



GS1 Europe Logistic Label

version 13
updated: 23.11.2006



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1. Introduction

These guidelines are an outcome of the GS1 Europe project aimed at harmonizing the use of logistic labels across Europe. The document sets out best practice recommendations for identifying and labeling logistic units, for example pallets, using the GS1 System. Its aim is to provide a common approach to labeling logistic units across Europe with an internationally accepted numbering and bar coding system – the GS1 System.

The guidelines describe four general types of logistic that are used in Europe. Each company should be able to match their own logistic units with one of these and label them accordingly.

The differing trading practices within individual European countries will still affect how pallets are identified, but this document offers advice about how best to standardise label design and content.

The guidelines address only some practical issues concerning proper labeling. They do not cover all the details of numbering and bar coding of trade items (e.g. cartons, boxes or bins) and logistic units. Full details about how to use the GS1 System to identify and bar code trade items e.g. cartons, boxes, and bins as well as logistic units can be found in the 'GS1 General Specifications'. Your local GS1 Member Organization will be able to provide you with details about how you can obtain these.

These guidelines have been agreed by 25 GS1 European Member Organizations, and are printed and distributed across Europe. All companies are strongly encouraged to adopt these guidelines in order to simplify the implementation of logistic labels and to remove differences across Europe.



2. General rules for logistic labels generation

A voluntary standard for bar code label applications, the GS1 Logistic Label, has been developed by GS1 along with the representatives of manufacturers, retailers, transporters and GS1 Member Organizations.

Logistic units are items made up for transport and distribution purposes, and pallets are one particular example. Using the GS1 Logistic Label allows users to identify logistic units uniquely so that they can be tracked and traced throughout the supply chain. The only compulsory requirement is that each logistic unit must be identified with a unique serial number, the Serial Shipping Container Code (SSCC). Scanning the SSCC bar coded on each logistic unit allows the physical movement of units to be matched with the electronic business messages that refer to them.

Using the SSCC to identify individual units opens up the opportunity to implement a wide range of applications such as cross docking, shipment routing, and automated receiving. Extra information, known as attribute data, such as lot number, best before date, and the identification of trade items contained in a logistic unit can also be shown on the logistic label.

The GS1 Logistic Label has three sections. The top section of the label contains free format information that the company can use for any purpose; the middle section contains the human readable interpretation of the GS1 data shown in the bar codes and the lowest section contains the bar codes symbol(s).

The SSCC is the only compulsory data on the logistic label, and it will be created by the company that is constructing the pallets. **The best practice is that the creator of logistic unit should use its own company prefix.** The format of the SSCC as shown in **Table 1** is explained below:

Table 1. The SSCC structure

<i>Application Identifier</i>	<i>SSCC</i>				
	<i>Extension digit</i>	<i>GS1 Company Prefix</i>		<i>Serial Reference</i>	<i>Check Digit</i>
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

The **application identifier** for the SSCC is always '00'. The application identifier is used within the GS1-128 bar code to ensure that the scanning systems process the SSCC correctly. The AI '00' is not part of the complete number.

The **Extension digit** can have any value from 0 to 9 and is used to increase the numbering capacity. Its use is at the discretion of the company creating the logistic labels.

The **GS1 Company Prefix** is assigned by a GS1 Member Organization to the company assembling the logistic unit. It makes the SSCC unique worldwide but it is not used to identify the origin of the unit. The length of a company prefix depends on each GS1 Member Organization's policy on number allocation.



The **serial reference** is a serial number created by the company assembling the logistic unit, and completes the string of digits N_2 to N_{17} . The simplest way to allocate the serial number is sequentially, for example00000, ...00001, ...00002.

The **check digit** is calculated using the algorithm defined by GS1. This algorithm can be found in **Appendix 6.** on page **56.**

The SSCC and attribute data are shown on the label in human readable text and in the GS1-128 bar codes. The Application Identifiers (AIs) are internationally agreed prefixes used within the GS1-128 bar code to identify the meaning and format of the data following each AI. The data following the AI may comprise alphabetic and/or numeric characters, of any length up to thirty characters. The data fields are either of fixed or variable length, depending on the AI. There is a range of AIs for additional data, such as weight, area or volume. Full details of all the application identifiers can be found in the 'GS1 General Specifications'.

List and description of recommended AIs – see **Appendix 3,** page **50.**

These guidelines cover the main issues related to coding additional information.

2.1. Rules for identifying logistic units

The following general rules should be applied when generating GS1 Logistic Labels:

- Each GS1 Logistic Label should be created by the company, which constructs logistic units, using their own GS1 company prefix
- Each logistic unit must be assigned its own unique SSCC. An SSCC can be re-used a year after it was first created if this will not cause any problems. Some regulatory, industry organization-specific or traceability requirements may extend this period. If the logistic unit identified is also a trade item (i.e. it appears on the manufacturer's product list as a single item that is ordered, priced or invoiced in its own right) it can also be identified with its own Global Trade Item Number (GTIN). GTINs may also be allocated to logistic units that have a fixed content of mixed trade items.

2.2. Rules for identifying the content of logistic units

- Data alignment for trade items is a prerequisite
- The creator of the logistic label is responsible for the data content of the label
- If the logistic **unit contains** more than one trade item having the same GTIN, one of the following rules **will apply**:
 - In cases when the **logistic unit is a trade item** (e.g., it appears on the manufacturer's product list as a single item that is ordered, priced or invoiced in its own right), it can also be identified with its own global trade item number (GTIN) that will be defined by the Application Identifier (01)
 - When the **logistic unit is not a trade item** (meaning only a unit for transport and distribution), it is possible to describe the contents of the pallet using the AI (02) to provide the GTIN of the highest packaging level and the AI (37) to provide their count

- If the **logistic unit contains** more than one trade item having different GTIN's (at the highest packaging level) only the SSCC identifies this logistic unit (except in cases where a pallet is a trade item – here AI (01) can be used if data alignment has been done before)
- When a logistic unit contains variable measure and homogeneous trade items, the GTIN of the contained packages (at the highest packaging level), will always be a GTIN-14 with a leading '9'

2.3. Rules for specifying a quantity

- When the identification of the trade items contained is provided by using AI (02), the count of trade items contained must be indicated using AI (37)
- When the logistic unit contains a count of **variable measure trade items**, a trade measure (e.g. (310n) for net weight) will be used in addition to complete the identification. AI (30) can be used to specify variable count in an item

2.4. Rules for specifying measures

- Trade (net) measures 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 but with the GTIN (with leading '9'). The use of one of the following metric measures is recommended depending on the nature of the product:
 - net weight in kilograms – AI (310n*)
 - length in meters – AI (311n*)
 - area in square meters – AI (314n*)
 - net volume in litres – AI (315n*)

* 'n' indicates the implied decimal point position

2.5. Rules for specifying dates

For many goods there are legal requirements for a date to be clearly communicated to the end consumer. Within Europe many of these rules are based upon European Commission Directives and are based upon the specific product types.

- if applicable **one of the following dates** should be given, depending on the type of product (grocery or non-grocery):
 - Production date: AI (11)
 - Packaging date: AI (13)
 - Best before date: AI (15)

- Expiry date: AI (17)
- Industry guidelines may dictate what dates should be used.
- The time sequence of the mentioned dates is illustrated in **Figure 1**

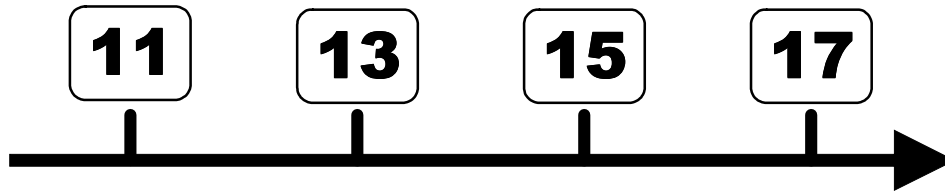


Figure 1. The time sequence of the mentioned dates.

- The choice of date will normally be the same type of date indicated in human readable form on the product itself [normally for legal reasons]. This then allows for consistent tracking and tracing in the unlikely event of a product recall, as the date used on the logistic label will match the date marked on the product.
- The following general rules should be applied when using dates on the GS1 Logistic Label:
 - Dates always refer to a GTIN. The date must relate to every item identified with this GTIN.
 - Traceability Systems will not work, and possibly legal requirements will not be met if the correct date is not used for example if AI (15) Best Before Date is used to encode an Expiry Date AI (17). AI (15) is a statement about quality (e.g. a bottle of drinking water past its best before date may have diminished quality but it should not be harmful). AI (17) is the date that determines the limit of consumption or use of a product (e.g. using a medical product after this date may pose a health risk).
 - Some products (e.g. skateboards, clothing) do not require any date. However it is recommended to use the dates on the GS1 Logistic Label, whenever applicable, because they are important, for inventory control systems (e.g. to realize FIFO strategy).
 - When expressed in Bar Code form, the date format for each AI is always YYMMDD where:
 - YY provides the tens and units of the year (e.g. 2006 = 06) and is mandatory
 - MM provides the number of the month (e.g. January = 01) and is also mandatory
 - Day provides the number of the day of the relevant month (e.g. second day = 02); For Best Before or Expiry Dates it may not be necessary to specify the day. In that case the field must be filled with two zeros.

2.6. Rule for batch / lot number

- Batch/Lot number should be used if applicable, especially for tracking and tracing



- Only one batch number can be put on a logistic label. If a pallet contains product of different batch numbers (at the highest level of packaging), these batch numbers cannot be shown on the label

Customer Specific information

- No customer specific information such as internal data represented using AI's (90 – 99) should be demanded from the trading partners. **GS1 strongly discourage companies to demand such information from trading partners as it increases cost and complexity in the supply chain.**

3. Types of logistic units

A **logistic unit** is an item of any composition established for transport and / or storage which needs to be managed throughout the supply chain. In Europe, there are four main types of logistic units as shown in **Table 2**.

A logistic unit can either be **homogeneous** or **heterogeneous**.

A **homogeneous** unit contains one type of trade item. All the items at the highest level of packaging are the same and are identified with the same GTIN. Example: a pallet containing 50 trade item groupings of shampoo.

A **heterogeneous** unit contains different types of trade items at the highest level of packaging that are identified with different GTINs. Example: a pallet containing 30 standard trade item groupings (e.g. boxes) of shampoo and 20 standard trade item groupings (e.g. boxes) of conditioner.

A **standard logistic unit** contains a fixed number of items as specified by a supplier and may have two functions:

- It may be used for materials handling (logistic functions). In this instance it is identified with the SSCC only. Additional information about the content can be given by using AI (02) and (37).
- **It may also be** a traded unit that is priced or ordered or invoiced (that is part of the supplier's regular offer) in which case it will be additionally identified with its own GTIN indicated by AI (01). It can be of fixed or variable measure. It also refers to goods in bulk.

A **non-standard logistic unit** is a unit that is especially created for the needs of a specific order (such a unit is not a part of the regular offer of the supplier). It is not identified with its own GTIN.

