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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****Forty-eighth Session**

Geneva, 30 November – 9 December 2015

Item 4 (d) of the provisional agenda

**Electric storage systems: miscellaneous****Transport of damaged/defective lithium batteries****Transmitted by the International Organization of Motor Vehicle  
Manufacturers (OICA)<sup>1</sup>****Introduction**

1. SP376 allows two ways of transporting lithium batteries, either P908/LP904 or regarding the transport of potentially risky damaged / defect batteries using competent authority approval.
2. Several competent authority approvals have been granted so far indicating different transport solutions using different packaging based on different testing and calculation methods.
3. OICA members have looked at the known existing competent authority approvals that have been granted in different countries so far and recognised many similarities on these approvals.
4. Based on experience acquired so far the attached list of measures has been established. This list has been presented to the experts participating in the 2nd Informal Working Group Meeting - Lithium Batteries and Manual of Tests and Criteria. As they are not directly mentioned in the terms of reference, the Working Group advised OICA to draft a document for the Sub-Committee.

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<sup>1</sup> In accordance with the programme of work of the Sub-Committee for 2015-2016 approved by the Committee at its seventh session (refer to ST/SG/AC.10/C.3/92, paragraph 95 and ST/SG/AC.10/42, para. 15).

## Proposal

5. OICA proposes to discuss the possibility and the need of defining standards to packaging and testing regarding the transport of such potentially risky damaged/defect batteries as a way to avoid competent authority approvals. In many cases that could be covered by already existing solutions based on granted competent authority approvals.

6. Following points have been summarized to be found repeatedly in granted competent authority approvals and are asked to be discussed. Some of these are more packaging specific and others focus on testing specification. OICA would leave relating them to the Sub-Committee to review where necessary:

- (a) All terminals of lithium cells and batteries shall be protected against external short circuit.
- (b) All openings for service fluids other than for electrolyte shall be closed.
- (c) Residues of dangerous goods as well as of the electrolyte on the surface of the outer casing of Lithium cells and batteries shall be removed.
- (d) Packagings shall conform to the packing group I performance level.
- (e) The packaging must be capable to withstand the potential risk scenarios related to the type of Lithium-cell/-battery at maximum energy content. The following scenarios must be considered, if applicable:
  - (i) Rapid disassemble,
  - (ii) Dangerous reaction,
  - (iii) Produce of a flame,
  - (iv) Dangerous evolution of heat, or
  - (v) Dangerous emission of acute toxic, corrosive or flammable gases or vapors.
- (f) The following points must be guaranteed successfully during these scenarios:
  - (i) The temperature on the outside of the packaging may not exceed 100°C during the reaction,
  - (ii) Gases or vapours escaping the packaging may not be flammable or acutely toxic. If an escape of flammable or acute toxic gases or vapors cannot be prevented by the construction of the packaging, the composed gas must be:
    - Directly treated or
    - A change of sufficient air in the load compartment of the cargo transport unit must be guaranteed, so that the flammable or acute toxic gases or vapors outside the packaging developed by venting the Lithium cells and batteries are not inflammable, flammable or dangerous or
    - The developed gases or vapors can be purged out of the load compartment without danger.
  - (iii) A damage or explosion of the packaging through developed overpressure must be prevented, e.g. per structural arrangements.

7. The test results shall be documented and the technical documentation shall include at least the following information:

- (a) A number of tested lithium cell(s)/battery(ies),
- (b) Weight of the tested lithium cell(s)/battery(ies),
- (c) Dimensions of the tested lithium cell(s)/battery(ies),
- (d) Type of lithium cell(s)/battery(ies) or chemistry of the tested lithium cell(s)/battery(ies),
- (e) Energy content of the tested lithium cell(s)/battery(ies).

On request the technical documentation must be submitted to the competent authority.

8. If a packaging has already been successfully proven capable (e.g. by testing as specified in (4), (5) and (6) or calculation as in (9)) with a lithium-cell-/battery-type at maximum energy content, this packaging can be used for the transport of other lithium-cells/-batteries under certain conditions. The conditions are that these lithium-cells/-batteries correspond to the successfully tested lithium-cell-/battery-type regarding construction and cell-/battery-chemistry, as well as that these have a lower energy content.

9. The capability of the packaging can either be demonstrated physically with a lithium cell/battery in the respective packaging or alternatively proven by simulated analysis. The following parameters should be considered as a minimum requirement for the analysis, if applicable:

- (a) 100% SOC for all lithium cells/batteries inside packaging,
- (b) Mass and dimension of the lithium cells/batteries,
- (c) Determine available air inside of packaging (oxygen for reaction and heat transfer),
- (d) All material properties: Density [ $\text{kg}\cdot\text{m}^{-3}$ ], specific heat capacity [ $\text{J}\cdot\text{kg}^{-1}\cdot\text{K}^{-1}$ ], heating value [ $\text{kJ}\cdot\text{kg}^{-1}$ ], thermal conductivity [ $\text{W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$ ], melting temperature and flammability temperature [K], heat transfer coefficient of the outer packaging [ $\text{W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$ ], ambient air temperature  $25^{\circ}\text{C}$ ,
- (e) Determine energy released with potential chemical reaction per element based on available elements for reaction (e.g. oxygen) for lithium cell/battery and packaging,
- (f) Electrical energy to be discharged by a single event
  - (i) Consider worst failure modes based on knowledge on cell(s), module(s) and total battery design,
  - (ii) Total energy conversion within 30 minutes,
  - (iii) Worst case scenario to be analyzed for 24 hours.

## Conclusion

10. These points are not presented for adoption of text but the Sub-Committee is invited to comment on these different points and define the possible next steps and the best place to elaborate proposals suitable for introduction in the Model Regulations.