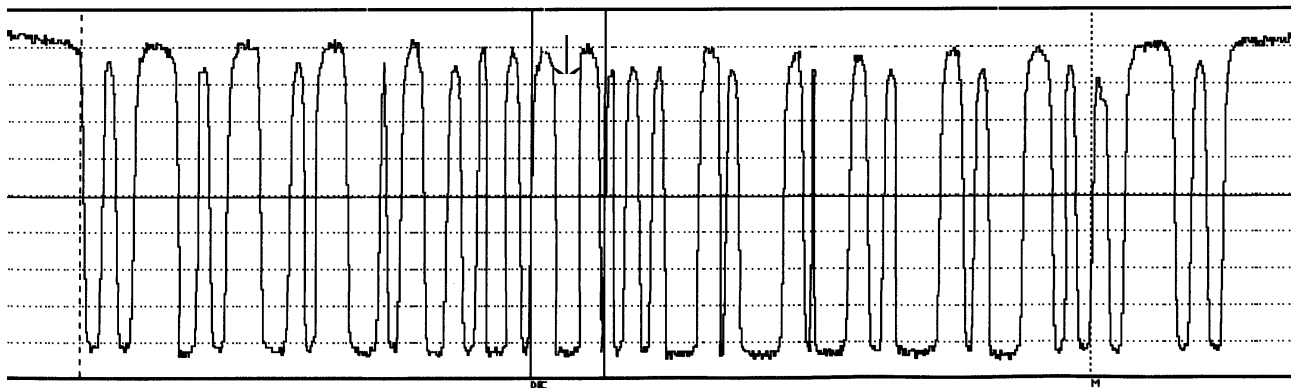
The symbol in Figure 5.4.3.3.12 – 3 is taken from the GS1 Calibrated Conformance Standard Test Card and has an engineered low Decodability grade of 50 percent. As may be determined from the accompanying Scan Reflectance Profile (SRP), just to the left of halfway across the symbol, the width of a two-module bar has been increased in the

sixth digit (and since the character is a 1, its Decodability is affected by bar width). Although the original symbol has a very consistent image density, the profile also shows the effect of Modulation (MOD), most noticeably on the narrow spaces.

Figure 5.4.3.3.12 – 3: Calibration Symbol with Engineered Low Decodability Grade



Figure 5.4.3.3.12 – 4: Scan Reflectance Profile of Symbol with Low Decodability Character



Defects, which show as irregularities in the Scan Reflectance Profile, may be caused by spots of extraneous ink in Quiet Zones or in the spaces. Small voids (white areas) in the bars are also highlighted as defects. In symbols printed on recycled or some other materials, local variations in reflectance of the background will also show as defects. The significance of a defect is in direct relation to the depth of the irregularity it causes in the Scan Reflectance Profile.

Common causes and the most likely solutions include:

- Defective print head elements (thermal printing or ink-jet printing), which will tend to produce an unprinted line running through the symbol in the direction of printing: Clean or replace print head
- Satellite (ink droplets in the white are surrounding the printed bars): Clean head; change ink formulation
- Haloing (e.g., a double line impression where there should only be a single line impression): Adjust impression pressure and/or ink viscosity

- Incorrect matching of thermal transfer ribbons and substrate (poor adhesion of ink to surface): Use correct ribbon for substrate; use smoother substrate
- Measuring aperture too small: Use verifier with correct aperture

The use of a smaller or larger measuring aperture than specified for the symbol will produce misleading Defect grades, and this is perhaps the strongest argument for ensuring that the right aperture size is used. Too small an aperture will exaggerate the apparent size of a defect; too large an aperture will tend to smooth it out.

Quiet Zones are a frequent source of scanning problems. Although the ISO standard does not directly require measurement of the Quiet Zones, it requires any additional requirements specified by the application specification to be graded on a pass/fail basis. The *GS1 General Specifications* establish Quiet Zone requirements for all symbols used in the GS1 System, and a Quiet Zone less than the minimum width will, therefore, cause the profile grade to fail.

Possible causes of Quiet Zone failure and the remedies are:

- Printed box surrounding symbol or other interfering print: Enlarge box; ensure symbol registration to other print allows adequate margins; use Quiet Zone Indicators if possible
- Symbol too close to label edge: Adjust label feed; reposition symbol farther from edge; use larger label size or smaller symbol

5.4.A.1 Appendix 1: Print Process Characterisation Techniques

5.4.A.1.1 Introduction

This technical bulletin is written to document and specify when EAN/UPC Symbols can be printed at less than the current minimum specification of 0.264 mm or 10.4 mils X-dimension (80% magnification).

5.4.A.1.2 Background

Many printer users have asked if the magnifications in the 75 to 80 percent range for EAN/UPC Symbols printed by thermal and laser on-demand printers are acceptable for use. The most common printing densities used by on-demand, bar code printers are 200 and 300 dpi. However, due to the constraints of the dot pitch, these printers cannot print an 80 percent symbol correctly. The nearest to 80 percent that these printers can print is 75.7 or 76.9 percent depending on the exact dot geometry.

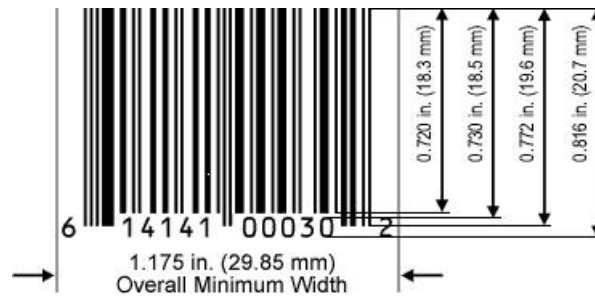
Even though 80 percent magnification is the minimum value specified in the EAN/UPC Symbol specification, users of on-demand printers have used magnifications between 75 and 80 percent in Point-Of-Sale scanning environments for years. They have done so with no significant reduction in scan rate, as compared to symbols printed precisely at 80 percent. Because larger in-specification EAN/UPC Symbols are always easier to scan, 80 percent symbols and larger are preferred. However, when an on-demand printer is required, the 75 to 80 percent EAN/UPC Symbols are an acceptable alternative given the conditions in [Section 5.4.A.1.3](#).

5.4.A.1.3 New Qualifications for Printing

- The allowance for EAN/UPC Symbol magnifications from 75 to 80 percent is only applicable to "on demand" (e.g., thermal or laser) print processes. For all other printing processes, 80 percent is attainable and is the minimum allowable size.
- When printing a minimum symbol with any method of printing, the area provided for printing the symbol and the required Quiet Zone should never be less than the area required for an 80 percent symbol. This area can be derived from the total width of an 80 percent symbol times its height as shown in the dimensions in Figure 5.4.A.1.3 – 1.
- When printing a minimum symbol with any method of printing, the symbol height should never be truncated below the 80 percent value (20.7 mm or 0.816 inches).

The minimum print quality grade should be the same for all EAN/UPC Symbols; at least an ISO/ANSI grade of 1.5 (or C). It is advisable to print EAN/UPC Symbols that are at least a 2.5 (B) grade at the time of printing regardless of size.

Figure 5.4.A.1.3 - 1 EAN/UPC Symbol Shown with Minimum Height and Overall Width Dimensions for Magnifications of 75% to 80%



Note: In Figure 5.4.A.1.3 – 1, as you move from 80 to 75 percent magnification, the Quiet Zone increases from 0.0936 in. (2.38 mm) to 0.124 in. (3.16 mm) in order to keep the overall width constant at 1.175 in. (29.85 mm).

5.4.A.1.4 Summary

When printing with on-demand printers (e.g., thermal or laser) the resulting element widths for EAN/UPC Symbols should never be less than 75 percent magnification. If the symbol printed with element widths is less than 80 percent, then the overall symbol shall have both larger Quiet Zones and taller bars such that the resulting area is not less than that of 80 percent magnification symbols. The symbol print quality must still meet the EAN/UPC Symbol requirements of 1.5/06/670.

Section 5.5:

Reduced Space Symbology® and Composite Symbology®

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5.5.1 Introduction

This section provides technical specifications for the Reduced Space Symbol, Composite Component™ Symbol and Composite Symbols. GS1 has developed these new symbologies with the intent of making them available for open application use. While work is currently underway to define a number of application standards for these symbologies, to date only the Very Small Healthcare Items application guideline (see Section 2.7) has been approved and published. Only when application standards and rollout schedules are established will GS1 endorse the use of these symbologies for use in other open supply channels.

The Reduced Space Symbology family of bar code symbols and associated Composite Components have been developed to meet the expressed needs of GS1 System members. The challenge was to provide better ways to automatically identify:

- Very small items (e.g., syringes, vials, and telecommunications circuit boards)
- Random measure retail items utilising full product identification (e.g., meat, poultry, and bagged produce)
- Individual produce items (e.g., apples and oranges)
- Logistic units that required more data to accompany the item than there was space available (e.g., content information for mixed trade item pallets)

To provide a solution for this application requirement, the following minimum technical issues needed to be resolved:

- Some symbols had to perform in an omnidirectional scanning environment.
- The symbol had to fit in a space-constrained area and provide strong performance for its size.
- The symbol had to maximise compatibility with an existing broad-based collection of applications and technologies.
- The symbol had to complement the selection of existing GS1 System data carriers
- The symbol had to provide the simplest set of solutions to fit the largest user base.

GS1 formed both user and technical committees to address this issue. The committees evaluated the EAN-8 Composite Symbology and GS1-128 Composite Symbology along with two-dimensional (2D) stacked and matrix symbologies. The committees determined that a new compact linear symbology, RSS, with an associated stacked two-dimensional symbol, versions of MicroPDF417, provided the most efficient and general solution. The combination of a linear symbol and associated 2D symbol is known as a composite symbol. It is the only GS1 System standard 2D symbology. The linear component encodes the item identification and can be read by most scanners.

The RSS family has a higher data density than other linear bar codes because it has a larger symbol character. The RSS Limited™ Bar Code Symbol encodes 2,013,571 values in one symbol character with 26 modules.

Figure 5.5.1 – 1: Data Density Comparison

Symbology	Modules per Digit
ITF-14	8.0
EAN/UPC	7.0
GS1-128	5.5
RSS Limited	4.1

To allow for broad functionality, the RSS linear component of the composite symbol has been designed in several formats. They include:

- RSS-14™
- RSS-14 Truncated
- RSS Limited
- RSS Stacked
- RSS Stacked Omnidirectional
- RSS Expanded™
- RSS Expanded Stacked

RSS-14, RSS-14 Truncated, RSS Stacked, and RSS Stacked Omnidirectional enable the full 14-digit numbering of items. They are smaller than EAN-13 or UPC-A Bar Code Symbols. Each provides a linkage flag to indicate the existence of a 2D Composite Component. RSS-14 and RSS Stacked Omnidirectional have omnidirectional scanning capability.

RSS Limited is designed for very small item identification. It encodes 14-digit item identification using indicator digits 0 or 1 and provides a linkage flag for the 2D Composite Component.

RSS Expanded and RSS Expanded Stacked encode all GS1 System Application Identifier (AI) Element Strings. Each symbol has a variable length with a capacity of up to 74 characters. Each provides a linkage flag to indicate the existence of a 2D Composite Component. Unlike the GS1-128 Bar Code Symbol, the RSS Expanded Symbologies are designed to be read in an omnidirectional scanning environment.

The Composite Component (CC) family of symbologies consists of new 2D symbologies that will be used by GS1 as an add-on to the linear symbologies in new applications. The family is in the public domain. A symbol that combines a linear symbol with a 2D component is known as a composite symbol.

The 2D component adds supplementary Application Identifier Element String data to GS1 System linear symbologies. It provides the following benefits:

- The composite symbol is the only one with an easily scannable item identification.
- The composite symbols are comparable in size to the matrix symbols but can be scanned with a wider range of scanner technologies.
- The composite symbols are smaller than other laser scannable 2D symbols.

2D components can be added to the RSS family, GS1-128, and EAN/UPC Bar Code Symbols. There are three versions of the 2D symbol: CC-A, CC-B, and CC-C. The Composite Components increase in size and capacity. CC-C composites have greater capacity than CC-B composites, and CC-B composites have greater capacity than CC-A. The three versions of the Composite Component are based on new versions of MicroPDF417 and PDF417: CC-A (new version of MicroPDF417) up to 56 characters, CC-B (MicroPDF417 variant) up to 338 characters, and CC-C (PDF417 variant) up to 2361 characters.

RSS and composite symbols can encode new features beyond the structure of the standard Element String carried by a GS1-128 Symbol. The symbol separator allows new structures such as nesting/looping to be used for logistics applications.

A new Symbology Identifier of "je0" is used to differentiate the data transmission from GS1-128 Bar Code Symbols because the data may easily exceed the 48-character limit for GS1-128.

Figure 5.5.1 – 2: Symbology Identifiers

	Message Content	Separator
je0	Standard AI Element Strings	none
je1	New ISO 646 structures	"symbol separator"
je2	ISO 8859-1 8-bit data	codeword > 899
je3	ECL escapes and 8/16-bit data	codeword > 899

5.5.1.1 Composite Symbol Features

The primary identification is encoded in the linear symbol that is easily scanned with a low cost scanner. Supplementary AI Element Strings may be encoded in the two-dimensional (2D) component where they take up less space. Specific application guidelines will provide full details.

Composite symbols are designed to be scanned with hand-held laser, linear CCD, or 2D imaging scanners.

Within the GS1 System, there are several possible linear/composite formats:

- RSS-14™ Composite
- RSS-14 Stacked Composite
- RSS Limited™ Composite
- RSS Expanded™ Composite
- UPC-A Composite
- UPC-E Composite
- EAN-8 Composite
- EAN-13 Composite

GS1-128 Composite (note that the linkage flag is an extra code set character between the last data character and the Symbol Check Character)

Composite Symbols can be selected to provide the best fit to a specific area. For example, the same data can be encoded in RSS-14 Truncated/CC-A, RSS Limited/CC-A, or RSS-14 Stacked/CC-A. Each of the three composites can be used to fit a different maximum height and width space requirement.

To provide assistance for rapid implementation, GS1 has:

- Patents granted and placed in the public domain
- Reduced Space Symbology® (RSS) and Composite Symbology® specifications issued by AIM, Inc.;
- Encoder and decoder models freely available to interested developers
- A verification model available to interested developers
- RSS verifiers available
- Two-dimensional 2D composite symbol verifiers in development.
- Active user application groups
- Completed pilot tests with additional tests underway

The specifications for RSS and Composite Symbologies contained within this publication are provided for GS1 staff, and technical users of the GS1 System. The information provides a template for implementation of RSS/Composite Symbology. Technical specifications are referenced in this document for those needing more detailed information.

5.5.2 Reduced Space Symbology® (RSS)

5.5.2.1 Introduction

Reduced Space Symbology® (RSS) is a family of linear symbologies used within the GS1 System. There are three types of RSS symbols, two of which have a number of versions optimised for different application requirements.

RSS-14™ encodes AI (01) in a linear symbol that can be scanned omnidirectionally by suitably programmed slot scanners. RSS Limited™ encodes AI (01) in a linear symbol for use on small items that will not be scanned in an omnidirectional scanning environment. RSS Expanded™ encodes GS1 System primary item identification plus supplementary AI Element Strings, such as weight and “best before” date, in a linear symbol that can be scanned omnidirectionally by suitably programmed slot scanners.

RSS-14 Stacked is a variation of the RSS-14 Symbology that is stacked in two rows and used when the normal symbol would be too wide for the application. It comes in two versions: a truncated version used for small item marking applications and a taller version that is designed to be read by omnidirectional scanners. RSS Expanded can also be printed in multiple rows as a stacked symbol.

Any member of the RSS family can be printed as a stand-alone linear symbol or as a component of a composite symbol with an accompanying two-dimensional (2D) Composite Component™ printed above the RSS linear component.

The RSS family is fully described in the Automatic Identification Manufacturers, Inc. document *AIM ITS 99-001 - International Symbology Specification - Reduced Space Symbology (RSS)*.

5.5.2.1.1 Symbology Characteristics

The Reduced Space Symbology® (RSS) family consists of the following versions:

- RSS-14™
- RSS-14 Truncated
- RSS-14 Stacked
- RSS-14 Stacked Omnidirectional
- RSS Limited™
- RSS Expanded™
- RSS Expanded Stacked

The characteristics of the RSS family are:

- Encodable character set:
 - RSS-14 versions and RSS Limited: digits 0 through 9 (with the restriction of RSS Limited to 0 or 1 in the first digit)
 - RSS Expanded: a subset of Table 1 of the *International Standard ISO/IEC 646*, consisting of the uppercase and lowercase letters, digits, spaces, and 20 selected punctuation characters in addition to the Function 1 Character (FNC1)
- Symbol character structure: Different (n,k) symbol characters are used for each member of the family, where each symbol character is n modules in width and is composed of k bars and k spaces.
- Code type: continuous, linear bar code symbology
- Maximum numeric data capacity (including implied Application Identifiers (AIs) where appropriate, but not including any encoded FNC1 characters):
 - RSS-14 versions and RSS Limited: AI (01) plus a 14-digit numeric item identification
 - RSS Expanded: 74 numeric or 41 alphabetic characters
- Error detection:
 - RSS-14 versions: mod 79 checksum
 - RSS Limited: mod 89 checksum
 - RSS Expanded: mod 211 checksum
- Character self-checking
- Bidirectionally decodable
- Quiet Zones: none required

5.5.2.1.2 Additional Features

Additional Reduced Space Symbology® (RSS) features include:

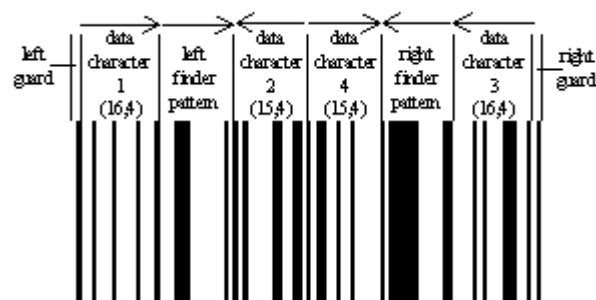
- Data compaction: Each member of the RSS family has data compaction methods optimised for the data strings that it will encode. RSS Expanded™ is also optimised for specific sequences of Application Identifiers (AIs) that are commonly used.
- Component linkage: All RSS symbols include a linkage flag. If the linkage flag is 0, then the RSS symbol stands alone. If the linkage flag is 1, then a 2D Composite Component™ and its separator pattern is printed above the RSS symbol with the separator pattern aligned and contiguous to the RSS symbol.
- Edge to similar edge decoding: All RSS family data characters, finder patterns, and check characters can be decoded using edge-to-edge measurements.
- Large data characters: Unlike EAN/UPC Symbols, an RSS symbol's data characters do not directly correspond to the encoded data character. The symbol's data characters encode thousands of possible combinations to increase the encoding efficiency. They are then combined mathematically to form the encoded data string.
- GS1-128 Symbol emulation: Readers set to the GS1-128 Symbol emulation mode transmit the data encoded within the RSS family symbol as if the data were encoded in one or more GS1-128 Symbols.

5.5.2.2 RSS-14™ Versions

RSS-14™ encodes the Element String AI (01). It has four versions: RSS-14, RSS-14 Truncated, RSS-14 Stacked, and RSS-14 Stacked Omnidirectional. All four versions encode data in an identical manner.

Figure 5.5.2.2 – 1 shows the structure of RSS-14. An RSS-14 Symbol contains four data characters and two finder patterns. The RSS-14 family is capable of being scanned in four separate segments, each consisting of a data character and an adjacent finder pattern. The two finder patterns together encode a modulo 79 check value for data security.

Figure 5.5.2.2 – 1: RSS-14 Structure



The left and right Guard Bar Patterns consist of a narrow bar and narrow space. RSS-14 does not require a Quiet Zone.

5.5.2.2.1 RSS-14™

The RSS-14™ Bar Code Symbol is designed to be read by an omnidirectional scanner, such as a retail slot scanner. Its dimensions are 96X wide, starting with a 1X space and ending with a 1X bar, by 33X high (where X is the width of a module). For example, an RSS-14 Symbol with an X-dimension of 0.25 mm (0.010 in.) would be 24 mm (0.96 in.) wide and 8.25 mm (0.33 in.) high.

Figure 5.5.2.2.1 – 1: RSS-14 Bar Code Symbol



5.5.2.2.2 RSS-14 Truncated

The RSS-14 Truncated Bar Code Symbol is a reduced height version of the RSS-14™ Bar Code Symbol that is designed for small items that will not need to be read by omnidirectional scanners. Its dimensions are 96X wide by 13X high (where X is the width of a module). For example, an RSS-14 Truncated Symbol with an X-dimension of 0.25 mm (0.010 in.) would be 24 mm (0.96 in.) wide by 3.25 mm (0.13 in.) high.

Figure 5.5.2.2.2 – 1: RSS-14 Truncated Bar Code Symbol



5.5.2.2.3 RSS-14 Stacked

The RSS-14 Stacked Bar Code Symbol is a reduced height two-row version of the RSS-14™ Bar Code Symbol that is designed for small items that will not need to be read by omnidirectional scanners. Its dimensions are 50X wide by 13X high (where X is the width of a module). For example, an RSS-14 Stacked Symbol with an X-dimension of 0.25 mm (0.010 in.) would be 12.5 mm (0.50 in.) wide by 3.25 mm (0.13 in.) high. Its structure includes a 1X high separator pattern between the two rows.

Figure 5.5.2.2.3 – 1: RSS-14 Stacked Bar Code Symbol



5.5.2.2.4 RSS-14 Stacked Omnidirectional

The RSS-14 Stacked Omnidirectional Bar Code Symbol is a full height two-row version of the RSS-14™ Bar Code Symbol that is designed to be read by an omnidirectional scanner, such as a retail slot scanner. Its dimensions are 50X wide by 69X high (where X is the width of a module). For example, an RSS-14 Stacked Omnidirectional Symbol with an X-dimension of 0.25 mm (0.010 in.) would be 12.5 mm (0.50 in.) wide by 17.25 mm (0.69 in.) high. The height of 69X includes a 3X high separator pattern between two rows of 33X each.

Figure 5.5.2.2.4 – 1: RSS-14 Stacked Omnidirectional Bar Code Symbol



5.5.2.3 RSS Limited™

The RSS Limited™ Bar Code Symbol encodes the Element String AI (01). This Element String is based on the UCC-12, EAN/UCC-8, EAN/UCC-13, or EAN/UCC-14 Data Structures. However, when using the EAN/UCC-14 Data Structure, only the indicator value 1 is allowed. The RSS-14™ family must be used for EAN/UCC-14 Data Structures with an indicator value greater than 1.

The RSS Limited Bar Code Symbol is designed for small items that will not need to be read by omnidirectional Point-of-Sale (POS) scanners. Its dimensions are 74X wide, starting with a 1X space and ending with a 1X bar, by 10X high (where X is the width of a module). For example, an RSS Limited Bar Code Symbol with an X-dimension of 0.25 mm (0.010 in.) would be 18.5 mm (0.74 in.) wide by 2.5 mm (0.10 in.) high.

Figure 5.5.2.3 – 1: RSS Limited Bar Code Symbol



Figure 5.5.2.3 – 2 shows the structure of the RSS Limited Bar Code Symbol. An RSS Limited Symbol contains two data characters and a check character. The check character encodes a modulo 89 check value for data security.

Figure 5.5.2.3 – 2: RSS Limited Bar Code Symbol Structure



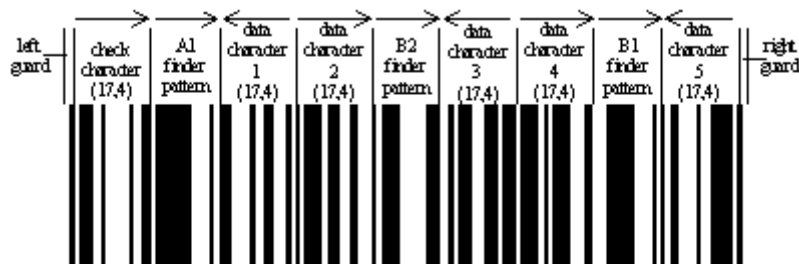
The left and right Guard Bar Patterns consist of a narrow bar and narrow space. The RSS Limited Bar Code Symbol does not require a Quiet Zone.

5.5.2.4 RSS Expanded™ Versions

RSS Expanded™ is a variable length linear symbology capable of encoding up to 74 numeric or 41 alphabetic characters of AI Element String data. RSS Expanded is designed to encode primary and supplementary data in items for Point-of-Sale (POS) and other applications. It has the same capabilities as a GS1-128 Symbol except that it is also designed to be scanned by omnidirectional slot scanners. It is designed for variable weight products, perishable products, traceable retail products, and coupons.

Figure 5.5.2.4 – 1 shows the structure of a six-segment RSS Expanded Symbol. RSS Expanded Symbols contain a check character, 3 to 21 data characters and 2 to 11 finder patterns, depending on the symbol length. RSS Expanded is capable of being scanned in separate segments, each segment consisting of a data character or check character and the adjacent finder pattern. The check character encodes a modulo 211 check value for data security.

Figure 5.5.2.4 – 1: RSS Expanded Structure



The left and right Guard Bar Patterns consist of a narrow bar and narrow space. RSS Expanded does not require a Quiet Zone.

5.5.2.4.1 RSS Expanded™

The RSS Expanded™ Bar Code Symbol has a variable width (from 4 to 22 symbol characters, or a minimum of 102X wide and a maximum of 534X wide) and is 34X high (where X is the width of a module). The symbol starts with a 1X space and ends with either a 1X bar or space. For example, the RSS Expanded Symbol shown in Figure 5.5.2.4.1 – 1 with an X-dimension of 0.25 mm (0.010 in.) would be 37.75 mm (1.51 in.) wide by 8.5 mm (0.34 in.) high.

Figure 5.5.2.4.1 – 1: RSS Expanded Bar Code Symbol



5.5.2.4.2 RSS Expanded Stacked

The RSS Expanded Stacked Bar Code Symbol is a multi-row stacked version of RSS Expanded™. It can be printed in widths of 2 to 20 segments and can have from 2 to 11 rows. Its structure includes a 3X high separator pattern between rows. It is designed to be read by an omnidirectional scanner such as a retail slot scanner. The RSS Expanded Stacked Symbol shown in Figure 5.5.2.4.2 – 1 with an X-dimension of 0.25 mm (0.010 in.) would be 25.5 mm (1.02 in.) wide by 17.75 mm (0.71 in.) high.

The white space at the end of the second row of the symbol shown in Figure 5.5.2.4.2 – 1 is not part of the symbol and can be used for other purposes, such as text.

Figure 5.5.2.4.2 – 1: RSS Expanded Stacked Bar Code Symbol



RSS Expanded Stacked is used when the symbol area or print mechanism is not wide enough to accommodate the full single-row RSS Expanded Symbol. It is designed for variable weight products, perishable products, traceable retail products, and coupons.

5.5.2.4.3 Compressed Element String Sequences

While RSS Expanded™ Symbols can encode any sequence of Application Identifier (AI) data up to the maximum capacity of the symbol, certain sequences of AI Element Strings have been selected for special compression in RSS Expanded versions. If the application requires the use of the AI Element Strings in one of these sequences and they are used in the predefined sequence, a smaller symbol will result.

The selected sequences are two types: fixed length, where the sequence of selected AI Element Strings is the only data encoded, and open-ended, where the sequence occurs at the start of the symbol's data, and other AI Element Strings may be added following the sequence. If the data to be encoded in an RSS Expanded Symbol starts with a sequence defined as fixed length but is followed by additional AI Element Strings, all the data will be encoded normally without special compression.

5.5.2.4.3.1 Fixed-Length Sequences

5.5.2.4.3.1.1 AI (01) and Weight with Limited Range

This sequence consists of the two Application Identifier (AI) Element Strings AI (01), followed by AI (3103), AI (3202), or AI (3203) for weight. The AI (01) Element String must start with an indicator value of 9 for variable measure. Using AI (3103) (weight in grams), the special compression can only be applied up to a maximum weight of 32.767 kg. Using AI (3202) (weight in 0.01 lbs.) the special compression can only be applied up to a maximum weight of 99.99 lbs. Using AI (3203) (weight in 0.001 lbs.) the special compression can only be applied up to a maximum weight of 22.767 lbs. If the weight is in excess of these values, the sequence defined in Section 5.5.2.4.3.1.2 still enables special compression to be performed.

5.5.2.4.3.1.2 AI (01): Weight and Optional Date

This sequence consists of the two or three Application Identifier (AI) Element Strings AI (01), AI (310n), or (320n) for weight (n ranging from 0 to 9) and optionally AI (11), AI (13), AI (15), or AI (17) for date. The AI (01) Element String must start with an indicator value of 9 for variable measure. If the date is not needed, this sequence still gives additional compression when the weight is outside the ranges required by the AI (01) and weight with limited range sequence above.

5.5.2.4.3.2 Open-Ended Sequences

5.5.2.4.3.2.1 AI (01) and Price

This sequence consists of the two Application Identifier (AI) Element Strings, AI (01), followed by AI (392x) for price or AI (393x) for price with ISO currency code (where x is in the range of 0 to 3). The AI (01) Element String must start with an indicator value of 9 for variable measure. For example, this sequence is used for an AI (01) Element String, price and weight, because the fixed-length sequence AI (01) and weight does not give additional compression if the AI Element String for price is added to the end since the length of the sequence is fixed.

5.5.2.4.3.2.2 AI (01)

Any sequence that starts with Application Identifier (AI) (01) will have special compression applied to the AI (01). So when the data includes AI (01), it should always be the first Element String encoded.

5.5.2.5 Human Readable Interpretation in RSS Symbols

The Human Readable Interpretation of data in a bar code must be shown below the bar code symbol.

The precise location of the human readable characters and the font used to represent them are not specified for the Reduced Space Symbology® (RSS) Symbol. However, characters should be clearly legible (such as OCR-B) and must be obviously associated with the symbol.

Application Identifiers (AIs) should be clearly recognisable to facilitate key entry. This is achieved by putting the AI between parentheses in the Human Readable Interpretation.

Note: The parentheses are not part of the data and are not encoded in the bar code symbol, following the same principle that applies to GS1-128 Symbols.

As an option, the data title (see [Section 3.A.4](#)) may be associated with the data instead of using the AI numbers.

Figure 5.5.2.5 – 1 shows the weight and price identified with text.

Figure 5.5.2.5 – 1: The Human Readable Interpretation



5.5.2.6 Data Transmission and Symbology Identifier Prefixes

5.5.2.6.1 Default Transmission Mode

The GS1 System requires the use of Symbology Identifiers. Reduced Space Symbology® (RSS) family symbols are normally transmitted using Symbology Identifier prefix “je0” (see [Section 5.0.3](#)). For example, an RSS Symbol encoding AI (01) Element String 10012345678902 produces the transmitted data string “je00110012345678902.” Data transmission follows the same principles that apply to the concatenation of AI Element Strings from GS1-128 Symbols.

If a 2D Composite Component™ accompanies a RSS family linear symbol, the AI Element String data from the 2D Composite Component immediately follows the linear component’s data. However, readers have an option to transmit only the linear component data and ignore the 2D Composite Component.

5.5.2.6.2 GS1-128 Symbol Emulation Mode

Readers also have an option for GS1-128 Symbol emulation mode. This mode emulates the GS1-128 Symbology for data transmission. This mode is used for applications programmed for GS1-128 but not yet programmed to recognise the Symbology Identifier prefix “je0.” The Symbology Identifier for GS1-128 emulation mode is “JC1.” RSS Expanded™ Symbols that exceed 48 data characters are transmitted as two messages so as not to exceed the maximum GS1-128 Symbol message length. Each of the two messages has a Symbology Identifier prefix of “JC1” and does not exceed 48 data characters. The two messages are split at a boundary between two Element Strings. This mode is inferior to the normal transmission mode as message integrity may be lost when a message is split.

5.5.2.7 Width of a Module (X)

The range of the X-dimension will be defined by the application specification, having due regard to the availability of equipment for the production and reading of symbols and complying with the general requirements of the application.

The X-dimension shall be constant throughout a given symbol.

5.5.2.8 Print Quality Grade

The International Standard *ISO/IEC 15416 Automatic identification and data capture techniques – Bar code print quality test specification – Linear symbols* methodology should be used for measuring and grading the Reduced Space Symbology® (RSS) family of symbols. The *ISO/IEC 15416* print quality specification is functionally identical to the older ANSI and CEN print quality specifications. The print quality grade is measured by verifiers that comply with the standard. The grade includes a grade level, measuring aperture, and the wavelength of light used for the measurement.

The minimum quality grade for RSS Symbols is:

$$1.5 / 6 / 670$$

where

- 1.5 is the overall symbol quality grade.
- 6 is the measuring aperture reference number (corresponding to an 0.15 mm or 0.006 in. diameter aperture).
- 670 is the peak response wavelength in nanometres.

In addition to the minimum print quality grade, all elements in the row separator patterns should be visually distinguishable.

5.5.2.9 Advice for Selecting the Symbology

Any use of Reduced Space Symbology® (RSS) should comply with GS1 System global application guidelines. RSS is not meant to replace other GS1 System Symbologies. Existing applications that are satisfactorily utilising EAN/UPC Symbols, ITF-14 Symbols, or GS1-128 Symbols should continue to use them.

Note: Scanning systems that need to read RSS Symbols must be appropriately programmed.

If RSS is used on items that will be read by omnidirectional slot scanners, then RSS-14™, RSS-14 Stacked Omnidirectional, RSS Expanded™, or RSS Expanded Stacked should be used. If only an AI (01) is to be encoded, then RSS-14 or RSS-14 Stacked Omnidirectional should be used. The selection of one or the other depends on the aspect ratio of the area available for the symbol.

If supplementary Application Identifier (AI) Element Strings are required or the primary identification has an AI other than AI (01), then RSS Expanded or RSS Expanded Stacked must be used. The selection of one or the other depends on the width of the print head or the area available for the symbol.

If RSS is used on small items that do not need omnidirectional scanning capability, then RSS-14 Stacked, RSS Limited™, or RSS-14 Truncated should be used. RSS Limited cannot be used to encode an EAN/UCC-14 number structure with an indicator value greater than 1. Otherwise RSS-14 or RSS-14 Stacked must be used. RSS-14 Stacked is the smallest symbol; however as the heights of both rows are very low, it is harder to scan and cannot be used with wand scanners. If space is available, RSS Limited can be used for number structures that it can encode. Otherwise RSS-14 Truncated should be used for EAN/UCC-14 Data Structures with an indicator value greater than 1.

If the symbol is an RSS Composite Symbol, then using a wider RSS Symbol such as RSS-14 Truncated instead of RSS Limited may be preferable because the wider companion 2D Composite Component™ may result in an RSS Composite Symbol of lower overall height even though the RSS component itself is slightly taller.

If the data capacity in a two-column or three-column CC-B 2D Composite Component is inadequate to encode the required 2D component's data message, then the linear component can be changed to increase the number of columns of the companion CC-B component. This will increase the maximum data capacity of the CC-B component as shown in Figure 5.5.2.9 – 1.

Figure 5.5.2.9 – 1: Data Capacity of CC-B

Number of CC-B Columns	Used with	Maximum Numeric Characters	Maximum Alpha Characters
2	RSS-14 Stacked RSS-14 Stacked Omnidirectional	95	55
3	RSS Limited	219	127
4	RSS-14 RSS Expanded RSS Expanded Stacked	338	196

5.5.3 Composite Symbology®

5.5.3.1 Composite Symbology® Introduction

The Composite Symbology® integrates both a GS1 System linear symbol and a 2D Composite Component™ as a single symbology. There are three types of Composite Symbols A, B and C, each with different encoding rules. The encoder model is designed to automatically select the appropriate type and optimise.

The linear component encodes the item's primary identification. The adjacent 2D Composite Component encodes supplementary data, such as a batch number and expiration date. The Composite Symbol always includes a linear component so that the primary identification is readable by all scanning technologies. The Composite Symbol always includes a multi-row 2D Composite Component that can be read with linear- and area-CCD scanners, and with linear and rastering laser scanners.

The Composite Symbology is described in the Automatic Identification Manufacturers, Inc. *AIM ITS 99-002 - International Symbology Specification - Composite Symbology*.

5.5.3.1.1 Composite Symbology® Characteristics

The characteristics of the Composite Symbology® are:

- Encodable character set:
 - Linear components:
 - EAN/UPC Symbol, RSS-14™ Symbol versions, and RSS Limited™ Symbol: digits 0 through 9
 - GS1-128 Symbol and RSS Expanded™ Symbol: a subset of Table 1 of the International Standard ISO/IEC 646, consisting of the uppercase and lowercase letters, digits, spaces, and 20 selected punctuation characters in addition to the Function 1 Character (FNC1)
 - 2D Composite Components™:
 - All types: GS1-128 Symbols and RSS Expanded Symbols together with the symbol separator character
 - Additionally, for CC-B and CC-C: 2D Composite Component escape character
- Symbol character structure: Various (n,k) symbol characters are used in accordance with the underlying symbology of the selected linear and 2D Composite Components of the symbol.
- Code type:
 - Linear component: continuous, linear bar code symbology
 - 2D Composite Component: continuous, multi-row bar code symbology
- Maximum numeric data capacity:
 - Linear component:
 - GS1-128 Symbol: up to 48 digits
 - EAN/UPC Symbol: 8, 12, or 13 digits
 - RSS Expanded Symbol: up to 74 digits
 - Other RSS Symbols: 16 digits
 - 2D Composite Component:
 - CC-A: up to 56 digits
 - CC-B: up to 338 digits
 - CC-C: up to 2,361 digits

- Error detection and correction:
 - Linear component: a modulo check value for error detection
 - 2D Composite Component: a fixed or variable number of Reed-Solomon error correction codewords, depending upon the specific 2D Composite Component
- Character self-checking
- Bi-directionally decodable

5.5.3.1.2 Additional Features

The following is a summary of additional Composite Symbology® features:

- Data compaction: The 2D Composite Components™ utilise a bit-oriented compaction mode designed to encode data efficiently using Application Identifiers (AIs).
- Component linkage: The 2D Composite Component of each Composite Symbol contains a linkage flag, which indicates to the reader that no data shall be transmitted unless the associated linear component is also scanned and decoded. All linear components except EAN/UPC Symbols also contain an explicit linkage flag.
- GS1-128 Symbol emulation: Readers set to the GS1-128 Symbol emulation mode transmit the data encoded within the Composite Symbol as if the data were encoded in one or more GS1-128 Symbols.
- A symbol separator character: a flag character to support future applications that instructs the reader to terminate transmission of the message at that point and to transmit the remaining data as a separate message
- 2D Composite Component escape mechanism: a mechanism to support future applications that require data content beyond the ISO 646 subset encodable in the standard form of the Composite Symbology

5.5.3.2 Symbol Structure

Each Composite Symbol consists of a linear component and a multi-row 2D Composite Component™. The 2D Composite Component is printed above the linear component. The two components are separated by a separator pattern. Up to 3X of light space is permitted between the separator pattern and 2D Composite Component to facilitate printing the two components separately; however, if the two components are printed at one time, the nominal alignment should be followed as shown in Figure 5.5.3.2 – 1.

Figure 5.5.3.2 – 1: RSS Limited Composite Symbol with CC-A



(01)13112345678906(17)010615(10)A123456

In Figure 5.5.3.2 – 1, the AI (01) Global Trade Item Number™ (GTIN™) is encoded in the RSS Limited™ linear component. The AI (17) expiration date and the AI (10) lot number are encoded in the CC-A 2D Composite Component.

The linear component is one of the following:

- A member of the EAN/UPC Symbology (EAN-13, EAN-8, UPC-A, or UPC-E)
- A member of the Reduced Space Symbology® (RSS) family
- A GS1-128 Symbol

The choice of linear component determines the name of the Composite Symbol, such as an EAN-13 Composite Symbol, or a GS1-128 Composite Symbol.

The 2D Composite Component (abbreviated as CC) is chosen based on the selected linear component and on the amount of supplementary data to be encoded. The three 2D Composite Components, listed in order of increasing maximum data capacity, are:

- CC-A: a variant of MicroPDF417
- CC-B: a MicroPDF417 symbol with new encoding rules
- CC-C: a PDF417 symbol with new encoding rules

Figure 5.5.3.2 – 2: GS1-128 Composite Symbol with CC-C



(01)03812345678908(10)ABCD123456(410)3898765432108

In Figure 5.5.3.2 – 2, the AI (01) GTIN is encoded in the GS1-128 Symbol linear component. The AI (10) lot number and the AI (410) ship-to location are encoded in the CC-C 2D Composite Component.

Based upon the width of the linear component, a choice of “best-fit” 2D Composite Component is specified. Figure 5.5.3.2 – 3 lists all of the permissible combinations.

Figure 5.5.3.2 – 3: Permissible Combinations of Linear and 2D Composite Components

Linear Component	CC-A/CC-B	CC-C
UPC-A and EAN-13	Yes (4-columns)	No
EAN-8	Yes (3-columns)	No
UPC-E	Yes (2-columns)	No
GS1-128	Yes (4-columns)	Yes (variable width)
RSS-14™ and RSS-14 Truncated	Yes (4-columns)	No
RSS-14 Stacked and RSS-14 Stacked Omnidirectional	Yes (2-columns)	No
RSS Limited	Yes (3-columns)	No
RSS Expanded™ and RSS Expanded Stacked	Yes (4-columns)	No

5.5.3.2.1 CC-A Structure

CC-A is a variant of MicroPDF417 with a unique combination of row address patterns (RAP). It is the smallest of the 2D Composite Components™ and can encode up to 56 digits. It has from 3 to 12 rows and 2 to 4 columns.

Each row is a minimum of 2X high (where X is the width of a module, narrow bar or space). A 1X high minimum separator pattern is positioned between the linear component and 2D Composite Component. (A different separator pattern, 6X high, is used in Composite Symbols with EAN/UPC linear components).

Each column contains one $n,k = 17,4$ data or error correction character (codeword) per row (n is the number of modules, and k is the number of bars and also the number of spaces). So the width of a codeword is 17X.

In addition to the codeword columns, CC-A has two or three $n,k = 10,3$ RAP columns that encode the row numbers (each 10X wide). The rightmost RAP column is terminated on the right by a 1X bar so it is 11X instead of 10X wide.

Each row also requires a 1X Quiet Zone at each end. There is no Quiet Zone required above CC-A. The separator pattern is printed directly above the linear component and no Quiet Zone is required below the CC-A.

The two-column and three-column CC-A versions have two RAP columns, and the four-column CC-A version has three RAP columns, as shown in Figure 5.5.3.2.1 – 1.

Figure 5.5.3.2.1 – 1: CC-A Column Structures

Two-Column CC-A Structure

Quiet Zone	RAP Column	Codeword Column	Codeword Column	RAP Column	Quiet Zone

Three-Column CC-A Structure

Quiet Zone	Codeword Column	RAP Column	Codeword Column	Codeword Column	RAP Column	Quiet Zone

Four-Column CC-A Structure

Quiet Zone	RAP Column	Codeword Column	Codeword Column	RAP Column	Codeword Column	Codeword Column	RAP Column	Quiet Zone

Figure 5.5.3.2.1 – 2 lists all possible column and row combinations for CC-A. It also shows the capacity and size of the 2D Composite Components. For example, a two-column, five-row CC-A would be 57X wide (including 1X for the extra right-most guard bar) by 10X high (not including the separator pattern). With an X-dimension of 0.25 mm (0.010 in.), it would be 14.25 mm (0.57 in.) wide by 2.50 mm (0.10 in.) high.

Figure 5.5.3.2.1 – 2: CC-A Row and Column Sizes

Number of Data Columns (c)	Number of Rows (r)	Total CWs in Data Region	Number of EC CWs (k)	Percent of CWs for EC	Number of CWs for Data	Max Alpha Chars	Max Digits	Component Width, in X (see Note 1)	Component Height, in X (see Note 2)
2	5	10	4	40.00%	6	8	16	57	10
2	6	12	4	33.33%	8	12	22	57	12
2	7	14	5	35.71%	9	13	24	57	14
2	8	16	5	31.25%	11	17	30	57	16
2	9	18	6	33.33%	12	18	33	57	18
2	10	20	6	30.00%	14	22	39	57	20
2	12	24	7	29.17%	17	26	47	57	24
3	4	12	4	33.33%	8	12	22	74	8
3	5	15	5	33.33%	10	15	27	74	10
3	6	18	6	33.33%	12	18	33	74	12
3	7	21	7	33.33%	14	22	39	74	14
3	8	24	7	29.17%	17	26	47	74	16
4	3	12	4	33.33%	8	12	22	101	6
4	4	16	5	31.25%	11	17	30	101	8
4	5	20	6	30.00%	14	22	39	101	10
4	6	24	7	29.17%	17	26	47	101	12
4	7	28	8	28.57%	20	31	56	101	14

CW = Codeword; EC = Error Correction

Note 1: Includes a 1X Quiet Zone on each side

Note 2: Assumes row height = 2X; does not include separator pattern

5.5.3.2.2 CC-B Structure

CC-B is a MicroPDF417 symbol uniquely identified by the codeword 920 as the first codeword in the symbol. Encoding systems normally automatically select CC-B when the data to be encoded exceeds the capacity of CC-A. CC-B can encode up to 338 digits. It has from 10 to 44 rows and 2 to 4 columns.

Each row is a minimum of 2X high (where X is the width of a module, narrow bar or space). A 1X high minimum separator pattern is positioned between the linear component and 2D Composite Component™. (A different separator pattern, 6X high, is used in Composite Symbols with EAN/UPC linear components).

Each column contains one n,k = 17,4 data or error correction character (codeword) per row (where n is the number of modules, and k is the number of bars and also the number of spaces). So the width of a codeword is 17X.

In addition to the codeword columns, CC-B has two or three n,k = 10,3 row address pattern (RAP) columns that encode the row numbers (each 10X wide). The rightmost RAP column is terminated on the right by a 1X bar, so it is 11X instead of 10X wide.

Each row also requires a 1X Quiet Zone on each end. There is no Quiet Zone required above CC-B. The separator pattern is printed directly above the linear component and no Quiet Zone is required below the CC-B.

The two-column CC-B version has two RAP columns and the three- and four-column CC-B versions have three RAP columns, as shown in Figure 5.5.3.2.2 – 1.

Figure 5.5.3.2.2 – 1: CC-B Column Structures

Two-Column CC-B Structure

Quiet Zone	RAP Column	Codeword Column	Codeword Column	RAP Column	Quiet Zone

Three-Column CC-B Structure

Quiet Zone	RAP Column	Codeword Column	RAP Column	Codeword Column	Codeword Column	RAP Column	Quiet Zone

Four-Column CC-B Structure

Quiet Zone	RAP Column	Codeword Column	Codeword Column	RAP Column	Codeword Column	Codeword Column	RAP Column	Quiet Zone

CC-B differs from CC-A in the three-column structure in that CC-B has a third RAP column on the left end that is missing in CC-A.

Figure 5.5.3.2.2 – 2 lists all the possible column and row combinations for CC-B. It also shows the capacity and size of the 2D Composite Components. For example a four-column, 10-row CC-B would be 101X wide by 20X high (not including the separator pattern). With an X-dimension of 0.25 mm (0.010 in.), it would be 25.25 mm (1.01 in.) wide by 5.00 mm (0.20 in.) high.

