Formula SAE-A Rules Enquiries

Questions and Answers

Contents

Last updated: 08-03-2021

Pressured Systems Fittings – RE-06-21 – 08/03/21

Question: T.6.1.3: What constitutes "direct mounting" - is the mounting of our second inline regulator to the first regulator by a hose, or rigid elbow etc classified as "direct" (the weight of the tank would then be supported by a bracket)?

T.6.1.10: What defines the maximum possible operating pressure of the system - the operating pressure we will run the system at each point, or the pressure that will be present in the tank, prior to regulation?

Answer: Your sketches do not really assist your explanation nor explain why you need a second regulator. We presume the first regulator is directly screwed to the cylinder outlet as is normal industry practice and the basis of the rules wording? A second regulator would be required to have the same level of mounting strength either by directly screwing into the first regulator or mounted securely to the chassis or to structure leading to the chassis. Reliance on a hose connection would not be satisfactory.

The cylinder must also be mounted securely directly to a chassis member or monocoque structure, or equivalent structure that leads directly to the chassis itself.

As failure of the regulator(s) could lead to full cylinder pressure throughout the system, that is the pressure that the lines and fittings could experience and what should be used for your design.

Pneumatic Cylinder Mounting – RE-01-21 – 08/03/21

Question: (T.6.1.5) What constitutes protection from failure - is a firewall adequate protection?

(T.6.1.6) In a hybrid spaceframe monocoque chassis, is the mounting of a pressure vessel in front of the main (rear) roll hoop, but behind the firewall (and contained within the monocoque and hence the primary structure) classed as being mounted outside of the cockpit?

Answer: With regards to your two questions on Pressure Cylinders and Clause T.6, we advise as follows, firstly addressing your second question (T.6.1.6.)

The location of the cylinder inside the monocoque chassis but behind the firewall protecting the driver and driver's seating/harness, would be regarded as meeting the requirement to be located outside of the cockpit.

With regards to T.6.1.5, Protection from Failure, specific designs/restrictions are not defined and your team should use sound engineering practice and consideration of failure modes, strengths of mounting, etc. A firewall will provide thermal protection and may provide adequate mechanical protection, dependent on the type of failure which might occur but you need to consider this in your design. Your team should also consider the mounting location, method, strength (40g crash, etc.,) as to whether these are sufficient or if some kind of additional physical barrier between this component and the driver may be required. These will obviously be considered by teams alongside the other requirement clauses in Section T.6.

Internal Cross Section Steering Column Support – RE: 04-21 – 03/03/2021

Question: We are wanting to clarify the new rule for 2021 (T.1.2.3.f) which defines components included as part of the steering column. Our understanding is that fixed supports would refer to the supporting elements for the steering system that are welded to the chassis, and therefore these components cannot pass through the 50mm wide centre band of the template. However, we would like to clarify that the box surrounding the universal joint (comprising of bearings, bearing blocks and fasteners) is included as part of the steering column and is therefore able to pass through the 50mm gap (it also purposes to cover moving steering components as per T.1.3.3).

Attached shows a configuration we believe would be acceptable per this rule (figure 1) and one that we believe would not be (figure 2). (note that this is an example design simply to illustrate the difference between what we believe is acceptable and unacceptable, and is missing things such as additional coverings for the vertical column and the rear of the universal joint cover).

A similar question answered in February of 2019 seems to give the impression that figure 1 would be acceptable, however with the addition of the new rule defining the components of the steering column we are seeking clarification. Your feedback would be much appreciated.

Answer: The intent of the rule is not changed from 2020 to 2021 and the words were intended to clarify what was meant by the slot reference on the template drawing of 2020. Your interpretation is correct with Figure 1 as acceptable but Figure 2, is not as the bracket affixed to the chassis extends beyond the 50 mm radius semi-circle and into the slot area. We will issue a further clarification of intent of T.1.2.3 for all teams in the Local Rules Addendum to be issued shortly.

Precharge Circuit – RE: 48-2020 – 29/09/2020

Question: For clause EV.6.6.1.b (The Precharge Circuit must be supplied from the Shutdown Circuit), does it mean that any PCB for Precharge control must also be power supplied by the shutdown circuit; or is it just the Precharge relay that has to be powered by shutdown circuit?

What we are intending to do is to use one of the digital output pins of our motor controller (BAMOCAR D3) for our precharge control.

As shown in the nDrive (software for configuring BAMOCAR D3 servo), any of the 4 digital output pins (example, Dout1) can be configured to send out a logic 'High' when the DC-bus voltage (intermediate capacitor's voltage) reaches 90% of accumulator voltage during precharge. We are intending to use this signal to control the switching of the Precharge Relay and AIR+. Is this method of precharge control acceptable?

