

Electrical Rules & Scrutineering



EV 1.2.2 High Current Path – any path of a circuitry that, during normal operation, carries more than 1 A.

- Only RMS Current is meant (Gate driver pulses can be higher)
- Only TS. LV supply for inverter, fans, DV ECUs are not covered by this rule

EV 3.1.3 An electrically conductive part is grounded if its resistance to LVS ground is below 100 mΩ, measured with a current of 1 A, and the grounding wire is able to continuously carry at least 10 % of the TS accumulator main fuse current rating.

- Keep an eye on EV 3.1.2
- LVS ground measuring point ≠ Vehicle ground
 - You define vehicle ground point (main hoop, frame, ...)
 - For EMI reasons all shields, TS housings, power GNDs, ... should go direct to this GND
 - Use 2,5mm² wire to LVSGMP
- NO TEAM WILL NOT DRIVE ONLY BECAUSE THEY CAN'T REACH THE 100mOHMS

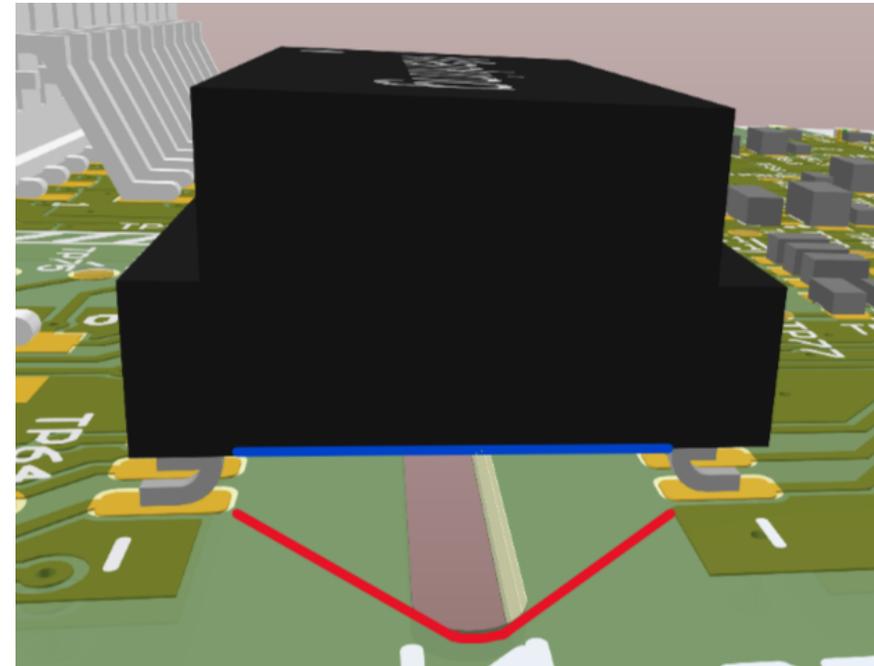
EV 4.1.1 The maximum allowed voltage that may occur between any two electric connections is 600 VDC and for motor controller and Accumulator Management System (AMS) internal low power control signals 630 VDC.

- Exception for AMS was added
- Not more than 600V at the accumulator connector
- Not more than 600V outside any TS container
- >600V at the Datalogger -> DQ (Safety Issue)

EV 4.3.6 If TS and LVS are on the same PCB, they must be on separate well-defined areas of the board, meeting the spacing requirements in table 5, each area clearly marked with “TS” or “LV”. The outline of the area required for spacing must be marked.

Groves and cut-outs must have a minimum width of 1.5 mm to influence the creepage path. “Conformal coating” refers to a coating insulator on a PCB. Solder resist is not a coating.

