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Aircraft and space — Industrial data — Product identification and traceability

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*.

This second edition cancels and replaces the first edition (ISO 21849:2006), which has been technically revised.

The main changes are as follows:

— In 5.2, A.8, B.8 and B.15, included an option for use of the enterprise identifier MFR as equal to CAG with 5-character enterprise identifier assigned by the issuing agencies with issuing agency codes (IAC) VFS and KRU.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The accuracy of data collected and exchanged by trading partners can be improved by using automatic identification technologies in lieu of manual key entry. Automatic identification technologies include matrix symbologies, linear bar code and radio frequency identification (RFID) tags (Annex I).

Employment of automatic identification technology provides an accurate, timely and efficient method of data entry and facilitates data transfer and storage for computerized information management systems.

This document defines and establishes a repeatable process and data structure for product identification and traceability that supports life cycle management of a product regardless of ownership and configuration changes (Annex C). Use of the product identification and traceability guidelines described in this document enables repeatable processes for error free data entry, part tracking, dispatch, inventory, maintenance, import/export, detection of unapproved parts and repairs. Most importantly, a repeatable process and data structure allows industry partners to share data efficiently (Annex H). The macro-processes of product data management, asset management, configuration management, reliability and maintenance management, and product performance management are the direct beneficiaries of the product identification and traceability schema defined in this document.

Establishment of a common set of data and well-defined definitions and formats for product identification and traceability provides the base on which to build specific requirements for the exchange of product life cycle information. The specific requirements that the product identification and traceability schema defined in this document fulfils are as follows:

— to provide a unique, permanent identification for the life of the product;

— to provide a schema which meets engineering, operational, and logistics identification and traceability needs;

— to use machine-readable media to obtain accurate and timely data;

— to provide a schema which is independent of marking, symbology and recording media technology; and

— to provide a structure which allows data to be exchanged without the use of data mappers (cross-reference/translation tables), throughout an enterprise and with trading partners, while taking advantage of the World Wide Web.

The focus of this document is industrial products within the aircraft and space sectors. Industrial products have a life cycle measured in years, normally are repairable, and often are upgraded to a new configuration; change of ownership over their life cycle is commonplace. Normally industrial products are not sold in the retail marketplace.

The decision to use automated identification processes should be a cooperative effort by trading partners within an industry and between industries to achieve more timely data input, data accuracy and increased productivity with decreased costs.

Aircraft and space — Industrial data — Product identification and traceability

1 Scope

This document specifies the requirements for a product identification and traceability schema for life cycle management of aircraft and space products/parts. It specifies the minimum essential identification information needed for traceability of a product for its life cycle. It also provides the data structures for use with automatic identification technologies that support product/part life cycle data management activities.

This document defines a structure and rules for establishing a unique identifier for product/part identification and traceability. The rules and structure provide sufficient options to support various business practices. They provide the minimum amount of standardization required to support interoperability, improved business processes and efficiency across multiple users and applications of machine-readable media technologies.

This document also defines and establishes repeatable processes to allow efficient exchange of product data for life cycle product/part traceability, configuration, reliability, maintenance, and product performance management purposes.

It specifies the data carriers appropriate for representing the product data in a machine-readable form and associated dimensional and quality parameters.

Specific implementation guidelines can be developed by industries or trading partners to employ the principles defined in this document.

Although primarily intended for aircraft and space products/parts, this document can be used for other products/parts where desired.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 646, *Information technology — ISO 7-bit coded character set for information interchange*

ISO 8601-1:2019, *Date and time — Representations for information interchange — Part 1: Basic rules*

ISO/IEC 15415, *Information technology — Automatic identification and data capture techniques — Bar code symbol print quality test specification — Two-dimensional symbols*

ISO/IEC 15416, *Automatic identification and data capture techniques — Bar code print quality test specification — Linear symbols*

ISO/IEC 15417, *Information technology — Automatic identification and data capture techniques — Code 128 bar code symbology specification*

ISO/IEC 15418, *Information technology — Automatic identification and data capture techniques — GS1 Application Identifiers and ASC MH10 Data Identifiers and maintenance*

ISO/IEC 15434, *Information technology — Automatic identification and data capture techniques — Syntax for high-capacity ADC media*

ISO/IEC 15459-2, *Information technology — Automatic identification and data capture techniques — Unique identification — Part 2: Registration procedures*

ISO/IEC 15459-3, *Information technology — Automatic identification and data capture techniques — Unique identification — Part 3: Common rules*

ISO/IEC 15459-4, *Information technology — Automatic identification and data capture techniques — Unique identification — Part 4: Individual products and product packages*

ISO/IEC 15459-6, *Information technology — Automatic identification and data capture techniques — Unique identification — Part 6: Groupings*

ISO/IEC 16022, *Information technology — Automatic identification and data capture techniques — Data Matrix bar code symbology specification*

ISO/IEC 16388, *Information technology — Automatic identification and data capture techniques — Code 39 bar code symbology specification*

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

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

Common Support Data Dictionary (CSDD), Air Transport Association

Extensible Markup Language (XML) 1.0, W3C

GS1 General Specifications, GS1

SAE AS9132*(EN9132) (SJAC9132), Data Matrix Quality Requirements for Parts Marking*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
alphanumeric
character set that contains both letters and digits and may contain special characters

3.2
conformance class
category of data representation specified in terms of the variability allowed for the data content

3.3
data delimiter
character or set of characters which separates data elements in a string of data elements

3.4
enterprise identifier
code uniquely assigned to an enterprise by an issuing agency

Note 1 to entry: The issuing agencies shall be assigned by the registration authority of ISO/IEC 15459-2.

Note 2 to entry: The term "enterprise identifier" is equal to the term "Company Identifying Number" defined in ISO/IEC 15459-3.

3.5
forward oblique stroke
/
special character used to separate data elements in a data string

Note 1 to entry: It is character value 47 in ISO 646.

3.6
in-service product/part
product/part for which the original manufacturing process, including application of the identification symbology, has been completed and which is no longer an asset of the manufacturer or portion of the enterprise which owns the manufacturing process

3.7
limited marking space
space available on the product/part which is insufficient for a machine-readable symbol and associated human translation representing the essential data for the *conformance class* (3.2)

3.8
optional data
data which is not essential to provide a unique identifier for product/part identification or configuration management/control (part number), but provides supplementary information relative to the product/part

EXAMPLE Traceability data.

3.9
syntax
set of rules defining the way in which data is put together with appropriate identifiers, delimiters, separator character(s), and other non-data characters to form messages

Note 1 to entry: Syntax is equivalent to grammar in spoken language.

3.10
text element identifier
TEI
string of four characters (three upper-case alpha characters followed by a space character) that precedes a given data field and defines the data that follow

4 Product/part identification and traceability process

4.1 General provisions

In order that automated processes can be used to identify and facilitate “cradle to grave” traceability of products/parts, a product identification and traceability schema is defined in this document.

The use of text element identifiers is the preferred semantic for use in this process. GS1 application identifiers or ASC MH10 data identifiers may be used with trading partner agreement.

The standard data and formats described herein are structured to be compatible/interoperable with most types of machine-readable media and human translation. Standard data formats for the identification of both new and in-service products/parts are provided. The use of two conformance classes allows the product identification schema to be widely employed.

The architecture of unique identification using a single data construct shall be referenced as defined in ISO/IEC 15459-3, ISO/IEC 15459-4, ISO/IEC 15459-6.

The applicable character set to be used for data encoding shall be the International Reference Version (IRV) of ISO/IEC 646.

For direct part marking, Data Matrix (in accordance with ISO/IEC 16022) or QR Code (in accordance with ISO/IEC 18004) shall be used. Direct part marking is considered the most permanent of the machine-readable media techniques for providing life cycle identification of products/parts.

NOTE Unless otherwise stated, this document uses the term "matrix symbol" to refer to both Data Matrix and QR Code symbols.

For labelling or nameplates, either a matrix symbol, as above, or linear bar codes, namely Code 128 (in accordance with ISO/IEC 15417) or Code 39 (in accordance with ISO/IEC 16388) shall be used.

This document makes provision for the use of RFID tags for the representation of both static and dynamic data in a tag affixed to the part, to enable additional operational processes to be performed.

This document also provides a legacy product/part identification schema, which is defined in Annex G.

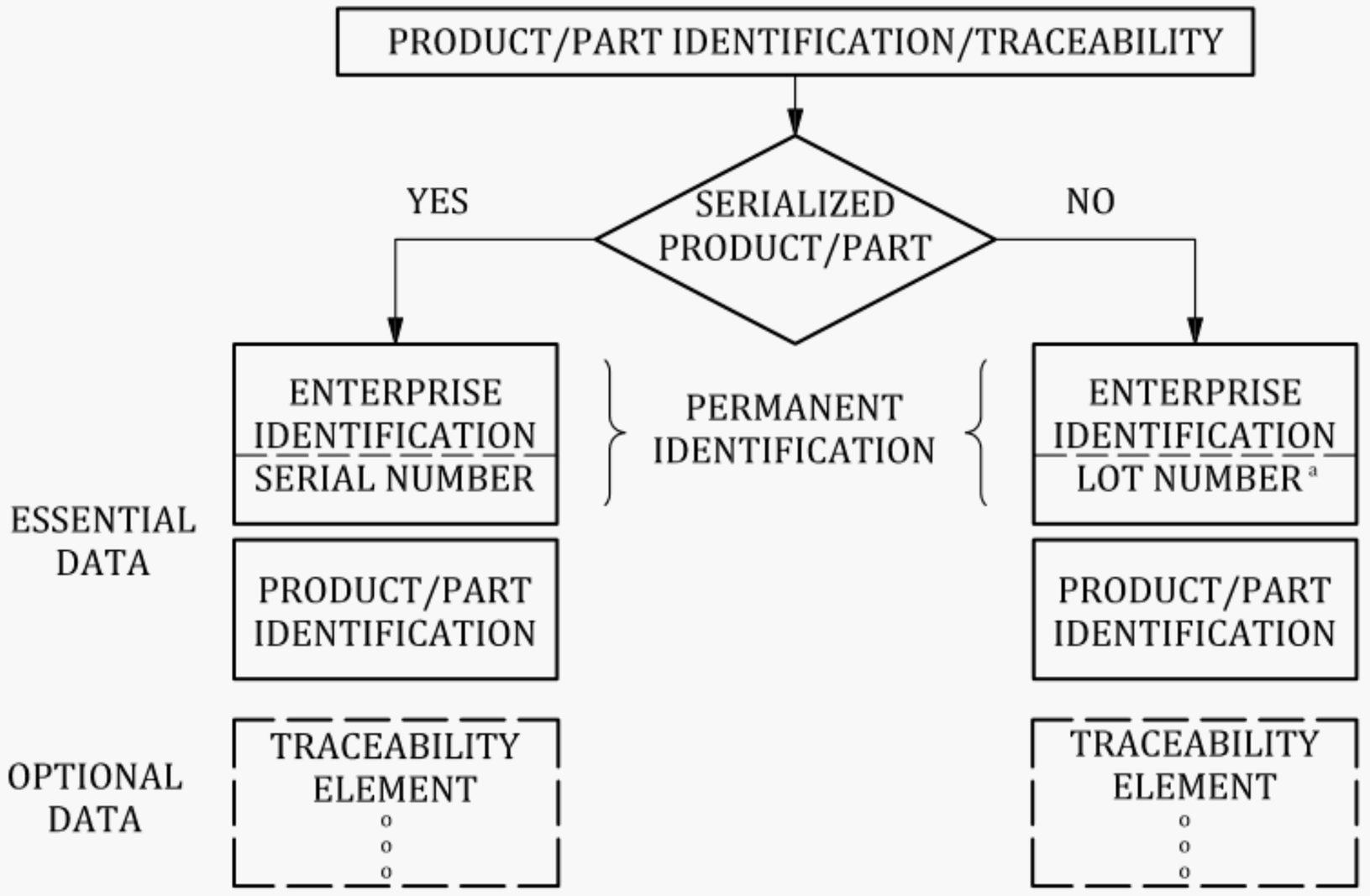
4.2 Product/part identification and traceability decision tree diagram

Figure 1 is a decision tree diagram which illustrates

— the product/part identification and traceability schema,

— the three essential product/part identification data elements, and

— the difference between a serialized and a non-serialized product/part.



a Permanent identification which shall be used for a lot of products/parts.