Answer: It is acceptable for you to use the output from the motor controller as a signal, but the pre-charge controller must then be deactivated directly by the TSMS as well as the main AIRs. Some form of interposed circuit may therefore be needed

Motor Scatter Shield – RE: 47-2020 – 29/09/2020

Question: According to the rule, the motor (EMRAX 228 MV) requires a scatter shield. Would the scatter shield below be accepted? Additionally, if the bottom of the motor is uncovered by the scatter shield to allow for air cooling, would it be accepted as well?

Answer: The applicable rules clauses are EV.3.1.4 and T.5.2.1. Provision of cooling holes, or an open section, in the bottom part of the Motor Shield are acceptable provided that the shield ensures that any dislodged part will impact the ground between two lines drawn transversely at the position of the centreline of the two rear wheels and at the bottom of the Main Roll Hoop and inside the track of the vehicle.

Driverless Cones – RE: 44-2020 – 14/09/2020

Question: I just wanted to get a rules clarification regarding the specific cones to be used for any future FSAE-A driverless competition. Will they be the same brands of cones used in the FSG driverless competition? If not, would you be able to give us more details about the cones you will use? We are currently in the beginning developments of our driverless vehicle and want to make sure we are developing our car to suit any future FSAE-A competition.

Answer: While it is likely to be some time before we have a full Driverless Vehicle segment to our Australasian event, we can advise it will be our policy to coordinate with overseas requirements wherever possible. Therefore you should proceed on the basis of following the Cone descriptions as used for the FSG event per their Table 3.

Note that the key is to follow the cone design/colour/dimensions, rather than the actual Brand referred to in the FSG Table, as that will give the necessary visual inputs to your control systems.

We understand that lower cost brands meeting these descriptions may be available from other sources (e.g. China).

Brazing in the high current path – RE: 43-2020 – 14/09/2020

Question: EV.4.2.6 States that soldering in the high current path is prohibited. My understanding is the reasoning for this is that the melting point of solder (approx. 90 – 450 °C) is on the same order of magnitude as the potential temperatures seen in the pack – especially during over-current failure conditions. My question is whether or not high temperature brazing falls under this category as well. Our intention would be to braze nickel aluminium bronze (melting point approx. 1000 °C) as a method of joining our nickel fuse tabs to our segment terminating copper bus bars. Image 1 shows a general isometric view of our accumulator segment design with one of the two terminating copper bus bars circled in red. The bus bar consists of 19 x 3mm copper flat bar that has been nickel plated for corrosion protection. Image 2 shows a zoomed in detail view of our end fusible links where they join to the copper bus bar. The fusible links are made of approx. 8mm x 0.15mm pure nickel and the intention would be to braze this to the copper bus bar using nickel bronze in the area highlighted by the yellow circle. The brazing is to be conducted before the bus bar is installed in the segment and thus there is no possibility of subjecting cells to the high temperatures involved. My reasoning is that because of the considerable thermal mass of the copper bus and the braze material having a melting point essentially equivalent to copper (copper melting point approx. 1085 °C) this joining method is not likely to lead to a failure as the individual cell fuses or main pack fuse would blow during various failure modes before the joint could reach a temperature that would lead to separation of the nickel fuse link and the copper bus bar.

Answer: Brazing in the high current path is acceptable, subject to this being performed via a method which does not risk damage to the cells (or people). Obviously there is less high temperature risk if using Laser or Ultrasonic welding/brazing, versus exposed flame brazing.

We note that you intend to carry out the brazing prior to the installation of the bus bar to the pack, which should ensure adequate heat protection for the cells from use of this process.

There is a possibility that the brazing may affect the performance of the "fusible link" because of temperature, or intrusion of the brazing filler onto the link.

You should develop a test to ensure high confidence that a link will still achieve the required current interruption expectations after it is brazed onto the main busbar.

Alternative Material Accumulator Panel Testing – RE:42-2020 – 14/09/2020

Question: Rule F.10.2.2 states that alternative material accumulators are allowed, so long as there is proof of equivalency per rule F.4.3. The tests outlined in this rule specify a baseline test consisting of two steel side impact tubes, whereas baseline accumulator panels are thin steel/aluminium panels per F.10.2.2. This seems to be an inadequate way of testing and validating alternative material accumulators. Can the 1.25 mm steel plates be used as the equivalent baseline material instead of the side impact tubes? Furthermore, previous testing of alternative accumulator material panels (from Rules Enquiry 66-2018)has shown that the testing of such thin laminates over a 400 mm span does not result in material failure due to the

excessive deformation(refer Figure 1 in the attached PDF). The attached test results (refer Figure 2) show that a bending test span of 400mm, resulting in a span: thickness ratio in excess of 100:1, is not appropriate for testing thin panels. For reference, Figure 3 shows a test sample of the same material and thickness performed to ASTM D790. Is it permissible to use an international recognized testing standard to determine material properties? Such as: • ASTM D790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials • ISO 178:2010 Plastics --Determination of flexural properties Alternatively, can T3.30 be used with a modified span distance to accurately capture the design span?

