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

Part 2: Numbering schemes for radio frequency identification

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

Partie 2: Schémas de numérotage pour identification par radiofréquences

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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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 58, *Gas cylinders*, Subcommittee SC 4, *Operational requirements for gas cylinders*.

This third edition cancels and replaces the second edition (ISO 21007-2:2013), which has been technically revised with the following changes:

— a new registration body has been added to Annex B;

— a new Annex E has been added;

— the former Annex C, which provided a list of RFID codes, as well as marks for gas cylinder manufacturers, has been removed from this part of ISO 21007 and will be published in a separate document, ISO/TR 17329.

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*

— *Part 2: Numbering schemes for radio frequency identification*

Introduction

Cylinders can contain a wide variety of gases, and identification is of paramount importance. It could be desirable to identify not only the type of gas or liquid contained in the GC, but also such details as the filling station where the cylinder was filled, the batch of cylinders filled and the date the cylinder was filled.

Various methods and technologies such as physical identification through indentation; paper, card, metal and plastic labelling; colour code identification; bar coding and, in some circumstances, vision systems 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 transponder returns the signal in a modified form to the reader/interrogator and the data are decoded. The data component in a portable gas or liquid cylinder environment provides the basis for unambiguous identification of the transponder and also can provide a medium for a bi-directional interactive exchange of data between the reader/interrogator and transponder. The signal can be modulated or unmodulated according to architecture of the system.

Recently, RFID has started using new, higher frequencies called ultra high frequency (UHF). These higher frequencies facilitate a faster reading and writing process and deliver longer reading/writing distances. Therefore, the UHF band frequency has been included in this part of ISO 21007. The aim of this part of ISO 21007 is to provide the data structure respectively suitable for all frequency bands including UHF.

In many cases, it is necessary or desirable to use one air carrier frequency and protocol; however, this will not always be the case. Within a global market, different applications could require different solutions for the carrier frequency (e.g. reading distance and velocity) and protocols (e.g. security, company rule).

However, there is benefit in using a standard common core data structure that is capable of upwards integration and expandable from the simplest low-cost cylinder identification system to 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, as defined in the ISO/IEC 8824 series) from ISO/IEC 8824-1 as a notation to specify data and its associated Packed Encoding Rules (PER) from ISO/IEC 8825-2 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 gas cylinder identification in that it

— enables and uses existing standard coding,

— is adaptable and expandable,

— does not include unnecessary information for a specific application, and

— has a minimum of overhead in storage and transmission.

RFID standards other than ASN.1, for definition of frequencies and protocols, have been developed within recent years [see ISO/IEC 18000 (all parts)].

ISO 21007-1 provides a framework reference architecture for such systems. This part of ISO 21007 is a supporting part to ISO 21007-1 and provides a standardized yet flexible and interoperable framework for numbering schemes. This part of ISO 21007 details individual numbering schemes within the framework for the automatic identification of gas cylinders.

Central to the effective use of many of the constructs is a structure to provide unambiguous identification. This part of ISO 21007 provides a standardized data element construct for the automatic identification of gas cylinders.

The inconvenience of such a flexible concept is that a large storage memory is needed, particularly if a large amount of information has to be stored and read directly from the RFID tag.

The following two alternatives could be used to address this issue:

— limit the information directly accessible on the RFID tag and obtain the additional information from the host (ERP system);

— use a fixed data structure and length as shown in Annex E, as this can minimize the storage demand.

This part of ISO 21007 is intended to be used under a variety of national regulatory regimes, but has been written so that it is suitable for the application of the UN Model Regulations.[1] Attention is drawn to requirements in the relevant national regulations of the country (countries) where the cylinders are intended to be used that might override the requirements given in this part of ISO 21007. Where there is any conflict between this part of ISO 21007 and any applicable regulation, the regulation always takes precedence.

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

Part 2:
Numbering schemes for radio frequency identification

1 Scope

This part of ISO 21007 establishes a common flexible framework for data structure to enable the unambiguous identification in gas cylinder (GC) applications and for other common data elements in this sector.

This part of ISO 21007 enables a structure to allow some harmonization between different systems. However, it does not prescribe any one system and has been written in a non-mandatory style so as not to make it obsolete as technology changes.

The main body of this part of ISO 21007 excludes any data elements that form any part of transmission or storage protocols such as headers and checksums.

For details on cylinder/tag operations, see Annex A.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes*

ISO 13769, *Gas cylinders — Stamp marking*

ISO/TR 17329, *Gas cylinders — Identification of gas cylinder manufacturer marks and their assigned radio frequency identification (RFID) codes*

ISO 21007-1:2005, *Gas cylinders — Identification and marking using radio frequency identification technology — Part 1: Reference architecture and terminology*

ISO/IEC 8824-1:2008, *Information technology — Abstract Syntax Notation One (ASN.1): Specification of basic notation — Part 1*

ISO/IEC 8825-2, *Information technology — ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)*

ISO/IEC 18000-6, *Information technology — Radio frequency identification for item management — Part 6: Parameters for air interface communications at 860 MHz to 960 MHz General*

3 Terms, definitions and numerical notations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21007-1 and the following apply.

3.1.1
bit rates
number of bits per second, independent of the data coding

3.1.2
carrier frequency
centre frequency of the downlink/uplink band

3.1.3
construct
one or more primitive constructs to form an ASN.1 message

3.1.4
data coding
coding that determines the baseband signal presentation, i.e., a mapping of logical bits to physical signals

Note 1 to entry: Examples are bi-phase schemes (Manchester, Miller, FM0, FM1, differential Manchester), NRZ and NRZ1.

3.1.5
modulation
keying of the carrier wave by coded data described in accordance with commonly understood methodologies (amplitude shift keying, frequency shift keying)

3.1.6
octet
set of eight binary digits (bits)

3.1.7
power limits within communication zone
limits that determine the minimum and maximum values of incident power referred to a 0 dB antenna in front of the tag

Note 1 to entry: These two values also specify the dynamic range of the tag receiver. Power values are measured without any additional losses due to rain or misalignment.

3.1.8
registration body
organization entitled to issue and keep track of issuer identification

Note 1 to entry: For examples, see Annex B.

3.1.9
tolerance of carrier frequency
maximum deviation of the carrier frequency expressed as a percentage

3.2 Numerical notations

The numerical notations used in this part of ISO 21007 are as follows:

— decimal ("normal") notation has no subscript, e.g. 127;

— hexadecimal numbers are noted by subscript 16, e.g. $7F_{16}$;

— binary numbers are noted by subscript 2, e.g. 01111111_2.

4 Data presentation

4.1 General requirements

The data element construct determined in this part of ISO 21007 is an “enabling” structure. It is designed to accommodate within its framework, data element constructs for a variety of GC applications, from simple GC identification to more complex transactions with a wide variety of uses, and to allow combinations of data elements to be used in a composite data construct. It is designed to allow as much interoperability of the data elements within an electronic data interchange/electronic data transfer (EDI/EDT) environment as is possible and has to provide a capability for a significant expansion of the number of GC applications in the future.

This part of ISO 21007 takes cognizance of and accommodates the operation of systems of different capabilities and will enable within its structure the interoperability of one transponder in any country, even though the operator systems themselves may be significantly different, so long as there is a common air interface (at reference point Delta) and protocol. Even where information has to be collected by a separate interrogator because air carrier compatibility does not exist, the data once collected is in a commonly interoperable format and so may be used accurately and effectively within an EDI/EDT environment.

The data element structure defined in this part of ISO 21007 specifies the general presentation rules for transfer of ASN.1 data schemes. It is also the purpose of this part of ISO 21007 to determine how ASN.1 will be used for data transmission in GC applications.

Excluding transfers in a predefined context, the first level of identification required in ASN.1 messages identifies the context of the message. This part of ISO 21007 determines that in GC applications this is achieved by using an object identifier that shall be determined in accordance with an arc determined in ISO/IEC 8824-1:2008, Annex B.

The objective of this part of ISO 21007 is therefore to establish a basis where the message can always be identified simply by reference to the relevant standard and without the requirement of central registration authorities (except where those are specifically required in the referred-to document).

