BSI Standards Publication

Freight containers — RFID cargo shipment tag system

National foreword

This British Standard is the UK implementation of ISO 18186:2011.

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Freight containers — RFID cargo shipment tag system

Conteneurs pour le transport de marchandises — Système d'étiquettes RFID d'expédition de fret

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Foreword

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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 18186 was prepared by Technical Committee ISO/TC 104, *Freight containers*, Subcommittee SC 4, *Identification and communication*.

This first edition of ISO 18186 cancels and replaces the first edition of ISO/PAS 18186:2010.

Introduction

This International Standard describes the composition, application requirements and operational procedures of an RFID cargo shipment tag and its relevant system used for improving transparency of the freight container transportation process. It identifies data content and format as well as operational characteristics of an RFID cargo shipment tag. It also provides a solution for electronic transfer of relevant information between an RFID cargo shipment tag and its associated information system platform.

The overall purpose of this International Standard is to improve freight container logistic transparency and efficiency by using an RFID cargo shipment tag and an associated, Internet-based information management system.

INTERNATIONAL STANDARD

Freight containers — RFID cargo shipment tag system

1 Scope

This International Standard is applicable to freight containers as defined in ISO 668 as well as other associated containers and transport equipment.

This International Standard defines how freight container logistic transparency and efficiency can be improved through use of an RFID cargo shipment tag system and an Internet-based software package. Such an RFID cargo shipment tag system can co-exist with, but is separate from, a container security and identification RFID framework using container "license plate" tags, described in ISO 10374 and ISO/TS 10891, and electronic seals ("e-seals"), described in ISO 18185 (all parts). In all cases, operation of and information from ISO/TS 10891 and ISO 18185 devices is independent from the operation and information of the cargo shipment tag and information from these devices is passed in discrete messages that are not routed via the RFID cargo shipment tag.

2 Normative references

The following referenced documents are indispensable for the application 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 668, *Series 1 freight containers — Classification, dimensions and ratings*

ISO 6346, *Freight containers — Coding, identification and marking*

ISO 10374, *Freight containers — Automatic identification*

ISO/TS 10891, *Freight containers — Radio frequency identification (RFID) — Licence plate tag*

ISO 18185 (all parts), *Freight containers — Electronic seals*

IEC 60068-2 (multiple sub-parts), *Environmental testing*

IEC CISPR/TR 28, *Industrial, scientific and medical equipment (ISM)-Guidelines for emission levels within the bands designated by the ITU*

3 Terms and definitions

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

3.1
RFID cargo shipment tag
read-write tag into which data specific to a containerized cargo shipment can be stored and the tag and the data uploaded in it are the responsibility of the shipper

NOTE   The tag can be affixed to the container by the shipper or, as per the shipper's instructions, by the party that physically performs the loading ("stuffing") of the container. Data capabilities are flexible and can, at the shipper's discretion, include destination, routing, conveyance or other transportation information, time and location of the interrogation, cargo information (including hazardous material information, where applicable) or other trip-specific information. The tag must perform reliably from the point of stuffing of the container to delivery destination, and is to be removed by the consignee upon final delivery. The tag is reusable.

3.2
reader
device that can exchange information with RFID cargo shipment tags by wireless communication methods and move information to and from an internet-based information system

3.3
network platform
information processing system through which data from an RFID cargo shipment tag is communicated, processed and viewed

NOTE   It is a subset within/of the cargo shipment tag system. The network platform system includes a wireless radio network, a server, terminal(s), database, middleware, etc. Information from the cargo shipment tag system is accessible, according to pre-determined access criteria, to authorized users through a dedicated internet website.

3.4
operators of network platform
network operator
neutral entity/organization/party that operates the network platform of the RFID cargo shipment tag system

NOTE   This entity operates/maintains the web server, database server and/or the middleware.

3.5
RFID cargo shipment tag system
system consisting of RFID cargo shipment tag, its associated reader(s) and the network platform

4   RFID cargo shipment tag system

4.1   System composition

The RFID cargo shipment tag system is composed of the following basic elements: RFID cargo shipment tag, reader(s) and network platform (including database, operational system and related system software). The system is open and distributed, which can achieve management efficiencies in different geographical areas. Components of the RFID cargo shipment tag system operate in a manner described later in this International Standard.

4.2   System operator

The shipper, or its authorized representative, is the only one who may affix and remove the RFID cargo shipment tag. The shipper is responsible for the supply, placement and ultimate removal of the physical tag as well as all operations using it, including uploading, maintaining, altering, deleting and reading cargo shipment tag data.

4.3   System authorization

The shipper may, at its discretion and in accordance with 5.1, write any relevant container transport and shipping data onto the cargo shipment tag. The shipper shall enter into an agreement with the network operator of the cargo shipment tag system before dispatching the shipment. As part of this agreement, the network operator shall provide access credentials which allow the shipper to upload tag, cargo and other information to the network platform and query the network platform for journey information as needed.

