United Nations ST/SG/AC.10/C.3/2012/84

Secretariat

Distr.: General
14 September 2012

Original: English

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

Forty-second session
Geneva, 3 – 11 December 2012
Item 2 (c) of the provisional agenda
Recommendations made by the Sub-Committee on its thirty-ninth, fortieth and forty-first sessions and pending issues: electric storage systems

New proper shipping name for asymmetric capacitors

Transmitted by the expert from Japan[1]

Introduction

1. The Sub-Committee, at its forty-first session, considered document ST/SG/AC.10/C3/2011/23 submitted by the expert from Japan proposing to establish a new proper shipping name for asymmetric capacitors. Following a preliminary discussion in plenary session, the expert from Japan prepared a new proposal (informal document INF.64) to take into account the various comments made. At the Chairman's request, the expert from Japan agreed to submit a new proposal at the next session, taking into account some of the comments, particularly involving editorial questions. The proposal in this document was prepared based on the previous proposal in ST/SG/AC.10/C3/2012/23 and informal document INF.64 reflecting discussions from previous sub-committee as well as intersessional communications.

[1] In accordance with the programme of work of the Sub-Committee for 2011-2012 approved by the Committee at its fifth session (refer to ST/SG/AC.10/C.3/76, para. 116 and ST/SG/AC.10/38, para. 16).

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Summary of discussion

2. From a transport perspective, the inherent electrical hazard in energy storage devices is best quantified by energy density as described in working document ST/SG/AC.10/C.3/2012/23.

3. The energy density held by asymmetric capacitors (10-50Wh/L) is considerably less than lithium ion batteries (150-600Wh/L) and nonspillable lead acid batteries (60-100Wh/L). Therefore, the amount of heat that may be generated accidentally inside a casing through an unintended short circuit is much lower for asymmetric capacitors compared to these other higher energy devices. While capacitors possess higher power density, the total energy is directly related to the amount of heat that may be generated inside a casing.

4. The safety of asymmetric capacitors, including lithium ion capacitors (LICs), is markedly different from that of lithium ion batteries. In lithium ion batteries, lithium metal oxides are used in the positive electrode. Free oxygen may be generated by the thermal decomposition of these oxides upon heating over 200ºC and this phenomenon may lead to an uncontrolled exothermic reaction, potentially resulting in venting of gases, fire or explosion. On the other hand, LICs contain no metal oxides in the positive electrode and instead use carbon materials. Thus an uncontrolled exothermic reaction does not occur.

5. Dry batteries including alkali-manganese (390Wh/L), zinc-carbon (195Wh/L), and nickel-cadmium (146Wh/L) batteries are not subject to the Model Regulations provided that they are protected against short circuit. Considering the level of regulations for other electric storage devices, Japan considers that the electrical hazard for asymmetric capacitors can be properly treated by protecting against short circuit during transport.

6. Asymmetric capacitors may contain an electrolyte meeting the criteria of a class or division of dangerous goods. Capacitors which contain dangerous goods of any class or division should be required to withstand a 95kPa pressure differential to confirm the robustness of the capacitor casing.

7. The amount of flammable liquid in LICs with an energy storage capacity of up to 20Wh is below 0.5 litre and the amount of free liquid is about 5 ml - approximately the same amount as in an EDLC of 10Wh. On this basis, it is proposed that asymmetric capacitors containing flammable liquids with an energy storage capacity of 20Wh or less should be transported without applying other Regulations when they are capable of withstanding a 1.2 metre drop test unpackaged and a 95kPa pressure differential test. These tests are the same as those for EDLCs.

8. Considering energy levels of existing primary batteries such as 1.35Wh for the AAA and 3Wh for the AA alkaline manganese battery, Japan considers the risks associated with transporting asymmetric capacitors with 0.3Wh or less to be considerably lower than those batteries. Therefore, it is reasonable for asymmetric capacitors with 0.3Wh or less to be transported without being subject to these Regulations.

