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# Aircraft and space — Industrial data — Product identification and traceability

*Aéronautique et espace — Données industrielles — Identification des produits et traçabilité*



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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).

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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

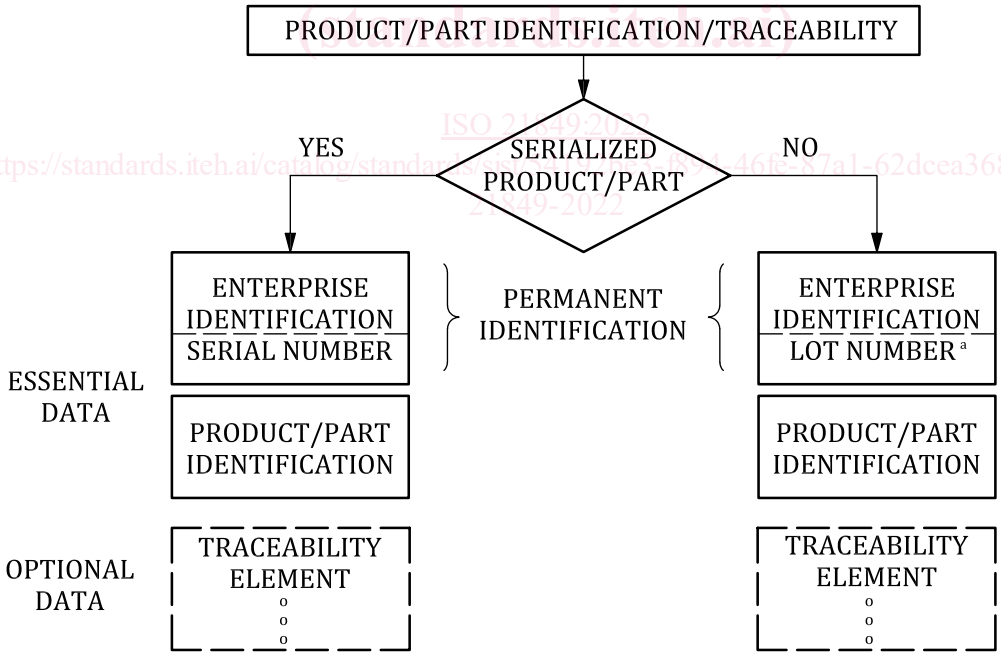
Figure 1 is a decision tree diagram which illustrates

— 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.

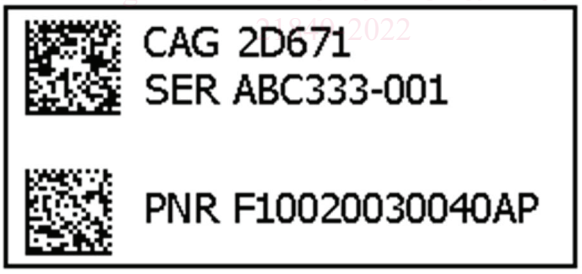
3) When using CAGE/NCAGE as the enterprise identifier, space may be saved by using a combined element. The combined element TEI is UST (see A.9).

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**



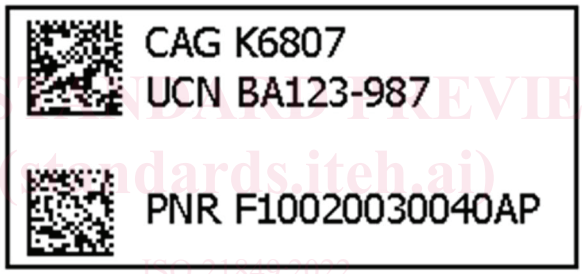

**b) Data encoded in Data Matrix format with human translation added**

**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