4.4   System functions

Reading from and writing to the RFID cargo shipment tag may only be done by the shipper, or its authorized representative, using access credentials supplied by the network operator. Each shipper, or its authorized representative, shall only have access to data on its own shipment tags.

Container transport and shipping data, or any other allowed information, can be transferred by the shipper between network memory locations, including the RFID cargo shipment tags themselves. Use of access credentials, and/or other security measures, shall prevent one shipper from accessing the tag information or network information of another shipper.

Search capabilities are available to the shipper, or an authorized party identified by it, through the network platform using access credentials supplied by the network operator. A shipper shall only have the ability to search through its own information and its own tags.

4.5   System internal data transmission

Except for wireless transmissions between cargo shipment tags and readers, all internal EDI data transmissions through the network platform should use HTTP protocol, data format to be described by XML. For more detailed data, refer to Annex A.

4.6   System safeguard measures

A shipper, using its unique access credentials, shall set up the reading and writing authority levels of RFID cargo shipment tags through the network platform according to its own requirements.

A shipper, using its unique access credentials, shall set up the inquiry and search authority levels for shipment information through the network platform according to its own requirements.

Information within the RFID cargo shipment tag shall be encrypted or otherwise secured at the point and time when it is first written into the tag and during any subsequent modifications, alterations, changes and/or erasures. The tag shall be capable of having encrypted or otherwise secure data written to it and read from it without interference from the tag design or structure. Further, the system shall not write to the tag cargo shipment-specific data that is not encrypted or otherwise secured.

All parts of the cargo shipment tag system, especially the network platform and associated information systems, shall implement suitable disaster tolerance and protections from hostile attacks, including hacking, viruses and denial of service.

5   RFID cargo shipment tag

5.1   General requirements

The RFID cargo shipment tag shall have its own unique tag identification number in permanent memory. The container serial number (see ISO 6346), as well as any other desired container transport and shipping data, may be programmed into the volatile memory of the tag.

Information written to the RFID cargo shipment tag shall be encoded using formats defined in Annex A for transmission between tags and readers.

A clock chip shall be built into each RFID cargo shipment tag and it shall be set to UTC time. The RFID cargo shipment tag system shall automatically record all interrogation events, including each trip's initial activation and deactivation of the tag, including the date and time of these events. The time error shall be less than 5 seconds per day.

The RFID cargo shipment tag system shall automatically receive and record the geographical location information from each reader interrogating it. The geographical location information refers to the reader position when it reads the tag.

The RFID cargo shipment tag shall be capable of carrying any cargo shipment and/or logistic information as desired by the shipper and described in Annex A.

The RFID cargo shipment tag data shall be protected as described in 4.6.

The RFID cargo shipment tag may be either a one-time-use or a reusable device. In either case, the tag shall be removed by the consignee after final delivery. Prior to re-use, it is the shipper's responsibility to make sure that a reusable tag has had its user memory cleared. Return and recycling of reusable tags is also the sole responsibility of the shipper.

An RFID cargo shipment tag shall support data capturing, amendment and deletion events for one full trip from the container's origin to final destination, as per the shipper's requirements.

An RFID cargo shipment tag shall be capable of reporting battery status. A tag configured for one-time-use shall have a minimum battery life span of 60 days from battery activation. A reusable tag shall have a minimum battery life span of five years under normal operational circumstances, based on having a read/write event 10 times per day without changing the built-in battery.

The RFID cargo shipment tag shall have its unique tag identification number marked permanently onto the exterior of the tag in a location that can be easily seen by the human eye when the tag is installed on a container.

5.2   Tag installation

An installed RFID cargo shipment tag shall not protrude beyond the exterior frame of the freight container. Further, its installation shall not cause the structure or integrity of the freight container to fall below its defined service requirements.

An installed RFID cargo shipment tag shall be mounted in a location on the freight container that allows it to be seen by the human eye and affixed and removed relatively easily by workers at ground level.

An RFID cargo shipment tag may be mounted in any container location except those prescribed for the license plate tag as specified in ISO 10374 or ISO/TS 10891 or reserved for or dedicated to the container seal, whether electronic (see ISO 18185) or mechanical (see ISO 17712).

An installed RFID cargo shipment tag shall be mounted in a manner that allows it to be reliably read/written by an installed RFID tag reader system.

5.3   Data content and format

5.3.1   General

A detailed description of all RFID cargo shipment tag data items, including precise format information, is found in Annex A.

