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Transmitted by JAPAN

Proposal for Vibration test procedure and requirement

Explanation/Discussion

1. For the practical limitation of test facilities, the test with sub-assembly should be allowed under certain conditions.
 2. The most likely failures caused by the vibration test would be;
 - Internal short circuit of the cell
 - Loss of tightness of component in the battery enclosure that may cause short circuit inside the enclosure and/or rupture of the enclosure.Justification required under section 3.1.1 should address the influence on such aspects.
 3. Vibration profile is as required in UN Manual of Tests and Criteria for lithium ion batteries (UN 38.3) as amended by ST/SG/AC.10/C.3/2010/81 (to be confirmed with the final document expected as ST/SG/AC.10/38/Add.2). The UN38.3 is, in practice, applied as a mandatory requirement for lithium ion batteries and therefore, it is more beneficial to harmonize the test profile rather than defining another profile, since the actual vibration profile on the vehicle will anyway vary depends on the vehicle structure or the method of installation.
 4. The criteria are to avoid critical phenomena for the safety of vehicle occupants and surroundings.
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Proposed provisions

3.1. Vibration

- 3.1.1. This test shall be carried out with a RESS or, at the discretion of the manufacturer, with sub-assembly(ies) of RESS [that includes Lithium ion cells]. If the manufacturer chose the test with sub-assembly(ies) of RESS, the manufacturer shall demonstrate that such test result can reasonably represent the performance of RESS with respect to the safety performance under similar condition.
- 3.1.2. The test shall be conducted following the method described in [Annex A] to the present Regulation.
- 3.1.3. During the test, the RESS (or the sub-assembly of RESS) shall exhibit no evidence of battery enclosure rupture, fire or explosion, and shall maintain high voltage to ground isolation no less than 100 Ω /volt. Post-test open circuit voltage shall be no less than 90% of the pre-test open circuit voltage.

[Annex A]

VIBRATION TEST FOR RESS

1. PURPOSE

The purpose of this test is to verify the safety performance of a RESS (or a sub-assembly of RESS) under a vibration environment.

2. INSTALLATIONS, PROCEDURES AND MEASURING INSTRUMENTS

2.1. Installation of RESS for the test

For the purpose of this [Annex A], the devices of RESS (or sub-assembly(ies) of RESS) subject to the vibration test shall be referred to as DUT (Device Under Test). DUT shall be firmly secured to the platform of the vibration machine in such a manner as to faithfully transmit the vibration. If certain electronic management unit for RESS is not integrated, such control unit may not be installed on DUT.

2.2. State of charge of RESS

The state of charge (SOC) of DUT shall be at the maximum which is possible during normal vehicle operation. After the adjustment of SOC, the DUT shall be stored under the temperature of $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for more than 8 hours or until the temperature measured on DUT becomes stable within $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ prior to initiation of the vibration.

2.3. Vibration

The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell. One of the directions of vibration must be perpendicular to the terminal face.

The logarithmic frequency sweep shall differ for DUT with a gross mass of not more than 12 kg (small DUT), and for DUT with a gross mass of 12 kg and greater (large DUT).

For small DUT: from 7 Hz a peak acceleration of 1 g_n is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 8 g_n occurs (approximately 50 Hz). A peak acceleration of 8 g_n is then maintained until the frequency is increased to 200 Hz.

For large DUT: from 7 Hz to a peak acceleration of 1 g_n is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 2 g_n occurs (approximately 25 Hz). A peak acceleration of 2 g_n is then maintained until the frequency is increased to 200 Hz.

3. RESULTS

3.1. Records

Open circuit voltage of DUT shall be measured prior to initiation of vibration and after the vibration test.

Isolation measurement shall be done in accordance with ISO 6469-1, Section 6.1.3; or equivalent prior to initiation of vibration and after the vibration test.