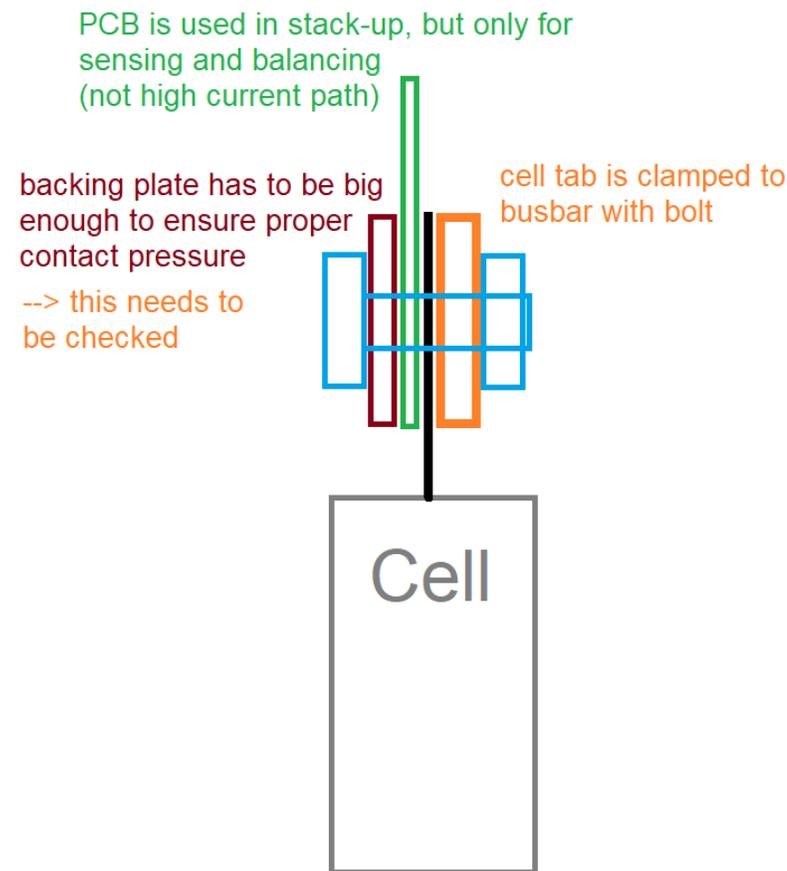
- Be careful about the creepage path beyond the chip



