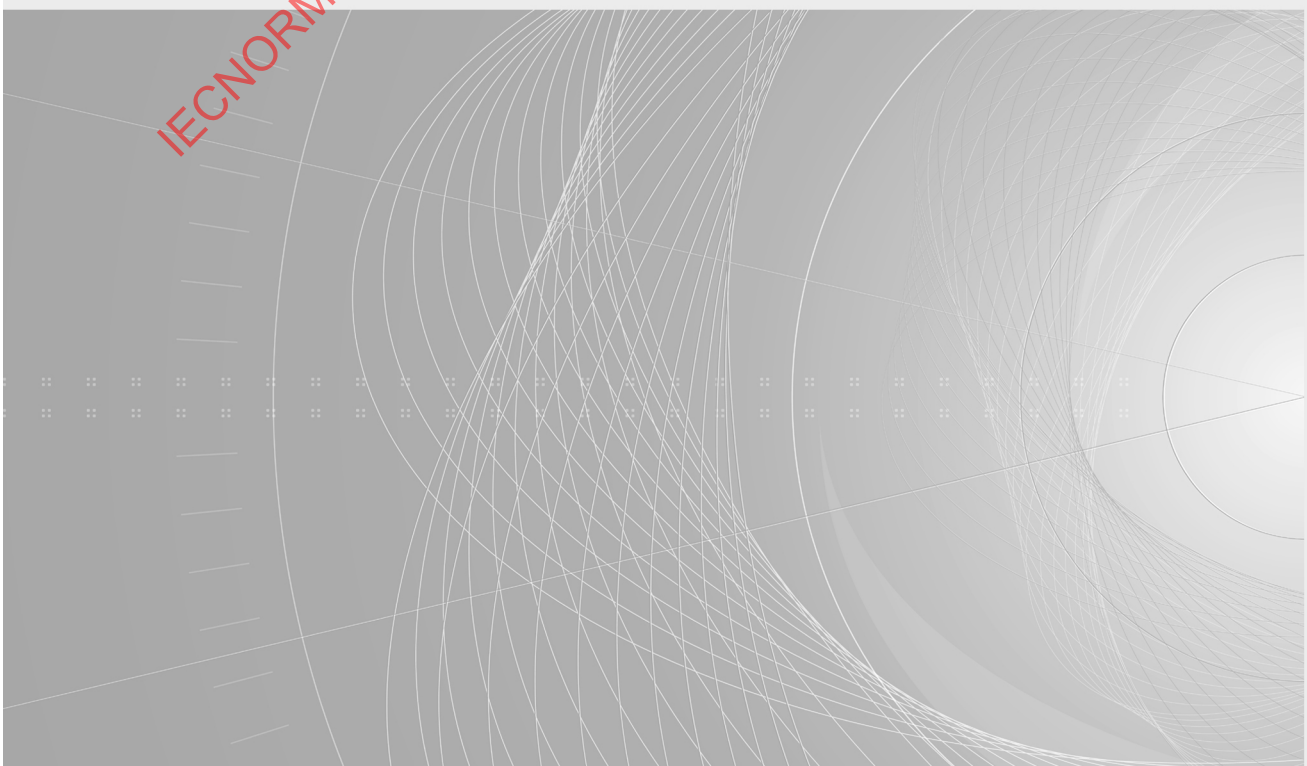
IEC/TR 62540

Edition 1.0 2009-11

TECHNICAL REPORT

Radio frequency identification (RFID) of stationary lead acid cells and monoblocs – Tentative requirements



IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub
The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub
Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv
If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

IEC/TR 62540

Edition 1.0 2009-11

TECHNICAL REPORT

Radio frequency identification (RFID) of stationary lead acid cells and monoblocs – Tentative requirements