Figure 5.5.3.2.2 – 2: CC-B Row and Column Sizes

Number of Data Columns (c)	Number of Rows (r)	Total CWs in Data Region	Number of EC CWs (k)	Percent of CWs for EC	Number of non-EC CWs	Number of CWs for Data (Note 1)	Max Alpha chars	Max Digits	CC-B Width, in X (see Note 2)	CC-B Height, in X (see Note 3)
2	17	34	10	29	24	22	34	59	57	34
2	20	40	11	28	29	27	42	73	57	40
2	23	46	13	28	33	31	48	84	57	46
2	26	52	15	29	37	35	55	96	57	52
3	15	45	21	47	24	22	34	59	84	30
3	20	60	26	43	34	32	50	86	84	40
3	26	78	32	41	46	44	68	118	84	52
3	32	96	38	40	58	56	88	153	84	64
3	38	114	44	39	70	68	107	185	84	76
3	44	132	50	38	82	80	127	219	84	88
4	10	40	16	40	24	22	34	59	101	20
4	12	48	18	38	30	28	43	75	101	24
4	15	60	21	35	39	37	58	100	101	30
4	20	80	26	33	54	52	82	141	101	40
4	26	104	32	31	72	70	111	192	101	52
4	32	128	38	30	90	88	139	240	101	64
4	38	152	44	29	108	106	168	290	101	76
4	44	176	50	28	126	124	196	338	101	88

CW = Codeword; EC = Error correction

Note 1: Excludes EC codewords and 2 codewords to define CC-B encodation

Note 2: Including 1X Quiet Zones on either side

Note 3: Assumes $Y = 2X$; does not include separator pattern

5.5.3.2.3 CC-C Structure

CC-C is a PDF417 symbol uniquely identified by the codeword 920 as the first codeword in the symbol following the symbol length descriptor. CC-C can be used as a 2D Composite Component™ within a GS1-128 Composite Symbol. It has the greatest data capacity of the Composite Symbols, encoding up to 2,361 digits. It has from 3 to 30 rows and 1 to 30 data/EC codeword columns.

Each row is a minimum of 3X high (where X is the width of a module, narrow bar or space). A 1X high minimum separator pattern is positioned between the linear component and 2D Composite Component.

Each column contains one $n, k = 17, 4$ data or error correction character (codeword) per row (where n is the number of modules, and k is the number of bars and also the number of spaces). So the width of a data/EC codeword is 17X.

In addition to the codeword columns, CC-C has two 17,4 row indicator columns, a 17X wide start pattern, and a 18X wide stop pattern as illustrated in Figure 5.5.3.2.3 – 1.

Each row also requires a 2X Quiet Zone on each end. There is no Quiet Zone required above CC-C. The separator pattern is printed directly above the linear component, and no Quiet Zone is required below the CC-C.

Figure 5.5.3.2.3 – 1: CC-C Row Structure

Quiet Zone	Start Pattern	Left Row Indicator Column	1 to 30 Data/EC Codeword Columns	Right Row Indicator Column	Stop Pattern	Quiet Zone

CC-C is normally printed with the number of columns that will result in a width nearly matching the width of the GS1-128 Symbol linear component. However, as an option, the user may specify a wider CC-C to be printed. This reduces the height of the 2D Composite Component. A lower Composite Symbol may be needed to fit in a height-restricted application. A wider CC-C may also be required if the amount of data would not fit in the default width CC-C.

5.5.3.2.4 Special Compressed Element String Sequences

While 2D Composite Components™ can encode any sequence of Application Identifier (AI) Element Strings up to the maximum capacity of the component, certain sequences of AI Element Strings have been selected for special compression in 2D Composite Component Symbols. If the application requires the use of the AI Element Strings in one of these sequences, and they are used in the predefined sequence, a smaller symbol will result.

For special compression to be performed, the AI Element String sequence must occur at the start of the 2D Composite Component's data. Other AI Element Strings may be added following the sequence.

The AI Element Strings selected for special compression are:

- Production date and lot number: AI (11) production date followed by AI (10) lot number
- Expiration date and lot number: AI (17) expiration date followed by AI (10) lot number
- AI (90): AI (90) followed by the Element String data starting with an alphabetic character and a digit; AI (90) may be used to encode data identifier data; the AI (90) followed by data in the data identifier format has special compression applied only if it is the start of the first Element String.

5.5.3.3 Human Readable Interpretation in Composite Symbols

The Human Readable Interpretation of the linear component of the Composite Symbol must be shown below the linear component. If there is a Human Readable Interpretation of the 2D Composite Component™, there is no required location, but it should be close to the Composite Symbol.

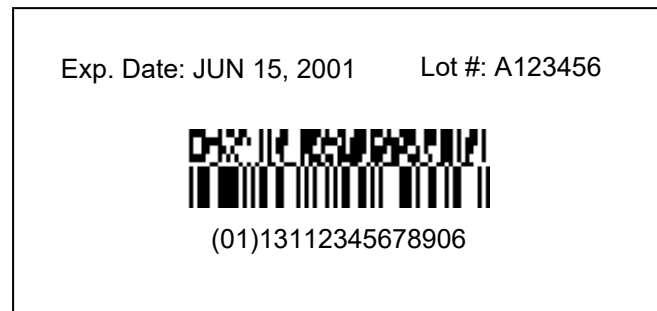
The precise location of the human readable characters and the font used to represent them are not specified for Composite Symbols. However, the characters should be clearly legible (such as OCR-B) and must be obviously associated with the symbol.

Application Identifiers (AIs) should be clearly recognisable to facilitate key entry. This is achieved by putting the AI between parentheses in the Human Readable Interpretation.

Note: The parentheses are not part of the data and are not encoded in the bar code symbol, following exactly the same principle that applies to GS1-128 Symbols.

As an option, the data title (see [Section 3.A.4](#)) may be associated with the data instead of using AIs. Figure 5.5.3.3. – 1 shows the expiration date and lot number identified with text. This can be compared with [Figure 5.5.3.2 – 1](#), where the same data is shown using the all-AI format.

Figure 5.5.3.3. –1: The Human Readable Interpretation



For Composite Symbols encoding a large amount of data, it may not be practical to display all the data in Human Readable Interpretation form or, even if there is space to show it in this form, it may not be practical to key enter that much data. In these instances, some of the data may be omitted from the Human Readable Interpretation. However, primary identification data such as the Global Trade Item Number™ (GTIN™) and Serial Shipping Container Code (SSCC) must always be shown. Application specifications provide guidance on Human Readable Interpretation.

5.5.3.4 Data Transmission and Symbology Identifier Prefixes

5.5.3.4.1 Default Transmission Mode

The GS1 System requires the use of Symbology Identifiers. Composite Symbols are normally transmitted using Symbology Identifier prefix “je0,” with the data from the 2D Composite Component™ directly appended to that of the linear component. For example, an Composite Symbol encoding (01)10012345678902(10)ABC123 produces the data string “je0011001234567890210ABC123” (note that the Symbology Identifier prefix “je0” is different from the Symbology Identifier prefix “JE0,” which has an uppercase “E” and is used for standard EAN/UPC Symbols). However, readers have an option to transmit only the linear component data and ignore the 2D Composite Component.

Data transmission follows the same principles that apply to the concatenation of Application Identifier (AI) Element Strings from GS1-128 Symbols. If the linear component data ends with a variable length AI Element String, an ASCII 29 character (°s) is inserted between it and the first character of the data from the 2D Composite Component.

5.5.3.4.2 GS1-128 Symbol Transmission Mode

Readers also have an option for GS1-128 Symbol emulation mode. This mode emulates the GS1-128 Symbology for data transmission. It can be used for applications programmed for GS1-128 Symbols but not yet programmed to recognise the Symbology Identifier prefix “je0.” The Symbology Identifier for GS1-128 Symbol emulation mode is “JC1.” Composite Symbols that exceed 48 data characters are transmitted as two or more messages so as not to exceed the maximum GS1-128 Symbol message length. Each of the messages has a Symbology Identifier prefix of “JC1” and does not exceed 48 data characters. The messages are split at boundaries between Element Strings. This mode is inferior to the normal transmission mode as message integrity may be lost when a message is split into multiple messages.

5.5.3.4.3 Symbol Separator Character

The 2D Composite Component™ can encode symbol separator characters as defined in the decoder. This character instructs the reader to terminate the current Composite Symbol's data message and transmit the data following the symbol separator as a separate message. This new message will have the Symbology Identifier prefix of "je1." This feature will be used for future GS1 System applications such as encoding the mixed contents of a logistical container.

5.5.3.4.4 2D Composite Component™ Escape Mechanism

The CC-B and CC-C also can encode 2D Composite Component™ escape mechanism codewords. These instruct the reader to terminate the current Composite Symbol's data message and transmit the data following the escape mechanism codeword as a separate message. This new message has the Symbology Identifier prefix of "je2" for standard data message or "je3" if the data message includes an ECI codeword. The codewords following the escape mechanism codeword are encoded and decoded using the standard PDF417 encoding defined in *ISO/IEC 15438 – Automatic identification and data capture techniques - Symbology specification - PDF417*. This feature is used for future GS1 System applications that require characters beyond the ISO 646 character subset defined for Application Identifier (AI) Element String data.

5.5.3.5 Width of a Module (X)

The X-dimension of the 2D Composite Component™ must be the same as that of the associated linear component. Refer to the linear component's X-dimension requirements.

5.5.3.6 Print Quality

The print quality assessment methodology defined in the International Standard *ISO/IEC 15416* should be used for measuring and grading the linear components. The ISO print quality specification is functionally identical to the older ANSI and CEN print quality specifications. The print quality grade is measured by verifiers that apply the standard. The print quality grade reported includes a grade level, measuring aperture, and the wavelength of light used for the measurement.

AIM ITS 99-002 – International Symbology Specification - MicroPDF417 and *ISO/IEC 15438 – Automatic identification and data capture techniques - Symbology specification - PDF417* specify the methods for determining the print quality grade of the 2D Composite Components™ CC-A/B and CC-C respectively. An additional grading parameter unused error correction (UEC) is defined in these specifications.

The minimum quality grade for Composite Symbols is:

$$1.5 / 6 / 670$$

where

- 1.5 is the overall symbol quality grade.
- 6 is the measuring aperture reference number (corresponding to an 0.15 mm or 0.006 in. diameter aperture).
- 670 is the peak response wavelength in nanometres. In addition to the print quality grade, all elements in the separator patterns should be visually distinguishable.

Both the linear component and the 2D Composite Component must independently achieve the minimum print quality grade.

Note: An international standard methodology for quality grading two-dimensional symbologies is under development and may eventually supersede the method defined in the above specifications.

5.5.3.7 Advice for Selecting the Symbology

Any use of the 2D Composite Component™ should comply with GS1 System global application guidelines. The linear component of an Composite Symbol should be selected according to the application rules defined in these *GS1 General Specifications*, but where a choice of linear components is available for the application, consideration should also be given to the 2D Composite Component options available. A wider linear component will result in a shorter 2D Composite Component and, particularly for CC-B, a higher capacity symbol.

For CC-A and CC-B, the selection of the linear component automatically determines the number of columns of the 2D Composite Component. The selection of CC-A or CC-B is automatically determined by the amount of data to be encoded. CC-A is always used unless the data exceeds its capacity.

When the linear component is a GS1-128 Symbol, the user may specify CC-A/B or CC-C. CC-A/B will produce a smaller 2D Composite Component. However, CC-C can increase in width to match the width of the GS1-128 Symbol or be selected to be even wider. This may produce an Composite Symbol of lower height. CC-C also has a larger data capacity, so it is suitable for applications such as logistics.

5.5.3.8 Sample Composite Symbols

Figure 5.5.3.8 – 1: EAN-13 Symbol with a Four-Column CC-A Component



Figure 5.5.3.8 – 2: UPC-A Symbol with a Four-Column CC-B Component



Figure 5.5.3.8 – 3: EAN-8 Symbol with a Three-Column CC-A



Figure 5.5.3.8 – 4: UPC-E Symbol with a Two-Column CC-A



Figure 5.5.3.8 – 5: RSS-14™ Symbol with a Four-Column CC-A:



(01)03612345678904(11)990102

Figure 5.5.3.8 – 6: RSS-14 Stacked Symbol with a Two-Column CC-A



(01)03412345678900(17)010200

Figure 5.5.3.8 – 7: RSS Limited™ Symbol with a Three-Column CC-B



(01)03512345678907

Note: The three-column CC-B is wider than the three-column CC-A shown in [Figure 5.5.3.2 – 1](#).

Figure 5.5.3.8 – 8: RSS Expanded™ Symbol with a Four-Column CC-A



(01)93712345678904(3103)001234
(91)1A2B3C4D5E

Figure 5.5.3.8 – 9: GS1-128 Symbol with a Four-Column CC-A



(01)03212345678906
(21)A1B2C3D4E5F6G7H8

Section 5.6:

Data Matrix Symbology

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5.6.1 Introduction

This section of the *GS1 General Specifications* addresses some of the technical aspects of the two-dimensional bar code symbology called Data Matrix. Data Matrix is a standalone, two-dimensional matrix symbology that is made up of square modules arranged within a perimeter finder pattern. Unlike a Composite Component[®] symbol (see [Section 5.5](#)), Data Matrix does not require a linear symbol. Data Matrix has been used in the public domain since 1994.

This section provides only a brief technical description and overview of the Data Matrix symbology. A more detailed technical specification can be found in the International Standard *ISO/IEC 16022 Information technology - International Symbology Specification - Data Matrix*. The GS1 System has adopted Data Matrix partly because it can encode GS1 System data structures and offers other technical advantages. Its compact design and the existence of various production methods that accommodate placing the symbology onto various substrates offer certain advantages over other symbologies currently in the GS1 System.

Data Matrix ISO version ECC 200 is the only version that supports GS1 System data structures, including Function Code 1. The ECC 200 version of Data Matrix uses Reed-Solomon error correction, and this feature helps correct for partially damaged symbols. In the remainder of this section, the ECC 200 version of Data Matrix is assumed when the symbology is described as Data Matrix or DM. This version of Data Matrix is similar in stability to ISO versions of current GS1 System symbologies.

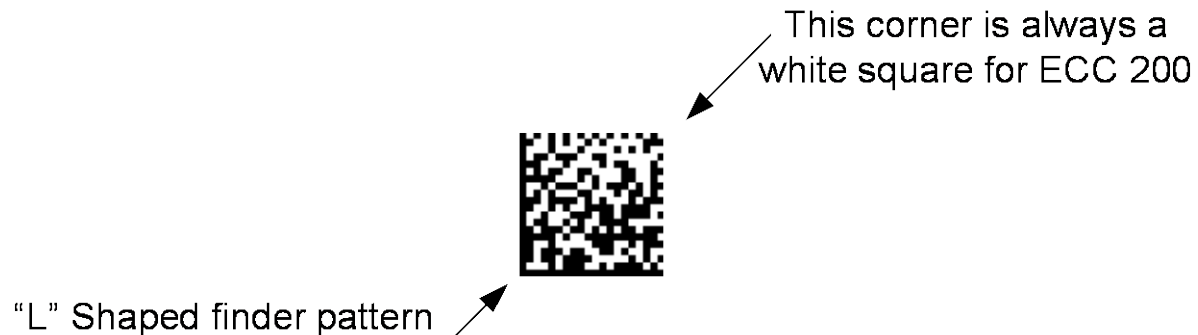
Implementation of Data Matrix shall be done per approved GS1 System application guidelines. This section will not describe the specific applications. The user needs to refer to specific application standards and guidelines in other sections of these *GS1 General Specifications* as they are approved for use. However, some of the production processes that can be used to produce Data Matrix Symbols are as follows:

- Direct part marking, such as is done by dot peening on items, such as automotive, aircraft metal parts, medical instruments, and surgical implants
- Laser or chemically etched parts with low contrast or light marked elements on a dark background (e.g., circuit boards and electronic components, medical instruments, and surgical implants)
- High-speed ink jet printed parts and components where the marked dots cannot form a scannable linear symbol
- Very small items that require a symbology with a square aspect ratio and/or cannot be marked within the allocated packaging space by existing Reduced Space Symbology[®] (RSS) and Composite Symbols

Data Matrix Symbols are read by two-dimensional imaging scanners or vision systems. Most other scanners that are not two-dimensional imagers cannot read Data Matrix. Data Matrix Symbols are restricted for use with new niche applications that will involve imaging scanners throughout the supply chain.

5.6.2 Data Matrix Features and Symbol Basics

Figure 5.6.2 – 1: Data Matrix Symbol



- Figure 5.6.2 – 1 represents a Data Matrix Symbol with 20 rows and 20 columns (including the perimeter finder pattern but not including Quiet Zones).
- Data Matrix solid “L” shaped finder or alignment pattern is one module wide.
- Data Matrix Quiet Zone is one module wide on all four sides. As with other bar code Quiet Zones, do not print in this area.
- ECC 200 symbols can always be recognized from older versions of Data Matrix because the corner opposite the middle of the finder pattern is a zero module or white in normal print.
- For Square Data Matrix symbols, only an even number of rows and columns exist. Depending on data requirements, symbols can range from 10 row by 10 columns (10 x10) to 144x144 (including finder pattern but not the Quiet Zone)
- For normal printing, a module is one X by one X in dimension. Representation of data: A dark module is a binary one and a light module is a binary zero (or a light module is a binary one and a dark module is a binary zero for a symbol with reflectance reversal).
- ECC 200 (ECC = Error Checking and Correction) that uses Reed-Solomon error correction. Figure 5.6.3.2 – 1: ECC 200 Square Symbol Attributes shows the fixed amounts of error correction associated for each allowable Data Matrix Symbol size.
- FNC1 for GS1 System compatibility can be encoded at the beginning of the data string and as a group separator. When a FNC1 is used as a group separator, it shall be represented in the transmitted message by the ASCII character <GS> (ASCII value 29).
- Encodable character set:
 - Values 0 - 127 in accordance with ISO/IEC 646 International Reference Version (e.g., all 128 ASCII characters)
 - Values 128 - 255 in accordance with ISO/IEC 8859-1; Latin alphabet No. 1. These are referred to as extended ASCII.
 - The GS1 System requires that only the subset of ISO/IEC 646 International Reference Version defined in these *GS1 General Specifications* be used for Application Identifier (AI) Element Strings.

- Data characters per symbol (for the maximum symbol size):
 - Alphanumeric data: up to 2335 characters
 - Eight-bit byte data: 1556 characters
 - Numeric data: 3116 digits
- Large, square ECC symbols (at least 32 X32) will include alignment patterns to separate the data regions.
- Code type: matrix (Composite Component[®] is a stacked type)
- Orientation independence: Yes (requires a two-dimensional imaging scanner)
- Summary of additional features inherent or optional in Data Matrix:
 - Reflectance reversal: (Inherent) Symbols can be read when marked so that the image is either dark on light or light on dark.
 - Rectangular symbols: Six symbol formats are specified in a rectangular form.
 - Extended Channel Interpretation (ECI) capability allows Data Matrix to encode data from other alphabets.

5.6.3 Data Matrix Symbology

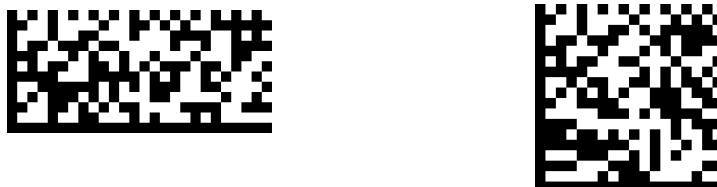
The technical description of Data Matrix contained within this section provides additional information based on ISO technical specification 16022, and it is provided as a further aid in the development of specific applications. Data Matrix Symbols shown in the following subsections have been magnified to show detail; otherwise, they might not be seen clearly.

5.6.3.1 Square and Rectangular Formats

Data Matrix may be printed in a square or rectangular format. The square format is usually used as it has a larger range of sizes and is the only format available for symbols encoding a large amount of data. The largest rectangular symbol can encode 98 digits, while the largest square symbol can encode 3,116 digits. An enlarged rectangular symbol and an equivalent square symbol are shown in Figure 5.6.3.1 – 1.

Figure 5.6.3.1 – 1: Rectangular and Square Data Matrix Symbols

(Specific applications are not used in the data encodation. Both symbols contain the same data)



5.6.3.2 Data Matrix Symbol Sizes

Data Matrix Symbology has multiple sizes to match various data content (see Figure 5.6.3.2 – 1). Data Matrix Symbols have 24 sizes of the square format ranging from 10 by 10 modules up to 144 by 144 modules, not including the 1-X surrounding Quiet Zone. The rectangular format has 6 sizes from 8 by 18 modules up to 16 by 48 modules not including the 1-X surrounding Quiet Zone. Data Matrix sizes of 52 by 52 or larger have 2 to 10 interleaved blocks of Reed-Solomon error correction codewords.

The term “codeword” is used often to describe attributes concerning the encoding of data into Data Matrix Symbols. *ISO 16022* defines codeword as “A symbol character value. An intermediate level of coding between source data and the graphical encoding in the symbol.” Codewords are typically eight bits of data. FNC1, two numerics, and one alpha all take up one codeword each.

Figure 5.6.3.2 – 1: ECC 200 Square Symbol Attributes***

Symbol Size*		Data Region		Mapping	Total		Reed-Solomon		Inter-	Data Capacity			Error	Max. Correctable
				Matrix	Codewords		Block		leaved	Num.	Alphanum.	Byte	Correction	Codeword
Row	Col	Size	No.	Size	Data	Error	Data	Error	Blocks	Cap.	Cap.	Cap.	Overhead %	Error/Erasure
10	10	8x8	1	8x8	3	5	3	5	1	6	3	1	62.5	2/0
12	12	10x10	1	10x10	5	7	5	7	1	10	6	3	58.3	3/0
14	14	12x12	1	12x12	8	10	8	10	1	16	10	6	55.6	5/7
16	16	14x14	1	14x14	12	12	12	12	1	24	16	10	50	6/9
18	18	16x16	1	16x16	18	14	18	14	1	36	25	16	43.8	7/11
20	20	18x18	1	18x18	22	18	22	18	1	44	31	20	45	9/15
22	22	20x20	1	20x20	30	20	30	20	1	60	43	28	40	10/17
24	24	22x22	1	22x22	36	24	36	24	1	72	52	34	40	12/21
26	26	24x24	1	24x24	44	28	44	28	1	88	64	42	38.9	14/25
32	32	14x14	4	28x28	62	36	62	36	1	124	91	60	36.7	18/33
36	36	16x16	4	32x32	86	42	86	42	1	172	127	84	32.8	21/39
40	40	18x18	4	36x36	114	48	114	48	1	228	169	112	29.6	24/45
44	44	20x20	4	40x40	144	56	144	56	1	288	214	142	28	28/53
48	48	22x22	4	44x44	174	68	174	68	1	348	259	172	28.1	34/65
52	52	24x24	4	48x48	204	84	102	42	2	408	304	202	29.2	42/78
64	64	14x14	16	56x56	280	112	140	56	2	560	418	277	28.6	56/106
72	72	16x16	16	64x64	368	144	92	36	4	736	550	365	28.1	72/132
80	80	18x18	16	72x72	456	192	114	48	4	912	682	453	29.6	96/180
88	88	20x20	16	80x80	576	224	144	56	4	1152	862	573	28	112/212

96	96	22x22	16	88x88	696	272	174	68	4	1392	1042	693	28.1	136/260
104	104	24x24	16	96x96	816	336	136	56	6	1632	1222	813	29.2	168/318
120	120	18x18	36	108x108	1050	408	175	68	6	2100	1573	1047	28	204/390
132	132	20x20	36	120x120	1304	496	163	62	8	2608	1954	1301	27.6	248/472
144	144	22x22	36	132x132	1558	620	156	62	8**	3116	2335	1556	28.5	310/590
							155	62	2**					

Figure 5.6.3.2 – 2: ECC 200 Rectangular Symbol Attributes***

Symbol Size*		Data Region		Mapping	Total		Reed-Solomon		Inter-	Data Capacity			Error	Max. Correctable
				Matrix	Codewords		Block		leaved	Num.	Alphanum.	Byte	Correction	Codeword
Row	Col	Size	No.	Size	Blocks	Cap.	Cap.	Cap.	Blocks	Cap.	Cap.	Cap.	Overhead %	Error/Erasure
8	18	6x16	1	6x16	5	7	5	7	1	10	6	3	58.3	3/+
8	32	6x14	2	6x28	10	11	10	11	1	20	13	8	52.4	5/+
12	26	10x24	1	10x24	16	14	16	14	1	32	22	14	46.7	7/11
12	36	10x16	2	10x32	22	18	22	18	1	44	31	20	45.0	9/15
16	36	14x16	2	14x32	32	24	32	24	1	64	46	30	42.9	12/21
16	48	14x22	2	14x44	49	28	49	28	1	98	72	47	36.4	14/25

* Note: Symbol size does not include Quiet Zones.

** Note: In the largest symbol (144x144), the first eight Reed-Solomon blocks shall be 218 codewords long encoding 156 data codewords. The last two blocks shall encode 217 codewords (155 data codewords). All the blocks have 62 error correction codewords.

*** Equivalent to Table 11 in the international standard *ISO-16022*, first edition, 2000-05-01.

The square format is divided into 4 to 36 data regions for symbols sized 32 by 32 modules and larger. The rectangular format symbols may also be divided into two data regions. Each data region is separated from the other regions by alignment patterns that consist of an alternating pattern of ones and zeroes and a solid line of ones (a dark line when there is no reflectance reversal). Figure 5.6.3.2-3 shows a four-segment square symbol on the left and a two-segment rectangular symbol on the right, each with hypothetical data shown to create the effect.

Figure 5.6.3.2 – 3: Segmented Data Matrix Symbols: Square and Rectangular Formats

(Sizes of these Data Matrix Symbols are larger than what would be used in a typical application so that typical alignment patterns can be easily seen.)



5.6.3.3 Data Transmission and Symbology Identifier Prefixes

The GS1 System requires the use of Symbology Identifiers. Data Matrix uses the Symbology Identifier of "jd2" (see Figure 5.6.3.3 - 1) for GS1 System compliant symbols that have a leading FNC1 character. This indicates that Application Identifier (AI) data is encoded equivalent to the Symbology Identifier "JC1" for GS1-128 Symbols and "je0" for Reduced Space Symbology® (RSS) and Composite Symbols. For more information on Symbology Identifiers, see the International standard *ISO/IEC 15424 Information technology — Automatic identification and data capture techniques — Data Carrier Identifiers*.

For example, a Data Matrix Symbol encoding AI (01) Element String 10012345678902 produces the transmitted data string "jd20110012345678902." Data transmission follows the same principles that apply to the concatenation of AI Element Strings from GS1-128 Symbols or RSS Expanded®.

Figure 5.6.3.3 – 1: Symbology Identifier for Data Matrix ECC 200

	Message Content	Separator
jd2	Standard AI Element Strings	None

5.6.3.4 Width and Height of a Module (X)

The range of the X-dimensions will be defined by the application specification, having due regard to the availability of equipment for the production and reading of symbols and complying with the general requirements of the application.

The X-dimension shall be constant throughout a given symbol. The X-dimension should apply to both the width and height of the modules.

5.6.3.5 Symbol Quality Grade

The International Standard *ISO/IEC 15415 Information technology - Automatic identification and data capture techniques - Bar code symbol print quality test specification - Two-dimensional symbols* methodology shall be used for measuring and grading Data Matrix. The print quality grade is measured by verifiers that comply with the standard. The grade includes a grade level, measuring aperture, the wavelength of light used for the measurement, and the illumination angle relative to the symbol.

A symbol grade is only meaningful if it is reported in conjunction with the illumination and aperture used. It should be shown in the format *grade/aperture/light/angle*, where:

- "grade" is the overall symbol grade as defined in *ISO/IEC 15415 Information technology - Automatic identification and data capture techniques - Bar code symbol print quality test specification - Two-dimensional symbols* (e.g., the arithmetic mean to one decimal place of the Scan Reflectance Profile or scan grades). For Data Matrix, the grade number may be followed by an asterisk, *, which indicates that the surroundings of the symbol contain extremes of reflectance that may interfere with reading. For most applications, this should be specified as causing the symbol to fail.

- "aperture" is the diameter in thousandths of an inch (to the nearest thousandth) of the synthetic aperture defined in *ISO/IEC 15415 Information technology - Automatic identification and data capture techniques - Bar code symbol print quality test specification - Two-dimensional symbols*.
- "light" defines the illumination: A numeric value indicates the peak light wavelength in nanometres (for narrow band illumination); the alphabetic character W indicates that the symbol has been measured with broadband illumination (white light) the spectral response characteristics of which must imperatively be defined or have their source specification clearly referenced.
- "angle" is an additional parameter defining the angle of incidence (relative to the plane of the symbol) of the illumination. It shall be included in the reporting of the overall symbol grade when the angle of incidence is other than 45 degrees. Its absence indicates that the angle of incidence is 45 degrees.

Note: This international standard provides for 30 degrees and 90 degrees illumination in addition to the default 45 degrees.

The aperture is normally specified as being 80% of the minimum X-dimension allowed for the application. The printing method must produce the Data Matrix "L" pattern with gaps between the dots less than 25% of the specified aperture. If symbols with greater than the minimum X dimension are allowed by the application, the same absolute maximum gap dimension must be maintained.

Examples:

- 2,8/05/660 would indicate that the average of the grades of the Scan Reflectance Profiles, or of the scan grades, was 2,8 when these were obtained with the use of a 0,125 mm aperture (ref. no. 05) and a 660 nm light source, incident at 45 degrees.
- 2,8/10/W/30 would indicate the grade of a symbol intended to be read in broadband light, measured with light incident at 30 degrees and using a 0,250 mm aperture (ref. no. 10), but would need to be accompanied either by a reference to the application specification defining the reference spectral characteristics used for measurement or a definition of the spectral characteristics themselves.
- 2,8/10/670* would indicate the grade of a symbol measured using a 0,250 mm aperture (ref. no. 10), and a 670 nm light source, and indicates the presence of a potentially interfering extreme reflectance value in the surroundings of the symbol.

Recommended symbol grades for Data Matrix are identified in individual applications in [Section 5.4](#).

5.6.3.6 Advice for Selecting the Symbology

Any use of Data Matrix should comply with GS1 System global application guidelines and be restricted to those applications defined by the GS1 System for Data Matrix. Data Matrix will not replace other GS1 System Symbologies. Existing applications that are satisfactorily utilising EAN/UPC Symbols, ITF-14 Symbols, GS1-128 Symbols, Reduced Space Symbology® (RSS) Symbols, or Composite Symbols should continue to use them.

Note: Scanning systems that need to read Data Matrix Symbols must be 2D imaging scanners and be appropriately programmed to read the GS1 System version of Data Matrix or ECC 200.

5.6.3.7 Human Readable Interpretation of Data Matrix Symbols

The Human Readable Interpretation of the primary Application Identifier (AI) Element String encoded in the Data Matrix Symbol should be shown with the symbol. How the human readable data will be shown shall be determined by the specific application guidelines. Typical conventions, as used for Reduced Space Symbology® (RSS) and Composite Component® Symbols, place the key information, such as the Global Trade Item Number™ (GTIN™), in the human readable data underneath the bar code symbol, while secondary information is placed above. The characters should be clearly legible (such as OCR-B) and must be obviously associated with the symbol.

Als should be clearly recognisable to facilitate key entry. This is achieved by putting the AI between parentheses in the Human Readable Interpretation. Note: The parentheses are not part of the data and are not encoded in the bar code symbol, following the same principles that apply to GS1-128 Symbols and RSS Expanded® Symbols.

For Data Matrix Symbols encoding large amounts of data, it may not be practical to display all the data in Human Readable Interpretation form. Even if there is space to show it in this form, it may not be practical to key enter that much data. In these instances, some of the data may be omitted from the Human Readable Interpretation. However, primary identification data (GS1 System keys), such as the GTIN, must always be shown. Application specifications may provide additional guidance on Human Readable Interpretation.

Section 6.0:

Symbol Placement Guidelines

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6.1. INTRODUCTION

This section includes guidelines for the placement of bar code symbols on packages and containers. It gives the general principles that apply, mandatory rules, and recommendations for symbol placement on specific packaging and container types.

Consistency of symbol placement is critical to successful scanning. With manual scanning, variation of symbol placement makes it difficult for the scanning operator to predict where the symbol is located, and this reduces efficiency. With automated scanning, the symbol must be positioned so that it will pass through the field of vision of a fixed scanner as it travels past. Respecting the guidance in this section will result in the consistency and predictability required.

The guidelines in this global specification replace previous local recommendations; however, manufacturers should not scrap packaging that has been printed according to a previous guidance. When packaging is redesigned, the global specifications in this document should be observed.

If government regulatory guidelines are inconsistent with those in this manual, the government guidelines should always take precedence.

Note: Bar code symbols in this guideline that are used as examples are For Position Only and are not intended to denote correct symbol type, size, colour, or quality.

6.2. GENERAL PLACEMENT PRINCIPLES

The following general principles for bar code symbol placement should be considered for any package type, whether it is scanned at the Point-of-Sale or elsewhere in the supply chain. Trade items intended to be scanned at a Point-of-Sale must be marked with an EAN-13, UPC-A, EAN-8*, or UPC-E* Bar Code Symbol. The bar code symbols that are scanned elsewhere are the EAN-13, UPC-A, ITF-14, and GS1-128 Bar Code Symbols.

*EAN-8 and UPC-E Bar Code Symbols are intended for use on very small trade items sold at the Point-of-Sale.

6.2.1 Number of Symbols

Bar code symbols representing different Global Trade Item Numbers™ (GTINs™) must never be visible on any one item. Although a minimum of one is required, two symbols representing the same GTIN are recommended on trade items for scanning in warehousing or General Distribution Scanning environments (see [Section 6.7](#)). Two or more symbols representing the same GTIN are recommended on heavy or bulky items for Point-of-Sale (see [Section 6.4.9](#)) and are permissible on random wraps intended for Point-of-Sale (see [Section 6.3.3.6](#)).

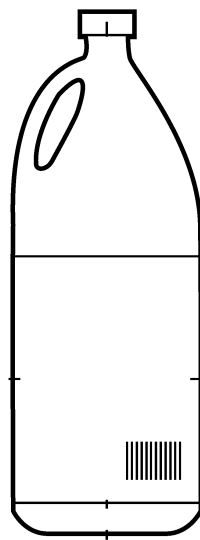
6.2.2 Scanning Environment

Before considering the package type, determine whether the item will be scanned in a Point-of-Sale or a General Distribution Scanning environment. If the item is scanned at a Point-of-Sale only, the bar code symbol placement guidelines in [Sections 6.4](#) and [6.5](#) apply. However, if the item is scanned in both a Point-of-Sale and General Distribution Scanning environment or in a General Distribution Scanning environment only, the requirements in [Section 6.7](#) take precedence.

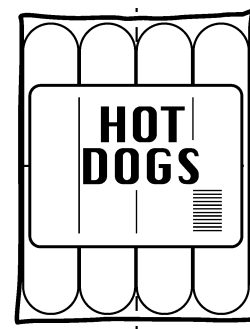
6.2.3 Orientation

Bar code symbol orientation is determined primarily by the print process and any curvature of the item. If the printing process and curvature allow, the preferred placement is Picket Fence Orientation rather than Ladder Orientation; that is, the bars of the bar code symbol should be perpendicular to the surface on which the package stands in its normal display position. On a Picket Fence Orientation Bar Code Symbol, the Human Readable Characters beneath the symbol should read from left to right. The text and orientation of the Ladder Orientation Bar Code Symbol can be read either from the top down, or from the bottom up, whichever is consistent with other text and graphics on the container. Empirical data has demonstrated that it makes no difference to the scanning process one way or the other. Rules for positioning bar code symbols on curved surfaces are given in [Section 6.A.1](#).

Figure 6.2.3 – 1



Picket Fence
Orientation



Ladder
Orientation

6.2.3.1 Printing Direction

Bar code orientation is often determined by the printing process. Some printing processes give much higher quality results if the bars of the symbol run in the direction of print, also known as the web direction. The printing company should always be consulted.

6.2.3.2 Trade Items with Curved Surfaces

When a bar code symbol is printed onto a curved surface it is sometimes possible for the extremes of the symbol to disappear around the curve, so that both ends cannot be visible to the scanner at the same time. This is more likely to occur the bigger the symbol and the tighter the curve of the packaging. There are certain combinations of X-dimension and diameter of curved surface in which the bars must be printed around the curve (e.g., in Ladder Orientation on a can, in Picket Fence Orientation on a cylindrical packet of biscuits). The effect of this is to ensure that the curve results in an apparent loss of height of the bars rather than the more serious apparent loss of complete bars.

The angle between the tangent to the centre of the curved symbol and the tangent to the extremity of the curved symbol (outer edge of the guard bars for symbols in the EAN/UPC Symbology family) must be less than 30°. If this angle is more than 30°, the symbol must be oriented such that the bars are perpendicular to the generating lines of the surface of the item. See [Section 6.A.1](#).

Figure 6.2.3.2. Bar codes in ladder orientation are recommended for curved surfaces with a small radius



6.2.3.3 Avoiding Scanning Obstacles

Anything that will obscure or damage a bar code symbol will reduce scanning performance and should be avoided. For example:

- Never position the bar code symbol on the item in an area with inadequate space. Do not let the other graphics encroach on the space for the bar code.
- Never place bar code symbols, including Quiet Zones, on perforations, die-cuts, seams, ridges, edges, tight curves, folds, flaps, overlaps, and rough textures.
- Never put staples through a bar code symbol or its Quiet Zones.
- Never fold a symbol around a corner.
- Never place a symbol under a package flap.

6.3. GENERAL PLACEMENT GUIDELINES FOR POINT-OF-SALE

This section outlines the guidelines for bar code symbol placement on trade items that will be scanned at the Point-of-Sale. For detailed information on specific package types, see Sections [6.4](#) and [6.5](#). [Section 6.7](#) outlines the guidelines for bar code symbol placement on trade items that will be scanned in warehousing or General Distribution Scanning environments.

6.3.1 Number of Symbols

Only one bar code symbol should be visible on a trade item intended for the Point-of-Sale. Exceptions include large or bulky items (see [Section 6.4.9](#)) and random or unregistered wrapping (see [Section 6.3.3.6](#)).

Trade items should never have more than one bar code symbol carrying a single Global Trade Item Number™ (GTIN™) visible. At the Point-of-Sale, this is particularly relevant to multipacks, such as over-wrapped items, sleeved items, and banded items, where the individual inner units carry a different GTIN from that on the outer wrapper or container. The bar code symbols on the inner products must be totally obscured so that they cannot be read by the Point-of-Sale system. (See [Section 6.3.3.6](#) for over-wrap special considerations.)

6.3.2 Identifying the Back of the Trade Item

The front of the trade item is the primary trading/advertising area, which typically displays the product name and the company's logo. The back of the trade item is directly opposite the front and is the preferred placement area for the bar code symbol on most trade items.

6.3.3 Symbol Placement

Information in this section is provided to guide symbol placement when developing packaging for new products and should be adopted if economically feasible when changing the graphics of existing products.

6.3.3.1 Preferred Placement

Preferred bar code symbol placement is on the lower right quadrant of the back, respecting the proper Quiet Zone areas around the bar code symbol and the edge rule (see the Edge Rule in [Section 6.3.3.3](#) and special considerations in [Section 6.3.3.7](#)).

6.3.3.2 Undesirable Alternative

The undesirable alternative placement for a bar code symbol is the lower right quadrant of another side of the container.

6.3.3.3 Edge Rule

When possible, the bar code symbol must not be closer than 8 mm (0.3 in.) or farther than 100 mm (4 in.) from the nearest edge of the package/container. Previous guidelines suggested a distance of 5 mm (0.2 in.) as a minimum. Practical experience has shown this to be inadequate. For example, cashiers often grab bags and other trade items on the edge with their thumbs. Avoid placing the bar code symbol too close to the edge. Such placement reduces efficiency at the Point-of-Sale.

6.3.3.4 Avoid Truncated Symbols

Truncation of a bar code symbol is the reduction of the height of a bar code symbol relative to its length. Truncation is not recommended because it destroys the ability of a symbol to be scanned omnidirectionally at the Point-of-Sale. A truncated symbol can only be scanned when the trade item is oriented in particular directions across the scanning beam. Truncation, therefore, reduces checkout efficiency. The more the height of the symbol is reduced, the more critical becomes the alignment of the symbol across the scanning beam. Truncation should be avoided unless absolutely necessary, for example when printing on a tightly curved surface, and then the maximum height possible should be printed. See [Section 6.A.1](#) for the rules on the relationship between the diameter of the item and the X-dimension.

6.3.3.5 Bottom Marking

Bottom marking of the trade item with the bar code symbol continues to be acceptable, except for large, heavy or bulky trade items. However, back (side) marking is preferred.

6.3.3.6 Exceptions to the General Placement Guidelines

Some trade items require special considerations for bar code symbol placement.

- Bags

Settling of the contents usually results in bag edges bulging to the extent that bar code symbols located on the lower right quadrant may not be flat enough to permit successful scanning. For this reason, bar code symbols on bags should be placed in the centre of the back about one third up from the bottom and as far from the edge as possible while respecting the edge rule. (See [Section 6.4.1](#) for more details on bags.)

- Blister packs or unpackaged items

Trade items that cause scanners to read beyond the flat plane include blister packs and unpackaged items (e.g., deep bowls). For these package types, the distance between the scanner window and the bar code symbol on the container or item must be considered. The bar code symbol cannot be closer than 8 mm (0.3 in.) or farther than 100 mm (4 in.) from any edge of the package/container. (See [Section 6.4](#) for more details on blister packs and unpackaged items.)

- Large, heavy, or bulky items

Any package/container weighing more than 13 kg (28 lb.) or having two dimensions greater than 450 mm (18 in.) (width/height, width/depth, or height/depth) is considered a large, heavy, or bulky item. Large, heavy, or bulky items tend to be hard to handle. Large bags require two symbols, one on top and one on the bottom of opposite quadrants of the bag. Large, heavy, or bulky bottles, boxes, cans, jars, jugs, and tubs require only one label. (See [Section 6.4](#) for more details on large, heavy, or bulky items.)

- Thin items or containers

Thin Items or Containers are packages/containers with a dimension less than 25 mm (1 in.) (height, width, or depth). Examples of thin items or containers are packages of pizza, powdered drink mixes, and writing pads. Any placement of the symbol on the edge hinders effective scanning because the symbol is obscured from the cashier and is likely to be truncated. (Refer to [Section 6.4](#) for more details on thin items or containers.)

6.3.3.7 Special Packaging Considerations for Bar Code Placement

Specific packaging methods require special considerations for bar code symbol placement.

- Over-wrap

Trade items to be sold in multiples are mechanically gathered and covered with clear over-wrap material that will carry print. Typical over-wrapped items are small cereal boxes and chocolate bars. Package over-wrap can create two distinct problems:

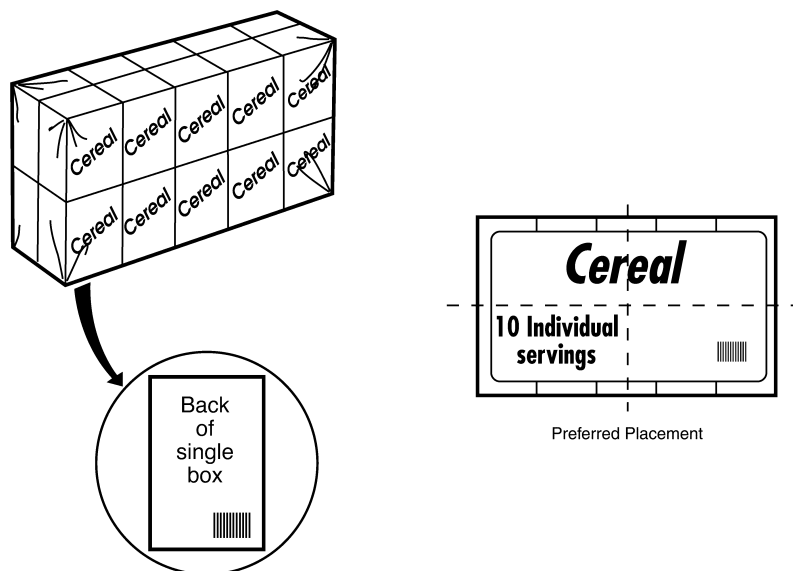
- Obscuring the bar code symbols on individual units inside the multipack is necessary so they are not confused with the outer multipack bar code symbol, which must be different.

- Over-wrapping with such materials as cellophane causes diffraction or reflection of the light beam of the scanner and can reduce contrast, which causes scanning inefficiencies.

To determine proper bar code symbol placement for over-wrapped packaging, follow the guidelines specific to the applicable package type/shape. (Refer to [Section 6.4](#) for details on symbol placement for specific package types.)

Figure 6.3.3.7 – 1

Bar Code Symbol Placement on Over-Wrapped Item



- Random (unregistered) wrap

Some wrappers, like those used on sandpaper or margarine, have a repeating design and are neither cut nor placed on the product such that a particular part of the design always appears in the same location. This is referred to as random or unregistered wrapping. As the wrapper is not registered, it is unlikely that the symbol will appear on one face of the package when the wrapper is placed on the product.

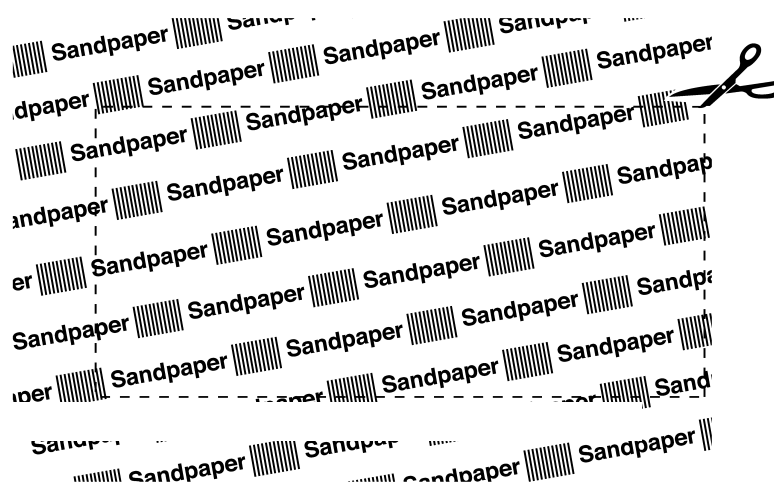
Experience has shown that the presence of more than one bar code symbol on a package can have a detrimental effect on scanning productivity and, more importantly, can lead to a double read. For this reason, the use of registered packaging is preferred. If random wrap must be used, the minimum requirement is to print the symbol with sufficient frequency that a full symbol will appear on one package face.

Double reads are more likely when the gaps between the symbols are larger. Repeating symbols should never be more than 150 mm (6 in.) apart.

Consideration should also be given to elongating the bars of the symbol to ensure a full symbol on one face, instead of repeating the symbol.

Figure 6.3.3.7 – 2

Bar Code Symbol Placement on Random-Wrapped Item



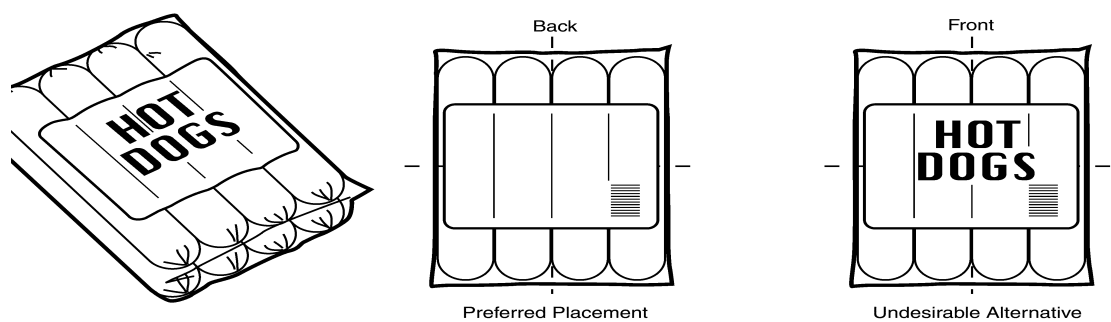
- Shrink film/vacuum-formed packages

The bar code symbol on an item packaged in shrink film or that is vacuum-formed should be located on a flat surface and in an area free of creases, wrinkles, or other types of distortions. Refer to Figure 6.3.3.7 – 3, which shows bar code symbol placement on hot dogs. Since the curvature of the hot dogs was greater than the diameter shown within the [Section 6.A.1](#) figures, a Ladder Orientation Bar Code Symbol was selected.

To determine proper bar code symbol placement for shrink film/vacuum-formed packaging, follow the guidelines specific to the applicable package type/shape. (Refer to [Section 6.4](#) for details on symbol placement for specific package types/shapes.)

