

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(c) of the provisional agenda

Electric storage systems: Transport provisions

Transport provisions for hybrid batteries with both lithium-ion and sodium-ion cells

Submitted by the expert from China

Introduction

1. At its 61st session, the TDG Sub-Committee was invited to consider the informal document INF.37 from China about transport provisions for hybrid batteries consisting of both lithium-ion cells and sodium-ion cells.
2. During the discussion in the previous session, some experts questioned whether the two types of cells are electrically connected as an integrated unit or just put together without any connection. And, the experts from China are suggested to consider the designation and test procedures for these hybrid batteries referring to current provisions on batteries with both lithium metal and lithium-ion cells (special provision (SP) 387 and 2.9.4(f)).

Research results

3. Based on our study, in the hybrid battery, lithium-ion cells and sodium-ion cells are usually connected in series. In some cases, for obtaining greater energy, several lithium-ion/sodium-ion cells can be connected in parallel respectively to form cell modules and then the modules will be connected in series with each other. And, a more accurate Battery Management System (BMS) is applied to monitor and prevent overcharge and over discharge of lithium-ion cells and sodium-ion cells with different voltages.
4. The hybrid battery seems more similar with the lithium-ion battery. During discussions on sodium-ion batteries in the last two biennia, it has been widely agreed that lithium-ion batteries and sodium-ion batteries are very comparable, but only sodium-ion batteries can be fully discharged. Because of the existence of lithium-ion cells, the fully discharged state is also not reachable for the hybrid battery. Therefore, it is more plausible for this kind of hybrid batteries to be designated as lithium-ion batteries.
5. Moreover, it will be safer if they are transported as lithium-ion batteries in consideration of energy density. According to document ST/SG/AC.10/C.3/2020/45/Rev.1 submitted by experts from France and United Kingdom, energy densities of certain lithium-ion battery chemistries are generally in the range 190 Wh/kg to 250 Wh/kg, and currently available sodium-ion batteries can achieve energy densities from 22 Wh/kg to 150 Wh/kg. At present, energy densities of the hybrid battery can reach around 150 Wh/kg to 180 Wh/kg.
6. For test procedures, each cell can be tested separately, as for lithium batteries described in 2.9.4(f) and SP 387. And, by comparing Table 38.3.3 and Table 38.3.4 in the Manual of Test and Criteria, test procedures for lithium-ion and sodium-ion batteries are exactly the same, except for single cell batteries. Hybrid battery can never be a single cell

one, so it does not really matter which test procedure it should follow. Since the battery is designated as a lithium-ion battery, it seems logistic to say that it should be tested as a lithium-ion battery.

Proposals

7. Therefore, the experts from China suggested that the hybrid battery should be classified and tested as a lithium-ion battery. We propose the following amendments:

8. In Chapter 2.9, renumber the current 2.9.4(g) as 2.9.4(h) and add a new 2.9.4(g) as follows:

“(g) Hybrid batteries, containing both lithium ion cells and sodium ion cells (see special provision XXX of Chapter 3.3), shall meet the following conditions:

- (i) The lithium ion cells and sodium ion cells are electrically connected;
- (ii) The battery has been tested as a lithium ion battery;
- (iii) Component cells of the battery shall be of a type proved to meet the respective testing requirements of the Manual of Tests and Criteria, part III, sub-section 38.3.”

9. Add a special provision XXX to the entries UN 3480, UN 3481, UN 3551 and UN 3552 to read as follows:

“XXX Hybrid batteries in conformity with 2.9.4 (g) containing both lithium ion cells and sodium ion cells shall be assigned to UN Nos. 3480 or 3481 as appropriate.”