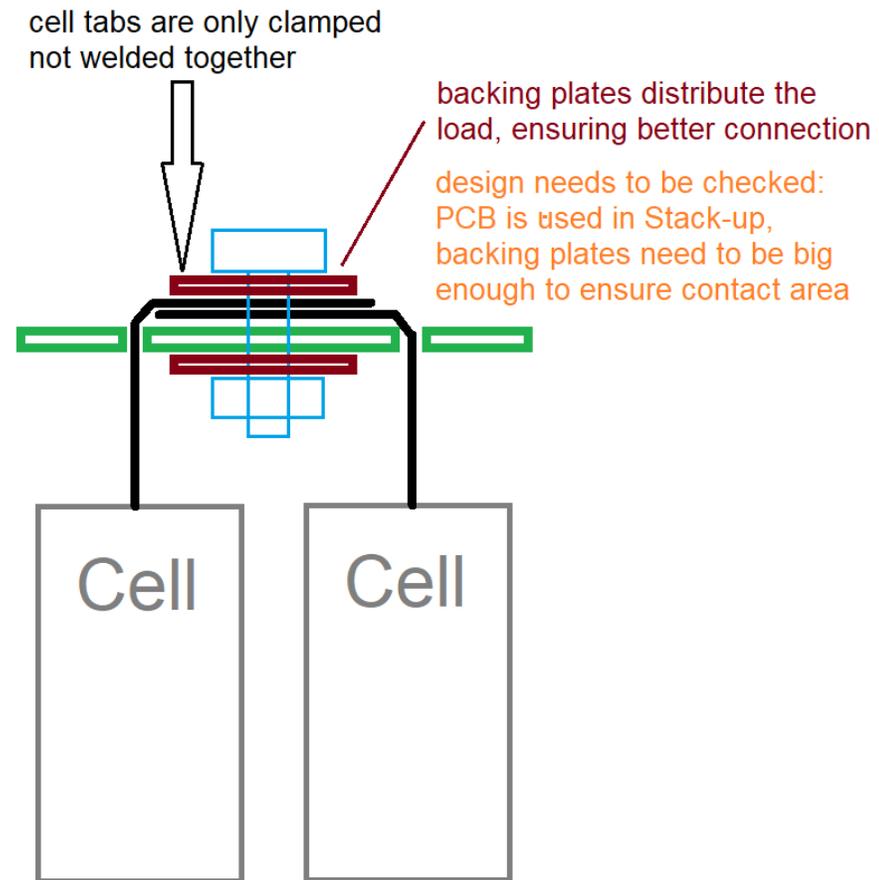
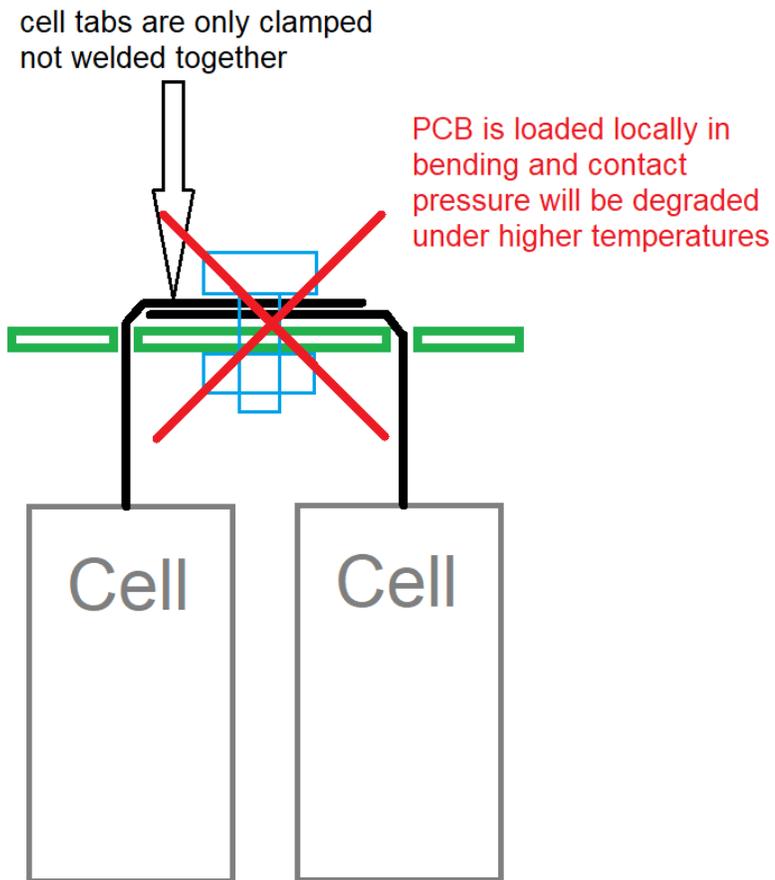
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EV4.5.12 All materials used in a stack-up or as a fastener of a TS connection must ensure equal pressure across the full contact area over the entire temperature range.