Figure 6.3.3.7 – 3

Bar Code Symbol Placement on Shrink Film/Vacuum-Formed Item



- Spot labels

Bar code symbols printed on spot labels that are applied to the trade item are acceptable alternatives that incorporate symbols into existing packaging graphics or for use on items without packages, such as some pots, pans, tableware and glassware. The most suitable type of spot labels are those that cannot be removed from the item without destroying the symbol. Labels that are applied directly to the product should use an adhesive that is strong enough to adhere to the label for an extended shelf life, but which also allows the label to be removed without the use of solvents or abrasives.

To determine proper bar code symbol placement on items bearing spot bar code symbol labels, follow the guidelines specific to the applicable package type/shape. (Refer to [Section 6.4](#) for details on symbol placement for specific package types.)

Figure 6.3.3.7 – 4

Bar Code Symbol Placement with a Spot Label

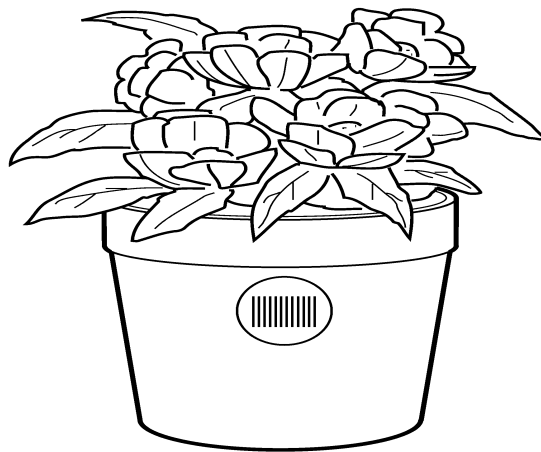


Figure 6.3.3.7 – 5 Tableware items using Bar Code Spot Labels. The adhesive used should not damage the item.



6.3.3.8 Operational Considerations of Bar Code Placement

Speed, efficiency, and effectiveness in scanning operations are the ultimate goals of proper bar code symbol placement. To ensure that scanning performance will not be compromised, consider the following matters before deciding on final bar code symbol placement:

- Consistent symbol location

Compare your package/container to packaging for like products to ensure equivalent symbol placement. The ease with which bar code symbols are located by a cashier from product to product essentially relies on consistent symbol placement.

- Scan simulation (Hand motion effectiveness)

Pass the bar code symbol across the scanner with your hand to test the initial bar code symbol placement. This test is intended to confirm that the bar code symbol placement does not necessitate unnatural hand motions while you are scanning the symbol.

6.3.3.9 Security Tag Placement

When a security tag is used, which is intended to be visible, the preferred placement is within a 75 mm (3 in.) diameter of the bar code symbol placement. Consistent security tag placement makes it easier for the operator to predict where the security tag is located and thus improves efficiency.

6.4. PLACEMENT GUIDELINES FOR SPECIFIC PACKAGE TYPES

The following bar code symbol placement guidelines apply to specific package types. [Section 6.5](#) contains diagrams illustrating symbol placement for clothing and fashion accessories. Figure 6.4 – 1, Package Type Reference, describes the main packaging categories and products. This figure can be used to determine correct bar code symbol placement by product or packaging. For example, according to the figure, a package of flower seeds in a 50 mm (2 in.) by 75 mm (3 in.) envelope is classified as a thin item or container. The example given of this type of package is powdered soft drink mix. According to the first column of the Package Type Reference, the correct bar code symbol placement for this package type can be determined by looking at [Section 6.4.12](#).

Figure 6.4 – 1
Package Type Reference

Section	Package Type	Package Characteristics	Product Examples
<u>6.4.1</u>	Bags	Sealed cylindrical or rounded-corner wrapped units	Potato chips, flour, sugar, bird seed
<u>6.4.2</u>	Blister packs	Flat card backing a formed clear plastic bubble placed over product	Toys, hardware parts
<u>6.4.3</u>	Bottles and jars	Small or large-mouth vessels sealed with removable lids	Barbecue sauce, fruit jelly
<u>6.4.4</u>	Boxes	Folded, sealed heavy paper or corrugated cardboard cartons	Crackers, cereal, detergent
<u>6.4.5</u>	Cans and cylinders	Cylindrical-shaped units sealed at each end	Soups, drinks, cheese, biscuits
<u>6.4.6</u>	Carded items	Items mounted or sealed on flat cards	Hammers, parcels of candy, kitchen utensils
<u>6.4.7</u>	Egg cartons	Irregular hexahedrons of plastic or moulded pulp with hinged lids	Eggs
<u>6.4.8</u>	Jugs	Glass or plastic vessel with built-in handle(s) and removable lid(s)	Household cleaners, cooking oil
<u>6.4.9</u>	Large, heavy, bulky items	Items having physical dimension of 450 mm (18 in.) or more in any two dimensions and/or weight in excess of 13 kg (28 lbs.)	Pet food, unassembled furniture, sledge hammers
<u>6.4.10</u>	Multipacks	Multiple items mechanically bound to create one package	Soft drink cans
<u>6.4.11</u>	Publishing items	Printed paper media that is bound, stapled, or folded	Books, magazines, newspapers, tabloids
<u>6.4.12</u>	Thin items or containers	Items or containers with one dimension less than 25 mm (1 in.)	Boxes of pizza, CD jewel boxes, powdered soft drink mix packages, writing pads
<u>6.4.13</u>	Trays	Flat, formed receptacles holding product covered with over-wrap	Prepared meats, pastries, snacks, pies, pie crusts
<u>6.4.14</u>	Tubes	Firmly packed cylinders sealed at both ends, or sealed at one end with a cap or valve on the other end	Toothpaste, sausage, caulk
<u>6.4.15</u>	Tubs	Deep vessels with removable lids	Margarine, butter, ice cream, whipped cream
<u>6.4.16</u>	Unpackaged	Trade items that have no packaging, are often of an unusual shape, and are hard to label and scan	Frying pans, mixing bowls, cooking pots, and giftware
<u>6.4.17</u>	Sets	Trade items that can be sold individually or as part of a boxed set.	Table and giftware.

Section	Package Type	Package Characteristics	Product Examples
<u>6.4.18</u>	Sporting Goods	Unpackaged items of specific size and shape.	Racquets, skis, and skateboards.

6.4.1 Bags

Although this category is referred to as “bags,” these packages/containers are often called sacks or pouches. This category includes paper or plastic containers that are:

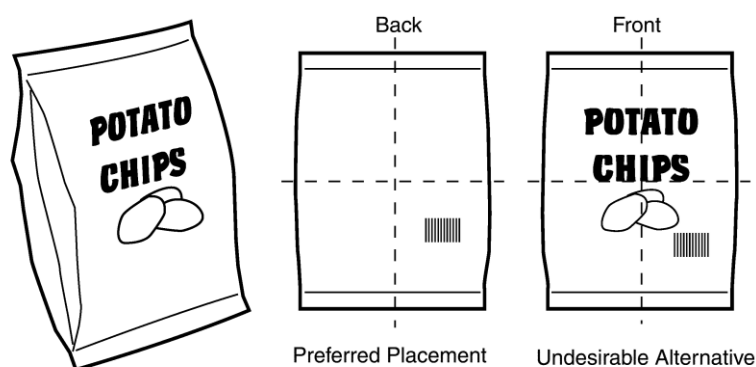
- Fold-sealed on both ends (e.g., flour and sugar)
- Fold-sealed on one end and pinched sealed at the other end (e.g., potato chips)
- Pinch-sealed at both ends (e.g., cough drops)
- Fold-sealed on one end and gathered at the other end (e.g., bread)

Note: Some bags are sealed at both ends and carded for display, such as bags of sweets. These types of items are not considered bags but fall into the carded items category. (See [Section 6.4.6](#) for more details on carded items.)

- Package characteristics: Sealed cylindrical or rounded-corner wrapped units
- Unique considerations: Bags have a tendency to have contents that shift and bulge. Consequently, the bar code symbol placement must be on an area of the bag that is most likely to remain flat.
- Bar code symbol placement: Identify the front of the package/container. (Refer to [Section 6.3.2, Identifying the Back of the Trade Item](#), for instructions on how to identify the package front.)
 - Preferred placement: On the lower right quadrant of the back and away from the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Undesirable alternative: On the lower right quadrant of the front, and away from the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Edge rule: See Section 6.3.3.3.

Figure 6.4.1 – 1

Symbol Placement on Bags



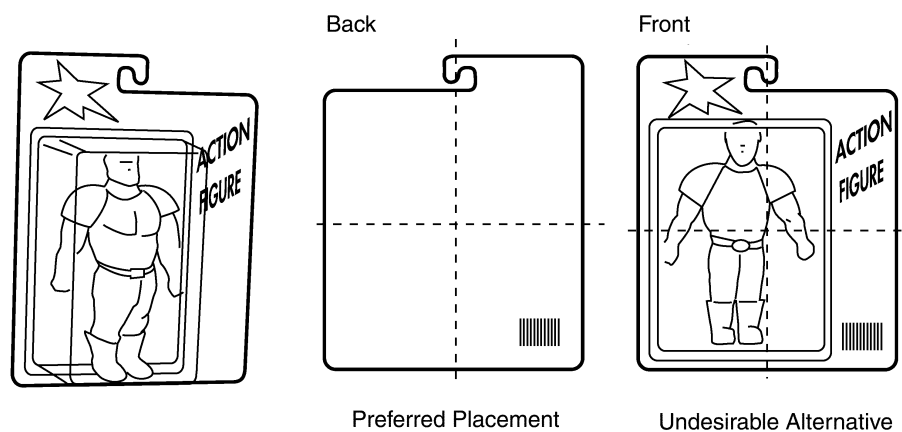
6.4.2 Blister Packs

Blister packs are pre-formed clear plastic bubbles, or blisters, containing a product and backed or topped with card stock.

- Package characteristics: Flat card, backing a formed clear plastic bubble placed over the product
- Unique considerations: To ensure quality scanning, the bar code symbol must be clear of the edges of the blister. Avoid placing the symbol under the blister pack or placing the symbol over any perforations on the back of the package.
- Bar code symbol placement: Identify the front of the package/container. (Refer to [Section 6.3.2, Identifying the Back of the Trade Item](#), for instructions on how to identify the package front.)
 - Preferred placement: On the lower right quadrant of the back, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Undesirable alternative: On the lower right quadrant of the front, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Edge rule: See Section 6.3.3.3.

Figure 6.4.2 – 1

Symbol Placement on Blister Packs



6.4.3 Bottles and Jars

Bottles and jars normally carry spot labels applied to confined areas of the package, not covering the entire surface or wrapping around the entire perimeter.

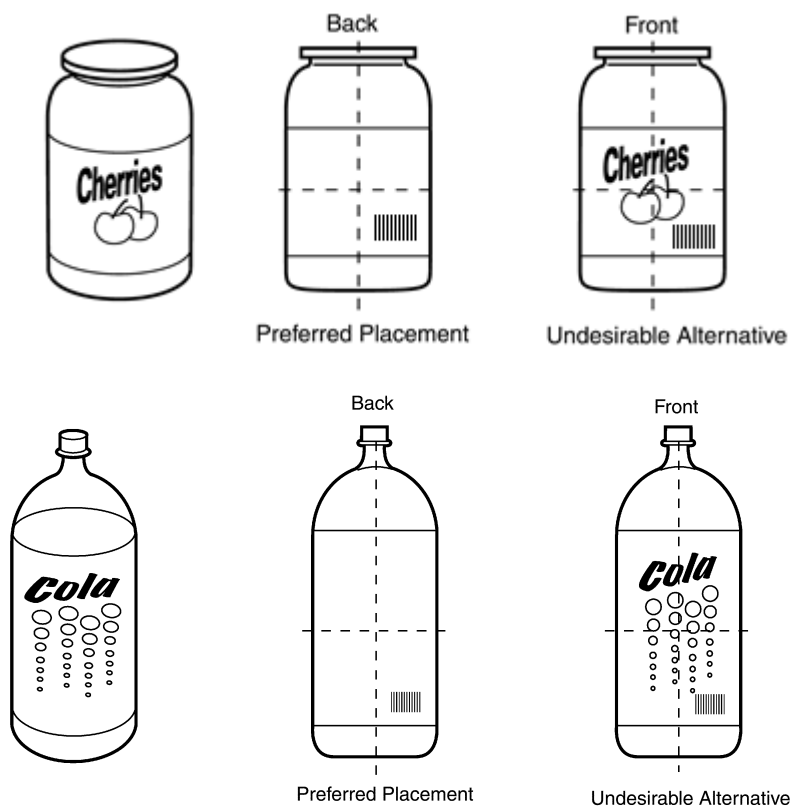
- Package characteristics: Small or large-mouth containers sealed with removable lids
- Unique considerations: Application of the bar code symbol to the neck of a bottle is not allowed. Symbol placement on the neck of the bottle necessitates additional handling at the Point-of-Sale, and space limitations on this area of the bottle usually result in symbol truncation.

When a bar code symbol is printed onto a curved surface it is sometimes possible for the extremes of the symbol to disappear around the curve. See [Section 6.A.1](#) for the rules on the relationship between the diameter of the item and the X-dimension.

- Bar code symbol placement: Identify the front of the package/container. (Refer to [Section 6.3.2, Identifying the Back of the Trade Item](#), for instructions on how to identify the package front.)
 - Preferred placement: On the lower right quadrant of the back, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Undesirable alternative: On the lower right quadrant of the front, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Edge rule: See [Section 6.3.3.3](#).

Figure 6.4.3 – 1

Symbol Placement on Bottles and Jars



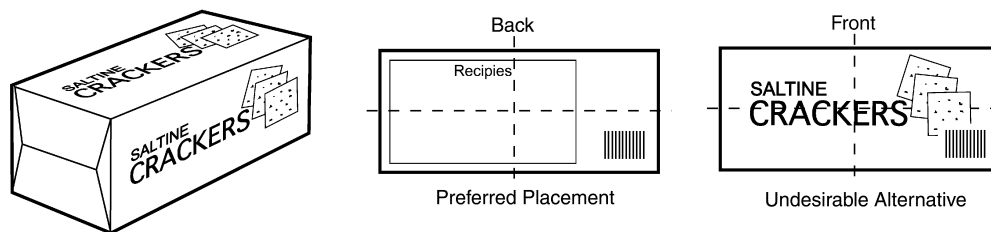
6.4.4 Boxes

This package type includes cuboid or cylindrical card or plastic cartons, as well as rectangular sleeves (used for products such as light bulbs). These packages might contain anything from crackers or cereal to detergent.

- Package characteristics: Folded, sealed heavy paper or corrugated cardboard cartons
- Unique considerations: There are no unique considerations that apply to this package type.
- Bar code symbol placement: Identify the front of the package/container. (Refer to [Section 6.3.2, Identifying the Back of the Trade Item](#), for instructions on how to identify the package front.)
 - Preferred placement: On the lower right quadrant of the back, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Undesirable alternative: On the lower right quadrant of the front, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Edge rule: See Section 6.3.3.3.

Figure 6.4.4 – 1

Symbol Placement on Boxes



6.4.5 Cans and Cylinders

This category includes cylindrical shaped containers (usually made of plastic or metal) that are sealed at each end. Some containers have removable lids or openings. Common examples are canned fruit and vegetables, paints, and adhesives.

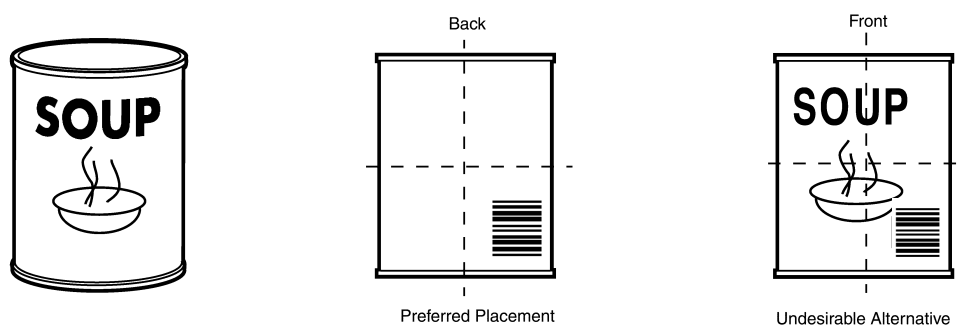
- Package characteristics: Cylindrical-shaped units sealed at each end
- Unique considerations: Obstacles, such as beading, seams, and/or ridges on the package/container should be avoided, as they will reduce scanning performance.

When a bar code symbol is printed onto a curved surface it is sometimes possible for the extremes of the symbol to disappear around the curve. See [Section 6.A.1](#) for the rules on the relationship between the diameter of the item and the X-dimension.

- Bar code symbol placement: Identify the front of the package/container. (Refer to [Section 6.3.2, Identifying the Back of the Trade Item](#), for instructions on how to identify the package front.)
 - Preferred placement: On the lower right quadrant of the back, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Undesirable alternative: On the lower right quadrant of the front, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Edge rule: See [Section 6.3.3.3](#).

Figure 6.4.5 – 1

Symbol Placement on Cans and Cylinders



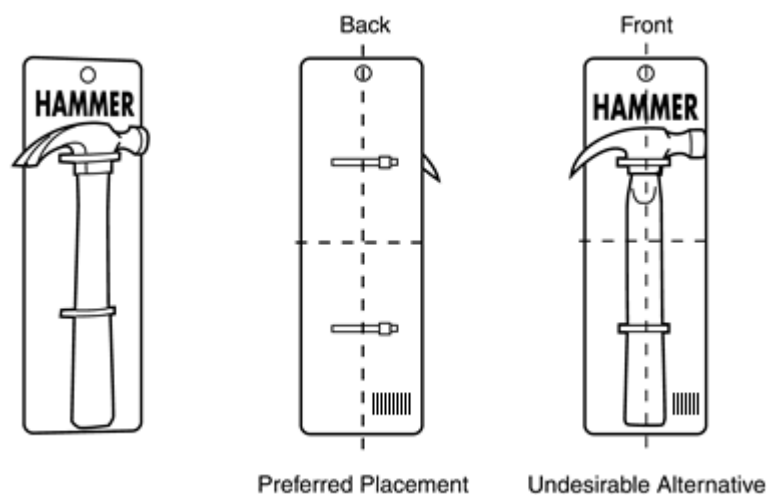
6.4.6 Carded Items

Small, loose, or non-packaged items that are difficult to label are placed on cards that are marked with a bar code symbol. Examples include hammers, toys, and kitchen utensils.

- Package characteristics: Items mounted or sealed on flat cards
- Unique considerations: When placing bar code symbols on carded items, it is important to take into consideration the proximity of the bar code symbol to the product. Be sure to allow adequate space for the symbol, avoiding any obstructions that might be caused by placing the symbol too close to the product. In addition, do not place the symbol over any perforations or other obstructions on the package.
- Bar code symbol placement: Identify the front of the package/container. (Refer to [Section 6.3.2, Identifying the Back of the Trade Item](#), for instructions on how to identify the package front.)
 - Preferred placement: On the lower right quadrant of the back, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Undesirable alternative: On the lower right quadrant of the front, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Edge rule: See Section 6.3.3.3.

Figure 6.4.6 – 1

Symbol Placement on Carded Items



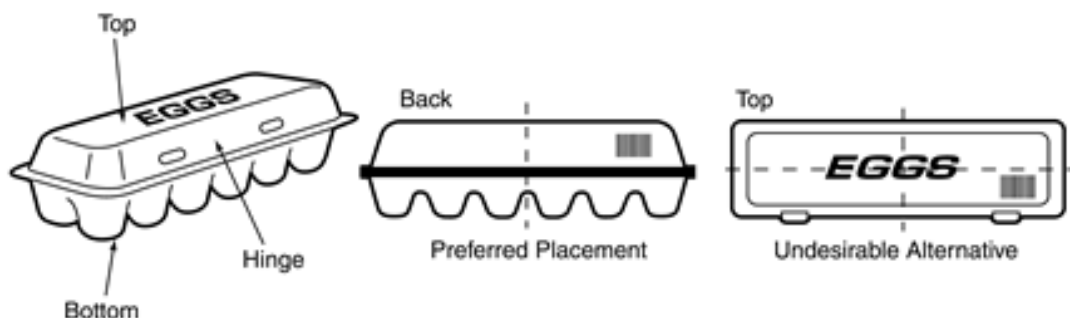
6.4.7 Egg Cartons

Molded pulp, foam, or plastic egg cartons come in sizes according to the count of the eggs contained.

- Package characteristics: Irregular shaped hexahedrons of plastic or moulded pulp with a hinged lid
 - Unique considerations: The recommended symbol placement is on the side of the lid portion of the egg carton that opens and closes to cover the eggs. The uneven surface of the moulded bottom of an egg carton prevents bar code symbol placement in this area.
 - Bar code symbol placement: To determine bar code symbol placement on an egg carton, first identify the top of the carton by locating the primary trading/advertising area, which is marked with the product name and the company's logo. The bottom of the egg carton is the moulded area directly opposite the top in which the eggs sit. The sides are divided horizontally by a hinged lid. The front of the carton is the long side containing the opening/closing mechanism. The back of the carton is directly opposite the front, on the long side with the hinge.
- Preferred placement: Near the edge, on the right half of the back, above the hinge on the lid, respecting the proper Quiet Zone areas around the bar code symbol
- Undesirable alternative: On the lower right quadrant of the top, on the lid adjacent to the opening/closing mechanism, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
- Edge rule: See Section 6.3.3.3.

Figure 6.4.7 – 1

Symbol Placement on Egg Cartons



6.4.8 Jugs

Jugs are glass or plastic containers with built-in handle(s) that aid in pouring of contents. Jugs normally carry spot labels applied to defined areas of the package, not covering the entire surface of the trade item or wrapping around the entire perimeter of the item.

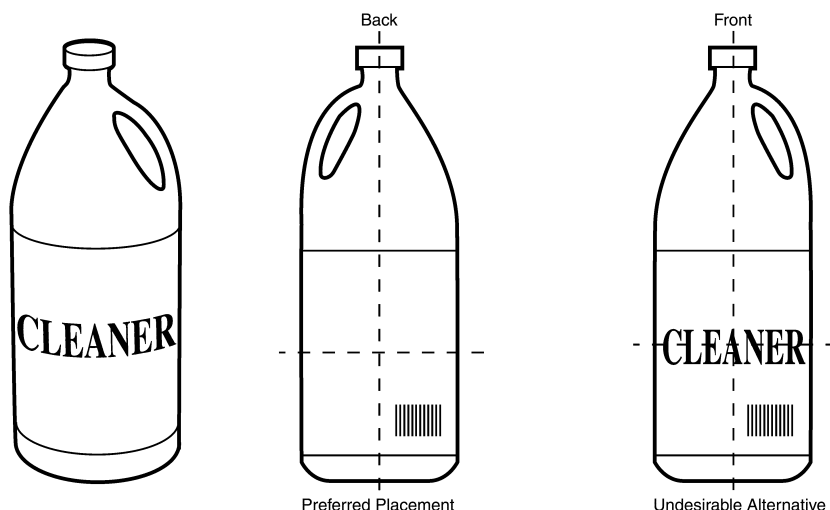
- Package characteristics: Glass or plastic vessels with built-in handles and removable lids
- Unique considerations: Application of the symbol to the neck of the jug is not allowed. Placement of the symbol on the neck of the jug necessitates additional handling at the Point-of-Sale, and space limitations on the neck usually result in symbol truncation.

When a bar code symbol is printed onto a curved surface it is sometimes possible for the extremes of the symbol to disappear around the curve. See [Section 6.A.1](#) for the rules on the relationship between the diameter of the item and the X-dimension.

- Bar code symbol placement: Identify the front of the package/container. (Refer to [Section 6.3.2, Identifying the Back of the Trade Item](#), for instructions on how to identify the package front.)
 - Preferred placement: On the lower right quadrant of the back, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Undesirable alternative: On the lower right quadrant of the front, near the edge, respecting the proper Quiet Zone areas around the bar code symbol.
 - Edge rule: See [Section 6.3.3.3](#).

Figure 6.4.8 – 1

Symbol Placement on Jugs

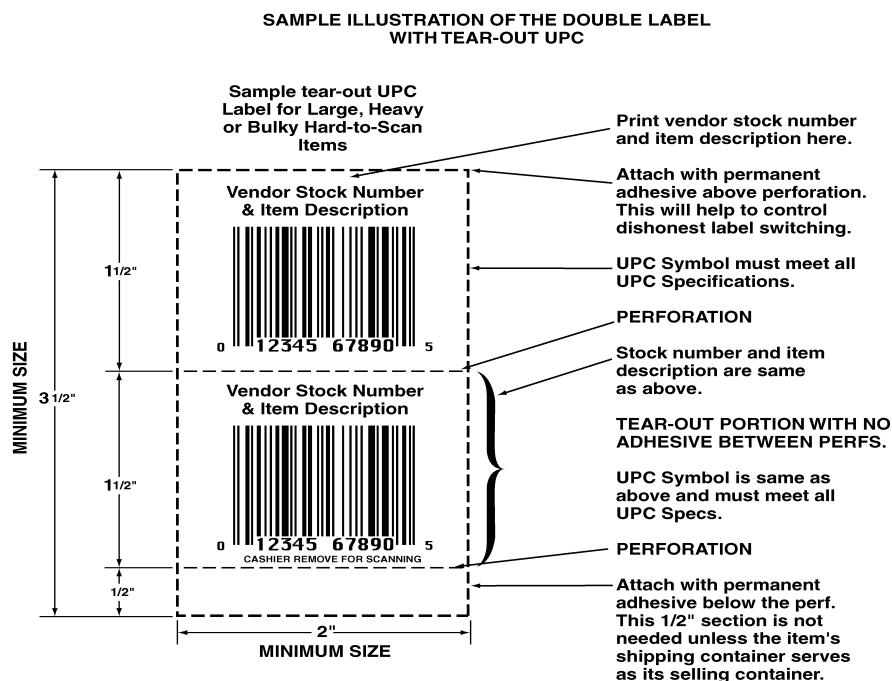


6.4.9 Large, Heavy, or Bulky Items

Large, heavy, or bulky items of any kind are difficult to handle and scan, and, therefore, different symbol placement guidelines apply.

- Package characteristics: Items considered large, heavy, or bulky have a physical dimension of 450 mm (18 in.) or more in any two dimensions (width/height, width/depth, or height/depth), and/or weigh in excess of 13 kg (28 lbs.).
- Unique considerations:
 - Number of symbols: For large or heavy bags, two bar code symbols should be used, one on top of the front and one on the bottom of the back in opposite quadrants. For boxes, bottles, jars, cans, jugs, tubs, and unpackaged items, one bar code symbol is used.
 - Special labels: A special double label with a tear-out bar code symbol may be applied to large, heavy, or bulky items that are too heavy or too awkward to pick up and pass over a fixed scanner. This label has one section that is permanently adhered to the item's box (or to a hang-tag or card if the item is not boxed). This section has a Human Readable Interpretation number and item description printed above a full-size bar code symbol. Beneath a perforation, a second section contains exactly the same human readable information and an identical full-size bar code symbol. The two sections are virtually identical except that the section below the perforation has no adhesive on its back.

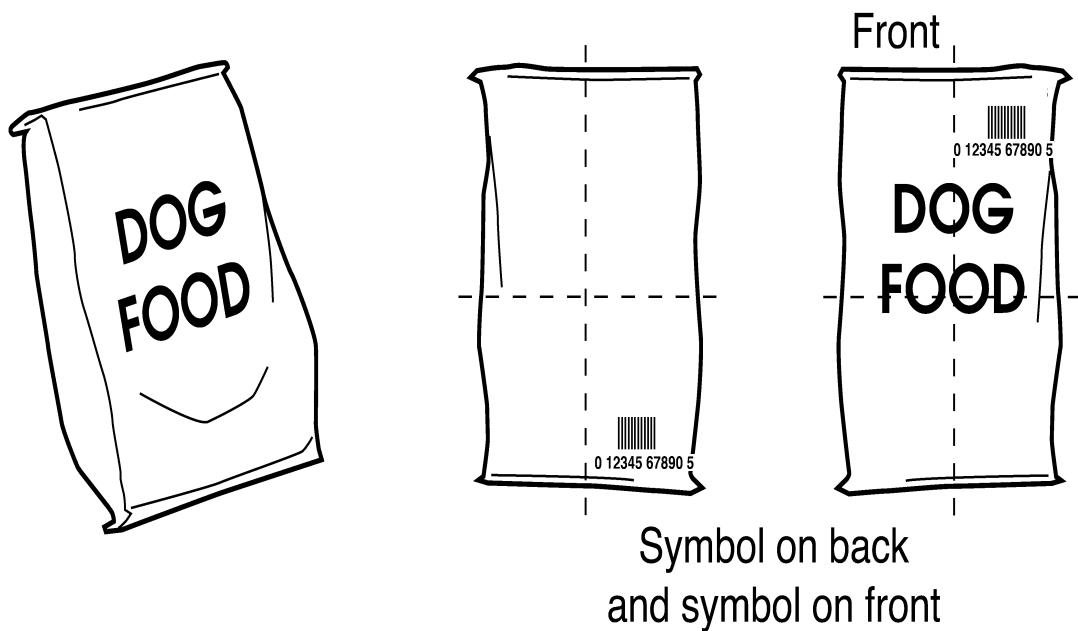
Figure 6.4.9 – 1



When the item is brought to the Point-of-Sale, the lower half of the label below the perforation is removed. The cashier then either scans the label, or if the symbol cannot be scanned, the cashier key-enters the human readable information beneath the symbol. The top label remains attached to the item or its box.

In the instances where the large, heavy, or bulky item is displayed and sold in its shipping container, a third section of label is recommended. Beneath the tear-out label, a second perforation and a 12 mm (0.50 in.) section with permanent adhesive should be added. This provides a more secure vehicle for the tear-out section and makes it less likely to tear off in transit.

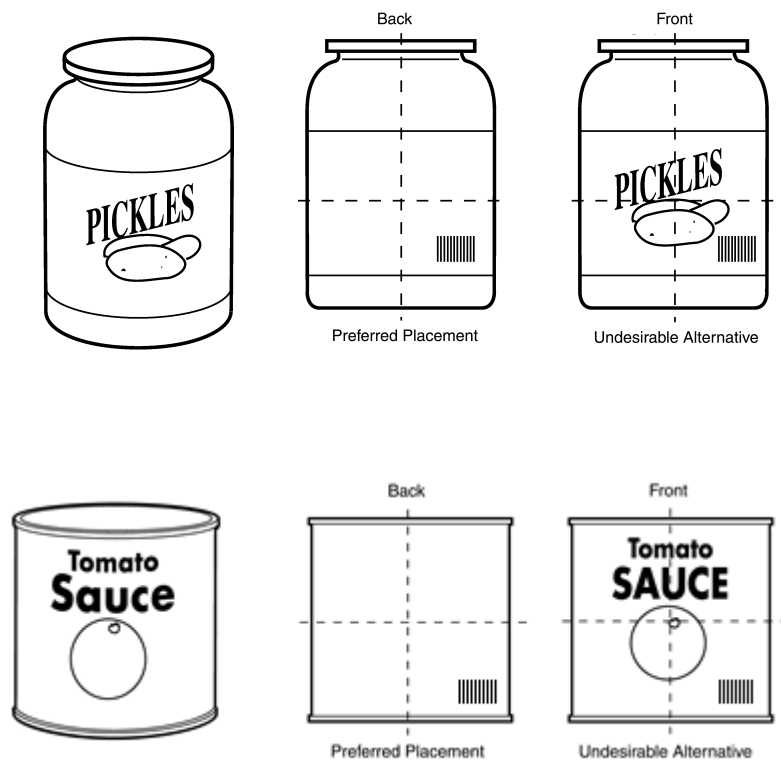
- Human Readable Interpretation: Human readable numbers or text on large, heavy, or bulky items should be a minimum of 16 mm (5/8 in.) high. This facilitates easier capture of the number by the cashier without having to pick up the product and move it across the scanner.
- Bar code symbol placement: Identify the front of the package/container. (See [Section 6.3.2, Identifying the Back of the Trade Item](#), for instructions on how to identify the package front.)
- Preferred placement:
 - Bags: Two bar code symbols are required, one on the front of the bag, at the top of the upper right quadrant, near the edge, and the other on the back of the bag, centred in the lower right quadrant, near the edge (to accommodate settling of contents).



- Bottles, jars, boxes, cans, jugs, tubs, and unpackaged items: These items are subject to the same symbol placement guidelines as corresponding smaller sized items. (Refer to the appropriate subsection in [Section 6.4](#) for symbol placement guidelines for specific package types.)

Figure 6.4.9 – 2

Symbol Placement on Large, Heavy, or Bulky Jars, Cans, Jugs, or Tubs



- Undesirable alternative: On the lower right quadrant of the front, near the edge, respecting the proper Quiet Zone areas around the bar code symbol

- Edge rule: See Section 6.3.3.3.

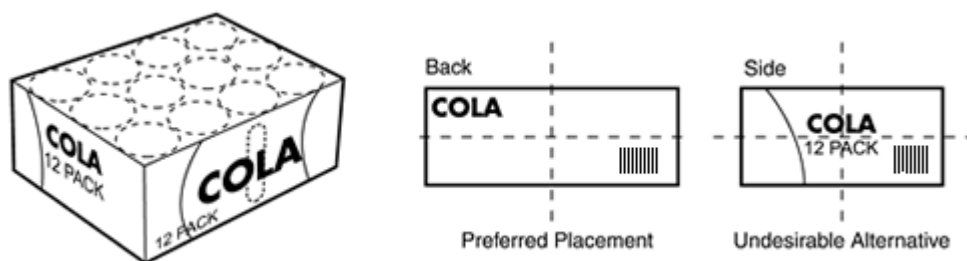
6.4.10 Multipacks

Multipacks are single items that are packaged together as one unit or trade item. Multipacks provide convenience to the consumer and/or may represent a price reduction compared to purchasing items individually. Typical multipacks contain bottles, cans, jars, and tubs.

- Package characteristics: Multiple single items bound together to create one package
- Unique considerations: As a general rule, a bar code symbol should be placed on every consumer package traded through the supply chain. Consequently, items sold in multipacks as well as those sold individually must carry a unique bar code symbol for each consumer package variation or aggregation. To avoid confusion at the Point-of-Sale, the multipack bar code symbol should be the only visible symbol when both the multipack and individual items are symbol-marked. The binder of the multipack acts as a screen to obscure the symbols on the individual items.
- Special note for can multipacks: Avoid placing the symbol on the top or bottom of the container as shown in Figure 6.4.10 – 1, since the cans have a tendency to cause impressions in the corrugated cardboard and distort the symbol. These can impressions in the symbol may reduce scannability.
- Bar code symbol placement: Identify the front of the package/container. (Refer to [Section 6.3.2, Identifying the Back of the Trade Item](#), for instructions on how to identify the package front.)
 - Preferred placement: On the lower right quadrant of the back, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Undesirable alternative: On the lower right quadrant of the side, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Edge rule: See Section 6.3.3.3.

Figure 6.4.10 – 1

Symbol Placement on Multipacks

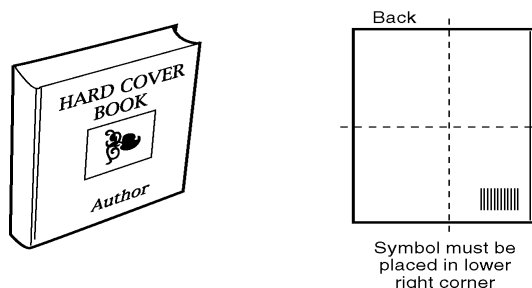


6.4.11 Publishing Items

Publishing items represent printed materials sold individually for consumer use including books, magazines, newspapers, and tabloids. Bar code symbol placement on published items varies depending on type.

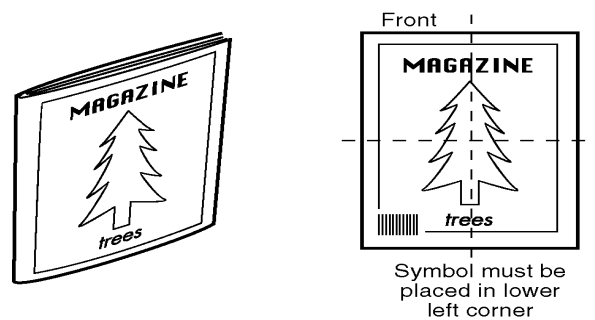
- Package characteristics: Printed paper media that is bound, stapled, or folded
 - Unique considerations: In addition to the regular bar code symbol, some publishing items have Add-On Symbols that carry supplementary information such as an Issue Code. Bar code symbol placement on published items varies depending on the media type. If an Add-On Symbol is used, it must be located to the right of the regular bar code symbol and parallel to it.
 - Bar code symbol placement: Identify the front of the package/container. (Refer to [Section 6.3.2, Identifying the Back of the Trade Item](#), for instructions on how to identify the package front.)
- Preferred placement:
- Books: On the lower right quadrant of the back, near the spine, respecting the proper Quiet Zone areas around the bar code symbol

Figure 6.4.11 – 1



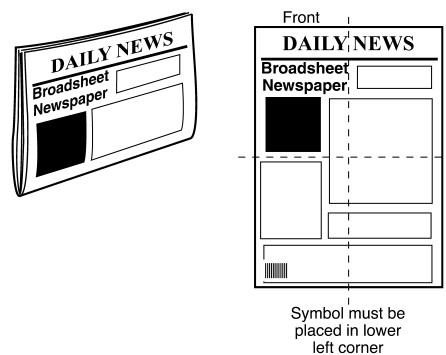
- Magazines: On the lower left quadrant of the front, near the edge, respecting the proper Quiet Zone areas around the bar code symbol

Figure 6.4.11 – 2



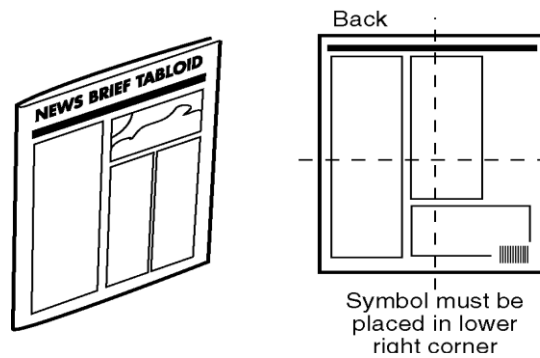
- Newspapers: When displayed for sale as shown on the left in Figure 6.4.11 – 3, place the symbol on the lower left quadrant of the front, near the edge, respecting the proper Quiet Zone areas around the bar code symbol. If an Add-On Symbol is used, it must be located to the right of the regular bar code symbol and parallel to it.

Figure 6.4.11 – 3



When displayed for sale as shown in Figure 6.4.11 – 4, place the symbol on the lower right quadrant of the back, near the edge, respecting the proper Quiet Zone areas around the bar code symbol. If an Add-On Symbol is used, it must be located to the right of the regular bar code symbol and parallel to it.

Figure 6.4.11 – 4



- Undesirable alternative: The undesirable alternative is not feasible for this package type.
- Edge rule: See Section 6.3.3.3.

6.4.12 Thin Items or Containers

This package type is so named as items or containers in this category have one physical dimension less than 25 mm (1 in.). For such items, particularly those without a significant bottom surface, should be marked on the lower right quadrant of the back side. Boxes of pizza, compact disk boxes, packages of powdered drink mix, and writing pads are examples.

- Package characteristics: Items or containers with one dimension less than 25 mm (1 in.)
- Unique considerations: There are no unique considerations that apply to this package type.
- Bar code symbol placement: Identify the front of the package/container. (Refer to [Section 6.3.2, Identifying the Back of the Trade Item](#), for instructions on how to identify the package front.)
 - Preferred placement: On the lower right quadrant of the back, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Undesirable alternative: On the lower right quadrant of the front, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Edge rule: See Section 6.3.3.3.

Figure 6.4.12 – 1

Symbol Placement on Thin Items or Containers

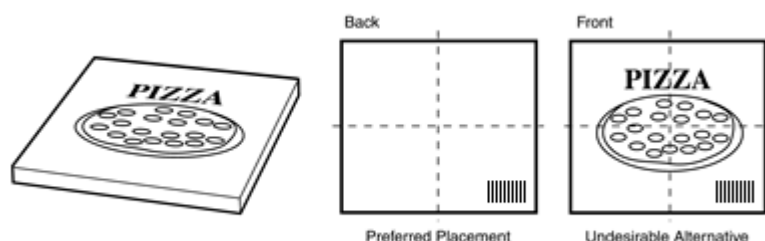
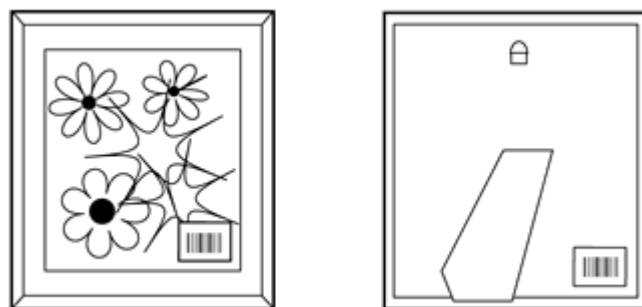


Figure 6.4.12 – 2

Unpackaged item without room for bottom marking



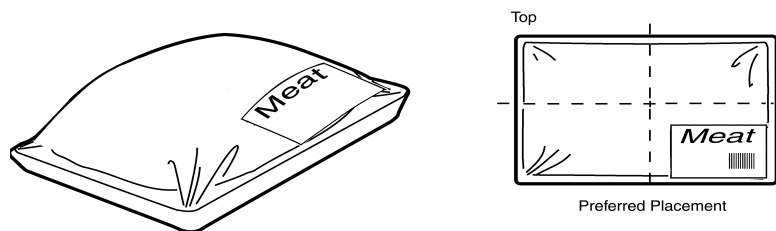
6.4.13 Trays

This package type includes thin square, rectangular, or circular trays holding items that are covered with over-wrap of clear shrink-film or that are vacuum-sealed. Examples include meats, pastries, snacks, and pies or piecrusts.

- Package characteristics: Flat, formed receptacles holding product covered with over-wrap
- Unique considerations: When placing bar code symbols on trays, it is important to ensure that the bar code symbol is placed on a flat surface. In addition, do not place the symbol over any perforations or other obstructions on the package.
- Bar code symbol placement: Identify the front of the package/container. (Refer to [Section 6.3.2, Identifying the Back of the Trade Item](#), for instructions on how to identify the package front.)
 - Preferred placement: On the lower right corner of the top, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Edge rule: See Section 6.3.3.3.

Figure 6.4.13 – 1

Symbol Placement on Trays



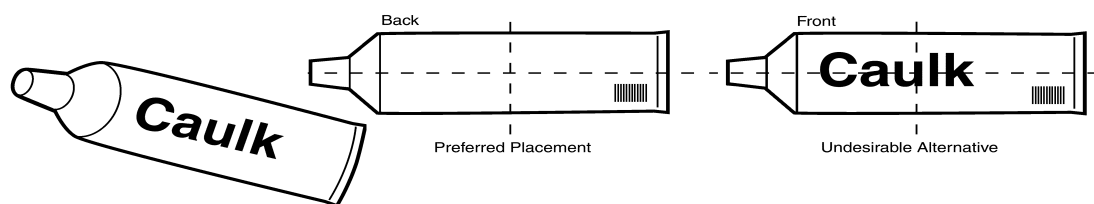
6.4.14 Tubes

Tubes are cylindrical shaped items or containers that are either sealed at both ends, such as sausage or refrigerated dough, or that are sealed at one end and have a cap or valve on the other end, such as toothpaste or caulk.

- Package characteristics: Firmly packed cylinders sealed at both ends, or sealed at one end with a cap or valve on the other end
- Unique considerations: When a bar code symbol is printed onto a curved surface it is sometimes possible for the extremes of the symbol to disappear around the curve. See [Section 6.A.1](#) for the rules on the relationship between the diameter of the item and the X-dimension.
- Bar code symbol placement: Identify the front of the package/container. (Refer to [Section 6.3.2, Identifying the Back of the Trade Item](#), for instructions on how to identify the package front.)
 - Preferred placement: On the lower right quadrant of the back, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Undesirable alternative: On the lower right quadrant of the front, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Edge rule: See Section 6.3.3.3.

Figure 6.4.14 – 1

Symbol Placement on Tubes



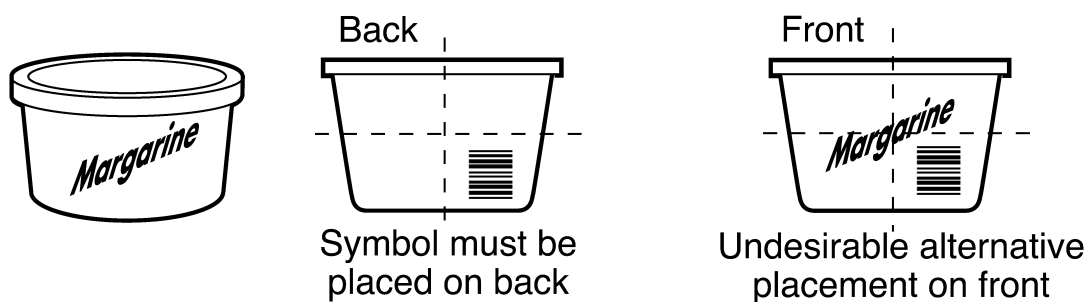
6.4.15 Tubs

Tubs are circular containers (usually made of paper, plastic, or metal) that have removable lids. In most cases, they have spot labels that do not cover the entire surface of the container. Examples include margarine, butter, ice cream, and whipped topping.

- Package characteristics: Deep vessels with removable lids
- Unique considerations: When a bar code symbol is printed onto a curved surface it is sometimes possible for the extremes of the symbol to disappear around the curve. See [Section 6.A.1](#) for the rules on the relationship between the diameter of the item and the X-dimension.
- Bar code symbol placement: Identify the front of the package/container. (Refer to [Section 6.3.2, Identifying the Back of the Trade Item](#), for instructions on how to identify the package front.)
 - Preferred placement: On the lower right quadrant of the back, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Undesirable alternative: On the lower right quadrant of the front, near the edge, respecting the proper Quiet Zone areas around the bar code symbol
 - Edge rule: See Section 6.3.3.3.

Figure 6.4.15 – 1

Symbol Placement on Tubs



6.4.16 Unpackaged Items

These are square, rectangular, circular, concave, or convex shaped items, including bowls, pots, pans, skillet, cups, vases, and other products (with or without contents), that lack an upright surface suitable for symbol placement.

- Package characteristics: These are items that are unpackaged and sold with spot labels, hangtags or carded sleeves.
 - Unique considerations: When selecting symbol placement, consider the product's concave shape on the inside or irregular curvature on the outside while respecting the scanning distances defined in the edge rule below.
 - The general marking guideline for a table and giftware items is to use a hangtag. This avoids any damage to the item that could be caused by the spot label adhesive. If this is not practical, the spot label should be applied to the bottom of the item and below the backstamp (where present).
 - Bar code symbol placement: Bar code symbol placement on unpackaged items depends on the shape and type of the item. The following examples illustrate symbol placements appropriate to specific item types.
- Preferred placement: The figures that follow indicate acceptable placement locations for other shaped items.

