FORMULA SAE®

2024 Pre-Competition Accumulator Video

Although the Submission of this Video is optional, see the *Reason to Submit a Video* section below for incentives!

Purpose

The main reason for an accumulator video submission is to shorten the on-site accumulator inspection process while identifying major rules violations approximately a week prior to the start of the competition so that corrections can be made at your shop instead of in the hot work area at competition.

Accumulators are very compact, normally with multiple layers of components. Submission of a video will allow the judges to see critical accumulator features without asking your team to disassemble it at the inspection. To create a video in a less time consuming manner, your team should take video footage as you assemble your accumulator.

It is anticipated that teams with more refined accumulators will be given a lower tech number and complete Accumulator Inspection first/early. Historically these teams take the least amount of time to complete the accumulator inspection. For a thorough accumulator Video submission, it is our hope that your team will be complete with the rest of their accumulator inspection in approximately 30 minutes. This will allow an even flow of EVs into Active Electric Inspections.

Deadlines and Submission Details

- The video submission can be submitted between May 1st until May 31st
- The submission must be a video that is under 10 minutes in duration
- Submission on FSAEOnline should be a Word document which contain an accessible link to where you have stored the video. For example, host your video privately on YouTube, put a link to that video in a Word document, then submit the Word document.
- Accumulator Inspection sheets with the results of your accumulator video will be posted on or before June 4th. (Located in your document submission area)
- Tech number order will be posted on June 6th.

Reason to Submit a Video & What is Accepted

- Any item on the accumulator checklist that is evident in the video will be pre-checked (i.e., it won't be checked at accumulator inspection)
- If everything is NOT totally evident in the video, the item in question will be noted on your Accumulator Inspection sheet (inspection of noted item instead of everything for that line item)
  - Video must display as built hardware; electrical schematics and CAD drawings DO NOT COUNT and will not be evaluated. Feel free to move the camera in and around your built components.
  - If claiming conformal coatings on a board – get a UV light and demonstrate.
  - For example, of an acceptable video, click here <NEED to insert link to sample video>
- All videos will be reviewed, and accumulator tech sheets and acceptable items will be checked off.

- If a video is submitted, the team's accumulator tech sheet will be available to the teams **approximately** a week before competition. The team will know which items/criteria are already approved and which items/criteria will need to be demonstrated at accumulator inspection.
- ***Tech Number order will be influenced by the completeness of the accumulator tech sheet.***

Video Best Practices

- Read the rules, they evolve/change from year to year
- Download the Accumulator Inspection Sheet
- Take video segments as you assembly your accumulator making sure to capture video of built components
- Make your video so that the order of the presentation follows the Accumulator Inspection Sheet from top to bottom
- Submit and have your ESF accepted. The first portion of the Accumulator Tech sheet (Design section) is marked as complete with an accepted ESF.

Sample Accumulator Tech Sheet

- The next page shows the ***ANTICIPATED*** accumulator checklist. The following Accumulator checklist is for illustration purposes only. The Accumulator checklist posted online will be the one that is used for each team's inspection.
  NOTE: all accumulator rules are still enforced even though they may not appear on the Tech sheet.
- Items shown may be marked complete from a team's submitted accumulator video.

ACCUMULATOR

HV warning stickers	Accumulator housing must be labeled with "High Voltage Always Energized" and  . Visible from all angles	Visible check	
Separation on self-developed PCBs	GLV and TS circuits have at least the spacing specified in EV.6.5.7.	Visible check	
HV Path	Bolted connections in the high current path must have a positive locking mechanism. **Lock washers and thread locking compound are NOT allowed.** Patch bolts allowed into blind OEM components. (EV.6.4.3)	Visible check	
	Soldering is not allowed in the high current path.	Visible check	
Internals	The poles of the accumulator stack(s) and cells must be insulated against the inner wall of the accumulator container if the container is made of electrically conductive material.	Visible check	
	Every accumulator container must contain at least one fuse in the high current path.	Visible check	
	No always energized TS wires leaving accumulator container (All TS wires leaving accumulator disconnected by an AIR).	Visible check	
	Branch circuits are fused within 150mm of source in both positive and negative.	Visible check	
	Fuse and AIRs must be separated from the rest of the enclosure by an electrically insulating fireproof material.	Visible check	
Maintenance Plugs	Maintenance plugs can be removed without tools or further disassembly.	Visible check	
	Surfaces of the maintenance plugs must be non-conductive except as required to make the electrical connection.	Visible check	
	Maintenance plugs cannot be incorrectly installed.	Visible check	
Internals - Cell stacks	Each stack has to be separated by the use of an electrically insulating and fire resistant materials towards other stacks in the container and on top of the stack. **Air is not a suitable insulation material in this case.**	Visible check	
Indicator Light	Each container must have an indicator showing that voltages greater than 60V DC are present outside of the container. **Indicator must function with accumulator removed from vehicle.**	Visible check	
Accumulator Container Connectors	All Tractive System connectors outside of an enclosure must include an interlock or be sealed with tamper seal.	Visible check	
Chargers	Charger connector must incorporate an interlock such that the connectors only become live if is correctly connected.	Visible check	
	HV charging leads must be orange.	Visible check	
	TS+ and TS- shrouded red banana jack available when charging	Visible check	
Energy Meter	Energy Meter Installed (if located in accumulator) Energy Meter provided (if not in accumulator)	Visible check	

Common Mistakes from Past Inspections

- Brake Pedal Plausibility – Teams are no longer allowed to simulate a power discharge form the accumulator while the brake pedal is depressed using software. The rules require a wire to be installed in the accumulator that is ‘wrapped’ around your current sensor so that an external power supply can simulate a power discharge while the brake pedal is depressed. A good implementation would have the wire wrap around the current sensor 5 to 8 times (this will multiply the supplied current) and have the wires routed to an accumulator bulkhead connector. This plausibility test will be conducted during the active test portion when the accumulator will be installed in your car in the ready to drive mode active (i.e., the accumulator will be sealed – hence the bulkhead connector out of the accumulator).

- High Voltage test points – read the rules! Chassis ground must have a black test point, both POSITIVE and MINUS high voltage test points must be red. Also, all test points must be labeled.

- Power Meter should not be supported by unsupported wire. This is a terrible engineering practice and will not be allowed this year. STANDOFFS!

- Clearly define/mark your high voltage and low voltage regions on mixed circuit boards. Demonstrate the required separation distance for your accumulator design voltage. The best practice is to design a high voltage and low voltage label onto the board with corresponding lines indicating their ‘borders’.

- Ground Fault Isolation systems not functioning during battery charger portion of accumulator inspection. Try this before you leave your shop.

- A GLV GND banana jack must be located next to the TSMP (Rule EV.5.4.3)