4.2 ASN.1 messages

Where there is a simple message where no further subdivision according to ASN.1 rules is possible, the message is called an ASN.1 “primitive message”. Such messages will have only one identification and length statement. The GC identification structure defined in ISO 21007-1:2005, Clause 3 is an ASN.1 primitive message.

4.3 Message identification requirements

The data constructs shall conform to ISO/IEC 8824-1.

With the exception of transfers in a predetermined context (see 4.4):

— All GC standard ASN.1 messages shall commence with a unique object identifier that shall be determined in accordance with the arc 2 (joint ITU-T), followed by the object class indicating a standard arc 0, followed by the reference to the standard:

{ ITU-T)(2) standard(0) standardxxx(yyy) }

— Where the data content relates to standards produced by other identified organizations, they shall commence with a unique object identifier that shall be determined in accordance with the arc 2 (joint ITU-T), followed by the identification of an identified organization arc 3, followed by the identification of the identified organization (as provided in Annex B), followed by the object class indicating a standard arc 0, followed by the reference to the standard:

{ ITU-T(2) identified-organization (3) organization-identity(xxx) standard(0) standardxxx(zzz) }

4.4 Predetermined context and the use of packed encoding rules

Where the context of a transfer is known, the data constructs determined in this part of ISO 21007 may be assumed to be in accordance with the rules determined in ISO/IEC 8825-2.

In respect of any identification of an item using an ISO ASN.1 message, the data necessary for unambiguous identification shall reside on the on-board equipment associated with the item being identified.

4.5 Sample GC data structure constructs

The ISO complete ASN.1 format is as follows:

octet 0	octet 1	octet 2	octet 3–4	octet 5-xx
02_{16}	20_{16}	00_{16}	ISO standard reference	GC identification structure

The predetermined GC context follows:

octet 0-yy
GC identification structure

5 Gas cylinder identification structure (variable)

5.1 General requirements

The general requirement of the structure proposed shall be that it is constructed from one or more data elements to form an ASN.1 message.

Each of these data elements shall be preceded by 2 octets that identify

a) the data scheme identifier (also referred to as DSI), and

b) the length of the data field.

Data scheme identifier (1 octet)	Length of data field (1 octet)	Data field

This part of ISO 21007 has been designed by adopting the principles of ISO/IEC 8824-1 and ISO/IEC 8825-2, which utilize octets (bytes) of data elements to provide an application identifier, a coding identifier and a length/use identifier in an “abstract syntax notation” for “open systems interconnection”.

By adopting the ISO/IEC 8824-1 and ISO/IEC 8825-2 abstract syntax notation with the inclusion of a data element length indicator, the flexibility is provided for data elements of any length to be supported. This data structure standard is itself given a migration path so that as technological developments allow further capabilities, subsequent standards may provide additional data fields for use in all or some sector-specific applications while maintaining the upwards compatibility from and to this part of ISO 21007.

The structure enables the chaining of multiple data elements from different application sectors to build complex data element constructs. For example, a GC identification shall be followed by an ISO country code, or perhaps a GC identification followed by a transient data set of the current contents, fill date and location followed by a country identifier, etc.

It is expected that several data element structures will start with a GC identification data element.

5.2 Data structure construct

5.2.1 General

The data structure construct is as follows:

Data scheme identifier	Length of data field	Data field	Data scheme identifier	Length of data field	Data field

5.2.2 Data scheme identifier (DSI)

The octet used for the data scheme identifier shall be used to identify to which of the standardized GC coding scheme data formats the data element construct conforms.

Each number issued shall be supported by an ISO format standard detailing the data scheme that is to be used within that format.

NOTE Clause 6 details the initial list of primitive data scheme allocations.

5.2.3 Length

The length octet shall determine the number of octets in the subsequent data fields. It shall be a length indicator as defined in ISO/IEC 8825-2.

For coding, this field will be kept to less than 127, i.e. 1-byte length is expected. For constructs, the extension bit may be used to signify a 3-byte length indicator.

5.2.4 Data field

The data field shall follow the number of octets of data that comprises the data field as determined in the previous octet.

The data structure of the data field shall be defined in a series of standard data formats issued and published by the gas cylinder data scheme issuing authority and forming subordinate standards in support of this part of ISO 21007.

This field may also contain constructs of primitives as defined in ISO/IEC 8824-1 and ISO/IEC 8825-2.

6 Gas cylinder identification data schemes (variable)

6.1 General requirements

The essence of the general requirement of GC systems is constructed around a basic core unambiguous identification. This GC identification numbering scheme provides a "fixed" core unambiguous identification element.

It is envisaged that this core element of unambiguous identification will form the first data set of one or many data sets in a GC environment using data structures that comply with the structure established in ISO 21007-1.

Either data scheme "01" or data scheme "02" shall be used in accordance with 6.2 or 6.3, respectively. In addition, data schemes "10", "11", "12", etc., may optionally be used (see Table 1).

This data structure is designed to be used not only as a form for simple GC identification, but to form the GC identification element of all standard GC messages where GC identification is a component. To this extent, while this part of ISO 21007 has been primarily designed for use in a transponder/interrogator environment, it is expected that other GC systems, while they use different transmission media and effect similar data exchanges, shall adopt this standard numbering scheme.

Table 1 — GC primitive data scheme identifiers

Data scheme number	Data scheme identifier	GC data scheme
0	40_{16}	Non-standard scheme
01	41_{16}	GC numbering scheme (binary)
02	42_{16}	GC numbering scheme (ASCII)
10	$4A_{16}$	GC manufacturer information
11	$4B_{16}$	GC approval information
12	$4C_{16}$	GC package information
13	$4D_{16}$	GC content information
14	$4E_{16}$	GC commercial product information
15	$4F_{16}$	GC production lot information
16	50_{16}	GC accessories information
20	54_{16}	GC acetylene specifics

This compact numbering data scheme can be replaced or combined with a more versatile identification scheme allowing the use of existing non-numeric gas cylinder identifications. This alternate unambiguous identification data set will be given the DSI appellation: data scheme “02”.

Other data schemes concerning the package and content of gas cylinders proposed in 6.4 to 6.11 provide capability for other applications that simplify GC identification.

The data scheme identifier (DSI) is described in Table 1; the length is the number of bits of the information field. 6.2 to 6.11 give some examples for the content of these data schemes. 6.2 and 6.3 describe the minimum definition for the unique identification number of a GC. The choice is between a binary (6.2) and an ASCII (6.3) version. All other definitions in 6.4 to 6.11 are optional.

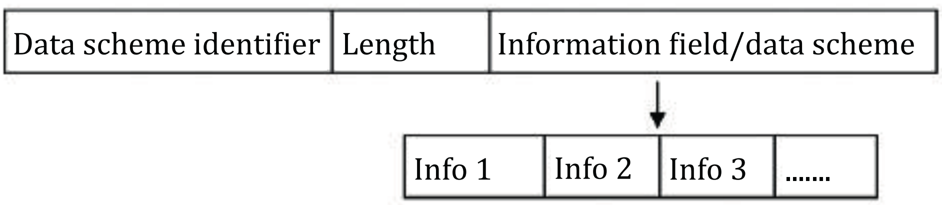


Figure 1 — Flow chart for principles of 6.2 to 6.11

6.2 Data scheme “01”: numbering (binary)

6.2.1 General

If data scheme “01” is used, the unique number shall be coded in binary format as indicated below.

The format provides a transponder code mandatory field providing specific adaptation to the requirements for GC identification in the GC environment.

The code length is 64 bits or more and will be preceded by 2 octets that identify, respectively, the GC DSI (i.e. 41_{16} primitive) and the code length in octets (i.e. 08_{16} or more).

The data scheme “01” structure is as follows:

Data scheme identifier	Length	Unique number data field
41_{16}	08_{16} or more	

The third field contains the GC unambiguous identification number.

The following structure details the elements and content of the unambiguous data structure and is to be read in conjunction with the notes shown following the structure.