Figure 6.4.16 – 1

Option 1

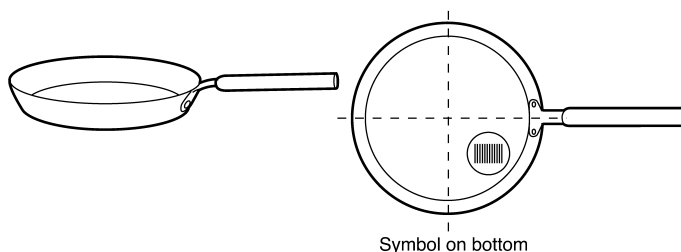


Figure 6.4.16 – 2

Option 2

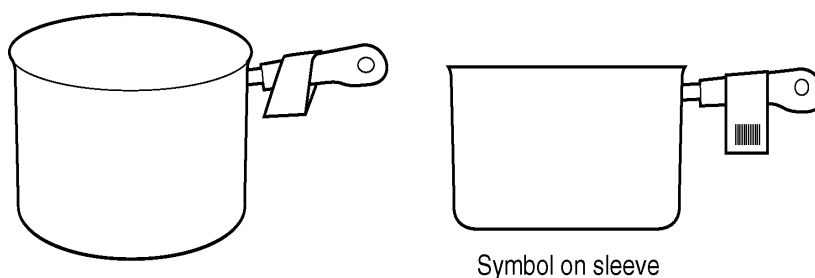


Figure 6.4.16 – 3 Option 3

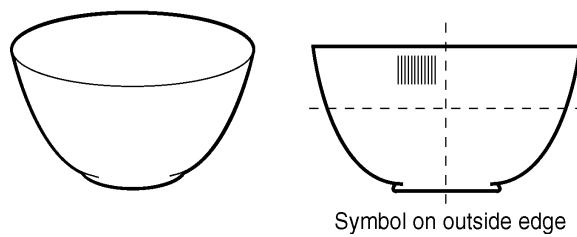


Figure 6.4.16 – 4

Option 4

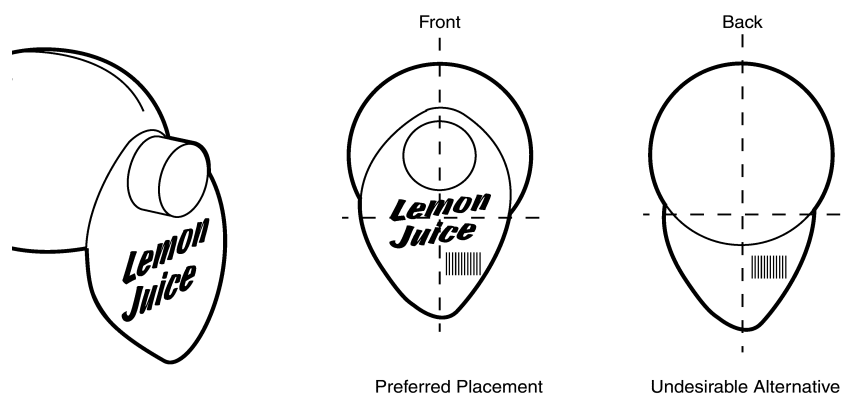


Figure 6.4.16 – 5

Option 5 Giftware using Hangtag



Figure 6.4.16 – 6

Option 6 Tableware using Spot Label below backstamp



- Undesirable alternative: The undesirable alternative is not applicable.
- Edge rule: See Section 6.3.3.3.

6.4.17 Sets [Grouping of individually bar coded items]

For bar coding purposes, sets are defined as two or more items that are packaged and sold together as one unit, regardless of whether those items can be sold separately as well. If the items are packaged together for shipping purposes but are not intended to be sold as a single unit, they do not qualify as a set. Examples of sets include a pair of candlesticks, a set of four soup bowls, and a five-piece dinner place setting.

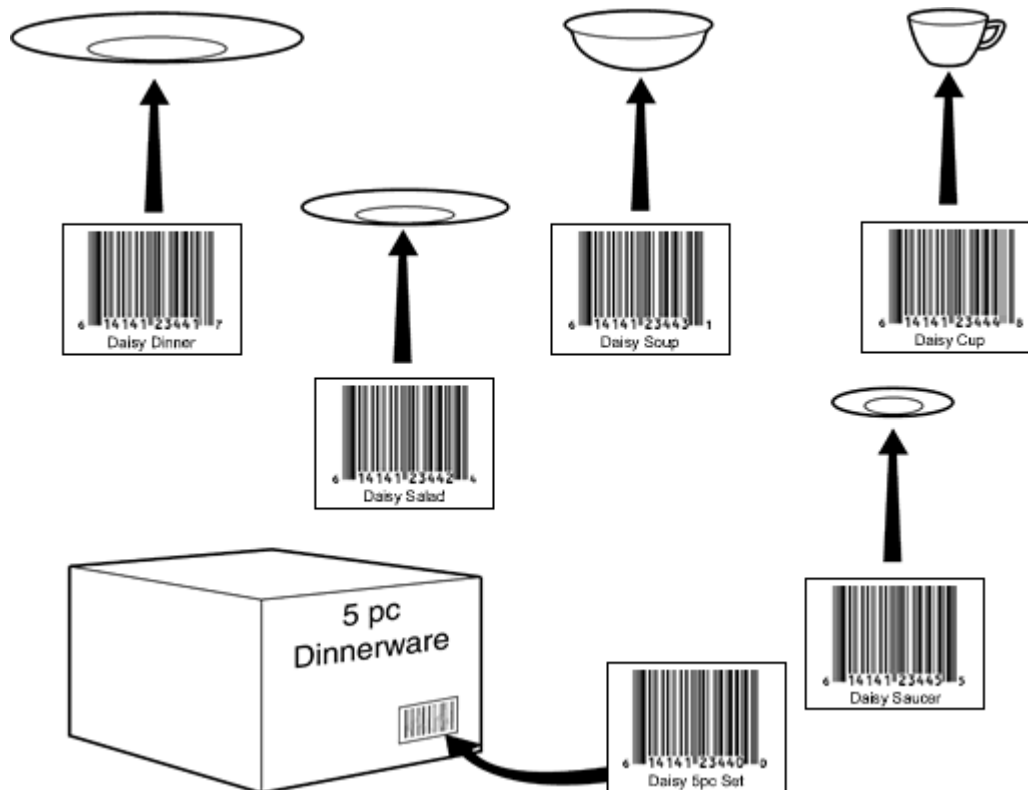
If a set is not intended to be sold as individual components, only the package for the set needs to be bar coded.

Figure 6.4.17–1: Example of a set where Individual Components are not Sold Separately



If the set is made up of components that can be ordered as separate trade items, then the components of the set must be marked. If the set can be sold as individual components or as the set, then both the package and the components need to be marked with unique symbols. The bar code symbols on the inner products must be totally obscured so that they cannot be read by the Point-of-Sale system when sold as a set. (See [Section 6.3.3.6](#) for over-wrap special considerations.)

Figure 6.4.17–2: Example of a Multi-piece set sold as a set or as Individual Components



If an item is made up of multiple components that cannot be sold separately such as a teapot with lid, the main piece only should be marked with one symbol. Such items are not considered sets.

Figure 6.4.17–3: Items with Multiple Pieces that are not Sold Separately
(these are not considered sets)



6.4.18 Sporting Goods

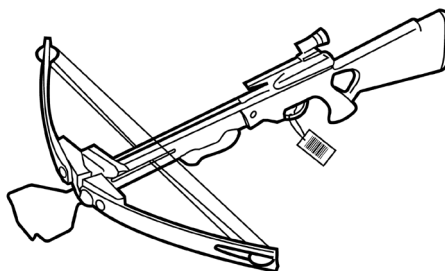
Sporting goods provide an excellent example of a category composed of many irregular sized and shaped goods. However, an understanding of each product type, the logistics involved in the supply chain, and the sales floor presentation are key to improving the overall efficiency. Of particular importance is consistent bar code symbol placement for sporting goods as presented at the retail Point-of-Sale. This enables the Point-of-Sale operator to accurately predict the symbol location and thereby improve efficiency.

The following examples, while not exhaustive, provide the general principles that may be applied to similar product types.

- **Archery Bows, Arrows**

- Preferred placement:
 - If packaged in boxes, see Section 6.4.4.
 - If packaged using a hangtag, see Section 6.6.2
- Edge rule: See Section 6.3.3.3.

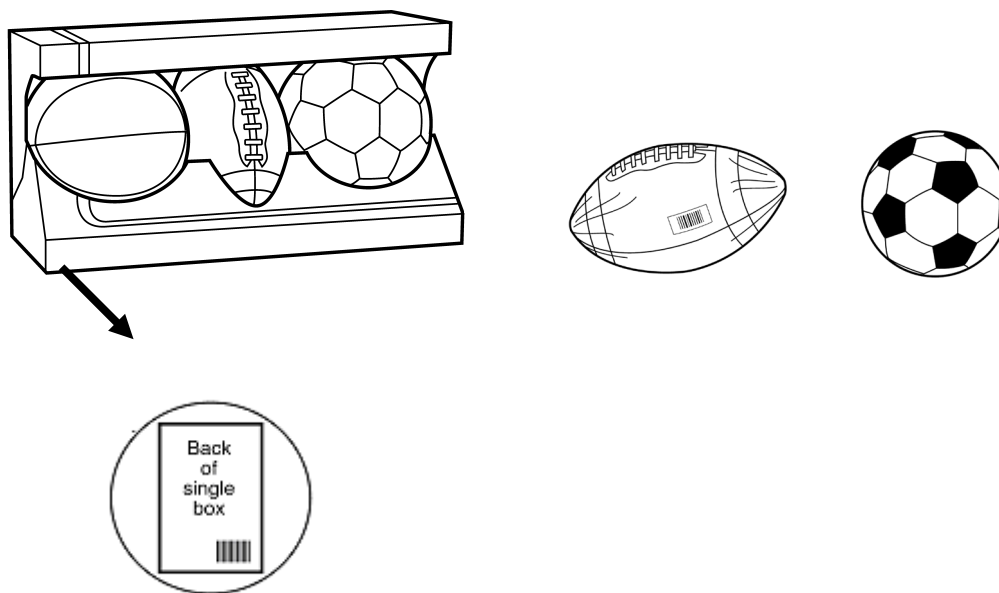
Figure 6.4.18 – 1: Example Bar Code Location on an Archery Bow



- **Balls, Team Sports**

- Preferred placement:
 - If packaged individually, placement on the shrink wrap.
 - If packaged in boxes or boxed sets, see Section 6.4.17 and Section 6.5, shoebox. If a master SKU is not utilized for a boxed set of balls or a pack set of ball and pump, each product type within the pack set should have a screened barcode symbol.
 - If not packaged, screen the barcode symbol on the opposite side of the logo on the ball.
- Edge rule: See Section 6.4.17 and Section 6.5, shoebox.

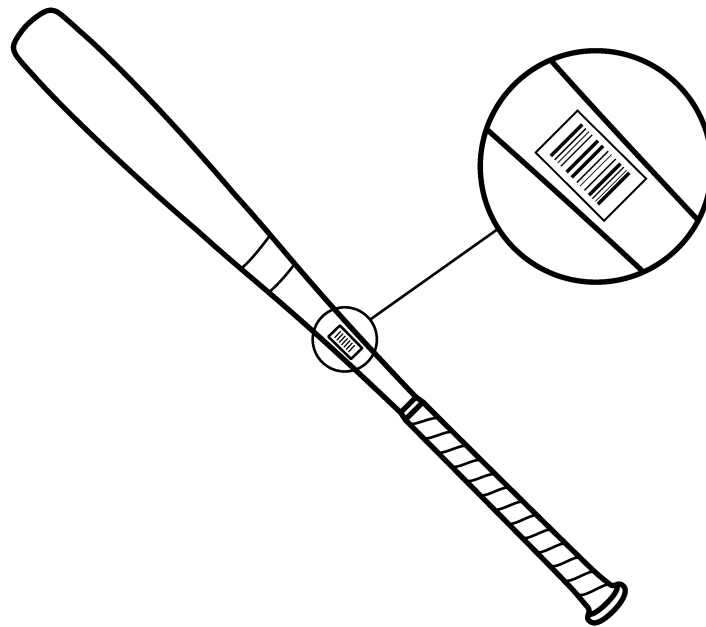
Figure 6.4.18 – 2: Example Bar Code Locations on a Box of Balls & Separate Balls



- **Bats, Team Sports**

- Preferred placement: On the barrel handle of the bat, respecting the proper Quiet Zone areas around the bar code symbol.
- Edge rule: See Section 6.3.3.3.

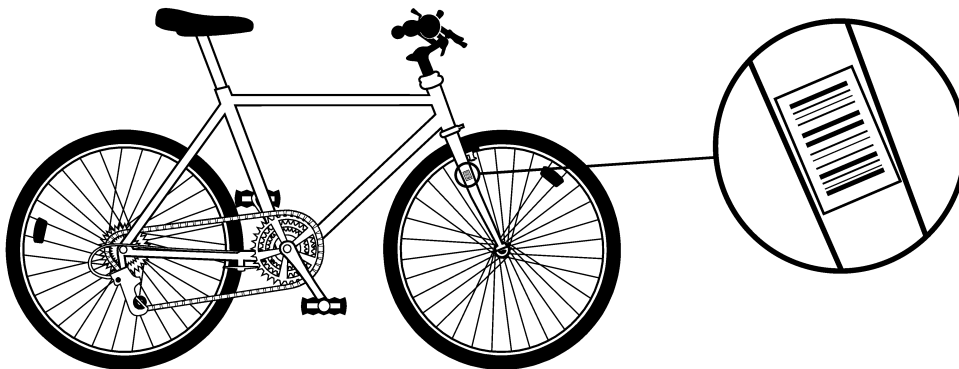
Figure 6.4.18 – 3: Example Bar Code Location on a Baseball Bat



- **Bicycles**

- Preferred placement: On the right hand fork of the bike, respecting the proper Quiet Zone areas around the bar code symbol.
- Undesirable alternative: On a hangtag around the right hand brake cable, respecting the proper Quiet Zone areas around the bar code symbol.
- Edge rule: See Section 6.3.3.3.

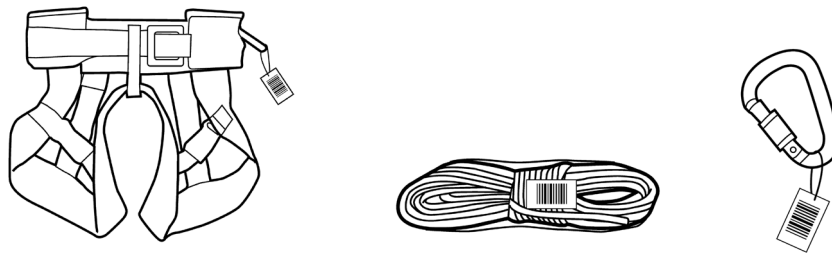
Figure 6.4.18 – 4: Example Bar Code Location on a Bicycle



- **Climbing Gear**

- Preferred placement:
 - If packaged in boxes, see Section 6.4.4.
 - If packaged using a hangtag, see Section 6.6.2.
 - If packaged as carded items, see Section 6.4.6.
- Edge rule: See Section 6.3.3.3.

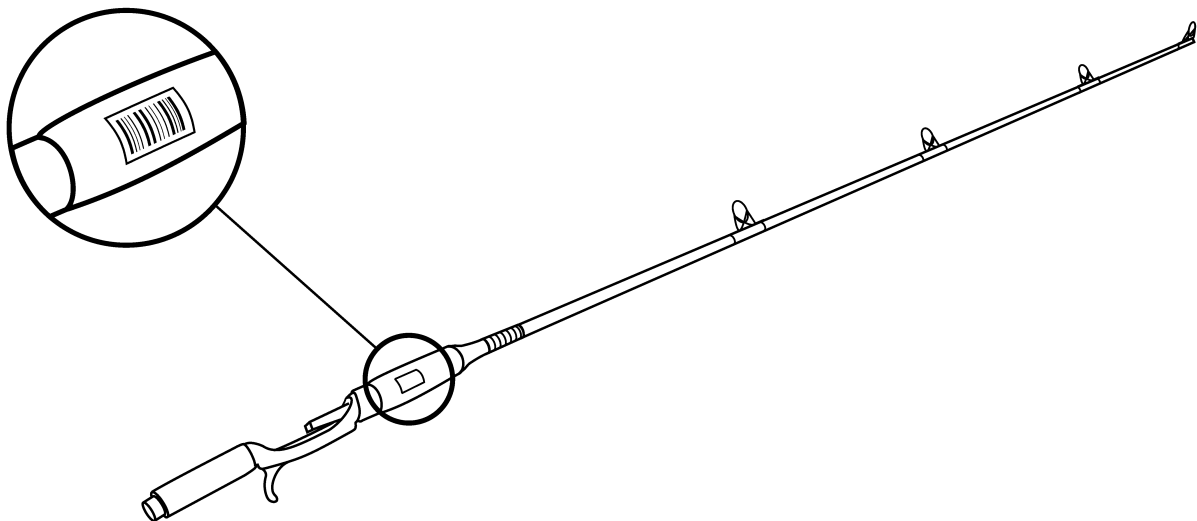
Figure 6.4.18 – 5: Example Bar Code Locations on Climbing Gear



- **Fishing Rods:**

- Preferred placement: On the grip of the fishing rod near the sealed end, respecting the proper Quiet Zone areas around the bar code symbol. When a bar code symbol is printed onto a curved surface it is sometimes possible for the extremes of the symbol to disappear around the curve. See Section 6.A.1 for the rules on the relationship between the diameter of the item and the X-dimension.
- Undesirable alternative: On a cardboard wrap or a hang tag on the shaft of the fishing rod, respecting the proper Quiet Zone areas around the bar code symbol.
- Edge rule: See Section 6.3.3.3.

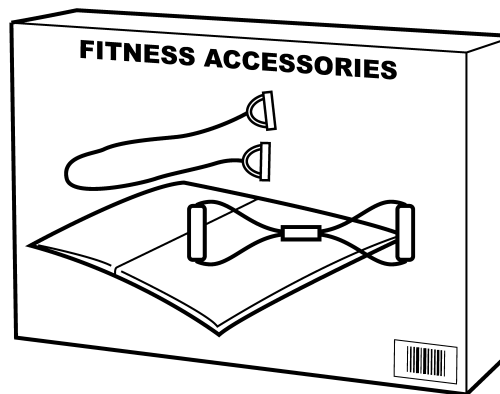
Figure 6.4.18 – 6: Example Bar Code Location on a Fishing Rod



- **Fitness Accessories**

- Preferred placement:
 - If packaged in boxes, see Section 6.4.4.
 - If packaged using hangtags, see Section 6.6.2.
 - If packaged as a carded item, see Section 6.4.6.
- Edge rule: See Section 6.3.3.3.

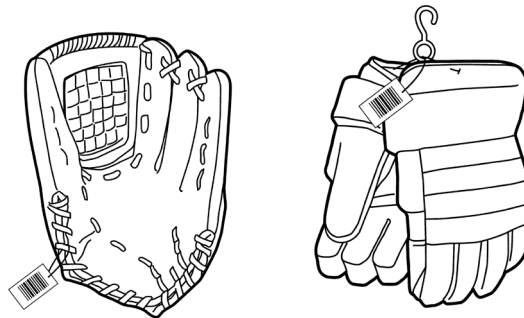
Figure 6.4.18 – 7: Example Bar Code Location on a Box of Fitness Accessories



- **Gloves, Mitts (Sports)**

- Preferred placement:
 - If packaged in boxes, see Section 6.4.4.
 - If packaged using hangtags, see Section 6.6.2.
 - If packaged in bags, see Section 6.4.1.
 - If not packaged, see Section 6.6.4.
- Edge rule: See Section 6.3.3.3.

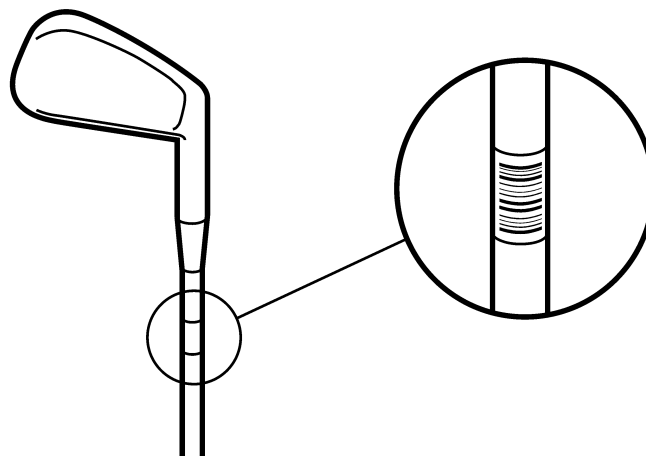
Figure 6.4.18 – 8: Example Bar Code Locations on Gloves



- **Golf Club:**

- Preferred placement: On the shaft of the club located near the club head, respecting the proper Quiet Zone areas around the bar code symbol. When a bar code symbol is printed onto a curved surface it is sometimes possible for the extremes of the symbol to disappear around the curve. See Section 6.A.1 for the rules on the relationship between the diameter of the item and the X-dimension. Symbols should not be located on the head of the golf club as symbols located on this flat area (normally preferable to locating bar codes on a curved surface) are easily damaged due to customer trials.
- Undesirable alternative: On the grip of the club near the sealed end, respecting the proper Quiet Zone areas around the bar code symbol.
- Edge rule: See Section 6.3.3.3.

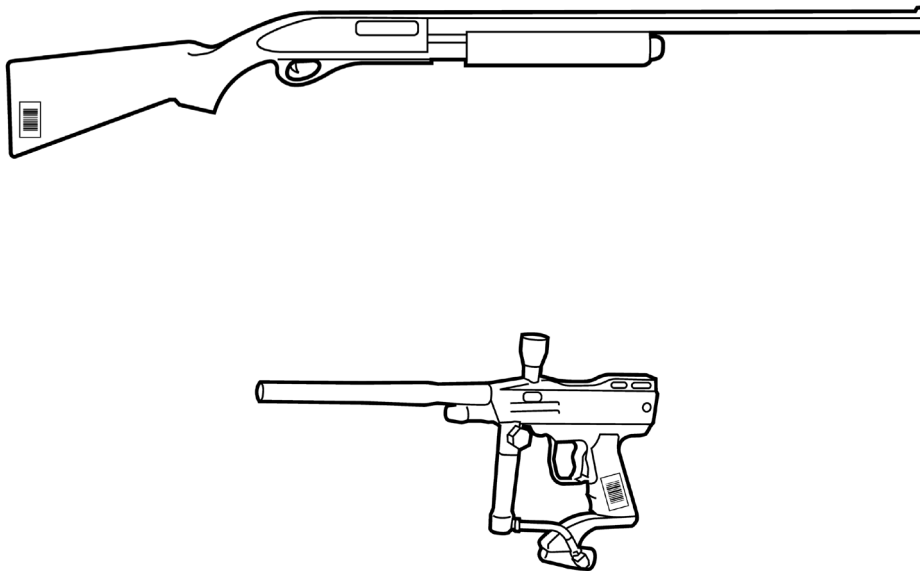
Figure 6.4.18 – 9: Example Bar Code Location on a Golf Club



- **Guns**

- Preferred placement:
 - If packaged using a hangtag, see Section 6.6.2.
 - If packaged as a blister pack, see Section 6.4.2.
 - If not packaged, placement near serial number.
- Edge rule: See Section 6.3.3.3.

Figure 6.4.18 – 10: Example Bar Code Locations on a Rifle and Paint Ball Gun



- **Helmets, Masks (Sports)**

- Preferred placement:
 - If packaged in boxes, see Section 6.4.4.
 - If packaged using hangtags, see Section 6.6.2.
 - If not packaged, see Section 6.6.4.
- Edge rule: See Section 6.3.3.3.

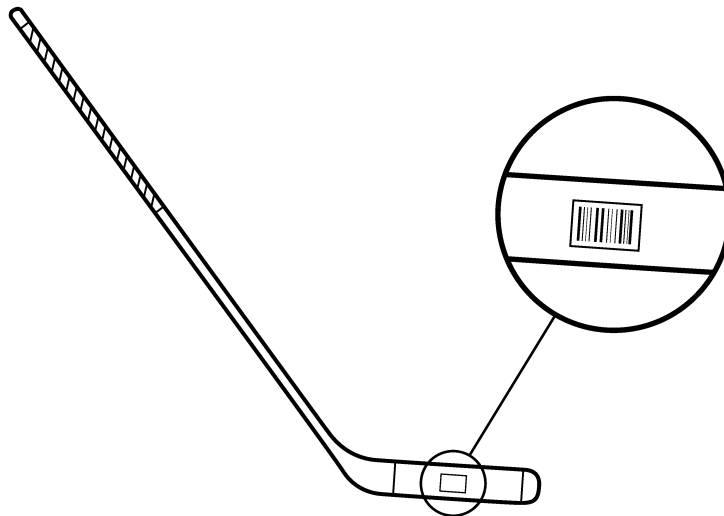
Figure 6.4.18 – 11: Example Bar Code Location on a Helmet



- **Ice-Hockey and Field Hockey:**

- Preferred placement: On the flat blade of the stick, respecting the proper Quiet Zone areas around the bar code symbol.
- Undesirable alternative: At the very top of the shaft of the stick, respecting the proper Quiet Zone areas around the bar code symbol. When a bar code symbol is printed onto a curved surface it is sometimes possible for the extremes of the symbol to disappear around the curve. See Section 6.A.1 for the rules on the relationship between the diameter of the item and the X-dimension.
- Edge rule: See Section 6.3.3.3.

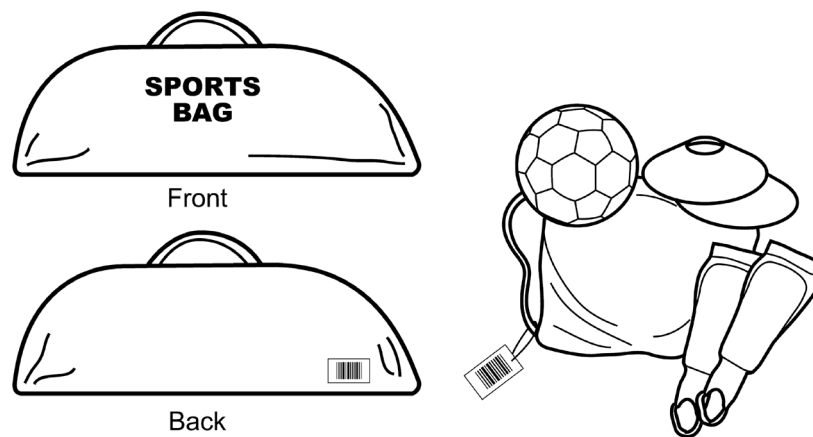
Figure 6.4.18 – 12: Example Bar Code Location on an Ice-Hockey Stick



- **Multi-Sports-Product Pack Sets**

- Preferred placement:
 - For placement on bags see Section 6.4.1
 - For placement on hangtags, see Section 6.6.2.
- Edge rule: See Section 6.4.17 and Section 6.5, shoebox

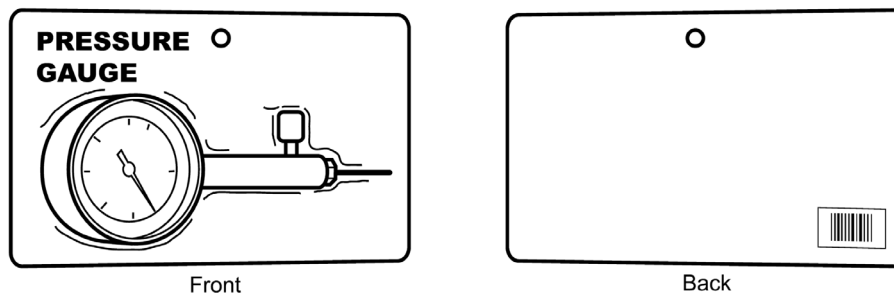
Figure 6.4.18 – 13: Example Bar Code Location on a Product Pack



- **Pressure Gauges**

- Preferred placement:
 - If packaged as carded items, see Section 6.4.6.
 - If packaged in bags, see Section 6.4.1.
 - If not packaged, placement on the wrap band securing the tip/needles, etc.
- Edge rule: See Section 6.3.3.3.

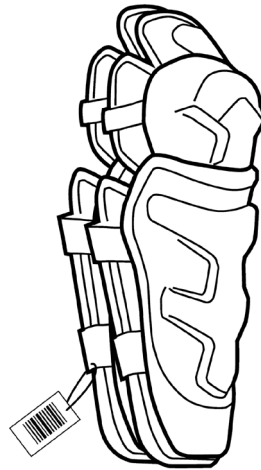
Figure 6.4.18 – 14: Example Bar Code Location on a Carded Item



- **Protective Gear, Guards, Vests**

- Preferred placement:
 - If packaged as a carded item, see Section 6.4.6.
 - If not packaged, see Section 6.6.4.
- Edge rule: See Section 6.3.3.3.

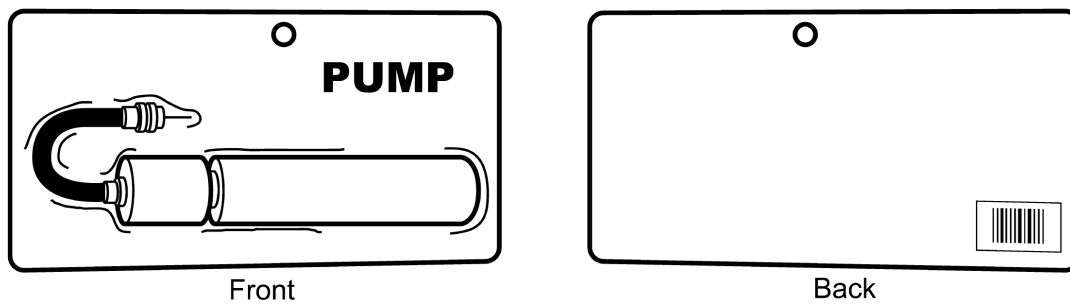
Figure 6.4.18 – 15: Example Bar Code Location on Guards



- **Pumps (Sports)**

- Preferred placement:
 - If packaged as carded items, see Section 6.4.6.
 - If not packaged, placement on the wrap band securing the tip/needles, etc.
- Edge rule: See Section 6.3.3.3.

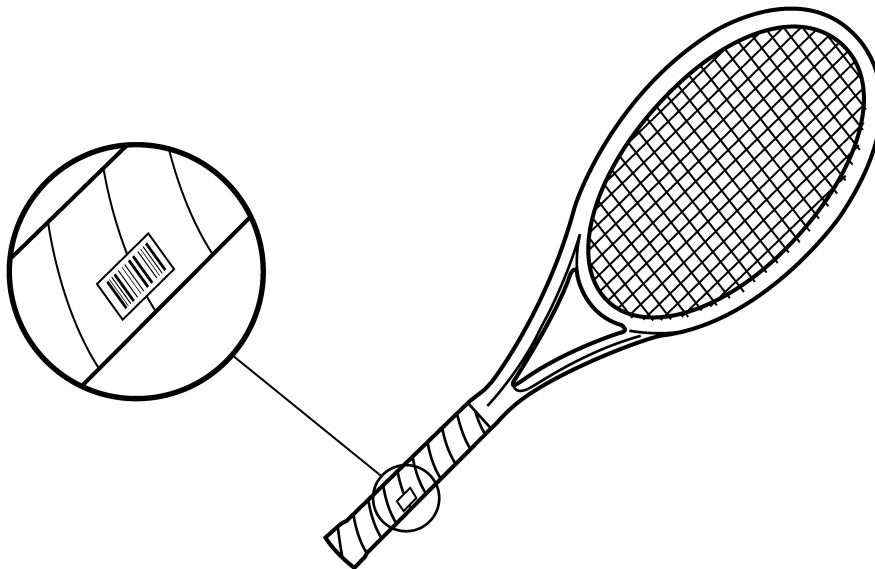
Figure 6.4.18 – 16: Example Bar Code Location on Carded Item



Racquets:

- Preferred placement: On the grip of the racquet near the sealed end, respecting the proper Quiet Zone areas around the bar code symbol. When a bar code symbol is printed onto a curved surface it is sometimes possible for the extremes of the symbol to disappear around the curve. See Section 6.A.1 for the rules on the relationship between the diameter of the item and the X-dimension.
- Undesirable alternative: On the cardboard wrap placed over the head of the racquet near the edge of the racquet head, respecting the proper Quiet Zone areas around the bar code symbol.
- Edge rule: See Section 6.3.3.3.

Figure 6.4.18 – 17: Example Bar Code Location on a Racquet

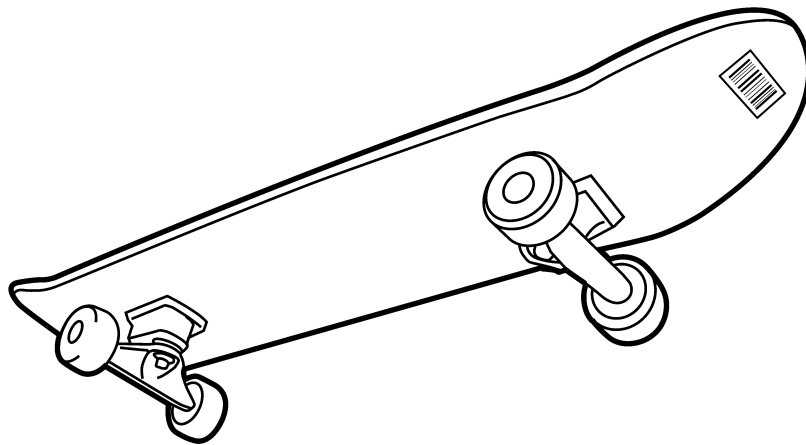


- **Skateboards:**

Skateboards are often displayed in their packages. See Section 6.2.3, Orientation, to determine the back of the package. For unpackaged items:

- Preferred placement: One bar code symbol is placed on the bottom side of the skateboard on the top above the wheels, respecting the proper Quiet Zone areas around the bar code symbol.
- Edge rule: See Section 6.3.3.3.

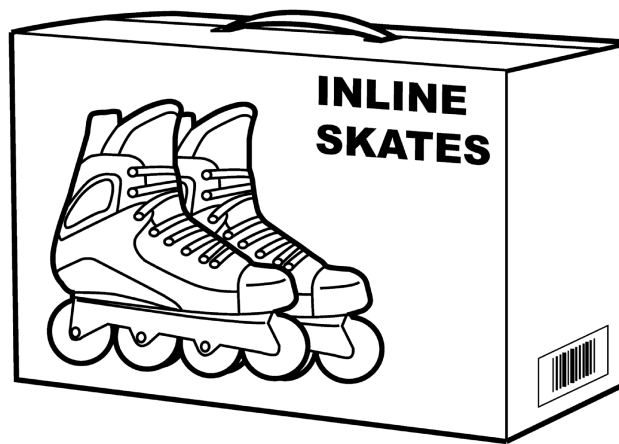
Figure 6.4.18 – 18: Example Bar Code Location on a Skateboard



- **Skates**

- Preferred placement:
 - If packaged in boxes, see Section 6.4.4.
 - If packaged using hangtags, see Section 6.6.2.
- Edge rule: See Section 6.3.3.3.

Figure 6.4.18 – 19: Example Bar Code Location on a Box of Skates

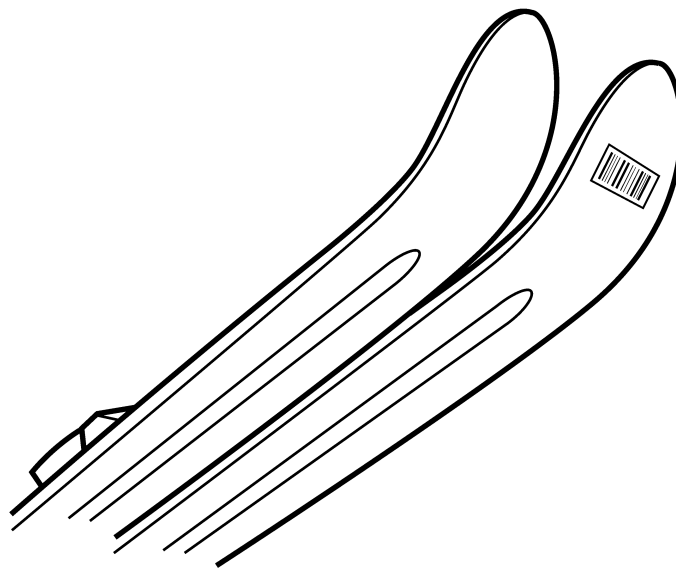


- **Skis**

Skis are displayed without their packaging. The orientation of the ski is that the front of the ski is the side where the ski boots are placed and the back of the ski is the opposite side.

- Preferred placement: One bar code symbol is placed on the back of the ski near the top of the ski, respecting the proper Quiet Zone areas around the bar code symbol. Only one bar code symbol is required per pair.
- Edge rule: See Section 6.3.3.3.

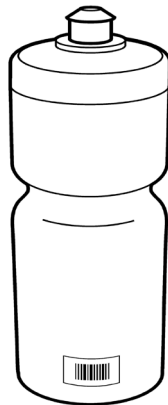
Figure 6.4.18 – 20: Example Bar Code Location on a Ski



- **Water Bottles (Sports)**

- Preferred placement:
 - If packaged in boxes, see Section 6.4.4.
 - If packaged using hangtags, see Section 6.6.2.
 - If not packaged, placement on the side of the bottle.
- Edge rule: See Section 6.3.3.3.

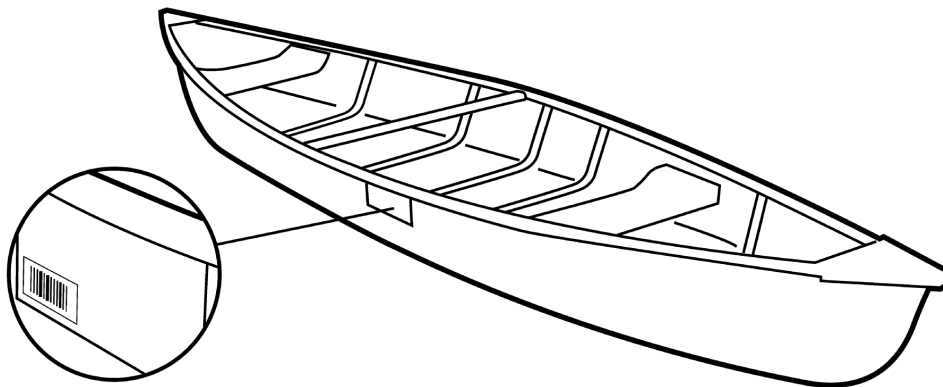
Figure 6.4.18 – 21: Example Bar Code Location on a Water Bottle



- **Water Sports Crafts**

- Preferred placement:
 - If packaged in boxes, see Section 6.4.4.
 - If packaged using a hangtag, see Section 6.6.2.
 - If not packaged, see Section 6.4.9, Large, Heavy, or Bulky Items.
- Edge rule: See Section 6.3.3.3.

Figure 6.4.18 – 22: Example Bar Code Location on a Canoe

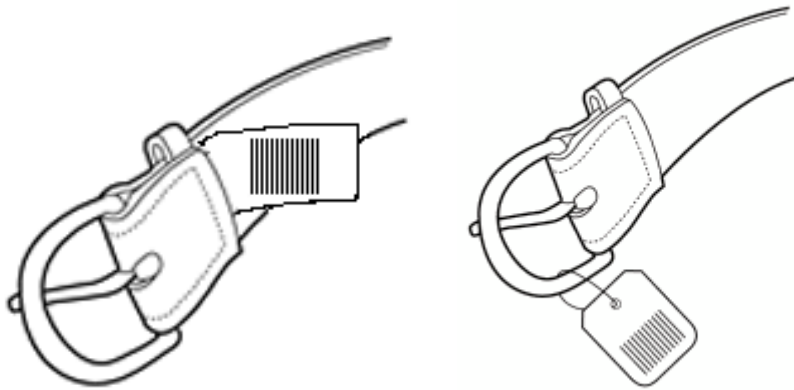


6.4.19 Textured Surfaces

Some merchandise may not allow for application of bar code labels due to rough or textured surfaces. These surfaces can distort the label and thus the bar code. Alternative labelling options such as hang tags or loop tags may be necessary.

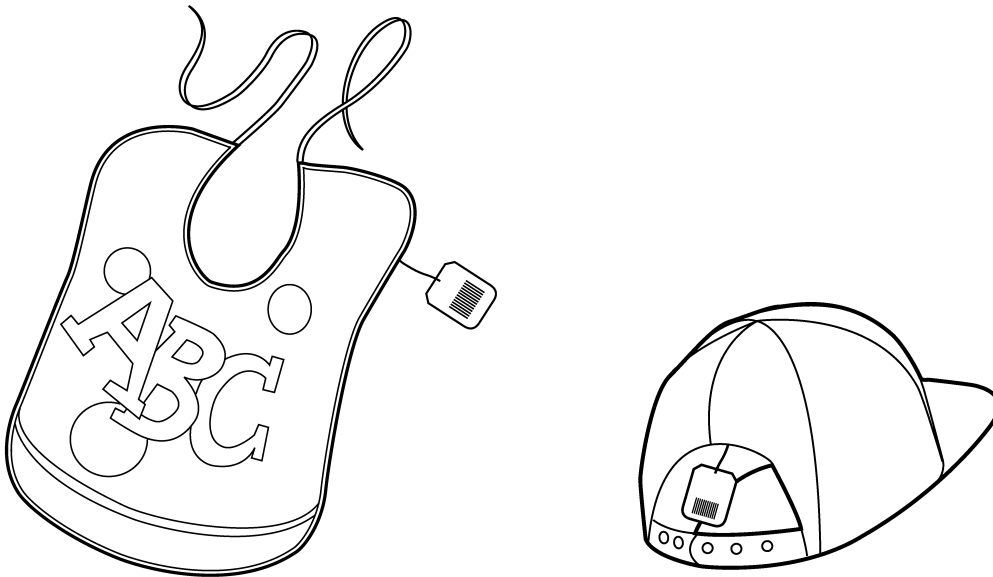
6.5. SYMBOL PLACEMENT FOR CLOTHING AND FASHION ACCESSORIES

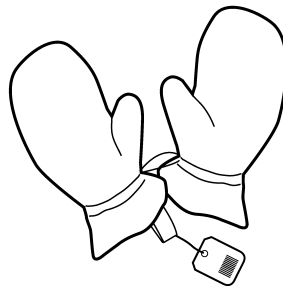
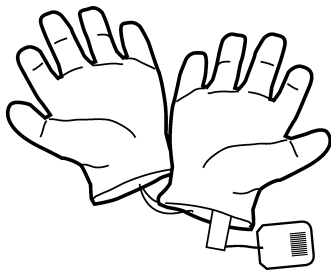
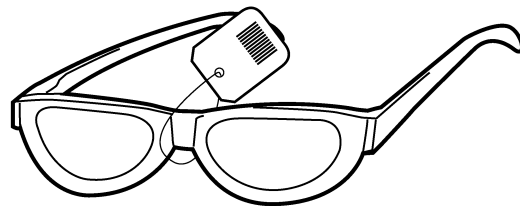
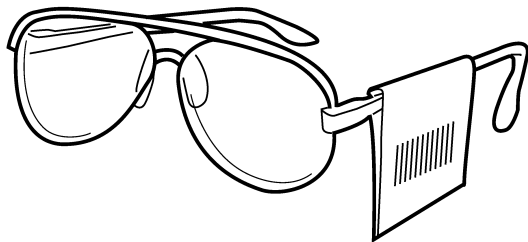
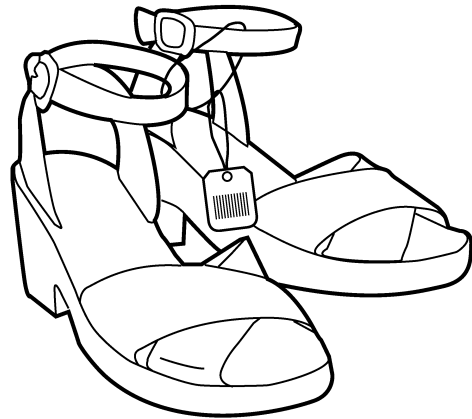
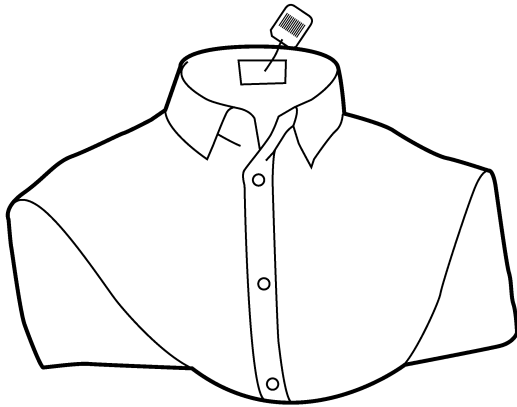
The following examples show recommended placement of symbols on clothing and fashion accessories.