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE S

ICS 29.220.20

ISBN 978-2-88910-758-2

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

RADIO FREQUENCY IDENTIFICATION (RFID) OF STATIONARY LEAD ACID CELLS AND MONOBLOCS – TENTATIVE REQUIREMENTS

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC/TR 62540, which is a technical report, has been prepared by IEC technical committee 21: Secondary cells and batteries. It is an informative document destined to lay the groundwork for a possible future IEC/ISO standard. Such a standard would be established by a joint ISO/IEC working group with IEC TC 21 and ISO/IEC JTC1/SC31 acting as the leading technical committees.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
21/685/DTR	21/703/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

RADIO FREQUENCY IDENTIFICATION (RFID) OF STATIONARY LEAD ACID CELLS AND MONOBLOCS – TENTATIVE REQUIREMENTS

1 Scope

IEC/TR 62540, which is a technical report, applies to all stationary lead-acid cells and monobloc batteries for float charge applications (i.e. permanently connected to a load and to a d.c. power supply), in a static location (i.e. not generally intended to be moved from place to place) and incorporated into stationary equipment or installed in battery rooms for use in telecom, uninterruptible power supply (UPS), utility switching, emergency power or similar applications. These batteries are covered by IEC 60896-11, IEC 60896-21 and IEC 60896-22.

The objective of this technical report is to assist the supplier and user of radio frequency identification devices (RFID) in the understanding of the requirements for performance, durability, data content and structure, the write/read capability of such devices, and to provide guidance so that the RFID tag on the battery will result in meeting the needs of a particular industry application and operational condition.

This technical report does not directly apply to lead-acid cells and batteries used for vehicle engine starting applications (IEC 60095 series), solar photovoltaic applications (IEC 61427), or general purpose applications (IEC 61056 series) but nevertheless can also be the base of standardization activities for these types of lead acid batteries.

2 Terms and definitions

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

2.1
ambient temperature
temperature of the medium in the immediate vicinity of a cell or battery

[IEC 60050-826:2004, 826-10-03, modified]

2.2
ampere-hour
quantity of electricity or a capacity of a battery obtained by integrating the discharge current in ampere with respect to time in hours

NOTE One ampere-hour equals 3 600 coulombs.

2.3
secondary battery
two or more secondary cells connected together and used as a source of electrical energy

[IEC 60050-811:1991, 811-20-02, modified]

2.4
monobloc battery
secondary battery in which the plate packs are fitted in a multi-compartment container

2.5
floating battery
secondary battery whose terminals are permanently connected to a source of constant voltage sufficient to maintain the battery approximately fully charged, intended to supply a circuit, if the normal supply is temporarily interrupted

[IEC 60050-482:2004, 482-05-35, modified]

2.6
battery capacity
quantity of electricity or electrical charge which a fully charged battery can deliver under specified conditions

NOTE The SI unit for electric charge is the coulomb (1 C = 1 A·s) but in practice, battery capacity is expressed in ampere-hours (Ah).

2.7
charge
operation during which a secondary battery receives from an external circuit electrical energy, which is converted into chemical energy

NOTE A charge is defined by its maximum voltage, current and duration.

2.8
cell
assembly of electrodes and electrolyte, which constitutes the basic unit of a secondary battery

[IEC 60050-482:2004, 482-01-01, modified]

2.9
electrochemical cell
electrochemical system capable of storing in chemical form the electric energy received and which can give it back by reconversion, i.e. a secondary cell

[IEC 60050-811:1991, 811-20-01, modified]

2.10
secondary cell
assembly of electrodes and electrolyte which constitutes the basic unit of a secondary battery

2.11
valve-regulated cell
secondary cell which is coded under normal conditions but which has an arrangement, which allows the escape of gas if the internal pressure exceeds a predetermined value

NOTE 1 The cell cannot normally receive the addition of electrolyte.

NOTE 2 Such cells have an immobilized electrolyte to prevent spillage and allow for oxygen recombination on the negative electrode.

2.12
actual capacity
C_a
quantity of electricity delivered by a cell or battery, determined experimentally with a discharge at a specified rate to a specified end-voltage and at a specified temperature

NOTE This value is usually expressed in ampere-hours (Ah).

2.13
nominal capacity
C_n
suitable approximate quantity of electricity used to identify the capacity of a cell or battery

NOTE This value is usually expressed in ampere-hours (Ah).