To allow a large number of unique cylinder numbers, the unique number data field shall have the following structure:

ISO 3166-1 issuer country code	Registration body	Issuer identifier	Service number/unique number

6.2.2 Issuer country code

The issuer country code as specified by ISO 3166-1 is as follows:

	Bits	Variables	Type
(binary 0–4 095)	12	4 096	Binary

e.g., 276 for Germany.

6.2.3 Registration body

The registration body is as follows:

	Bits	Variables	Type
(binary 0–15)	4	16	Binary

e.g., 02 for EIGA (see Annex B).

6.2.4 Issuer identifier

The issuer identifier is as follows:

	Bits	Variables	Type
(binary 0–16 772 215)	24	16 772 216	Binary

e.g., 123 for gas supplier 123.

6.2.5 Unique number

A unique number within each country specified by ISO 3166-1 shall be allocated by a registration body (see Annex B).

	Bits	Variables	Type
(binary 0–16 772 215 or more)	24	16 772 216 or more	Binary

e.g., 12345678.

6.2.6 Conclusion

In the above example, the minimum information for the gas cylinder would be:

2760212312345678.

6.3 Data scheme “02”: numbering (ASCII)

6.3.1 General

If data scheme “02” is used, the unique number shall be coded in ASCII format as indicated below.

The format provides a transponder code mandatory field providing specific adaptation to the requirements for GC identification in the GC environment.

The code length is 40 bits plus unique string length and will be preceded by 2 octets that identify, respectively, the GC DSI (i.e. 42_{16} primitive) and the code length in octets (i.e. 05_{16} plus string length).

The data scheme “02” structure is as follows:

Data scheme identifier	Length	Unique number data field
42_{16}	05_{16} + string length	

The third field contains the GC unambiguous identification number.

The following structure details the elements and content of the unambiguous data structure and is to be read in conjunction with the notes following the structure.

The unique number data field is as follows:

ISO 3166-1 issuer country code	Registration body	Issuer identifier	Service number/unique number

6.3.2 Issuer country code

The issuer country code as specified by ISO 3166-1 is as follows:

	Bits	Variables	Type
(binary 0–4 095)	12	4 096	Binary

6.3.3 Registration body

The registration body is as follows:

	Bits	Variables	Type
(binary 0–15)	4	16	Binary

6.3.4 Issuer identifier

The issuer identifier is as follows:

	Bits	Variables	Type
(binary 0–16 772 215)	24	16 772 216	Binary

A unique number within each country specified by ISO 3166-1 shall be allocated by a registration body (see Annex B).

6.3.5 Unique string

A unique string provides a unique service/number issued by the operator. Strings should include alphanumeric characters only, excluding accented characters or special symbols such as "-" or blank [i.e. 26 roman uppercase alphabetic letters (A to Z) plus 10 (0 to 9) numeric characters] and shall be as follows:

	Bits	Variables	Type
(8 bit characters ASCII string)	96	2 176 782 336 or more	ASCII

6.3.6 Conclusion

This concept would deliver a similar minimum data field as defined in 6.2, but could have ASCII strings at the end. An example would be:

27602123ABCDEFGH.

6.4 Data scheme "10": cylinder manufacturer information (optional)

6.4.1 Overview

6.2 and 6.3 provide examples for the minimum identification of a gas cylinder. Typically, additional information is provided as outlined below.

6.4.2 General

Data scheme "10" determines the form of the data field content, for GC identification for DSI 10 of ISO 21007-1. The data scheme "10" structure is as follows:

Data scheme identifier	Length	Cylinder manufacturer information data field
$4A_{16}$	40_{16} or more	

This part of ISO 21007 defines the content for the third field as the following:

— the cylinder manufacturer identification number;

— the manufacturing serial number of the cylinder.

The following structure details the elements and content of the data structure and is to be read in conjunction with the notes following the structure.

The cylinder manufacturer information data field is as follows:

Manufacturer code	Manufacturer serial number

6.4.3 Manufacturer code

To allow this small binary structure, codes for the different manufacturers were developed. See ISO/TR 17329 for these codes.

	Bits	Variables	Type	Default value
(binary 0–131 071)	17	131 072	Binary	0

NOTE In addition, although it is 16 bit by ISO standards, this field is extended to 17 bits to allow the code to designate the country.

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Manufacturer of cylinder																

6.4.4 Manufacturer serial number

The manufacturer serial number is an alphanumeric field allocated by the manufacturer and readable on the cylinder in accordance with ISO 13769.

	Bits	Variables	Type
(8 bit characters ASCII string)	48 or more	2 176 782 336 or more	ASCII

Strings should include alphanumeric characters only, excluding accented characters or special symbols such as "-" or blank [i.e. 26 roman uppercase alphabetic letters (A to Z) plus 10 (0 to 9) numeric characters].

The recommended length of this DSI unique data element is 64 bits (with a 6-character manufacturer serial number) or more.

6.5 Data scheme "11": cylinder approval information (optional)

6.5.1 General

Data scheme "11" determines the form of the data field content, for GC identification for DSI 11 of ISO 21007-1.

The data scheme "11" structure is as follows:

Data scheme identifier	Length	Cylinder approval information data field
$4B_{16}$	10_{16}	

The third field contains information about the countries where the cylinder is approved.

The following structure details the elements and content of the data structure and is to be read in conjunction with the notes following the structure.

The cylinder approval information data field is as follows:

ISO 3166-1 country code	Type approval

6.5.2 Country code

The country code specified by ISO 3166-1 is as follows:

	Bits	Variables	Type
(binary 0–65 535)	17	65 536	Binary

This field contains the code for the country where the cylinder is approved. ISO 3166-1 provides the 900 to 999 codes range for private uses. In the context of this International Standard, 900_{10} is reserved to indicate a European approval, 901_{10} to 999_{10} can be used to build private groups of countries, for cylinders having several approval stamps and not a European approval.

The recommended length of this DSI unique data element is 16 bits.

6.6 Data scheme "12": cylinder package information (optional)

6.6.1 General

Data scheme "12" determines the form of the data field content, for GC identification for DSI 12 of ISO 21007-1.

The data scheme “12” structure is as follows:

Data scheme identifier	Length	Cylinder package information data field
$4C_{16}$	44_{16}	

The third field contains the water capacity, working pressure, tare weight and last test date of the cylinder.

The following structure details the elements and content of the data structure and is to be read in conjunction with the notes following the structure.

The cylinder package information data field is as follows:

Water capacity	Working pressure	Tare weight	Last test date

6.6.2 Water capacity (l)

The water capacity is a numeric field indicating the water capacity, in litres, in accordance with ISO 13769 in a specific compact decimal floating point coding:

	Bits	Variables	Type
	(float)	12	Real

Numbers are noted as $x \times 10^y$ with x ranging from 0 to 255 and y ranging from −7 to +7. The 12-bit field is coded as follows.

The 8 most significant bits (0 to 7) are used for the mantissa (x) coded in binary, bit 8 is used for the sign of the exponent (0 = +, 1 = −), and the 3 least significant digits are used for the exponent y (power of 10).

EXAMPLE

1	0	0	1	0	1	1	1	1	0	0	1
x								±	*y*		

represents 151×10^{-1}, or 15,1 in decimal ($10010111_2 = 151_{10}$)

6.6.3 Working pressure (bar)

The working pressure is a numeric field indicating the working pressure, in bar, in accordance with ISO 13769:

	Bits	Variables	Type
	(float)	12	Real

6.6.4 Test pressure (bar)

The working pressure is a numeric field indicating the working pressure, in bar, in accordance with ISO 13769:

	Bits	Variables	Type
	(float)	12	Real

6.6.5 Tare weight (kg)

The tare weight is a numeric field indicating the tare weight, in kilograms.

	Bits	Variables	Type
	(float)	12	Real

6.6.6 Last test date

The last test date is a numeric field indicating the last test date of the cylinder:

	Bits	Variables	Type
	(date)	24	Date

The date is coded as YYYYMMDD, on a 24-bit data structure. Bits 19 to 23 (5 least significant bits) are used to code the day number in binary (1 to 31), bits 15 to 18 are used to code the month number in binary (1 to 12) and bits 0 to 14 are used to code the year in binary.