Table 2. Matrix illustrated four main types of logistic unit

	<i>Standard logistic unit</i>	<i>Non-standard logistic unit</i>
<i>Homogeneous content (uniform)</i>	Delivered regularly Uniform content	Delivered irregularly Uniform content
<i>Heterogeneous content (mix)</i>	Delivered regularly Mixed content	Delivered irregularly Mixed content

4. Data represented on label

For each type of logistic unit, the data – to be represented in the GS1-128 bar codes – has been divided into two groups:

- mandatory
- recommended

Other information may also be supplied as required by business processes such as traceability.

Table 3 shows the options for identifying and describing the four different types of logistic unit.

Table 3. Recommended AIs for the different types of logistic units.

Type of logistic unit	Mandatory data	Recommended data
Standard homogeneous	SSCC	If a unit is a trade item – GTIN (of the logistic unit), defined by AI (01) If a unit is not a trade item – GTIN of content and count defined by AIs (02) and (37)
Non-standard homogeneous	SSCC	GTIN of content and count defined by AIs (02) and (37)
Standard heterogeneous	SSCC	GTIN (of the logistic unit), defined by AI (01) only if unit is a trade item
Non-standard heterogeneous	SSCC	–

The SSCC is the only mandatory information on a logistic label for any type of logistic unit. The detailed specifications of data on all types of logistic units are provided in the following chapters.

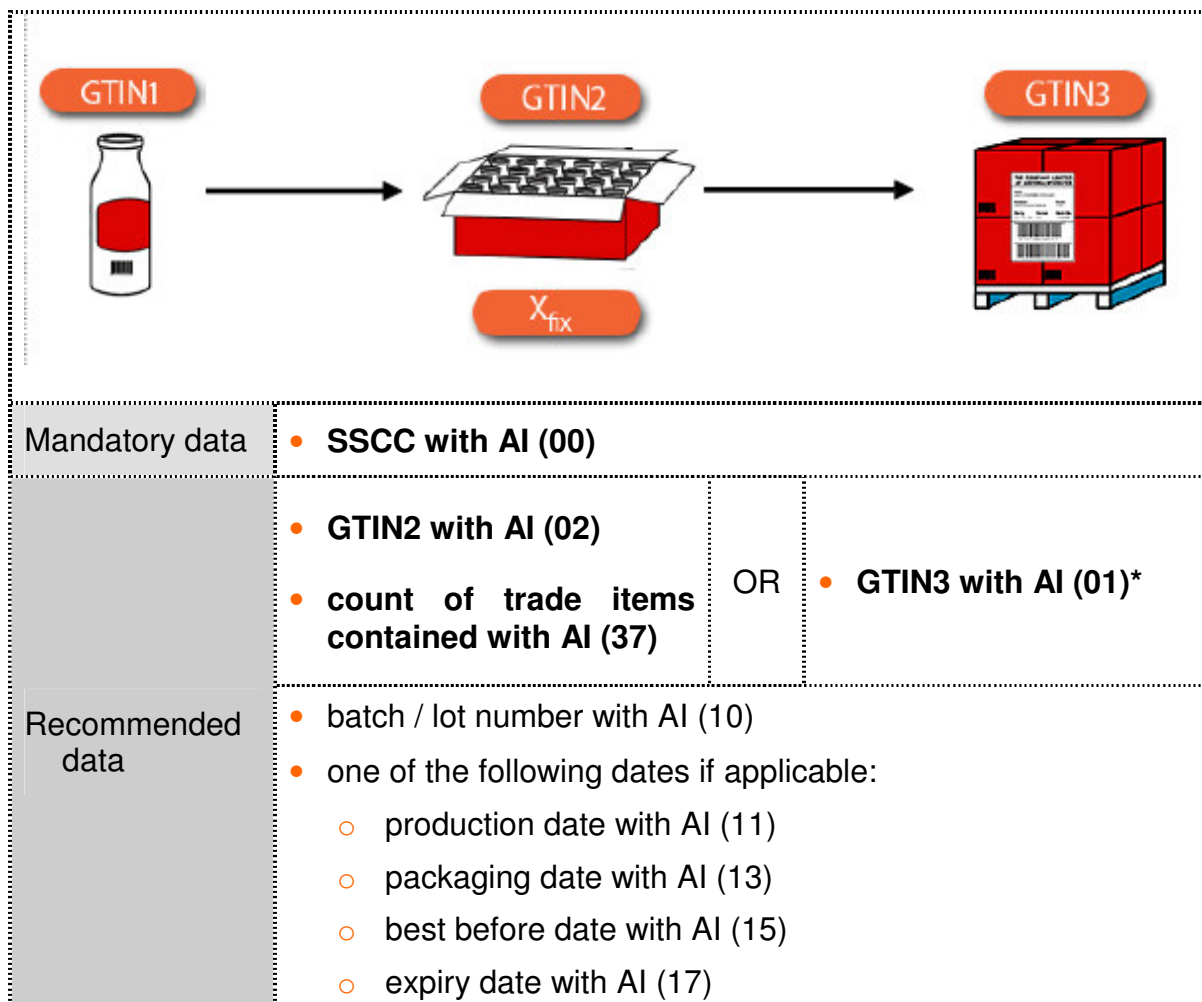
4.1. Standard homogenous logistic units

Standards homogenous logistic units can consist of one of the following:

1. Fixed measure trade items
2. One piece on the logistic unit
3. Variable measure trade items

4.1.1. Fixed measure trade items


If a standard homogeneous logistic unit includes fixed measure trade items, a logistic label should contain the following data:



* If the logistic unit (e.g. pallet) is a trade unit and its master data is available to all trading partners. Master data has been exchanged before.

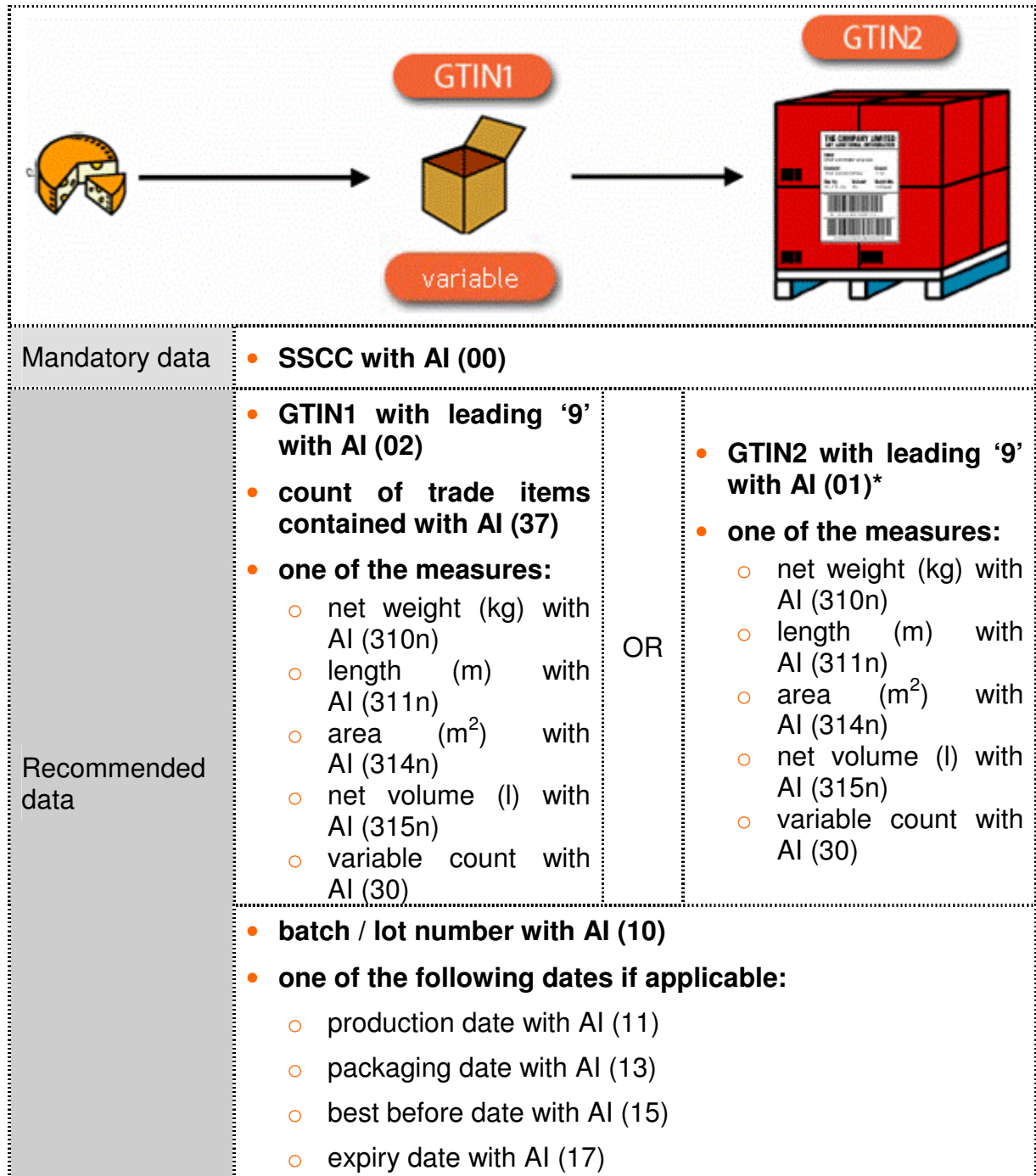
4.1.2. One piece on the logistic unit

If a standard homogeneous logistic unit includes only one trade item, a logistic label should contain the following data:

	
Mandatory data	<ul style="list-style-type: none"> • SSCC with AI (00)
Recommended data	<ul style="list-style-type: none"> • GTIN with AI (01) • batch / lot number with AI (10) – if applicable • serial number with AI (21) – if applicable • one of the following dates if applicable: <ul style="list-style-type: none"> ○ production date with AI (11) ○ packaging date with AI (13) ○ best before date with AI (15) ○ expiry date with AI (17)

4.1.3. Variable measure trade items

If a standard homogeneous logistic unit includes variable measure trade items, the logistic label should contain the following data:



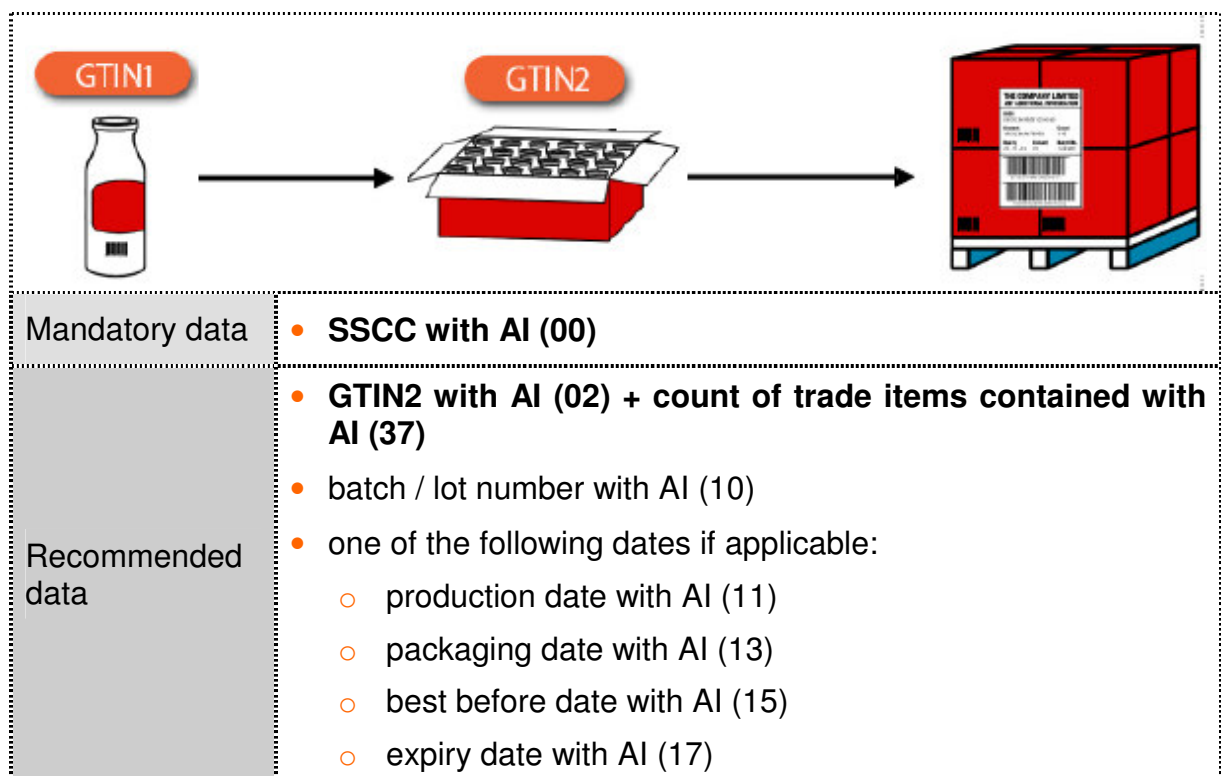
* If the logistic unit (e.g. pallet) is a trade unit and its master data is available to all trading partners. Master data has been exchanged before.

4.2. Non – standard homogenous logistic units

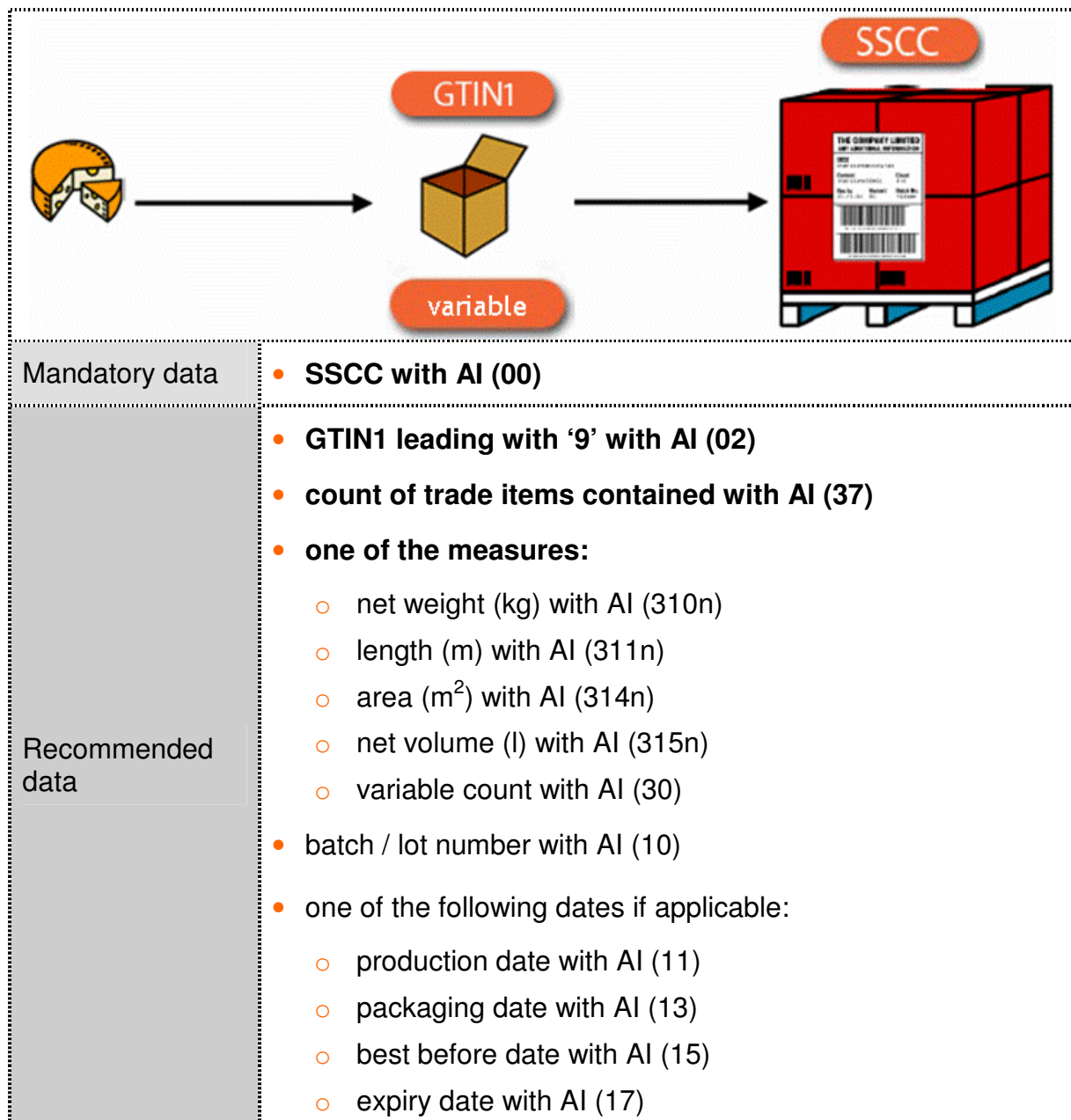
Non – standard homogenous logistic units can include the following goods:

1. Fixed measure trade items
2. Variable measure trade items


4.2.1. Fixed measure trade items



4.2.2. Variable measure trade items



4.3. Standard heterogeneous logistic units

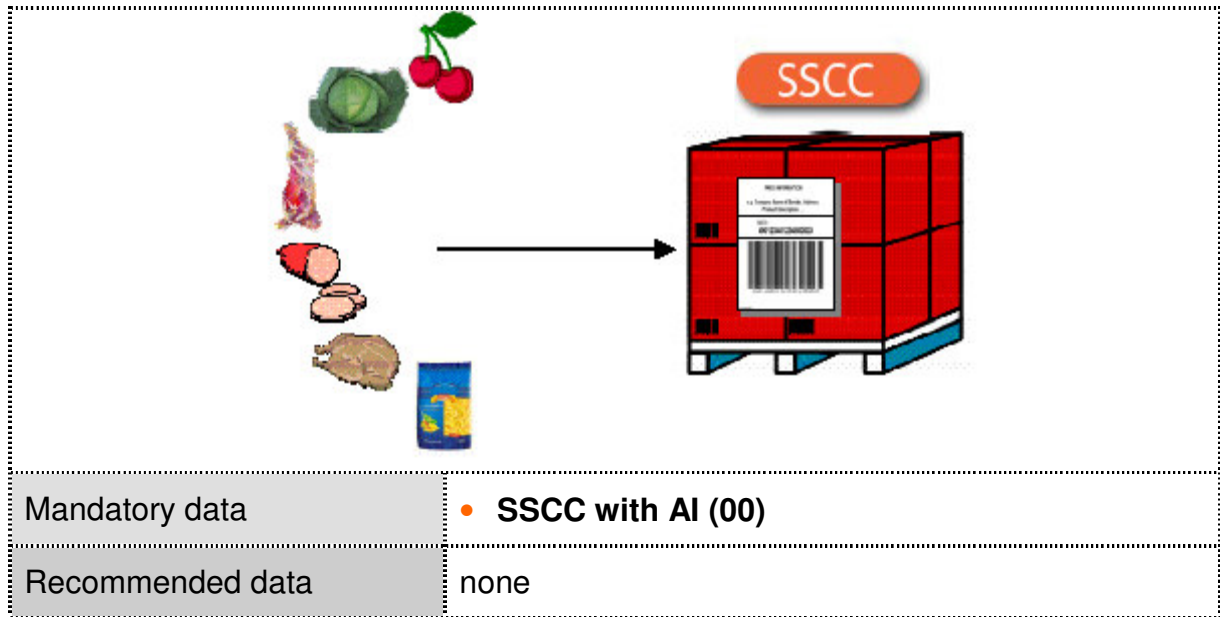
	
Mandatory data	<ul style="list-style-type: none"> • SSCC with AI (00)
Recommended data	<ul style="list-style-type: none"> • GTIN with AI (01)*
Optional data	<ul style="list-style-type: none"> • packaging date of the logistic unit with AI (13) if applicable** • batch / lot number of the logistic unit with AI (10)***

* If the logistic unit (e.g. pallet) is a trade unit and its master data is available to all trading partners. Master data has been exchanged before.

** The date is only for information. For quality purposes the users should rely on information contained in the EDI message (Despatch Advice – DESADV).

*** The batch / lot number is optional. For quality purposes the users should rely on information contained in the EDI message (Despatch Advice – DESADV). It is the creator of the logistic unit who decides whether he needs this information or not.

4.4. Non – standard heterogeneous logistic units





5. Technical requirements for label generation

The GS1 Logistic Label consists of three sections. The top section of the label contains free format information, which the logistic label issuer can use for any purpose; the middle section contains the human readable interpretation of the GS1 data shown in the bar codes and the lowest section contains the bar codes.