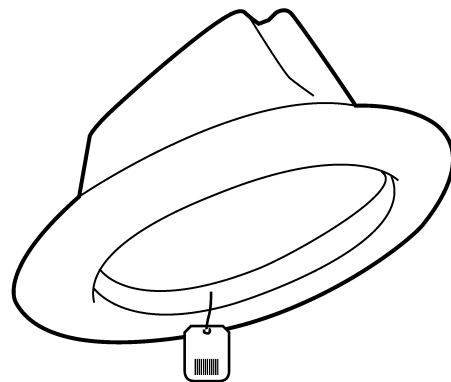
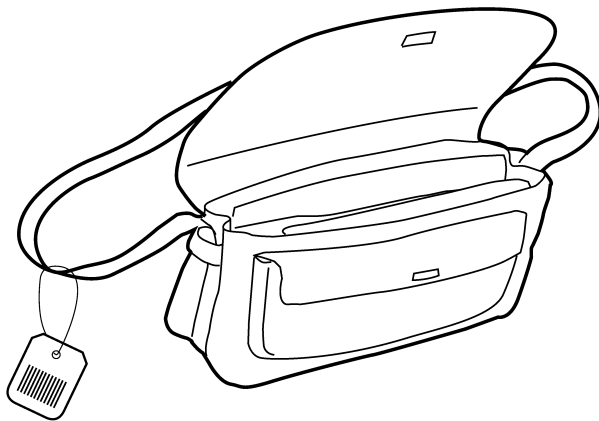
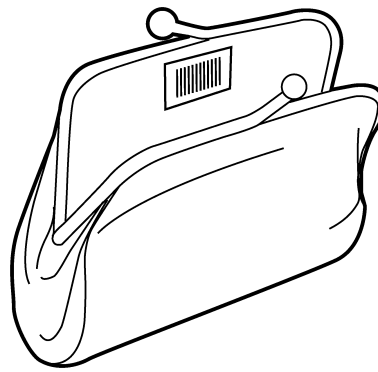
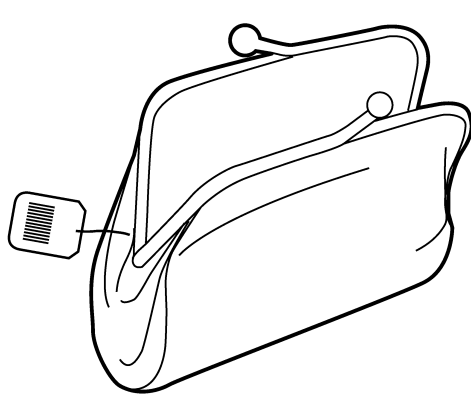


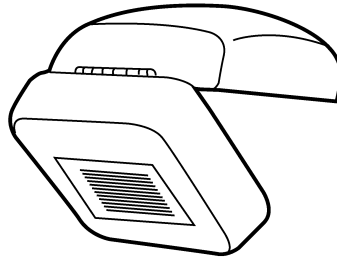
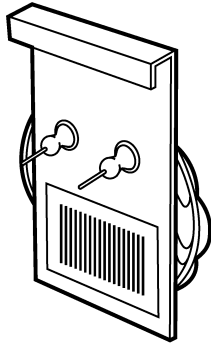
Option 1

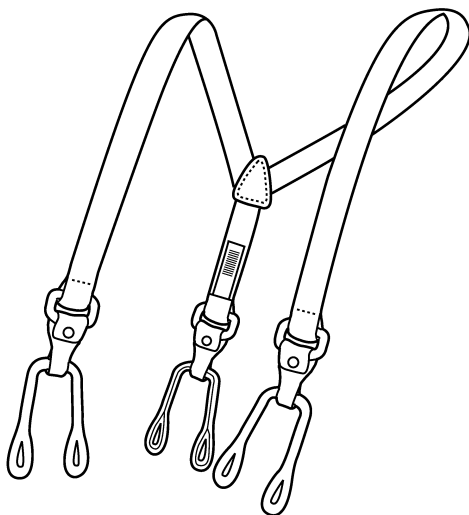
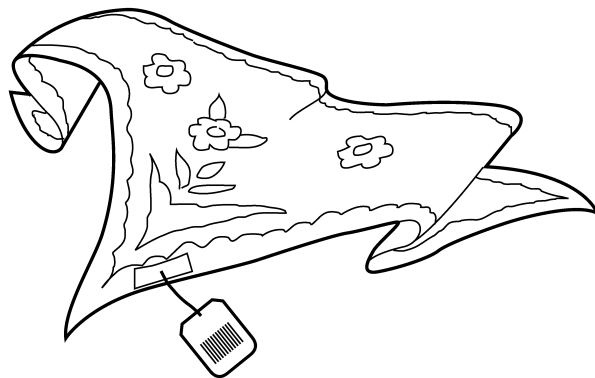
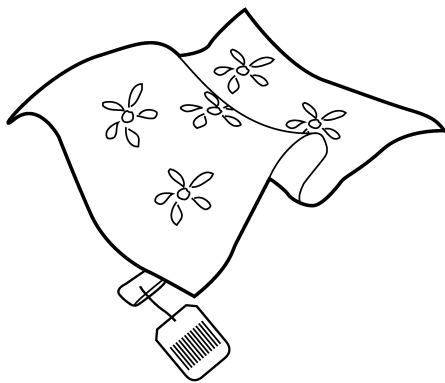
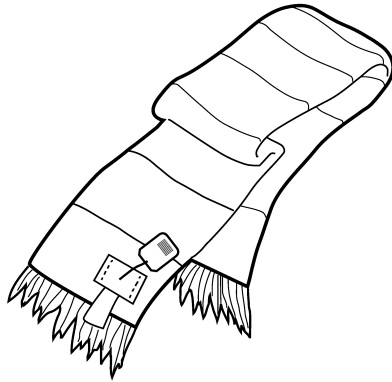
Option 2

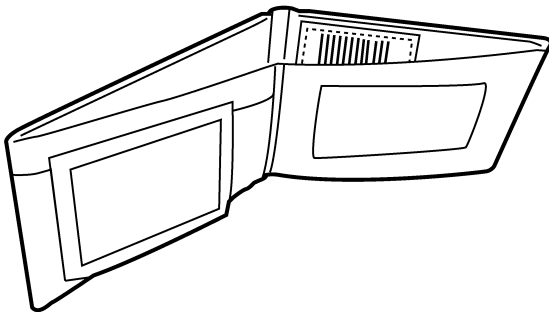
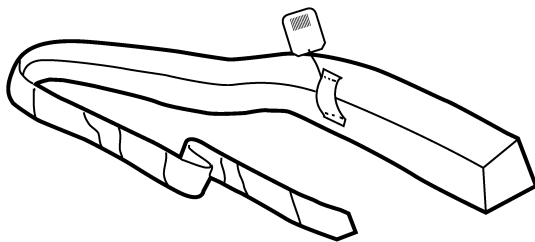
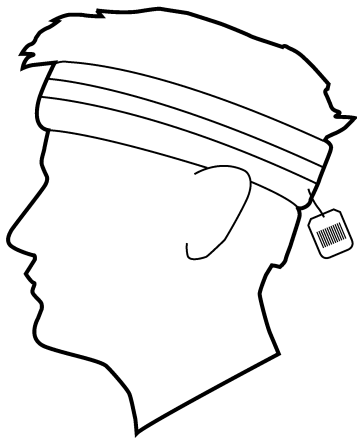


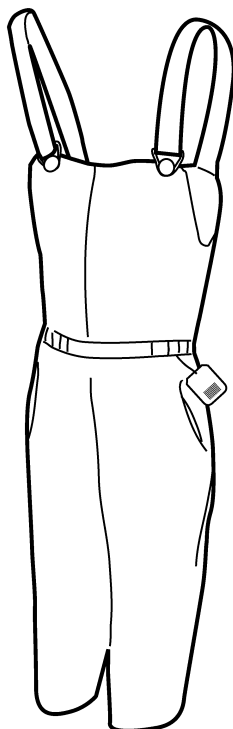
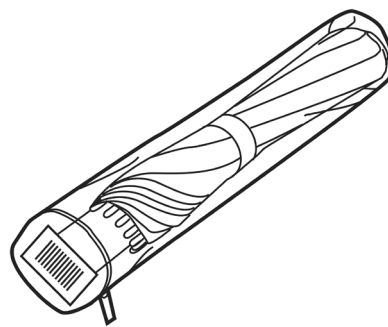
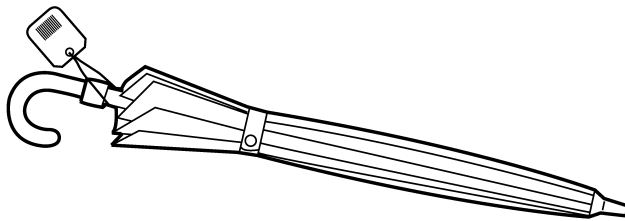
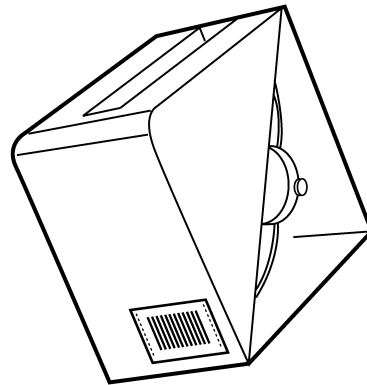
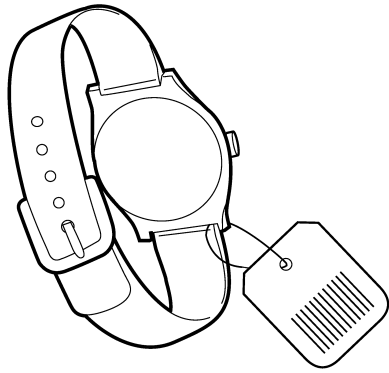


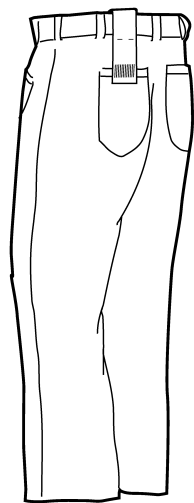
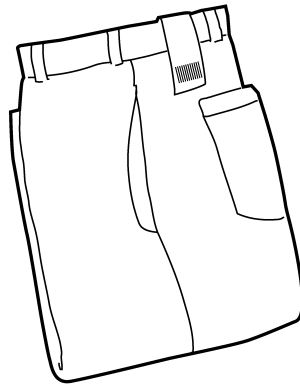








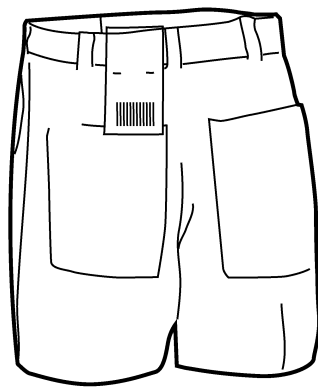




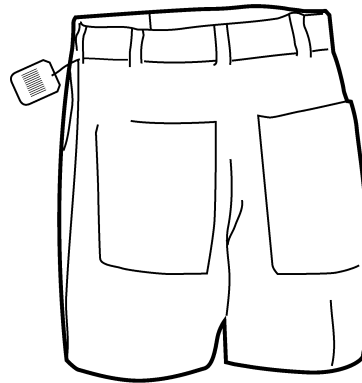
Option 1



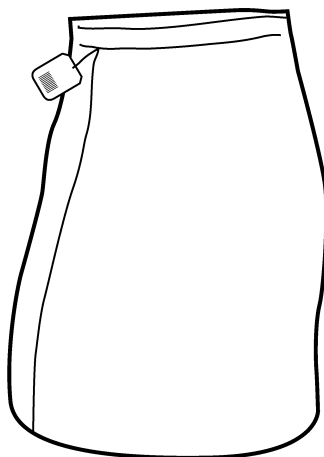
Option 2



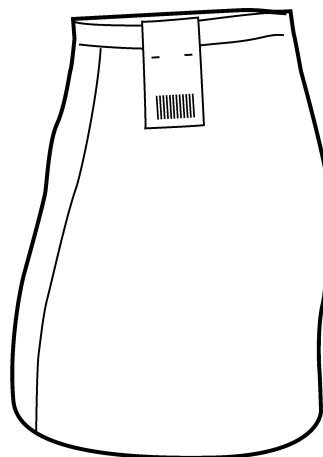
Option 1



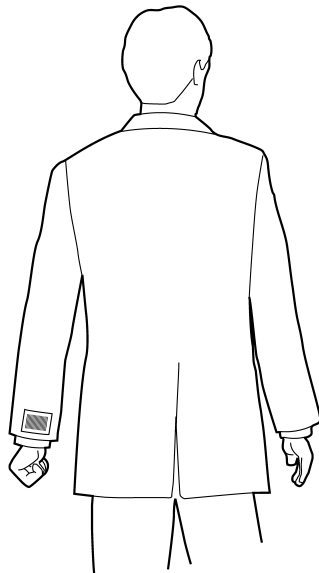
Option 2



Option 1



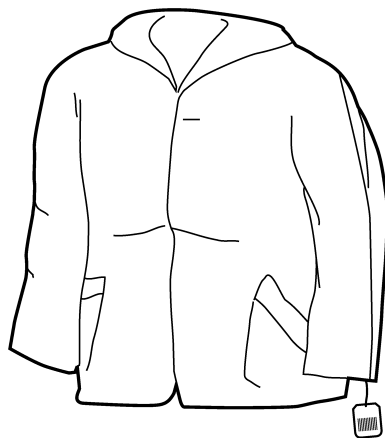
Option 2



Option 1



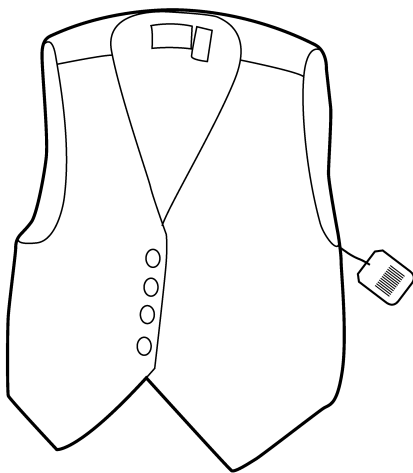
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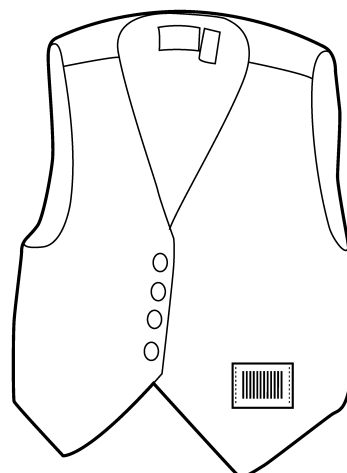
Option 1



Option 2



Option 1



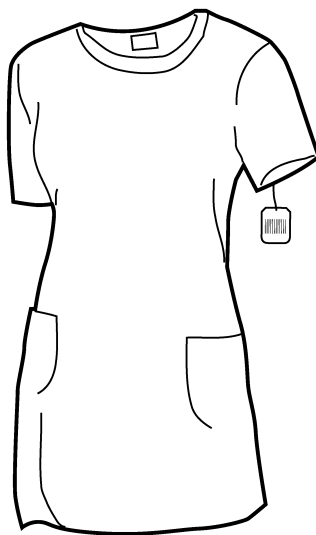
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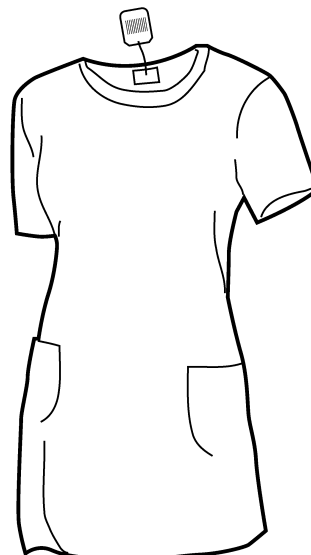
Option 1



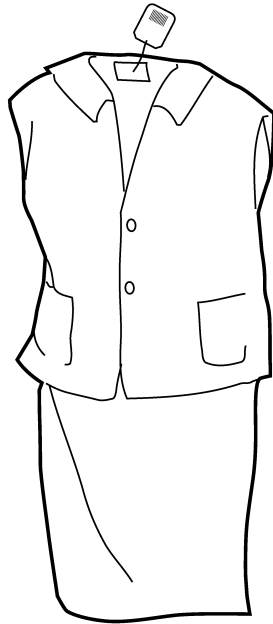
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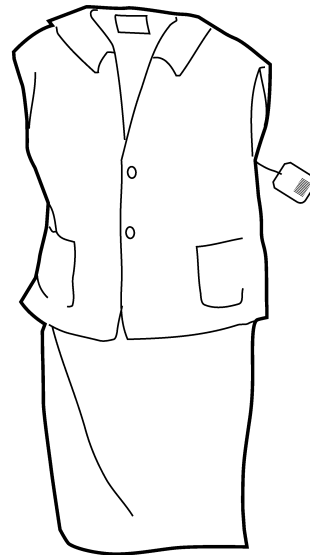
Option 1



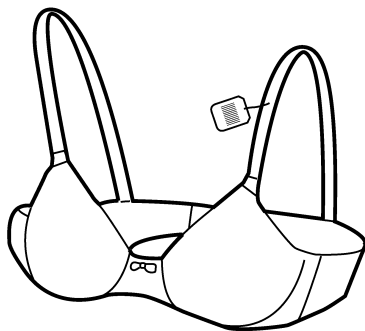
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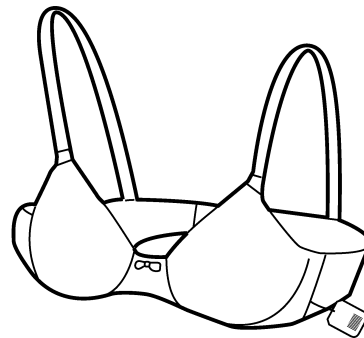
Option 1



Option 2

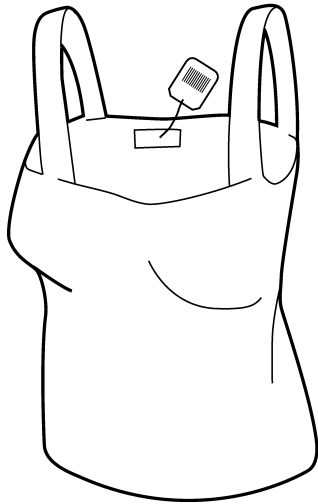


Option 1

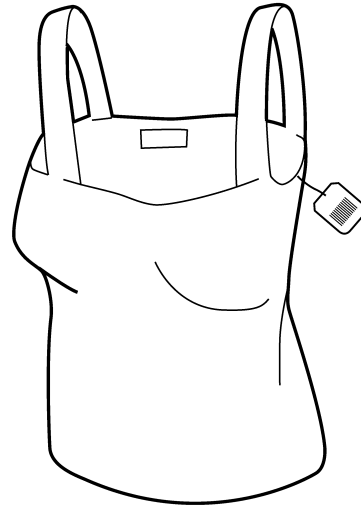


Option 2

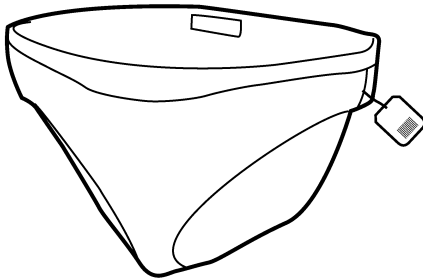




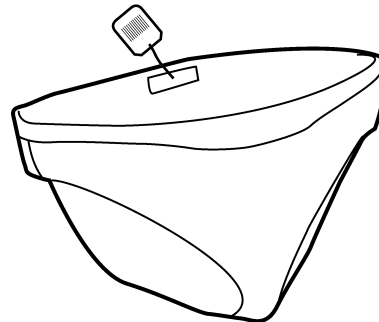
Option 1



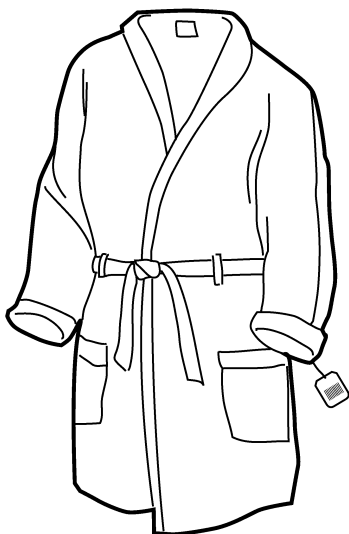
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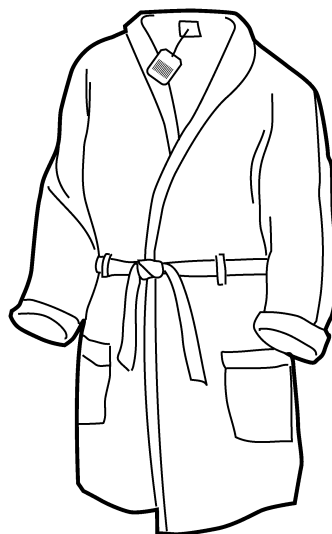
Option 1



Option 2



Option 1



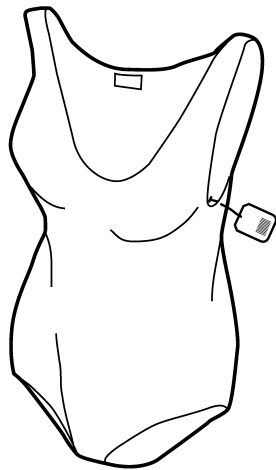
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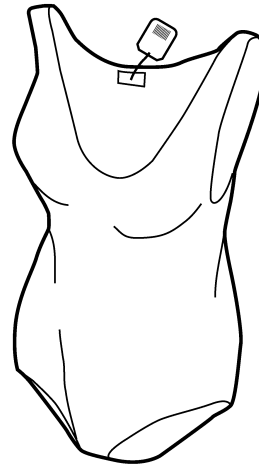
Option 1



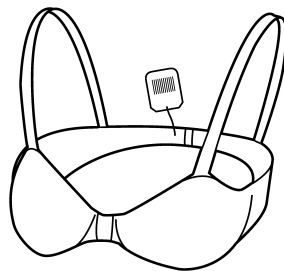
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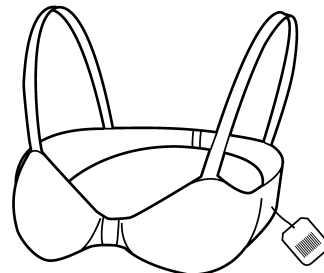
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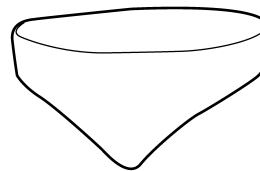
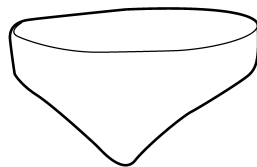
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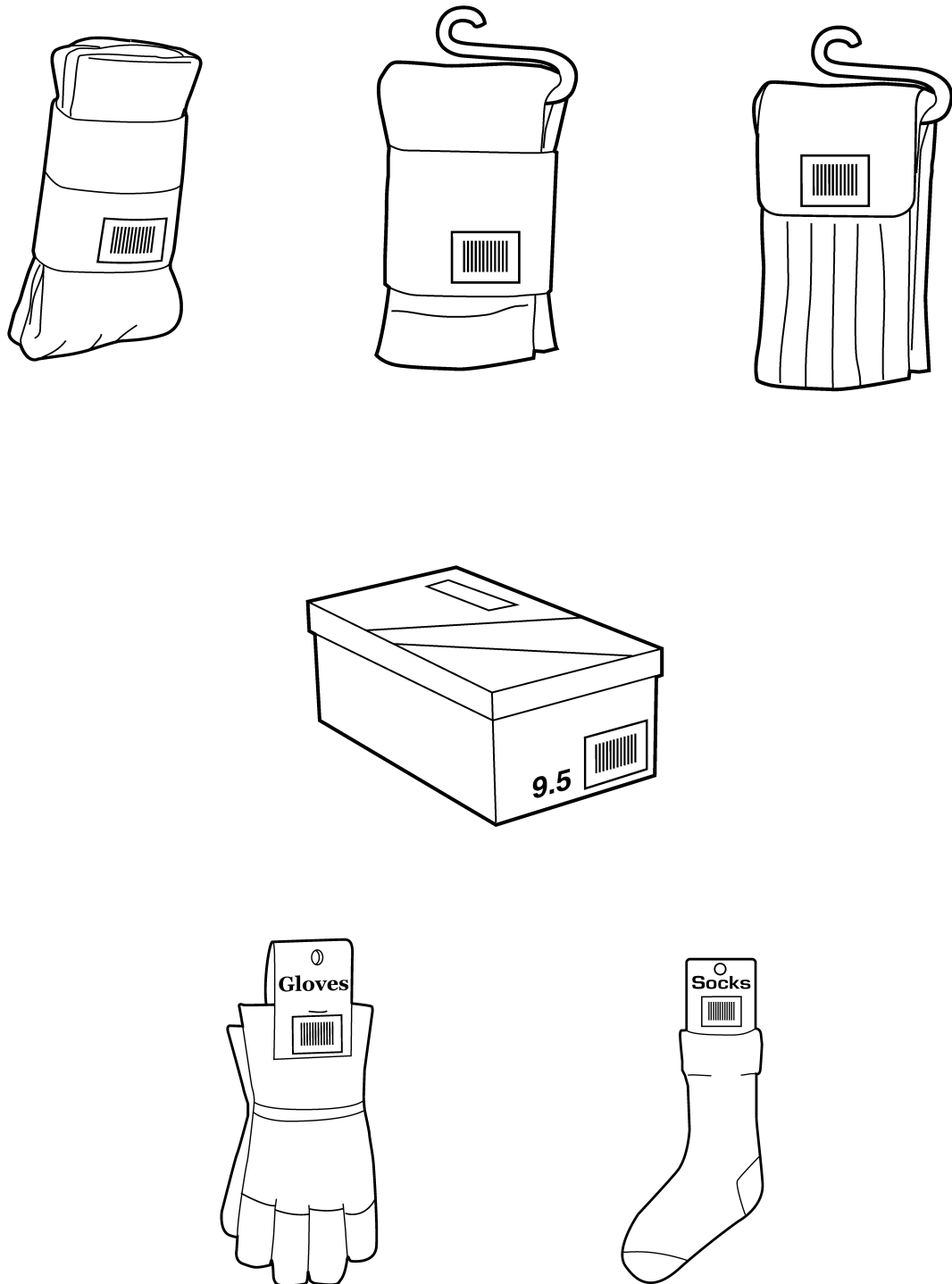


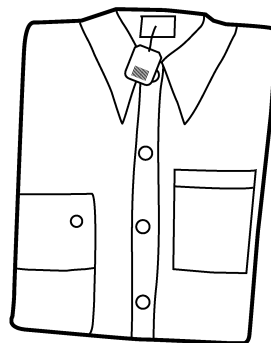
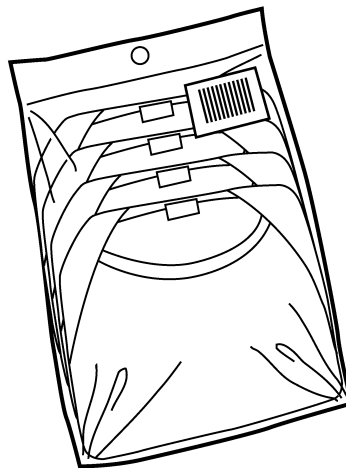
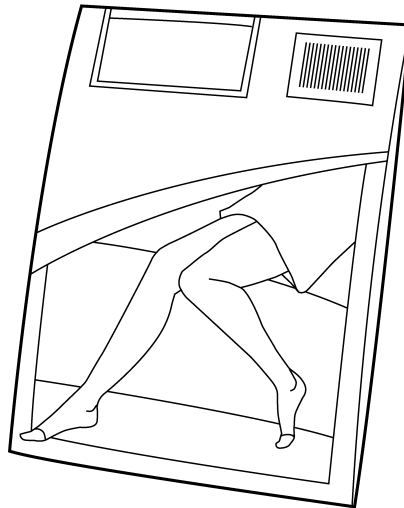
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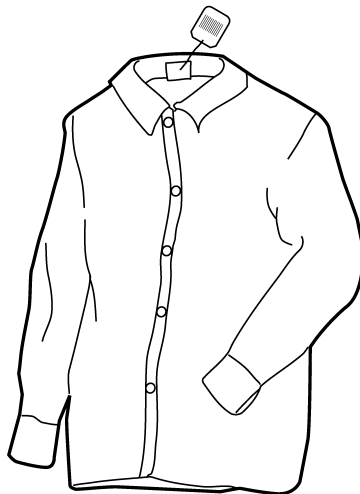
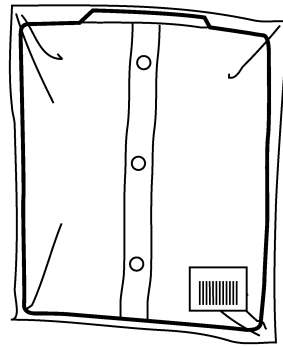


Option 2









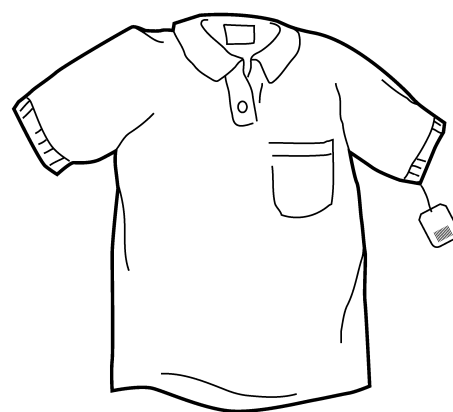
Option 1



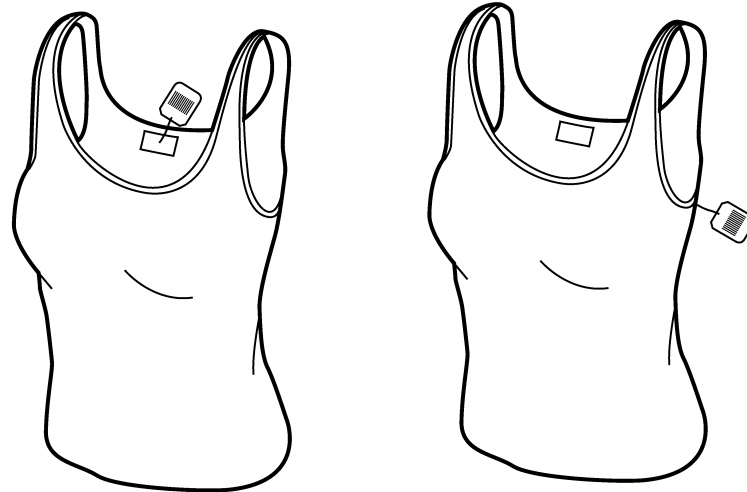
Option 2



Option 1

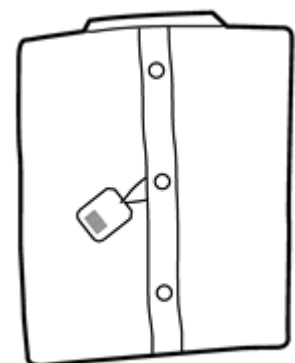
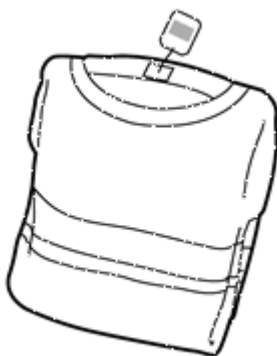
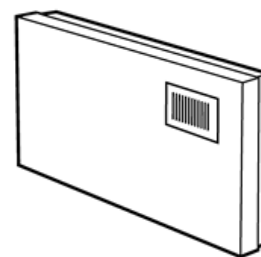
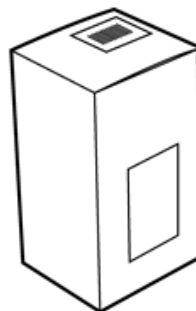
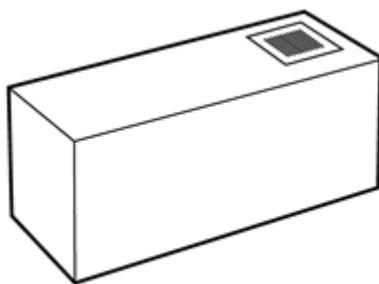


Option 2



Option 1

Option 2

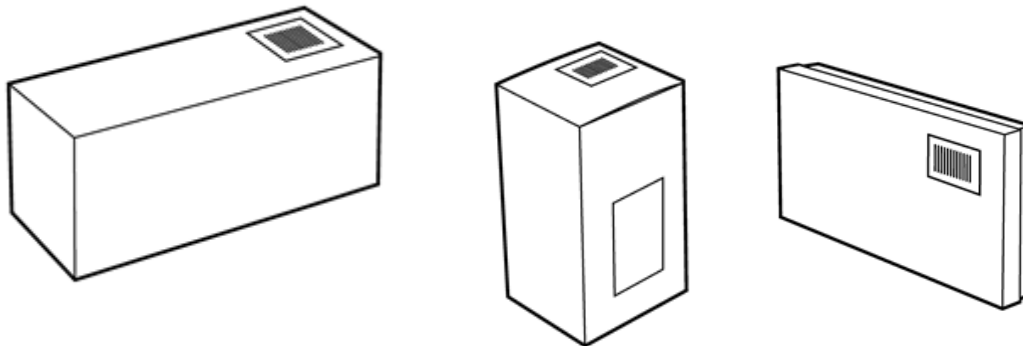




6.6. GENERAL FORMAT GUIDELINES FOR CLOTHING AND FASHION ACCESSORIES

Clothing is displayed in a variety of ways, such as loose (e.g., hanging garments), in boxes, or in bags. In many cases, a relatively small label must carry all the pertinent information relevant to the product. A retail label normally carries not only product-specific information important to the retailer (e.g., die lot, batch) and consumer related information (e.g., style, size, colour), but also the bar code symbol itself.

The correct general layout for a retail label is indicated below. Because there are many clothing types on



the retail market, detailed label formats are presented in [Section 6.6.2](#).

- Layout of label: The label should be divided into three portions:
 - Manufacturer/retailer information: The upper portion of the format is the preferred location for Human Readable Interpretation product identification. This information is important to manufacturers and retailers, but usually not to the consumer.
 - Bar code symbol: The centre portion of the format is the best location for the bar code symbol. Symbols in this location are the least likely to present obstructions to scanners because a natural boundary exists between the manufacturer/retailer information (upper portion) and the consumer information (lower portion).
 - Consumer information: The lower portion of the format is the preferred location for information that is provided for the consumer, such as price, size, and fabric content.
- Label placement on clothing and fashion accessories: To determine the placement of the printed label on clothing and fashion accessories, see [Section 6.5](#) for drawings that illustrate where to attach or place the label on each type of product.

6.6.1 Information Zones Concept

There are seven information zones that carry product information needed for the vendor, retailer, and consumer. Some information is optional based upon the type of label.

6.6.1.1 General Label Information Zones

Zones	Information Type	Description	Status: Required/ Optional
Zone 1	Merchandise identification	This is the primary human readable merchandise identifier, usually the style number, although it may be pattern, model, or garment type. The merchandise identifier should be located in the upper left-hand portion of Zone 1.	Always required (see Note)
Zone 2	Vendor information	This includes optional vendor production information, such as vendor Stock Keeping Unit (SKU), cut number, dye lot, colour, and pattern. (Vendor information helps ensure that the correct bar code symbol is attached to the product.)	Optional
Zone 3	Data structure (EAN/UCC-13, UCC-12, EAN/UCC-8)	Bar code symbol	Always required
Zone 4	Consumer information	This includes optional product information for the consumer, such as fiber content, fire retardancy, and country of origin.	Optional
Zone 5	Size/dimension	Size/dimension is a key requirement for the consumer. Size information can be emphasised in large bold print and should be located in the right-hand portion of Zone 5. Vendors may optionally include a style name as a selection aid for the consumer.	Usually required unless defined by the product (e.g., towels)
Zone 6	Retail price	Allow space to print the price with minimum dimension characters of 25 mm (1 in.) x 32 mm (1.25 in.). For plastic packaged, boxed, and banded products, the required space for price can be provided by several methods: - For bar code symbol marking on an adhesive label, the space for price can be included as part of the label. - For bar code symbol marking designed into the packaging, the space for price can be included on the package artwork. - Providing package space adjacent to Zone 5 that is reserved for retail item pricing creates an implied space for price. Implied space replaces the requirement for actual space on labels or package artwork. If implied space for price is used, no information of importance should be printed in the area that might be covered by adhesive item price labels.	Usually required unless defined by the ticket format (e.g., sewn-in tickets)
Zone 7	Manufacturer's suggested retail price	This is for use only if merchandise is pre-priced or the suggested retail price is printed on the tag. If provided, the area must be perforated for optional removal.	Optional

Note: Size and colour are optional in Zone 1 if vendor usage requires this information to define the product.

6.6.1.2 General Label Format

See the Figures 6.6.1.2 – 1 and 6.6.1.2 –2 for examples of how the zones appear in a typical vertical and horizontal label format.

Figure 6.6.1.2 – 1

Vertical Label Format

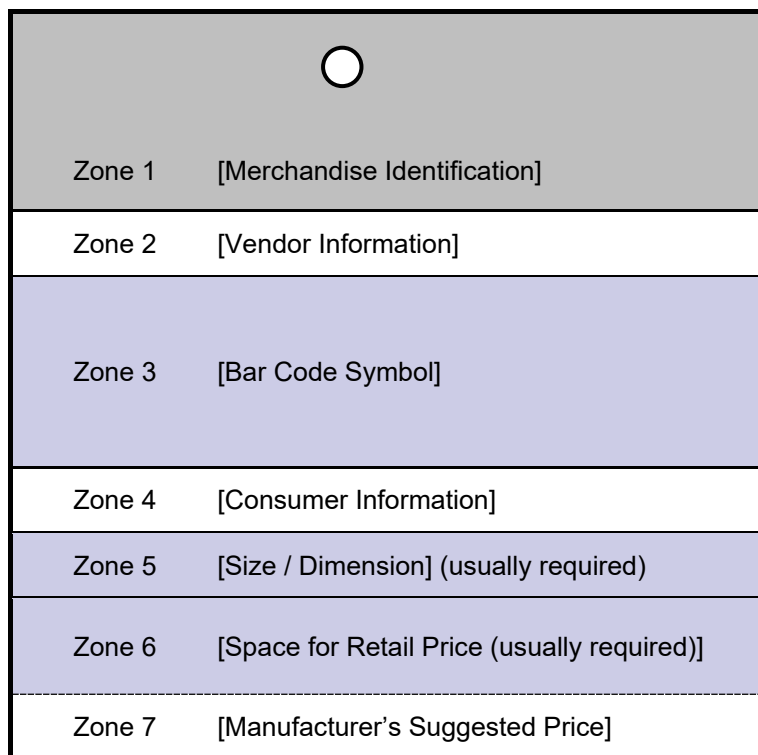
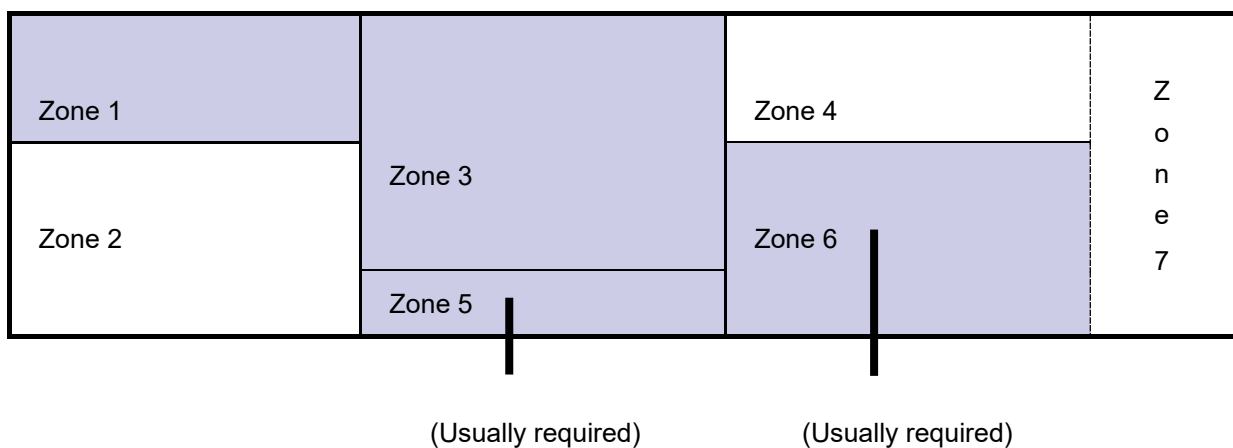


Figure 6.6.1.2 – 2

Horizontal Label Format



KEY

Required

Optional

6.6.2 Hangtag (Hanging Label) Format

Although hangtags (hanging labels) are primarily associated with hanging ready-to-wear apparel, a wide variety of products are identified with hangtags. Flat-folded apparel, jewellery, belts, handbags, lamps, and furniture are all identified by some form of hangtag. Therefore, the voluntary hangtag format guidelines outlined in this section provide for flexibility in hangtag design while maintaining the overall concept of the information zones.

Hangtags serve a dual purpose. First, they provide brand identification to the consumer. Second, as the back of a hangtag is frequently used for product information and product identification codes, it should carry the bar code symbol that identifies the product.

The typical hangtag layout features the vendor's logo on the front and product identification codes and the bar code symbol on the back. Vendors may optionally include an additional logo on the back of the hangtags. However, a logo should not appear at the bottom because a retail price label may obscure it or it could be torn off if a manufacturer's suggested retail price is removed. Background printing of logos should be avoided, as this may obscure required information or important consumer information. Logos must never obscure the bar code symbol.

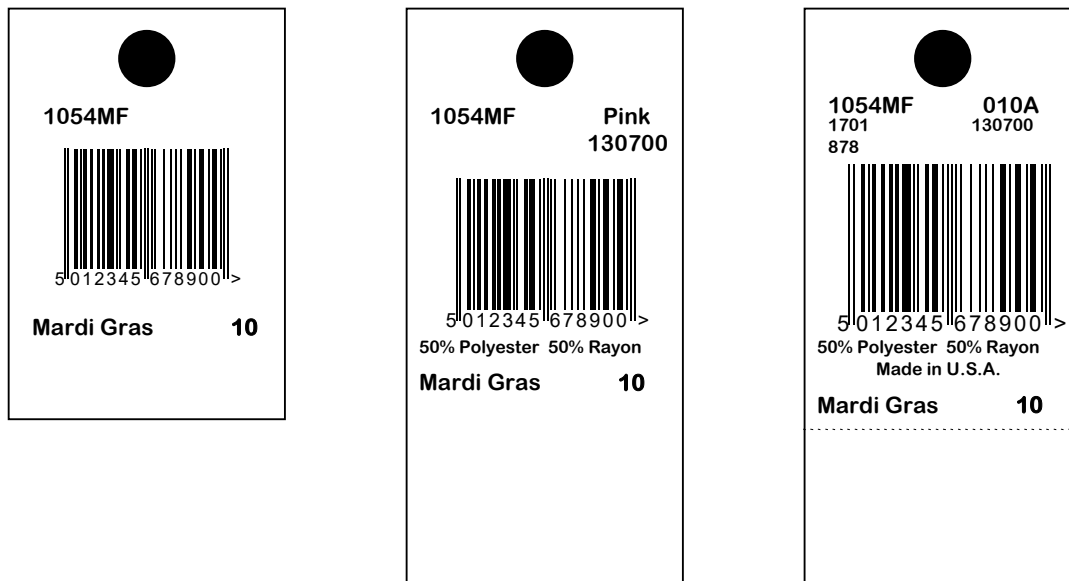
6.6.2.1 Hangtag Label Information Zones

Zones	Information Type	Description	Status: Required/ Optional
Zone 1	Merchandise identification	This is the primary human readable merchandise identifier, usually the style number, although it may be pattern, model, or garment type. The merchandise identifier should be located in the upper left-hand portion of Zone 1.	Always required (see Note)
Zone 2	Vendor information	This includes optional vendor production information, such as vendor Stock Keeping Unit (SKU), cut number, dye lot, colour, and pattern. (Vendor information helps ensure that the correct bar code symbol is attached to the product.)	Optional
Zone 3	Data structure (EAN/UCC-13, UCC-12, EAN/UCC-8)	Bar code symbol	Always required
Zone 4	Consumer information	This includes optional product information for the consumer, such as fiber content, fire retardancy, and country of origin.	Optional
Zone 5	Size/dimension	Size/dimension is a key requirement for the consumer. Size information can be emphasised in large bold print and should be located in the right-hand portion of Zone 5. Vendors may optionally include a style name as a selection aid for the consumer.	Usually required unless defined by the product (e.g., towels)
Zone 6	Retail price	Allow space to print the price with minimum dimension characters of 25 mm (1 in.) x 32 mm (1.25 in.).	Usually required unless defined by the ticket format (e.g., sewn-in tickets)
Zone 7	Manufacturer's suggested retail price	This is for use only if merchandise is pre-priced or the suggested retail price is printed on the tag. If provided, the area must be perforated for optional removal.	Optional

Note: Size and colour are optional in Zone 1 if vendor usage requires this information to define the product.

6.6.2.2 Hanging Tag Label Examples

Figure 6.6.2.2 – 1



6.6.3 Sewn-On (Joker) Label Format

Used almost exclusively for apparel merchandise, joker labels are similar in format to hangtags, but differ in one important respect: They are sewn directly onto the product instead of hung from the product. Because it is sewn on, only one side of the label is available for the vendor's logo, the bar code symbol, and merchandise identification information.

Inclusion of a vendor logo on the label is optional. If it is included, it should not appear at the bottom, because it may be obscured by a retail price label, or it could be torn off by the removal of a manufacturer's suggested retail price. Background printing of logos should be avoided, as this may obscure required information or important consumer information. Logos must never obscure the bar code symbol.

6.6.3.1 Sewn-On (Joker) Label Information Zones

Zones	Information Type	Description	Status: Required / Optional
Zone 1	Merchandise identification	This is the primary human readable merchandise identifier, usually the style number, although it may be pattern, model, or garment type. The merchandise identifier should be located in the upper left-hand portion of Zone 1.	Always required (see Note)
Zone 2	Vendor information	This includes optional vendor production information, such as vendor Stock Keeping Unit (SKU), cut number, dye lot, colour, and pattern. (Vendor information helps ensure that the correct bar code symbol is attached to the product.)	Optional
Zone 3	Data structure (EAN/UCC-13, UCC-12, EAN/UCC-8)	Bar code symbol	Always required
Zone 4	Consumer information	This includes optional product information for the consumer, such as fiber content, fire retardancy, and country of origin.	Optional
Zone 5	Size/dimension	Size/dimension is a key requirement for the consumer. Size information can be emphasised in large bold print and should be located in the right-hand portion of Zone 5. Vendors may optionally include a plain language style name on the size line as a selection aid for the consumer.	Usually required unless defined by the product (e.g., towels)
Zone 6	Retail price	Allow space to print the price with minimum dimension characters of 25 mm (1 in.) x 32 mm (1.25 in.).	Usually required unless defined by the ticket format (e.g., sewn-in tickets)
Zone 7	Manufacturer's suggested retail price	This is for use only if merchandise is pre-priced or the suggested retail price is printed on the tag. If provided, the area must be perforated for optional removal.	Optional

Note: Size and colour are optional in Zone 1 if vendor usage requires this information to define the product.

6.6.3.2 Sewn-On (Joker) Label Examples

Figure 6.6.3.2 – 1

Vertical Layout

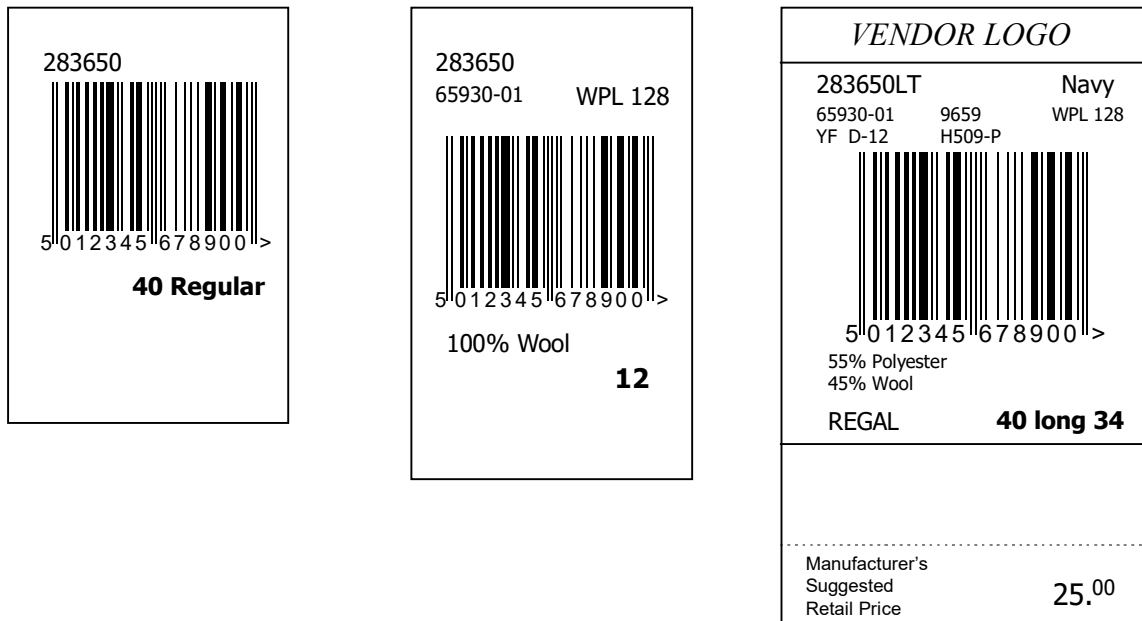
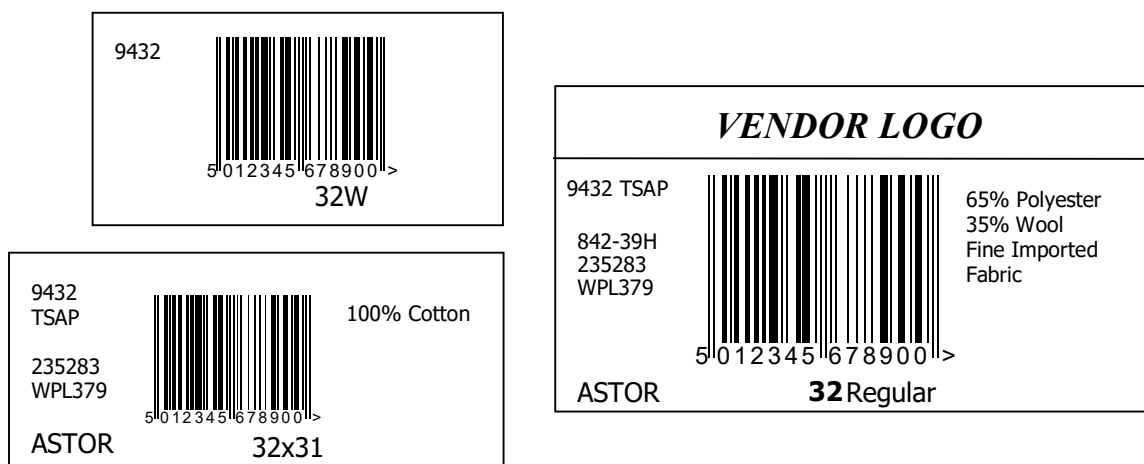


Figure 6.6.3.2 – 2

Horizontal Layout



6.6.4 Sewn-In Label Formats

Sewn-in labels are often used for towel products. Sewn-in labels may be paper based, for removal by the consumer, or cloth based and more permanent.

Because a portion of the sewn-in label is normally covered by a hem, the label should be designed with sufficient blank space on the end that will be attached to the product. Care must be taken to ensure that the product identification information on the label is not obscured by the hem, and that it does not interfere with the readability of the bar code symbol at the Point-of-Sale.

