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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 **9 June 2010**

Thirty-seventh session
Geneva, 21–30 June 2010
Item 4 of the provisional agenda
Electric storage systems

Transport requirements for ultracapacitors (Electric Double Layer Capacitors)

Transmitted by the Kilo Farad International (kFI)

Introduction

1. Since the December 2009 Sub-Committee meeting, KFI has had ongoing discussions with JEITA, the Japanese industry association with an interest in Electric Double Layer Capacitors. The proposal in ST/SG/AC.10/C.3/2010/33 reflects some of the recommendations provided by JEITA and discussions have continued subsequent to KFI's submission.

2. The subsequent discussions have focused on adapting the proposal:

   - To clarify the requirements as they should apply to EDLCs containing an electrolyte that does not meet any criteria for dangerous goods;
   - To take into account packaging practices used by Japanese industry and others and which have provided for safe transport of EDLCs for many years; and
   - To rationalize the EDLC proposal with current requirements for batteries.

3. JEITA provided the attached powerpoint slides which may help to illustrate the size of EDLCs being discussed and their electrical characteristics in comparison to selected batteries.

Discussion

4. Dangerous goods regulations have traditionally taken a rationalized approach so that requirements provide equivalent safety for substances of comparable danger level. In this respect JEITA has questioned the Farad level KFI previously proposed for requiring a metal strap connecting EDLCs terminal. KFI's proposal was in response to IATA concerns for verifying EDLCs are uncharged and no attempt was made by KFI to rationalize its proposal with existing UN requirements. The theory being that if the two opposing terminals are connected, airline personnel can conclude the EDLC is uncharged. KFI's proposal was based on practical considerations. JEITA rightly points out that a typical 10 kF EDLC holds approximately 10 Wh of energy. Therefore, in taking a rationalized approach relative to battery requirements, a 10kF capacitance level appears to be a more appropriate, and still conservative threshold level, for applying a connecting wire requirement, particularly since EDLCs will already be transported in an uncharged state. On this basis KFI has amended its proposal accordingly and welcomes Sub-committee opinions on this aspect of the proposal.

5. The conclusion of discussions between KFI and JEITA has led to a revision of our proposal in ST/SG/AC.10/C.3/2010/33 as follows:

- The 95 kPa pressure differential requirement should be limited to EDLCs that contain an electrolyte that meets one of the dangerous goods criteria;
- Small EDLCs up to 300 F should be transported uncharged but permitted to be transported loose within a packaging;
- EDLCs with a capacitance of more than 300 F but not more than 10 kF should be protected against short circuiting or have terminals connected by a metal strap; and
- EDLCs containing no dangerous goods should only be required to bear the mark "No DG" when the marked capacitance exceeds 10 kF; and
- Use of Watt hours (Wh) as an indicator of EDLC size in place of Farads. For modules capacitance varies according to series or parallel connection of EDLCs. Use of the maximum energy content when charged, expressed in Wh, simplifies size limits for modules and Wh, a unit already used in the regulations, more appropriately reflects short circuit risk if EDLCs or modules are inadvertently charged. A 300 F EDLC has an energy storage capacity of approximately 0.3 Wh and a 10 kF EDLC has a capacity of approximately 10 Wh. (no spec as to how big or how to provide the marking, so it is up to the manufacturer right?)

Proposal

6. On the basis of the discussions between KFI and JEITA, KFI's proposal in ST/SG/AC.10/C.3/2010/33 (option 3) would be revised to read as follows:

The new table entry would read as follows:

(1)	(2)	(3)	(4)	(5)	(6)	(7a)	(7b)	(8)	(9)	(10)	(11)
XXXX	CAPACITOR, electric double layer	9			AAA	None	E0	P003			

The accompanying special provision AAA would read:

"AAA This entry applies to energy storage devices known as Electric Double Layer Capacitors (EDLCs). EDLCs transported under this entry must meet the following conditions:

(a) Capacitors and modules are transported in an uncharged state, except that capacitors and modules installed in equipment are transported uncharged or protected against short circuiting;

(b) Each capacitor or module with a maximum energy storage capacity of more than 0.3 Wh, is protected against a potential short circuit hazard in transport as follows:

– When the energy storage capacity is more than 0.3 Wh but less than or equal to 10 Wh, each unit must be protected against short circuit or be fitted with a metal strap connecting the terminals; and

– When the energy storage capacity is more than 10 Wh, each unit must be fitted with a metal strap connecting the terminals;

(c) Capacitors containing dangerous goods shall be designed to withstand a 95 kPa pressure differential and all capacitors shall be designed to safely relieve any pressure buildup through a vent or a weak point in the receptacle; and

(d) Capacitors with a maximum energy storage capacity of more than 0.3 Wh are marked with the maximum capacity in Wh.

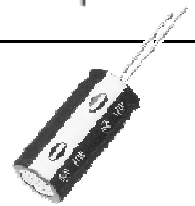
Capacitors containing no dangerous goods, as indicated by a marking that states “No DG” when the marked energy storage capacity exceeds 10 Wh, and meeting the conditions in paragraphs (a) to (d) are not subject to other provisions of these regulations.