EXAMPLE

0	0	0	0	1	1	1	1	1	0	0	1	1	1	1	0	1	1	1	1	1	1	0	0
Year: 1999															Month: 07				Day: 28				

represents the 28th of July 1999.

The length of this DSI data element is 60 bits ($3C_{16}$).

6.7 Data scheme “13”: cylinder content information (optional)

6.7.1 General

Data scheme “13” determines the form of the data field content, for GC identification for DSI 13 of ISO 21007-1.

Data scheme “13” structure is as follows:

Data scheme identifier	Length	Cylinder content information data field
$4D_{16}$	28_{16}	

The third field contains the content UN number code and the fill date of the cylinder.

The following structure details the elements and content of the data structure and is to be read in conjunction with the notes following the structure.

The cylinder content information data field is as follows:

Content code (UN number)	Fill date

6.7.2 Content code

The content code is an alphanumeric field containing the UN number code for the content of the cylinder:

	Bits	Variables	Type
(binary 0–65 535)	16 or more	65 636 or more	Binary

6.7.3 Fill date

The fill date is a date field indicating the date the cylinder was filled (see 6.6.6 for date coding):

	Bits	Variables	Type
	(date)	24	Date

The length of this DSI data element is 40 bits (28_{16}) or more.

6.8 Data scheme “14”: commercial product information (optional)

6.8.1 General

Data scheme “14” determines the form of the data field content, for GC identification for DSI 14 of ISO 21007-1.

The data scheme “14” structure is as follows:

Data scheme identifier	Length	Commercial product information data field
$4E_{16}$	48_{16} or more	

The third field contains the commercial product ID and, optionally, lot number and expiration date.

The following structure details the elements and content of the data structure and is to be read in conjunction with the notes following the structure.

The commercial product information data field is as follows:

Quantity	Quantity unit	Product ID

6.8.2 Quantity

Quantity is a numeric field containing the quantity of product (gas) sold with the cylinder:

	Bits	Variables	Type
(binary 0–4 095)	12	4 096	Binary

6.8.3 Quantity unit code

Quantity unit code is a numeric field indicating the engineering unit used for the previous quantity (see Annex C):

	Bits	Variables	Type
(binary 0–4 095)	12	4 096	Binary

6.8.4 Product ID

Product ID is an alphanumeric field (5 characters or more) referencing the commercial product sold with the cylinder:

	Bits	Variables	Type
(8 bit characters ASCII string)	40 or more	2 176 782 336 or more	ASCII

Strings should include alphanumeric characters only, excluding accented characters or special symbols such as “-” or blank [i.e. 26 roman uppercase alphabetic letters (A to Z) plus 10 (0 to 9) numeric characters].

The length of this DSI data element is 64 bits (40_{16} or more).

6.9 Data scheme “15”: production lot information (optional)

6.9.1 General

Data scheme “15” determines the form of the data field content, for GC identification for DSI 15 of ISO 21007-1.

The data scheme “15” structure is as follows:

Data scheme identifier	Length	Lot information data field
$4F_{16}$	48_{16} or more	

The third field contains the commercial product ID and, optionally, lot number and expiration date.

The following structure details the elements and content of the data structure and is to be read in conjunction with the notes following the structure.

The lot information data field is as follows:

Expiration date	Lot ID

6.9.2 Expiration date

Expiration date is a numeric field containing the expiration date of the cylinder (see 6.6.6 for date coding):

	Bits	Variables	Type
	(date)	24	Date

6.9.3 Lot ID

Lot ID is an alphanumeric field (6 characters or more) referencing the cylinder filling lot identifier:

	Bits	Variables	Type
(8 bit characters ASCII string)	48 or more	2 176 782 336 or more	ASCII

Strings should include alphanumeric characters only, excluding accented characters or special symbols such as “-” or blank [i.e. 26 roman uppercase alphabetic letters (A to Z) plus 10 (0 to 9) numeric characters].

The length of this DSI data element is 72 bits (48_{16}) or more.

6.10 Data scheme “16”: accessories information (optional)

This data scheme will contain information about accessories with which the cylinder is equipped (valve, connector, fittings).

6.11 Data scheme “20”: acetylene specifics (optional)

6.11.1 General

Data scheme “20” determines the form of the data field content, for GC identification for DSI 20 of ISO 21007-1.

The data scheme "20" structure is as follows:

Data scheme identifier	Length	Acetylene specifics
54_{16}	8_{16}	

The third field contains information about the porous mass for acetylene cylinders.

The following structure details the content of the data structure and is to be read in conjunction with the notes following the structure.

Acetylene specifics are as follows:

Porous mass characteristics

6.11.2 Porous mass characteristics

Porous mass characteristics is a numeric field providing characteristics of the porous mass:

	Bits	Variables	Type
(binary 0–255)	8	256	binary

Bit 0 (most significant bit) is used to define a non-monolithic/monolithic attribute of the porous mass. Bit 0 = 0: non-monolithic, bit 0 = 1: monolithic.

The length of this DSI data element is 8 bits (8_{16}).

Additional information can be stored per cylinder package. This is limited only by the storage capacity of the RFID tag and the requirement for the reading/writing speed.

7 Gas cylinder identification structure (optimized storage size)

7.1 General

The concept described in Clause 6 has the advantage to deliver a very flexible system. Each user can decide how much information is used and/or stored onto the RFID tag. The standardized reading protocol allows each reader to manage this flexibility.

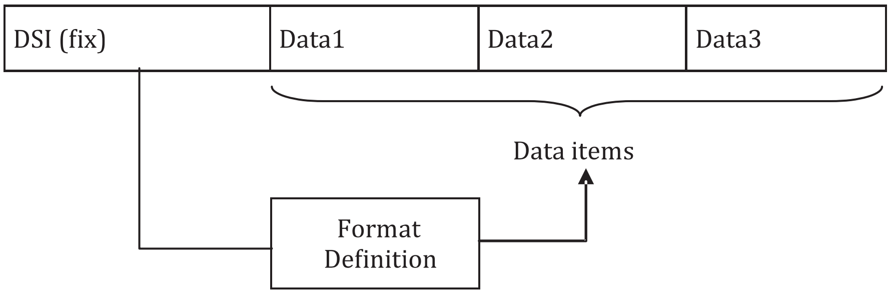
Another approach is to use only one data scheme identifier and predefine the following bits in detail by the user. Annex E provides such an example for an application from the Japanese Industrial and Medical Gases Association (JIMGA).

This will require "translation mechanisms" when trade across different regions/countries is desired.

7.2 Data structure construct

7.2.1 General

Fixed-length-data format is a system that accesses the data item of fixed-length-data format. Such a concept should appear as follows:



7.2.2 DSI (fix)

The DSI identification number defines the storing format of cylinder information and is always set as the head of a user memory area.

7.2.3 Data item attribute

Each data item shall define the attribute of item number, item name, data type, data offset, data length and default value. Table 2 describes these attributes.

Table 2 — Data item attributes

Attribute	Description
Item no.	Unique number for every item in a format
Item name	Name of a data item is described
Data type	ASCII, binary or decimal
Data offset	Starting position of a data item
Data length	Length of a data item
Default value	Default value when formatting a tag

Annex E provides an example for such structure described in detail.

7.2.4 Remarks

The above-mentioned system will deliver an optimized storage concept.

8 Air interface specifications

8.1 Technical requirements

RFID systems used in the GC sector use different frequencies. GC RFID application standards specify the use of a limited number of air interfaces.

However, where the same frequency is used, the standard air interface parameters are defined in 8.3 to ensure minimum physical interoperability.

Other parameters listed in 8.3 shall be fully documented.

Standard parameters correspond to layer 1 (physical communication layer) in the OSI convention. Conformance will allow communication between a standard interrogator and multiple tag/transponders, provided that the interrogator is driven by appropriate software. However, OSI communication layers 2 and above shall be fully documented for each standard tag/transponder technology.

8.2 Downlink and uplink

Communication for information from reader/interrogator to tag is considered as “downlink”.

Communication for information from tag to reader/interrogator is considered as “uplink”.