6.6.4.1 Sewn-In Label Information Zones

Zones	Information Type	Description	Status: Required/Optional
Zone 1	Merchandise identification	This is the primary human readable merchandise identifier, usually the style number, although it may be pattern, model, or garment type. The merchandise identifier should be located in the upper left-hand portion of Zone 1.	Always required (see note)
Zone 2	Vendor information	This includes optional vendor production information, such as vendor Stock Keeping Unit (SKU), cut number, dye lot, colour, and pattern. (Vendor information helps ensure that the correct bar code symbol is attached to the product.)	Optional
Zone 3	Data structure (EAN/UCC-13, UCC-12, EAN/UCC-8)	Bar code symbol	Always required
Zone 4	Consumer information	This includes optional product information for the consumer, such as fiber content, fire retardancy, and country of origin.	Optional
Zone 5	Size/dimension	Size or dimension is optional for sewn-in labels. Size or dimension may assist the consumer with product selection or may help the vendor ensure that the correct label and bar code symbol are attached to the product.	Usually required unless defined by the product (e.g., towels) and readily apparent to the consumer.
Zone 6	Retail price	Allow space to print the price with minimum dimension characters of 25 mm (1 in.) x 32 mm (1.25 in.).	Usually required unless defined by the ticket format (e.g., sewn-in tickets)
Zone 7	Manufacturer's suggested retail price	This is for use only if merchandise is pre-priced or the suggested retail price is printed on the tag. If provided, the area must be perforated for optional removal.	Optional

Note: Size and colour are optional in Zone 1 if vendor usage requires this information to define the product.

6.6.5 Plastic Packaged Products Label Location Guidelines

The plastic packaged category covers a wide assortment of merchandise including sheets, pillowcases, table linens, pantyhose, underwear, stationery supplies, pillows, bedspreads, and numerous types of flat-folded apparel that are plastic packaged.

There are two methods of marking plastic packaged products with bar code symbols:

- Incorporate the bar code symbol and other merchandise identification information into the packaging's artwork.
- Print the bar code symbol and other merchandise identification information on an adhesive label that can be press-applied to the product.

Inclusion of a vendor logo on the label is optional. If it is included, the logo should not appear at the bottom, because it may be obscured by a retail price label, or it could be torn off by the removal of a manufacturer's suggested retail price. Background printing of logos should be avoided, as this may obscure required information or important consumer information. Logos must never obscure the bar code symbol.

6.6.5.1 Plastic Packaged Products Label Information Zones

Zones	Information Type	Description	Status: Required/Optional
Zone 1	Merchandise identification	This is the primary human readable merchandise identifier, usually the style number, although it may be pattern, model, or garment type. The merchandise identifier should be located in the upper left-hand portion of Zone 1.	Always required (see Note 1)
Zone 2	Vendor information	This includes optional vendor production information, such as vendor Stock Keeping Unit (SKU), cut number, dye lot, colour, and pattern. (Vendor information helps to ensure that the appropriate bar code symbol is attached to the product.)	Optional
Zone 3	Data structure (EAN/UCC-13, UCC-12, EAN/UCC-8)	Bar code symbol	Always required
Zone 4	Consumer information	This includes optional product information for the consumer, such as fiber content, fire retardancy, and country of origin.	Optional (see Note 2)
Zone 5	Size/dimension	Size/dimension is a key requirement for the consumer. Size information can be emphasised in large bold print and should be located in the right-hand portion of Zone 5. Vendors may optionally include a style name as a selection aid for the consumer.	Usually required (see Note 3)
Zone 6	Retail price	Allow space to print the price with 25 mm (1 in.) x 32 mm (1.25 in.) minimum dimension characters. For plastic packaged products, this required space for price can be provided by several methods: • For bar code symbol marking on an adhesive label, the space for price can be included as part of the label. • For bar code symbol marking designed into the packaging, the space for price can be included on the package artwork. • Providing package space adjacent to Zone 5 that is reserved for retail item pricing creates an implied space for price. Implied space replaces the requirement for actual space on labels or package artwork. If implied space for price is used, no information of importance should be printed in the area that might be covered by adhesive item price labels.	Usually required
Zone 7	Manufacturer's suggested retail price	This is for use only if merchandise is pre-priced or the suggested retail price is printed on the tag. If provided, the area must be perforated for optional removal.	Optional

Note 1: Size and colour are optional in Zone 1 if vendor usage requires this information to define the product.

Note 2: Some jurisdictions require that certain products include a permanently affixed statement of information of this type in Zone 4 that may not be satisfied by inclusion on the package.

Note 3: Size may be omitted from Zone 5 if the size information is readily available on the product packaging.

6.6.5.2 Plastic Packaged Products Label Placement Guidelines

Consistent bar code symbol placement is required for successful scanning at the Point-of-Sale. The symbol placement guidelines for plastic packaged products have been designed with the flexibility to accommodate differences that may arise from industry to industry:

- On plastic packaged products, the front top right-hand corner is the preferred placement for the bar code symbol and other product identification information.
- The bar code symbol and other product identification information may be located on the front or back of plastic packaged products. However, all products within a particular merchandise category must have their bar code symbols placed on the same side of the package.

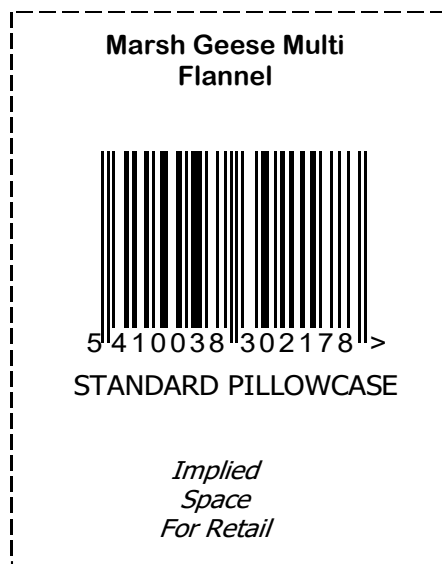
Caution: Placement of the bar code symbol on the back of a product may result in the presentation of the product on the display counter in a backside up orientation by some retailers so that the bar code symbol and retail price appear together in full view by the customer.

- The orientation of the bar code symbol and other product identification information should be consistent with any graphics or descriptive data on the plastic package.
- Where possible, the symbol and other product identification information, whether built into the package artwork or an adhesive label, must not be closer than 8 mm (0.3 in.) or farther than 100 mm (4 in.) from the nearest edge of the package. Experience has shown that the previously recommended minimum distance of 5 mm (0.2 in.) is inadequate. Also, cashiers often grab packages on the edge with their thumbs. Avoid placing the bar code symbol too close to the edge. Such placement reduces Point-of-Sale efficiency and may cause distortion of the symbol. (See [Section 6.3.3.3, Edge Rule](#).)
- The bar code symbol and other product identification information on plastic packaged products should normally be located on the front top right-hand corner. However, for very large, bulky, or unusually shaped products, this may be impractical or inappropriate. See [Section 6.4.9](#) for information on large, heavy, and bulky items.

Note: [Section 6.4](#) specifies the lower right quadrant of the back of the package or container as the recommended location for the bar code symbol. This recommendation remains in effect for plastic packaged products that are sold in a grocery store environment.

6.6.5.3 Plastic Packaged Products Label Example

Figure 6.6.5.3 – 1



6.6.6 Boxed Products Label Formats

Some boxed products may be sold in or out of the box. Other boxed products are actually sets that may also be sold as individual items. Some boxes carry significant amounts of design graphics, while others are plain boxes containing the product.

Box size can range from very small, as in jewelry or cosmetics, to very large, as in home furnishings. For extremely large boxed products, consider using a two-part tear-off bar code symbol label to facilitate scanning at the Point-of-Sale while leaving one label on the box.

There are two methods of marking boxed products with bar code symbols:

- Incorporate the bar code symbol and other merchandise identification information the box's artwork.
- Print the bar code symbol and other merchandise identification information on an adhesive label that can be affixed to the box.

Inclusion of a vendor logo in the box marking format is optional. If the logo is included, it should not appear at the bottom, because it may be obscured by a retail price label, or it could be torn off if a manufacturer's suggested retail price is removed. Background printing of logos should be avoided, as this may obscure required information or important consumer information.

6.6.6.1 Boxed Products Label Information Zones

Zones	Information Type	Description	Status: Required/Optional
Zone 1	Merchandise identification	This is the primary human readable merchandise identifier, usually the style number, although it may be pattern, model, or garment type. The merchandise identifier should be located in the upper left-hand portion of Zone 1.	Always required (see Note 1)
Zone 2	Vendor information	This includes optional vendor production information, such as vendor Stock Keeping Unit (SKU), cut number, dye lot, colour, and pattern. (Vendor information helps ensure that the correct bar code symbol is attached to the product.)	Optional
Zone 3	Data structure (EAN/UCC-13, UCC-12, EAN/UCC-8)	Bar code symbol	Always required
Zone 4	Consumer information	This includes optional product information for the consumer, such as fiber content, fire retardancy, and country of origin.	Optional (see Note 2)
Zone 5	Size/dimension	Size/dimension is a key requirement for the consumer. Size information can be emphasised in large bold print and should be located in the right-hand portion of Zone 5. Vendors may optionally include a style name as a selection aid for the consumer.	Usually required (see Note 3)
Zone 6	Retail price	Allow space to print the price with minimum dimension characters of 25 mm (1 in.) x 32 mm (1.25 in.). For boxed products, this required space for price can be provided by several methods: - For bar code symbol marking on an adhesive label, the space for price can be included as part of the label. - For bar code symbol marking designed into the packaging, the space for price can be included on the package artwork. - Providing package space adjacent to Zone 5 that is reserved for retail item pricing creates an implied space for price. Implied space replaces the requirement for actual space on labels or package artwork. If implied space for price is used, no information of importance should be printed in the area that might be covered by adhesive item price labels.	Usually required
Zone 7	Manufacturer's suggested retail price	For use only if merchandise is pre-priced or the suggested retail price is printed on the tag. If provided, the area must be perforated for optional removal.	Optional

Note 1: Size and colour are optional in Zone 1 if vendor usage requires this information to define the product.

Note 2: Some jurisdictions require that certain products include a permanently affixed statement of information of this type in Zone 4 that may not be satisfied by inclusion on the package.

Note 3: Size may be omitted from Zone 5 if the size information is readily available on the product packaging.

6.6.6.2 Packaged Versus Freestanding Single Selling Units

Certain single selling units (trade items) may be sold as freestanding items, or they may be sold in a package. This creates a dilemma for the supplier: to mark the item or mark the package? For GTIN Allocation Rules pertaining to this scenario, see Section 2.1.4.

6.6.6.3 Boxed Products Label Placement Guidelines

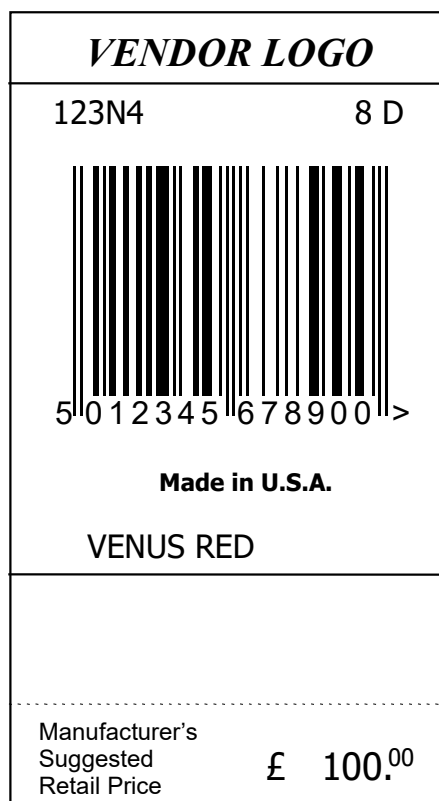
Consistent bar code symbol placement within an industry or product category is required if merchandise carrying a bar code symbol is to successfully scan at the Point-of-Sale. Since the category of boxed products includes a diverse merchandise group, location guidelines have been designed with considerable flexibility to accommodate differences that may arise from industry to industry:

- The exposed surface of the box is the preferred location for bar code symbols and other product identification information on boxed products sold primarily in the department or specialty store environment.
- The orientation of the bar code symbol and other product identification information should be consistent with any graphics or descriptive data on the box.
- Where possible, the symbol and other product identification information, whether built into the package artwork or an adhesive label, must not be closer than 8 mm (0.3 in.) or farther than 100 mm (4 in.) from the nearest edge of the package. Experience has shown that the previously recommended minimum distance of 5 mm (0.2 in.) is inadequate. Also, cashiers often grab packages on the edge with their thumbs. Avoid placing the bar code symbol too close to the edge. Such placement reduces Point-of-Sale efficiency and may cause distortion of the symbol. (See [Section 6.3.3.3, Edge Rule](#).)
- The bar code symbol and other product identification information on plastic packaged products should normally be located on the front top right-hand corner. However, for very large, bulky, or unusually shaped products, this may be impractical or inappropriate. See [Section 6.4.9](#) for information on large, heavy, and bulky items.

Note: [Section 6.4](#) specifies the lower right quadrant of the back of the package or container as the recommended location of the bar code symbol. This recommendation remains in effect for plastic packaged products that are sold in a grocery store environment.

6.6.6.4 Boxed Products Label Examples

Figure 6.6.6.4 – 1



6.6.7 Banded Products Label Formats

Banded packaging involves a specialised group of products. This type of packaging is most commonly associated with hosiery (socks) or yarn products.

There are the two methods of marking banded products with bar code symbols:

- Incorporate the bar code symbol and other merchandise identification information into the band's artwork.
- Print the bar code symbol and other merchandise identification information on an adhesive label that can be applied to the band.

The typical banded product label will feature the vendor's logo on the front while the back will contain product identification codes, consumer information, and the bar code symbol. The vendor's logo can also be printed on the back of the band as part of the band marking format. However, care should be taken to ensure that there is no obstruction of the bar code symbol or other important product identification information. Background printing of logos should also be avoided.

6.6.7.1 Banded Products Label Information Zones

Zones	Information Type	Description	Status: Required/Optional
Zone 1	Merchandise identification	This is the primary human readable merchandise identifier, usually the style number, although it may be pattern, model, or garment type. The merchandise identifier should be located in the upper left-hand portion of Zone 1.	Always required (see Note 1)
Zone 2	Vendor information	This includes optional vendor production information, such as vendor Stock Keeping Unit (SKU), cut number, dye lot, colour, and pattern. (Vendor information helps ensure that the correct bar code symbol is attached to the product.)	Optional
Zone 3	Data structure (EAN/UCC-13, UCC-12, EAN/UCC-8)	Bar code symbol	Always required
Zone 4	Consumer information	This includes optional product information for the consumer, such as fiber content, fire retardancy, and country of origin.	Optional (see Note 2)
Zone 5	Size/dimension	Size/dimension is a key requirement for the consumer. Size information can be emphasised in large bold print and should be located in the right-hand portion of Zone 5. Vendors may optionally include a style name as an aid to the consumer in selection.	Usually required (see Note 3)
Zone 6	Retail price	Allow space to print the price with minimum dimension characters of 25 mm (1 in.) x 32 mm (1.25 in.). For banded products, this required space for price can be provided by several methods: - For bar code symbol marking on an adhesive label, the space for price can be included as part of the label. - For bar code symbol marking designed into the packaging, the space for price can be included on the package artwork. - Providing package space adjacent to Zone 5 that is reserved for retail item pricing creates an implied space for price. Implied space replaces the requirement for actual space on labels or package artwork. If implied space for price is used, no information of importance should be printed in the area that might be covered by adhesive item price labels.	Usually required
Zone 7	Manufacturer's suggested retail price	This is for use only if merchandise is pre-priced or the suggested retail price is printed on the tag. If provided, the area must be perforated for optional removal.	Optional

Note 1: Size and colour are optional in Zone 1 if vendor usage requires this information to define the product.

Note 2: Some jurisdictions require that certain products include a permanently affixed statement of information of this type in Zone 4 that may not be satisfied by inclusion on the package.

Note 3: Size may be omitted from Zone 5, if the size information is readily available on the product packaging.

6.7. GENERAL PLACEMENT GUIDELINES FOR GENERAL DISTRIBUTION

General Distribution Items include any item handled as a single unit in the transport and distribution process. This definition covers a wide variety of package types, such as pallets, cartons, cases, bins, and totes. These items can be trade items and/or logistic units.

Bar code scanning may be carried out manually or automatically and the recommended symbol location cannot be optimised for one or the other in an Open Supply Chain scenario. These guidelines have been prepared with the objective to reduce overall supply chain cost but in the full knowledge that implementation will only be driven by a proven [supply-chain] business-case.

6.7.1 General Rule

The bar codes on units intended for General Distribution should be upright (i.e. in picket fence orientation) and placed on the sides of the unit. Each item shall have at least one bar code, and two are recommended when these symbols are pre-printed (see Section 6.7.2).

As not all products are packed in an identical way, this general rule may not apply to unusual packaging types (e.g., low height items, display cases, bags).

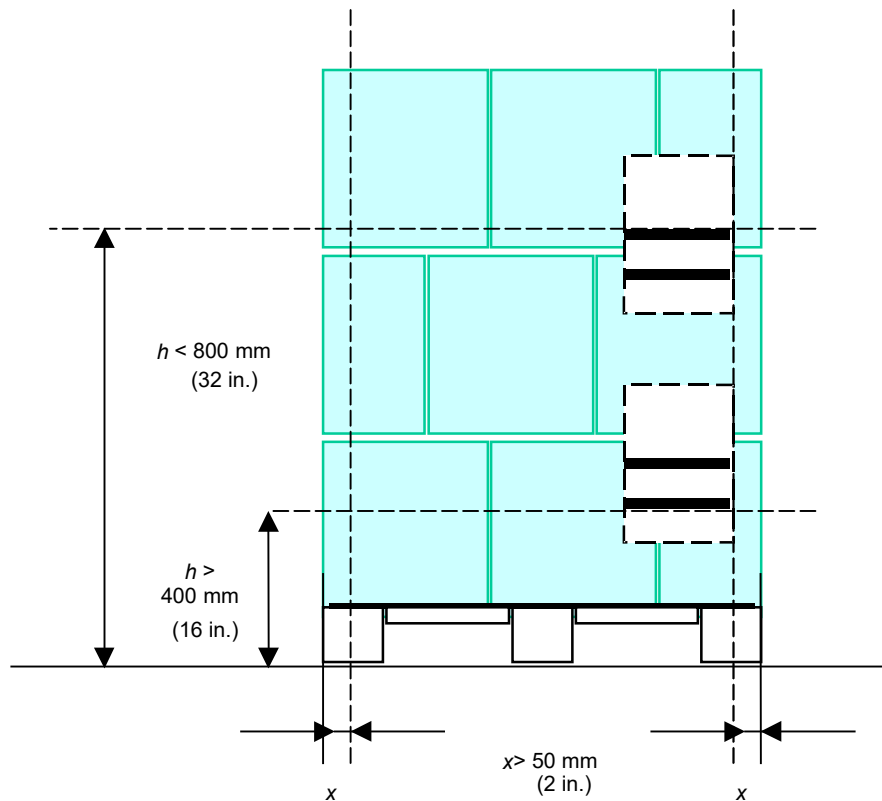
The bar codes should be kept away from any vertical edges so that the bar codes are less likely to be accidentally damaged in transit.

6.7.1.1 Symbol Placement on Pallets

For all types of pallets, including full pallets containing individual trade items and single trade items, (such as a fridge or washing machine), the target height for the bottom of the bar code symbol is between 400 mm (16 in.) and 800 mm (32 in.) from the base of the pallet. For pallet less than 400mm (16in.) high, the bar code symbol should be placed as high as possible while protecting the bar code.

The symbol including, its quiet zones, should be at least 50 mm (2.0 in.) from any vertical edge to avoid damage.

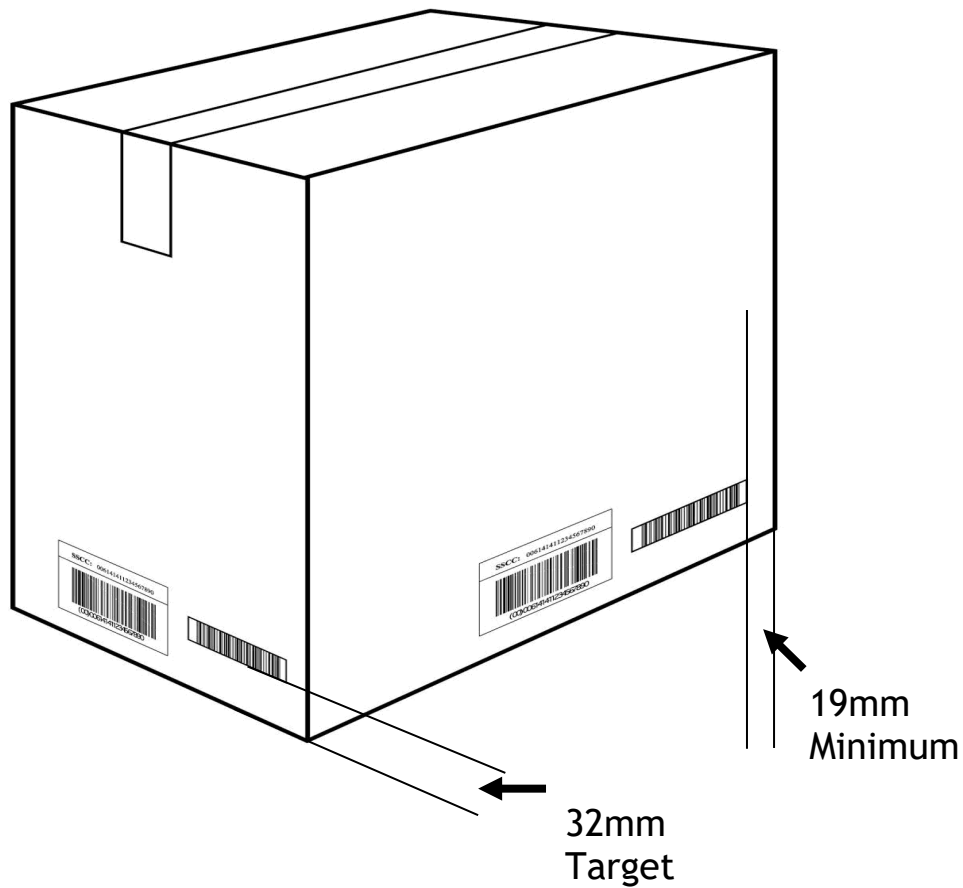
Figure 6.7.1.1 – 1 Symbol placement on a pallet



6.7.1.2 Symbol Placement on Cartons and Outer Cases

For Cartons and Outer Cases, symbol placement will vary slightly in practice, however the target placement for the bottom of the bar code symbol is 32 mm (1.25 in.) from the natural base of the item. The symbol including, its quiet zones, should be at least 19 mm (0.75 in.) from any vertical edge to avoid damage.

Figure 6.7.1.2 – 1 Symbol placement on cartons and outer cases

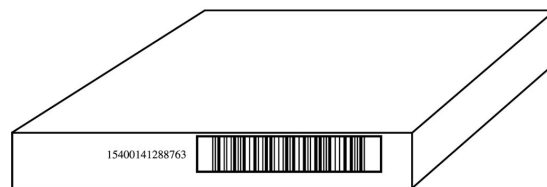


6.7.1.3 Symbol Location on Shallow Trays and Cases

If the height of a case or tray is less than 50 mm (2.0in), making it impossible to print a full height bar code with the human readable interpretation below the bars, or if the construction of the unit is such that the full symbol height cannot be accommodated, the following options should be considered in this order of preference:

1. Place the Human Readable Interpretation to the left of the symbol, outside the compulsory Quiet Zones.

Figure 6.7.1.3 – 1 Human-readable text to left of symbol



2. When the height of the unit is less than 32 mm, the symbol may be placed on the top of the package. The symbol should be placed with the bars perpendicular to the shortest side, no closer than 19 mm (0.75 in.) from any edge.

Figure 6.7.1.3 - 2



Sometimes two bar code symbols are used on variable measure units. If it is necessary to remove the Human Readable Interpretation from beneath the unit, the human readable characters of the main symbols should be placed to the left of the bars of the main symbol. The Human Readable Interpretation of the Add-On Symbol should be placed to the right of the bars of the Add-On Symbol.

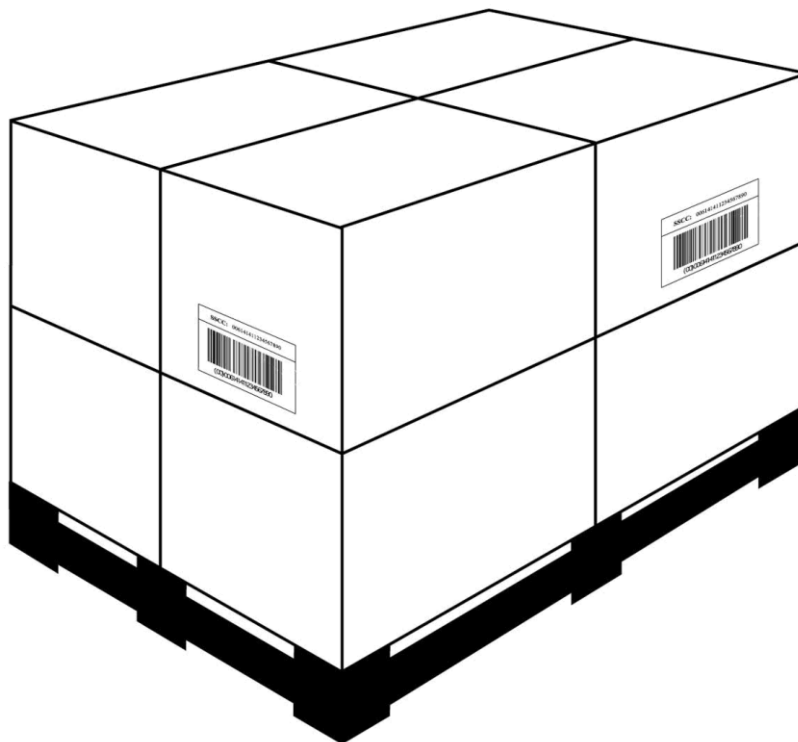
6.7.2 Recommendation to bar code two sides

Although at least one side of all General Distribution Items shall display the bar coded information, it is recommended that two (or more) sides of the item be bar coded with the exact same data when:

- The printing process makes this cost effective (e.g. Pre-Printed corrugated cartons)
- The Supply Chain requirement is that one symbol is always visible (e.g. pallets that are stored either long or short edge facing)

Figure 6.7.2 – 1 Two (or more) identical bar code symbols

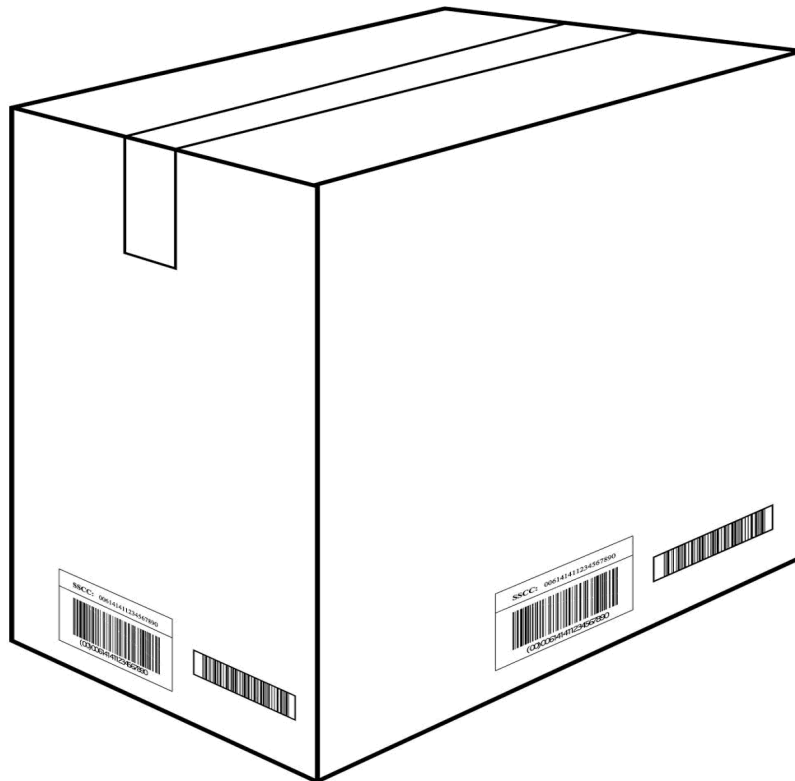
Two identical labels improves scanning performance



6.7.3 Add-on Symbols

If the unit is already marked with a symbol, any Add-On Symbol shall be placed so as not to obscure the primary bar code symbol. The preferred location for the symbol in this case is to the side of the primary bar code symbol, so that a consistent horizontal location is maintained. Maintain Quiet Zones for both symbols.

Figure 6.7.3 – 1



If there is the potential for both parts of the data content to be represented in a GS1-128 Bar Code Symbol, they should be concatenated and one symbol produced. Bar code symbols containing data essential for complete product identification (e.g., trade measurements) should always be aligned with and to the right of the bar code symbol containing the Global Trade Item Number™ (GTIN™) (the primary symbol).

6.8. PACKAGE MEASUREMENT RULES FOR DATA ALIGNMENT

This section establishes rules for the global, unambiguous definition of nominal measurement attributes of product packaging to facilitate communication of the same for retail and non-retail products from the consumer unit to the case level and all intermediate packaging levels in between. This standard provides a repeatable process to determine measurements for a given product package when measured by different individuals independently. These rules will be independent of shelf orientation for the product. The rules will not establish tolerances for nominal dimensions.

When a new Global Trade Item Number™ (GTIN™) is assigned to a trade item, it is essential that the party allocating the number, normally the manufacturer, provide detailed information to trading partners about the characteristics of the new trade item. This information should be provided as soon as possible before the product is actually traded and should include details such as brand name, net weight, packaging materials, etc, and package measurements.

In relationship to Global Data Synchronization, the effective date for this standard is July 1, 2006.

6.8.1 Package Dimension Measurement Methodology

6.8.1.1 Introduction

The accurate and consistent dimensional measurement of trade item packaging is key to the successful implementation of Data Synchronisation between trading partners. These rules are provided for use for all trading partners wishing to exchange data about product package measurements. This common methodology for determining product package measurements is intended to ensure global compatibility.

6.8.1.2 Metric and Imperial Dimensions

GDSN allows up to three decimal places for population of dimensions, but the level of precision is left to the discretion of the supplier. The following rounding rules have been established as the minimal level of precision required.

6.8.1.2.1 Linear Measurements

When using the metric system, all height, width and depth measurements are represented in millimetres and are always rounded up to a whole millimetre. For example 99.3 mm would become 100 mm.

When using the imperial system, all height, width and depth measurements are represented in inches and are always rounded up to the nearest 0.05 of an inch. For example, 2.942 inches would become 2.95 inches.

When exchanging data between trading partners using differing systems the following conversion ratios must be used with the converted measure being rounded up:

$$1 \text{ inch} = 25.4 \text{ mm}$$

$$1 \text{ mm} = 0.03937 \text{ inches}$$

6.8.1.2.2 Weight Measurement

GDSN allows up to three decimal places for population of dimensions, but the level of precision is left to the discretion of the supplier and to applicable local laws. If rounding is required, all weight measurements are to be rounded up to match that level of determined precision.

Conversions are made using the following conversion ratios:

1.000 Pound (avoirdupois) = 0.454 Kilograms

1.000 Kilogram = 2.205 Pounds (avoirdupois)

6.8.1.3 Consumer (End-user) Trade Items

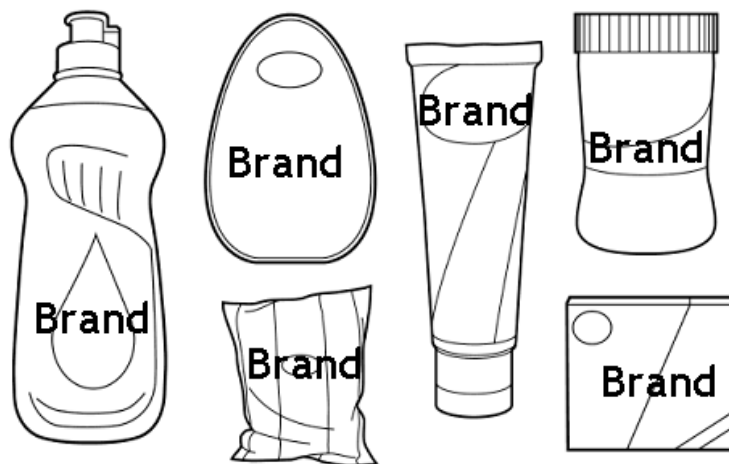
6.8.1.3.1 Overview

Consumer trade items are identified with a GTIN. For the retail channel, these trade items are those that are sold at a Retail Point-of-Sale.

6.8.1.3.2 Determining the Default Front of an Item

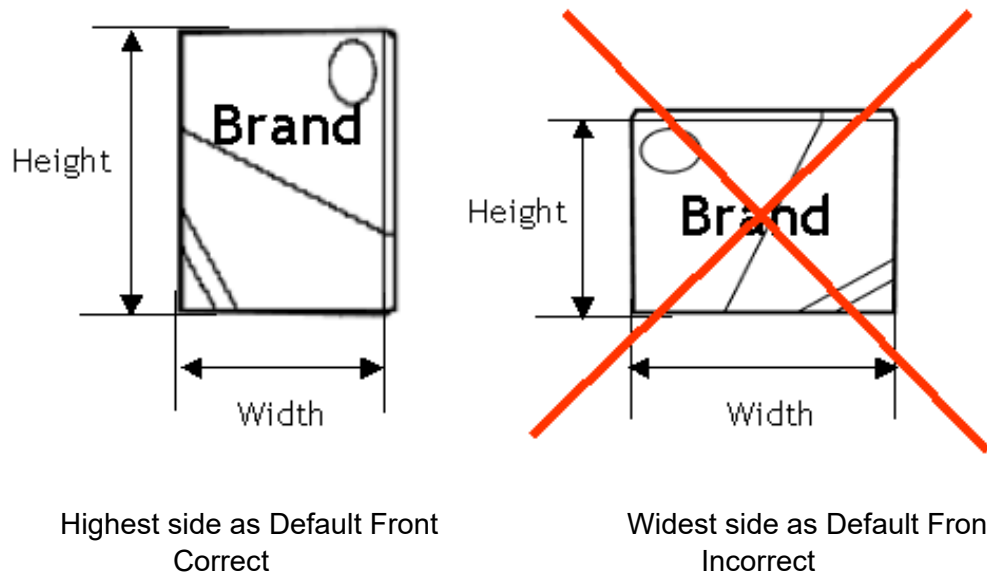
Prior to any measurement capture, the Default Front of the trade item must be determined. For the purposes of this standard, the Default Front is the side with the largest surface area that is used by the manufacturer to 'sell' the product to the consumer, in other words, the side with markings such as the product name.

Figure 6.8.1.3.2 – 1 Determining the Default Front of an Item



Some product packages have more than one possible front with the same surface area. These products can be presented both vertically and horizontally on the shelves. If a product package has more than one possible front, the highest side is considered to be the Default Front (see Figure 6.8.1.3.2 - 2).

Figure 6.8.1.3.2 – 2 Determining Default Front of an Item with More than One Front with the Same Surface Area



6.8.1.3.3 Determining the Height, Width and Depth

After the Default Front has been determined, it is possible to determine the height, width and depth of an item.

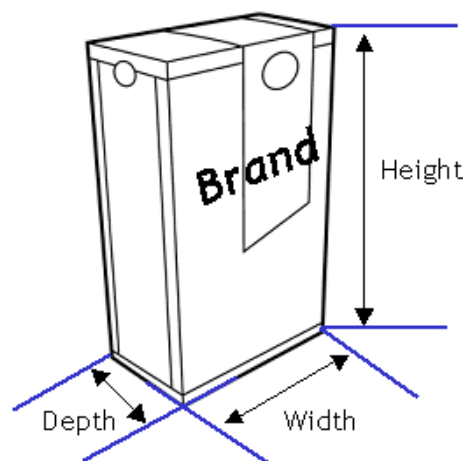
While facing the Default Front:

Height: from the base to the top

Width: from the left to the right

Depth: from the front to the back

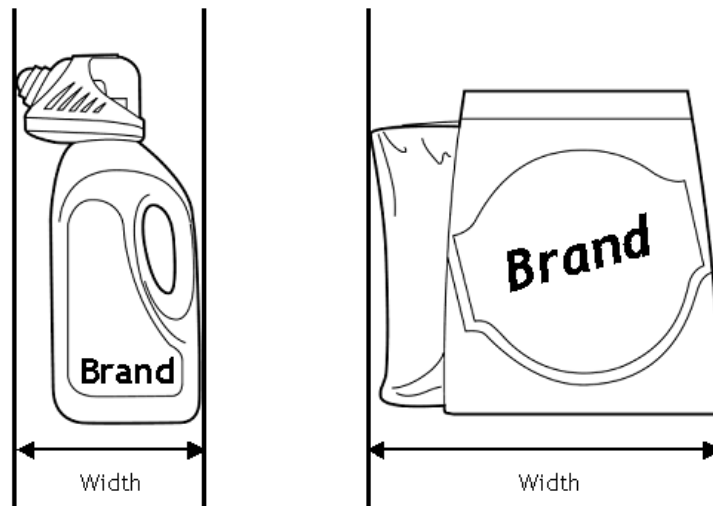
Figure 6.8.1.3.3 - 1 Height, Width and Depth of an Item



After the height, width and depth have been determined, the dimensions can be measured.

Always measure the maximum distance, i.e. include things such as projections, caps, lids and complimentary products (e.g., on-packs, collectables, or samples) in the measurement.

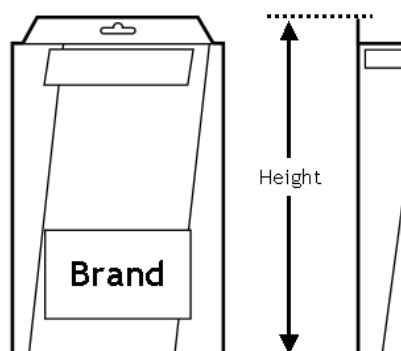
Figure 6.8.1.3.3 - 2 Always Measure the Maximum Distance



6.8.1.3.4 Hanging-Item

A Hanging-Item is any consumer trade item that is presented on a hanger. If the Hanging-Item has a hole for hanging purposes, it must be measured as though it were hanging. Even if it is presented horizontally or stacked, the measurements should be determined while it is hanging. The requirement to always measure the maximum distance also applies to Hanging-Items (inclusive of tab).

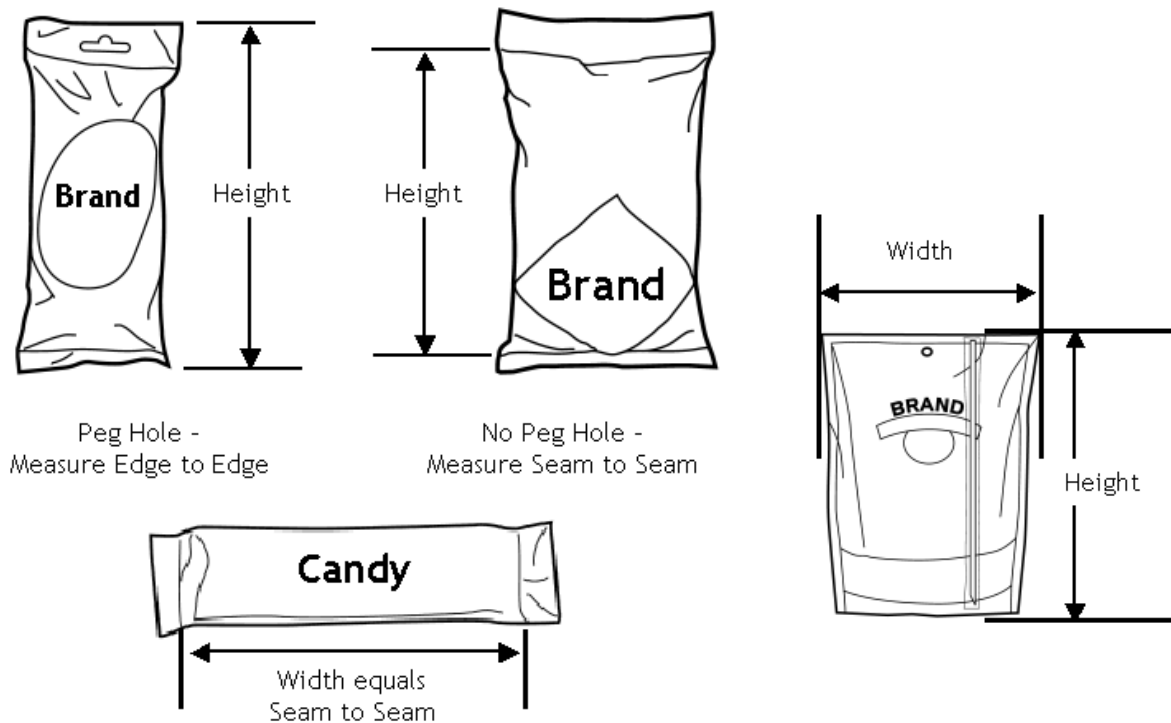
Figure 6.8.1.3.4 - 1 Always Measure Hanging Items in the Hanging Position



If a consumer trade item has flexible packaging with a peg hole for hanging purposes, it must be measured as though it was hanging. In this case, the item should be measured from edge to edge (both sealed seams should be included in the measurement).

Flexible packaging, such as a bag of potato chips (crisps), must be measured with the item lying flat to evenly settle the contents. It is important to remember that Default Front determination is independent of shelf orientation. The measurements are taken while facing the trade item's Default Front. The sealed seams at the ends of the item must not be measured unless there is a peg hole or unless the seal is intended to serve as a base (e.g., allow a drink container to stand).

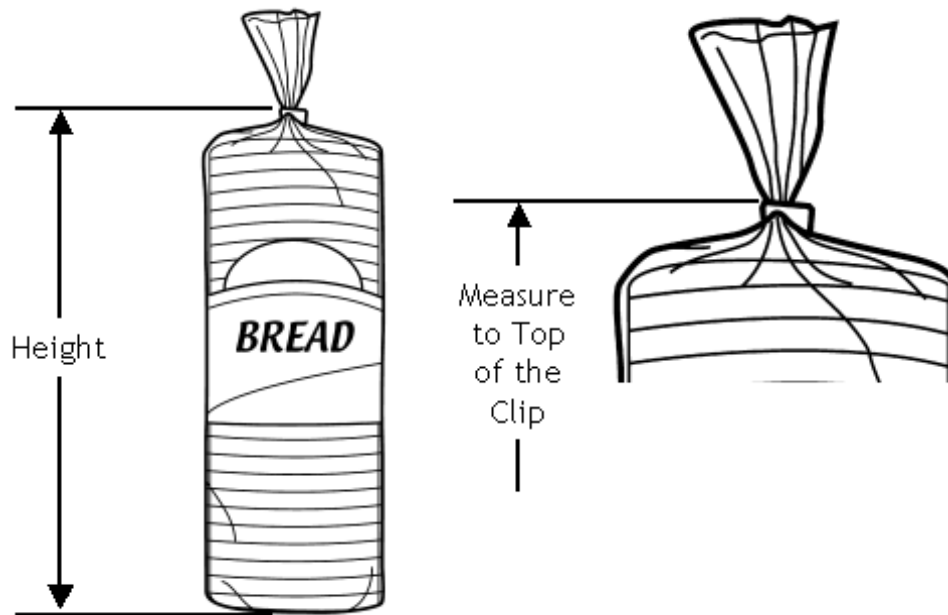
Figure 6.8.1.3.4 - 2 Examples of Hanging-Items with Flexible Packaging



6.8.1.3.5 Flexible Packaging with Clips

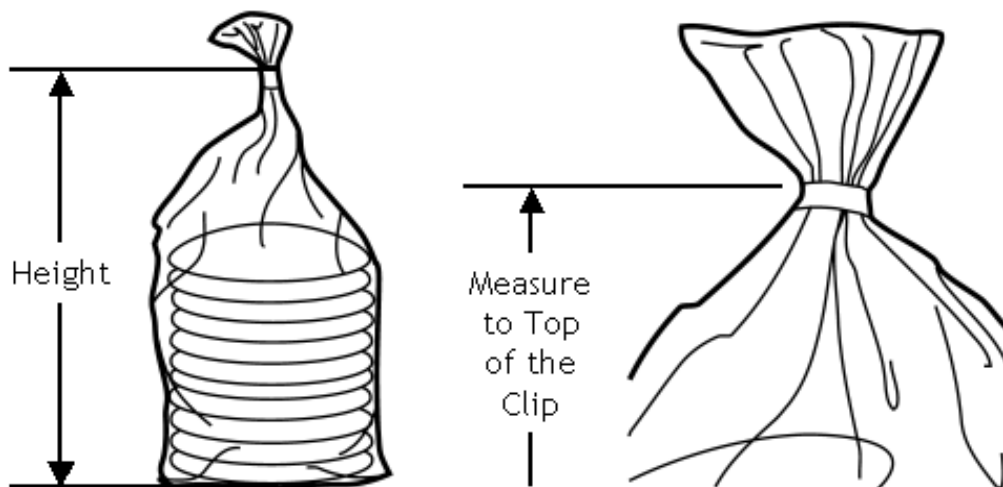
For items with a clip, the height is the distance from the bottom of the bag to the top of the clip.

Figure 6.8.1.3.5 – 1 Dimensions of Items with Clips

**6.8.1.3.6 Flexible Packaging with No Marking**

For trade items sold in clear bags with no markings, the largest panel by area is the Default Front and the longest dimension is the height.

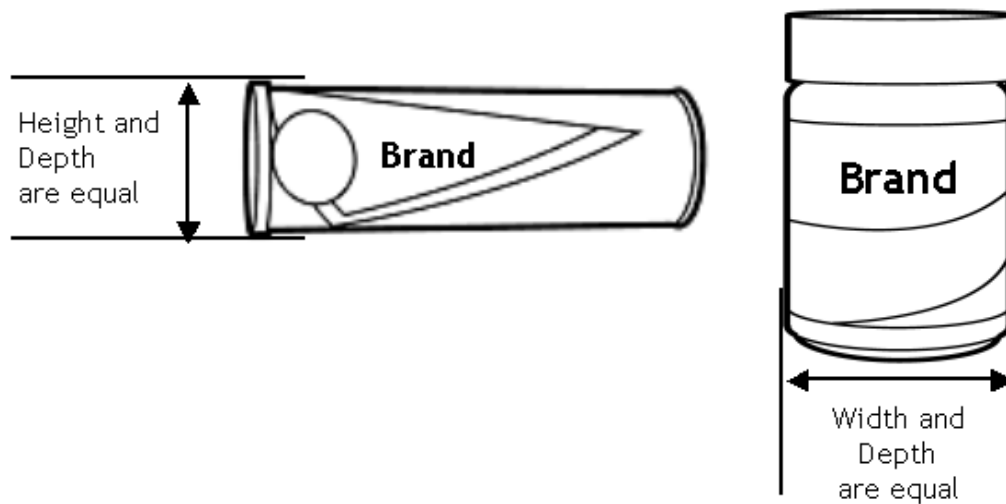
Figure 6.8.1.3.6 – 1 Dimensions of Items with No Marking



6.8.1.3.7 Cylindrical Items

For cylindrical items two dimensions will be nominally equal. Which dimensions are equal is determined by the result of determination of the Default Front for the consumer trade item.

