

# Ticket #1257

<b>Ticket Status:</b>	Closed	<b>Name:</b>	Philip Piper
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<b>Create Date:</b>	03/13/2016 4:06 pm	<b>Phone:</b>	(713) 501-2744
<b>Field of Study:</b>	Electrical Engineering		

Subject: **Yale University**  
**03/13/2016 4:06 pm Philip Piper**

This question is with regards to EV3.5.7 concerning electrical separation of the accumulator segments.

The attached image shows our accumulator configuration. Note that the cell tabs are completely covered by a plastic insulating tab cover 3D printed out of Stratasys's RGD525. However there is a lug sticking out of each tab cover (labelled "conductive"). Are the tab covers enough to meet EV3.5.7 if we properly insulate the lugs?

Thanks!

Phil  
EV3.5.7 Question.jpeg(132 kb)

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**03/16/2016 10:21 am**

Hi Philip,

I need to clarify a few points before I can answer you question about EV3.5.7. What is the energy content of your accumulator segments? Also, I can't tell from your attached photo if your segments are physically separated by a UL94-V0, FAR25 material. Covering the Cell Tabs alone would not be sufficient to meet 3.5.7 if each segment has more than 6 MJ.

Carrie

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**03/16/2016 8:08 pm Philip Piper**

The energy content of each accumulator segment is 5.23MJ according to  $E = V_{nom} * Ah * \#cells = 3.3 * 20 * 22$  (note that all 22 cells are in series). The segments are separated by 0.035" 4130 steel, which should be UL94-V0 compliant (as far as I know). We can test that compliance if absolutely necessary, but I think that much steel would hold up. The mechanical structure was designed in line with Formula Electric's very detailed, and quite heavy, accumulator mechanical configuration rules (Formula Electric EV3.4).

Hope that helps. Looking forwards to your response, as always!

Best,

Phil

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**03/21/2016 1:35 pm**

Phil,  
The steel should meet the UL94-V0 section but what are you using to comply with the electrically insulating component of the rule? As far as the lugs are concerned, you are okay so long as you properly insulate them. we will want a data sheet for whatever you choose to use. (For what it's worth, Kapton tape is what I would use, but you can certainly come up with your own solution.)

Thanks,

FHRC

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**03/21/2016 2:59 pm Philip Piper**

That gets back to my original question which may not have been worded well. Do the tractive system conductors in each accumulator segment need to be insulated from other segments or do the entire accumulator segments need to be insulated from each other? Obviously the latter covers the former. I hope I have made the distinction clear.

Best,

Phil

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**03/22/2016 11:40 am**

Phil,

Let me see if I can clear all of this up. The rule says that you must isolate the segments from each other mechanically and electrically. However, as you seem to be bolting your segments to sheet metal and not shorting out, I'm guessing that you have some sort of built-in isolation to your segments. If this is the case then you would only need to isolate the parts of your segment that protrude outside of your isolated segment, ie, your lugs. The logic behind this rule comes from working on and inspecting the accumulator boxes rather than during the dynamic events as they will all be wired together at this time anyway. Based on the CAD, it looks like you just need to cover the exposed parts, but if you have actual pictures, I could advise you better. I hope this has cleared the rule. Let us know if not.

Thanks,

FHRC

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**03/23/2016 3:40 am Philip Piper**

That answers my question. You are correct in assuming that the segment expansion limiter and heat sinks are insulated from the cells. Additionally the cell tabs are completely enclosed in an insulating tab cover, with only the copper lugs protruding. We will be sure to insulate these lugs with Kapton tape and heat shrink. Thank you!

Best,

Phil

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**Please Wait!**

Please wait... it will take a second!