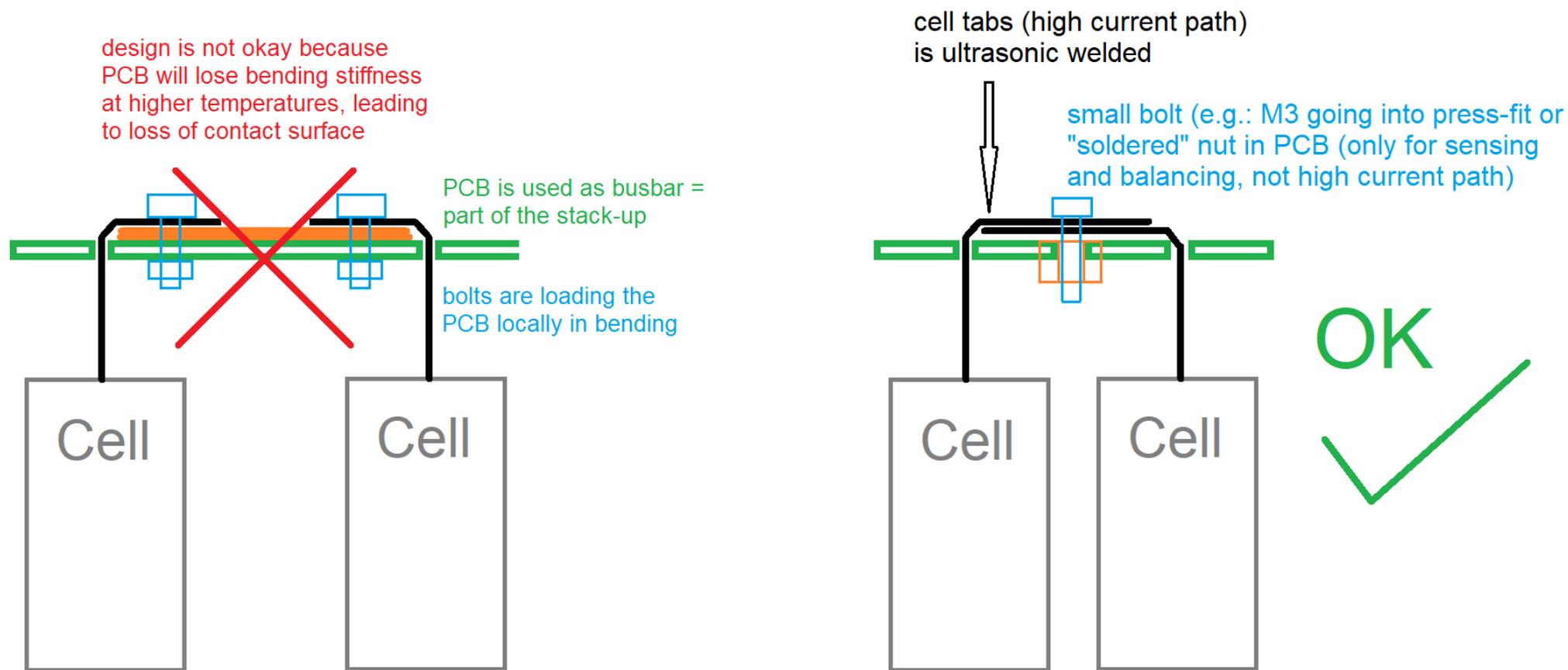
- FR4 will be allowed, but restricted
- No bending force on PCB
- FR4 will not spread the force, so you need a metal structure on both sides of the PCB



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EV 4.7.7 All electric connections needed to connect the TSMP to the intermediate circuit capacitors, including bolts, nuts, and other fasteners, must be secured from unintentional loosening by the use of positive locking mechanisms. Bolted connections must follow T 10.2, soldered connections EV 4.5.15.

- Use full metal lock nuts
- When connectors wanted/needed interlock is necessary
- Rules for soldering are the same as in High Current Path (see EV 4.5.15)
- Best solution is crimped wire lug + lock nut

deleted ~~If spare TS accumulators are used, they must be of the same size, weight, and type as those that are replaced.~~

- No spare containers allowed anymore
- There was no team with additional TSAC at any event in the last years, so this possibility was withdrawn

EV 5.4.8 Each TSAC must have a prominent indicator, a voltmeter, or a red LED visible even in bright sunlight that will continuously illuminate whenever a voltage greater than 60 V DC or half the maximum TS voltage, whichever is lower, is present at the vehicle side of the AIRs.

- LED must light the whole time
- No flashing, dimming, shimmering or something else
- Is also possible with VIPER06 from STM

EV 5.5.7 TS accumulator segments, see EV 5.3.2, must be separated by internal vertical walls which extend upwards until the lid. Openings must follow EV 5.5.14.

- Segments and Sections are now one thing
- Max. 25% must be covered

EV 5.8.12 The AMS must be able to read and display all measured values according to EV 5.8.3 in a single overview e.g. by connecting a laptop to the AMS at any place and any time e.g. inside the dynamic area.

- Use a Laptop with working Battery
- Battery must be charged during the whole event
- No Power outlet at scrutineering for Laptop
- Temperature and Voltages on car Display are OK, if everything important is visible

EV 6.3.4 The response value must not be changed after electrical inspection.

- New IMD (iso175) has CAN interface
- Response value can be changed via CAN
- If misuse detected, usage of CAN will be forbidden

EV 7.1.9 TSAL's green light, see EV 4.10.3, must be available as an easily visible green indicator.