2.14
rated capacity
C_{rt}
quantity of electricity, declared by the manufacturer, which a cell or battery can deliver under specified conditions after a full charge

NOTE This value is usually expressed in ampere-hours (Ah).

[IEC 60050-482:2004, 482-02-15, modified]

2.15
shipping capacity
C_{sh}
quantity of electricity, declared by the manufacturer, which a cell or battery can deliver, at the time of shipment, under specified conditions of charge

NOTE 1 This value is usually expressed in ampere-hours (Ah).

NOTE 2 In the present technical report this value is assumed to be at least 0,95 C_{rt}.

2.16
durability
ability of an item (battery) to perform a required function under given conditions of use and maintenance, until a limiting state is reached

NOTE A limiting state of an item (battery) may be characterized by the end of the useful life, unsuitability for any economic or technological reasons or other relevant factors.

[IEC 600505-101:1990, 191-02-02]

2.17
electrolyte
liquid or solid phase containing mobile ions that render the phase electrically conducting

[IEC 60050-482:2004, 482-02-29, modified]

2.18
stationary equipment
either fixed equipment or equipment not provided with a carrying handle and having such a mass that it cannot easily be moved

[IEC 60050-826:2004, 826-6-06, modified]

2.19
failure
termination of the ability of an item (battery) to perform the required function

[IEC 60050-603:1996, 603-05-06]

2.20
lead-acid battery
secondary battery in which the electrodes are made mainly from lead and the electrolyte is a sulphuric acid solution

[IEC 60050-482:2004, 482-05-01, modified]

2.21
design life
expected period of useful life of a battery according to components, design and application

2.22
service life
period of useful life of a battery under specified conditions

[IEC 60050-482:2004, 482-03-46, modified]

2.23
useful life
under given conditions, the time interval beginning at a certain instant of time, and ending when the failure intensity becomes unacceptable or when the item (battery) is considered un-repairable as a result of a fault

[IEC 60050-191:1990, 191-10-06]

2.24
performance
characteristics defining the ability of a battery to achieve its intended functions

[IEC 60050-300:2001, 311-06-11]

2.25
product range
range of products, i.e. cells or monobloc batteries, over which specified design features, materials, manufacturing processes, and quality systems (e.g. ISO 9000) of manufacturing locations are identical

2.26
accelerated test
test in which the applied stress level is chosen to exceed that stated in the reference conditions in order to shorten the time duration required to observe the stress response of the item (battery), or to magnify the response in a given time duration

NOTE To be valid, an accelerated test shall not alter (or conceal) the basic fault modes and failure mechanisms, or their relative prevalence.

[IEC 60050-191:1990, 191-14-07]

2.27
acceptance test
contractual test to prove to the customer that the item (battery) meets certain conditions of its specification

[IEC 60050-151:2001, 151-16-23]

2.28
commissioning test
tests on an item (battery) carried out on site to prove that it is correctly installed and can operate correctly

[IEV 151-16-24]

2.29
compliance test
test used to show whether or not a characteristic or property of an item (battery) complies with the stated requirements

[IEC 60050-191:1990, 191-14-02]

2.30
endurance test
test carried out over a time interval to investigate how the properties of an item (battery) are affected by the application of stated stresses and by their duration or repeated application

[IEC 60050-151:2001, 151-16-22]

2.31
laboratory test
compliance test or determination test made under prescribed and controlled conditions, which may or may not simulate field conditions

[IEC 60050-191:1990, 191-14-04]

2.32
life test
test to ascertain the probable life, under specified conditions, of an item (battery)

IEC 60050-151:2001, 151-16-21]

NOTE In stationary lead acid batteries it is customary to assume that for every 10 K rise in service temperature above the reference temperature (20 °C – 25 °C) a halving of the life in a life test is observed (for a test temperature up to 60 °C).