Figure 1 — Product/part identification and traceability decision tree diagram

Permanent identification for the life cycle of the product/part includes both the enterprise identification and the serial or lot number contained in a matrix symbol or on a label. The product/part identification (part number), which is used primarily for configuration management, is in a separate/second matrix symbol or on a separate/second label. This schema allows the product/part identification number to be updated when the form, fit or function changes without altering the permanent identification matrix symbol or label.

4.3 Conformance classes

Permanent machine-readable media product/part identification has two approaches to the representation of data, known as conformance classes. The conformance classes shall apply to direct part marking, labels, nameplates, RFID tags and other forms of machine-readable media. The data elements associated with the two conformance classes are specified in Tables 1 and 2. Any stream of data complying with a conformance class specified in Table 1 or Table 2 may be input to product life cycle processes and be represented in machine-readable media.

Conformance class 1 is the approach using only specified TEI data elements. Using specified well-defined data elements minimizes transmission, storage and retrieval times. Trading partners may agree on adding additional traceability data elements. conformance class 1 is intended for those products/parts which require life cycle traceability for decades; for example, industrial products like aircraft, ships, turbine engines and conveyance power generation equipment.

Conformance class 2 provides a more flexible approach which can require more marking space and time to exchange data than conformance class 1. Conformance class 2 provides examples of product/part identifiers to be used in place of the precisely defined standardized data elements in conformance class 1. Conformance class 2 is intended for use by trading partners who have product/part identifiers already in place, for which a business case cannot be made to change to conformance class 1 specific identification requirements. Trading partners shall agree on the product/part identifiers to be used for conformance class 2 and may agree on additional data elements.

Trading partners need to agree on which conformance class to employ in order to obtain interoperability between multiple users, but conformance class 1 shall be the default if no agreement is in place.

5 Conformance class 1

5.1 Purpose

Conformance class 1 is an approach using only specified TEI data elements for product identification. It provides both for the identification of products and parts that are serialized and for the identification of those that are identified by lot.

5.2 Detailed requirements

5.2.1 General

Table 1 — Conformance class 1

	Essential data	
Data element	**TEI**	**Valid values/size**
Enterprise identifier [a, b]		
CAGE/NCAGE	CAG [c]	5 characters, alphanumeric
DUNS	DUN	9 characters, numeric
GS1	EUC	6 to 13 characters, numeric
Unique product/part serial number (for serialized products/parts only) [a, d, e]	SER	1 to 15 characters, alphanumeric
Enterprise lot number (for products/ parts identified by lot only) [e]	LTN	1 to 15 characters, alphanumeric
Current product/part identifier [f]	PNR	1 to 15 characters, alphanumeric
	Optional data	
Traceability element(s) [g]	To be determined by trading partners	

[a] Permanent identification is the combination of the enterprise identifier and the unique product/part serial number within the enterprise identifier. When using CAGE/NCAGE as the enterprise identifier, space may be saved by using a combined element. For a new product/part, the combined element TEI is USN (universal serial number); for an in-service product/part, the combined element TEI is UST (universal serial tracking number). Permanent identification, based on the use of TEI SER, LTN, USN, UST, in all cases is considered as belonging to the conformance class 1. The combination of enterprise identifier, PNO and (LOT or SEQ) is also considered as belonging to conformance class 1.

[b] Selection of the enterprise identifier(s) to be used shall be determined by the trading partners.

[c] Where employed in existing applications, MFR shall be considered equal to CAG. As business conditions permit, MFR should be phased out in favour of CAG. MFR may be used as equal to CAG with 5-character enterprise identifier assigned by the issuing agencies for ISO/IEC 15459-2 with issuing agency codes (IAC) VFS (letters K,L,M,N in the first position of code), (IAC) KRU (other characters in the first position) and letter «O» in the last position of code.

[d] Unique product/part serial number (SER) shall be assigned by the original manufacturer and shall be unique within the enterprise identifier of the manufacturer. If the serialization is being accomplished by an organization other than the original manufacturer, the TEI for unique component identification number (UCN) shall be used.

[e] SER shall be used for parts which are serialized and LTN for those which are identified by lot number. Only one of these TEIs shall be used.

[f] The current product/part identifier (PNR) shall be assigned by the organization responsible for configuration of the product/part. The responsible organization is normally engineering. The current product/part identifier shall be assigned to one or more like units which have the same form, fit and function. The current product/part identifier marking should be separate from the permanent identification marking so that it can be updated over the life cycle of the part when the form, fit or function changes. For a non-serialized part defined in an international/national standard, the part number should be assigned by the organization controlling the standard, e.g. AIA, SAE.

[g] Traceability data element selection sequence precedence shall be as follows.

First, as identified and defined in this document.

Second, as identified and defined in the Air Transport Association (ATA) Common Support Data Dictionary (CSDD).

For a listing of additional data elements, contact A4A Publications Department (see https://publications.airlines.org/).

5.2.2 New serialized product/part requirements

5.2.2.1 Required data elements

For a new product/part, the following data elements are required.

a) Permanent unique identification of the product/part throughout its life, in a matrix symbol, or on a data plate/label, or in an RFID tag. This shall consist of

   1) an enterprise identifier for the manufacturer (CAG, DUN or EUC) (see A.1, A.3 and A.4), followed by

   2) a unique product/part serial number (SER) (see A.7).

When using CAGE/NCAGE as the enterprise identifier, space may be saved by using a combined element.

The combined element TEI is USN (see A.8).

b) Current product/part identifier (PNR) (See A.2). This data element shall be in a second matrix symbol or data plate/label to easily allow for necessary changes over the life of the part (see Figures 2 b) and 3 b) for examples).

The unique product/part serial number shall be a unique number within the manufacturer's enterprise identifier. The unique product/part serial number shall remain constant during the life of the product/part, even if the current product/part identifier is changed due to a form, fit or function change. Only the original manufacturer shall use the unique product/part serial number. All others shall use the unique component identification number (UCN) (see A.6).

NOTE Annexes D and E identify the equivalent application identifiers and data identifiers to use in the product/part identification schema defined in this document.

5.2.2.2 Optional traceability data elements

The optional traceability data elements shall be agreed between trading partners. When matrix symbols are being used, the optional traceability data elements shall be contained in a separate matrix symbol, i.e. a third symbol, additional to those provided for by 5.2.2.1 a) and b). For an RFID tag, the traceability data elements shall follow the essential data elements. Refer to Table 1, footnote [g] for the order of preference when selecting traceability data elements.

5.2.3 In-service serialized product/part requirements

For a serialized product/part that is already in service, the current product/part owner should first contact the original manufacturer to determine if the company will provide a unique product/part serial number within their appropriate enterprise identifier. If agreement is obtained, the requirements specified in 5.2.2 apply. If an agreement cannot be obtained from the original manufacturer, or the original manufacturer is out of business, the data elements listed below shall be applied. Either the combination of the original manufacturer's enterprise identifier and unique product/part serial number or the current owner's enterprise identifier and unique component identification number shall be the permanent identification for an in-service serialized product/part.

a) Permanent identification for the product/part, consists of the following.

   1) The current owner's appropriate enterprise identifier (CAG, DUN or EUC) (see A.1, A.3 and A.4).

   2) A unique component identification number (UCN) (see A.6) assigned by the current owner in place of a unique product/part serial number. The UCN number shall be unique within the owner's appropriate enterprise identifier.

      NOTE UCN is used when serialization is accomplished by an organization other than the original manufacturer of the product/part.

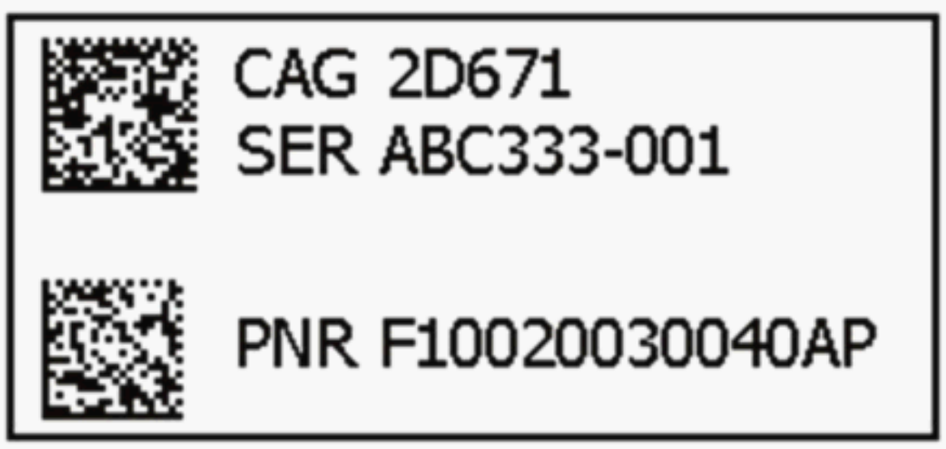
3) When using CAGE/NCAGE as the enterprise identifier, space may be saved by using a combined element. The combined element TEI is UST (see A.9).

b) For the current product/part identifier (PNR), the requirements specified in 5.2.2.1 apply.

5.2.4 Examples of serialized product/part marking

Figures 2 and 3 are illustrative only and show examples based on the CAGE/NCAGE Code enterprise identifier. They are not necessarily to scale; encoded data may not meet the quality requirements specified in this document.