8.3 Standard downlink/uplink parameters

Standard GC parameter sets are as follows:

Carrier frequency	125 kHz	13,56 MHz
Tolerance of carrier frequency	±0,01 % (downlink) ±3 % (uplink)	±0,01 % (downlink) ±1,6 % (uplink)
Modulation	ASK	ASK
Data coding	Manchester	Miller
Power limits within communication zone	67 dBµA/m at 10 m or 77 dBµA/m at 3 m	42 dBµA/m at 10 m or 52 dBµA/m at 3 m
Bit rate (kbps)	≤8	26

Additional carrier frequencies have been developed (see ISO/IEC 18000-6).

Parameter		Type A	Type B	Type C
Carrier frequency (MHz)		860–960		
Uplink	Modulation	Bi-state Amplitude Modulated Backscatter		ASK and/or PSK
	Data coding	FM0		FM0 or Miller
	Bit rate (kbps)	40–160	40–160	40–640
Downlink	Modulation	AM	AM	DSB-ASK SSB-ASK PR-ASK
	Data coding	PIE	Manchester	PIE
	Bit rate (kbps)	33	10 or 40	26,7–128

9 Transponder memory addressing

9.1 General requirements

Beyond conformance to the air interface specification of this part of ISO 21007 enabling physical communication at OSI layer 1 to achieve interoperability, RFID systems used in the GC sector should adopt common rules for accessing standard GC data sets. A specific concern is transponder/tag memory addressing. Different transponders/tags include different features such as passwords, control zones and transponder/tag serial numbers. Application addressable memory areas thus have different address limits, making it inappropriate to adopt a fixed address for GC data sets.

The situation is the same whether using predetermined context rules or not (see 4.3 and 4.4). The ISO/IEC 8824-1 notion of “message” cannot directly be extracted from actual transponder memory mappings.

It is proposed, therefore, that interoperability is achieved at interrogator level by software features (reference point Zeta).

The communication protocol between host and interrogator shall include a layer of “virtual transponder/tag addressing” that will be transponder/tag independent.

The GC data sets will be accessed at fixed virtual addresses using that protocol. The interrogator will translate or offset these fixed virtual address access requests into transponder-/tag-dependent requests at point Delta after identification of the actual transponder/tag technology. This protocol shall be fully documented by interrogator vendors. Fixed virtual addresses shall be allocated by an issuing authority appointed by the standardization authority and will form subordinate standards in support of this part of ISO 21007.

9.2 Modbus/JBUS implementation

Annex D provides an example of a framework for implementing a virtual tag addressing area when using the *de facto* standard Modbus protocol between the interrogator and a host.

In such a context, it is proposed that for read-only tags, standard GC data sets start at virtual address 0000h, and for read/write tags, standard GC data sets start at address 0040h, leaving room for communication control headers such as checksums, tag mapping version control, etc.

Annex A
(normative)

Technical solution

Companies need to develop their own operational standard when dealing with tagged cylinders.

The following are given as examples of some operational concerns.

— The tag could be located on the cylinder shoulder, neck ring, valve guard or any other suitable location.

— The choice of technology and location can have an influence on the performance of the tag.

— The tag and its protection (if relevant) shall be compatible with the intended service conditions, e.g. temperature (including during maintenance if relevant), mechanical impact and load, corrosion, etc.

— Care shall be taken that a damaged tag does not result in some illegible data.

— New requirements for bulk reading (several RFID tags at the same time) need new frequencies, other energy basis, etc.

— Reading range also should be defined to prevent the reading of the cylinder located beside the "to be read" container/group of containers.

Annex B
(informative)

List of codes for registration bodies

Name	Code
EAN	01
EIGA	02
KGS	03
JIMGA	04

NOTE Any body can apply to ISO/TC 58/SC 4 to be included in this list.

Annex C
(informative)

Gas quantity units code

Unit	Code
kilogram (kg)	0
“normal” m^3 for ideal gas (amount of gas in 1 m^3 at 0 °C and 1 013 mbar)	1
“standard” m^3 for ideal gas (amount of gas in 1 m^3 at 15 °C and 1 013 mbar)	2
“normal” m^3 for actual gas	3
“standard” m^3 for actual gas	4
litre (l)	5
“standard” m^3 for ideal gas (amount of gas in 1 m^3 at 35 °C and 1 013 mbar)	6

Annex D
(informative)

Host to interrogator to Modbus communication protocol

D.1 General

The communication protocol between a host (hand-held computer or fixed field device such as a PLC) and one or more tag reader is a standard Modbus protocol where the host is the master and the tag readers are slaves, identified by a unique address from 00h to FFh.

D.2 General format of Modbus frames

Command:

Address	Function	Parameters	CRCh	CRCl

Correct answer:

Address	Function	Parameters	CRCh	CRCl

Error:

Address	Function+80h	Parameters	CRCh	CRCl

D.3 Function codes

01 and 02	read 1 bit
03 and 04	read 1 word
05	write 1 bit
06	write 1 word
0F	write N bits
10	write N words

D.4 Tag reader access

D.4.1 Modbus slave number access

The first byte at address 8000h is the Modbus address of the device. It can be rewritten using 06 function in single drop (RS 232C) only. The device address is preset by the manufacturer to 80.

Command:

80	06	80 00 00 New address	CRCh	CRCl

Answer:

80	06	80 00 00 New address	CRCh	CRCl

D.4.2 Communication parameter register

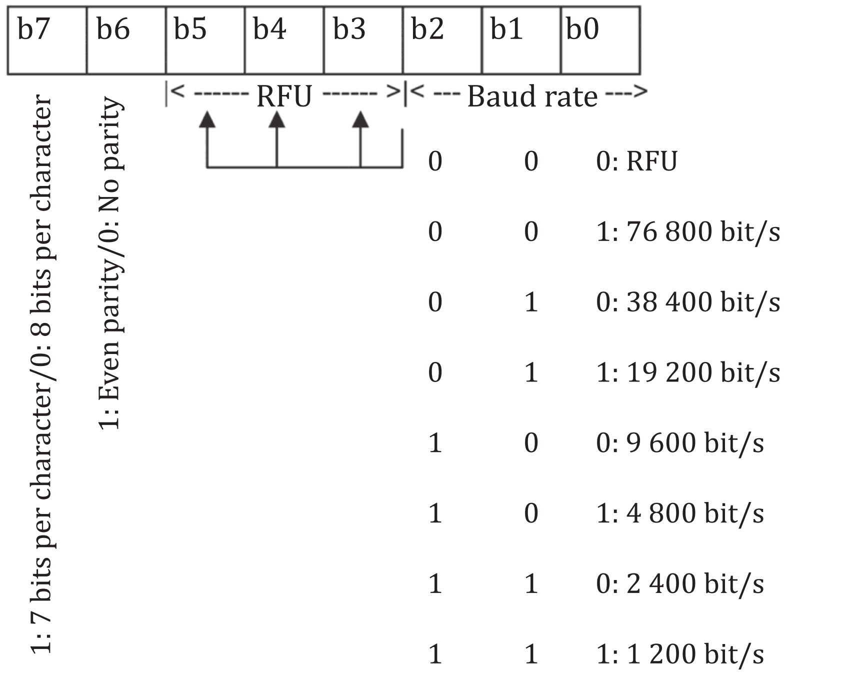
This 8-bit register at address 7FFBh will be used to set reader communication parameters depending on the actual physical link used (serial, IrDA). For instance for a serial link, this register could be used as follows:

Command:

80	06	7F FB CB XX	CRCh	CRCl

The line is immediately reconfigured when the command is executed, without acknowledgement.

CB bits details:



The least significant octet in the word (designated as XX) is ignored.

D.4.3 Reader status registers

Tag reader statuses are available as bit registers at addresses 7FF0h to 7FF7h. Each bit register can be read or forced to control the reader status from the Modbus master.

Sample implementation:

7FF0h	Red LED: 1 = on ; 0 = off
7FF1h	Green LED: 1 = on ; 0 = off
–––	
7FF7h	

D.4.4 Tag operations registers

Tag select is a 16-bit word at address 7FF8h. It can be written using function 06 to execute select tag and reset operations.

The 8 most significant bits designate tag type, for example:

— 01 = tag brand 1, type 1;

— 02 = tag brand 1, type 2;

— auto detection.