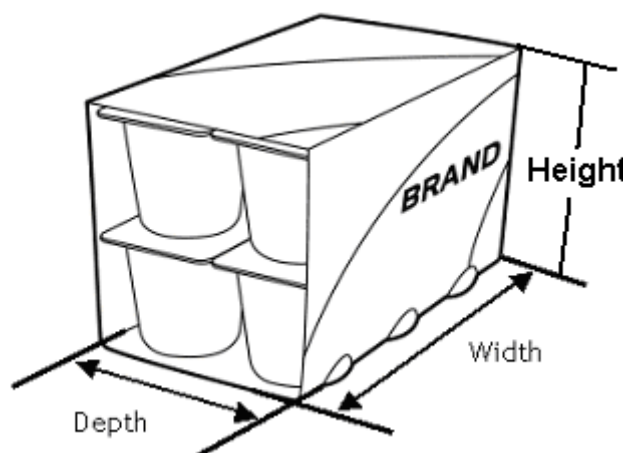
Figure 6.8.1.3.7 – 1 Cylindrical Item Measurements



6.8.1.3.8 Multi-packs

Multi-packs are consumer trade items themselves but contain a multiple of single trade items that can also be sold individually to the consumer. When a trade item meets the definition of a multi-pack it will be measured according to the Default Front rule in Section 6.8.1.3.2. If a multi-pack can be hung it must be measured according to the rule for hanging items. See Figure 6.8.1.3.4 – 2.

Figure 6.8.1.3.8 - 1 - Determine the Default Front of a Multi-pack



6.8.1.4 Non-consumer Trade Item

6.8.1.4.1 Overview

These trade items are identified with a GTIN and are intended for General Distribution scanning. This includes outer cases up to the largest form of bulk packaging for trade items and may include pallets or units such as sea containers if they are explicitly traded. If the trade item could be considered as a consumer trade item, the requirements in Section 6.8.1.3 take precedence.

6.8.1.4.2 Determining the Base

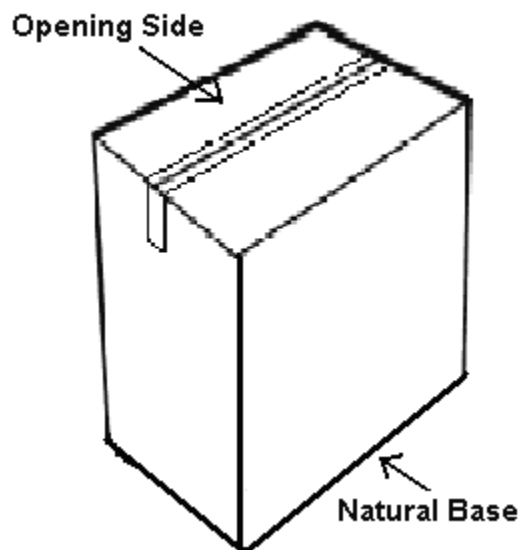
First, the Natural Base of the non-consumer trade item must be identified before the height, width and depth of the non-consumer trade item can be determined. The Natural Base is the natural underside of the packaged item pre-shipment (e.g. case). The Natural Base is a Supplier defined surface.

For consistency in measuring:

- Determine if case markings point to natural base orientation. Text, arrows or other graphics printed on the item may aid suppliers in identifying the Natural Base. The Natural Base for a package without markings is frequently the opposite surface from the opening side
- When the Natural Base is not readily apparent, then determine the natural base where the height is the shortest of the three dimensions (similar to the rule for determining dimensions of the consumer unit where there are multiple facings), and the next 2 longer dimensions define the Natural Base.

When measuring a trade item the maximum measure should be recorded for any given dimension.

Figure 6.8.1.4.2 - 1 Container without markings



6.8.1.4.3 Determining the Height, Width and Depth

After the Natural Base has been determined, it is possible to determine the height, width and depth of an item:

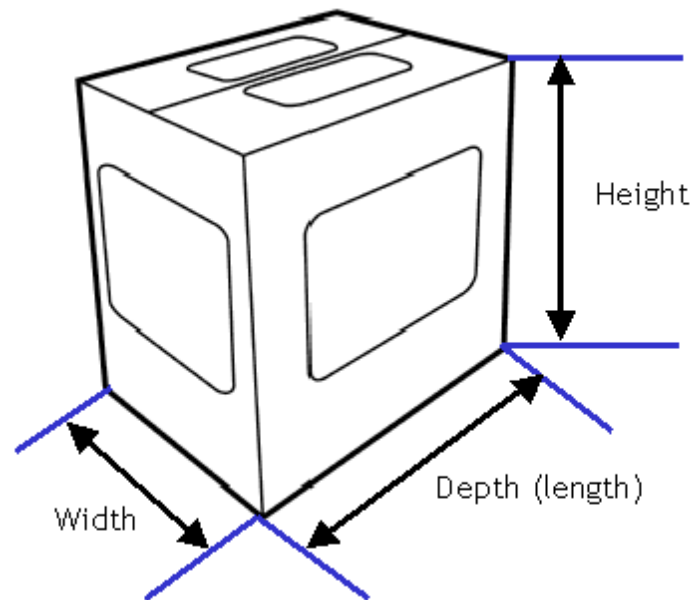
Height: The measure of the trade item from the natural base to the top.

Width: The shorter side of the natural base of the trade item.

Depth (*length): The longer side of the natural base of the trade item.

* For the purposes of naming the longer dimension of a non-consumer Trade Item, length is an appropriate term. It is not used in the Item BRD because the attribute Depth is also used for consumer trade items where the depth may or may not be the longer dimension.

Figure 6.8.1.4.3 - 1 Dimensions of Non-Consumer Trade Items (Outer Case)

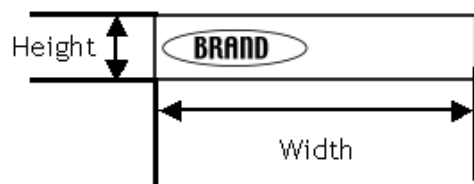
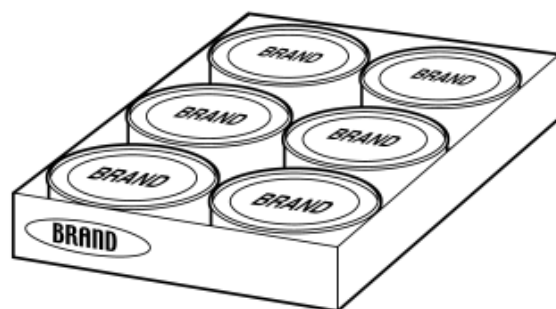


It is important that the measurement of non-consumer trade items is done in a free and unrestricted manner (e.g., not in a stack). The item being measured must also be in good condition and not damaged (e.g., damp, torn).

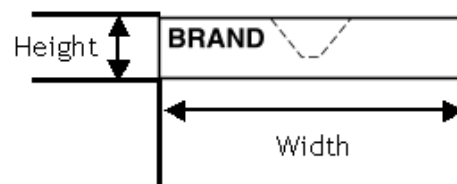
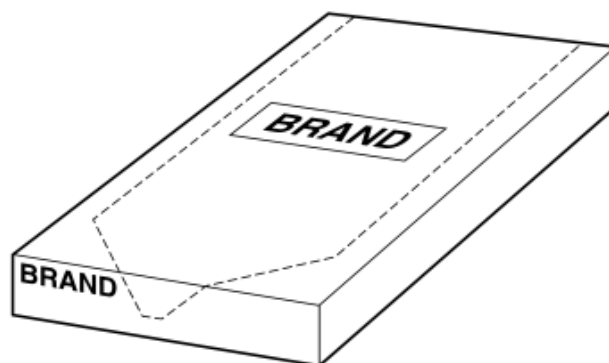
The Natural Base rule is used to measure display boxes. This rule is independent of whether the display box has an open top or a tear-away top.

Figure 6.8.1.4.3 - 2 Dimensions of Non-Consumer Trade Items (Display Box)

Open Top Display Box

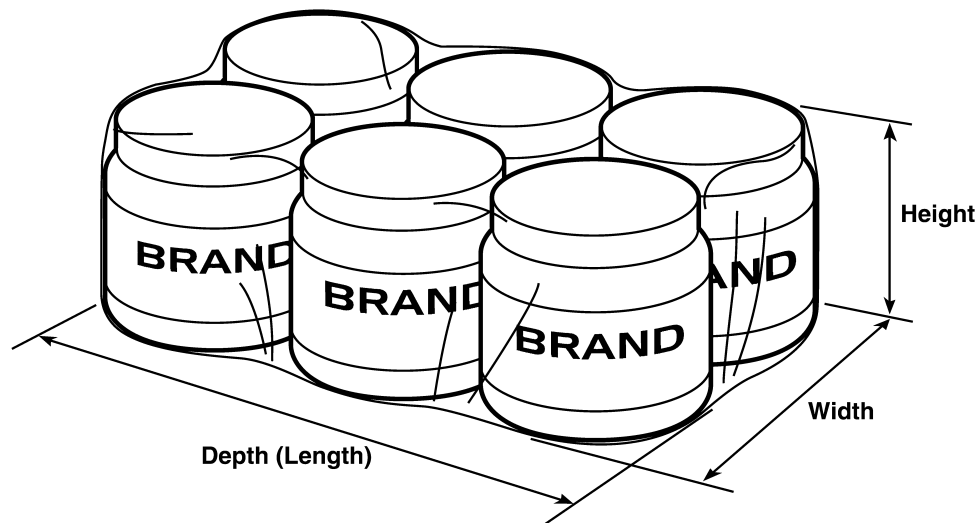


Tear-Away Display Box



The Natural Base rule is used to measure shrink-packs.

Figure 6.8.1.4.3 - 3 Dimensions of Non-Consumer Trade Items (Shrink-pack)



The Natural Base rule is used to measure tray-packs.

Figure 6.8.1.4.3 - 4 Dimensions of Non-Consumer Trade Items (Tray-packs)

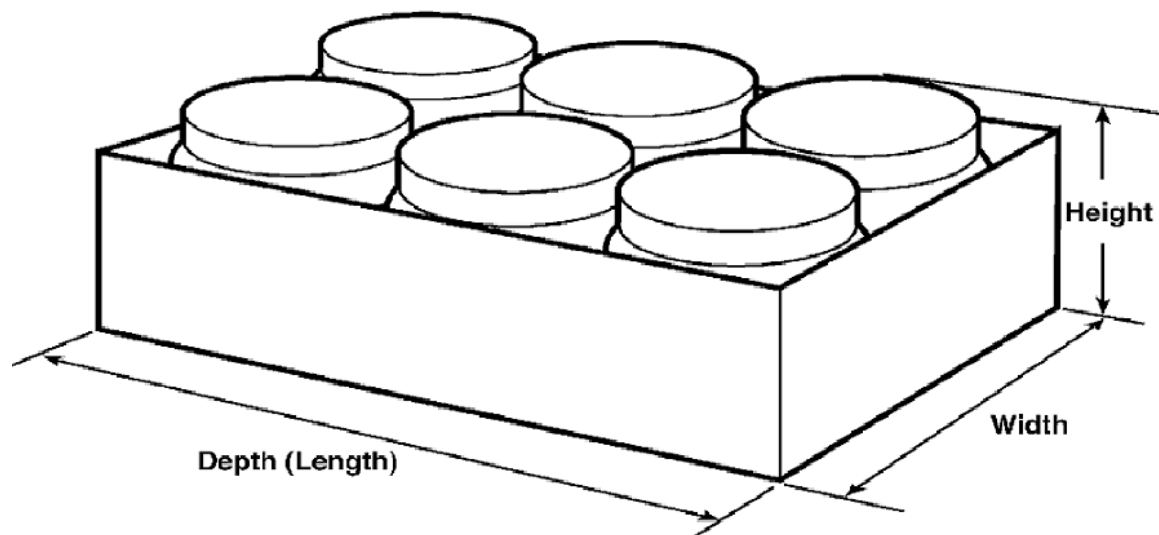
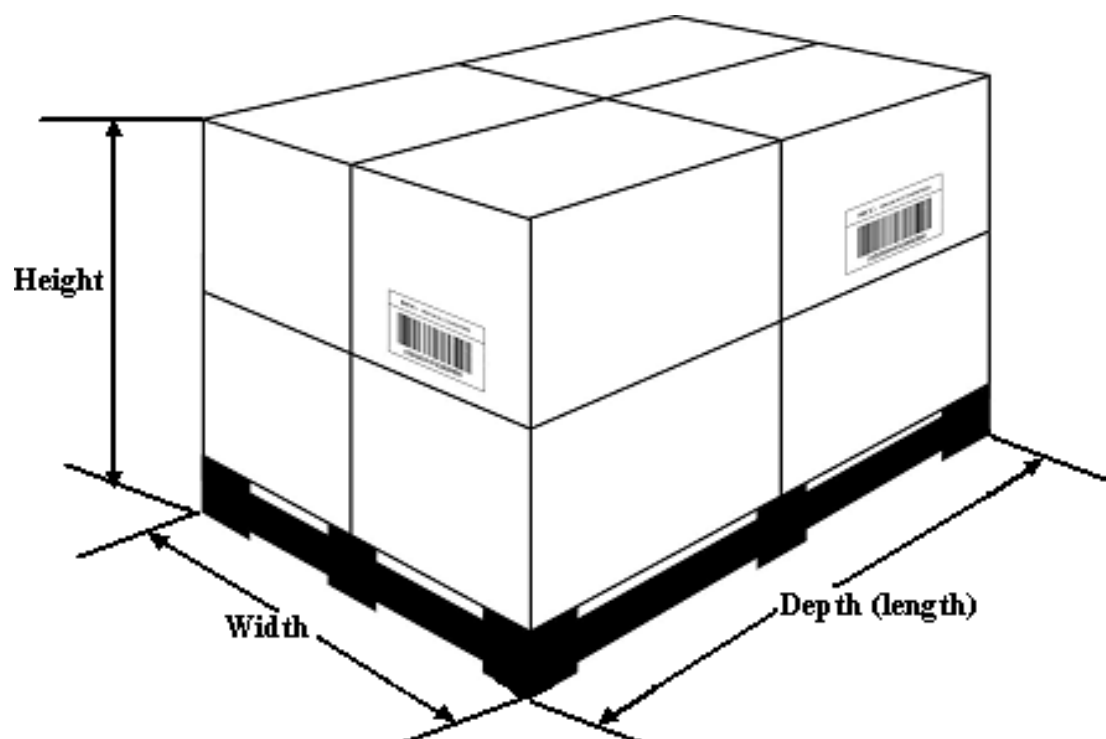


Figure 6.8.1.4.3 - 5 Dimensions of Non-Consumer Trade Items



6.A.1 APPENDIX 1: GENERAL RULES FOR CURVED SURFACES

If a bar code symbol is printed on a curved surface, it is preferable for the bars to be perpendicular to the axis of the cylinder (so that a scan line can pass through the symbol on as near a flat plane as possible). The bar code symbol may be printed top-down or bottom-up, whichever is consistent with other text and graphics on the item, as this does not impact scanning performance.

Figure 6.A.1 – 1

Bar Code Symbol Placement on Curved Surfaces



Ladder orientation
(recommended)

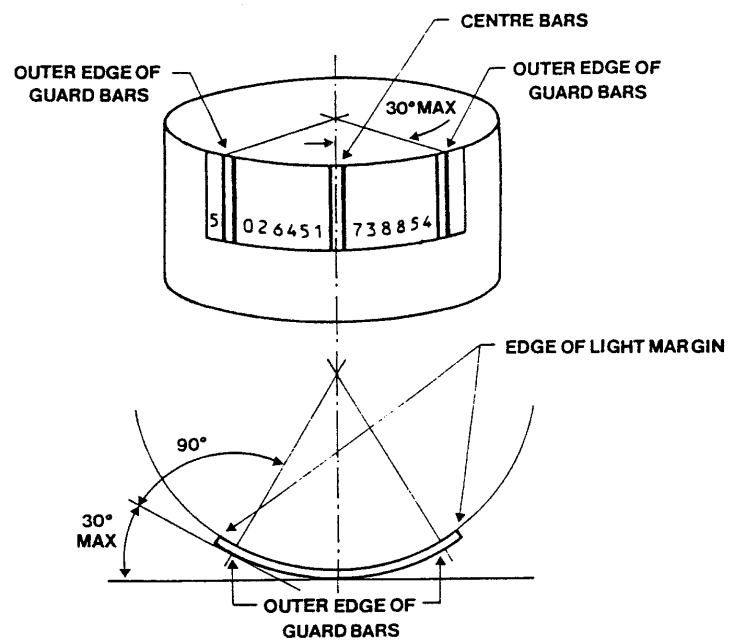


Picket Fence orientation
(avoid on tightly curved
surfaces)

This preference may be subject to space considerations and to the direction of printing (better printing quality is normally obtained when the bars are parallel to the direction of printing (see Section 5.4)). However, if the symbol must be printed in the Picket Fence orientation (bars parallel to the axis of the cylinder), then the angle between the tangent to the centre of the curved symbol and the tangent to the extremity of the curved symbol (outer edge of the guard bars for symbol in the EAN/UPC Symbology Family) must be less than 30 degrees. If this angle is more than 30 degrees, the symbol must be re-oriented such that the bars are perpendicular to the generating lines of surface of the item.

Figure 6.A.1 – 2

Relationship Between Symbol and Curvature



The following figures, 6.A.1 – 3 and 6.A.1 – 4, show the relationship between acceptable X-dimensions (narrow element width) for units of different diameters and the minimum diameters for different X-dimensions for bar code symbols printed in the Picket Fence Orientation. Please refer to Section 5.4. for the minimum, target, and maximum X-dimension for the symbol, based on the scanning environment.

Figure 6.A.1 – 3

Diameter of Container		Maximum Value of X-Dimension			
		EAN-13 or UPC-A Bar Code Symbol		EAN-8 Bar Code Symbol	
		mm	Inches	mm	Inches
30 or below	1.18 or below	*	*	*	*
35	1.38	*	*	(0.274)	(0.0108)
40	1.57	*	*	(0.314)	(0.0124)
45	1.77	*	*	0.353	0.0139
50	1.97	(0.274)	(0.0108)	0.389	0.0153
55	2.16	(0.304)	(0.0120)	0.429	0.0169
60	2.36	0.330	0.0130	0.469	0.0185
65	2.56	0.356	0.0140	0.508	0.0200
70	2.75	0.386	0.0152	0.549	0.0216
75	2.95	0.413	0.0163	0.587	0.0232
80	3.25	0.446	0.0174	0.627	0.0247
85	3.35	0.469	0.0185	0.660	0.0260
90	3.54	0.495	0.0195	0.660	0.0260
95	3.74	0.525	0.0207	0.660	0.0260
100	3.94	0.551	0.0217	0.660	0.0260
105	4.13	0.578	0.0228	N/A	N/A
110	4.33	0.607	0.0239	N/A	N/A
115	4.53	0.634	0.0250	N/A	N/A
120 or above	4.72	0.660	0.0260	N/A	N/A

Note: An asterisk (*) indicates that the package diameter is too small to permit a Picket Fence Orientation Bar Code Symbol, and the symbol must be rotated 90 degrees to a Ladder Orientation (See Section 5.4 so that the bar code symbol is printed perpendicular to the generating lines of the surface of the container.

Note: *Italics* indicate X-dimensions that are permissible, but are not recommended on curved surfaces.

Note: EAN-8 Bar Code Symbols are reserved for very small items (See Section 2.1).

Figure 6.A.1 – 4

Relationship Between the X-Dimension and Diameter

X-Dimension		Minimum Diameter of Container					
		EAN-13 or UPC-A Bar Code Symbol		EAN-8 Bar Code Symbol		UPC-E Bar Code Symbol	
mm	inches	mm	inches	mm	inches	mm	inches
0.264	0.0104	48	1.33	34	1.89	26	1.01
0.300	0.0118	55	1.51	38	2.14	29	1.51
0.350	0.0138	64	1.76	45	2.50	34	1.53
0.400	0.0157	73	2.02	51	2.86	39	1.54
0.450	0.0177	82	2.27	58	3.21	44	1.73
0.500	0.0197	91	2.52	64	3.57	49	1.92
0.550	0.0217	100	2.77	70	3.93	54	2.11
0.600	0.0236	109	3.02	77	4.29	59	2.31
0.650	0.0256	118	3.27	83	4.64	63	2.50
0.660	0.0260	120	3.35	85	4.72	64	2.54

Section 7.0:

System Processing in EDP Applications

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7.1 Introduction

The purpose of entering data transmitted from a reading device into a system is to record a transaction. In the GS1 System, a transaction is an electronic message to be processed according to the meaning and content of the data fields contained in the message. This should be possible without requiring any human intervention to determine the data's meaning and content.

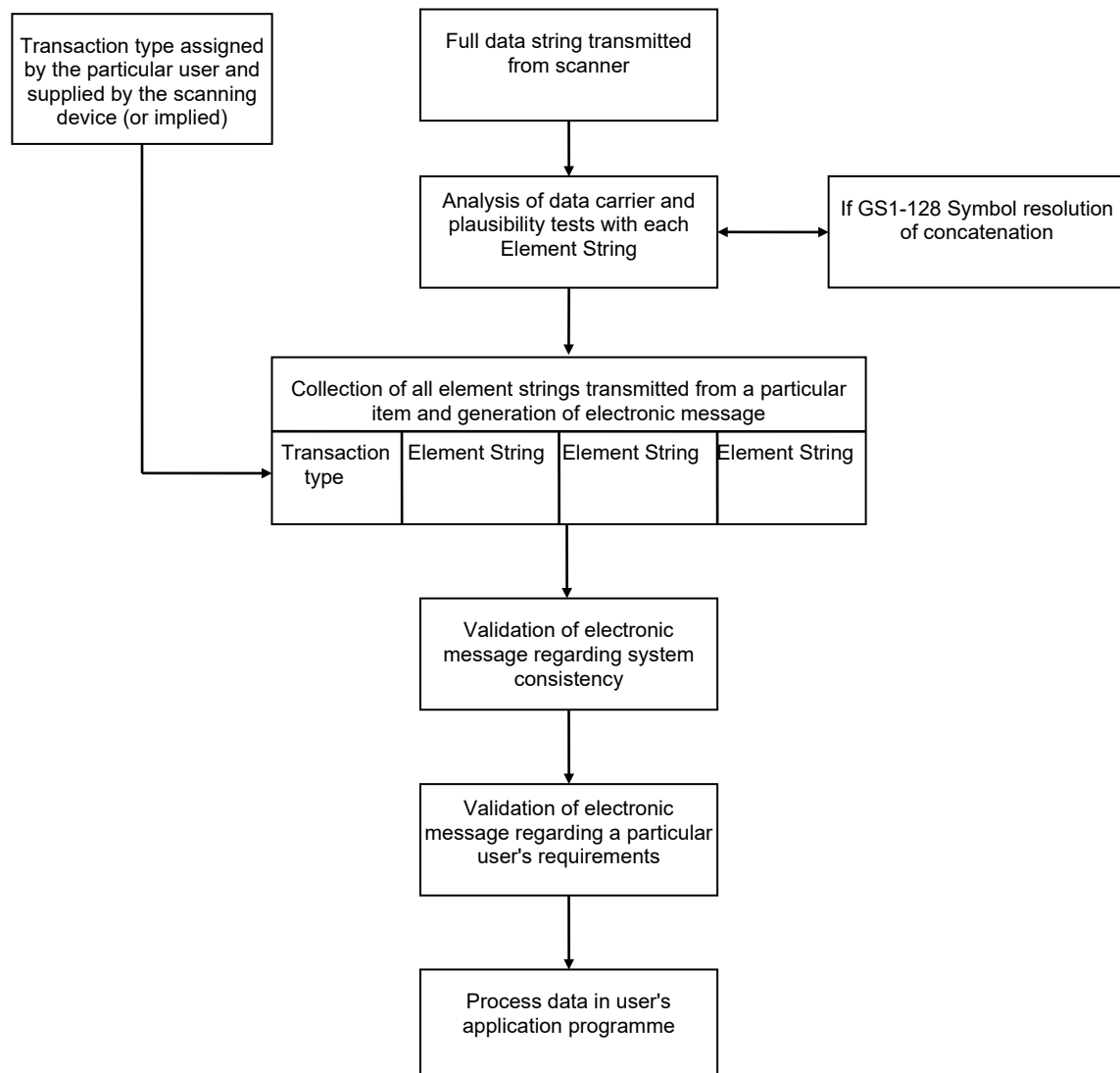
The standardised Element Strings of the GS1 System are the basis for the identification of items of every kind. They identify a particular item in an unambiguous manner and supply relevant attribute information.

When these Element Strings are printed on items, the scanned and transmitted data refers to that item and identifies its physical presence at a given location. When the message read from the scanned data carrier is coupled with an internally assigned designation of the type of item movement (e.g., warehouse entry, stock taking, sales), it is possible to automatically record data related to each movement of items. This provides security in two ways. First, an item must be physically present in order to produce a bar code reader message about the item, and, second, only the data in the bar code on the item and, therefore, relevant to it, can be recorded. False notification of movements is thereby largely eliminated.

When Element Strings are used in administrative areas (e.g., in order entry) they also can be used for automatic, error-free data capture. Because of the considerable length of many GS1 System ID numbers, automatic reading has great significance. By using a Check Digit, a digit that ensures the data has been correctly composed; the accuracy of the reading can be verified.

7.2 Synopsis of Message Processing

Figure 7.2 – 1



For details on any of the actions in Figure 7.2 – 1, see the following subsections.

7.2.1 Analysis of the Data Carrier and Plausibility Tests for Element Strings

Figure 7.2.1 – 1



For details on any of the actions in Figure 7.2.1 – 1, see the following subsections.

7.2.1.1 Symbology Identification

Each transmitted full string consists of a symbology identifier and one or more Element Strings (see [Section 3.0](#)). The identifiers of bar code symbologies are stated in [Section 5.0](#).

7.2.1.2 Prefix in Internal Table

System users may generate an internal table showing the GS1 Prefixes of Element Strings they wish to process. This table also serves to sort out the Element Strings representing item identification numbers in order to check their presence in the data file. Details on the respective prefixes are stated in [Section 3.0](#).

7.2.1.3 Item Identification

The symbols in the EAN/UPC Symbology family contain identification data for trade items and special data structures (e.g., coupons). Whether an Element String contains the identification of a trade item is determined by the GS1 Prefix. System users must determine the specific structure and meaning of prefixes 20 to 29 as defined by their GS1 Member Organisation.

7.2.1.4 Application Identifier (AI) in Internal Table

The Element Strings using Application Identifiers cover a wide range of applications. In order to keep the amount of programming on a reasonable level, it is possible to ignore processing of unwanted Element Strings. This is achieved by establishing an internal table with only the Application Identifiers intended for processing.

7.2.1.5 Length of Data 14 Digits

ITF-14 Bar Code Symbols are used to represent trade item identification numbers. They have 14 Human Readable Interpretation characters, which can be printed above or below the symbol. In the GS1 System, Global Trade Item Numbers™ (GTINs™) are stored in the GTIN Format, a 14-digit reference field in computer files that is used to ensure the uniqueness of the identification numbers.

7.2.1.6 Check Digit Calculation

In EAN/UPC Symbology, the Check Digit verifies reading and decoding of bar code symbols as well as Global Trade Item Numbers™ (GTINs™). This is performed automatically by the bar code reader.

Bar code readers processing ITF-14 Symbols may be programmed to verify the Check Digit as well. If this recommended verification has been performed, it is indicated by the symbology identifier] I 1 (see [Section 5.0](#)). Data transmitted from ITF-14 Symbols with symbology identifier] I 0 must be verified.

GS1-128 Bar Code Symbols have an integral Symbol Check Character that verifies correct decoding of scanned data. If an Element String encoded in GS1-128 includes a Check Digit, the Check Digit will not be verified by the bar code reader. While the data security provided by the GS1-128 Symbol Check Character guarantees proper decoding of the entire Element String, correctness of the contained identification number is achieved by having the application software verify the ID number's Check Digit. Logical Tests

Logical tests check for reasonable data content, such as verifying:

- Data field ranges (e.g., month < 13 and > 00)
- The maximum length of a variable length Element String
- Alphanumeric characters in numeric-only fields
- Correct GS1 Prefixes in given applications

7.2.1.7 Move Element String to Message Field

Several Element Strings may be scanned in a single transaction. In order to verify the correctness and completeness of the transmitted data, each Element String is transferred to a message record. If an Element String does not include an Application Identifier, verification of the message is simplified if an Application Identifier is internally assigned. Global Trade Item Numbers™ (GTINs™) that are carried by EAN-13, UPC-A, UPC-E or ITF-14 bar code symbols may be denoted with an internally assigned AI (01). Other Element Strings may be assigned "ghost" Application Identifiers

7.3 Validation of the Electronic Message Regarding System Consistency

The GS1 System enables system users to process scanned data without human intervention. This implies that the electronic message generated from data scanned and transmitted from data carriers needs to substitute all human activities during a particular transaction. In other words, the transmitted data must provide all information required for its correct processing.

The GS1 System is designed to fulfil these requirements. [Section 4.0](#) describes the association of Element Strings to form valid messages.

Validation of system consistency refers to the verification of the correct composition of the electronic message by a system processing the transaction messages. Whether the message is adequate in business application terms is dealt with by the application software.

Only messages containing a valid set of Element Strings defined in the GS1 System can be unambiguously processed. The processing of invalid messages may lead to data file errors because the meaning and relationship of the Element Strings are not defined. This is illustrated in Figures 7.3 – 1 and 7.3 – 2.

Figure 7.3 – 1

Examples of Valid Messages			
Element Strings in Message			Comment
AI 00	AI 33nn		Identification of a logistic unit + logistic weight
AI 00	AI 01		Identification of an entity as a logistic unit and as a Fixed Measure Trade Item
AI 00	AI 01 '9'	AI 31nn	Identification of an entity as a logistic unit and as a Variable Measure Trade Item
AI 00	AI 02	AI 37	Identification of a logistic unit and its contained Fixed Measure Trade Items
AI 01	AI 10	AI 15	Identification of a trade item + lot number + best before date
AI 00	AI 401		Identification of a logistic unit as part of a consignment
AI 01 '9'	AI 31nn	AI 33nn	Identification of a Variable Measure Trade Item + logistic weight
AI 00	AI 01	AI 33nn	Identification of an entity as a logistic unit and a Fixed Measure Trade Item; the logistic weight is associated with the identification number of the logistic unit

Figure 7.3 – 2

Examples of Invalid Messages			
Element Strings in Message			Comment
AI 00	AI 01	AI 37	Invalid identification of an entity as a logistic unit and as a Fixed Measure Trade Item; AI 37 (quantity of items contained) must be used with AI 02 only
AI 01	AI 10	AI 33nn	Invalid identification of a Fixed Measure Trade Item + lot number; AI 33nn is incorrect because logistic measures of a Fixed Measure Trade Item are fixed attributes stored in the data file
AI 01'9'	AI 33nn		Invalid identification of a Variable Measure Trade Item + logistic weight; the mandatory Element String with a trade measure is missing
AI 00	AI 11		Invalid identification of a logistic unit; AI 11 is incorrect because a production date must be associated with the identification number of a trade item
AI 00	AI 01	AI 02/37	Invalid identification of an entity as a logistic unit and as a Fixed Measure Trade Item; AI 02/37 must not be associated with AI 01
AI 01	AI 30		Invalid identification of a Fixed Measure Trade Item; AI 30 must only be associated with the identification number of a Variable Measure Trade Item
AI 02	AI 37		Invalid identification of the fixed measure trade units contained in an unidentified logistic unit; AI 00 is missing
AI 00	AI 02		Invalid identification of a logistic unit and of the contained Fixed Measure Trade Items; AI 02 requires the mandatory presence of AI 37 to complete the identification of the content

7.4 Validation of the Electronic Message Regarding User Requirements

Some industry groups and organisations specify the use of particular Element Strings for attributes and other information not directly identifying the item. Contrary to the validation of messages for system conformity, GS1 do not define the rules for the validation and application of these particular Element Strings. Validation of messages containing these Element Strings in these environments (e.g., trade item identification with best before date and batch number) is left to the discretion of the particular system user community.

Validation of the correctness of a message may be performed differently for each Global Trade Item Number™ (GTIN™), and instructions must be stored in the data file. System users should include the Application Identifiers and their specific application rules in the stored instructions.

Validation of the user requirements must be performed after validation of system consistency. Missing elements in consistent messages may be by-passed or completed in given instances. Inconsistent messages can never be processed properly.

7.5 Conversion of Weights and Measures in User Applications

All weights and measures that are encoded in the Element Strings with the Application Identifiers (31nn) to (36nn) are structured according to the same mathematical rules. The determination of basic units of measurement and the freedom to choose the number of decimal positions will lead to variations in data representation. Suppliers will choose the value that best suits the respective trade item in terms of weight/size and the degree of accuracy required (e.g., grams) for the representation of weights and measures in the six-position data field.

The recipient of such goods also may want to store these details in a standardised form in his data file. This requirement is easily fulfilled through programming with the conversion formula shown below.

As described in Section 3.0, the Application Identifier in position A₄ denotes the position of the implied decimal point, called the Inverse Exponent.

The three-step formula to convert weights and measures is as follows:

1. Define the company's internal Inverse Exponent in accordance with the basic unit of measure of the company's internal field structure (e.g., for an AI expressing weight in kilograms, Inverse Exponent 0 could signify kilograms and Inverse Exponent 3 could signify grams).
2. Subtract the company's internal Inverse Exponent from the value of the position A₄ of the Application Identifier in the decoded Element String. Call the result X.
3. Divide the amount of the six-digit applicable value field from the decoded data string by 10^X. The result is the value required in the company's data structure.

In the examples in Figure 7.5 – 1, the company's system uses internal weight fields eight digits in length (format: nnnnnnn.n) with a unit of measure equal to grams. Thus, the company uses the internal Inverse Exponent of 3.

Figure 7.5 – 1

Decoded Data String					Conversion		Internal Weight Field							
Application Identifier A ₁ A ₂ A ₃ A ₄				Weight			Eight-Digit Data Field Defined as Grams with One Decimal Position							
3	1	0	0	005097 (= 5097 kg)	Step 2: X = 0 minus 3 = -3 Step 3: 005097 divided by 10 ⁻³ (.001) =	5	0	9	7	0	0	0		
3	1	0	2	005097 (= 50.97 kg)	Step 2: X = 2 minus 3 = -1 Step 3: 005097 divided by 10 ⁻¹ (.1) =	0	0	5	0	9	7	0		
3	1	0	3	045250 (= 45.250 kg)	Step 2: X = 3 minus 3 = 0 Step 3: 045250 divided by 10 ⁰ (1) =	0	0	4	5	2	5	0		
3	1	0	4	012347 (= 1234.7 g)	Step 2: X = 4 minus 3 = 1 Step 3: 012347 divided by 10 ¹ (10) =	0	0	0	1	2	3	4	7	



Decimal point

In the examples in Figure 7.5 – 2, the company's system uses internal weight fields eight digits in length (format: nnnnn.nnn) with a unit of measure equal to kilograms. Thus the company uses an internal Inverse Exponent of 0.

Figure 7.5 – 2

Decoded Data String					Conversion		Internal Weight Field							
Application Identifier A ₁ A ₂ A ₃ A ₄				Weight			Eight-Digit Data Field Defined as Kilograms with Three Decimal Position							
3	1	0	0	005097 (= 5097 kg)	Step 2: X = 0 minus 0 = 0 Step 3: 005097 divided by 10 ⁰ (1) =	0	5	0	9	7				
3	1	0	2	005097 (= 50.97 kg)	Step 2: X = 2 minus 0 = 2 Step 3: 005097 divided by 10 ² (100) =	0	0	0	5	0	9	7		
3	1	0	3	045250 (= 45.250 kg)	Step 2: X = 3 minus 0 = 3 Step 3: 045250 divided by 10 ³ (1000) =	0	0	0	4	5	2	5		
3	1	0	4	012347 (= 1234.7 g)	Step 2: X = 4 minus 0 = 4 Step 3: 012347 divided by 10 ⁴ (10000) =	0	0	0	0	1	2	3	5	

↑

Decimal point

↑

Position rounded

7.6 Linkage of GTINs™ in a Database

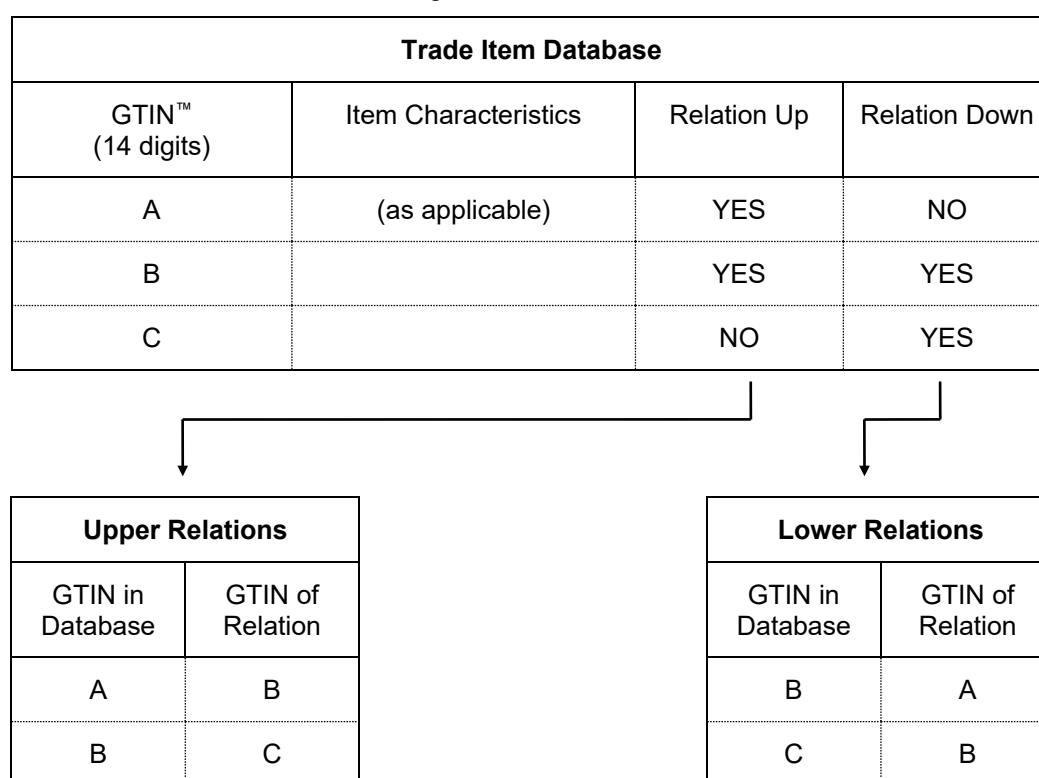
A trade item is any item (product or service) upon which there is a need to retrieve pre-defined information and that may be priced, or ordered, or invoiced at any point in any supply chain. Trade items may be a single item, part, unit, product, or service, or a pre-defined multiple or grouping or combination of such items. A separate Global Trade Item Number™ (GTIN™) identifies each of these items unambiguously, irrespective of the applied data structure. This also applies to identification numbers for restricted distribution in a closed environment.

Information about the hierarchical structure of trade items is an important issue in a business. [Section 7.6.1](#) illustrates an example of how the required links can be established by using a relational database.

7.6.1 The Principle

The hierarchy for the example in Figure 7.6.1 – 1 is basic product = A; 10 x A = product B; 5 x B = product C.

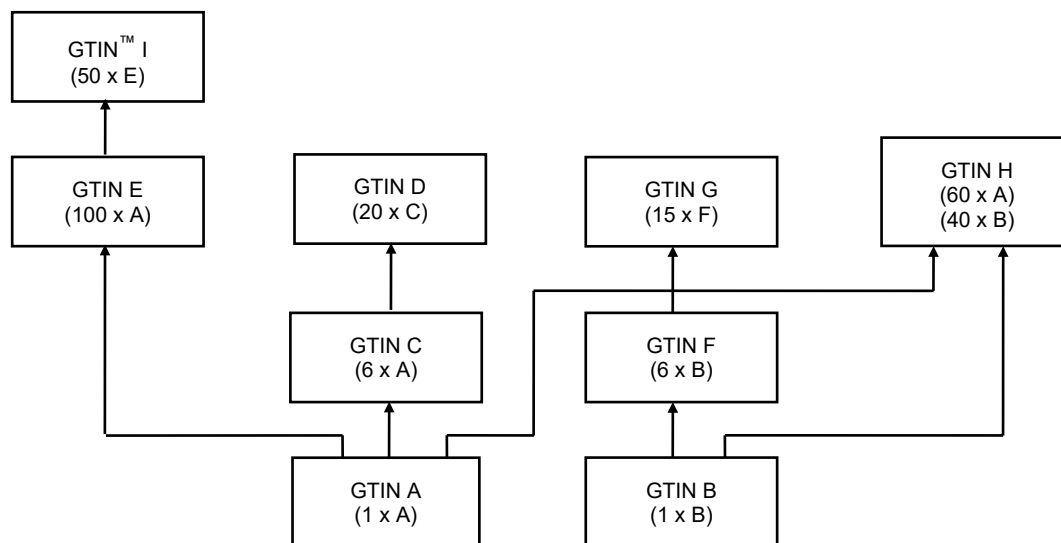
Figure 7.6.1 – 1



See [Figure 7.6.2 – 1](#) for the mechanism of linkage for the various types of trade items.

7.6.2 Extended Example of a Trade Item Hierarchy

Figure 7.6.2 – 1



Note: For reasons of simplicity, Global Trade Item Numbers™ (GTINs) are expressed in letters in this example, signifying that they may be of any standardised structure.

Figure 7.6.2 – 2

Trade Item Database			
GTIN™ (14 digits)	Item Characteristics	Relation Up	Relation Down
A	(as applicable)	YES	NO
B		YES	NO
C		YES	YES
D		NO	YES
E		YES	YES
F		YES	YES
G		NO	YES
H		NO	YES
I		NO	YES



Upper Relations				Lower Relations			
GTIN in Database	GTIN of Relation	Quantity of Items Contained	Relation is Mixed Trade Item	GTIN in Database	GTIN of Relation	Quantity of Items Contained	Relation is Mixed Trade Item
A	C	6*	NO	C	A	6**	NO
A	E	100	NO	D	C	20	NO
A	H	60	YES	E	A	100	NO
B	F	6	NO	F	B	6	NO
B	H	40	YES	G	F	15	NO
C	D	20	NO	H	A	60	NO
E	I	50	NO	H	B	40	NO
F	G	15	NO	I	E	50	NO

*Quantity of items numbered A contained in item C

**Quantity of items numbered A contained in item C

Note: The columns "GTIN in Database" and "GTIN of Relation" are sufficient to establish the links between the different items. The column "Quantity of Items Contained" provides additional information, which may be useful in particular business applications. The column "Relation is Mixed Trade Item" provides the relations pointing to all trade items contained in a mixed trade item.

7.6.3 Linkage of GTINs™ in a Non-Relational Database by Trade Item Manufacturer

Many types of items are produced and distributed in fixed measure standard nested packaging configurations (e.g., consumer unit, carton, case, pallet) with fixed quantity relationships. The various packaging configurations are often broken into lower levels at various points in the supply chain, and, therefore, each level of the packaging may be a trade item. Computer systems must be capable of understanding the relationships of the units or trade items in the configuration and treating inventory of all levels of the configuration as one SKU (Stock Keeping Unit).

Use of the first digit Indicator (values 1 to 8) of the EAN/UCC-14 Data Structure can be used to identify levels of a standard packaging configuration. This allows digits 2 to 13 to remain constant for all levels of the standard packaging configurations for an item. If this method of numbering item configurations is used when necessary to support business processes or when driven by system constraints, the non-relational database construct defined below may be appropriate.

The item database is constructed with a base item record (table) and segments (tables) for each level of the item packaging configuration. Properly designed, this type of system can support pricing, ordering, and shipping of any level of the packaging configuration (trade item) with appropriate dimension and weight information. It enables inventories to be maintained by packaging level and in total for the base item. It also provides channel partners or customers the choice of ordering and invoicing units. Meeting these requirements often makes this approach a good business solution for manufacturers, because it meets the most critical needs in the supply chain and is practical to implement, particularly in distributed and small systems where performance is critical.

Using the EAN/UCC-14 Data Structure, the base item record contains the base EAN/UCC-8, UCC-12, or EAN/UCC-13 ID Number (digits 2 to 13) as a key, with all information relating to the base unit and the item in total (including total inventory balance). Each of the packaging segments contains information unique to the respective packaging configuration (e.g., Indicator, Check Digit, quantity relationship to next lower level of the configuration, dimensions, weight, prices). After accessing the item record using the GTIN of the base item (digits 2 to 13), the packaging segments are accessed using the Indicator (first digit).

This construct demands that:

- the trade item must be fixed in measure
- there must be a single Global Trade Item Number™ (GTIN™) for the base item of the related packaging configurations that is an EAN/UCC-8, UCC-12, or EAN/UCC-13 ID Number
- each related packaging configuration is limited to eight levels of packaging for the base item using Indicator values 1 to 8

When storing EAN/UCC-8, UCC-12, or EAN/UCC-13 ID Numbers in a 14-digit reference field or 14-digit data carrier, they must be stored based on rules that ensure their uniqueness. When a GTIN is stored in the GTIN Format, a 14-digit reference field represented in computer files, the uniqueness of the ID number is ensured.

The GTIN Format is intended to support the uniqueness management process for the construction of GTINs and not for the receiving process. Companies that receive trade items with GTINs must be able to process the complete GTIN without regard to how it was constructed.

7.7 Element Strings Represented in Data Carriers

Scanned Element Strings are decoded as a full string by the reading device and are then transmitted for processing in the application software. The full string is composed of a symbology identifier and one or more Element Strings. The meaning of an Element String is also determined by the data carrier in which it is represented.

A synopsis by data carrier of the Element Strings described in these specifications is shown in [Figure 7.7.1 – 1](#), which also provides an overview of the sequential number range of trade items by data carrier.

