



Classification of lithium batteries

Some issues....

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Overview

- History of classification
 - UN Recommendations and UN Manual of Tests and Criteria
 - ICAO Technical Instructions
- Issues....



Legal structure

- Multimodal transport
 - UN Recommendations on the Transport of Dangerous Goods
- Aviation
 - Convention on International Civil Aviation
 - Annex 18 – applicable from 1.1.1984
 - Technical Instructions for the Safe Transport of Dangerous Goods by Air



History....

- 1984
 - No UN number, transported as Division 4.3 (dangerous when wet) on cargo aircraft
- 1988 UN (1991 ICAO)
 - **UN 3090 Lithium batteries**
 - **UN 3091 Lithium batteries contained in equipment**



History (continued)

- 2006 UN (2009 ICAO)
 - UN 3480 Lithium ion batteries
 - UN 3481 Lithium ion batteries packed with or contained in equipment
 - UN 3090 Lithium metal batteries
 - UN 3091 Lithium metal batteries packed with or contained in equipment



Issue 1

- Lack of “granularity” – two UN numbers and PSNs for ion and metal cells and batteries
 - Different energy densities (or mass/size)
 - Different chemistries
 - Different cell and battery type



Issue 2

- There is no differentiation between cells and batteries although there are SIX different sequences of tests to be performed
 - cell/rechargeable battery/non-rechargeable battery/rechargeable single cell/component cell (transported with/separate from battery)



Class 9 – Miscellaneous dangerous substances and articles, including environmentally hazardous substances

- Lithium batteries
- Cells and batteries, cells and batteries contained in equipment, or cells and batteries packed with equipment, containing lithium in any form must be assigned to UN Nos. 3090, 3091, 3480 or 3481 as appropriate



Assignment to Class 9

- Each cell or battery is of the type proved to meet the requirements of each test of the UN Manual of Tests and Criteria, Part III, subsection 38.3
- Cells and batteries must be manufactured under a quality management programme



Design type tests

- Test T.1: Altitude simulation
- Test T.2: Thermal
- Test T.3: Vibration
- Test T.4: Shock
- Test T.5: External short circuit
- Test T.6: Impact/crush
- Test T.7: Overcharge
- Test T.8: Forced discharge



Conditions for new type

- Primary cells and batteries
 - A change of more than 0.1g or 20% by mass, whichever is greater, to cathode, anode or electrolyte
- Rechargeable cells and batteries
 - A change in nominal energy in Watt-hours or in nominal voltage of more than 20%
- A change that would lead to failure of any of the tests



Type of change

- The type of change that might be considered to differ from a tested type, such that it might lead to failure of any of the test results, may include.....a change in material of the anode, cathode, the separator or the electrolyte.....etc.



Specifications of tests

- Number and conditions of cells and batteries of each type to be tested
- Procedure
 - Purpose
 - Test procedure
 - Requirement



Issue 3

- Tests are for new design type only, not for quality assurance
- There is no time limitation on design type tests



Issue 4

- There is no requirement to provide this information, even though shippers require it if they are to meet the requirements of the relevant packing instructions



Issue 5

- There is no requirement for the UN test report to be in a specified format or in any language or within any specified time frame
 - Does design type test report apply to a battery if the report is 5 years old and the manufacturer has increased the lithium metal by less than 20% in the interim? Do they have to prove it is still applicable?



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Quality management programme

- Description of organizational structure
- Relevant inspection and test, quality control, quality assurance and process operation instructions that will be used
- Quality records
- Procedures to ensure no damage to final product



Issue 6

- Requirements for QMP for manufacturing are contained in transport regulations, not manufacturing standards



Issue 7

- Test data must be kept and made available to the appropriate national authority upon request
 - Lack of transparency of safety information



Lack of transparency

- One possible solution
 - Third party oversight programme
 - Verifiable source of data/information



Future work

- Request by ICAO for UN to continue work on lithium batteries in next biennium
 - Increased granularity
 - Provision of information



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