



U.S. Department of Transportation  
**Pipeline and Hazardous Materials  
Safety Administration**

MAR 16 2010

1200 New Jersey Ave, SE  
Washington, D.C. 20590

Mr. Michael Greiner  
MGA Research Corporation  
12790 Main Road  
Akron, NY 14001

Ref. No.: 10-0017

Dear Mr. Greiner:

This is in response to your January 26, 2010 email requesting clarification of requirements in the Hazardous Materials Regulations (HMR; 49 CFR Parts 171-180) applicable to design-type testing of lithium ion batteries. The specific requirements you address are contained in Section 38.3 of the 5<sup>th</sup> Revised Edition of the United Nations Manual of Tests and Criteria. Currently, the HMR reference the 4<sup>th</sup> Revised Edition of the United Nations Manual of Tests and Criteria. PHMSA proposed to incorporate the 5<sup>th</sup> revised edition in a notice of proposed rulemaking published on January 11, 2010 (HM-224F; 75 FR 1301).

Your letter describes two lithium ion hybrid electric vehicle battery assemblies consisting of electrically connected cells and modules. Your questions have been paraphrased and answered as follows:

Q1. You ask us to confirm your understanding of the appropriate number and condition of cells and batteries required to be tested in accordance with the 5<sup>th</sup> Revised Edition of the United Nations Manual of Tests and Criteria.

A1. The information you provided in your letter pertaining to the number and condition of lithium cells and batteries required to complete the design type tests outlined in the 5<sup>th</sup> Revised Edition of the United Nations Manual of Tests and Criteria is correct.

Q2. Provided the lithium battery modules or lithium battery assemblies are internally disconnected when offered for transportation and transported, is the lithium battery module or lithium battery pack subject to the UN design type tests?

A2. Provided the lithium cells comprising the battery module or the lithium battery modules comprising the battery assembly are not electrically connected, then each component is considered an individual battery for the purposes of testing. However, once electrically connected, the entire battery module or battery assembly must be tested as a single battery.

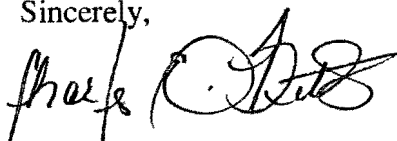
Q3. If the battery cells and modules successfully pass the UN design type tests, is the battery assembly subject to testing?

A3. The answer to this question depends on the size of the battery assembly. The 4<sup>th</sup> revised edition of the UN Manual of Tests and Criteria does not require further testing of battery assemblies comprised of successfully tested cells and batteries when the aggregate lithium content of all anodes, when fully charged, is more than 500 g or in the case of a lithium ion battery, is more than 6200 Watt-hours provided certain conditions are met. This means that battery assemblies with not more than 500 g aggregate lithium content or in the case of a lithium ion battery, is not more than 6200 Watt-hours are subject to each of the appropriate tests in the quantity indicated.

The 5<sup>th</sup> revised edition would permit alternative testing for battery assemblies in which the aggregate lithium content of all anodes, when fully charged, is not more than 500 g, or in the case of a lithium ion battery, a Watt-hour rating of not more than 6200 Watt-hours, that is assembled from cells or batteries that have passed all applicable tests. In this case, one battery assembly in a fully charged state must be tested under Tests 3, 4, and 5, and, in addition, Test 7 in the case of a rechargeable battery assembly. For a rechargeable battery assembly, the assembly shall have been cycled at least 25 cycles.

I hope this answers your inquiry. If you have further questions, please do not hesitate to contact this office.

Sincerely,

A handwritten signature in black ink, appearing to read "Charles E. Betts", written in a cursive style.

Charles E. Betts  
Chief, Standards Development  
Office of Hazardous Materials Standards

Leary  
 § 172-101  
 § 173.

**Drakeford, Carolyn (PHMSA)**

**From:** Betts, Charles (PHMSA)  
**Sent:** Tuesday, January 26, 2010 7:38 AM  
**To:** Drakeford, Carolyn (PHMSA)  
**Subject:** FW: UN testing requirements  
**Importance:** High

Batteries  
 10-0017

Carolyn,

Please log the attached email from Mr. Michael Greiner as a new request for interpretation and assign to Kevin.

Thanks,  
 Charles

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**From:** Ke, Charles (PHMSA)  
**Sent:** Monday, January 25, 2010 9:19 AM  
**To:** Michael Greiner  
**Cc:** Ke, Charles (PHMSA); Betts, Charles (PHMSA)  
**Subject:** RE: UN testing requirements

Please send your inquiry to: Mr. Charles Betts at [charles.betts@dot.gov](mailto:charles.betts@dot.gov)

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**From:** Michael Greiner [mailto:[Michael.greiner@mgaresearch.com](mailto:Michael.greiner@mgaresearch.com)]  
**Sent:** Friday, January 22, 2010 4:21 PM  
**To:** Ke, Charles (PHMSA)  
**Subject:** RE: UN testing requirements

Hello Charles,

Thank you for the reply. It seems I will need an official written reply. Could you please direct me to the proper e-mail address and/or phone number?

