IEC ExTAG

Secretariat

INTERNATIONAL ELECTROTECHNICAL COMMISSION

IEC SCHEME FOR CERTIFICATION TO STANDARDS FOR SAFETY OF ELECTRICAL EQUIPMENT FOR EXPLOSIVE ATMOSPHERES (IECEx SCHEME)

For consideration by Members of Ex Testing and Assessment Group, ExTAG

(For information to Members of Ex Management Committee, ExMC)

Discussion paper – Distribution of ExTAG Decisions

Introduction

This discussion paper was prepared by the ExTAG Chairman for consideration by ExTAG members and aims at an approval and recording system for decisions taken within ExTAG that assist with a standard approach to testing and assessment of Ex products.

ExTAG members are requested to consider this draft and prepare any comments for discussion during the September 2000 meeting of ExTAG

Proposal for discussion by ExTAG, in Brunschweig 2000

Originator: Wolf Dill, chairman ExTAG

Collection of ExTAG Decisions taken from ExTAG minutes

One of the task of the Committee of Testing Laboratories (ExTL) and Accepted Certification Bodies (ACB) of IECEx is to improve uniform application of the IEC Standards used in the IECEx Scheme for tests and verifications.
The recommendations for uniform application made during the IECEx meetings and quoted in the relevant minutes should be collected in a collection of decision sheets.

This work will not be done with the intention to modify or "interpret" standards. If ExTAG comes to the opinion, that there possibly are mistakes or gaps in the standards, the question will be transferred to the relevant technical committee responsible for the standard.

An updating of the ExTAG decision sheets should be made, deleting the sheets obsolete and converting the remaining into a new format to make them more concise, i.e. in the form of Question and Decision, with some explanatory notes, if any.

The sheets should be in a format containing:

- the number of the Standard involved with the relevant edition;
- the subject of the question;
- the clause/subclause of the standard relevant to the subject;
- the keyword relevant to the matter treated;
- the number of the sheet;
- the number or the date of the IECEx meeting or date of resolution when achieved via correspondence, in which the decision has been taken, as well as the number of the decision quoted in the minutes,
- the involved committee of IEC.

To make easier the use of these sheets, it should be decided to put them in an INTERNET site, instead of having them written on a paper.

The use of INTERNET allows to have the collection updated in real time, while before the updating was made once a year.

As file format the Acrobat Reader (*.pdf) format is proposed.

Two examples are attached:

- A sample CTL decision; the structure was adopted for the following proposal
- A sample ExTAG decision proposal; from the final decision most of the more detailed comments and background information should be removed.

Standard: IEC 335-1, Ed.2	Sub clause: 30.3	Sheet n. 253 A Page 1(1)
Subject: Resistance to tracking	**Key words:** **- tracking**	**Decision 16 of 34th meeting/1997**

Question:
What is the minimum potential below which a tracking path is not any more liable to occur and therefore the test is not necessary ?

Decision:
Based on sub clauses 2.9.4, note 1, and 8.1.4, no tracking test is needed for SELV and PELV circuits.

Explanatory notes: ---

Standard: IEC 79 - 11: 1999	Sub clause: 10.9	Sheet n.
Subject: **Test for cells and batteries**	**Key words:** **- batteries** **- short circuit test** **- temperature class** **- spark test**	**Decision of meeting** **date** **Originator of proposal:** **DE / DMT** **TC / SC involved:** **IEC SC 31G**

Question: Is it necessary to comment the test procedure for cells and batteries as described in 10.9. more detailed?

Answers: Yes. Add the following comments

Before the tests the cells have to be charged and discharged at least 2 times to reverse passivating effects of storage (10.9.1) before it is charged and then tested.

Cells should be tested at normal room temperature (~ 21 °C) and also be tested after heating them up to the required maximum ambient temperature.

In a chamber - no fan working - the cell is positioned horizontally close to the thermally low conductive bottom (- to reduce convective heat transport -) and short-circuited.

Note: Precautions to safe guard personnel from exploding cells might be necessary.

A "test cover" should be used during the test for the maximum surface temperature (see background).