a) Data encoded in Code 128 format

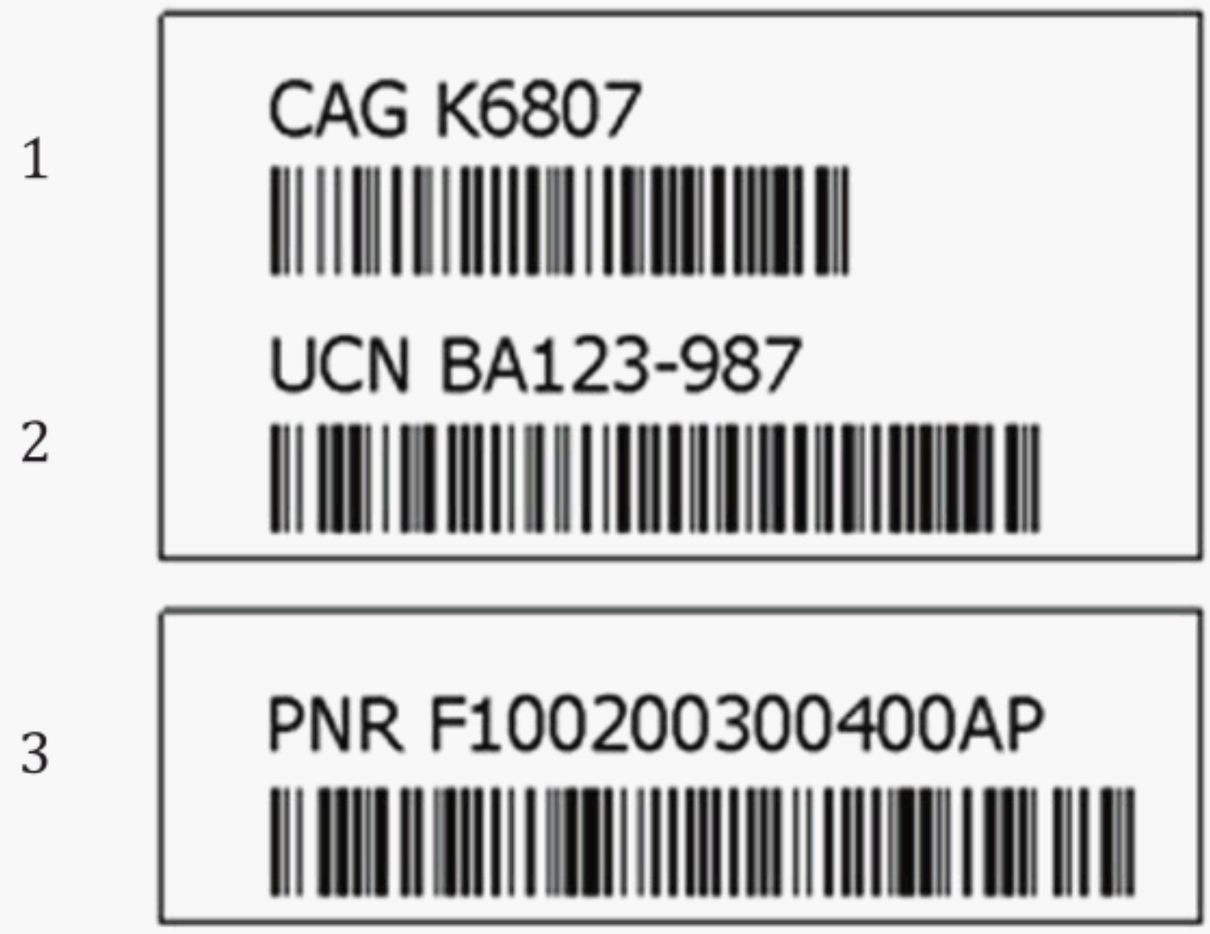


b) Data encoded in Data Matrix format with human translation added

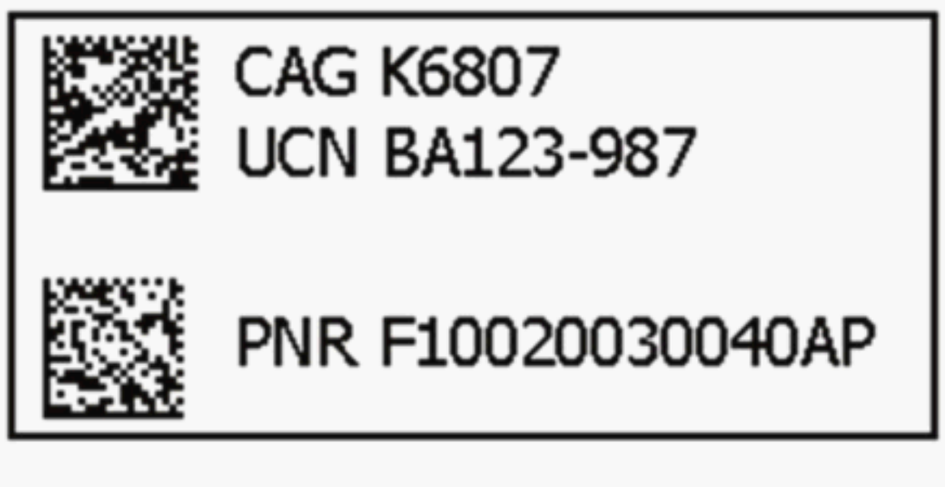
Key

1 enterprise identifier
2 unique product/part serial number
3 current product/part identifier number

Figure 2 — New product/part



a) Data encoded in Code 128 format



b) Data encoded in Data Matrix format with human translation added

Key

1 enterprise identifier
2 unique component identification number
3 current product/part identifier number

Figure 3 — In-service product/part or where serial number not assigned by the original manufacturer

5.2.5 Requirements for product/parts identified by lot

5.2.2 and 5.2.3 apply, except that enterprise lot number (LTN) (see A.5) shall replace unique product/part serial number (SER).

If it is necessary to provide a further breakdown of the lot, the appropriate TEI is batch item identification (BII) (see B.4), which shall only be used as optional data and only in conjunction with the primary lot identification.

6 Conformance class 2

6.1 Purpose

Conformance class 2 allows for the use of a more flexible range of product/part identifiers than the precisely defined standardized data elements in conformance class 1, and is intended for use by trading

partners. Trading partners shall agree on the product/part identifiers to be used and may agree on adding additional data elements.

6.2 Detailed requirements

Conformance class 2 follows similar overall principles to conformance class 1 in requiring an enterprise identifier and primary and secondary product/part identifiers. Table 2 sets out examples of the data elements that may be represented, but is not an exhaustive list as trading partners shall agree on the data elements to be included.

Table 2 — Conformance class 2

	Essential data	
Data element type	**Data element examples**	**Data qualifier/acceptable values**
Enterprise identifier [a, b]	CAGE/NCAGE	
	DUNS	DUN, 9 characters, numeric
	GS1	EUC, 6 to 13 characters, numeric
Primary product/part identifier [a, b]	Serial number, tail number, hull number, lot number, NSN (NATO stock number)	
Secondary product/part identifier [b]	Part number, model number, block number, batch number, registration number	
	Optional data	
Traceability element(s) [c]	To be determined by trading partners	

[a] Permanent identification is the combination of enterprise identifier and primary product/part identifier. Permanent identification, based on the use of TEI, other than SER, LTN, USN, UST, PNO with (LOT or SEQ) and on the use of semantic systems GS1 application identifiers (AI) and ASC MH10 data identifiers (DI), in all cases is considered as belonging to the conformance class 2 and may be used with trading partner agreement.

[b] Trading partners shall select the data element they desire to use.

[c] Data element selection sequence precedence shall be as follows.

First, as identified and defined in this document.

Second, as identified and defined in the Air Transport Association (ATA) Common Support Data Dictionary (CSDD).

For a listing of additional data elements, contact A4A Publications Department (see https://publications.airlines.org/).

6.3 Recommended process

When trading partners establish a product/part identification system based on conformance class 2, the procedures used with conformance class 1, defined in 5.2.2 to 5.2.4, shall be followed.

7 Data formats

7.1 General

Data elements are identified by means of a data qualifier prefixed to the data content. They take the form of a sequence of up to four characters, depending on the data qualifier system used, directly prefixed to the data content in question. The acceptable data qualifiers are defined in 7.2, 7.3, and 7.4.

ISO/IEC 15434 defines the message structure and syntax for compliant messages transferring information from a high-capacity ADC media, such as two-dimensional symbols, and defines a number of formats as the structure for representing data using specified qualifier schemes in such media. ISO/IEC 15434 is the recommended data syntax for use with this document when matrix symbols are used, either on the product/part itself, or a label, or on the cover of an RFID tag. Data to be encoded

in an RFID tag shall be formatted according to the XML syntax as defined in the W3C specification "Extensible Markup Language (XML)" and illustrated in 8.6.3.

At the time of preparation of this document, there are three semantic systems listed in ISO/IEC 15434 which are being used for product identification: GS1 application identifiers (AI), ASC MH10 data identifiers (DI) and text element identifiers (TEI). GS1 AI and ASC MH10 DI are identified in ISO/IEC 15418, and detailed definitions of them are given in the standards referenced in ISO/IEC 15418, namely the "GS1 General Specifications" for AI and ANS MH10.8.2 for DI. TEIs are identified in the ATA "Common Support Data Dictionary (CSDD)". For trading partners who desire to use these identification schemes described in ISO/IEC 15434, Annexes D and E specify AI and DI approximate equivalents to the recommended TEIs. See also 7.3 and 7.4.

7.2 Text element identifiers

TEIs are the preferred form of data qualifiers. They are a four-character string, consisting of three upper-case letters followed by a space, which is prefixed to the data content in question. When represented in machine-readable form, all four characters shall be encoded; and when shown in human-readable form, all four characters shall be shown. Annexes A and B provide details of the TEIs most commonly used in conjunction with this document.

When data is encoded in a matrix symbol, the ISO/IEC 15434 syntax shall be used. If multiple data elements are concatenated into a single data element, there is no explicit data element delimiter.

NOTE Before the ISO/IEC 15434 revision in 2019, the format indicator DD was allowed for representing the data with TEIs as well as the use of the forward oblique stroke as a delimiter between the elements of data stream. For in-service parts that have been identified with this approach, format indicator DD is equal to format indicator 12 and forward oblique stroke as a delimiter is equal to data element separator G_S as is defined in ISO/IEC 15434.

When data is encoded in a linear bar code, a separate symbol shall be used for each data element.

See Annex F for an example.

7.3 GS1 application identifiers

GS1 application identifiers may be used with trading partner agreement. GS1 application identifiers are identified in ISO/IEC 15418 and fully defined, with their data element characteristics, in the "GS1 General Specifications". They take the form of a numeric sequence of two to four digits directly prefixed to the data content in question.

ISO/IEC 15434 defines format 05 as the structure for representing data using GS1 application identifiers in high-capacity media.

When represented in a linear bar code symbol, the data shall be encoded in the GS1-128 version of Code 128, as specified in the "GS1 General Specifications" and ISO/IEC 15417.

When data is encoded in a matrix symbol, the ISO/IEC 15434 syntax shall be used; and if multiple data elements are concatenated the data element delimiter shall be the G_S character (byte value 29).

When multiple data elements are concatenated in an GS1-128 bar code symbol, the rules for the sequence of elements and the use of the FNC1 character as a delimiter defined in the "GS1 General Specifications" shall be followed.

There are some TEIs for which there is no corresponding application identifier; and the precise definition of other application identifiers can differ from that of the approximately corresponding TEI. Annex D shall be referred to for approximate equivalencies for certain application identifiers.

7.4 ASC MH10 data identifiers

ASC MH10 data identifiers may be used with trading partner agreement. ASC MH10 data identifiers are identified in ISO/IEC 15418 and fully defined in ANS MH10.8.2. They take the form of either a single upper-case alphabetic character, or from one to three digits followed by a single upper-case alphabetic character, directly prefixed to the data content in question.

ISO/IEC 15434 defines format 06 as the structure for representing data identifiers in high-capacity media.

When multiple data elements are concatenated in a matrix symbol, the ISO/IEC 15434 syntax shall be used; and the data element delimiter shall be the G_S character (byte value 29). Multiple data elements shall not be concatenated in a linear symbol; but each data element shall be encoded in a separate symbol.

It is technically possible to encode multiple data elements of this nature in a GS1 symbol, following the GS1 application identifier rules referred to in 7.3, by prefixing each ASC MH10 data identifier with application identifier 90. This usage is not however widely supported and is inefficient in its encoding; it is therefore not recommended.

There are some TEIs for which there is no corresponding data identifier; and the precise definition of other data identifiers can differ from that of the approximately corresponding TEI. Annex E shall be referred to for approximate equivalencies for certain data identifiers.

8 Product/part marking

8.1 Direct

For items which are marked directly on the part, matrix symbology shall be used. A matrix symbol can be readily marked on different substrates using various processes: dot peen, laser etch, electro-chemical etching, ink jet, laser bonding, etc. The combination of process methodology and substrate shall not degrade the performance of the product/part and suit its functionality in the environments in which it is required to operate over its life cycle. Subject to technical constraints, the method of direct product/part marking shall be selected to last the life of the product/part. The decision regarding the process to use and location of the symbol(s) shall be made by the responsible design or in-service engineer. ISO/IEC TR 24720 gives guidance on the selection of the direct part marking technique to be used; and SAE AS9132 and ISO/IEC TR 24720 define requirements and recommendations to maximize the quality of the resulting symbol.