9. Nickel-Carbon capacitors are asymmetric capacitors in which charge and discharge can be repeated by potassium ion adsorption at the double layer of the negative electrode and by electrochemical reaction at the nickel hydroxide positive electrode. The electrolyte used is an alkaline electrolyte which is not flammable and there is no fire risk for Ni-C capacitors

10. Ni-C capacitors currently produced contain considerable free liquid and the structure of these devices is quite different from capacitors such as EDLCs and other asymmetric capacitors in which the electrolytes are nearly completely absorbed by solid substances to

keep free liquid to a minimum. Taking into account that Ni-Carbon capacitors are currently transported under UN2795; Batteries, Wet, Filled with Alkali, it could be a possible choice to continue current practice for Ni-C capacitors if the Sub-Committee deemed it necessary.

11. Taking into account discussions at the previous sub-committee, the e**x**pert from Japan proposes to amend the shipping name for asymmetric capacitors to "CAPACITOR, ASYMMETRIC (with an energy sto**r**age capacity greater than 0.3Wh)". In order to avoid confusion between this proposed entry and the existing entry for UN3499, "CAPACITOR, electric double layer (with an energy storage capacity greater than 0.3Wh)", considering that the term "electric double layer" is expressed in lower case letters, it is appropriate to amend the proper shipping name for UN3499 by placing these words in upper case lettering.

Proposal

12. The following provisions are proposed for transport of asymmetric capacitors. A new entry table would read as follows:

(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*
3XXX	CAPACITOR, ASYMMETRIC (with an energy storage capacity greater than 0.3Wh)	9			AAA	0	E0	P003		

The accompanying special provision AAA would read:

"AAA This entry applies to asymmetric capacitors with an energy storage capacity greater than 0.3 Wh. Capacitors with an energy storage capacity of 0.3Wh or less are not subject to these Regulations.

Energy storage capacity means the energy stored in a capacitor, as calculated according to the following equation,

Wh = 1/2 CN (UR2- UL2) × (1/3600),

using the nominal capacitance(CN), rated voltage(UR) and rated lower limit voltage(UL).

All asymmetric capacitors to which this entry applies shall meet the following conditions:

(a) Capacitors or modules shall be protected against short circuit;

(b) Capacitors shall be designed and constructed to safely relieve pressure that may build up in use, through a vent or a weak point in the capacitor casing. Any liquid which is released upon venting shall be contained by the packaging or by equipment in which a capacitor is installed;

(c) Capacitors shall be marked with the energy storage capacity in Wh; and

(d) Capacitors containing an electrolyte meeting the classification criteria of any class or division of dangerous goods shall be designed to withstand a 95kPa pressure differential;

(e) Capacitors containing an electrolyte not meeting the classification criteria of any class or division of dangerous goods, including when configured in a module or when installed in equipment, are not subject to other provisions of these Regulations.

(f) Capacitors containing an electrolyte meeting the classification criteria of any class or division of dangerous goods, with an energy storage capacity of 20Wh or less, including when configured in a module, are not subject to other provisions of these Regulations when

the capacitors are capable of withstanding a 1.2 metre drop test unpackaged on an unyielding surface without loss of contents.

(g) Capacitors containing an electrolyte meeting the classification criteria of any class or division of dangerous goods that are not installed in equipment and with an energy storage capacity of more than 20Wh are subject to these Regulations.

(h) Capacitors installed in equipment and containing an electrolyte meeting the classification criteria of any class or division of dangerous goods, are not subject to other provisions of these Regulations provided that the equipment is packaged in a strong outer packaging constructed of suitable material, and of adequate strength and design, in relation to the packaging's intended use and in such a manner as to prevent accidental functioning of capacitors during transport. Large robust equipment containing capacitors may be offered for transport unpackaged or on pallets when capacitors are afforded equivalent protection by the equipment in which they are contained."

13. As consequential amendments, the proper shipping name for UN3499 shall be changed from "CAPACITOR, electric double layer (with an energy storage capacity greater than 0.3 Wh)" to "CAPACITOR, ELECTRIC DOUBLE LAYER (with an energy storage capacity greater than 0.3Wh)".