

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

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Item 4 (f) of the provisional agenda

Electric storage systems: miscellaneous

Suggestions for a further study on test items in sub-section 38.3 of the *Manual of Tests and Criteria*

Transmitted by the expert from China

Introduction

1. Nowadays, with the increasing popularity of electronic products using rechargeable lithium batteries, the transportation demand for goods containing lithium cells or batteries is also growing rapidly. Sub-section 38.3 of the UN Manual of Tests and Criteria (UN 38.3) puts forward the test methods and requirements to ensure the safe transport of lithium batteries. Since the introduction of UN 38.3, global climate change and the emergence of new transport modes (such as high-speed rail) have greatly changed the actual transport conditions. After carefully studying the existing test items, experts from China found that the test conditions specified in UN 38.3 were different from the current conditions in real transport. As the currently most widely used safety test standard for global transport of lithium batteries, it is necessary that UN 38.3 be revised to take account of the actual situation to better ensure transport safety.

2. UN 38.3 lists eight tests required for lithium cells and batteries, namely Altitude simulation, Thermal test, Vibration, Shock, External short circuit, Impact/Crush, Overcharge, and Forced discharge. However, some test conditions described in procedures are different from the real conditions in transport, for example:

(a) Thermal test:

3. Test procedure in 38.3.4.2.2 of *Manual of Tests and Criteria* reads:

“Test cells and batteries are to be stored for at least six hours at a test temperature equal to 72±2 °C, followed by storage for at least six hours at a test temperature equal to -40±2 °C. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated until 10 total cycles are complete, after which all test cells and batteries are to be stored for 24 hours at ambient temperature (20±5 °C). For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.”

4. According to relevant literature, during transport in summer, the internal temperature of the freight container can generally reach about 70 °C, when the ambient temperature is about 38 °C. With the increase in extreme weather, the maximum temperature in summer can often exceed 40 °C in many places, which means that the temperature in freight containers may exceed 70 °C. And, in winter, the temperature in the container may be lower than -40 °C for a long time. It is necessary to further study whether the temperature settings of 72 °C ± 2 °C and -40 °C ± 2 °C used in UN 38.3 thermal test have sufficient safety margins.

(b) Vibration test:

5. UN 38.3 requires vibration to be applied to cells or batteries directly in a sinusoidal waveform. But in real transport, on one hand, different transport modes (air, sea, railway, highway etc.) have different vibration modes; on the other hand, lithium cells and batteries are generally put into the outer packaging and transported in the form of packages. In international test standards, such as ASTM D4728-17 *Standard Test Method for Random Vibration Testing of Shipping Containers* and ISO 13355:2016 *Packaging - Complete, filled transport packages and unit loads - Vertical random vibration test*, and the Chinese standard GB/T 4857.23-2021 *Packaging — Basic tests for transport packages — Part 23 : Vertical random vibration test method*, the package is taken as the test specimen and random vibration is adopted. Therefore, whether it is necessary to add or modify the test object in vibration test (add or change to test of the package) and whether it is necessary to adopt different vibration modes (e.g., random vibration) should be studied.

6. The above two examples are problems that experts from China have found in their current study. Similar problems may also exist for other tests of UN 38.3.

Proposal

7. Experts from China invited the Sub-Committee to consider whether it is necessary to carry out research on the applicability of the test items in UN 38.3, taking consideration of the current actual transport conditions.
