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Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals

Sub-Committee of Experts on the Transport of Dangerous Goods

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Item 4 (a) of the provisional agenda
Electric storage systems:
Testing of lithium batteries

UN 38.3 Lithium battery test rupture definition

Transmitted by PRBA – The Rechargeable Battery Association*, **

I. Introduction

1. According to the *Manual of Tests and Criteria*, section 38.3.2.3 defines "rupture" as "the mechanical failure of a cell container or battery case induced by an internal or external cause, resulting in exposure or spillage but not ejection of solid materials".

2. There is uncertainty about the interpretation of the word "exposure" in the definition of rupture, particularly for a battery with a casing that has visual exposure to the cells by design.

3. Large format battery assemblies typically use component batteries (e.g., modules), which by design use plastic and metal frames to hold the battery together physically, but may not necessarily fully encase the battery resulting in visual exposure before UN 38.3 tests begin. These exposed battery designs are then subjected to the UN 38.3 lithium battery tests. If there is a bend in the battery frame, which may create "more" visual exposure, the question has been raised as to whether this is considered a failure. It is therefore unclear how to apply the "exposure" term in the rupture definition for a battery that by design already exposes the interior of the battery.

4. For fully encased batteries, there is a general consensus within the industry that mechanical failure of a fully encased enclosure that results in visual exposure of the internal components of the battery case would be interpreted as a rupture. For fully-enclosed cases that bend or flex but do not open causing an exposure would result in "no exposure".

5. Reviewing other definitions in 38.3.2.3, it is clear "leakage means the visible escape electrolyte or other materials". While "venting means the release of excessive internal pressure". The term leakage appears to cover liquids, while venting appears to cover gases. The definition of rupture includes "spillage of solid materials" but should it be assumed

* A/78/6 (Sect. 20), table 20.5.

** The document was submitted late to the conference services for processing without the explanation required under paragraph 8 of General Assembly resolution 53/208 B.

exposure is applicable to only “solid materials” (e.g., resulting in exposure or spillage but not ejection of sold materials)?

6. The definition of disassembly includes the term rupture: “Disassembly means a rupture of the cell or battery case where solid components are ejected”. Tests T.1 through T.5 have requirements for “No Rupture” and “No Disassembly”. This appears redundant in that you can’t have “Disassembly” without “Rupture”. So, it is not necessary to have a requirement for “No Disassembly” whenever “No Rupture” is already listed.

7. Tests T.6 (Crush/Impact), T.7 (Overcharge), and T.8 (Forced Discharge) are all external abuse events to the cell or battery. The requirements for these tests do not include “No Rupture”, but instead only requires “No Disassembly” and “No Fire”. Test T.5 is very similar to T.6, T.7, and T.8 in that it is an external abuse condition applied to the battery. It seems that T.5 should follow the same requirements as T.6, T.7, and T.8 and not use rupture, but merely reference disassembly due to the abusive nature of this test.

8. PRBA therefore proposes a change to the definition of rupture in 38.3.2.3 and modification to the T.1 through T.5 requirements to remove the redundant disassembly requirement when rupture is already required and to align T.5 requirements with similar T.6, T.7, and T.8 tests.

9. As a suggestion: Add references to multiple various definitions in standards, and include these industry references in the appendix, to emphasize industry disagreements on the term rupture existing today.

II. Proposal

10. The Sub-Committee is invited to amend 38.3.2.3 definition of rupture and the requirements listed in 38.3.4.1.3, 38.3.4.2.3, 38.3.4.3.3, 38.3.4.4.3, 38.3.4.5.3 as follows (new text is underlined, deleted text in ~~strikethrough~~):

“Rupture means the mechanical failure of a cell container or battery case induced by an internal or external cause, resulting in exposure or spillage but not ejection of solid materials. In the case of batteries which are not fully enclosed by its casing and is exposed prior to the tests in subsection 38.3 by design, rupture means the mechanical failure of the battery case induced by an internal or external cause, resulting in spillage but not ejection of solid materials.”

“38.3.4.1.3 Requirement

Cells and batteries meet this requirement if there is no leakage, no venting, ~~no disassembly,~~ no rupture and no fire...”

“38.3.4.2.3 Requirement

Cells and batteries meet this requirement if there is no leakage, no venting, ~~no disassembly,~~ no rupture and no fire...”

“38.3.4.3.3 Requirement

Cells and batteries meet this requirement if there is no leakage, no venting, ~~no disassembly,~~ no rupture and no fire...”

“38.3.4.4.3 Requirement

Cells and batteries meet this requirement if there is no leakage, no venting, ~~no disassembly,~~ no rupture and no fire...”

“38.3.4.5.3 Requirement

Cells and batteries meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly~~, no rupture~~ and no fire during the test and within six hours after the test.”