- On a cylindrical cell the temperature sensor is fixed at highest point of the cell enclosure in the middle between the contacts. (see drawing a).
- On flat cells the sensor is fixed in the middle of the top surface (see 1 b)
- On small cells, e.g. for watches, the loss of heat through massive copper contacts of the test equipment is not acceptable. In these cases it is necessary to use smaller but adequate copper wires. These cells are positioned immediately on a thermally non conductive material, e.g. wood and then short circuited (see 1 c)

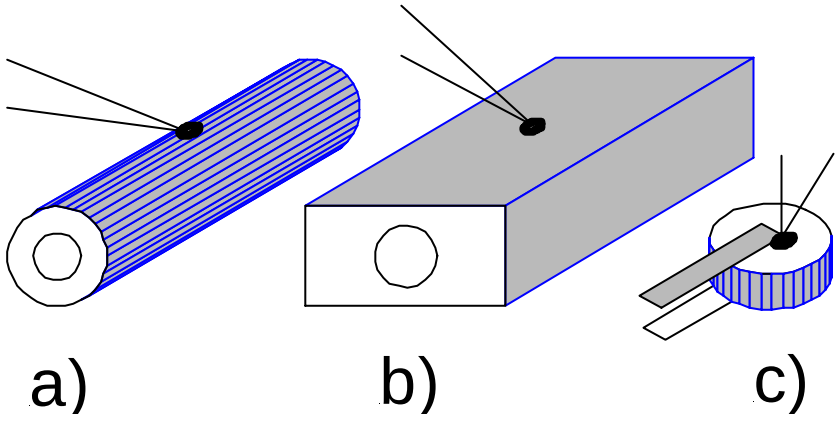


Figure 1: Position of thermocouple

Note: For batteries (assemblies of cells, frequently with own enclosure) the position of the thermocouple needs special consideration.

The short circuit shall be of low resistance, see 10.9.1 .
Modern Ni-Cd cells have very low internal resistance. Size Baby (R14/C) for example delivered for a short time (some seconds) more than 100 A (up to 200 A). At 1.2 V the resistance is less than 12 mOhm. The external resistance has to be less than 1.8 mOhm, to realise a maximum acceptable voltage drop, e.g. 0.15 times the nominal voltage.

For batteries, used in intrinsically safe circuits of type/category "ia", it is <u>not</u> necessary to short circuit two cells at one time. It is very unlikely, that two fresh primary cells or fully loaded secondary cells

short circuit at exactly the same time.

Lithium-cells react very severe with oxygen, when damaged. The cells have to comply with standard IEC 86-4:1996 "safety standard".

Primary cells have to comply with standard IEC 86-5 "product safety standard".

Cells have to be defined by manufacturer, type and rated capacity.

Testing single cells with the spark test apparatus is not necessary.

Background information:
The following is mainly referred to "small" cells, like cells for watches or Micro-(R03/AAA), Mignon-(R6/AA), Baby-(R14/C), Mono-cells (R20/D) or similar cells up to 20 Ah.

Temperature tests:

The short circuit test is done to simulate a possible internal short circuit of the cell.
Up to now no manufacturer of primary or secondary cells has given a written guarantee, that internal short circuits are impossible.
And, all above mentioned "standard-cells" do not comply with table 4 of IEC 79-11 (according to our knowledge) and therefore are not infallible. E.g. the solid insulation between "+" and "-" parts of the metal housing is less than 0.5 mm and in some cases even less than 166 µm.

A battery, an interconnection of two or more cells, is handled in the normal way, i.e. if the distances between the single cells met requirements according to table 4, only one single cell is short circuited (see above).

According to our experience single cells of most of the 9-V-blocks have solid insulation between the cells of less than 150 µm (6LR61) or the clearance is less than 0.5 mm (6F22) and therefore 9-V-blocks should be short circuited at their outer contacts.

Necessity of spark tests:

In table 5 of IEC 79-11 lithium-manganese-dioxide is the type of cell with the maximum voltage: 3,7 V. This voltage is far below the minimum voltage for sparks. Only high currents plus an inductance or the interconnection of cells (battery) can cause ignitions by sparks.