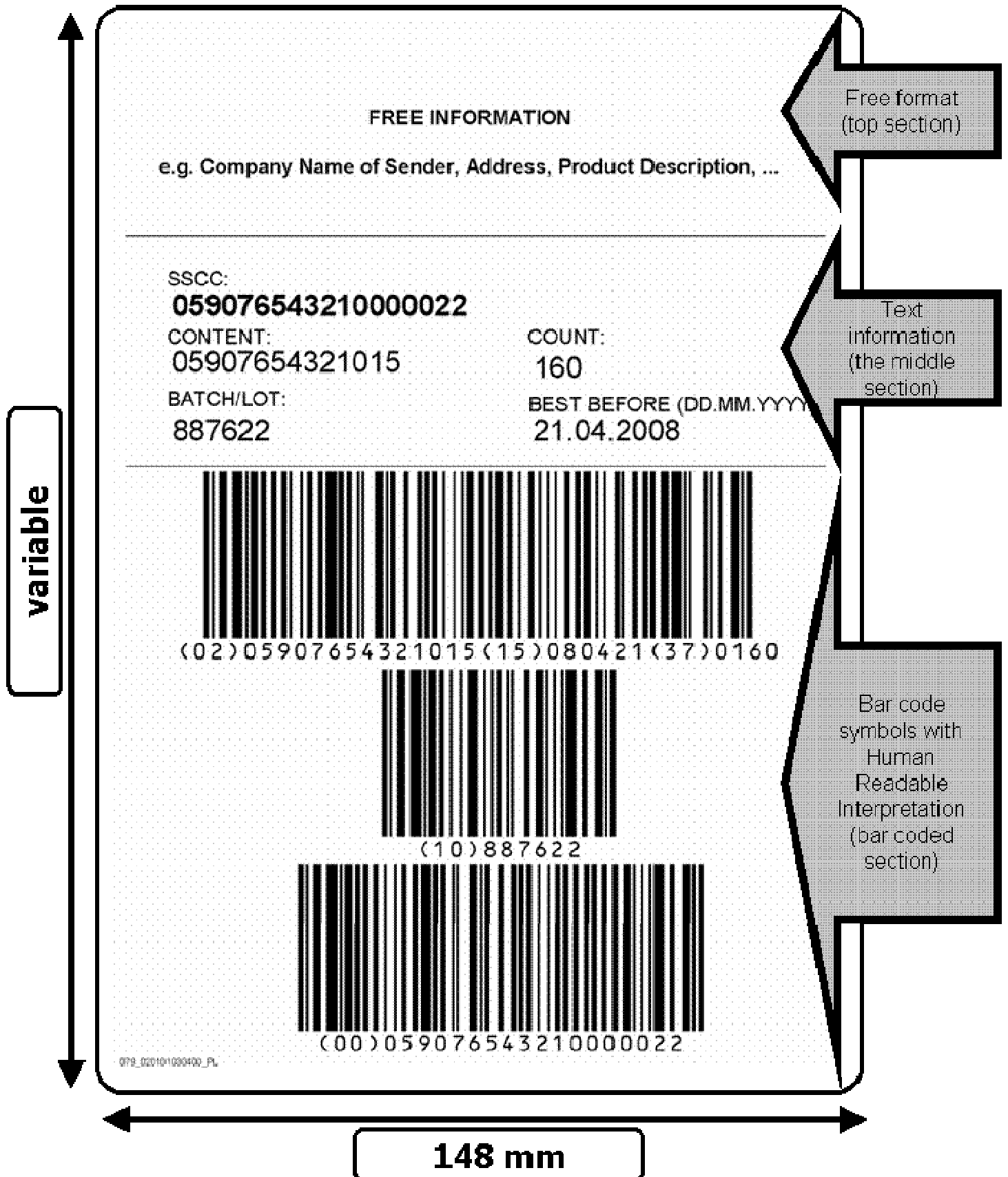


Figure 2. 3 sections of the GS1 Logistic Label.



Figure 3. GS1 Logistic Label with SSCC only.

The label can be any size that suits the labeler's requirements, but it must be large enough to carry all the information required together with the GS1-128 bar codes. Factors influencing label sizes include the amount and type of data required, the content and X-dimension of the bar code symbols used, and the dimensions of the logistic unit to be labeled.

The label width of 105 mm is ideal when only the SSCC is shown on the label. Other dimensions are typically variations driven by data requirements or logistic unit size. Generally, if more data is necessary, it is recommended to use A5 (148 mm x 210 mm).

The following requirements relating to the GS1 Logistic Label are based on 'GS1 General Specifications'.

5.1. Top section

The top section of the label contains free format information that is entirely at the discretion of the labeler. This may include company-specific codes or any other type of information. Companies usually put their company name and logo in this section

If there is a need to put other necessary information (like GTIN of the consumer unit, internal number), it should be introduced in the human readable format, not in bar code form (such information, with no bar code equivalent can be put in top or middle section).

5.2. Middle section

The middle section contains text human readable interpretation of all the bar code symbol(s) and other text information.



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 comprises data titles and data content.

Data content

- The entire bar coded data must be given in Human Readable Interpretation
- The data content should be at least 7 mm in height
- Application Identifiers (AIs) are not included here and are replaced by the data titles
- Frames are not recommended as it limits space for other data

Data titles

- Data titles are the standard abbreviated descriptions of data fields used to denote the Human Readable Interpretation of encoded data
- English data titles should be used as specified in the 'GS1 General Specifications'. Data titles **MUST** be provided in English. In addition, data titles can be provided in the home language of the creator of the logistic unit if necessary.
- Globally agreed data titles can be found in **Appendix 3. List and description of recommended GS1 AIs** on page 50.
- The data tag for dates should be followed by the chosen format for the human readable representation of the date. E.g. BEST BEFORE (dd.mm.yyyy): 24.12.2006. This is not to be confused with the format to be used within the AI data field that is always YYMMDD.

5.3. Bar coded section (lowest section)

The bottom section contains the GS1-128 bar codes that represent all the data shown in the middle section. A verification process should be in place in order to maintain symbol quality (see section 6.5).

Concatenation

- Concatenation is an effective means for encoding several AIs in a single bar code and should be used to save label space and optimize scanning operations.
- The best practice is to put data of fixed length before any variable data
- The order in which the element strings appear in GS1-128 bar codes is free. Good software contains optimization procedures, which improves scanning, and printing
- The SSCC, defined by the AI (00), should always appear in the lowest bar code on the label. The SSCC can be alone or concatenated with other data in the same bar code. Concatenation shall not be used with SSCC on cartons and outer cases and on standard A6 labels.



X-dimension (Symbol Size)

The X-dimension is the specified width of the narrowest element in a bar code symbol.

The recommended X-dimension range is between 0,495 mm and 0,94 mm. The target X-dimension recommended for the GS1-128 Bar code symbol is 0,495 mm.

Scanning systems work more effectively if all the bar codes have similar X-dimensions.

Careful consideration should be given to the likely scanning environment (e.g., freezing can degrade print quality and using an X-dimension at the higher end of the permitted range can help maintain reduce this effect).

Bar code height

A recommended height of at least 32 mm applies to all the bars of the bar codes on the label, especially the GS1-128 Bar Code encoding the SSCC.

Quiet Zones / Light Margins

Bar codes shall be printed with quiet zones (or light margins) at each side. The quiet zones must be at least 10 X-dimension (10 X) in width. Centered bar codes will help ensure the quiet zones are respected.

Orientation and placement

Horizontal orientation (picket fence orientation) of bar code symbols must be used on logistic units. In other words, the bars and spaces shall be perpendicular to the base on which the logistic unit stands.

Human readable Interpretation

All the data shown in each bar code must be provided below each symbol. Brackets (parentheses) are normally printed around each AI but these must not be encoded in the bar code. The data must be shown in characters at least 3 mm high and should be legible.

5.4. Label location

For all types of logistic units, the target location is shown below.

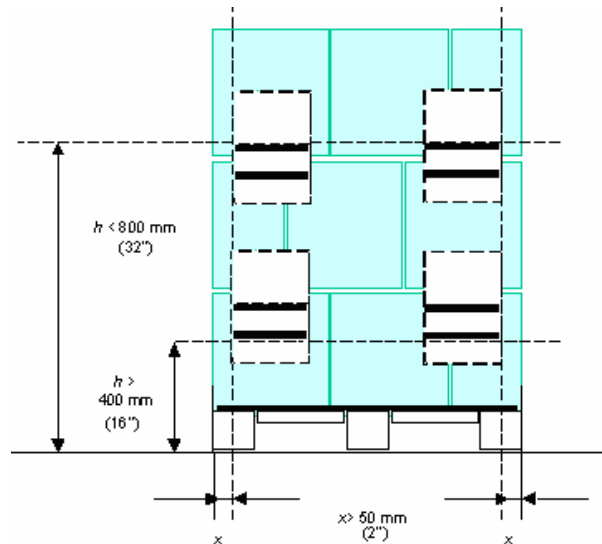


Figure 4. Symbol placement on a pallet.

For logistic unit less than 400 mm high, the label should be placed as high as possible while protecting the bar code.

There is no regulation that specifies where the labels should be placed – to the left, in the middle, or to the right on these sides – **but as most forklift operators are right-handed, the most ergonomically correct scanning is done when the labels are placed to the right of each side.**

5.5. Number of labels

When the logistic unit is a pallet, it should have two identical labels, one on a short side and one on the long side to the right.

5.6. Additional labels

Once a logistic unit has been created and the logistic label has been attached, additional information (e.g. routing data) may become necessary for logistic service providers at a later point in the supply chain. This information can be encoded in an additional label and placed above the existing logistic label (if the data is known during label creation, all the data can be placed on one label). In this case the SSCC of the initial logistic label remains valid and it does not need to be repeated or replaced on the additional label.

Rules for Cross Docking

AI (I413) “Ship for – deliver for – forward to” refers to the final destination, and AI (410) ‘Ship for – deliver for’ refers to the intermediate destination (e.g. distribution center). AI (413) may be used by the consignee to indicate the internal or subsequent final destination of a physical unit.

Cross docking is a typical that uses this data field. Here, a bar code symbol carrying the element string AI (410) 'Ship for – deliver for' 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 data field AI (413) 'Ship for – deliver for – forward to' is also shown on the label to direct the goods to their final destination (e.g., a retail store served by the distribution centre).

In addition, the purchase order number with AI (400) on the pallet helps the recipient to check if the delivery is correct, especially if the pallet is a mixed pallet and the delivery is split into several different pallets.

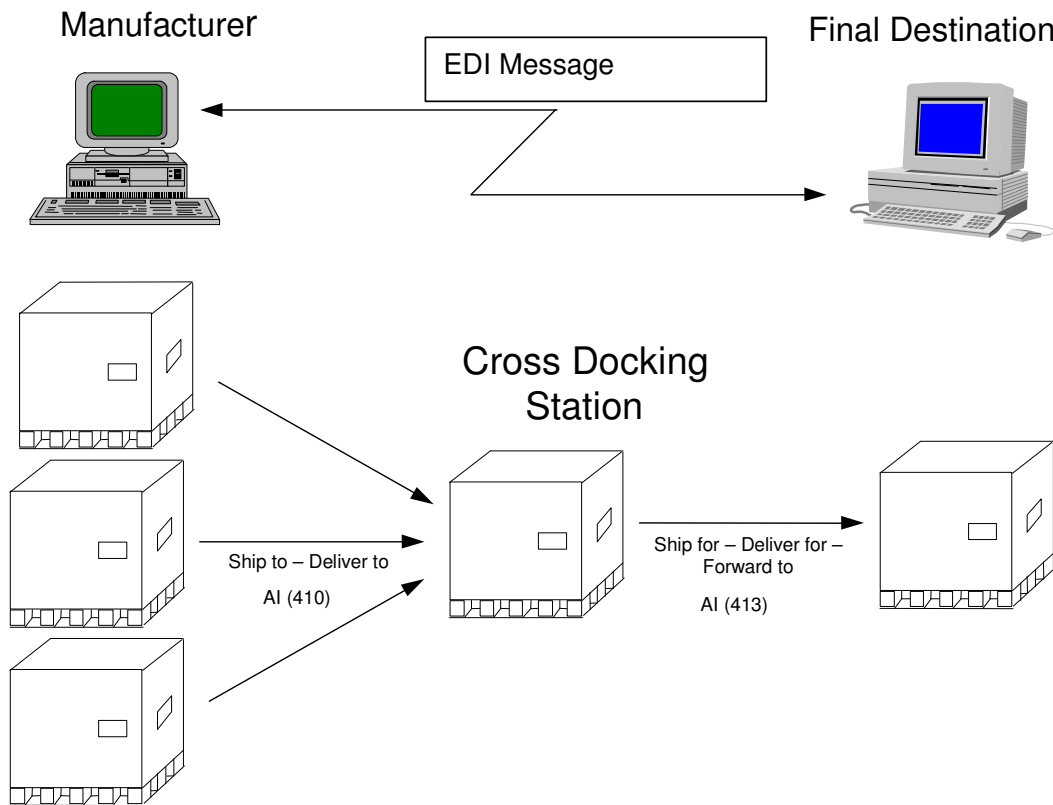


Figure 5. Example of a cross docking application.