For auto detection operation (code 10), actual tag type can be re-read in tag type octet.

The 8 least significant bits are used for detection time out.

Time out parameter values range from 0 to 255 and are multiples of 50 ms if time base is 0, or multiples of time base.

Time base is a 16-bit word at address 7FF9h containing a time unit for time out in milliseconds, only the least significant octet is used (the most significant octet is set to 00h).

D.4.5 Tag control registers

D.4.5.1 Tag password and **new password** registers are write-only accessible.

With actual tag technologies, passwords have indivisible length (32, 56 bits). Only multiple word write function (Modbus code 10) with the appropriate field length is available in these registers.

Writing in password register is equivalent to using the password or login or similar tag-dependent function.

The tag password register address is 7FE0h, the tag new password register is at 7FE1h.

D.4.5.2 Tag serial number and **tag identification**, when available, are word read-only registers of variable length at 7FE2h and 7FE3h, accessible with Modbus 03 or 04 function codes.

D.5 Tag access

The tag addressing area, seen from the protocol, ranges from 0000h to 7CFFh (9k). It may be extended to upper segments above 7FFFF without change in the protocol. The Modbus word functions (03, 04, 06, 10) are available.

Read N Word

Adr	03 or 04	AdrH AdrL 00 NWord	CRCh	CRCl

Answer:

Adr	03 or 04	AdrH AdrL Nbyte DATA(Nword*2 bytes)	CRCh	CRCl

Write 1 Word

Adr	06	AdrH AdrL DATA(2 bytes)	CRCh	CRCl

Answer:

Adr	06	AdrH AdrL DATA(2 bytes)	CRCh	CRCl

Write N Word

Adr	10	AdrH AdrL 00 NWord Nbyte DATA (NWord*2 bytes)	CRCh	CRCl

Answer:

Adr	10	AdrH AdrL 00 NWord	CRCh	CRCl

Bit and word level read and write are available, whatever the actual tag memory segmentation technology. The tag reader performs the necessary tag commands to achieve apparent bit and word operations.

For instance, if a given tag type can be read/written only by “blocks” of 32 bits, the actions performed by the tag read receiving a “write 1 word” command could be the following:

— read one 32-bit tag block into reader memory;

— mask 16 unwritten bits and modify the other 16 bits in reader memory;

— write modified block into tag memory.

The same logic applies for bit read/write operations in tag registers.

D.6 Error codes

Code	Description
01h	Invalid function code
02h	Invalid address
03h	Invalid data
04h	Others

D.7 Global reader + tag memory mapping

Address	Zone	Definition	Type
0000h	User data	Tag memory area	r/w - bit/word
–––	–––	–––	–––
–––	–––	–––	–––
–––	–––	–––	–––
7CFFh	User data	–––	–––
7D00h	<RFU>		
–––			
7DBFh	<RFU>		
7DC0h	Password	Login/password	w - 64 bits word
7DC1h	New password	New password	w - 64 bits word
7DC2h	Tag SN	Serial number (if available)	r - word
7DC3h	Tag ID	Identifier (if available)	r - word
7DC4h	<RFU>	-	-
7DC5h	<RFU>	-	-
7DC6h	Modbus version	Read Modbus driver version number	r - word
7DC7h to 7DCEh	Tag driver version	Read tag driver active version number	8 r - word
7DCFh	<RFU>		
7FF0h	Reader parameters	Specifics: LEDS, buttons, standby, ...	r/w
–––			
7FF7h			

7FF8h	Select tag and reset	Type = xxh or 10h (auto detect)	r/w - word
7FF9h	Time-base	Time-base (ms) for time-out	r/w - word
7FFAh	<RFU>		w - word
7FFBh	Communication parameters	According to CB settings	w - word
–––			w - bit
7FFFh			w - byte

8000h	Reader slave number		r/w - byte
8001h	User data		–––

Annex E
(informative)

Data scheme identifier (DSI) definition for fixed length format

E.1 General

E.1.1 Method to identify format ID

Since each format ID issued by a registration body is unique, the combination of the organization code and the format ID should be handled as a unique code. The organization code shall be applied with the unique code issued by the standards organization (ISO or EPC), in accordance with the protocol-control (PC) bits in the UII memory bank defined by ISO/IEC 18000-6.

E.1.2 List of organization code and format ID

Table E.1 lists the definition of format ID in countries or registration bodies.

Table E.1 — List of organization code and format ID

Registration body	Organization code	Standards organization	Format ID	Format type	User area
JIMGA (Japan Industrial and Medical Gases Association)	456036533	EPCglobal™	27	Format ver.3	512 bits

E.2 JIMGA format

E.2.1 General

This format is defined by JIMGA as a common format in Japan.

Table E.2 — RF tag required specification

Item	Description
Correspondent standard	ISO/IEC 18000-6 Type C (Class1 Gen2 conformity)
UII	GRAI96
User memory	512 bits (64 bytes)
Communication range	When it is mounted to metal gas cylinder, reading shall be available in 2,5 m with the frequency band in Japan. 16-bit data can be written within 1 s from the distance of 1 m or more. (For either case, transmitting output is 1 W.)

E.2.2 List of data items and memory address

Table E.3 — List of data item and memory address for JIMGA format Ver.3

Item no.	Item name	Type	Offset	Bits
1	Reserved	Binary	0	16
2	Format ID	Binary	16	8
3	GC class (optional)	Binary	24	8
4	GC symbol	ASCII	32	48
5	GC number	ASCII	80	48
6	GC manufacturer code (optional)	Binary	128	17
7	Gas kind (optional)	Binary	145	15
8	GC owner’s phone number (optional)	Decimal	160	32
9	GC expiration date (optional)	Binary	192	16
10	GC owner code (optional)	Binary	208	18
11	Notice code/“No oil allowed,” toxicity, etc. (optional)	Binary	226	11
12	Last pressure retest date of GC (optional)	Binary	237	11
13	Fill volume unit (optional)	Binary	248	3
14	Reserved	Binary	251	5
15	Tare weight (optional)	Binary	256	16
16	Fill volume (optional)	Binary	272	16
17	Fill date (optional)	Binary	288	16
18	Fill pressure (optional)	Binary	304	12
19	Expiration date of content filled (optional)	Binary	316	16
20	Fill station ship date (optional)	Binary	332	16
21	Return due date (optional)	Binary	348	16
22	Dealer ship date (optional)	Binary	364	16
23	GC delivery date (optional)	Binary	380	16
24	Empty GC collection date (1) (optional)	Binary	396	16
25	Empty GC collection date (2) (optional)	Binary	412	16
26	Operator code fill in GC delivery date (optional)	Decimal	428	12
27	Operator code fill in empty GC collection date (1) (optional)	Decimal	440	12
28	Operator code fill in empty GC collection date (2) (optional)	Decimal	452	12
29	GC manufacture date (optional)	Binary	464	11
30	GC status, filled/empty (optional)	Binary	475	1
31	GC use kind (optional)	Decimal	476	4
32	Free area (optional)	Binary	480	24
33	Reserved	Binary	504	8

E.2.3 Data item 3: GC class (optional)

Classification of gas cylinder is a code for distinguishing a classification of cylinders such as seamless, welded, brazed, etc.

GC class	
Bits	8 bit

7	6	5	4	3	2	1	0
Reserved		Classification1			Classification2		

Default value: 00_{16} (Reserved = 0, Classification1 = 0, Classification2 = 0)

Table E.4 — GC class classification value

Type of GC	Class		Conditions
	1	2	
Seamless	1	1	More than 500 l
		2	Less than 500 l
Welded, cryogenic and brazed	2	1	More than 500 l
		2	Less than 500 l excluding 2–3 to 2–6
		3	LP gas cylinder from 50 l to 120 l
		4	LP gas cylinder below 50 l excluding 2–5
		5	Below 25 l (excluding cylinders in service of hydrogen cyanide, ammonia, and chlorine, manufactured after July 1955 and TP not more than 3.0 MPa)
		6	LP gas container for automobile fuel equipment fixed to vehicles
FRP	3	1	FRP cylinder among oxygen cylinder used for domiciliary oxygen therapy
Other cylinders unnecessary to conduct retesting	0	0	-

E.2.4 Data item 4: GC symbol

Character section of unique identification number of cylinder: Fill in with a space (20_{16}) if characters are less than 6.