8.2 Label or nameplate

Where the identification is carried on a label or nameplate, the symbology used may be any symbol specified in 8.3. The choice of the symbology or symbologies acceptable shall be defined by the trading partners concerned, subject to the constraints on data content of the linear symbologies.

8.3 Marking symbology

8.3.1 Matrix symbol

When Data Matrix is selected as the symbology, ECC200 as specified in ISO/IEC 16022 shall be used. When QR Code is selected as the symbology, Model 2 as specified in ISO/IEC 18004 shall be used. Trading partners should determine if Data Matrix or QR Code will be used. If no agreement is in place, Data Matrix shall be the default.

The preferred/default data element structure is TEIs and their corresponding data content, use ISO/IEC 15434. GS1 application identifiers or ASC MH 10 data identifiers may be used with trading partner agreement. When required by agreement with trading partners (see 8.5), human translation text shall be provided adjacent to the symbol.

Annex F gives examples of the encoding of typical data elements.

8.3.2 Linear bar code

The symbology should be Code 128 as specified in ISO/IEC 15417. Trading partners may agree to use Code 39 as specified in ISO/IEC 16388. If no agreement is in place, Code 128 shall be the default.

Individual data elements shall be encoded in separate linear bar codes, each with a data qualifier and its corresponding data content. When required (see 8.5), human translation text shall be provided either above or below the linear bar code symbol. TEIs are the preferred/default semantics system to be used. GS1 application identifiers or ASC MH 10 data identifiers may be used with trading partner agreement.

When trading partners agree to use the GS1 application identifier scheme (see 7.3) in linear bar code symbols, the GS1-128 version of Code 128 shall be used in accordance with the rules of the "GS1 General Specifications".

8.4 Marking layout

8.4.1 Permanent identification

To provide permanent product/part identification, the first and second elements listed under 'Essential data' in Tables 1 and 2 shall be encoded in the same matrix symbol (i.e. the enterprise identifier together with the unique product/part serial number or the unique component identification number or the enterprise lot number).

In the case of linear bar coding, the first and second elements listed under 'Essential data' in Tables 1 and 2 shall be placed in separate linear bar codes on the same label or nameplate. See Figures 2 a) and 3 a) for examples.

No other data elements shall be included in the permanent identification matrix symbol or on the linear bar code label/nameplate which contains the permanent identification data elements.

8.4.2 Product/part identifier

The product/part identifier (part number) shall be on a separate label or nameplate for linear bar coding or shall be contained in a separate matrix symbol for matrix symbol marking.

8.4.3 Matrix symbol spacing

The adjacent edges of matrix symbols shall be a minimum of 0,318 mm apart and should be at least 0,635 mm apart.

8.4.4 Examples

See Figures 2 and 3 for examples of matrix symbol and linear bar code layout.

8.5 Human translation

When an industry or trading partners agree that a human translation is required along with the matrix symbol, the text shall meet the following requirements.

— The text shall be clear enough for an individual to grasp its meaning without the use of interpretative devices or lookup tables.

— The text shall be located adjacent to the matrix symbol, with the content (data qualifier and corresponding data content) for each data element for which human translation is required contained on a separate line.

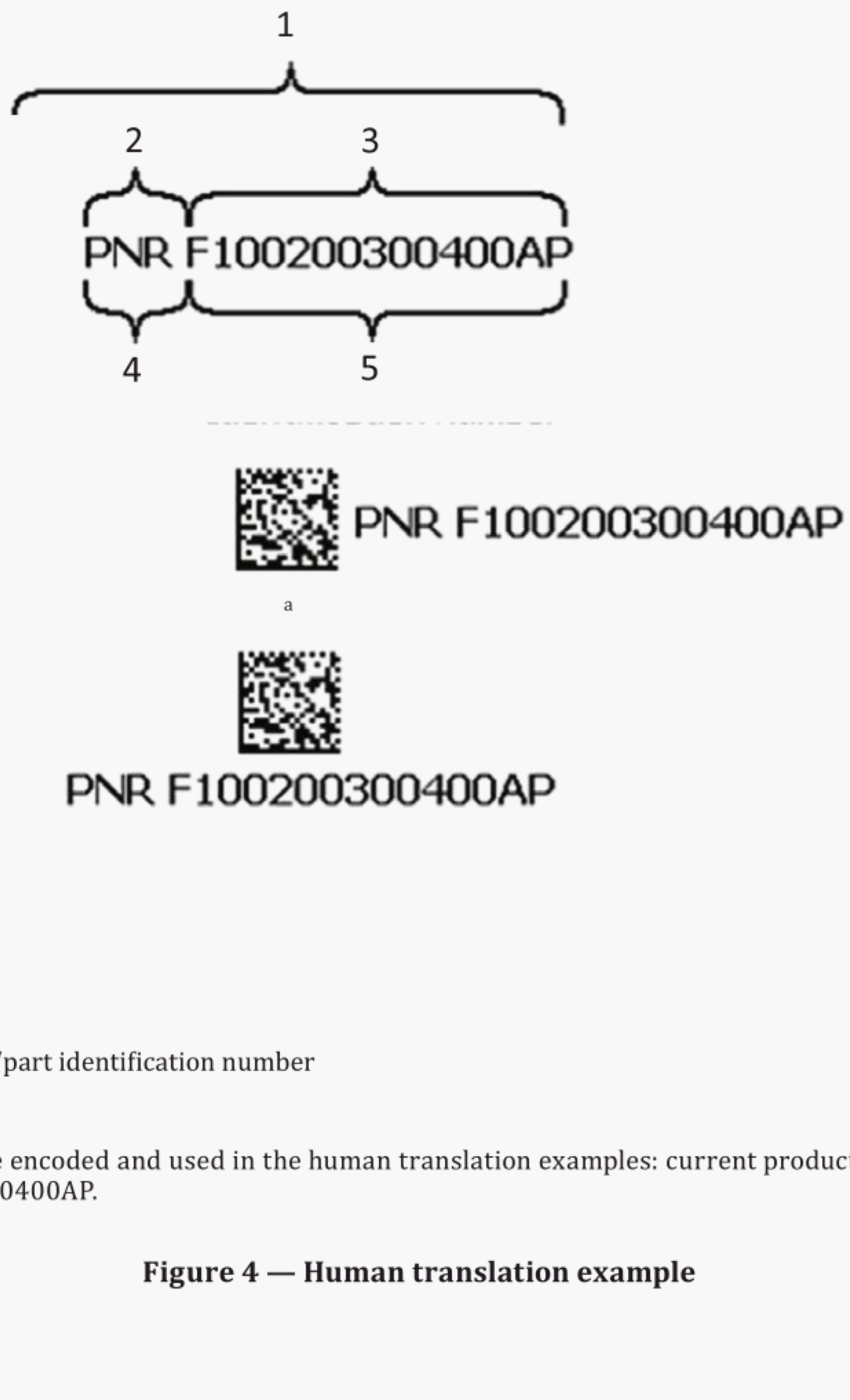
— Any encoded data delimiter used to separate data elements shall be removed from the human translation text.

— A single space shall be located between the data qualifier and the data content characters to improve human readability. For TEIs the space already forms part of the TEI data qualifier structure, therefore no additional space is added. If AI or DI data qualifiers are used, a space shall be added between the data qualifier and the data content.

NOTE 1 Spaces added to the human translation are not encoded in the machine-readable symbol.

NOTE 2 AIs can alternatively be shown in the human translation with the AI enclosed in parentheses, as specified in the "GS1 General Specifications".

Figure 4 gives a human translation example.



Key

1 data element
2 data qualifier
3 data content
4 TEI
5 current product/part identification number
[a] Or.

NOTE Data to be encoded and used in the human translation examples: current product/part identification number - F100200300400AP.

Figure 4 — Human translation example

8.6 Extended data content

8.6.1 General

Emerging technologies, such as RFID, provide features that allow new operational processes to be implemented. Key features of the emerging technologies include the following:

— the quantity of data that can be contained in the device provides an abbreviated data base;

— it is possible to separate the data into static (permanent) and dynamic (updatable) data.

However, the affixing of a new technology does not obviate the necessity to provide an optically readable Data Matrix and visually readable human translation markings (see Figures 2 b), 3 b) and I.7).

The abbreviated data base capability allows product/part traceability data to be stored in addition to essential identification and configuration data. Storing traceability data allows maintenance personnel to install a part without connection to an authoritative source of data. Business processes shall be established to ensure validation of the data with an authoritative source of data before the mechanic is issued the part.

8.6.2 Data content

8.6.2.1 Static data

Static data shall never be changed during the life cycle of the product/part. The static data elements are:

a) enterprise identifier (CAG, DUN, EUC);

b) unique product/part serial number (SER) or enterprise lot number (LTN);

c) original product/part identification number (PNO) in conjunction with the sequential product/part serial number (SEQ) or lot number (LOT);

d) manufacture date (DMF) [conditional, per trading partner agreement]. See Annexes A and B for detailed specifications of TEIs.

8.6.2.2 Dynamic data

Dynamic data elements may be updated. Updating shall only be accomplished by an authorized source. The dynamic data elements are:

a) current product/part identification number (PNR);

b) condition code — product or part (CND);

c) traceability data elements (conditional, per trading partner agreement).

8.6.3 Example of a data structure using XML

```
<StaticData>
  <CAG>F9111</CAG>
  <SER>DERXY1234567890</SER>
  <PNO>FF1234567890</PNO>
  <DMF>2004-11-28</DMF>
</StaticData>
<DynamicData>
  <PNR>FF1234567890-01</PNR>
  <CND>SRV</CND>
  <WEX>20000 HOUR</WEX>
  <SRI>2500 HOUR</SRI>
```

```
</DynamicData>
```

Annex A or B shall be referred to for a description of the XML start-tag and end-tag names.

8.7 Limited marking space procedure

Where limited space prevents the full recommended marking being applied to the product/part, the procedure in this subclause ensures that the most critical information can be fitted into the available space. The sequential list below starts with the minimum information needed for product/part identification and traceability. The list is additive from top to bottom. As many of the items, in order of priority, as space permits shall be included.

a) Minimum information shall be the two permanent identification elements identified in Figure 1 in a single matrix symbol. Before using only the permanent identification matrix symbol, trading partners shall agree that available space can only accommodate one matrix symbol.

b) Add the current product/part identifier in a separate matrix symbol.

c) Add human translation:

   1) start with current product/part identification number;

   2) add unique product/part serial number;

   3) add enterprise identifier.

   When available marking space is limited, trading partners shall determine how many human text elements to eliminate.

d) Add linear bar code(s) in accordance with trading partner agreement:

   1) start with current product/part identification number;

   2) add unique product/part serial number;

   3) add enterprise identifier.

NOTE When a linear bar code is added, the human translation is part of the linear bar code.

8.8 General requirements for permanent product/part identification

To enable the machine-readable data to be properly identified, a data qualifier shall immediately precede the associated data content and be a part of the machine-readable code in both the matrix symbol and linear bar code.

When data is shared between trading partners, a data qualifier shall immediately precede the associated data content.

If the data to be encoded is less than the maximum field length, filler characters shall not be added to bring the field to its maximum length. Only actual data characters shall be encoded.

It is the responsibility of the receiving system to be able to accommodate the maximum field length within the receiving system.

Alpha, numeric and punctuation (special characters) shall be those identified in ISO/IEC 646.

If there is a discrepancy between the data resulting from a machine-readable symbol and its human-readable translation, the human-readable text shall be controlling. The human-readable text is not intended to be machine readable. In order to minimize the risk of discrepancies between machine-readable data and the human translation interpolation, both representations should be derived from a single data input.

In addition to the essential data contained in Tables 1 and 2, a non-permanent identification label or nameplate may contain information such as company logos and free-form text descriptions of the part.