6. Label verification

6.1. Basic principles

Logistic label verification aims at checking the label's compatibility with GS1 content and technical standard requirements. Verification ensures that labels comply with the GS1 System resulting in successful implementation of logistic labels so that all supply chain partners can use them.

Verification should be an integral part of quality control processes in order to ensure readability of barcodes along the whole supply chain. It should therefore be performed after the first printing and at regular intervals. In case of a problem, verification reports can be used to identify the source of the problem. Verification should be performed by GS1 Member Organizations or companies entitled to issue such verification reports by GS1 MO's.

As verification aims at checking whether a logistic label complies with technical and content-requirements, it is necessary to:

- identify the type and kind of logistic unit such as type of product,
- establish a label type and any additional data required by supply chain partners,
- check if all the data applied (e.g. GTIN, SSCC) is correct,
- analyze the GS1 Logistic Label in regards to content, structure and technical requirements as specified in chapter 6.5, page 30.

If either content-related or technical requirements are not met, mistakes must be identified, and corrections made. Recommendations aimed at avoiding the mistakes identified should be communicated to the user.

It is therefore necessary to verify an original sample of a label (the printout) of each type.

Verification should include:

- a list of parameters to be verified
- information on whether a given parameter complies with GS1 requirements
- in case of a negative assessment – information on correct data and recommendations on how to avoid mistakes

If a logistic label does not comply with GS1 technical and content-related requirements, another label should be produced and all previous remarks should be taken into account. Then the new label should be verified again. Verification-related documentation should include a printout containing detailed verification results (print-out from verifier) and a copy of the verified label.

The scope of content-related and technical verification of a label is shown in chapter 6.5.

More detailed information about verification can be obtained from your local GS1 Member Organization.

6.2. Common verification approach

So as to ensure a common logistic label verification approach on a European level, common processes are needed. This will guarantee similar results regardless of where the symbols are tested. This sections aims at highlighting critical issues relating to verification.

Basically verification is done on three levels:

- Visual appearance of the label
- Data content
- Technical parameters

6.2.1. Visual appearance

The visual assessment includes:

- the dimension of the label
- the three sections of a logistic label are observed
- bar-code and text location on a label
- correct languages of data titles applied
- correct data titles in the middle part for encoded information

6.2.2. Data content

Data content verification includes:

- company prefix (or prefixes applied)
- GS1 identification keys applied (e.g. GTIN, SSCC)
- check digits of all GS1 identification keys applied (e.g. GTIN, SSCC)
- Applied GS1 Application Identifiers and their structure

6.2.3. Technical parameters

Verification of technical parameters includes:

- correct use of FNC1 in order to generate a GS1-128 symbol
- correct use of FNC1 as separator character (if required)

- correct combinations of data elements, mandatory association of data elements (e.g. AI (02) and AI (37))
- correct structure of data elements
- correct check digits of GS1 identification keys (e.g. GTIN, SSCC) presented in the bar code symbol,
- correct X dimension
- height of bars of the GS1-128 bar code symbol
- height of font under the GS1-128 bar code symbol
- height of data titles font in the middle part for encoded information
- the length of the GS1-128 bar code symbol
- correct size of quiet zones
- decodability (width of bars)
- adequate print quality (decodability, modulation, symbol contrast, etc.)

6.3. Measurements of the barcode symbol

For standardized quality assessment of the technical parameters of bar code symbols it is recommended to use verifiers that meet the international standard ISO/IEC 15416. Nevertheless, results from verifiers can vary depending on scanning environment, calibration and the equipment's condition. It is therefore recommended to follow a bar code verification process as described below:

- The equipment must be properly calibrated regularly according using conformance test card. This is usually provided by the verifier manufacturer or a standard conformance test card is available from GS1. With these test cards the scanned results can be compared with the given values on the card. For correct calibration no deviation must occur beyond the specified tolerances. In order to ensure correct values test cards must be replaced when damaged in order to ensure correct values.
- Verification grades are always expressed in conformance to ISO/IEC 15416 as **g.g/aa/www**, where **g.g** is the overall symbol grade to one decimal place (1.5 is the minimum passing grade for GS1-128), **aa** is the effective measuring aperture in thousandths of an inch (10mils for GS1-128), and **www** is the wavelength of the light source in nanometers (670 for GS1-128).

6.4. Results of technical verification – 4, 3, 2, 1 and 0 grades

Before using a verifier, check that the bar codes are the correct height, and that no horizontal lines or spaces cut through the symbol. Any marks crossing the bars and spaces of a bar code will reduce its effective height and make it very difficult to scan.

A verifier that meets the ISO/IEC 15416 requirements will measure and grade seven different parameters that affect how easily and accurately a bar code can be read.

- Decoding according to the reference-decoding algorithm specified in the standard ISO/IEC 15417 for GS1-128 barcode symbols. Decoding is prerequisite for quality measurement of a symbol
- Symbol contrast is the relationship between the lowest reflection of a bar and highest reflection of a space. The higher the contrast the better quality the symbol
- Minimal reflection. The lower this value is (the darker the bars) the better the contrast
- Minimal adjacent contrast is the smallest value of the transition from space to bar. The higher this value the better the symbol
- Modulation is the relation between minimal adjacent contrast and symbol contrast and reflects the consistency of contrast within the symbol
- Defects measures irregularities within an element reflection
- Decodability indicates print accuracy in relation to the reference-decoding algorithm.

All of these parameters are measured separately, and the grade given to the bar code is the lowest score for any one of these.

<i>ISO/IEC 15416 grade</i>	<i>Minimal reflection</i>	<i>Symbol contrast</i>	<i>Minimal adjacent contrast</i>	<i>Modulation</i>	<i>Defects</i>	<i>Decodability</i>
4	$\leq 0,5$	$\geq 70\%$	$\geq 15\%$	$\geq 0,70$	$\leq 0,15$	$\geq 0,62$
3		$\geq 55\%$		$\geq 0,60$	$\leq 0,20$	$\geq 0,50$
2		$\geq 40\%$		$\geq 0,50$	$\leq 0,25$	$\geq 0,37$
1		$\geq 20\%$		$\geq 0,40$	$\leq 0,30$	$\geq 0,25$
0	$> 0,5$	$< 20\%$	$< 15\%$	$< 0,40$	$> 0,30$	$< 0,25$

The grade given by a verifier is only an indication of the quality of a symbol and each bar code being tested should be checked ten times with the verifier so that an average reading is obtained. The grade is only informative together with the indication of the used measuring aperture and wavelength.

The following table gives help for selecting the right grade in respect to the scanning environment:

- 3.5 – 4.0: highest grade should be the target grade
- 2.5 – 3.4: acceptable grade, scanning performance should be good
- 1.5 – 2.4 the minimum passing grade is 1.5
- 0.5 – 1.4: there is a huge possibility to get a no-read. Such symbols are unlikely to be acceptable in the supply chain

- 0: Fail symbols with this grade are unusable

GS1-128 bar codes on the logistic label should achieve grade **1.5/10/670** or better.

If from any reason (equipment which gives results only in ANSI standard) it is not possible to express results of verification according to ISO/IEC 15416 grades, but only according to ANSI X3.182 grades, there should be a conversion table attached to the verification report.

Information on conversion between ISO (ISO/IEC15416) and ANSI (ANSI X3.182) grades is attached.

A	B	C	D	F	ANSI
					ISO
3,5	2,5	1,5	0,5		
4	3	2	1	0	

Figure 6. Conversion between ISO and ANSI grades.

6.5. Quality check list

GS1 MOs offer verification service and contact them for details.

The following quality check list highlights the main elements to be checked.

- type and kind of logistic unit (standard / non-standard, homogeneous or heterogeneous)
- other information if important

Check list
Visual appearance
dimension of the label
number of sections in the label
bar codes and text location on a label
correct languages of data titles
correct data titles for encoded information
Data content
correct company prefix (prefixes)
correct GTIN's applied (if any)
correct check digits in GS1 identification keys



GS1 Application Identifiers and their structure

Technical parameters

GS1-128 symbology (use of FNC1)

FNC1 as a separator

mandatory association of GS1 Application Identifiers (if any)

correct data structure

correct check digits of GS1 numbers represented in the bar code symbol

X dimension

height of bars in the bar code symbol

height of font under the GS1-128 bar code symbol

height of data titles font in the middle part of the label

the length of the GS1-128 bar code symbol

quiet zones (right and left)

decodability (width of bars)

symbol contrast:

- minimal reflection
- symbol contrast
- minimal contrast
- modulation

7. Frequently asked questions

The FAQs are constantly updated on www.gs1.org/faq

1. Who decides the content of the SSCC?

It is the creator of the logistic unit who allocates the SSCC. The recipient may not impose the structure of the SSCC on the supplier. The SSCC and the GTIN are separate numbering systems with their own rules for number allocation.

2. Is the extension digit in SSCC always '3'?

No, the extension digit may vary from 0 to 9 and its use is left at the discretion of the company generating logistic labels – does not have to be '3'.

3. Are there any recommendations for the structure of batch number on a label?

A batch number cannot be longer than 20 characters. However, if it is possible, due to space efficiency and printing requirement, it is recommended to use:

- preferably numeric characters
- even number of characters, if they are numeric
- preferably as few characters as possible

4. Are the brackets presented in the GS1-128 barcode?

No, the brackets containing AI's are not presented in GS1-128 barcode. The brackets are only used in human readable text under the barcode to differentiate separate data elements. GS1-128 software recognizes different information on the basis of the standardized AI format.

5. Can I also encode additional information (such as the gross weight) on the label?

Yes, this is possible, but not recommended.

The GS1 European Logistic Label Guidelines were developed to reduce overall supply chain cost by providing harmonized recommendations for the use data on various label types (see www.viewyourlabel.at). The use of additional data, to meet individual trading partner needs, means that a standard label can not be used and therefore adds to overall supply chain cost.