2.33
performance test
test carried out to determine the characteristics of a machine (battery) and to show that the machine (battery) achieves its intended function

2.34
type test
conformity test made on one or more items (batteries) representative of the production

IEC 60050-151:2001, 151-16-16]

2.35
final voltage
U_{final}
specified voltage at which a discharge of a battery is considered finished

[IEC 60050-482:2004, 482-03-30, modified]

NOTE This voltage relates to the demand of the exterior circuit, the discharge rate and temperature.

2.36
float voltage
U_{flo}
constant charge voltage specified by the manufacturer for a floating battery

3 Functional requirements

3.1 Overview

In the framework of this technical report, the following tentative requirements are deemed essential to comprehensively assure the ability of the RFID tags to perform their intended function as a reliable, multiple write and read depository of data concerning battery properties.

These requirements are grouped for data content and data display structure, physical dimensions, performance and durability needs.

3.2 Data content and display requirements

These requirements (see Table 1) define essential data content and display features for the RFID tags on stationary lead-acid batteries.

Table 1 – Data content and display requirements

Clause	Defines	Purpose
4.1	Information to be stored	To normalize information written onto the RFID
4.2	Information display structure	To facilitate data display on read-out devices
4.3	Information translator	To convert numerical values to battery properties
4.4	Data safety	To define needs of data integrity when in service

3.3 Physical dimensions requirements

These requirements (see Table 2) define performance properties of the RFID tags on stationary lead acid-batteries.

Table 2 – Physical dimensions requirements

Clause	Defines	Purpose
4.5	Preferred physical dimensions	To define form factor and dimensions.
4.6	RFID hull material	To define the preferred hull material of the RFID
4.7	RFID fixation on cells or monoblocs	To define preferred battery assembly compatible fixation and attachment methods

3.4 Performance requirements

These requirements (see Table 3) define performance properties of the RFID tags on stationary lead-acid batteries.

Table 3 – Performance requirements

Clause	Defines	Purpose
4.8	Writing of data	To define writing speed and distances
4.9	Reading of data	To define readout speed and distances
4.10	Reading of data when 1+n units are present	To define interrogation anti-collision features
4.11	Reading of data in transmission damping conditions	To define read-out under possible strong RF wave absorption due to metallic cabinet wall shielding
4.12	Survival of data content for years in service	To define longest duration for reliable readout

3.5 Durability requirements

These requirements (see Table 4) define essential durability properties of the RFID tags on stationary lead-acid batteries.

Table 4 – Durability requirements

Clause	Defines	Purpose
4.13	Temperature conditions	To define the temperature range in operation
4.14	Vibration conditions	To define vibration stresses in operation
4.15	Stability against chemicals	To define chemicals present
4.16	Stability during battery manufacturing	To indicate short term stresses induced by battery assembly processes

4 Requirements and characteristics

4.1 Requirement for information stored

4.1.1 The purpose of this requirement (see Table 1) is to assure the uniformity of the information stored as alphanumeric values (A-Z and 0-9) on the RFID tag. The information is divided into “open information” and “coded information”.

Open information is information available to anyone equipped with a compatible RFID tag interrogation device. Its meaning can be inferred from its position in the data string stored in the RFID memory and the publicly available correlation table of the said alphanumeric value (A-Z and 0-9) with further textual information. This open information is mandatory.

Coded information is information written into the RFID tag memory at a specific position of the data string and for which the correlation table of the said alphanumeric value (A-Z and 0-9) with further textual information is not publicly available. The space for coded information may also be left empty or contain only zeros. Coded information can also be displayed as open information based on the manufacturer’s decision.

This coded information may contain information which the battery manufacturer considers confidential but nevertheless wants to store in the RFID tag memory for later retrieval directly on-site.

The example of a data string and the textual content correlation information is shown below in Table 5.