The size of the label, nameplate or matrix symbol depends on available space and technical constraints.

Subject to technical constraints, the durability of the coded data on the label, nameplate or matrix symbol shall be sufficient for the data to be readable for the expected life of the part.

8.9 Detailed requirements for symbols

8.9.1 Dimensional parameters

8.9.1.1 Linear bar code

Code 128: X dimension shall be between 0,200 mm and 0,510 mm (8 mil and 20 mil approx.)

Code 39: X dimension shall be between 0,200 mm and 0,510 mm (8 mil and 20 mil approx.) with a minimum wide:narrow ratio of 2,5:1, preferred wide:narrow ratio of 3,0:1

For improved readability, increase the X dimension of the symbol, space permitting, and/or take other steps to improve symbol quality.

8.9.1.2 Linear bar code symbol height

For Code 128 and Code 39, the height of the bars in the bar code symbol itself should be a minimum of 3,2 mm (0.125 in).

8.9.1.3 Matrix symbol

Cell size shall be no smaller than defined in SAE AS9132.

8.9.1.4 Human translation

For both linear bar code and matrix symbols, the font height shall be a minimum of 3,2 mm (0.125 in).

Linear bar codes shall have the human translation text placed directly above or below the symbol.

Matrix symbols shall have the human translation text placed either adjacent to or below the symbol, with each data element shown on a separate line. See Figures 2 b), 3 b) and 4.

8.9.2 Symbol conformance

8.9.2.1 Durability

Subject to technical constraints, the durability of the symbol and human translation text should be sufficient for them to remain readable for the expected life of the product.

8.9.2.2 Quality level

8.9.2.2.1 Matrix symbol

8.9.2.2.1.1 Direct marked symbols

ISO/IEC 15415 will be updated to include a new clause for measuring the quality of matrix symbols directly marked on a product/part. When available, the new clause should be used to measure the quality of matrix symbols directly marked on a chart.

Annex J outlines an approach which can be used to measure the quality of a matrix symbol directly marked on a part.

8.9.2.2.1.2 Printed symbols

When measured according to ISO/IEC 15415, matrix symbols shall achieve a minimum overall symbol grade of 2,5/04/W/45 when new and 1,5/04/W/45 for the life of the product/part, where:

— 2,5 is the mean of the individual grades for five scans of the symbol, rotated through 72° between scans (corresponding to an overall grade of B);

— 1,5 is the mean of the individual grades for five scans of the symbol, rotated through 72° between scans (corresponding to an overall grade of C);

— 04 [i.e. a 0,100 mm (4 mil) aperture] is the aperture reference number appropriate to a module size range from 0,125 mm (5 mil) (the minimum permitted under this document);

— W indicates that a broad-band (white light) light source has been used for measurement (the spectral distribution of which should match that expected to be used for reading the symbols);

— 45 indicates that the angle of incidence of the light is 45°.

8.9.2.2.2 Linear bar code symbols

When measured according to ISO/IEC 15416, Code 39 and Code 128 symbols shall achieve a minimum overall symbol grade of 2,5/06/660 when new and 1,5/06/660 for the life of the product/part, where

— 2,5 is the mean of the individual grades for ten scans of the symbol (corresponding to an overall grade of B);

— 1,5 is the mean of the individual grades for ten scans of the symbol (corresponding to an overall grade of C);

— 06 is the aperture reference number [corresponding to a 0,200 mm (8 mil) symbol element size];

— (660 ± 10) nm is the recommended wavelength for measurement of linear symbol print quality (matching that expected to be used for reading the symbols).

NOTE 660 nm is typical of many laser diode and red LED light sources.

Annex A
(normative)

Data dictionary: essential data elements

Data definitions contained in this annex (Tables A.1 to A.9) are the primary TEIs needed to support the product/part identification schema defined in this document.

Table A.1 — CAGE/NCAGE code

NAME: CAGE/NCAGE code	
TEI: CAG	
Definition: A unique five-character identification for an enterprise or an identifiable portion of an enterprise.	
Class:	AN
Decimals:	
Min_Length:	5
Max_Length:	5
Case sensitive:	Yes
Business rules 1) Alpha characters shall be upper case. 2) Use the five position alphanumeric codes specified in Cataloging Handbook H4/H8: Sections A and B, Commercial and Government Entity (CAGE) Codes (United States and Canada only) and Sections C and D, NATO Supply Codes for Manufacturers (NSCM) (excluding United States and Canada). 3) CAG is the TEI for the enterprise assigning a unique product/part serial number (SER) or a unique component identification number (UCN). The owner of the CAGE/NCAGE code assigns the unique product/part serial number or unique component identification number which is unique within the CAGE/NCAGE code. 4) Unique product/part serial number (SER) shall only be assigned by the original manufacturer of the product/part. 5) Unique component identification number (UCN) shall be assigned when the organization is any other than the original manufacturer.	

Table A.2 — Current product/part identification number

NAME: Current product/part identification number	
TEI: PNR	
Definition: The design activity or industry standard identity for the subject part, assembly, kit or material item. It is used to identify a given configuration that is interchangeable. The current product/part identification number is unique within a business entity.	
Class:	AN
Decimals:	
Min_Length:	1
Max_Length:	15
Case sensitive:	Yes
Business rules 1) All products/parts of the same configuration (form, fit, and function) shall have the same product/part identification number. 2) Alpha characters shall be upper case.	

Table A.2 *(continued)*

3) The hyphen (-) is the only special character permitted in the current product/part identification number. However, the hyphen (-) is not allowed as the first or last character of a current product/part identification number.

4) Current product/part identification numbers are controlled by the cognizant design authority. Normally this is engineering.

5) For a part defined in an international/national standard, the part number is assigned by the organization controlling the standard.

Remarks
For life cycle product/part management, the data base should contain the identity of the company/organization that is the cognizant design activity. See action code data definition in B.1 for the method to record designer.

Table A.3 — D&B D-U-N-S® [a] number

NAME: D&B D-U-N-S® number	
TEI: DUN	
Definition: A nine- numeric-character identification sequence which provides a unique ID for business entities while linking corporate family structures together.	
Class:	N
Decimals:	
Min_Length:	9
Max_Length:	9
Case sensitive:	No
Business rules	
1) Data content shall be the nine numeric characters of the D-U-N-S® number.	
2) DUN is the TEI for the enterprise assigning unique product/part serial number (SER) or a unique component identification number (UCN). The owner of the D-U-N-S® code assigns the unique product/part serial number or unique component identification number which is unique within the D-U-N-S® code.	
3) Unique product/part serial number (SER) shall only be assigned by the original manufacturer of the product/part.	
4) Unique component identification number (UCN) shall be assigned when the organization is any other than the original manufacturer.	
Remarks	
1) The hyphen in the D&B D-U-N-S® number shall be dropped, leaving only the nine numeric characters.	
2) For assignment of a number and details on the D&B D-U-N-S® number, see URL https://www.dnb.com/	
[a] D-U-N-S is the trade name of a numbering system supplied by Dun and Bradstreet. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named.	

Table A.4 — GS1 company identifier

NAME: GS1 company identifier	
TEI: EUC	
Definition: A unique numeric identification for an enterprise or an identifiable portion of an enterprise.	
Class:	N
Decimals:	
Min_Length:	6
Max_Length:	13
Case sensitive:	No
Business rules	
1) Data content shall be the GS1 assigned 6 to 13 digit company identifier.	

Table A.4 *(continued)*

2) EUC is the TEI for the enterprise assigning unique product/part serial number (SER) or a unique component identification number (UCN). The owner of the company identifier code assigns the unique product/part serial number or unique component identification number which is unique within the company identifier code.

3) Unique product/part serial number (SER) shall only be assigned by the original manufacturer of the product/part.

4) Unique component identification number (UCN) shall be assigned when the organization is any other than the original manufacturer.

Remarks
For assignment of a company identifier and details on the data structure, contact GS1 in Brussels, Belgium or the appropriate GS1 national body member.

Table A.5 — Enterprise lot number

NAME: Enterprise lot number	
TEI: LTN	
Definition: The original manufacturer's unique identity for a group of units of the same item which are processed, manufactured or assembled by one producer under uniform conditions, and which are expected to function in a uniform manner. Enterprise lot number, when linked with the enterprise identifier, provides the permanent identification for a given group of like items. The enterprise lot number is unique within the enterprise identifier.	
Class:	AN
Decimals:	
Min_Length:	1
Max_Length:	15
Case sensitive:	Yes
Business rules	
1) Alpha characters shall be upper case.	
2) The hyphen (-) is the only special character permitted in the enterprise lot number. However, the hyphen (-) is not allowed as the first or last position of a lot number.	
Remarks	
1) When used as part of the permanent identification, LTN shall be used in lieu of SER.	
2) To subdivide a lot, use batch item identifier (BII).	
3) Lot is being used as the prime identifier because of common usage.	
4) LTN shall only be used in conjunction with the product/part identification scheme defined in conformance class 1 in Clause 5. It shall not be used in conjunction with the legacy part identification schema described in Annex G.	

Table A.6 — Unique component identification number

NAME: Unique component identification number	
TEI: UCN	
Definition: Used in lieu of the unique product/part serial number (SER) when the serial number assigned to a product/part is accomplished by an organization other than the original manufacturer. The unique component identification number is unique within the enterprise identifier.	
Class:	AN
Decimals:	
Min_Length:	1
Max_Length:	15
Case sensitive:	Yes
Business rules	

Table A.6 *(continued)*

1) Alpha characters shall be upper case.
2) The hyphen (-) is the only special character permitted in the unique component identification number field. However, the hyphen (-) is not allowed as the first or last character of the UCN.

Remarks

See the CAGE/NCAGE code, D&B D-U-N-S number or GS1 company identifier data definitions for the rules on the proper use of this TEI.

Table A.7 — Unique product/part serial number

NAME: Unique product/part serial number	
TEI: SER	
Definition: The original manufacturer's unique identity for an individual part, assembly, kit or materiel item. Unique product/part serial number, when linked with the appropriate enterprise identifier, provides the permanent identification for a given item. The unique product/part serial number is unique within the enterprise identifier.	
Class:	AN
Decimals:	
Min_Length:	1
Max_Length:	15
Case sensitive:	Yes
Business rules 1) Alpha characters shall be upper case. 2) The hyphen (-) is the only special character permitted in the product/part serial number. However, the hyphen (-) is not allowed as the first or last character of a product/part serial number.	
Remarks 1) Only the original manufacturer of the product/part shall use SER. 2) See the CAGE/NCAGE code, D&B D-U-N-S® number or GS1 company identifier data definitions for the rules on the proper use of this TEI.	

Table A.8 — Universal serial number

NAME: Universal serial number	
TEI: USN	
Definition: Element which combines the data content of a CAGE/NCAGE code enterprise identifier and unique product/part serial number under a single TEI.	
Class:	AN
Decimals:	
Min_Length:	6
Max_Length:	20
Case sensitive:	Yes
Business rules 1) Data format is $AN_5AN_{1–15}$. 2) Data content is CAGE/NCAGE code, unique product/part serial number. USN may be used with 5-character enterprise identifier assigned by the issuing agencies with issuing agency codes (IAC) VFS and KRU. 3) The first five characters are the CAGE/NCAGE code data content characters for the original manufacturer of the product/part. 4) The second set of 1 to 15 characters are the unique product/part serial number data content characters assigned by the enterprise owning the CAGE/NCAGE being used. 5) There is no space between the enterprise identifier data content characters and the following unique product/part serial number data content characters.	

Table A.8 *(continued)*

6) Alpha characters shall be upper case.