6. What is an FNC1? What is it used for?

FNC1 is used in a GS1-128 bar code:

- following the start character: This double start pattern (start character + FNC1) is reserved for GS1 System applications worldwide. This makes it possible to distinguish GS1-128 bar code symbols from other non-standard bar code symbols. This FNC1 is translated in the bar code as]C1
- as a separator: all element strings not of pre-defined length must be followed by a Function 1 Code (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. This FNC1 corresponds to ASCII character 29 (<GS>)

7. Which subset must preferably be used in the GS1-128 bar code? A, B or C?

Start character set C should always be used when the data inclusive of the AI begins with four or more numeric characters. Character set C is preferred as it encodes data with a double density. This way the length of the bar code is optimized. A and B do not have this double density characteristic. A and B should only be used when alpha-numeric characters are encoded or when at the end of the bar code odd-numbered positions occur. For example, when using character set C and further on in the bar code an alpha-numeric character appears, then a shift must be made from character set C to A or B. Whether to use A or B depends on the type of data that follows.

8. Which of the examples below is correct?



Half pallets, quarter pallets, pallet layers, etc. are common in many parts of Europe. When applying GS1 Logistic Labels to such items, the key recommendations to follow are:

- The best practice for any pallet is to have two logistic labels (Section 5), with identical data content, apply to all pallet types.
- The data content for any pallet (Section 4) apply to all pallet types.
- Separate physical items should always have separate GS1 Logistic Labels.
- When multiple items are bound together only a single SSCC should be visible.
- When a pallet (identified with its own SSCC) will be broken down, at a later stage, into smaller logistic units (e.g., four quarter pallets) each of the smaller items should have its own SSCC. This approach only makes economic sense if requested by the trading partner (e.g., to enable efficient cross-docking) at a retailer distribution centre.



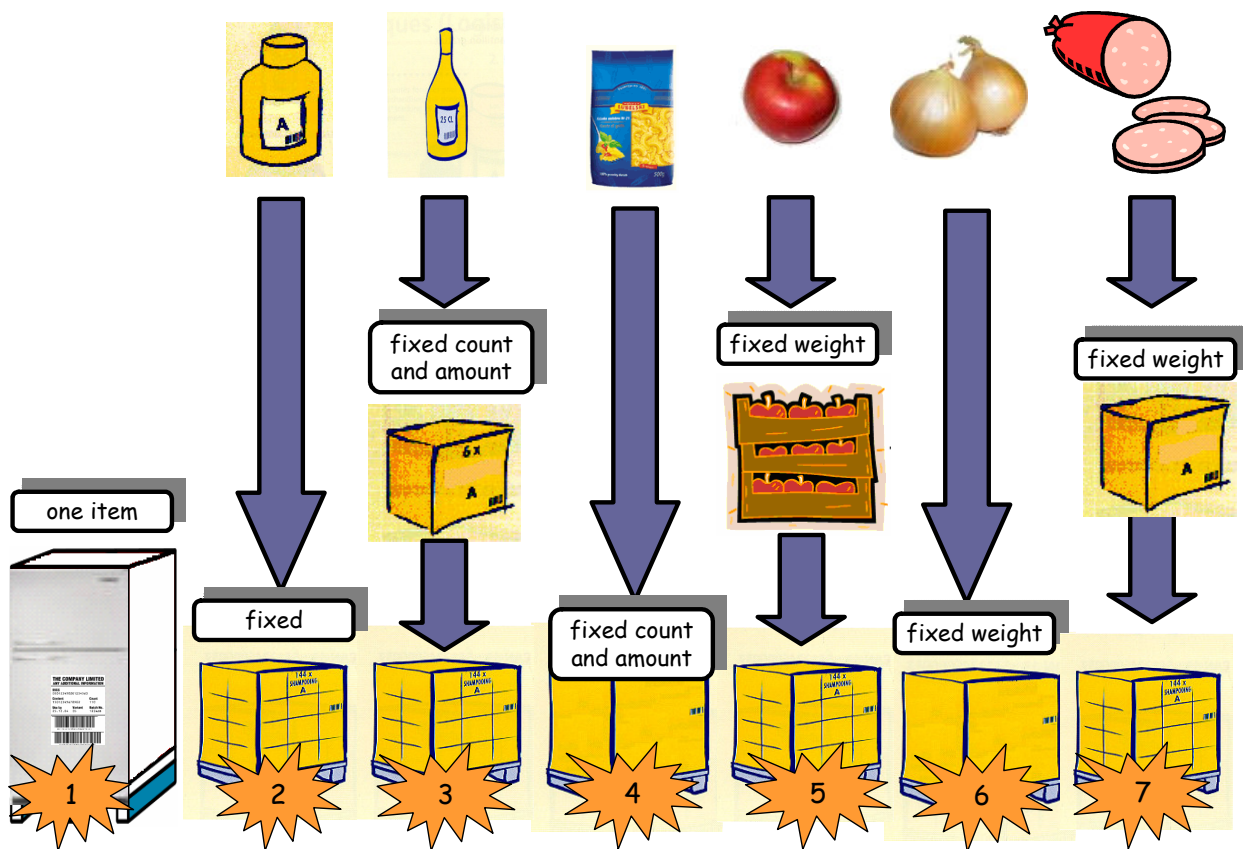
9. Where should extra human readable information (e.g. maximum temperature for frozen goods) be placed?

Where human readable information is legally required (e.g., in some countries the law requires food 'NOT FOR HUMAN CONSUMPTION' to be clearly marked as such) must follow the local legal requirements. These legal requirements may include font size, the location of the information, the exact wording, etc. Such information is perhaps best suited to a separate informational label. However, if the labeler so wishes (e.g. to avoid the extra cost of an additional label) and it is in line legal requirements, the content of this section is free and the content is provided at their discretion.

8. Appendix 1. Examples of logistic units

Examples of the most common logistic units containing both fixed and variable weight products are shown on **Figure 7**. Logistic unit number 1 is an example of standard homogeneous logistic unit. Logistic units number 2 – 12 can be standard or no-standard logistic units depending whether they are ordered regularly or occasionally. Logistic unit number 12 is an example of heterogeneous logistic unit. It can be a standard if it is always offered with the same contents or a no-standard, if its content varies.

Logistic units containing fixed or variable measure trade items:



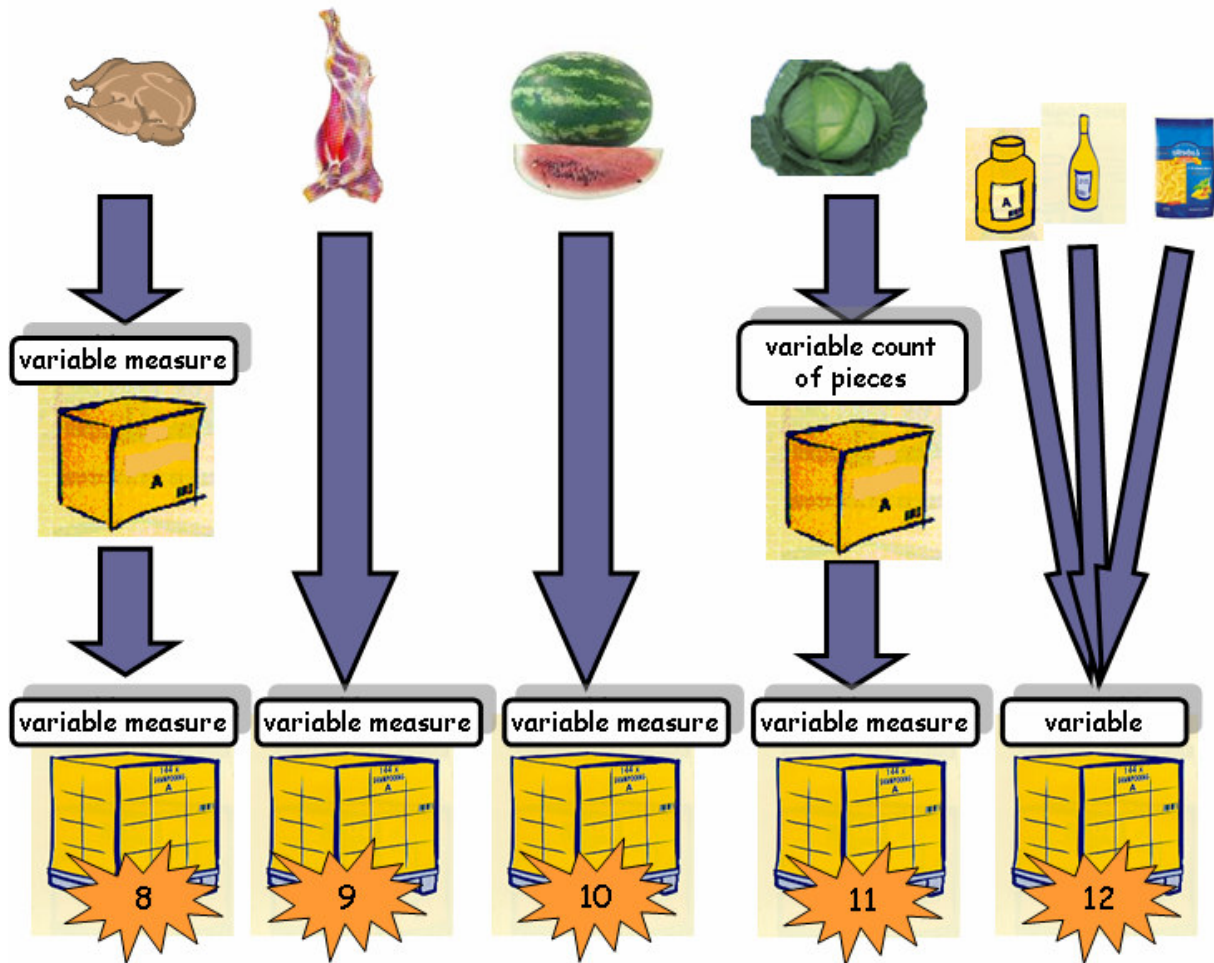


Figure 7. Logistic units containing fixed and variable measure trade items.

1. A logistic unit containing one single trade item

This kind of unit refers to a unit that is both a trade unit and a logistic unit. This pallet type concerns among other things home appliances such as a fridge on a pallet.

2. A logistic unit containing retail trade items without intermediate packaging

This kind of unit refers to a pallet which contains any amount of retail trade items (more than one piece). A logistic unit can contain a fixed count of trade items without intermediate packaging and a variable count of trade items without intermediate packaging. An example of this pallet type is mineral water in bottles of 5 l on a pallet.

3. A logistic unit containing standard groupings of trade items

This kind of unit is a pallet containing a certain amount of retail trade items. These retail trade items are additionally grouped in trade item groupings, e.g. boxes. This pallet type may refer to mineral water in bottles, grouped in boxes and then placed on a pallet.

4. A logistic unit, also a trade item, containing one box with a fixed number of retail trade items

This kind of unit refers to a logistic unit that contains a fixed number of retail trade items packaged together in one trade item grouping. This trade item grouping is then placed on a pallet, being a trade and logistic unit at the same time. An example of this logistic unit type is a pallet containing a box with fixed number of cereal packets.

5. A logistic unit containing standard groupings of not bar coded fixed weight trade items

This kind of unit refers to a pallet containing fixed measure collective packagings. The retail trade items contained inside are not identified with a GTIN and are not bar coded. They will be weighted at the POS. This type concerns loose apples in fixed measure cases on a pallet.