Table 5 – Data string

N°	Example	Alphanumeric or digits and punctuation	Information equivalent	Purpose	Open/coded
1	@@@	@@@	Beginning of data string	For display formatting	Open
2	Best Battery Company	26	Name of cell or monobloc manufacturer	Indentify supplier and the responsible for data content	Open
3	1200567190	10	Unique type code	Manufacturing setup in factory	Coded
4	004598760	10	Unique manufacturer given ID number	Unique unit identification	Open
5	02	2	Cell or monobloc type 01 VLA – 02 VRLA – 03 Other	Stock keeping Ventilation setup	Open
6	13.65 02.25	2.2	Unit float voltage at 25°C	Equipment setup	Open
7	00845	5	Unit 10h capacity at 25°C to 1,80 Vpc	Equipment setup	Open
8	00099	5	Maximum discharge current in A	Equipment setup	Open
9	01111	5	Maximum charge current in A with float voltage setting	Equipment set-up	Open
10	13092010	8	Date stamp of electrolyte filling	Stock control	Coded
11	2359120920 10	12	Time and date stamp of cover sealing	Traceability	Coded
12	0059130920 10	10	Time and date stamp of first electrolyte filling	Traceability	Coded
13	123456	6	Geographic location of electrolyte filling	Traceability	Coded
14	13092010	8	Start of warranty	Shipping date Stock control	Open
15	0125	4	Weight Kg ready to operate	Transport Storage	Open
16	1567	4	Smallest projected unit footprint in cm^2 when shipped	Storage Shipment	Open
17	1002	4	Kg lead (Pb) as metal Pb grid + Pb mass + 0.826PbO_2 +top lead	Recycling Asset valuation	Coded/open
18	234	3	Kg H_2SO_4 (100%)	Recycling	coded/open
19	01	2	Other solid metals present when more than 1% of unit weight 01 brass – 02 steel – 03 copper – 04 others	Recycling Asset valuation	Coded/open
20	02	2	Alloy used for grids 01 PbSb – 02 PbCa 03 PbSn – 04 Others	Recycling	Coded/open
21	07	2	Main plastic used for container 01PP – 02 ABS – 03 SAN 04 PC – 05 PVC – 06 PPEPS 07 PCABS – 09 Other	Recycling	coded/open
22		6	Spare position	Future use	Coded/open
23		6	Spare position	Future use	Coded/open
24		6	Spare position	Future use	Coded/open
25		6	Spare position	Future use	Coded/open

N°	Example	Alphanumeric or digits and punctuation	Information equivalent	Purpose	Open/coded
26	Calculated Sequence	8	Check sum derived from A calculation	Data manipulation Prevention	Open
27	@@@	@@@	End of data string	For display formatting	Open

4.1.2 An example of the possible mandatory minimum and voluntary maximum string information content is shown in Table 6.

Table 6 – Example of minimum and maximum string information

#	Mandatory or minimum open information content	Voluntary or maximum open information content
1	@@@	@@@
2	Best battery company	Best battery company
3	Coded	1200567190
4	004598760	004598760
5	02	02
6	13.65	13.65
7	00450	00450
8	00099	00099
9	01111	01111
10	Coded	12092010
11	Coded	235912092010
12	Coded	005913092010
13	Coded	Battery-town USA
14	30102008	30102008
15	0125	0125
16	1567	1567
17	Coded	125
18	Coded	234
19	Coded	03
20	Coded	02
21	Coded	07
22	000000	000000
23	000000	000000
24	000000	000000
25	000000	000000
26	TX564DFA	TX564DFA
27	@@@	@@@

4.1.3 The 8 alphanumeric values displayed in position 26 give a verification code/signature that the data are correct and no data manipulation has occurred after shipment. This string value is generated by a company confidential algorithm for each RFID anew based on the specific RFID memory content.

4.2 Requirement of information display structure

The purpose of this requirement (see Table 1) is to assure the uniformity of the information display on the RFID interrogation and readout device.

The information shall be displayed on the readout screen as follows:

String position	Alphanumeric sequence stored
Total interrogated	n
Present unit	(1 to n)
1	@@@
2	Best battery company
3	Coded or e.g. 1200567190
4	004598760
⇩	⇩
27	@@@

The interrogation and readout of the RFID tag on the cells or monoblocs may involve the simultaneous readout of many units (up to 50) in a very short time interval (<1s) such as during automatic inventory control or in a longer time interval (>30s) when a manual interrogation is carried out.