5.3.2   Mandatory tag data

Mandatory tag data shall include, as a minimum, the following items:

Mandatory, permanent (non-variable) data: Includes the unique identification number of the RFID cargo shipment tag, assigned to the tag and permanently programmed during tag production. Also includes tag manufacturer ID and date of manufacture. See Annex A for details.

5.3.3   Optional data

All data other than that specified in 5.3.2 is classified as optional data. This data is non-permanent and is included strictly in accordance with the shipper's requirements and responsibilities. Examples include container information, cargo information, transport information, customer information and container status information. However, the shipper may include, at its responsibility, any information desired. See Annex A for details.

The shipper may, at its discretion and responsibility, and in conformance with the conditions set out in Clause 1, upload into the RFID cargo shipment tag information from the container 'license plate' tag or, where a 'license plate' tag is not used, information that is physically marked on the container in conformance with ISO 6346.

5.3.4   Automatic data interaction

At a minimum, the mandatory data within an RFID cargo shipment tag shall be read automatically when the container carrying it passes by a reader, with no actions required on the part of container or tag to initiate the reading process.

5.3.5   Data format

Annex A defines the formats of all RFID cargo shipment tag data items.

5.4 Electronic security guarantee

All shipment-specific data shall be protected in a manner such that any modification of the electronically stored information, without proper authentication, is not possible.

5.5 Working environment

The RFID cargo shipment tag shall meet the environmental requirements of ISO 18185-3:2006, Clause 4.

Electronic security of the RFID cargo shipment tag shall meet the requirements of the relevant part of the multiple sub-part series of IEC 60068-2.

5.6 RF operations

The installed RFID cargo shipment tag system shall use an internationally available radio frequency, conform to an ISO-based air interface and communication protocol and comply with national regulatory requirements.

The RFID frequency shall conform to ITU regulations as specified in IEC CISPR/TR 28.

6 Reader

6.1 Types

Fixed readers may be permanently installed at nodal points in the logistics process and configured to read cargo shipment tags as they pass through the read zone.

Hand-held readers, used for walk-up interrogations of cargo shipment tags, must be completely portable and un-tethered.

6.2 Functions

Fixed readers shall reliably read all tags within a distance of up to 35 metres.

Handheld readers shall reliably read all tags within a distance of up to 5 metres.

All readers, fixed or hand-held, shall be capable of reliably transferring to/from the network platform all RFID cargo shipment tag information defined in 5.3 and Annex A.

6.3 Data interface

The data interface between fixed readers and the network platform can be wired or wireless as long as the connection method has no effect on the data exchange. The data interface between hand-held readers and the network platform must be wireless, using a communication medium that provides a high-quality, reliable connection in all operational scenarios. All transmissions between readers and network platform should be done in accordance with standard telecommunication protocols (e.g. RS232/RS485/Ethernet or 802.11b/g).

7 RFID cargo shipment tag system operation

7.1 RFID cargo shipment tag system operational conditions

Excluding the RFID air interface, all data management activities for the RFID cargo shipment tag system shall occur within an internet environment. All access to the network platform shall be conducted via Internet.

All readers, whether fixed or handheld, shall be connected to the system in a manner giving as close to real-time data interaction as possible.

The RFID cargo shipment tag system shall ensure that data is uniquely read from or written to the correct tag under operational conditions (i.e. discrimination).

The RFID cargo shipment tag system shall reliably transfer and process data flowing from/to multiple tags which can be within the reader's field of view (i.e. localization).

At time of affixing, all RFID cargo shipment tag information shall be initialized (except tag information defined in 5.3.2) and the internal clock function shall be verified. Initialization consists of clearing the tag memory of all parameters recorded during its last transport journey (in the case of a reusable tag). These initialization activities shall be performed by the shipper and shall not require any action by the cargo transport providers who are engaged to move the container from origin to final destination.

7.2   RFID cargo shipment tag system operational requirements

7.2.1   Nodes for operational process

Typical locations where operations involving the RFID cargo shipment tag system may include: container stuffing point, operational node, check point, and container devanning point.

7.2.2   Operational content for process nodes

7.2.2.1   Stuffing point

At the location where a container is stuffed, closed and sealed, the shipper may elect to affix an RFID cargo shipment tag. If affixed, the tag shall be initialized (in accordance with 7.1) activated, and a transaction, including date, time and location, shall be uploaded to the network platform.

7.2.2.2   Operational node

When a container equipped with RFID cargo shipment tag passes through an operational node, the fixed reader installed at the node shall automatically read tag data and exchange information with the network platform.

7.2.2.3   Check point

At any location where a container equipped with RFID cargo shipment tag is receiving special attention, the tag may be read by a handheld reader, thereby checking any authorized information and uploading relevant records to the network system.

7.2.2.4   Devanning (unstuffing) point

At the devanning point, fixed or handheld readers shall be used to extract information from an affixed RFID cargo shipment tag and send that information to the network platform. Also in this location, an affixed cargo shipment tag shall be physically removed by the consignee and either discarded, if a one-time-use tag, or recycled to the stuffing point, as per the shipper's instructions and responsibility, for another shipment.

8   Reliability and accuracy of RFID cargo shipment tag system

RF system reliability for an RFID cargo shipment tag system shall be better than 99,99% (i.e. no more than one missed read in 10 000 read/write events). RF system accuracy shall be better than 99,998% (i.e. no more than one information error in 100 000 read/write events).

The RFID cargo shipment tag system shall implement a CRC check in the data transmission process.

9   Tag operation

RF emissions from the RFID cargo shipment tag system shall conform to regulations related to national security and national radio band usage.

RF emissions from the RFID cargo shipment tag system shall conform to regulations related to radio system radiation, as published by the WHO (World Health Organization).

Annex A
(normative)

Data format for RFID cargo shipment tag

Table A.1 — Relevant data for shipment tag (Data code mark range)

Information field	Column	Data length (byte)	Specification	Note
Shipment tag inherent information (mandatory and permanent)	Tag ID	10	Fixed by Chip manufacturer permanently, abide by the format elaborated in ISO/IEC 15963	Read only
	Tag ex-factory date	8	YYYYMMDD	Read only
	Tag manufacturer ID	9	Tag manufacturer code, allocation in line with ISO 14816	Read only
Container information (optional and variable)	Container serial number	11	In accordance with ISO 6346	Read/write
	Dimension and container type code	4	In accordance with ISO 6346	Read/write
	Nominal length	2	In accordance with ISO 668, unit ft	Read/write
	Container body weight	5	According to container factory file, unit kg	Read/write
	Container rated weight	6	Refer to container factory file, unit kg	Read/write
	Container operator	60	Name of container line company/ transport company or cargo owner	Read/write
Shipment tag state information (optional and variable)	Tag status	1	Y-Authorized/N-Unauthorized	Read/write
	Tag activation time	42	YYYYMMDDHH24MI	Read/write
	Tag activation location	60	English location name	Read/write
	Reader ID	8	Letter and number	Read/write
	Operational staff code	14	Organization allocation code and staff code	Read/write
	Tag deactivation time	42	YYYYMMDDHH24MI	Read/write
	Tag deactivation location	60	English location name	Read/write
	Reader ID	8	Letter and number	Read/write
	Operational staff code	14	Organization allocation code and staff code	Read/write
Cargo shipment information (optional and variable)	Name of transportation subject	35	Vessel name or vehicle code/train trip number in English	Read/write
	Vessel registration number	12	Refer to vessel registration description/particular	Read/write
	Voyage number/trip number	8	Letter and number	Read/write

Table A.1 (*continued*)

Information field	Column	Data length (byte)	Specification	Note
Cargo shipment information (optional and variable)	Bill of lading number/ transport receipt number	200	Container cargo's B/L number or waybill number	Read/write
	Place of carrier receipt	60	UN/LOCODE	Read/write
	Loading port	60	UN/LOCODE	Read/write
	Transhipment port	60	UN/LOCODE **to be repeated according to shipper needs and requirements	Read/write
	Place of transhipment	60	UN/LOCODE **to be repeated according to shipper needs and requirements	Read/write
	Discharging port	60	UN/LOCODE	Read/write
	Place of delivery (to consignee)	60	UN/LOCODE	Read/write
	Shipper	100	English	Read/write
	Consignee	100	English	Read/write
	Cargo name	100	Plain language description (English) or HS CODE	Read/write
	Dangerous cargo class	3	For dangerous cargo provided by shipper in accordance with IMDG Code	Read/write
	UN Code	4	For dangerous cargo provided by shipper in accordance with IMDG Code	Read/write
	Refrigerator container temperature	4	For temperature-controlled cargo, provided by shipper	Read/write
	Temperature unit	1	F-Fahrenheit/C-Centigrade	Read/write
	Other shipment information	1 500	Reserved	Read/write
Process node information (optional and variable)	Process node	2	Container vanning-VC; Entrance-TY; Exit-YT; Vessel loading-YV; Vessel discharging-VT; Container devanning-UC; Inspection: IC; truck loading-CL; truck discharging-UL	Read/write
	Record time	14	YYYYMMDDHH24MI	Read/write
	Record location	20	English location name	Read/write
	Reader ID	8	Letter and number	Read/write
	Operational staff code	14	Organization allocation code and staff code	Read/write
Extension area (optional and variable)	EPC number of the container	20	Available for user	
	Others	24 500	Available for user	
NOTE 1 Date type for all information fields is unified to byte and date format is ASCII code.				
NOTE 2 Data lengths are maximum values.				

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