7.7.1 GTINs™ Represented in GS1 System Data Carriers

Figure 7.7.1 – 1

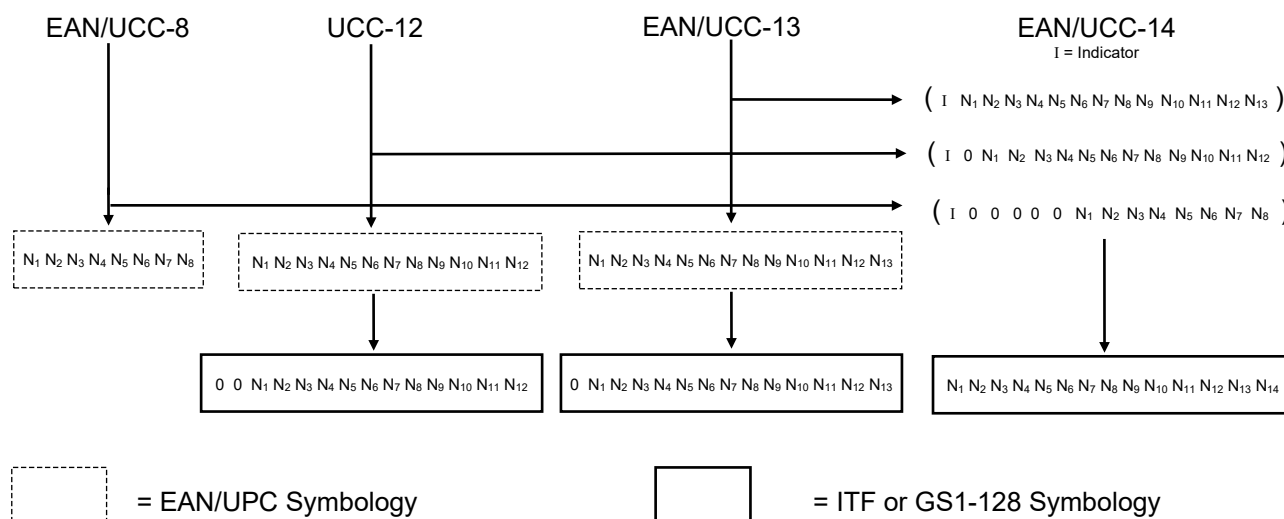
ITF-14 or GS1-128 Bar Code Symbol													
EAN-13 Bar Code Symbol													
UPC-A or UPC-E Bar Code Symbol													
EAN-8 Bar Code Symbol													
2.	*	*	*	*	*	*	0	0	0	0	0	0	C
							0	9	9	9	9	9	C
1.	*	*	*	*	*	*	1	0	0	0	0	0	C
							1	3	9	9	9	9	C
2.	*	*	*	*	*	*	2	0	0	0	0	0	C
							2	9	9	9	9	9	C
1.	*	*	*	*	*	*	3	0	0	0	0	0	C
							9	6	9	9	9	9	C
1.	0	0	0	0	0	1	0	0	0	0	0	0	C
	0	0	0	0	0	9	9	9	9	9	9	9	C
2.	*	*	0	0	1	0	0	0	0	0	0	0	C
			0	0	7	9	9	9	9	9	9	9	C
1.	0	0	0	0	8	0	0	0	0	0	0	0	C
	0	0	1	9	9	9	9	9	9	9	9	9	C
4.	*	0	2	0	0	0	0	0	0	0	0	0	C
		0	2	9	9	9	9	9	9	9	9	9	C
1.	0	0	3	0	0	0	0	0	0	0	0	0	C
	0	0	3	9	9	9	9	9	9	9	9	9	C
2.	*	0	4	0	0	0	0	0	0	0	0	0	C
		0	4	9	9	9	9	9	9	9	9	9	C
5.	*	0	5	0	0	0	0	0	0	0	0	0	C
		0	5	9	9	9	9	9	9	9	9	9	C
1.	0	0	6	0	0	0	0	0	0	0	0	0	C
	0	0	9	9	9	9	9	9	9	9	9	9	C
1. 8.	0	1	0	0	0	0	0	0	0	0	0	0	C
	0	1	3	9	9	9	9	9	9	9	9	9	C
2. 4.	0	2	0	0	0	0	0	0	0	0	0	0	C
	0	2	9	9	9	9	9	9	9	9	9	9	C
1. 8.	0	3	0	0	0	0	0	0	0	0	0	0	C
	0	9	6	9	9	9	9	9	9	9	9	9	C
7.	*	9	7	7	0	0	0	0	0	0	0	0	C
		9	7	9	9	9	9	9	9	9	9	9	C
5. 6.	*	9	8	0	0	0	0	0	0	0	0	0	C
		9	8	2	9	9	9	9	9	9	9	9	C
5.	*	9	9	0	0	0	0	0	0	0	0	0	C
		9	9	9	9	9	9	9	9	9	9	9	C
1.	1	0	0	0	0	0	1	0	0	0	0	0	C
	8	0	0	0	0	0	1	3	9	9	9	9	C
1.	1	0	0	0	0	0	3	0	0	0	0	0	C
	8	0	0	0	0	0	9	6	9	9	9	9	C
1. 3.	1	0	0	0	0	1	0	0	0	0	0	0	C
	9	0	0	0	0	9	9	9	9	9	9	9	C
1. 3.	1	0	0	0	9	0	0	0	0	0	0	0	C
	9	0	1	9	9	9	9	9	9	9	9	9	C
1. 3.	1	0	3	0	0	0	0	0	0	0	0	0	C
	9	0	3	9	9	9	9	9	9	9	9	9	C
1. 3.	1	0	6	0	0	0	0	0	0	0	0	0	C
	9	0	9	9	9	9	9	9	9	9	9	9	C
1. 3.	1	1	0	0	0	0	0	0	0	0	0	0	C
	9	1	3	9	9	9	9	9	9	9	9	9	C
1. 3.	1	3	0	0	0	0	0	0	0	0	0	0	C
	9	9	6	9	9	9	9	9	9	9	9	9	C

1. Fixed measure; 2. Fixed measure restricted distribution; 3. Variable measure; 4. Variable measure restricted distribution; 5. Coupons (not a GTIN); 6. Refund Receipts (not a GTIN); 7. ISBN, ISMN, and ISSN; 8. GRAI

7.7.2 Handling of Global Trade Item Numbers™ to Conform with the System

Figure 7.7.2 – 1

GTINs™ in GS1 System Bar Code Symbols



As shown in Figure 7.7.2 – 1, the GS1 System uses Global Trade Item Numbers™ (GTINs™) that vary in length. To avoid duplication in the GTIN Format in a computer file, it is necessary to observe some rules regarding GTIN arrangement.

Currently, the longest identification number for Fixed Measure Trade Items consists of 14 digits, which necessitates the creation of a 14-digit field. Figure 7.7.2 – 2 shows how GTINs transmitted in Element Strings are positioned in the GTIN Format.

Figure 7.7.2 – 2

Data Structure	Positions in the GTIN Format													
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	T ₁₁	T ₁₂	T ₁₃	T ₁₄
EAN/UCC-8	0	0	0	0	0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈
UCC-12	0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂
EAN/UCC-13	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃
EAN/UCC-14	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄

7.7.3 Element Strings Represented in GS1-128 Symbology

The Element Strings encoded in the GS1-128 Symbology are composed of an Application Identifier and one or several data fields. The Application Identifier denotes the contents and structure of the respective data fields. Full details are contained in Section 3.0.

7.8 Secondary Data for Specific Health Industry Products

Figures 7.8 – 1 and 7.8 – 2 show the correct data formats for secondary data for specific health industry products. If a column in Figure 7.8 – 3 is left blank, then that data format information is not used.

Figure 7.8 – 1

MM	two-digit expiration date month indicator (fixed length of two numeric digits)
YY	two-digit expiration date year indicator (fixed length of two numeric digits)
DD	two-digit expiration date day indicator (fixed length of two numeric digits)
HH	two-digit expiration date hour indicator (fixed length of two, G.M.T. format)
JJJ	three-digit expiration date Julian day indicator (fixed length of three numeric digits)
LOT	up to 13-digit alphanumeric lot number
L	1-digit link character (GTIN Check Digit)
QQ	two-digit quantity (fixed length of two numeric digits)
QQQQQ	five-digit quantity (fixed length of five numeric digits)

The data in Figure 7.8 - 2 is used in the example in Figure 7.8 - 3.

Figure 7.8 – 2

GTIN™	10312345678903
Lot number	3C001
Link character	3
Expiration date	September 28, 1995, at 10 p.m.
Two-digit quantity	24
Five-digit quantity	00100

Quantity represents the quantity of items contained within the trade item where the inside item is assigned the GTIN™ 00312345678906.

The data formats in Figure 7.8 – 3 show all combinations of the sub-fields possible within the Element String.

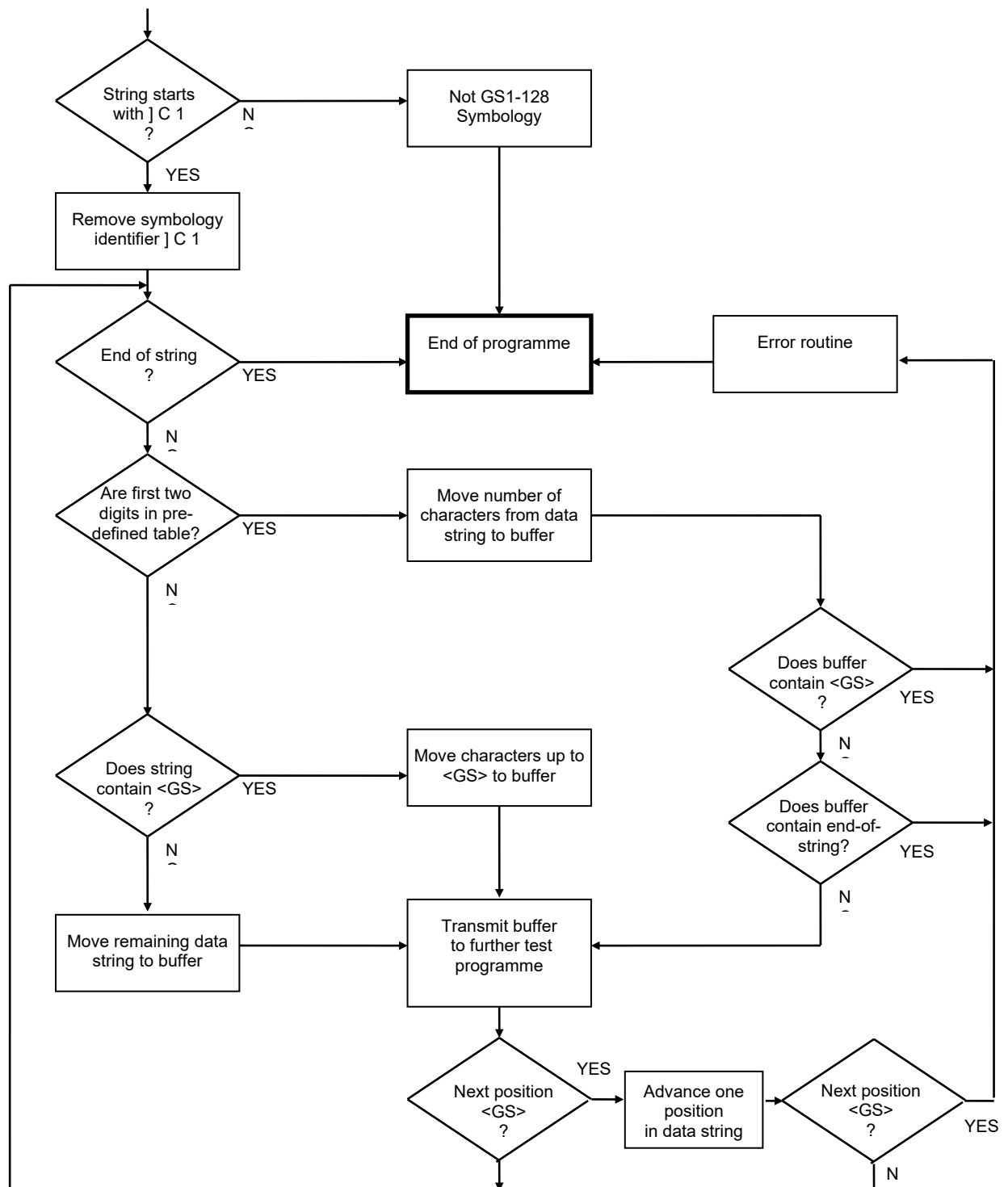
Figure 7.8 – 3

Row	Application Identifier	Quantity Format Digit	Quantity Format	Expiration Date Format Digit	Expiration Date Format	Lot Field	Link Digit	Example Data
1	22				MMYY	LOT	L	2209953C0013
2	22			2	MMDDYY	LOT	L	2220928953C0013
3	22			3	YYMMDD	LOT	L	2239509283C0013
4	22			4	YYMMDDHH	LOT	L	224950928223C0013
5	22			5	YYJJJ	LOT	L	225952713C0013
6	22			6	YYJJJHH	LOT	L	22695271223C0013
7	22			7		LOT	L	2273C0013
8	22	8	QQ		MMYY	LOT	L	2282409953C0013
9	22	8	QQ	2	MMDDYY	LOT	L	2282420928953C0013
10	22	8	QQ	3	YYMMDD	LOT	L	2282439509283C0013
11	22	8	QQ	4	YYMMDDHH	LOT	L	228244950928223C0013
12	22	8	QQ	5	YYJJJ	LOT	L	228245952713C0013
13	22	8	QQ	6	YYJJJHH	LOT	L	22824695271223C0013
14	22	8	QQ	7		LOT	L	2282473C0013
15	22	8	QQ			LOT	L	228243
16	22	9	QQQQQ		MMYY	LOT	L	2290010009953C0013
17	22	9	QQQQQ	2	MMDDYY	LOT	L	2290010020928953C0013
18	22	9	QQQQQ	3	YYMMDD	LOT	L	2290010039509283C0013
19	22	9	QQQQQ	4	YYMMDDHH	LOT	L	229001004950928223C0013
20	22	9	QQQQQ	5	YYJJJ	LOT	L	229001005952713C0013
21	22	9	QQQQQ	6	YYJJJHH	LOT	L	22900100695271223C0013
22	22	9	QQQQQ	7		LOT	L	2290010073C0013
23	22	9	QQQQQ			LOT	L	229001003

As an example, row 8 in Figure 7.8 – 3, using the required AI (01) and AI (22), would create the full string JC1 01 10312345678903 22 82409953C0013.

7.9 Processing of Data from GS1-128 Bar Code Symbols

Figure 7.9 – 1



7.9.1 General

GS1-128 Bar Code Symbols may represent several Element Strings in concatenated form (see [Section 5.0](#)). For processing as shown in [Figure 7.3 – 1](#), it is necessary to separate each Element String, which is performed by the processing routine illustrated in [Figure 7.9 – 1](#).

7.9.2 Element Strings with Pre-Defined Lengths using Application Identifiers

Representation of more than one Element String in a GS1-128 Bar Code Symbol requires the use of a separator character between the different Element Strings to mark their end. In GS1-128 Symbology, this is the Function Code 1 (FNC1). For details, see [Section 5.0](#).

However, in order to enable printing of shorter bar code symbols, some Element Strings have been pre-defined in length, so that their end may be determined, and the FNC1 is not needed. These Element Strings, are shown in [Figure 5.3.8.2.1](#)

7.9.3 The Function Code 1 (FNC1)

Only when used as a separator character is the Function Code 1 (FNC1) transmitted in the decoded data string as <GS> (ASCII character 29, seven-bit character set ISO 646). All Element Strings of variable length and those of fixed length not stated in [Figure 5.3.8.2.1 – 1](#) must be followed by an FNC1 when followed by another Element String in a single bar code symbol. An FNC1 is not required at the end of the last Element String represented in a bar code symbol.

Section 8.0:

GS1 Standards Glossary of Terms

The Glossary is now segmented into four parts:

- 8.1 GS1 Glossary Terms and Definitions
- 8.2 GS1 Acronyms
- 8.3 Legacy (Retired) Terms
- 8.4 GS1 Prefixes and GS1 Company Prefixes

Section 8.1 GS1 Glossary Terms and Definitions

Add-On Symbol	A bar code symbol used to encode information supplementary to that in the main bar code symbol.
AIDC Data Validation	Verification of scanned/read data from bar codes or RFID tags to determine whether it meets the application rules for system logic and consistency and/or a particular user's requirements, prior to processing in applications.
alphanumeric (an)	Describes a character set that contains alphabetic characters (letters), numeric digits (numbers), and other characters, such as punctuation marks.
aperture	A physical opening that is part of the optical path in a device such as a scanner, photometer, or camera. Most apertures are circular, but they may be rectangular or elliptical.
Application Identifier	The field of two or more characters at the beginning of an Element String that uniquely defines its format and meaning.
ASC X12	Accredited Standards Committee X12. ASC X12 is responsible for developing American National Standards for Electronic Data Interchange (EDI).
Asset Type	A number assigned by the owner of an asset to uniquely identify a type of asset.
attribute	A piece of information reflecting a characteristic related to an identification number (e.g., Global Trade Item Number™ (GTIN™), SSCC).
autodiscrimination	The capability of a reader to automatically recognise and decode multiple bar code symbologies.
auxiliary guard patterns	Components of the EAN/UPC Symbology. The centre guard bar pattern, the left guard bar pattern, and the right bar patterns that are represented in some of the symbols are specific types of auxiliary guard pattern.
bar gain/loss	The increase/decrease in bar width due to effects of the reproduction and printing processes.
Bearer Bars	Bars surrounding a bar code symbol to prevent misreads or to improve print quality of the bar code symbol.
billing unit	An item that is priced and invoiced in trade between two parties at any point in the supply chain.
brand owner	The party that is responsible for allocating GS1 System numbering and bar code symbols on a given trade item. The administrator of a GS1 Company Prefix.
carrier	The party that provides freight transportation services or a physical or electronic mechanism that carries data.

Check Digit	A digit calculated from the other digits of an Element String, used to check that the data has been correctly composed. (See GS1 Check Digit Calculation.)
Company Number	A component of the GS1 Company Prefix. GS1 Member Organisations assign GS1 Company Prefixes to entities that administer the allocation of GS1 System identification numbers. These entities may be, for example, commercial companies, not for profit organisations, governmental agencies, and business units within organisations. Criteria to qualify for the assignment of a GS1 Company Prefix are set by the GS1 Member Organisations.
Composite Component [®]	This term is used to refer to either a linear or 2D symbol component within a composite symbol.
Composite Symbology [®]	A GS1 System composite symbol consists of a linear component (encoding the item's primary identification) associated with an adjacent 2D Composite Component [™] (encoding supplementary data, such as a batch number or expiration date). The composite symbol always includes a linear component so that the primary identification is readable by all scanning technologies, and so that 2D imager scanners can use the linear component as a finder pattern for the adjacent 2D Composite Component [™] . The composite symbol always includes one of three multi-row 2D Composite Component [™] versions (e.g., CC-A, CC-B, CC-C) for compatibility with linear- and area-CCD scanners and with linear and rastering laser scanners.
concatenation	The representation of several Element Strings in one bar code symbol.
coupon	A voucher that can be redeemed at the Point-of-Sale for a cash value or free item.
Coupon Extended Bar Code	A supplemental bar code, used only in North America, that can be printed on a coupon to provide additional information, such as Offer Codes, expiration dates, and household identification numbers.
Coupon-12	A twelve-digit Restricted Circulation Number for coupons structured according to the rules defined in the target market.
Coupon-13	The 13-digit GS1 System Restricted Circulation Number defined according to rules in a target market used for coupons.
customer	The party that receives, buys, or consumes an item or service.
data carrier	A means to represent data in a machine readable form; used to enable automatic reading of the Element Strings.
data character	A letter, digit, or other symbol represented in the data field(s) of an element string.
data field	The smallest part of the data part of an Element String that needs to be distinguished.

Data Matrix	A standalone, two-dimensional matrix symbology that is made up of square modules arranged within a perimeter finder pattern. Data Matrix ISO version ECC 200 is the only version that supports GS1 System identification numbers, including Function Code 1. Data Matrix Symbols are read by two-dimensional imaging scanners or vision systems.
data titles	A standard abbreviated description of a data field; used to denote the Human Readable Interpretation of encoded data.
Default Front	The side of a consumer trade item that is used to capture dimensional attributes for the purpose of data alignment.
Direct Part Marking	Direct part marking refers to the process of marking a symbol on an item using an intrusive or non-intrusive method.
direct print	A process in which the printing apparatus prints the symbol by making physical contact with a substrate (e.g., flexography, ink jet, dot peening).
Document Type	The part of the data structure allocated by the document issuer to identify a document for a given GS1 Company Prefix.
EAN/UPC Composite Symbology [®] Family	A family of bar code symbols comprising the UPC-A Composite Symbology [®] , UPC-E Composite Symbology [®] , EAN-8 Composite Symbology [®] , and EAN-13 Composite Symbology [®] .
EAN/UPC Symbology	A family of bar code symbols including EAN-8, EAN-13, UPC-A, and UPC-E Bar Code Symbols. Although UPC-E Bar Code Symbols do not have a separate Symbology Identifier, they act like a separate symbology through the scanning application software. See also EAN-8 Bar Code Symbol, EAN-13 Bar Code Symbol, UPC-A Bar Code Symbol, and UPC-E Bar Code Symbol.
EAN-13 Bar Code Symbol	A bar code symbol of the EAN/UPC Symbology that encodes GTIN-13, Coupon-13, RCN-13, and VMN-13.
EAN-13 Composite Symbology [®]	The Composite Symbology [®] that utilises an EAN-13 Bar Code Symbol as the linear component.
EAN-8 Bar Code Symbol	A bar code symbol of the EAN/UPC Symbology that encodes GTIN-8.
EAN-8 Composite Symbology [®]	The Composite Symbology [®] that utilises an EAN-8 Bar Code Symbol as the linear component.
EANCOM [®]	The GS1 standard for Electronic Data Interchange (EDI) is a detailed implementation guideline of the UN/EDIFACT standard messages using the GS1 Identification Keys.
Electronic Commerce	The conduct of business communications and management through electronic methods, such as Electronic Data Interchange (EDI) and automated data collection systems.

Electronic Message	A composition of Element Strings from scanned data and transaction information assembled for data validation and unambiguous processing in a user application.
Electronic Product Code™	An identification scheme for universally identifying physical objects (e.g. trade items, assets, and locations) via RFID tags and other means. The standardised EPC data consists of an EPC (or EPC Identifier) that uniquely identifies an individual object, as well as an optional Filter Value when judged to be necessary to enable effective and efficient reading of the EPC tags.
Element String	A piece of data defined in structure and meaning, comprising an identification part (prefix or Application Identifier) and a data part, represented in a GS1 System endorsed data carrier.
EPC Manager Number	The number allocated to a company or a company entity.
EPC Middleware	EPC Middleware is the component of the EPCglobal Network that manages real-time read events and information, provides alerts, and manages the basic read information for communication to EPC Information Services and a company's other existing information systems. EPCglobal is developing a software interface standard for services enabling data exchange between an EPC reader or network of readers and information systems.
EPC Object Naming Service	Business information systems need a way of matching the Electronic Product Code to information about the associated item. The ONS is an automated networking service that provides this service by pointing computers to sites on the World Wide Web.
EPC tag	RFID tag that complies with the EPCglobal standard and contains an Electronic Product Code.
EPCglobal Inc™	A not-for-profit organisation entrusted by industry to establish and support the Electronic Product Code and the global adoption of the EPCglobal Network as the global standards for immediate, automatic and accurate identification of any item in the supply chain of any company, in any industry, in any country in the world.
EPCglobal Network™	A set of technologies that enable immediate, automatic identification and sharing of information on items in the supply chain.
EPCglobal Tag Data Standard	A specification or set of guidelines that, after extensive consensus-building, has received the endorsement of EPCglobal members and the EPCglobal Board of Governors.
even parity	A characteristic of the encodation of a symbol character whereby the symbol character contains an even number of dark modules.
Extension digit	A digit, allocated by the user, used to increase the capacity of the Serial Reference within the SSCC (Serial Shipping Container Code).
fixed length	Term used to describe a data field in an Element String with an established number of characters.

Fixed Measure Trade Item	An item always produced in the same pre-defined version (e.g., type, size, weight, contents, design) that may be sold at any point in the supply chain.
Full String	The data transmitted by the bar code reader from reading a data carrier, including Symbology Identifier and Element String(s).
Function Code 1 (FNC1)	A symbology element used to form the double start pattern of a GS1-128 Bar Code Symbol. It is also used to separate certain concatenated Element Strings, dependent on their positioning in the bar code symbol.
GDTI	The GS1 Identification Key comprising a GS1 Company Prefix, Document Type, and Check Digit used to identify documents.
General Distribution Scanning	Scanning environments that include bar coded trade items packaged for transport, logistic units, assets and location tags.
GIAI	The GS1 Identification Key comprising a GS1 Company Prefix and Individual Asset Reference used to identify assets.
GLN	The GS1 Identification Key comprising a GS1 Company Prefix, Location Reference, and Check Digit used to identify physical locations or legal entities.
Global Document Type Identifier	The GS1 Identification Key for a document type with an optional serial number.
Global Individual Asset Identifier	The GS1 Identification Key for an individual asset.
Global Location Number	The GS1 Identification Key to identify physical or legal entities.
Global Returnable Asset Identifier	The GS1 Identification Key for returnable assets.
Global Service Relation Number	The GS1 Identification Key used to identify the relationship between a service provider and service recipient.
Global Trade Item Number [®]	The GS1 Identification Key for trade items.
GRAI	The GS1 Identification Key comprising a GS1 Company Prefix, Asset Type, Check Digit, and optional serial number used to identify returnable assets.
GS1 Check Digit Calculation	A GS1 System algorithm for the calculation of a Check Digit to verify accuracy of data.
GS1 Common Currency Coupon Code	An identification number for coupons issued in a common currency area (e.g., the euro currency) that uses the Coupon Code-13 Data Structure.
GS1 Company Prefix	Part of the GS1 System identification number consisting of a GS1 Prefix and a Company Number, both of which are allocated by GS1 Member Organisations.

GS1 EANCOM	A component of GS1 eCom. The GS1 standard for Electronic Data Interchange providing users with a global business messaging language of e-business to conduct efficient Internet-based electronic commerce.
GS1 General Specifications	Defines the GS1 System data and application standards related to the marking and automatic identification of trade items, locations, logistic units, assets, and more using bar code, RFID, and GS1 Identification Keys.
GS1 Global Data Dictionary	A repository tool used to record GS1 member standards agreements on business terms and definitions used by all business units.
GS1 Global Office	Based in Brussels, Belgium, and Princeton, USA, is an organisation of GS1 Member Organisations that manages the GS1 System.
GS1 Global Product Classification	A component of GS1 GDSN. It provides the required global framework for trade item categorisation supporting global data synchronisation.
GS1 Global Registry	A component of GS1 GDSN. It acts as a pointer (directory for the registration) to source data pools where catalogue item and party master data is housed. It also fulfils the role of matching subscriptions to registrations to facilitate the synchronisation process.
GS1 Global Standards Management Process	A component of GS1 Services. It is offered as an integral part of GS1's standards development and maintenance process. It allows for user members' active involvement.
GS1 Identification Key	A numeric or alphanumeric field managed by GS1 to ensure the global, unambiguous uniqueness of the identifier in the open demand or supply chain.
GS1 Identification Keys	A globally managed system of numbering used by all GS1 Business Units to identify trade items, logistic units, locations, legal entities, assets, service relationships, and more. The Keys are built by combining GS1 member company identifiers (GS1 Company Prefix) with standards based rules for allocating reference numbers.
GS1 Member Organisation	A member of GS1 that is responsible for administering the GS1 System in its country (or assigned area). This task includes, but is not restricted to, ensuring user companies make correct use of the GS1 System, have access to education, training, promotion and implementation support and have access to play an active role in GSMP.
GS1 Prefix	A number with two or more digits, administered by the GS1global Office that is allocated to GS1 Member Organisations or for Restricted Circulation Numbers.
GS1 System	The specifications, standards, and guidelines administered by GS1.
GS1 XML	A component of GS1 eCom. It represents the GS1 standard for Extensible Markup Language schemas providing users with a global business messaging language of e-business to conduct efficient Internet-based electronic commerce.
GS1-128 Bar Code Symbol	A subset of the Code 128 that is utilised exclusively for GS1 System data structures.

GS1-128 Composite Symbology [®]	A Composite Symbology [®] that utilises a GS1-128 Bar Code Symbol as the linear component.
GS1-8 Prefix	A one-, two-, or three-digit index number, administered by GS1, denoting the area of distribution of trade items identified by a GTIN-8 or a number used in internal application (see RCN-8).
GSRN	The GS1 Identification Key comprising a GS1 Company Prefix, Service Reference, and Check Digit used to identify the relationship between a service provider and service recipient.
GTIN [®] Format	The format in which Global Trade Item Numbers [®] (GTINs [®]) must be represented in a 14-digit reference field (key) in computer files to ensure uniqueness of the identification numbers.
GTIN-12	The 12-digit GS1 Identification Key composed of a U.P.C. Company Prefix, Item Reference, and Check Digit used to identify trade items.
GTIN-13	The 13-digit GS1 Identification Key composed of a GS1 Company Prefix, Item Reference, and Check Digit used to identify trade items.
GTIN-14	The 14-digit GS1 Identification Key composed of an Indicator digit (1-9), GS1 Company Prefix, Item Reference, and Check Digit used to identify trade items.
GTIN-8	The 8-digit GS1 Identification Key composed of a GS1-8 Prefix, Item Reference, and Check Digit used to identify trade items.
Guard Bar Pattern	An auxiliary pattern of bars/spaces corresponding to start or stop patterns in bar code symbologies, and serving to separate the two halves of EAN-8, EAN-13, and UPC-A Symbols.
Hanging Item	Any consumer trade item that is normally presented in the store in a hanging position.
Header	Identifies the length, type, structure, version and generation of Electronic Product Code.
House Way Bill Number	A freight forwarder's document used mainly as a control for the goods within the freight forwarder's own service system.
Human Readable Interpretation	Characters that can be read by persons, such as letters and numbers, as opposed to symbol characters within bar code symbols, which are read by machines.
human translation	Text designed to support manual operations and to facilitate key entry in menu driven systems. Data titles and data content are included.
Identification number	A numeric or alphanumeric field intended to enable the recognition of one entity versus another.
Indicator	A digit from 1 to 9 in the leftmost position of the GTIN-14.
Individual Asset	An entity that is part of the inventory of a given company. (See also Returnable Asset.)

Inverse Exponent	The Application Identifier digit that denotes the implied decimal point position in an Element String.
Item Reference	The part of the data structure allocated by the user to identify a trade item for a given GS1 Company Prefix.
ITF Symbology	The Interleaved 2 of 5 Symbology.
ITF-14 Bar Code Symbol	An ITF Symbol used by the GS1 System to carry GTINs.
Local Assigned Code	A particular use of the UPC-E Bar Code Symbol for restricted distribution.
Location Reference	A number within a Global Location Number (GLN) assigned by various parties to identify a different entity.
logistic measures	Measures indicating the outside dimensions, total weight, or volume inclusive of packing material of a logistic unit. Also known as gross-measures.
logistic unit	An item of any composition established for transport and/or storage that needs to be managed through the supply chain. It is identified with SSCC.
magnification	Different sizes of bar code symbols based on a nominal size and a fixed aspect ratio; stated as a percent or decimal equivalent of a nominal size.
measure check-digit	A digit calculated from the measure field of an Element String encoded using the EAN/UPC Symbology. Used to check that the data has been correctly composed.
module	The narrowest nominal width unit of measure in a bar code symbol. In certain symbologies, element widths may be specified as multiples of one module. Equivalent to X-dimension.
modulo	An arithmetic scheme in which the result is the remainder after division.
Modulo 10	Modulo 10 creates a Check Digit according to the Modulo 10 algorithm specified in the GS1 General Specifications.
Modulo 103 GS1-128 Symbol Check Character	A number that results from a modulo calculation that is encoded in the GS1-128 Bar Code Symbol as a self-checking symbol character. It is created automatically by software as a symbol overhead character and is not expressed in the Human Readable Interpretation.
Natural Base	The side of a non-consumer trade item package that is used as a reference point for capturing dimensional attributes for the purpose of data alignment.
Non-GTIN [®] Packs	A packaging level for trade items where there is no trading partner requirement for GTIN identification. If a GTIN is required, then this item becomes a retail consumer trade item or standard trade item grouping.
Object Class	Similar to a stock keeping unit SKU or trade item level.

odd parity	A characteristic of the encodation of a symbol character whereby the symbol character contains an odd number of dark modules.
payment slip	The end customer's notification of a demand for payment for a billable service (e.g., utility bill) comprising an amount payable and payment conditions.
Point-of-Sale (POS)	Refers to the retail type checkout where bar code symbols are normally scanned.
price check-digit	A digit calculated from the price field of an Element String encoded using the EAN/UPC Symbology. Used to check that the data has been correctly composed.
Primary bar code	The bar code containing the identification number of the item (e.g. GTIN [®] , SSCC, etc.). Used to determine the placement of any additional bar code information.
Print Gain Gauge	A printed test pattern used to determine the print gain mean and the range of print gain (press variance) as it relates to bar widths. It may also be used throughout the print run to indicate whether the anticipated range of print gain is experienced.
Quiet Zone	A clear space containing no machine-readable marks, which precedes the Start Character of a bar code symbol and follows the Stop Character. Formerly referred to as "Clear Area" or "Light Margin."
Quiet Zone Indicator	A greater than (>) or less than (<) character, printed in the human readable field of the bar code symbol, with the tip aligned with the outer edge of the Quiet Zone.
radio frequency	Any frequency within the electromagnetic spectrum associated with radio wave propagation. When a radio frequency current is supplied to an antenna, an electromagnetic field is created that then is able to propagate through space. Many wireless technologies are based on radio frequency field propagation.
Radio Frequency Identification	A data carrier technology that transmits information via signals in the radio frequency portion of the electromagnetic spectrum. A Radio Frequency Identification system consists of an antenna and a transceiver, which read the radio frequency and transfer the information to a processing device, and a transponder, or tag, which is an integrated circuit containing the radio frequency circuitry and information to be transmitted.
RCN-12	A 12-digit Restricted Circulation Number (see Restricted Circulation Number).
RCN-13	A 13-digit Restricted Circulation Number (see Restricted Circulation Number).
RCN-8	An 8-digit Restricted Circulation Number (see Restricted Circulation Number) beginning with GS1-8 Prefix 8.

Reduced Space Symbology® (RSS)	A family of bar code symbols, including RSS-14®, RSS Limited®, RSS Expanded®, and RSS-14® Stacked. Any member of the RSS family can be printed as a stand-alone linear symbol or as a composite symbol with an accompanying 2D Composite Component® printed directly above the RSS linear component.
Refund Receipt	A voucher produced by equipment handling empty containers (bottles and crates).
Restricted Circulation Numbers	Signifies a GS1 identification number used for special applications in restricted environments, defined by the local GS1 Member Organisation (e.g., restricted within a country, company, industry). They are allocated by GS1 for either internal use by companies or to GS1 Member Organisations for assignment based on business needs in their country (e.g., variable measure product identification, couponing).
retail consumer trade item	The trade item intended to be sold to the end consumer at retail Point-of-Sale. They are identified with a GTIN-13, GTIN-12, or GTIN-8 using an EAN/UPC Symbol.
Retailer Zero-Suppression Code	A group of 4,500 ID numbers (separate from Local Assigned Codes), that enable the use of UPC-E Bar Codes in a closed system environment (not for open supply chain applications).
Returnable Asset	A reusable entity owned by a company that is used for transport and storage of goods.
RFID reader	Also known as an Interrogator or a reader, a Radio Frequency Identification reader communicates via radio waves with RFID tags and delivers the information in a digital format to a computer system.
RFID tag	A microchip attached to an antenna that sends data to an RFID reader. The RFID tag contains a unique serial number, and can also contain additional data. RFID tags can be active, passive or semi-passive tags.
RSS Composite Symbology® Family	A family of symbols comprised of the RSS-14® Composite Symbology®, RSS-14® Stacked Composite Symbology®, RSS Limited® Composite Symbology®, and RSS Expanded® Composite Symbology®.
RSS Expanded® Bar Code Symbol	A bar code symbol that encodes any GTIN plus supplementary AI Element Strings, such as weight and “best before” date, in a linear symbol that can be scanned omnidirectionally by suitably programmed Point-of-Sale scanners.
RSS Expanded® Composite Symbology®	The RSS Composite Symbology® that utilises an RSS Expanded® Bar Code Symbol as the linear component.
RSS Expanded® Stacked Bar Code Symbol	A bar code symbol that is a variation of the RSS Expanded® Bar Code Symbol that is stacked in multiple rows and is used when the normal symbol would be too wide for the application.

RSS Expanded [®] Stacked Composite Bar Code Symbol	The RSS Composite Symbology [®] that utilises an RSS Expanded [®] Stacked Bar Code Symbol as the linear component.
RSS Limited [®] Bar Code Symbol	A bar code symbol that encodes any GTIN with a leading digit zero or Indicator digit one in a linear symbol; for use on small items that will not be scanned at the Point-of-Sale.
RSS Limited [®] Composite Symbology [®]	The RSS Composite Symbology [®] that utilises an RSS Limited [®] Bar Code Symbol as the linear component.
RSS Omnidirectional	The members of the Reduced Space Symbology family designed to be read in segments by Omnidirectional Scanners at retail POS: RSS-14; RSS-14 Stacked Omnidirectional; RSS Expanded; RSS Expanded Stacked.
RSS-14 [®] Bar Code Symbol	A bar code symbol that encodes any of the GTIN data structures in a linear symbol that can be scanned omnidirectionally by suitably programmed Point-of-Sale scanners.
RSS-14 [®] Composite Symbology [®]	The RSS Composite Symbology [®] that utilises an RSS-14 [®] Bar Code Symbol as the linear component.
RSS-14 [®] Stacked Bar Code Symbol	A bar code symbol that is a variation of the RSS-14 [®] Symbology that is stacked in two rows and is used when the normal symbol would be too wide for the application. It comes in two versions: a truncated version used for small item marking applications and a taller omnidirectional version that is designed to be read by omnidirectional scanners. RSS Expanded [®] can also be printed in multiple rows as a stacked symbol.
RSS-14 [®] Stacked Composite Symbology [®]	The RSS Composite Symbology [®] that utilises an RSS-14 [®] Stacked Bar Code Symbol as the linear component.
scanner	An electronic device to read bar code symbols and convert them into electrical signals understandable by a computer device.
Separator Character	Function Code 1 used to separate certain concatenated Element Strings, dependent on their positioning in the GS1 Bar Code Symbols.
Serial Number	(1) A code, numeric or alphanumeric, assigned to an individual instance of an entity for its lifetime. Example: Microscope model AC-2 with serial number 1234568 and microscope model AC-2 with serial number 1234569. A unique individual item may be identified with the combined Global Trade Item Number (GTIN) and serial number. (2) Specific instance of the Object Class being tagged.
Serial Reference	The part of the data structure allocated by the user that, in conjunction with the Extension digit, establishes a unique SSCC for a given GS1 Company Prefix.

Serial Shipping Container Code	The GS1 Identification Key for logistic units.
Service Reference	The Service Reference is assigned by the service provider. The structure and content of the Service Reference is at the discretion of the particular service provider.
special characters	Special characters are designated by the symbology specification. For GS1-128 Symbology the special characters are the last 7 characters of codes sets A and B or the last 3 characters for code set C.
SSCC	The 18-digit GS1 System Identification Key comprising an Extension digit, GS1 Company Prefix, Serial Reference, and Check Digit used to identify a logistic unit.
standard trade item grouping	A standard composition for a trade item(s) that is not intended for Point-of-Sale scanning. They are identified with a unique GTIN-14, GTIN-13, or GTIN-12.
substrate	The material on which a bar code symbol is printed.
supplier	The party that produces, provides, or furnishes an item or service.
symbol	The combination of symbol characters and features required by a particular symbology, including Quiet Zone, Start and Stop Characters, data characters, and other auxiliary patterns, which together form a complete scannable entity; an instance of a symbology and a data structure.
symbol character	A group of bars and spaces in a symbol that is decoded as a single unit. It may represent an individual digit, letter, punctuation mark, control indicator, or multiple data characters.
Symbol Check Character	A symbol character or set of bar/space patterns included within a GS1-128 or RSS Symbol, the value of which is used by the bar code reader for the purpose of performing a mathematical check to ensure the accuracy of the scanned data. It is not shown in Human Readable Interpretation. It is not input to the bar code printer and is not transmitted by the bar code reader.
Symbol Contrast	An ISO 15416 parameter that measures the difference between the largest and smallest reflectance values in a Scan Reflectance Profile (SRP).
symbology	A defined method of representing numeric or alphabetic characters in a bar code; a type of bar code.
symbology element	A character or characters in a bar code symbol used to define the integrity and processing of the symbol itself (e.g., start and stop patterns). These elements are symbology overhead and are not part of the data conveyed by the bar code symbol.
Symbology identifier	A sequence of characters transmitted with the decoded data that identifies the data carrier from which the data has been decoded.
tag	See RFID tag.

trade item	Any item (product or service) upon which there is a need to retrieve pre-defined information and that may be priced, or ordered, or invoiced at any point in any supply chain.
trade measures	Net measures of Variable Measure Trade Items as used for invoicing (billing) the trade item.
transaction type	Information (not part of the GS1 System) denoting the particular operation in connection with which the scanned data has been captured.
transponder	A radio transmitter-receiver that is activated by a predetermined signal. RFID tags are sometimes referred to as transponders.
truncation	Printing a symbol shorter than the symbology specification's minimum height recommendations. Truncation can make the symbol difficult for an operator to scan.
U.P.C. Company Prefix	A special representation of a GS1 Company Prefix constructed from a U.P.C. Prefix and a Company Number. The U.P.C. Company Prefix is only used to create GTIN-12, Coupon-12, RCN-12, and VMC-12, which are encoded in a U.P.C. Bar Code Symbol.
U.P.C. Prefix	A special representation of the GS1 Prefixes '00 – 09' with the leading zero removed.
unrestricted distribution	Signifies that such system data may be applied on goods to be processed anywhere in the world without restraint as to such things as country, company, and industry.
UPC-A Bar Code Symbol	A bar code symbol of the EAN/UPC Symbology that encodes GTIN-12, Coupon-12, RCN-12, and VMN-12.
UPC-A Composite Symbology®	The GS1 Composite Symbology® that utilises a UPC-A Bar Code Symbol as the linear component.
UPC-E Bar Code Symbol	A bar code symbol of the EAN/UPC Symbology representing a GTIN-12 in six explicitly encoded digits using zero-suppression techniques.
UPC-E Composite Symbology®	The GS1 Composite Symbology® that utilises a UPC-E Bar Code Symbol as the linear component.
Variable Measure Number (VMN)	A Restricted Circulation Number to identify variable measure products for scanning at Point of Sale. It is defined per GS1 Member Organisation rules in their country (see VMN-12 and VMN-13).
variable measure trade item	An item always produced in the same pre-defined version (e.g., type, design, packaging) that may be sold at any point in the supply chain, which either may vary in weight/size by its nature or which may be traded without a pre-defined weight/size/length.
VMN-12	The 12-digit Restricted Circulation Number encoded in UPC-A Symbols to allow scanning of variable measure products at Point of Sale. It is defined per target market specific rules that are associated with GS1 US Prefix 2.

VMN-13	The 13-digit Restricted Circulation Number encoded in EAN-13 Symbols to allow scanning of variable measure products at Point of Sale. It is defined per target market specific rules that are associated with GS1 Prefixes 20 through 29.
wide-to-narrow ratio	The ratio between the wide elements and the narrow elements in a bar code symbology, such as ITF-14, which has two different element widths.
X-dimension	The specified width of the narrow element in a bar code symbol.

Section 8.2 GS1 Acronyms

Acronym	Abbreviation for
ADC	Automatic Data Capture
AI	Application Identifier
AIDC	Automatic Identification and Data Capture
ANSI	American National Standards Institute
DPM	Direct Part Marking
EAN	EAN International, now called GS1
EDI	Electronic Data Interchange
EPC	Electronic Product Code
FNC1	Function Code 1
GDD	Global Data Dictionary
GDTI	Global Document Type Identifier
GIAI	Global Individual Asset Identifier
GLN	Global Location Number
GPC	Global Product Classification
GRAI	Global Returnable Asset Identifier
GSMP	Global Standards Management Process
GSRN	Global Service Relation Number
GTIN	Global Trade Item Number
ISBN	International Standard Book Number
ISO	International Organisation for Standardisation
ISSN	International Standard Serial Number
LAC	Local Assigned Code
RCN	Restricted Circulation Number
RF	Radio Frequency
RFID	Radio Frequency Identification
RZSC	Retailer Zero-Suppression Code.

VMN	Variable Measure Number

Section 8.3 Legacy (Retired) Terms

When terms are replaced or retired by GS1, they are maintained within this section for a minimum of five years. The legacy terms are supplied to point GS1 stakeholders to new terminology. The period of five years ensures harmonization with external standards bodies whose standards make normative reference to the GS1 General Specifications.

Legacy Term	Current Term
auxiliary pattern	See auxiliary guard pattern
Clear Area	See Quiet Zone
Contrast	See Symbol Contrast
DUN-14 (Despatch Unit Number)	See GTIN-14 Data Structure
EAN	See GS1
EAN International	See GS1global Office
EAN Member Organisation	See GS1 Member Organisation
EAN/UCC-8 Data Structure	See GTIN-8
EAN/UCC-8 Identification Number	See GTIN-8
EAN/UCC-12 Data Structure	See GTIN-12, Coupon-12, RCN-12, and VMN-12
EAN/UCC-12 Identification Number	See GTIN-12, GLN, GDTI, Coupon-12, RCN-12, and VMN-12
EAN/UCC-13 Data Structure	See GTIN-13, Coupon-13, RCN-13, and VMN-13
EAN/UCC-13 Identification Number	See GTIN-13, GLN, GDTI, Coupon-13, RCN-13, and VMN-13
EAN/UCC-14 Data Structure	See GTIN-14
EAN/UCC-14 Identification Number	See GTIN-14
EAN.UCC Company Prefix	See GS1 Company Prefix
EAN.UCC Prefix	See GS1 Prefix
EAN.UCC XML	See GS1 XML
Interleaved 2 of 5	See ITF-14 Symbol
Item Number	See Item Reference
Item Reference Number	See Item Reference
Light Margin	See Quiet Zone

Light Margin Indicator	See Quiet Zone Indicator
Location Number	See Global Location Number
Manufacturer's ID	See GS1 Company Prefix
Manufacturer's Number	See GS1 Company Prefix
Number System Character	See U.P.C. Prefix
Numbering Organisation (NO)	See GS1 Member Organisation
Packaging Indicator	See Indicator
Packaging Type	See Extension digit
print gain/loss	See bar gain/loss
printability gauge	See Print Gain Gauge
SCC-14	Global Trade Item Number®
SSCC Serial Number	See Serial Reference
standard numbering structures	See data structure
Symbol Control Character	See symbology element
UCC	See GS1 US
UCC Company Prefix	See U.P.C. Company Prefix
UCC Prefix	See U.P.C. Prefix
UCC-12 Data Structure	See GTIN-12, GDTI-12, Coupon -12, RCN-12, and VMN-12
UCC-12 Identification Number	See GTIN-12, GDTI-12, Coupon -12, RCN-12, and VMN-12
Uniform Code Council, Inc	See GS1 US

Section 8.4 GS1 Prefixes and GS1 Company Prefixes

This section is temporarily added as an appendix to provide Member Organisation direction. It will be applied to the appropriate section (s) of the GS1 General Specifications as a part of the General Specifications re-organisation project.

To remove the instances where a Figure shows different structures based on zero-filling this section is added to the GS1 General Specifications and a link to this section added below each Figure where a Key's composition is displayed that states,

"GS1 assigns GS1 Company Prefixes using a GS1 Prefix administered by GS1global Office. Figure ABC illustrates a GS1 Company Prefix composed using a GS1 Prefix. If a member company has been assigned the GS1 Company Prefix type called U.P.C. Company Prefix (issued by GS1 US and GS1 Canada) or a GS1-8 Prefix (used with GTIN-8), then Section 8.4.0 should be reviewed as special implementation rules are discussed. GS1 Member Organisations can provide the GS1 Prefix type it has assigned to its members."

8.4.1 GS1 Prefixes

GS1 Prefixes are allocated to GS1 Member Organisations or Restricted Circulation Numbers.

8.4.2 GS1 Company Prefixes

GS1 Member Organisations, based in over 100 countries and territories world wide, use their allocated GS1 Prefix(es) to create GS1 Company Prefixes for their local user companies. While members, user companies using their assigned GS1 Company Prefix, can create any of the GS1 Identification Keys, namely GTIN, GLN, SSCC, GRAI, GIAI, GSRN, GDTI or any other GS1 data element, for example consignment number or shipment number, that is derived from a GS1 Company Prefix.

8.4.3 Special Note about U.P.C. Prefixes and U.P.C. Company Prefixes

GS1 US and GS1 Canada have issued in past years GS1 Company Prefixes from GS1 Prefixes '00' – '01', '03', and '06 – 09' where the leading zero was not shown on user company certificates. GS1 Prefixes '00 – 09' with the lead zero removed have been given differing names over the years and are now termed U.P.C. Prefixes '0 – 9'.

These user companies are cautioned to use the GS1 Company Prefix **with** the leading zero included when creating GS1 Identification Keys (e.g., SSCC, GLN, GRAI, GIAI, etc). These user companies are cautioned to use the GS1 Company Prefix **without** the leading zero when encoding GTIN-12, Coupon-12, RCN-12, or VMN-12s in a U.P.C. Bar Code Symbol (12-digit bar code). For example, a user company was assigned GS1 Company Prefix 0614141 by GS1 US. When creating a GLN or SSCC they would use the leading zero, but when creating a GTIN-12 they would not.

8.4.4 Special Note about GS1-8 Prefixes and GTIN-8

Generally GTIN-8 numbers are assigned one-by-one strictly for bar coding very small retail items. User companies that have been assigned GTIN-8s have NOT been assigned (on that basis) GS1 Company Prefixes to create other GS1 Identification Keys. GS1-8 Prefixes 1 and 3 through 9 are used for GTIN-8 while GS1-8 Prefixes 0 and 2 are used internally by GS1 member companies (not for open supply chain use).