

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

24 June 2010

Sub-Committee of Experts on the Transport of Dangerous Goods

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)**

**Response to comments on informal document INF.68**

1. Summary of comments: See attached
2. Information on flammable liquid amounts according to Wh rating: See attached
3. Based on Subcommittee discussions on Inf 68 the Subcommittee is asked to decide:
  - (a) Whether the threshold limit for EDLCs that should be fully regulated as class 9 dangerous goods should be 10 Wh or 20 Wh.
  - (b) Whether EDLCs subject to limited requirements (i.e., equal to or less than 10Wh or 20 Wh depending on the decision above) should be subject to:
    - (i) A drop test from a height of 1.2 m as **packaged for transport** in any orientation without loss of contents; or
    - (ii) A drop test from a height of 1.2 m **unpacked** without loss of contents.
  - (c) Whether to mark “nominal capacitance and voltage” in place of the “energy storage capacitance in Wh” in proposed SP AAA(d). Note:  $Wh = [1/2 CV^2 ]/3600$

Note: “No-DG mark” requirement deleted based on comments.

4. Based on Subcommittee discussions on Inf 68, the proposed text is as follows:

**Proposal**

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 (with an energy storage capacity greater than 0.3 Wh)	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) with an energy storage capacity greater than 0.3 Wh. Energy storage capacity is taken to mean the energy held by an EDLC as calculated using the nominal voltage and capacitance. EDLCs transported under this entry shall meet the following conditions:

- (a) Capacitors shall be transported in an uncharged state, except that capacitors and capacitor modules installed in equipment may be transported uncharged or protected against short circuiting;
- (b) Each capacitor or capacitor module shall be protected against a potential short circuit hazard in transport as follows:
  - (i) When a capacitor’s energy storage capacity is less than or equal to **10Wh** or when the energy storage capacity of each capacitor in a module is less than or equal to **10Wh** , the capacitor or module shall be protected against short circuit or be fitted with a metal strap connecting the terminals; and
  - (ii) When the energy storage capacity of a capacitor or any capacitor in a module is more than **10Wh**, each capacitor or module shall 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 capacitor casing; and
- (d) Capacitors shall be marked with the **energy storage capacity in Wh**.

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

Other capacitors with an 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 metre drop test [**in any orientation as packaged for transport**]/[**unpacked on an unyielding surface**] without loss of contents.

When installed in equipment, capacitors of more than **10Wh**, meeting the conditions in paragraphs (a) to (d) above, are not subject to these Regulations, provided the equipment is packaged in a strong outer packaging constructed of suitable material 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.

Cell Energy Storage Capacity (Wh)	Approximate Cell weight (g)	Approximate Cell Volume (L)	Approximate Nominal Capacitance (F)	Approximate Flammable Liquid Total Mass (g)	Approximate Free Flammable Liquid Mass (g)
0.3	39	0.04	296	13	1.00
1	130	0.12	988	45	1.00
10	1300	1.18	9877	449	6.74
20	2600	2.35	19753	899	8.09

Table 1 – Cell Energy Storage Capacity and Corresponding Cell Characteristics

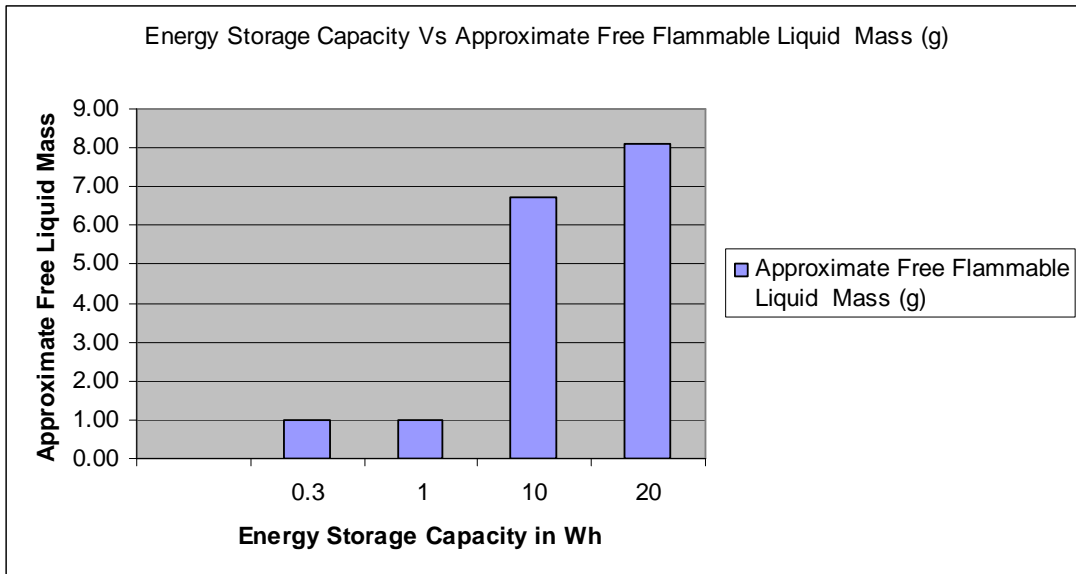


Figure 1 – For Reference; Comparison of Approximate Free Liquid Mass to Energy Storage Capacity