Remarks 1) Only the original manufacturer of the product/part shall use USN. 2) Refer to CAGE/NCAGE code and unique product/part serial number data definitions for structure.
Uses 1) This element shall be used when space does not permit using the CAG and SER data elements separately to permanently identify a product or part. 2) It may also be used by a company to provide a standardized permanent identification for both large and small size parts.

Table A.9 — Universal serial tracking number

NAME: Universal serial tracking number	
TEI: UST	
Definition: Element which combines the data content of a CAGE/NCAGE code enterprise identifier and unique component identification number under a single TEI.	
Class:	AN
Decimals:	
Min_Length:	6
Max_Length:	20
Case sensitive:	Yes
Business rules 1) Data format is AN_5AN_{1-15}. 2) Data content is CAGE/NCAGE code, unique component identification number. 3) The first five characters are the CAGE/NCAGE code data content characters for the enterprise assigning the unique component identification number. 4) The second set of 1 to 15 characters are the unique component identification number data content characters assigned by the enterprise owning the CAGE/NCAGE being used. 5) There is no space between the enterprise identifier data content characters and the following unique component identification number data content characters. 6) Alpha characters shall be upper case.	
Remarks 1) UST shall be used when retroactively identifying an in-service product/part or when the product/part is being identified by an enterprise other than the original manufacture. 2) Refer to CAGE/NCAGE code and unique component identification number data definitions for structure.	
Uses This element shall be used when space does not permit using the CAG and UCN data elements separately to permanently identify a product or part.	

Annex B
(normative)

Data dictionary: optional/other data elements

Data definitions contained in this annex (Tables B.1 to B.17) are included to support:

— in-service parts;

— a legacy part identification schema described in Annex G;

— unique identifier structure as defined in ISO/IEC 15459-1, ISO/IEC 15459-3, ISO/IEC 15459-4, ISO/IEC 15459-6;

— product/part traceability;

— ISO 10303-239.

Table B.1 — Action code

NAME: Action code	
TEI: ACT	
Definition: A list of action taken codes to describe at high level what action was taken. These codes report the action taken on a product, part or lot as it moves through its life cycle process.	
Class:	AN
Decimals:	
Min_Length:	5
Max_Length:	34
Case sensitive:	No
Business rules	
1) Data format is A_3-AN_1 ... AN_{30}.	
2) Data content is action taken code, hyphen, action description.	
Action taken code	**Action description (question to be answered for AN_1 to AN_{30})**
BUY-	Bought from
CDO-	Current design activity/organization
DES-	How destroyed
EXC-	Exchanged for/with
INP-	Inspected what, tested what, adjusted what
INS-	Installed on/in (vehicle or assembly)
MFG-	Manufactured by
MKR-	Marked by
ODO-	Original design activity/organization
OTH-	Freelance note
OVH-	How overhauled/remanufactured and/or new limits if applicable (calendar date, hours, cycles, etc.)
RCD-	Received from
RMV-	Removed from (vehicle or assembly)
RPR-	Repaired by

Table B.1 *(continued)*

SHP-	Shipped to	(inside or outside of a company)
SLD-	Sold to	
UPG-	Upgraded, new part number is	
WHR-	Warehoused at	

Remarks

1) Action taken codes modify ACT and are the initial part of the data content.
2) A hyphen is included immediately after the three-character action taken code.
3) No space is left between the hyphen and start of the free-format text.
4) Action descriptions are free-format text.
5) Free-format text characters shall be in accordance with ISO/IEC 646.

Table B.2 — Action company

NAME: Action company	
TEI: ACO	
Definition: Element used in combination with the appropriate enterprise identifier.	
Class:	AN
Decimals:	
Min_Length:	9
Max_Length:	27
Case sensitive:	Yes

Business rules

1) Data format is A_3-AN_5-AN_{13}.
2) Data content is enterprise identifier, hyphen, enterprise value.

Remarks

1) Allowable enterprise identifiers are CAG, DUN and EUC.
2) The three alpha characters of the enterprise identifier TEI followed immediately by a hyphen (-) are entered as the first part of the data content.

Table B.3 — Action date

NAME: Action date	
TEI: ACD	
Definition: The data element used to record the date on which an action was taken.	
Class:	N
Decimals:	
Min_Length:	10
Max_Length:	16
Case sensitive:	Yes

Business rules

1) Data format is YYYY-MM-DD.
2) Data content is year, hyphen, month, hyphen, day.
3) If hours and minutes are needed in addition to the year, month, and day, the 24-hour clock employing local time shall be used. In this case,

   the data format is YYYY-MM-DDThh:mm;

   the data content is year, hyphen, month, hyphen, day, 'T', hours, colon, minutes.
4) Alpha characters shall be upper case.

Table B.3 *(continued)*

Remarks
For rule 1) References shall be made to "complete representations for calendar date and time of day, extended format" in ISO 8601-1:2019, 5.4.2.1 for details on date structure.
For rule 3) Reference shall be made to "representations other than complete, a) calendar date and local time, extended format" in ISO 8601-1:2019, 5.4.3 for details on Date and time of day structure.

Table B.4 — Batch item identifier

NAME: Batch item identifier	
TEI: BII	
Definition: The identification number assigned to a specific quantity of products/parts which were produced during a particular production run. The batch item identifier provides valuable source of traceability information about the origin of a product/part.	
Class:	AN
Decimals:	
Min_Length:	1
Max_Length:	15
Case sensitive:	Yes
Business rules	
1) Alpha characters shall be upper case.	
2) The hyphen (-) is the only special character permitted in the batch item identifier. However, the hyphen (-) is not allowed as the first or last position of a batch item identifier.	
Remarks	
1) This TEI shall only be used to subdivide a lot.	
2) Batch identification is optional data. Lot number is the primary traceability number in the lot, batch sequence.	

Table B.5 — Condition code – Product or part

NAME: Condition code — Product or part	
TEI: CND	
Definition: Element which reports the status of a product, part or lot as it moves through the life cycle process.	
Class:	A
Decimals:	
Min_Length:	3
Max_Length:	3
Case sensitive:	Yes
Business rules	
1) Data format is A3.	
2) Data content is status code.	
3) There are five possible status codes:	
Code	**meaning**
SRV	the part is serviceable.
UNS	the part is unserviceable.
SCP	the part has been declared scrap.
DES	the part has been physically destroyed
UNK	the condition of the part is unknown.
4) The five status codes listed are the only valid data content entries for CND.	

Table B.5 *(continued)*

5) Codes are upper-case alpha characters.

Remarks
No data follows the status code.

Table B.6 — End of useful life date

NAME: End of useful life date	
TEI: LIF	
Definition: The calendar date when a component or part requires servicing, inspection or removal.	
Class:	AN
Decimals:	
Min_Length:	10
Max_Length:	10
Case sensitive:	No
Business rules 1) Date format is YYYY-MM-DD. 2) Data content is year, hyphen, month, hyphen, day.	
Remarks Reference shall be made to "complete representations for calendar date and time of day, extended format" in ISO 8601-1:2019, 5.4.2.1 for details on date structure.	

Table B.7 — Lot number

NAME: Lot number	
TEI: LOT	
Definition: The original manufacturer's unique identity for a group of units of the same item which are processed, manufactured or assembled by one producer under uniform conditions, and which are expected to function in a uniform manner. Lot number, when linked with the enterprise identifier and original product/part identification number, provides the permanent identification for a given group of like items. The lot number is unique within the original product/part identification number.	
Class:	AN
Decimals:	
Min_Length:	1
Max_Length:	15
Case sensitive:	Yes
Business rules 1) Alpha characters shall be upper case. 2) The hyphen (-) is the only special character permitted in the lot number. However, the hyphen (-) may not occupy the first or last position of a lot number.	
Remarks 1) When used as part of the legacy part identification schema (see Annex G) LOT is used in lieu of SEQ. 2) To subdivide a lot, use batch item identifier (BII) 3) Lot is being used as the prime identifier because of common usage. 4) LOT shall not be used in conjunction with the product/part identification scheme defined in conformance class 2 in Clause 6.	

Table B.8 — Manufacturer code

NAME: Manufacturer code

Table B.8 *(continued)*

TEI: MFR	
Definition: Element which identifies the manufacturer, government agency or other organization controlling the design and the part number of the subject part.	
Class:	AN
Decimals:	
Min_Length:	5
Max_Length:	5
Case sensitive:	Yes
Business rules	
Use the five-position alphanumeric codes specified in Cataloging Handbook H4/H8: Sections A and B, Commercial and Government Entity (CAGE) Codes (United States and Canada only) and Sections C and D, NATO Supply Codes for Manufacturers (NSCM) (excluding United States and Canada). Can use the 5-character alphanumeric codes specified in registers of issuing agencies for ISO/IEC 15459-2 with issuing agency codes (IAC) VFS (letters K,L,M,N in the first position of code) and (IAC) KRU (other characters in the first position of code)». The last position of code is always the letter «O».	
Remarks	
1) The previous edition of this document used MFR to identify the product/part designer/manufacturer. As business conditions permit, MFR should be phased out in favour of CAG, the TEI for the CAGE/NCAGE enterprise identifier.	
2) CAUTION During implementation of ATA Spec 2000 in the aviation industry, MFR has been used to identify the designer and/or the manufacturer.	

Table B.9 — Manufacture date

NAME: Manufacture date	
TEI: DMF	
Definition: The date on which the subject part, assembly, or material item is first certified by the manufacturer as a serviceable item. Where the customer stipulates fitment of its own serviceable unit, the manufacture date is the date of the release note, supplied with the equipment, by the customer.	
Class:	N
Decimals:	
Min_Length:	10
Max_Length:	10
Case sensitive:	No
Business rules	
1) Data format is YYYY-MM-DD.	
2) Data content is year, hyphen, month, hyphen, day.	
Remarks	
Reference shall be made to “complete representations for calendar date and time of day, extended format” in ISO 8601-1:2019, 5.4.2.1 for details on date structure.	

Table B.10 — Original product/part identification number

NAME: Original product/part identification number	
TEI: PNO	
Definition: The design activity or industry standard identity for the subject part, assembly, kit or material item. It is used to identify a given configuration that is interchangeable. The original product/part identification number is unique within a business entity.	
Class:	AN
Decimals:	

Table B.10 *(continued)*

Min_Length:	1
Max_Length:	15
Case sensitive:	Yes

Business rules

1) All products/parts of the same configuration (form, fit and function) shall have the same original product/part identification number.
2) Alpha characters shall be upper case.
3) The hyphen (-) is the only special character permitted in the original product/part identification number. However, the hyphen (-) may not be the first or last character of an original product/part identification number.
4) Original product/part identification numbers are controlled by the cognizant design authority. Normally this is engineering.

Remarks

1) This TEI shall only be used when there is a need to maintain the original product/part identification number on the product/part for the life cycle of the product/part.
2) For the legacy part identification schema, it is used in conjunction with the sequential product/part serial number (SEQ) or lot number (LOT).

Table B.11 — Overlength part number

NAME: Overlength part number

TEI: OPN

Definition: Element which identifies the characters for a product/part identification number exceeding 15 characters in length.

Class:	AN
Decimals:	
Min_Length:	1
Max_Length:	17
Case sensitive:	Yes

Business rules

1) Alpha characters shall be upper case.
2) This data field contains characters 16 to 32 of a product/part identification number which exceeds 15 characters.

Remarks

1) When needed, this data element is used in conjunction with the current or original product/part identification number (PNR or PNO) data element.
2) Refer to current or original product/part identification number (PNR or PNO) for definition and structure.
3) It is the responsibility of the sending and receiving system to separate or combine current or original product/part identification number (PNR or PNO) and overlength part number (OPN) for data encoding, data transmission and human translation text.

Table B.12 — Sequential product/part serial number

NAME: Sequential product/part serial number

TEI: SEQ

Definition: The original manufacturer's identity for an individual part, assembly, kit or materiel item. Sequential product/part serial number shall be unique within the original product/part identification number.