In the moment some accepted bodies certify primary cells of type alkaline-manganese size Mignon (R6/AA) to be used in "IIC T4" without defining a manufacturer/type.

It should not be acceptable to certify cells without defining manufacturer and type. Perhaps in future due to technical progress there will be cells of that type not satisfying the standard.

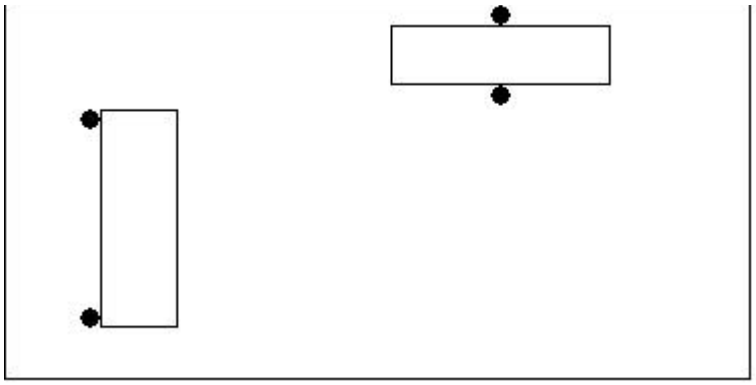
Evaluation of the maximum surface temperature

Although the housing of a cell is made of metal in most cases, there are different temperatures on the surface. There are several reasons and one of them is the air circulation.

Example:

At a Mono-cell, standing upright, the temperature difference measured by BVS/DMT between the (cool) bottom and the top was about 12 °C.

The temperature difference at the horizontally mounted cell measured between the lowest and the highest part was about 8 °C.



Note 1: Temperature rise at the bottom and the contact cap are mostly caused by high current density and are not taken into consideration, as the short circuit inside the cell is simulated.

Note 2: The possibility of the internal short circuit is tested by an external short circuit. A cell made of wrapped electrodes has the lowest internal resistance. The internal resistance measured at the outside contacts is increased by the additional resistance between the electrodes and the external contacts.

The ventilation inside the test chamber influences the surface temperature. After heating up the cell(s), the fan should be switched off. At that moment only the amount of air in the direct environment of the cell has to be heated up by the cell and is relevant for the result.

Note: The temperature of the shorted cell may cause higher ambient temperature in the complete apparatus. This may affect either the rating of safety components or the thermal evaluation of adjacent components. The procedure for this evaluation is not part of the test procedures for the cells described here.

Example:
A cell, size Baby (R14/C), -dummy with heating resistor- was tested in a chamber of 20000 cm3 reaching 142 °C and then inside a little box of about 20000 cm3 reaching 149 °C.

We suggest a "Test cover" e.g. made of A4-sized sheets of thick paper (thermally low conductive) for the sides and the top and a square sheet for one of the small sides, the other small side and the bottom left open.

The chemical reaction may be temperature sensitive. The chemical reaction of Ni-Cd for example most manufacturers give the maximum efficiency at 23 °C. Also the tests show that the maximum temperature rise is found at an ambient temperature of 23 °C, but the maximum temperature is still reached at maximum ambient temperature. This example would give highest surface temperature by adding up the temperature rise at Ta=23 °C to the maximum ambient temperature.

Inside the cell plastic material is used as solid insulation. These materials are changing their properties when they are heated up to more than 70 °C to 100 °C. This causes some type of cells to give different results when short circuited at different temperatures. Only special high temperature cells use adequate plastic material.

Note: This is the reason for testing also at maximum ambient temperature.

Additional information concerning IEC 79-11, clause 10.9.1; first two sentences:
According the technical data of VARTA, their Ni-MH cells reach the maximum capacity only after 400 cycles of charging and discharging. The rated lifetime is 1000 cycles.

Note: To take this into account without extended cycling of the cells a calculation of the possible additional heat generation and subsequently an increase of the maximum surface temperature could be an acceptable method.