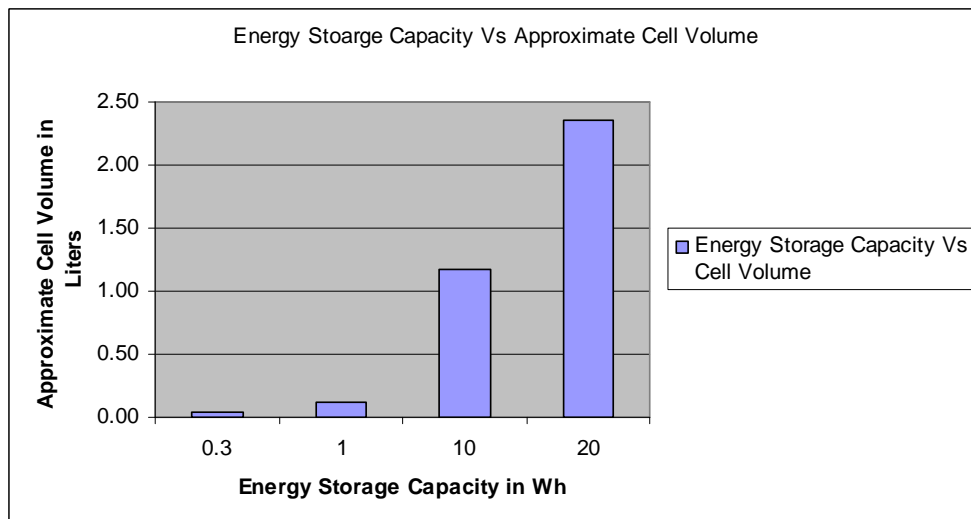


Figure 2 – For Reference; Comparison of Approximate Cell Volume to Energy Storage Capacity

Comment Classification	Comment	Frequency	Disposition
Additional Requirement	Need to make a link and reference quality system requirements to ensure manufacturers execute tests and have proof that their devices pass the required tests	2	Not Addressed in this Consolidated INF Paper
Additional Requirement	More information on Threshold Values and their meaning would be helpful	1	Provided in Consolidated INF Paper
Decision	Energy Threshold Value recommended to be 20Wh	1	Need Decision from Subcommittee
Decision	Cells should be marked with Farads and Voltage, Not Wh Energy	1	Need Decision from Subcommittee
Decision	1.2m Drop Test should be done as packaged for shipping, not on the article	2	Need Decision from Subcommittee
Decision	10 Wh Energy Threshold is acceptable	2	Need Decision from Subcommittee
Decision	1.2m Drop Test should be done on the article, not as packaged for shipping	1	Need Decision from Subcommittee
Decision	Does not support the "No DG" Marking	4	Deleted marking requirement
Decision	Prefer Wh marking over Farads and Voltage markings	1	Need Decision from Subcommittee
Drafting clarification	Need to be explicit about the fact that capacitors with energy less than 0.3Wh are unregulated	3	Redrafted to address shortcoming in this Consolidated INF paper
Drafting clarification	Are modules under 0.3Wh excluded from regulations or is it modules containing cells that are under 0.3Wh that are unregulated	1	Redrafted to clarify in this Consolidated INF paper
Drafting clarification	Need to clarify terms related to energy storage capacity, multiple forms of that term are used, should use a single term and define that term	1	Selected "Energy Storage Capacity" as the term of choice and utilized throughout this Consolidated INF paper
Drafting clarification	Packaging instructions need drafting revision to clarify those aspects appropriate for this regulation vs those appropriate for packing instructions	1	Updated and addressed in this Consolidated INF paper per the specific inputs from delegates
Drafting Clarification	Need to define the term "Large Equipment"	1	Updated the description to include the term "Large Robust Equipment" in this Consolidated INF paper, patterned after packing instruction for explosives

Table 2 – Delegation Comments on Consolidated INF paper 68 with frequency of comment and disposition as of this INF paper revision