Other capacitors with a marked energy storage capacity of 10 Wh or less are not subject to other provisions of these regulations when they meet the conditions in paragraphs (a) to (d) and are capable of withstanding a 1.2 meter drop test as packaged for transport."

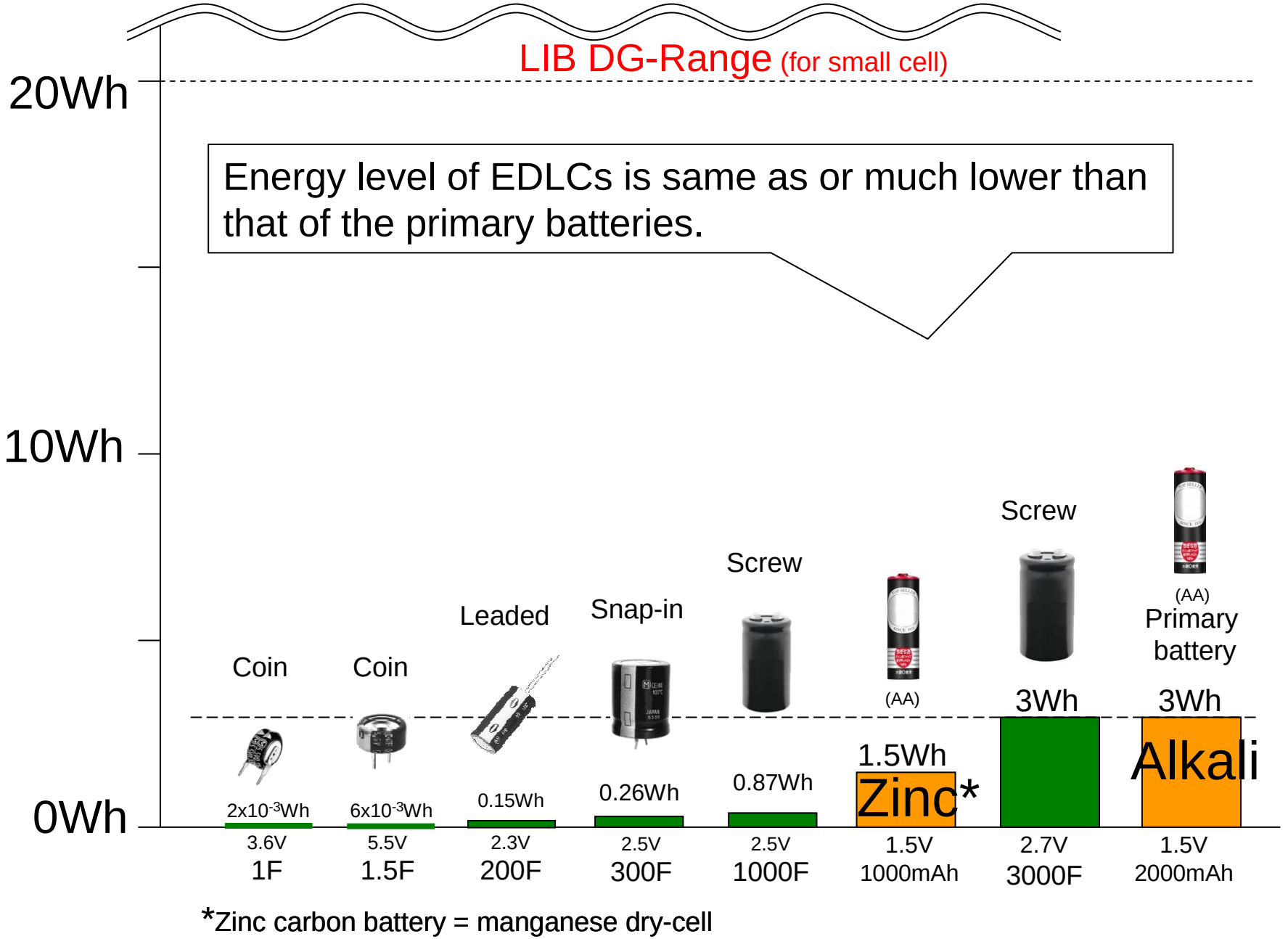
Note:
KFI has conducted a series of tests to demonstrate the safety of EDLCs. Videos of these tests are available for viewing by Subcommittee participants online by going directly to the private KFI members video site at: http://www.ecaus.org/kfi/video.cfm.

EDLC Energy Storage level (ex)

Typical product shape and its energy level

V	F	Wh (fully charged)	Type	
3.6	1	0.00180	Coin	
5.5	1.5	0.00630	Coin	
2.3	200	0.14694	Leaded	
2.5	300	0.26042	Snap-in	
2.5	3000	2.60417	Screw-terminal	

Comparison (EDLCs & Batteries)



*Zinc carbon battery = manganese dry-cell

Example EDLC loose-fill packaging in use since 1979

Energy level： 5.5V 1.5F = 0.0063Wh（Fully charged）