The total number of successfully interrogated units shall be displayed and the readout device shall attribute to each unit a temporary ID number so that a sequential scrolling through the information in each individual RFID is possible.

More complex data display or presentation schemes may be feasible or desirable and can be implemented.

4.3 Requirement of information translator

4.3.1 The purpose of this requirement (see Table 1) is to assure that once the information content in the RFID tag has been read the corresponding meaning can be accessed with ease.

4.3.1 The correlation table shall be published in the battery operating manual of the involved cell or monobloc

4.3.2 A publicly available correlation table shall be published in a dedicated homepage on the Internet (example **www.*BatteryRFID.org***) and whose yearly maintenance fee would be covered by the fixed and equal sized advertisement of lead acid battery companies (company logo - company homepage address – 1 product picture).

4.4 Requirement for data safety

The purpose of this requirement (see Table 1) is to assure that the information present on the RFID tag shall not be capable of being modified by third parties.

The safety level shall be as follows:

RFID data safety and integrity	
1	No writing or erasing of data shall be possible once the check sum value has been written

4.5 Requirement for preferred physical dimensions

The purpose of this requirement (see Table 2) is to assure the RFID tags offered by the RFID industry correspond to dimensions and shapes preferred by the battery manufacturers.

The following maximum sizes and shapes of the RFID tags shall be planned for:

RFID tag shape type		Size w x l x h
1	Stamp size	30mm x 30mm x 3mm
2	Button size	15mm Ø x 3mm
3	Square or round rod size	Ø5mm or 5mm x 5mm x 30mm

In order to minimize RFID tag cost through economy of scale, only a very limited number of the above shapes and dimensions shall be implemented.

4.6 Requirement for RFID tag hull material

The purpose of this requirement (see Table 2) is to assure that the material composition of the hull of the RFID tags offered by the RFID industry is compatible with the material requirements and use of the battery industry.

The following materials shall constitute the hull material of the RFID tag:

RFID tag hull material colour preferred: black	
1	PP flammability class [a] HB according to IEC 60695-11-10
2	PP flammability class [a] FV0 according to IEC 60695-11-10
3	PPE-PS flammability class [a] FV0 according to IEC 60695-11-10
[a] The required flammability rating shall be achieved without the use of halogen containing substances.	

The expected environmental conditions in battery production, transport and operation are listed in 4.16 to 4.19 below.

4.7 Requirement for RFID tag fixation on cells and monoblocs

The purpose of this requirement (see Table 2) is to assure that the hull material, shape and surface quality of the RFID tags allows affixing the device permanently to the cell or monobloc.

The following methods for attachment shall be possible:

RFID tag attachment	
1	Ultrasonic welding
2	Adhesive boding
3	Adhesive strip bonding
4	Snap-on connection

The above-mentioned attachment processes shall not impair the physical integrity of the RFID tag itself nor that of data stored.

4.8 Requirement for writing of data

The purpose of this requirement (see Table 3) is to define the conditions of writing and the minimum distance from the RFID writing emitter to the RFID tag mounted on a cell or monobloc.

The writing of the full set of information on a single RFID tag shall be carried out under conditions as follows:

RFID tag writing	
1	A full set of information, the data string, shall be written in less than 2s
2	Only one RFID shall/needs to be written to at any time
3	The time between writing of two consecutive sets of data strings shall be expected to be not less than 5s
4	The writing of the data string on the same RFID tag may occur in several steps and with up to 26 weeks between each step. step 1: generic cell or monobloc data step 2: time stamp of cover sealing step 3: date stamp of electrolyte filling step 4: time stamp of electrolyte filling step 6: Check sum writing
5	The distance from the RFID writer to the RFID tag on the monobloc shall be expected to be not more than 20 cm
6	The cell or monobloc may be mowing at 1 cm per second during this writing cycle
7	Other cells and monoblocs may be in immediate vicinity at a distance of less than 20 cm to which a different set of data shall be written
8	No mayor RF wave propagation damping is expected to occur in the RFID writing station
9	Magnetic fields induced by DC currents may be present in the immediate vicinity of the cell or monobloc
10	At the conclusion of the check sum writing step the RFID tag shall not accept any additional data writing or data deletion
11	Writing shall be possible on the same RFID tag in two or more distinct geographic regions where possibly different radio frequency legislation may be operative