Class:	AN
Decimals:	
Min_Length:	1

Table B.12 *(continued)*

Max_Length:	15
Case sensitive:	Yes

Business rules

1) Alpha characters shall be upper case.
2) The hyphen (-) is the only special character permitted in the sequential product/part serial number. However, the hyphen (-) may not occupy the first or last position of a sequential product/part serial Number.

Remarks

This TEI shall only be used in conjunction with the original product/part identification number (PNO).

Table B.13 — Service required interval

NAME: Service required interval

TEI: SRI

Definition: The duration, cycles or distance at which a component or part requires servicing, inspection or removal.

Class:	AN
Decimals:	
Min_Length:	4
Max_Length:	10
Case sensitive:	Yes

Business rules

1) For years — should be XXXX YEARS, may be XXXXXXX YR.
2) For months — should be XXX MONTHS, may be XXXXXXX MH.
3) For days — should be XXXXX DAYS, may be XXXXXXX DY.
4) For hours — should be XXXXX HOUR, may be XXXXXXX HR.
5) For cycles — should be XXXX CYCLE, may be XXXXXXX CZ.
6) For kilometres — shall be XXXXXXX KM.
7) For statute miles — shall be XXXXXXX MI.
8) For nautical miles — shall be XXXXXXX NM.

Remarks

1) Duration, cycle and distance descriptors are upper-case alpha characters.
2) A space is encoded and shown in human-readable form between the numeric quantity and the alpha unit of measure.

Table B.14 — Supplier code

NAME: Supplier code

TEI: SPL

Definition: Element which identifies the organization assigning a unique component identification number (UCN) to an in-service product/part, where the organization is not the original manufacturer of the product/part.

Class:	AN
Decimals:	
Min_Length:	5
Max_Length:	5
Case sensitive:	Yes

Business rules

Use the CAGE or NCAGE code of the organization assigning the unique component identification number (UCN).

Remarks

Table B.14 *(continued)*

1) Used when retroactively identifying an in-service product/part.
2) Refer to manufacturer code (MFR) data definition for the CAGE/NCAGE structure.
3) The previous edition of this document used SPL to identify the product/part owner when assigning a permanent identification for an in-service product/part. As business conditions permit, SPL should be phased out in favour of CAG, DUN or EUC as appropriate.

Table B.15 — Unique item identification number

NAME: Unique item identification number	
TEI: UID	
Definition: Element which provides an item identification number that is unique throughout the world in an open system environment.	
Class:	AN
Decimals:	
Min_Length:	7
Max_Length:	46
Case sensitive:	Yes

Business rules

1) CONSTRUCT 1:

   data format is $C_1.C_3E_5 \ldots E_{13}N_1 \ldots N_{15}$;

   data content is issuing agency code (C) defined in ISO/IEC 15459-2 plus enterprise identifier (E) data content plus unique product/part serial number (N) or unique component identification number (N) data content.

2) CONSTRUCT 2:

   data format is $C_1.C_3E_5 \ldots E_{13}P_1 \ldots P_{15}S_1 \ldots S_{15}$;

   data content is issuing agency code (C) defined in ISO/IEC 15459-2 plus enterprise identifier (E) data content plus original product/part identification number (P) data content plus sequential product/part serial number (S) data content.

3) Any hyphen (-) used in the data content of the data elements listed in 1) and 2) will be eliminated when deriving the UID number.
4) Once the data content is established for this TEI, it shall not be parsed to determine the data elements used to construct the UID.
5) Refer to ISO/IEC 15459-2 for the procedure to obtain the issuing agency code assigned to the enterprise identifier being used.

Remarks

1) This identification number meets the requirements contained in ISO/IEC 15459-3, ISO/IEC 15459-4 and ISO/IEC 15459-6 for a unique item identification.
2) The data content of this data element is intended to be used in a data base. It should not be used as a data element on a product/part.

Table B.16 — Warranty date

NAME: Warranty date	
TEI: DTW	
Definition: The calendar date on which the warranty ends for a product, component or part.	
Class:	AN
Decimals:	
Min_Length:	10
Max_Length:	10
Case sensitive:	No

Table B.16 *(continued)*

Business rules 1) Data format is YYYY-MM-DD. 2) Data content is year, hyphen, month, hyphen, day.
Remarks Reference shall be made to "complete representations for calendar date and time of day, extended format" in ISO 8601-1:2019, 5.4.2.1 for details on date structure.

Table B.17 — Warranty expiration

NAME: Warranty expiration	
TEI: WEX	
Definition: The duration, cycles or distance when the warranty expires.	
Class:	N
Decimals:	
Min_Length:	4
Max_Length:	10
Case sensitive:	Yes
Business rules 1) For years — should be XXXX YEARS, may be XXXXXXX YR. 2) For months — should be XXX MONTHS, may be XXXXXXX MH. 3) For days — should be XXXXX DAYS, may be XXXXXXX DY. 4) For hours — should be XXXXX HOUR, may be XXXXXXX HR. 5) For cycles — should be XXXX CYCLE, may be XXXXXXX CZ. 6) For kilometres — shall be XXXXXXX KM. 7) For statute miles — shall be XXXXXXX MI. 8) For nautical miles — shall be XXXXXXX NM.	
Remarks 1) Duration, cycle and distance descriptors are upper-case alpha characters. 2) A space is encoded and shown in human-readable form between the numeric quantity and the alpha unit of measure.	

Annex C
(informative)

Life cycle traceability

Life cycle traceability is required to safely maximize the performance of a product or part with the minimum expenditure of resources. This is achieved by using life cycle data to help accomplish activities such as improving reliability and maintainability, and identifying fraudulent and unapproved parts.

Table C.1 is an example of how a data file may be constructed using the TEIs listed in Annexes A and B.

Table C.1 — Example of a product/part traceability data file

Enterprise identifier (CAG) or (DUN) or (EUC)	Unique product/part serial number or enterprise lot number (SER) or (LTN)	Current product/part identification number (PNR)	Condition code — Product/part (CND)	Action date (ACD)	Action company (ACO)	Action code (ACT)	Extensibility elements [a]
Permanent identification data elements						BUY- Bought from CDO- Current design activity/organization is DES- How destroyed EXC- Exchanged for/with INP- What inspected, or tested, or adjusted INS- Installed on/in [b] MFG- Manufactured by whom MKR- Marked by ODO- Original design activity/organization was OTH- Freelance note OVH- How overhauled/remanufactured and/or new limits, if applicable [c] RCD- Received from RMV- Removed from [b] RPR- Repaired by SHP- Shipped to [d] SLD- Sold to UPG- Upgraded, new part number is WHR- Warehoused at	
Essential identification data elements			SRV UNS SCP DES UNK		CAG- DUN- EUC-		

[a] Determined by an industry, trading partners or a company.

[b] Vehicle or assembly.

[c] Calendar date, hours, cycles, etc.

[d] Inside or outside a company.

Annex D
(normative)

GS1 application identifier (AI) equivalencies

D.1 Purpose

This annex describes an approach which allows selected GS1 application identifiers (AI) to be used in lieu of text element identifiers (TEI) while employing the product/part identification schema described in this document. Application identifiers are only used with trading partner agreement (see 7.3).

For detailed information on AI structure and use, see the "GS1 General Specifications".

D.2 GS1 serial identification

As shown in Table D.1, AI 8004 (GIAI) is a combination of the GS1 company prefix and the individual asset reference number. Once combined, the number cannot be parsed into the two data elements used to construct the GS1 serial identification number. To breakout the individual asset reference number, a software algorithm needs to be constructed which subtracts the company prefix provided in AI 95 from the 8004 number.

Table D.1 — GS1 application identifier approach

Essential data		
Element	**Application identifier**	**Valid values/size** (characters)
Enterprise identifier [a] GS1 company prefix	95	6 to 13 characters, numeric
Unique product/part serial number [a, b] Global individual asset identifier (GIAI)	8004 [c]	1 to 30 characters, alphanumeric
Current product/part identifier Global trade item number (GTIN) Additional product [d] identification	01 240 [e]	14 characters, numeric 1 to 30 characters, alphanumeric
Optional data		
Traceability element	To be determined by trading partners	[f]

[a] Permanent identification is the combination of GS1 company prefix and the global individual asset identifier (GIAI) or batch/lot number within the enterprise identifier.

[b] Unique product/part serial number or batch/lot number is assigned by the original manufacturer and is unique within the company prefix of the manufacturer.

[c] The AI 8004 identification number assigned by the original manufacturer shall stay with the product/part for its entire life cycle. It shall not be changed or removed from the product/part even if the product/part ownership changes.

[d] This AI shall always be used in association with AI 01.

[e] Current product/part identifier (number) is assigned by the organization responsible for configuration of the part. The responsible organization is normally engineering. The current product/part number is a unique number assigned to one or more like units which have the same form, fit and function. The current product/part number marking should be separate from the permanent identification marking so that it can be updated over the life cycle of the part when the form, fit or function changes.

[f] Traceability data element selection sequence precedence shall be:

first, use application identifiers as published in the "GS1 General Specifications";

second, trading partner established using AI 90.

Annex E
(normative)

ASC MH10 data identifier (DI) (codified in ISO/IEC 15418) equivalencies

E.1 Purpose

This annex describes an approach which allows selected ASC MH10 data identifiers (DI) to be used in lieu of text element identifiers (TEI) while employing the product/part identification schema defined in this document (see Table E.1). DIs are only used with trading partner agreement (see 7.4).

NOTE These DIs were originally referred to as FACT data identifiers.

For detailed information on DI structure and use, see ANS MH10.8.2.

E.2 ASC MH10 data identifier (DI) serial identification

E.2.1 DI 18S

DI 18S is the "CAGE code and serial number unique within CAGE". To breakout the serial number, a software algorithm can be constructed which subtracts the CAGE code from the 18S associated data content.

E.2.2 DI 25S

DI 25S is the "identification of a party to a transaction as identified in 18 V, followed by the supplier assigned serial number". To breakout the serial number, a software algorithm can be constructed to subtract the IAC and associated enterprise identifier from the 25S associated data content.

Table E.1 — Data identifier approach

	Essential data	
Element	**Data identifiers**	**Valid values/size** (characters) [e]
Enterprise identifier [a]		
GS1	3V	6 to 13 characters, numeric
CAGE	17V	5 characters, alphanumeric
DUNS	12V	9 characters, numeric
Unique product/part serial number [a, b, c]		
CAGE code and serial number unique within CAGE	18S	5 characters, alphanumeric, plus 1 to 20 characters, alphanumeric
UII — Item	25S	7 to 36 characters, alphanumeric
Traceability number (lot, batch, etc.)	1T	Unformatted data [e]
Current product/part identifier [d]		
Item information First level (supplier assigned)	30P	Unformatted data [e]
Optional data		
Traceability element	To be determined by trading partners	[f]

[a] Permanent identification is the combination of enterprise identifier and the unique product/part serial number within the enterprise identifier.

[b] Unique product/part serial number is assigned by the original manufacturer and is unique within the enterprise identifier of the manufacturer.

[c] The 18S identification number assigned by the original manufacturer shall stay with the product/part for its entire life cycle. It shall not be changed or removed from the product/part even if the product/part ownership changes.

[d] Current product/part identifier (number) is assigned by the organization responsible for configuration of the part. The responsible organization is normally engineering. The current product/part number is a unique number assigned to one or more like units which have the same form, fit and function. The current product/part number marking should be separate from the permanent identification marking so that it can be updated over the life cycle of the part when the form, fit or function changes.

[e] When defining the valid values/size of the data content, one should consider:

first, the values/size defined in ANS MH10.8.2;

second, if not defined in ANS MH10.8.2, the data content values/size for the corresponding TEI;

third, data content values/size agreed between trading partners.