Best Regards,

Michael Greiner  
 MGA Research Corporation  
 12790 Main Road  
 Akron, NY 14001

Phone: 716-542-5515  
 Fax: 716-542-4437

[michael.greiner@mgaresearch.com](mailto:michael.greiner@mgaresearch.com)

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**From:** [charles.ke@dot.gov](mailto:charles.ke@dot.gov) [mailto:[charles.ke@dot.gov](mailto:charles.ke@dot.gov)]  
**Sent:** Friday, January 22, 2010 1:57 PM  
**To:** [michael.greiner@mgaresearch.com](mailto:michael.greiner@mgaresearch.com)  
**Cc:** [charles.ke@dot.gov](mailto:charles.ke@dot.gov); [GKerchner@wileyrein.com](mailto:GKerchner@wileyrein.com)

1/26/2010

**Subject:** RE: UN testing requirements

Hi Michael,

My reply here should be considered as an opinion not an official reply. If you need a written official reply you need to request to our Standards Office.

1. Your understanding on Item I is correct.
2. There is no provision in the test scheme to allow you tie in the transport conditions (with internal circuit disconnected) with alternative testing requirements. If I understand you correctly, with internal circuit disconnected between each module, would you have a battery pack? I do not quite understand what are you trying to accomplish.
3. The last paragraph on page 397 of the 5<sup>th</sup> ed. Of the Test Manual of Section 38.3 answers your question.

If I can be of further assistance please advise.

Charles Ke

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**From:** Michael Greiner [mailto:Michael.greiner@mgaresearch.com]  
**Sent:** Thursday, January 21, 2010 1:47 PM  
**To:** Ke, Charles (PHMSA)  
**Cc:** 'Kerchner, George'; 'Helen Kaleto'; 'Jason Gilham'; chris.sumner@mgaresearch.com  
**Subject:** UN testing requirements

Hello Mr. Ke

This e-mail is in regards to some questions that came up from a customer of mine.

Our customer is building a rechargeable pack that is going to be used in an HEV. They need to do testing from the cell level to the module level and finally at the pack level in accordance to the new Rev 5 standard coming out in 2011. There are going to be 2 different size modules (one consisting of 20 cells and one consisting of 10 cells). The final packs are going to be a grouping of these. The questions are as follows:

1. Is the information below for amounts correct?

Cells:

- 10 cells at first cycle in a fully charged state (T1-T5)
- 10 cells at first cycle at 50% of the design rated capacity (Impact prismatic)
- 10 cells at first cycle in a fully discharged state (T8)
- 10 cells after 50 cycles ending in a fully discharged state (T8)
- Total: 40 cells

Modules:

- 2 batteries at first cycle fully charged (T1-T5)
- 2 batteries after 25 cycles ending fully charged (T1-T5)
- Total: 4 batteries (assuming that the overcharge test is not required because the modules do not have overcharge protection and are going to be used in a larger assembly which affords such protection.)
- This would be 4 per style (module with 20 cells, module with 10 cells)
- If one of the modules is under 12kg? 4 batteries at each state mentioned above will be needed for a total of 8 small.

Pack:

- 2 pack ending fully charged after 25 cycles (T3-T5, T7)
- Total: 2 packs

1/26/2010

2. If the battery packs and or modules are being shipped with the contactors not engaged (with the internal circuit disconnected), will they need to be when performing the tests, mainly the electrical tests? (short circuit, overcharge)
3. If the cells and modules pass the UN testing is there a stipulation that says the pack would not need to be tested?

Best Regards,

Michael Greiner  
MGA Research Corporation  
12790 Main Road  
Akron, NY 14001

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Fax: 716-542-4437

michael.greiner@mgaresearch.com

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The 5<sup>th</sup> revised edition made several amendments applicable to the testing requirement of battery assemblies.

We have reproduced the information you provided in your letter in the following chart:

A total of 40 cells are subject to the appropriate tests as follows:

<b>Test</b>	<b>Number of cells</b>
T1- T5	10 cells at first cycle in a fully discharged State
T6	For prismatic cells, ten cells are required 5 cells along the longitudinal axis and, separately 5 cells along the other axes
T7	Not required for lithium cells
T8	10 cells at first cycle in a fully discharged state; and 10 cells at first cycle in a fully discharged State

A total of 8 small batteries (i.e. lithium ion battery with a gross mass of not more than 12 kg) and a total of 4 large batteries (i.e. lithium ion battery with a gross mass of more than 12 kg) are required for the T1 through T5 tests.

<b>Test</b>	<b>Number of Batteries</b>
T1 - T5	4 small batteries, at first cycle, in fully charged states; 4 small batteries after 50 cycles ending in fully charged states.  2 large batteries at first cycle, in fully charged states; and 2 large batteries after 25 cycles ending in fully charged states.
T7	Batteries not equipped with overcharge protection that are designed for use only in a battery assembly, which affords such protection, are not subject to the requirements of this test

When testing a lithium ion battery with a Watt-hour rating of not more than 6200 Watt-hours, that is assembled from cells or batteries that have passed all applicable tests, one battery

assembly in a fully charged state shall be tested under Tests 3, 4, and 5, and, in addition, Test 7 in the case of a rechargeable battery assembly. For a rechargeable battery assembly, the assembly shall have been cycled at least 25 cycles.

<b>Test</b>	<b>Number of Batteries</b>
T3 - T5	1 battery pack in a fully charged state
T7	1 battery pack in a fully charged state that has been cycled at least 25 cycles.