6. A logistic unit, also a trade item, containing a fixed weight of variable weight trade items

This kind of unit refers to a logistic unit containing not bar coded units of fixed measure. Such a pallet is both a trade and logistic unit. A pallet of fixed measure with loose fruit or vegetables is an example of this type.

7. A logistic unit containing standard groupings of bar coded fixed weight trade items

This kind of unit refers to a pallet containing variable measure retail trade items identified with a GTIN and bar coded. These items are packaged in fixed measure trade item groupings. Packaged sliced meat in boxes of fixed measure, pre-packed at the supplier, is an example of this pallet type.

8. A logistic unit containing groupings of variable measure trade items

This example refers to a pallet that contains bar coded units of variable measure. These units are additionally packaged in trade item groupings. A pallet with chicken of variable measure in boxes is an example of this pallet type.

9. A logistic unit containing variable measure trade items without intermediate packaging

This kind of unit refers to a pallet that contains non-retail bar coded items of variable measure. This type is used for goods, which are ordered and invoiced according to measure units of goods. (e.g. in kilograms). For example – one or several carcasses of variable weight on a pallet.

10. A logistic unit containing not bar coded loose variable measure trade items without intermediate packaging

This kind of unit refers to a pallet that contains variable measure trade items, which are delivered loose. This type is used for trade items, which are ordered and invoiced in quantities according to their measure units (e.g. in kilograms). For example – watermelons ordered by kg and delivered in a crate pallet.

11. A logistic unit containing groupings of variable measure trade items sold by the piece

This kind of unit refers to a pallet that contains a variable number of items packaged in boxes. Cabbage heads of variable number in trade item groupings are an example of this type.



12. A mixed pallet

This kind of unit refers to mixed pallets. These are pallets that contain different kinds of trade items with different GTINs.



9. Appendix 2. Examples of logistic labels

9.1. Logistic label for standard homogenous logistic units

9.1.1. Fixed measure trade items

FREE INFORMATION

e.g. Company Name of Sender, Address, Product Description, ...

SSCC:

059076543210000015

GTIN:

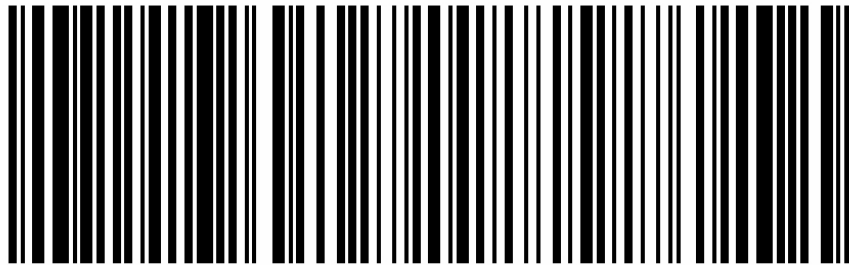
15907654321012

BATCH/LOT:

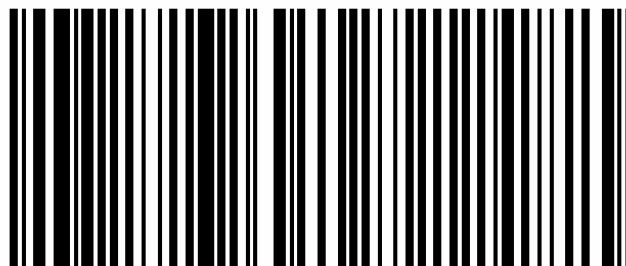
6412

BEST BEFORE (DD.MM.YYYY):

27.08.2007



(01)15907654321012(15)070827(10)6412



(00)059076543210000015

FREE INFORMATION

e.g. Company Name of Sender, Address, Product Description, ...

SSCC:

05907654321000022

CONTENT:

05907654321015

COUNT:

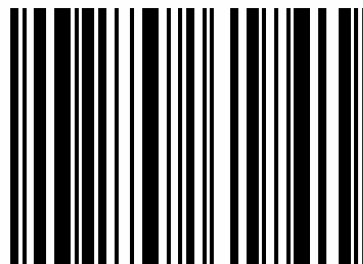
160

BATCH/LOT:

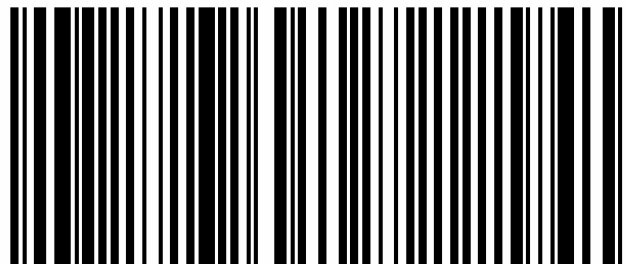
887622

BEST BEFORE (DD.MM.YYYY):

21.04.2008



(10)887622



(00)05907654321000022



9.1.2. One piece on the logistic unit

FREE INFORMATION

e.g. Company Name of Sender, Address, Product Description, ...

SSCC:

05907654321000039

GTIN:

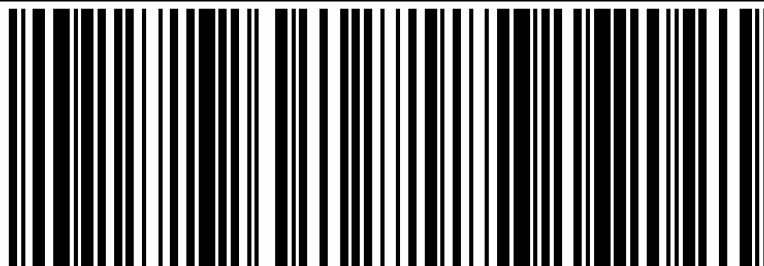
5907654321022

SERIAL:

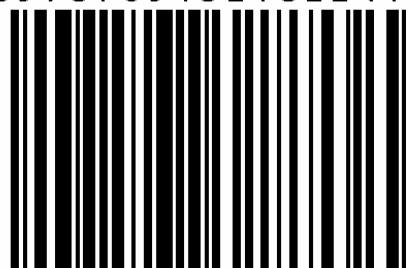
90540007

PROD DATE (DD.MM.YYYY):

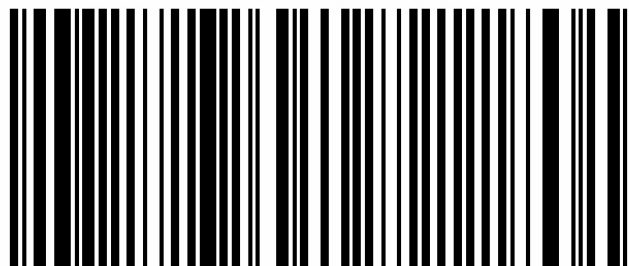
12.03.2006



(01)05907654321022(10)60312



(21)90540007



(00)05907654321000039

003_010101020100_PL

9.1.3. Variable measure trade items

FREE INFORMATION

e.g. Company Name of Sender, Address, Product Description, ...

SSCC:

05907654321000046

GTIN:

95907654321032

NET WEIGHT (kg):

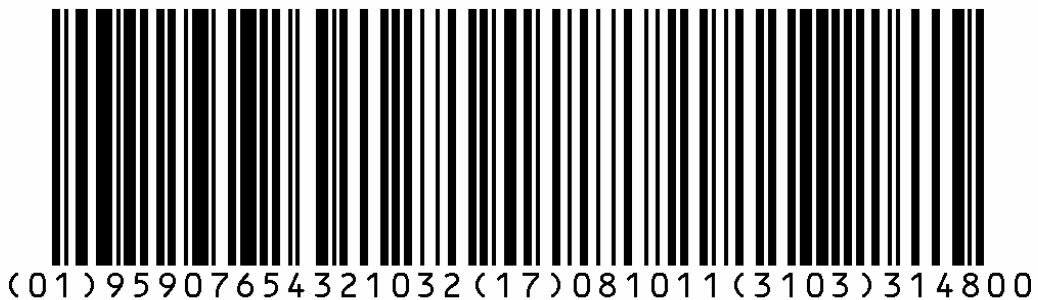
314,800

BATCH/LOT:

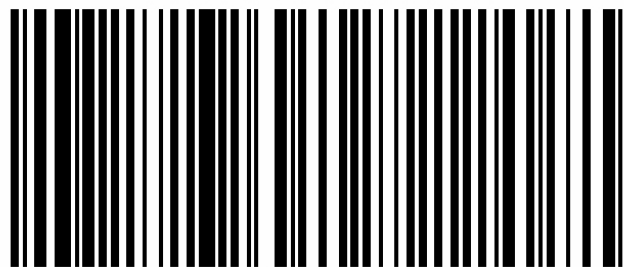
8274234522

USE BY (DD.MM.YYYY):

11.10.2008



(10)8274234522



(00)05907654321000046

056_010102070801_PL



FREE INFORMATION

e.g. Company Name of Sender, Address, Product Description, ...

SSCC:
059076543210000053

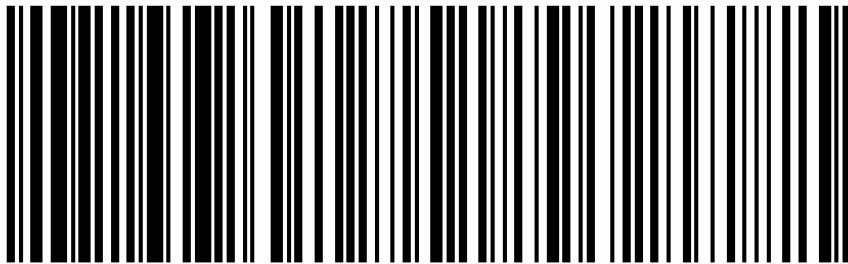
USE BY (DD.MM.YYYY):
14.04.2008

CONTENT:
95907654321049

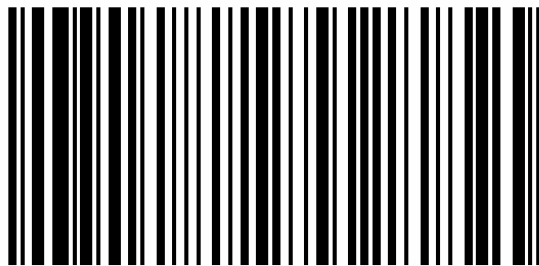
COUNT:
8

BATCH/LOT:
550008

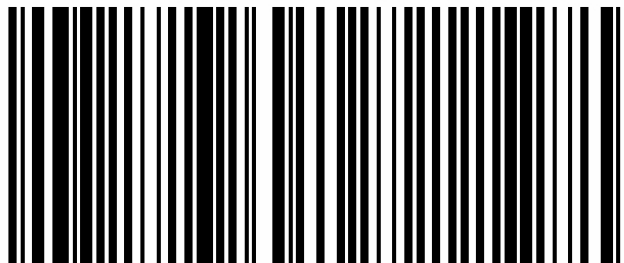
NET WEIGHT (kg):
167,000



(02)95907654321049(3103)167000(37)08



(17)080414(10)550008



(00)059076543210000053

126_020102070801_PL



9.2. Logistic label for non-standard homogenous logistic units

9.2.1. Fixed measure trade items

FREE INFORMATION

e.g. Company Name of Sender, Address, Product Description, ...