[f] For traceability data element selection, use data identifiers in accordance with ANS MH10.8.2.

Annex F
(informative)

Encoding comparison

F.1 Purpose

ISO/IEC 15434 defines a syntax which is used in many applications. This annex provides a comparison of the matrix symbol encoding and message syntax prescribed in 7.2 with the ISO/IEC 15434 syntax. The data string described as "encoding" is the data string that is either received by the symbol encoding software which then converts it to codewords and symbol characters according to the symbology specification — making use of features of the symbology that permit efficient encoding — or output by the symbol decoder which converts the symbol characters back to bytes corresponding to the input.

F.2 Examples

F.2.1 Permanent identification data

Permanent identification data to be encoded and communicated is as follows.

Enterprise identifier (CAGE/NCAGE): 2D671

Unique product/part serial number: ABC333-001

F.2.2 ISO 21849 with XML syntax for messages

Encoding in matrix symbol: CAG 2D671 G_S SER ABC333-001

Communication message (XML): <CAG>2D671</CAG> <SER>ABC333-001</SER>

NOTE The three upper-case alpha TEI characters are used as the well-formed, self-describing NAME in an XML start-tag and end-tag.

F.2.3 ISO/IEC 15434 syntax

Using the format indicator 12 for TEIs, the data stream is written as shown below.

Encoding in matrix symbol: []>R_S12G_SCAG 2D671G_SSER ABC333-001$R_S$$E_{OT}$

Annex G
(normative)

Legacy part identification schema

G.1 Purpose

The type of schema employed for part identification is dependent on the method of serialization used for a product/part. The schema used in the body of this document is based on assigning a unique serial number within the enterprise identifier.

This annex describes an approach in which a sequential serial number is sequenced within the original part number, and the original part number is unique within the enterprise identifier. Millions of in-service parts have been identified with this approach using human-readable characters marked on a data plate.

G.2 Legacy schema

If a group of trading partners or a company desires to use a sequential serial number within the original part number approach to permanently identify a part using automated identification technologies, the schema illustrated in Table G.1 shall be employed. Appropriate TEIs to use this schema are contained in Annexes A and B.

Table G.1 — Legacy part identification schema and example

Data element title	Example
Enterprise identifier	**CAG 1C275**
Original part number	**PNO A765982C567**
Sequential serial number within the original part number	**SEQ XYZ79865**

If trading partners agree to uniquely identify lot number within the original part number (PNO), use lot number (LOT) in lieu of the sequential serial number (SEQ). The TEI for enterprise lot number (LTN) shall not be utilized under this schema.

Annex H
(informative)

Data exchange

H.1 Purpose

Organizations receiving products/parts identified by automatic identification techniques shall be able to receive products with any of three semantic systems employed: GS1 application identifiers (AI), ISO/IEC 15418 ASC MH10 data identifiers (DI), and ISO 21849 text element identifiers (TEI). Two methods are available to permit data interchange between the three semantic systems: a standardization approach and a technical/interoperability approach.

H.2 Standardization approach

This method uses the ISO/IEC 15434 structure to obtain data interchange between the three commonly employed semantic systems. It cannot be used for data encoded in linear symbols.

Data streams from the decoder are identified by means of

a) a compliance indicator [four characters, []> followed by R_S (character value 30)], followed by

b) the format header consisting of a two-digit Format Identifier in the range 01 to 99 and the remainder of the header.

Format header $05G_S$ indicates data structured according to the GS1 application identifier rules and using G_S (character value 29) as the data element delimiter; format header $06G_S$ indicates data structured according to the ASC MH10 data identifier rules and using G_S (character value 29) as the data element delimiter; format header $12G_S$ indicates data using TEIs using G_S (character value 29) as the data element delimiter. The end of the data string for a particular format is indicated by the format trailer character R_S and the end of the complete message by E_{OT}.

Data streams from a linear symbol shall be parsed according to

— the symbology identifier prefixed to the decoder output, and

— the format of the first 1 to 4 characters.

Symbology identifier]C1 indicates a GS1-128 symbol with an initial FNC1 character (not transmitted) containing GS1 application data. The first two data characters are looked up in the AI list; if no match is found, the first three characters are looked up; and if no match is found, the first four characters are looked up. If a match is found, the next data character is interpreted in accordance with the rules for the particular AI. Subsequent data (which may include the FNC1 character as a data element separator) are then analysed in a similar manner until the end of the symbol data string.

Any other symbology identifier present at the beginning of the transmission (the character ‘]’ followed by two more characters) may be interpreted in accordance with ISO/IEC 15424 and/or stripped. If the next character (or, if no symbology identifier is present, the first character) is upper-case alphabetic and followed by numeric data, it is an ASC MH10 data identifier and should be interpreted by reference to ANS MH10.8.2. Otherwise, if the next character (or, if no symbology identifier is present, the first character) is upper-case alphabetic and followed by two more upper-case alphabetic characters and a space, it is assumed to be a TEI. However, if there is no space in the fourth position, it is assumed that the first alpha character is a DI and should be interpreted by reference to ANS MH10.8.2. Validate the data following the assumed TEI or DI by reference to the relevant definitions. Otherwise, if in the

next four positions there are one, two or three numeric digits followed by an upper-case alphabetic character, the two, three or four characters are an ASC MH10 data identifier.

H.3 Technical/interoperability approach

Figure H.1 provides a top-level view of the process used to differentiate between AIs, DIs, and TEIs. This document does not specify any particular method by which the process can be implemented, in order to enable solution providers to utilize an approach best suited to their requirements.

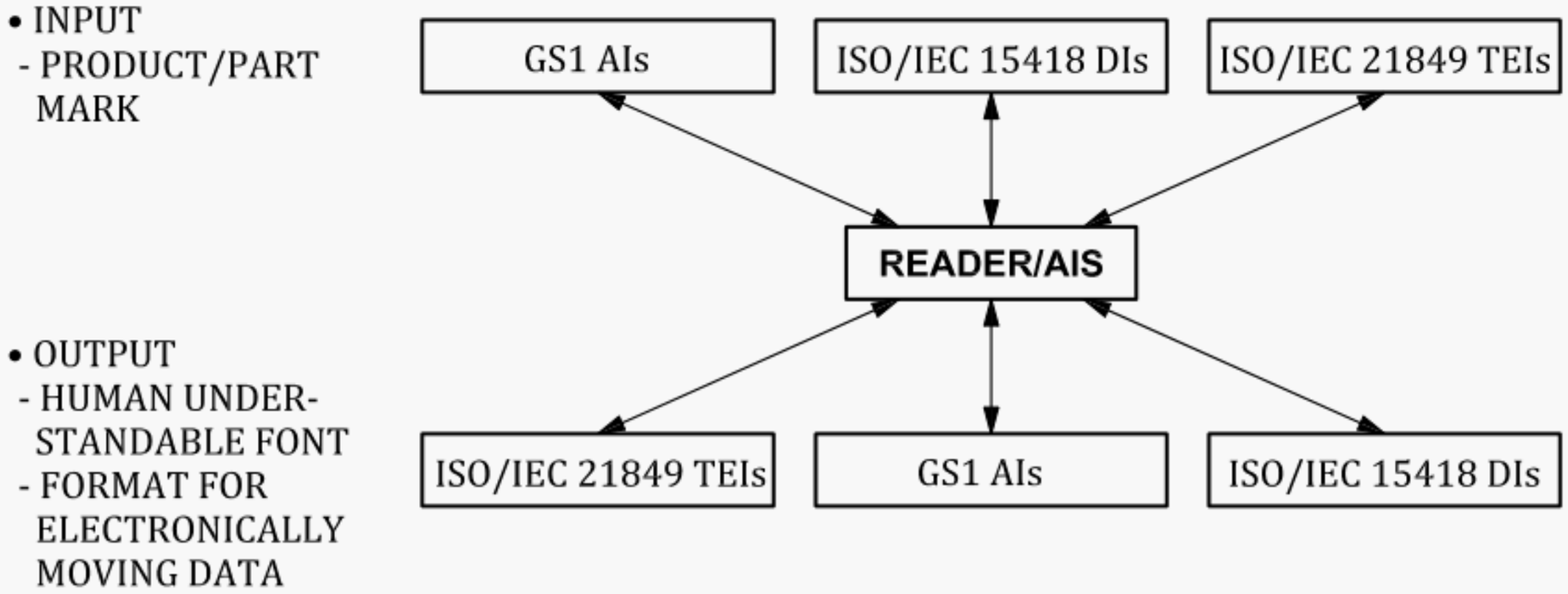


Figure H.1 — Top-level technical approach

Annex I
(informative)

RFID tag

I.1 General

RFID technology provides features that allow new operational processes to be implemented. Two of the key features are:

— encoded data can be updated without physical alteration to the tag or part;

— the data storage capability of the tag provides an abbreviated data base.

However, the affixing of an RFID tag does not obviate the necessity to provide an optically readable Data Matrix and a visually readable human translation markings (see Figures 2 b), 3 b) and I.7).

The abbreviated data base capability allows product/part traceability data to be stored in the tag in addition to essential identification and configuration data. Traceability data stored in the tag allows maintenance personnel to install a part without connection to an authoritative source of data. Business processes shall be established to ensure validation of the data in the tag with an authoritative source of data before the mechanic is issued the part.

I.2 Tag characteristics

The applied RFID technology shall be passive RFID transponders to prevent uncontrolled emission of electromagnetic waves in the aerospace operating environment.

The air interface and the communications protocol associated with RFID are identified in external documents usually published by ISO/IEC JTC 1/SC 31.

I.3 Data content

Data content shall be as defined in 8.6.

The data shall be encoded in the tag using XML.

I.4 Data validation

Because the data in the tag can be updated, data validation procedures are required. Data is divided into static (permanent) or dynamic (updatable) data. Static data shall be written in the memory chip during or immediately after manufacturing of the product/part has been completed. Static data shall not be changed again. Dynamic data may be updated during the life of the product/part by an authorized source. To ensure the validity of dynamic data, business processes shall be established to identify who is authorized to update the data in the memory chip and when the data should be updated. An electronic audit trail shall be established at an industry level or by the trading partners to reflect all changes made to the dynamic data.

I.5 Static data

Static data shall be in a locked section in the RFID memory chip. Static data shall be written once and never changed during the life cycle of the product/part.

I.6 Dynamic data

Dynamic data elements shall be in a section in the RFID memory chip that may be updated. Updating shall only be accomplished by an authorized source.

I.7 Optically readable data

The top cover of the tag shall contain the conformance class 1 essential data in two matrix symbols and human translation formats. Human-readable data is required so that identification of a product/part can be made in the event that either no reader equipment is available or there is a reader/tag malfunction.

Encoding of the data in the matrix symbol shall be in accordance with ISO/IEC 15434 syntax. The requirements in Clauses 5 and 8 apply.

Annex J
(informative)

Quality level, directly marked matrix symbols

Symbols and text produced by dot peening shall meet the requirements defined in SAE AS9132 and the tolerances defined in the appendix titled "Examples of Required Tolerances with Reference to the Nominal Cell Sizes for Dot Peening".

Symbols and text produced by the industrial ink jet process, which uses round dots to form a cell, should meet the SAE AS9132 dot peening requirements appropriate to this process.

Symbols and text produced by laser and electro-chemical etching shall meet the requirements defined in SAE AS9132 and should achieve a rating of not less than 6 on the "Visual Quality Guidelines".

Symbols and text produced by the ink stencil process, which creates square cells, should meet the SAE AS9132 laser and electro-chemical etching requirements appropriate to this process.

ISO/IEC TR 24720 and SAE AS9132 give useful guidelines for maximizing the readability of direct marked symbols.

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