4.9 Requirement for reading of data

The purpose of this requirement (see Table 3) is to define the conditions of reading and the minimum distance from the RFID reading emitter to the RFID tag mounted on a cell or monobloc.

The reading of the full set of information from a single RFID tag shall be carried out under conditions as follows:

	RFID tag reading
1	The data string of a RFID tag shall be read in less than 0,1 s
2	The data string shall be capable to be read many times over the cell or monobloc life
3	The RFID interrogator/reader shall offer the choice to read only one RFID tag or all the RFID tags in its active volume
4	The RFID reader shall be capable to read the data string of a RFID tag reliably at an distance of at least 80 cm
5	Reading of the same RFID tag shall be possible in two or more distinct geographic regions where possibly different radio frequency legislation may be operative

4.10 Requirement for reading of data when n+1 units are present

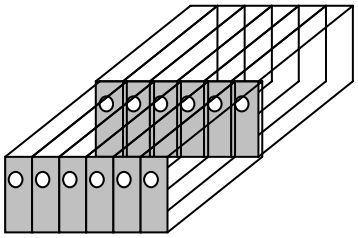
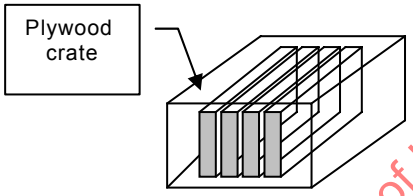
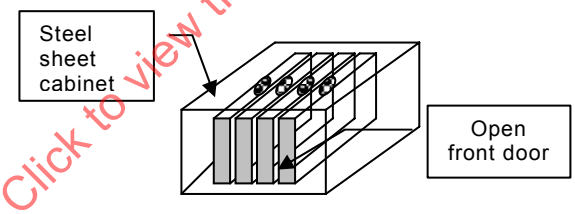
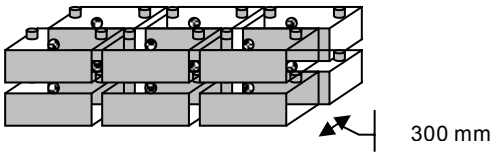
The purpose of this requirement (see Table 3) is to define the conditions of reading when many units are present in the active volume of the RFID reader:

	RFID tag reading of 1+n units
1	The RFID tag and RFDI reader shall have so called anti-collision features capably to cope with up to 24 units in the active volume of the RFID writer and reader

4.11 Requirement for reading of data in transmission damping conditions

The purpose of this requirement (see Table 3) is to define the persistence of the stored data string in the memory of the RFID tag.

In the following “worst” case installations, the correct reading of the RFID tag data content shall be feasible:

RFID tag reading of units under poor radio frequency propagation	
1	Packaged cells and monobloc on pallet. The RFID tag is represented by the white circle on the front face of the monoblocs.  The cells and monobloc may be covered with cardboard packing and enveloped in plastic film
	Packaged cells and monobloc in plywood crates  The crate may be secured with steel band straps and edge reinforcements
2	Cells and monoblocs installed in a steel sheet cabinet The RFID tag is represented by the ovals on top of the monoblocs.  The access to the cells and monoblocs is feasible through the open front of the cabinet or enclosure
3	Cells and monoblocs installed on steel railing racks  The layout comprises strings of cells and monoblocs in several parallel strings on one to more tiers

4.12 Requirement for durability of the data written on the RFID tag

The purpose of this requirement (see Table 4) is to define the minimum duration of persistence of the data string on the RFID tag and its capability to be read out successfully under the environmental conditions specified below.

The minimum durability of the written information shall be as follows: