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**Gas cylinders — Identification and  
marking using radio frequency  
identification technology —**

Part 1:

**Reference architecture and terminology**

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*Bouteilles à gaz — Identification et marquage à l'aide de la technologie  
d'identification par radiofréquences —*

*Partie 1: Architecture de référence et terminologie*

ISO 21007-1:2005

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Published in Switzerland

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 21007-1 was prepared by Technical Committee ISO/TC 58, *Gas cylinders*, Subcommittee SC 4, *Operational requirements for gas cylinders*.

ISO 21007 consists of the following parts, under the general title *Gas cylinders — Identification and marking using radio frequency identification technology*:

- *Part 1: Reference architecture and terminology* [ISO 21007-1:2005](https://standards.iteh.ai/catalog/standards/sist/e1484321-c418-4b2b-bbc0-c7a26193391a/iso-21007-1-2005)
- *Part 2: Numbering schemes for radio frequency identification* <https://standards.iteh.ai/catalog/standards/sist/e1484321-c418-4b2b-bbc0-c7a26193391a/iso-21007-1-2005>

## Introduction

Throughout industry and in commerce, trade and the domestic sector, the employment of gas cylinders to enable the local consumption and use of gases and liquids without the need for *in situ* high-cost permanent pressure vessel installations is an important part of modern practice.

Such cylinders may provide complex gas mixes for medical, industrial or research use.

The cylinders are made and used in a wide variety of shapes and sizes. All are controlled by international, regional or national regulations in respect of safety, and all require clear marking, and periodic safety checks and maintenance under the provisions of regulations for pressure testing. The requirements for testing will vary according to the design of the cylinder and its contents.

Although manufactured to a specific design for a specific content, the life of such cylinders may be long, often exceeding 50 years. During that lifetime, the cylinders may be used to contain different materials at different fill pressures. As a consequence, the amount of material contained in the cylinders may also vary. It is possible that during this lifetime the regulatory framework permitting and controlling their use may also change.

As the cylinders may contain a wide variety of gases, identification is of paramount importance. It is often mandatory to be able to uniquely identify each cylinder. As many contents are of limited life, and for product quality and liability tracking and tracing, in some circumstances it may be necessary or desirable to identify not only the type of gas or liquid, but also such details as filling station, batch and date of fill.

Various methods and technologies such as physical identification of cylinder characteristics through stamp marking (for information, see ISO 13769); paint (for information, see ISO 32), paper (for information, see ISO 7225), card, metal, and plastic labelling; colour code identification; bar coding and, in some circumstances, other means are already used to make or assist such identifications.

The technology of radio frequency identification (RFID) involves a reader/interrogator station that transmits a predetermined signal of inductive, radio or microwave energy to one or many transponders located within a read zone. The signal is returned in a modified form to the reader/interrogator and the data are decoded. The data component in a gas cylinder's environment provides the basis for unambiguous identification of the transponder and may also provide a medium for a bi-directional interactive exchange of data between the host and transponder. The signal may be modulated or unmodulated according to the architecture of the system.

In many cases, it will be necessary or desirable to use one air carrier frequency and protocol, but this will not always be possible or even desirable in all situations, and it may be useful to separate fundamentally different cylinders by the response frequency.

However, there is benefit in using a standard common core data structure that is capable of upwards integration and is expandable from the simplest low-cost cylinder identification system to the more complex functions. Such a structure will have to be flexible and enabling rather than prescriptive, thus enabling different systems degrees of interoperability within and between their host systems.

The use of Abstract Syntax Notation One (ASN.1) from ISO/IEC 8824 and ISO/IEC 8825 as a data identifier structure is widely used and gaining popularity. Its usage will provide maximum interoperability and conformance to existing standards and will meet the specifically defined requirements for a generic standard model for portable gas container identification in that it

- enables and uses existing standard codings,
- is adaptable and expandable,
- does not include unnecessary information for a specific application, and
- has a minimum of overhead in storage and transmission.

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# Gas cylinders — Identification and marking using radio frequency identification technology —

## Part 1: Reference architecture and terminology

### 1 Scope

This part of ISO 21007 establishes a common framework for data structure for unambiguous identification of single or manifolded gas cylinders and for other common data elements in this sector. It also serves as a terminology document in the area of radio frequency identification (RFID) technology.

The scheme and reference model architecture proposed is designed to be an enabling structure to allow some harmonization between different commercial systems and not prescriptive in determining any one system. It is not frequency or air interface protocol specific, provides maximum interoperability, has a high population capability and provides the possibility of upwards migration to more capable systems.

This part of ISO 21007 provides a reference structure within which the key core elements of the data structure form an unambiguous identification that may be used to identify the message as a message from a gas cylinder within an electronic data interchange (EDI) environment and provides an application reference identifying that different data structure is contained in the message. A wide variety of such systems can be supported within the structure determined in this part of ISO 21007 such as identification of specialty gases and different gas applications. Each such system may range from individual simple identification to identification of such factors as content, fill date, history of use, etc.

This part of ISO 21007 does not include the air interface or any aspect of the equipment, solely the data element structure. Subsequent parts of ISO 21007 will define the data structures for gas cylinders and for specific sectors of application.

The numbering scheme views the Identification (ID) as a data element, and the common basic data structure is defined as a data identifier code. The adoption of the Abstract Syntax Notification (ASN.1) structure in a form to meet the requirements of this and subsequent subordinate parts of ISO 21007 enables the ISO 21007 series of standards to meet its objectives of

- being adaptable and expandable,
- providing a migration path to enhancement and future developments,
- avoiding carrying unnecessary information for irrelevant applications in any data construct,
- using existing standard codings wherever possible, and
- carrying a minimum of overhead in storage and transmission.

## 2 Terms, definitions and abbreviated terms

For the purposes of this document, the following terms, definitions and abbreviated terms apply.

**2.1 address**  
character or sequence of characters designating the originating source or destination of data being transmitted

**2.2 air interface**  
conductor-free medium, usually air, between a transponder and the reader/interrogator through which the linking of the transponder to the reader/interrogator is achieved by means of a signal of radio, microwave or inductive frequencies

**2.3 antenna**  
structure for transmitting/receiving electromagnetic or radio signals

**2.4 ASCII**  
American Standard Code for Information Exchange  
standard form of bit encoding providing the identification of 128 standard keyboard characters

NOTE The standard ASCII character set is of 7 bits separated by 1 or 2 stop bits.

cf. **extended ASCII**

**2.5 ASN.1**  
Abstract Syntax Notation One  
International Standard for representing data types and structures

NOTE CCITT published the first version of the standard as x.409 in 1984. A newer version of ASN.1 resulting from a cooperative venture of CCITT and ISO was specified in x.208 (1988) of CCITT and ISO/IEC :1990. The latest version is specified in ISO/IEC 8824-1:2002 to ISO/IEC 8824-4:2002.

**2.6 automatic equipment identification**  
system of identification for equipment that uses the surface transportation infrastructures by means of transponders and interrogators combined with the unambiguous data structure defined in this part of ISO 21007

**2.7 automatic identification system**  
system for achieving accurate and unambiguous identification of a data bearing label, tag, transponder or a natural/prescribed feature, the data or feature being interrogated by means of a system-appropriate source

**2.8 bit**  
binary digit, which can take the value 0 or 1

**2.9 bits per second**  
**bps**  
measure of the information transfer rate of a data channel



**2.10****byte**

sequential series of bits comprising one character and handled as one unit

NOTE A byte is comprised of 8-data bits plus a parity bit and represents either one alphabetic or special character, two decimal digits or eight binary bits. It is usually encoded in the ASCII format.

**2.11****carrier signal**

electromagnetic signal, usually a high-frequency sinusoid that can be modulated to carry lower frequency encoded information across an air interface

**2.12****coding scheme identifier****CSI**

prescribed list of reference identifiers that relate to prescribed coding schemes determined in this and subordinate standards and/or issued by the authorized numbering scheme administrator

**2.13****CCITT**

International Consultative Committee on Telephony and Telegraphy  
part of the International Telecommunications Union, an agency of the United Nations

NOTE The principal members of CCITT are the world's public communications authorities (PTTs). CCITT issues recommendations that are not binding on its members, but in practice most PTTs, manufacturers and users accept and endorse CCITT standards.

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**2.14****compatibility**

capability of two or more items or components of equipment or materiel to exist or function in the same system without modification, adaption or mutual interference

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**2.15****cyclic redundancy check****CRC**

check sequence that is computed using each data bit in a block a number of times and is usually added to the end of the block, providing a method of detecting data transmission errors

**2.16****data element structure**

framework comprising a number of data elements in a prescribed form

**2.17****data substitution**

incorrect substitution of one legitimate character in place of another

**2.18****duplex**

method of communication capable of transmitting data in both directions

cf. **full duplex**, **half duplex** and **simplex**

**2.19****electronic data interchange****EDI**

passing of a data message or series of messages between computers and/or between different software systems

NOTE Within this context, an EDI message is normally compatible with the form specified in ISO 9897.

**2.20**  
**electronic data transfer**  
**EDT**

passing of data sets comprising an entire message from one computer to another or from one software system to another

**2.21**  
**environmental parameters**

used to describe different environmental component properties/specifications

**2.22**  
**effective radiated power**  
**ERP**

product of the transmitter power in watts and the relative gain of a directional antenna as compared with a standard half-wave dipole

NOTE A transmitter producing 10 watts of power connected to an antenna with a gain factor of 9 has an effective radiated power of 90 watts. In a given direction, the relative gain of a transmitting antenna with respect to the maximum directivity of a half-wave dipole is multiplied by the net power accepted by the antenna from the connected transmitter.

**2.23**  
**extended ASCII**  
**EBCDIC**

standard form of bit encodation providing the identification of 256 characters; the first 128 of which are the standard **ASCII** character set with an eighth bit providing a further 128 characters that are user definable

NOTE The character set is of 8 bits separated by 1 stop bit.

**2.24**  
**fixed RFID equipment**

equipment required to interrogate, receive and interpret the data in the on-board equipment (on-board transponders) in order to present the identification

**2.25**  
**full duplex**

method of communication capable of transmitting data in both directions at the same time

**2.26**  
**function block**

grouping of functional characteristics of a (sub)system

**2.27**  
**half duplex**

method of communication capable of transmitting data in both directions but only in one direction at any time

**2.28**  
**hertz**

measure of frequency equal to one cycle per second

**2.29**  
**interchangeability**

condition that exists when two or more items possess such functional and physical characteristics as to be equivalent in performance and durability and are capable of being exchanged without alteration of the items themselves or of adjoining items, and without selection for fit and performance

**2.30**  
**interoperability**

ability of systems to provide services to and accept services from other systems and to use the services so exchanged to enable them to operate effectively together

**2.31****incorrect read**

failure to read correctly all or part of a data set

**2.32****inductive signals**

electromagnetic signals, usually below 30 MHz, characterized by the use made of the magnetic component of the signals to couple a transponder to a reader by electromagnetic induction

**2.33****interrogator**

device that performs the functions of a **reader**, but in addition has the ability to write new data into the transponder via an air interface

**2.34****issuer**

body, recognized by an approved international or national regulatory body, whose identity is recognizable within the code structures by a unique "issuer identifier" data element, and which is assigned the issue and management of the subordinate data elements within the data construct

NOTE Issuers are likely to be bodies such as industrial gas bottlers and distributors.

**2.35****local area network****LAN**

network that spans a limited geographical area (usually within one building or site) and interconnects a variety of computers and terminals, usually at very high data rates

NOTE Because it uses physical media (wires or co-axial cables) owned by the operator and does not normally cross public roads, it is excluded from regulations of bodies such as the local PTT.

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**2.36****major application identifier**

first octet of a data element construct which is passed by a system to its host computer and which identifies that the message is a gas cylinder message

**2.37****management system**

software, firmware or hardware designed to receive and manage data from an RFID system, usually within a host computer

**2.38****manufacturer**

manufacturer of transponders for use within the applications defined in ISO 21007

**2.39****microwave frequencies**

electromagnetic energy emissions having frequencies of above 1 GHz

**2.40****minor application identifier**

second octet of a data element construct which is passed by the system to its host computer and which identifies the gas cylinder coding scheme to which it conforms

**2.41****operational parameter**

one of the different operational component properties or specifications