	Bits	Length	Type	Default value
(8 bit characters ASCII)	48	6	ASCII	20_{16} × 6

EXAMPLE

Offset	0–7	8–15	16–23	24–31	32–39	40–47
Value	41_{16}	42_{16}	43_{16}	20_{16}	20_{16}	20_{16}
ASCII	“A”	“B”	“C”	Space	Space	Space

When a unique identification number of cylinder is “ABC65535”, “ABC” + 20_{16} × 3 are stored.

E.2.5 Data item 5: GC number

Number section of unique identification number of cylinder: Fill in with a space (20_{16}) if characters are less than 6.

	Bits	Length	Type	Default value
(8 bit characters ASCII)	48	6	ASCII	2016 × 6

EXAMPLE

Offset	0–7	8–15	16–23	24–31	32–39	40–47
Value	36_{16}	35_{16}	35_{16}	33_{16}	35_{16}	20_{16}
ASCII	“6”	“5”	“5”	“3”	“5”	Space

When a cylinder’s unique identification number is “ABC65535”, “65535” + 20_{16} are stored.

Default value: 20_{16} × 6

When registering the identification number of high pressure gas cylinders outside of Japan, it is possible to treat data items 4 and 5 as one ASCII item with 12 characters.

EXAMPLE

Item	Data item 4						Data item 5					
Offset	0–7	8–15	16–23	24–31	32–39	40–47	0–7	8–15	16–23	24–31	32–39	40–47
Value	54_{16}	34_{16}	36_{16}	39_{16}	31_{16}	31_{16}	30_{16}	59_{16}	20_{16}	20_{16}	20_{16}	20_{16}
ASCII	“T”	“4”	“6”	“9”	“1”	“1”	“0”	“Y”	Space	Space	Space	Space

When a cylinder’s individual identification number is “T469110Y”, “T46911” and “0Y” + 20_{16} × 4 shall be stored.

E.2.6 Data item 6: GC manufacturer code (optional)

Code of gas cylinder manufacturer:

	Bits	Variables	Type	Default value
(binary 0–131 071)	17	131 072	Binary	0

To allow this, small binary structure codes for different manufacturers had to be developed (see Annex C).

In addition, although ISO has established the GC manufacturer code as 16 bits, it is extended to 17 bits for the GC manufacturer code as the code according to the country is included.

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Manufacturer of cylinder																

In Japan, it is possible to use the cylinder manufacturer code issued by JIMGA so that the manufacturer code for cylinders other than high pressure gas cylinders (LGC vessel, dewar, bucket, etc.) can be registered.

E.2.7 Data item 7: Gas kind (optional)

Use the UN number or gas code which is uniquely assigned by JIMGA:

Gas kind	Flag	UN code or code given by JIMGA
Bits	1 bit	14 bit
	15 bit	

14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
x(0–1)	y(0–16383)													

Default value: x = 0, y = 0

x: 0 = UN number 1 = Gas kind code which is uniquely assigned

y: UN number or gas kind code which is uniquely assigned by JIMGA

E.2.8 Data item 8: GC owner’s phone number (optional)

Phone number of gas cylinder owner: The telephone number is considered as one numerical value. In order to store the value, the zero (“0”) at the beginning is not registered.

	Bits	Type	Default value
(binary 0–4294967295)	32	Decimal	0

EXAMPLE When the owner’s telephone number is “03-1234-5678”, it is registered as 312345678_{10}.

E.2.9 Data item 9: GC expiration date (optional)

Expiration date of gas cylinder:

GC expiration date	
Bits	16 bit

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Year (0–127)							Month (0–15)				Day (0–31)				

Default value: Year = 0, Month = 1, Day = 1

Year: 0 to 99 is effective range. It is interpreted that 50 or more is in the 1900s and less than 50 is in the 2000s.

Month: 1 to 12 is effective range.

Day: 1 to 31 is effective range.

EXAMPLE

0	0	0	1	1	1	1	0	1	0	0	0	1	1	0	1
Year = 15							Month = 4				Day = 13				

Date = 13 April 2015

E.2.10 Data item 10: GC owner code (optional)

Code of gas cylinder owner: Use four-digit code defined by KHK (The High Pressure Gas Safety Institute of Japan).

GC owner code	ASCII	Binary
Bits	8 bit	10 bit
	18 bit	

17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
x = 1 Byte ASCII								y = (0–1023)									

Default value: x = “A”, y = 0

x: Alphabet 1 character

y: Numerical value from 1 to 999

EXAMPLE

0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1
x = $4C_{16}$								y = 01_{16}									

Owner code = L001

E.2.11 Data item 11: Notice code/“No oil allowed”, toxicity, etc. (optional)

Code of Notice/“No oil allowed”, toxicity, etc.:

Notice information code is the guideline number shown in “Emergency measure guideline” edited by Japan Chemical Industry Association. It is handled as notice information code by combining notice information and “No oil allowed”/toxicity information as “No oil allowed”/toxicity information is also included.

In the case when there is no applicable item in the guide number of “Emergency measure guideline”, it is also possible to use a guide number uniquely defined by the registration body.

Notice code/“No oil allowed”, toxicity, etc.	Flag	Guide number or the guide number uniquely defined
Bits	1 bit	10 bit
	11 bit	

10	9	8	7	6	5	4	3	2	1	0
x(0–1)	y = (0–1 023)									

Default value: x = 0, y = 0

x: 0 = Guide number of Japan Chemical Industry Association; 1 = Guide number uniquely defined

y: Guide number of Japan Chemical Industry Association or guide number uniquely defined by registration body

E.2.12 Data item 12: Last pressure retest date of GC (optional)

Date of pressure retest of gas cylinder:

Last pressure retest date of GC	
Bits	16 bit

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Year (0–127)							Month (0–15)				Day (0–31)				

Default value: Year = 0, Month = 1, Day = 1

Year: 0 to 99 is effective range. It is interpreted that 50 or more is in the 1900s and less than 50 is in the 2000s.

Month: 1 to 12 is effective range.

Day: 1 to 31 is effective range.

EXAMPLE

0	0	0	1	1	1	1	0	1	0	0	0	1	1	0	1
Year = 10							Month = 4				Day = 13				

Date = 13 April 2010

E.2.13 Data item 13: Fill volume unit (optional)

Filling volume unit: Code of volume unit is numerical field indicating engineering unit used by previous volume (see Annex C).

	Bits	Variables	Type
(binary 0–7)	3	8	Binary

Default value: 0

Codes 3 and 4 are not used in Japan.

E.2.14 Data item 15: Tare weight (optional)

Tare weight (kg):

Tare weight	Value	Multiplier
Bits	14 bit	2 bit
	16 bit	

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
x (0–16 383)														y (0–3)	

Default value: x = 0, y = 0

x: Valid number of digits including those digits to the right of the decimal point

y: Specifies multiplier of 10

Tare weight = x × 0,001 × 10^y

EXAMPLE

0	0	0	1	0	0	1	1	0	1	0	0	1	1	1	0
x = 1 235														y = 2	

$1\ 235 \times 0{,}001 \times 10^2 = 123{,}5$ kg

E.2.15 Data item 16: Fill volume (optional)

Filling volume: Unit is indicated by fill volume unit (data item 13).

Fill volume	**Value**	**Multiplier**
Bits	14 bit	2 bit
	16 bit	

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
x (0–16 383)														y (0–3)	

Default value: x = 0, y = 0

x: Valid number of digits including those digits to the right of the decimal point

y: Specifies multiplier of 10

Fill volume = $x \times 0{,}001 \times 10^y$

EXAMPLE

0	0	0	1	0	0	1	1	0	1	0	0	1	1	1	0
x = 1 235														y = 2	

$1\ 235 \times 0{,}001 \times 10^2 = 123{,}5$

E.2.16 Data item 17: Fill date (optional)

Date of filling:

Fill date	
Bits	16 bit

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Year (0–127)							Month (0–15)				Day (0–31)				

Default value: Year = 0, Month = 1, Day = 1

Year: 0 to 99 is effective range. It is interpreted that 50 or more is in the 1900s and less than 50 is in the 2000s.