SSCC:

059076543210000060

CONTENT:

15907654321050

COUNT:

160

BATCH/LOT:

887624

BEST BEFORE (DD.MM.YYYY):

21.04.2008



079A_020101030400_PL

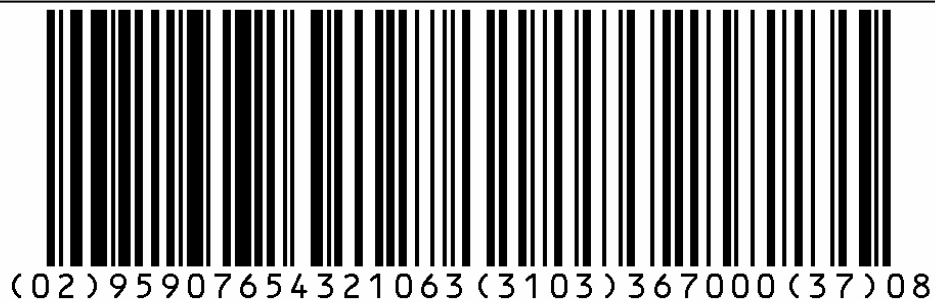


9.2.2. Variable measure trade items

FREE INFORMATION

e.g. Company Name of Sender, Address, Product Description, ...

SSCC:	05907654321000077	USE BY (DD.MM.YYYY):	14.04.2008
CONTENT:	95907654321063	COUNT:	8
BATCH/LOT:	550009	NET WEIGHT (kg):	367,000



126A_020102070801_PL

9.3. Logistic label for standard heterogeneous logistic units

FREE INFORMATION

e.g. Company Name of Sender, Address, Product Description, ...

SSCC:

05907654321000084

GTIN:

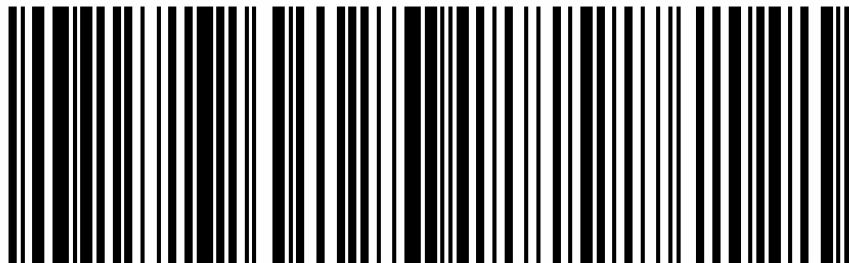
05907654321077

BATCH/LOT:

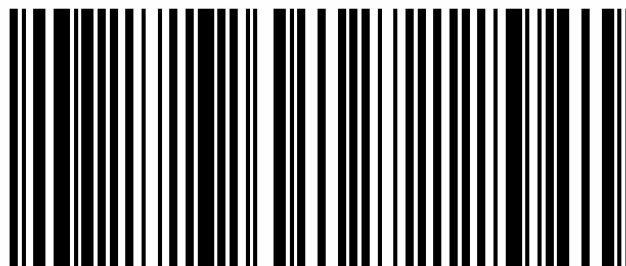
6418

BEST BEFORE (DD.MM.YYYY):

27.08.2007



(01)05907654321077(15)070827(10)6418



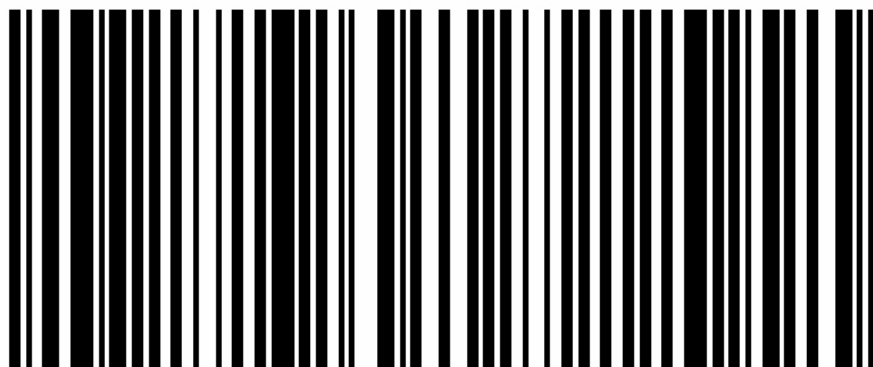
(00)05907654321000084

9.4. Logistic label for non-standard heterogeneous logistic units

FREE INFORMATION

e.g. Company Name of Sender, Address,
Product Description, ...

SSCC:
05907654321000091



(00)05907654321000091

10. Appendix 3. List and description of recommended GS1 AIs

Table 4. Summary of recommended GS1 AIs

<i>AI</i>	<i>Full Title</i>	<i>Data Title</i>	<i>Format</i>
00	Serial Shipping Container Code	SSCC	n2 + n18
01	Global Trade Item Number	GTIN	n2 + n14
02	GTIN of trade items contained in a logistic unit	CONTENT	n2 + n14
10	Batch or Lot Number	BATCH/LOT	n2 + an..20
11	Production Date (YYMMDD)	PROD DATE	n2 + n6
13	Packaging Date (YYMMDD)	PACK DATE	n2 + n6
15	Best Before Date (YYMMDD)	BEST BEFORE or SELL BY	n2 + n6
17	Expiration Date (YYMMDD)	USE BY or EXPIRY	n2 + n6
21	Serial Number	SERIAL	n2 + an..20
30	Variable Count	VAR. COUNT	n2 + n..8
310n*	Net Weight	NET WEIGHT (kg)	n4 + n6
311n*	Length or 1st dimension, trade	LENGTH (m)	n4 + n6
314n*	Area, trade	AREA (m ²)	n4 + n6
315n*	Net volume, trade	NET VOLUME (l)	n4 + n6
37	Count of Trade Items Contained in a Logistic Unit	COUNT	n2 + n..8
400	Customer's Purchase Order Number	ORDER NUMBER	n3 + an..30
410	"Ship To – Deliver To" GS1 Global Location Number	SHIP TO LOC	n3 + n13
413	"Ship For – Deliver For – Forward To" GS1 Global Location Number	SHIP FOR LOC	n3 + n13

* 'n' indicates the implied decimal point position.

11. Appendix 4. Glossary of terms

Table 5. Abbreviations and terms

<i>AI</i>	<i>Abbreviation for Application Identifier</i>
Application Identifier	The field of two or more characters at the beginning of an Element String that uniquely defines its format and meaning.
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 – page 56).
Concatenation	Joining together of element strings in one bar code symbol.
Data titles	A standard abbreviated description of a data field; used to denote the Human Readable Interpretation of encoded data.
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.
Global Trade Item Number [®]	A Global Trade Item Number [®] may use the GTIN-8, GTIN-12, GTIN-13, or GTIN-14 Data Structure.
GLN	Abbreviation for the Global Location Number.
GTIN [®]	Abbreviation for the Global Trade Item Number [®] .
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.
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”.
SSCC	Term used for the Serial Shipping Container Code. The unique identification of a logistic unit using an 18-digit data structure.
Symbol 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.
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.
GS1-128 Bar Code Symbol	A subset of the Code 128 that is utilized exclusively for GS1 System data structures.



X-dimension	The specified width of the narrowest element in a bar code symbol.
-------------	--------------------------------------------------------------------

12. Appendix 5. GS1-128 Symbology

The GS1-128 bar code is a special version or subset of Code 128. The GS1-128 bar codes are used together with the application identifier standards to represent the GS1 data required on the logistic label.

GS1-128 bar codes are distinguished from Code 128 bar codes by the use of the special Function Code 1 immediately after the start character. If FNC1 is not included at the start of each symbol, the bar code will not meet the requirements of the GS1 System.

An enlarged section of the first part of a GS1-128 bar code showing the FNC1 in blue is shown below.



Enlarged section of first part of a GS1-128 bar code showing the Function 1 character in blue.

Figure 8. FNC1 character in GS1-128 bar code.

- All the data in each GS1-128 bar code is denoted by the use of the GS1 Application Identifiers, which specify the format of the data which follows them. This data may be numeric only, alphanumeric, fixed or variable in length.
- An application identifier and the data that follows it are known as an element string, and several element strings may be shown in one GS1-128 bar code. This joining together of element strings is known as concatenation.

- The table below indicates the AI's with predefined format. After these, FNC1 **should not** be used as separator – for all remaining AIs a FNC1 is required, when additional data succeedingly is brought in the element string.

Table 6. GS1 Application Identifiers with pre-defined length

<i>First Two Digits of the Application Identifier</i>	<i>Number of Characters (Application Identifier and Data Field)</i>	<i>First Two Digits of the Application Identifier</i>	<i>Number of Characters (Application Identifier and Data Field)</i>
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

Table 6 is limited to the listed numbers and will remain unchanged. Those numbers in parentheses are not yet assigned.

- The characteristics of the GS1-128 Symbology are:
 - The GS1-128 bar code can encode 128 ASCII characters in 3 code sets: A, B and C.
Set C is able to represent a pair of digits in one symbol character. This means the bar code takes up less space. Changes to other character sets take place when users need to encode single digits or alphabetic characters.
 - The second character is always the Function Code 1 (FNC1) as explained above.
 - The following characters represent all the element strings to be encoded in the symbol.
 - The penultimate character is a symbol check character which is based upon all the preceding characters, and acts as a check on the integrity of the bar code. The value of this symbol check character is not shown below the bar code.



- The last character is the stop character.
- As with all other GS1 bar codes, quiet zones or light margins are required on both sides of the symbol, and these must be at least ten times the width of the X-dimension.
- The size of a GS1-128 bar code will vary according to how much data it represents, and the overall restrictions are given here.
 - The maximum length, including the quiet zones at each end, is 165 mm,
 - The maximum number of data characters in a single symbol is 48,
 - The length of a symbol is directly proportional to the choice of X-dimension, which will be chosen according to the printing process being used,
- The GS1-128 bar code is made up as follows, reading from left to right:

LQZ	Start	FNC1	Data	C	Stop	TQZ
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- LQZ – Leading Quiet Zone
- Start – A Start Character (A, B, or C)
- FNC1 – The Function Code 1 (FNC1)
- Data – Data as defined by the Application Identifier standards
- C – A symbol check character
- Stop – The stop character
- TQZ – Trailing quiet zone

The data shown in the bar code are shown below each symbol in human readable characters. These can be in any legible typeface, but OCR-B is often used.

More detailed information about GS1-128 bar codes is provided in 'GS1 General Specifications' in Section **5.3**.



13. Appendix 6. GS1 Check Digit calculation

This algorithm is identical for all fixed length numeric GS1 Data Structures that require a Check Digit.

		Digit Positions																	
GTIN-8											N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₁₈	
GTIN-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		
GTIN-13 GLN						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	
GTIN-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	
SSCC	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			
		Accumulated results = sum																	
		Subtract sum from nearest equal or higher multiple of ten = Check Digit																	