- Implement the logic for TSAL green inside the TSAC
- Route the signal for TSAL green to a green LED at the buttons and indicators
- TSAL green logic will be tested at accumulator scrutineering. Speed up your scrutineering with all SCS accessible in your accumulator



Q&A Session

If you have further questions,
please write us at Rules@fsaustria.at

Q&A for Session 2

Question	Answer
Could you clarify if using a digital voltmeter powered by an isolated flyback converter complies with Rule EV 5.4.10? Afaik, the voltmeter's display is driven purely by the hardware circuitry, without any software intervention.	It is important that the Voltmeter always works, even if LV is off. When the power for your DCDC is supplied by the TS, it is OK. (Additional no SW and all other rules)
What counts as wired connection on accumulator temperature sensors where you have to be able to disconnect it in scruti?	Everything with a wire. If your signal is only on one PCB or only with PCB to PCB connectors it is not a wire.
Will there be again 30mA RCD in FSA 2025? (To prepare chargers)	Yes
EV3.1.1 . Can the electronics compartment of TSAC be made out of electrically insulating material, while the segments compartment out of electrically conductive ?	Yes
Can TSAC have cooling holes on the structural wall facing the driver(firewall), if it has ducts made out of a fire retardant material that is mounted onto the same wall and "redirects" holes to the sides, away from the driver(firewall)	Yes, as long the ducts fulfill the material requirements for TSACs
EV 7.1.9 (green TSAL light during charging) Should this TSAL include the latching? We don't have TSAL logic implemented inside the TSAC so can you clarify that rule a little bit more?	Yes, the LED at the charger must have the same behavior as the green TSAL, so all latching. To simplify your E-Scruti you should implement everything in the battery, else you have to do the same tests in E-Scruti.
EV3.1.1. Can the TSAC be constructed from multiple different materials, as long as they are all either conductive or insulating? Or should it be made using strictly one material?	Your TSAC may contain different materials, when you have parts of the housing which are conductive, you have to cover them on the inside with additional insulating layers
For TSAC SES, in orther to measure the heigth of the panels, how should we take the measure if there are holes for ventilation?	As said in the talk: The holes in the wall must be less than 25% of the wall in every direction.

Q&A for Session 2

Question	Answer
Does the Tsal on the charger need to comply only with EV 4.10.3 or it has to comply with all the rules of the green light in TSAL?(Latching etc)	All rules for the green TSAL, so including latching.
Does the change of the rule EV 7.2.2 wants to keep the relays disarmed if the SDC is closed again, or is it ok to arm the relays and control the charging process with software?	This depends on your charger. If you have a benchtop power supply with an interlock input, this is fine for me. If the SW is student made it is not OK. Same intent as at the last years. Only latching added.
Is a thermal simulation of the battery pack required for the scruti?	As answered in the talk: No, not for FSA. Maybe you need a simulation for other events
If structural material in TSAC is resistant to 600deg but has not certificate for UL94-V0 could we perform tests by ourselves and make a video or this selftest apply just for firewall?	Yes, you can perform your own UL94 test, please document everything by filing it and keeping a stopwatch in the video frame for reference. You can use screenshots from the video as documentation in the SES and bring the whole video to tech inspection for reference.
What is the intent behind the rule change EV3.1.3? The 100 mΩ limit appears to be impractical to achieve, particularly in areas such as the screws of the TSAC housing. H how strictly this rule will be enforced at the FSA?	The intent is to make the rules closer to some ISO standards. There always ways to ground everything proper, especially screws. You will drive in FSA, if you have a few points not meeting the 100mOhms, but you probably get penalty points.
most TSMP banana Plugs have a copper thread, putting on a full metal lock nut will break them. I have heard of many teams that loosen the nut beforehand which is obviously no the intent. what would you suggest	Yes, you are right. As said after the talk you can use a tab washer to lock the nut.
is it okay for a the green TSAL circuit to be implemented both outside the TSAC in the car and in the charger in the handacart?	Yes, it is within the rules (for this year). But scrutineering will be easier for you if you have all inside the battery. Else we have to test this also in the car, what causes longer E-Scruti for your team.