Month: 1 to 12 is effective range.

Day: 1 to 31 is effective range.

EXAMPLE

1	1	0	0	0	1	1	0	1	0	0	0	1	1	0	1
Year = 99							Month = 4				Day = 13				

Date = 13 April 1999

E.2.17 Data item 18: Fill pressure (optional)

Filling pressure (Mp):

Fill pressure	**Value**	**Multiplier**
Bits	10 bit	2 bit
	12 bit	

11	10	9	8	7	6	5	4	3	2	1	0
x (0–1 023)										y (0–3)	

Default value: x = 0, y = 0

x: Valid number of digits including those digits to the right of the decimal point

y: Specifies multiplier of 10

Fill pressure = $x \times 0{,}01 \times 10^{y}$

EXAMPLE

0	0	0	1	1	1	1	0	1	1	0	1
x = 123										y = 1	

$123 \times 0{,}01 \times 10^{1} = 12{,}3$ Mp

E.2.18 Data item 19: Expiration date of content filled (optional)

Expiration date of content filled:

Expiration date of content filled	
Bits	16 bit

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Year (0–127)							Month (0–15)				Day (0–31)				

Default value: Year = 0, Month = 1, Day = 1

Year: 0 to 99 is effective range. It is interpreted that 50 or more is in the 1900s and less than 50 is in the 2000s.

Month: 1 to 12 is effective range.

Day: 1 to 31 is effective range.

EXAMPLE

0	0	0	1	1	1	1	0	1	0	0	0	1	1	0	1
Year = 15							Month = 4				Day = 13				

Date = 13 April 2015

E.2.19 Data item 20: Fill station ship date (optional)

Date of shipment of cylinder by manufacturer:

Fill station ship date	
Bits	16 bit

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Year (0–127)							Month (0–15)				Day (0–31)				

Default value: Year = 0, Month = 1, Day = 1

Year: 0 to 99 is effective range. It is interpreted that 50 or more is in the 1900s and less than 50 is in the 2000s.

Month: 1 to 12 is effective range.

Day: 1 to 31 is effective range.

EXAMPLE

0	0	0	1	1	0	0	0	1	0	0	0	1	1	0	1
Year = 12							Month = 4				Day = 13				

Date = 13 April 2012

E.2.20 Data item 21: Return due date (optional)

Date of return due:

Return due date	
Bits	16 bit

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Year (0–127)							Month (0–15)				Day (0–31)				

Default value: Year = 0, Month = 1, Day = 1

Year: 0 to 99 is effective range. It is interpreted that 50 or more is in the 1900s and less than 50 is in the 2000s.

Month: 1 to 12 is effective range.

Day: 1 to 31 is effective range.

EXAMPLE

0	0	0	1	1	1	1	0	1	0	0	0	1	1	0	1
Year = 15							Month = 4				Day = 13				

Date = 13 April 2015

E.2.21 Data item 22: Dealer ship date (optional)

Date of shipment of cylinder by dealer:

Dealer ship date	
Bits	16 bit

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Year (0–127)							Month (0–15)				Day (0–31)				

Default value: Year = 0, Month = 1, Day = 1

Year: 0 to 99 is effective range. It is interpreted that 50 or more is in the 1900s and less than 50 is in the 2000s.

Month: 1 to 12 is effective range.

Day: 1 to 31 is effective range.

EXAMPLE

0	0	0	1	1	0	0	0	1	0	0	0	1	1	0	1
Year = 12							Month = 4				Day = 13				

Date = 13 April 2012

E.2.22 Data item 23: GC delivery date (optional)

Date of delivery of cylinder:

GC delivery date	
Bits	16 bit

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Year (0–127)							Month (0–15)				Day (0–31)				

Default value: Year = 0, Month = 1, Day = 1

Year: 0 to 99 is effective range. It is interpreted that 50 or more is in the 1900s and less than 50 is in the 2000s.

Month: 1 to 12 is effective range.

Day: 1 to 31 is effective range.

EXAMPLE

0	0	0	1	1	0	0	0	1	0	0	0	1	1	0	1
Year = 12							Month = 4				Day = 13				

Date = 13 April 2012

E.2.23 Data item 24: Empty GC collection date (1) (optional)

Date of collecting gas cylinder from the last delivery point:

Empty GC collection date	
Bits	16 bit

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Year (0–127)							Month (0–15)				Day (0–31)				

Default value: Year = 0, Month = 1, Day = 1

Year: 0 to 99 is effective range. It is interpreted that 50 or more is in the 1900s and less than 50 is in the 2000s.

Month: 1 to 12 is effective range.

Day: 1 to 31 is effective range.

EXAMPLE

0	0	0	1	1	0	0	0	1	0	0	0	1	1	0	1
Year = 12							Month = 4				Day = 13				

Date = 13 April 2012

E.2.24 Data item 25: Empty GC collection date (2) (optional)

Date of collecting gas cylinder from the intermediate delivery point:

Empty GC collection date	
Bits	16 bit

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Year (0–127)							Month (0–15)				Day (0–31)				

Default value: Year = 0, Month = 1, Day = 1

Year: 0 to 99 is effective range. It is interpreted that 50 or more is in the 1900s and less than 50 is in the 2000s.

Month: 1 to 12 is effective range.

Day: 1 to 31 is effective range.

EXAMPLE

0	0	0	1	1	0	0	0	1	0	0	0	1	1	0	1
Year = 12							Month = 4				Day = 13				

Date = 13 April 2012

E.2.25 Data item 26: Operator code fill in GC delivery date (optional)

Code of the operator who fills in the date of delivery of cylinder:

	Bits	Variables	Type	Default value
(binary 0–4 095)	12	4 096	Binary	0

Use the code allocated by JIMGA for those who need to write information on the RF tag (manufacturer, dealer or retesting company etc.).

E.2.26 Data item 27: Operator code fill in empty GC collection date (1) (optional)

Code of the operator who fills in the date of collection of empty cylinder (1):

	Bits	Variables	Type	Default value
(binary 0–4 095)	12	4 096	Binary	0

Use the code allocated by JIMGA for those who need to write information on the RF tag (manufacturer, dealer or retesting company etc.).

E.2.27 Data item 28: Operator code fill in empty GC collection date (2) (optional)

Code of the operator who fills in the date of collection of empty cylinder (2):

	Bits	Variables	Type	Default value
(binary 0–4 095)	12	4 096	Binary	0

Use the code allocated by JIMGA for those who need to write information on the RF tag (manufacturer, dealer or retesting company etc.).

E.2.28 Data item 29: GC manufacture date (optional)

Date of manufacture of gas cylinder:

GC manufacture date	
Bits	16 bit

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Year (0–127)							Month (0–15)				Day (0–31)				

Default value: Year = 0, Month = 1, Day = 1

Year: 0 to 99 is effective range. It is interpreted that 50 or more is in the 1900s and less than 50 is in the 2000s.

Month: 1 to 12 is effective range.

Day: 1 to 31 is effective range.

EXAMPLE

1	0	0	0	0	0	1	0	1	0	0	0	1	1	0	1
Year = 65							Month = 4				Day = 13				

Date = 13 April 1965

E.2.29 Data item 30: GC status, filled/empty (optional)

Code of filled/empty cylinder:

	Bits	Variables	Type	Default value
(binary 0–1)	1	2	Binary	0

Condition	Code
Empty cylinder or cylinder with residual gas	0
Filled cylinder	1

E.2.30 Data item 31: GC use kind (optional)

Kind of use:

	Bits	Variables	Type	Default value
(binary 0–15)	4	16	Binary	0

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
GC use kind															

Code	GC use kind
0	For industrial
1	For medical
2	For food additive
3	Specialty gas
4	Standard gas
5–15	Reserved

E.2.31 Data item 32: Free area (optional)

Free area for your system:

	Bits	Variables	Type	Default value
(binary 0–16 777 215)	24	16 777 216	Binary	0

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