Answer: The reference to the baseline steel tubes is not to intend that equivalence is shown to them, but purely to establish the rig compliance.

This generally provides a higher modulus (E) than if you run your test without establishing the rig compliance.

The derived values for your composite material from the bending and shear tests can then be inserted into the SES and, once panel dimensions are entered, the material thickness, (A), (I), (E), and (S) in column P are derived from baseline steel sheet, at the minimum required thickness.
All of the boxes (Q 108 – 171) which will establish satisfactory Equivalence (as indicated in the 'S' Column boxes) use this comparison data to
indicate the compliance.

There are some improvements which can possibly be made to the rules and words for Composite material testing and related SES format. These will not be considered before 2022 and there will be no changes made to the defined requirements for 2020 or 2021

Using Bolts to Attach Rear Impact Panel – RE:39-2020 – 03/09/2020

Question: Our team is investigating use of a 'rear exit' system for our accumulator. Presently we plan to have a removable rear bulkhead to facilitate the removal of the accumulator from the rear of the chassis(as in the sectioned view from above, shown below). We are able to ensure that the bolted connections are able to resist a 30kN load in all directions as per F.7.9.1, and will not be using any kind of threaded insert, as outlawed in F.5.4.1. Firstly, is it correct to assume based on rule F.7.9.4, we are able to do this with only two m8 bolts, assuming that all structural requirements are met?

Secondly, we are unsure how to proceed when filling out the SES spreadsheet. Does the 'bolted members' tab need to be filled out? If so, how should we proceed with this, given that the only two options are 'double lug' and 'sleeved butt joint', neither of which represent our solution? If not, is there another part of the SES spreadsheet that needs to be filled out, or should we just provide calculations etc. as an appendix to the spreadsheet?

Answer: The Clause F.7.9.1 is primarily intended to cover attachments between a monocoque and any Tubular structures, although it does also provide a guide as to ensuring adequate strength in any other bolted connections within a full monocoque or composite vehicle structure.

You ask if you can use only 2 M8 bolts per F.7.9.4. Again, this is really aimed at ensuring at least two bolts are present at each attachment point between a tube part of the structure (such as the Main Roll Hoop) and a composite structure.

In your example, you indicate 4 bolts as a logical bolt pattern around the panel which appears to be a sensible engineering approach.

The SES section on bolted joints you refer to is really intended to cover bolted tubes in the Primary Structure and is not required here.

The best approach for you to take is to regard the panel as needing to meet the Rear Impact Protection requirements of Clause F.11.2 and fill in the related section of the SES F.11.2.1-3 within "Tab F.7 Composite Chassis". We presume the dimensions of the opening will be at least 250 mm.

If you use the same material and layup as for your Side Impact area of your monocoque, it should readily comply and you can include any other explanatory notes or calculations with this.

Tractive System Protection Rule – RE:37-2020 – 20/082020

Question: We would like to ask 3 questions regarding the Impact Attenuator, and what the required prove out for this will be for 2021.

Enquiry 1: Do we need to submit a separate IAD document, or is it acceptable just to do this in the 2020/21 SES Document? We are asking as there is a separate Impact Attenuator Document available on the SAE-A team information page; but we believe this may now be outdated as F.8.7.1 states; "F.8.7.1 All teams must include and Impact Attenuator Data (IAD) report as part of the SES",

Enquiry 2: Our second enquiry relates to F.8.5.2.b on sheet F.8.4 Impact Attenuator on the 2020 SES template. The rule states: "F.8.5.2.b. Bolted joints • Using no less than four 8 mm or 5/16" minimum diameter Critical Fasteners, T.8.2 • The distance between any two bolt centres must be at least 50 mm. • Foam IA must not be solely attached by the bolted method." We are intending to run a folded and riveted 2mm sheet 6061-T6 aluminium impact attenuator, bolted to a 4mm thick 6061-T6 Aluminium Anti-Intrusion plate. We believe we do not require the adhesive, as the IA is not foam and is attached using 2 sets of 4 M8 bolts as shown in the PowerPoint attachment to this enquiry. However the SES spreadsheet rejects our proposal as we do not have the adhesive, as seen in the PowerPoint attached.

We are also concerned about the bolt centre distance on the connecting brackets, which is currently less than 50mm. Was the intent of the bolt centre regulation to outlaw a design like this, or to stop 2 bolts being placed close together in a foam, or continuous sheet metal structure? Can we proceed with this attachment method, or do we need to change the design?

Enquiry 3: Our third enquiry also relates to the Impact Attenuator Document, if this is required, which we are filling out from the 2019 version available on SAEA online; http://www.saea.com.au/Team-Information. It states: "T.2.25.8 Teams with a thin wall IA (e.g. structural noses) must test the AI plate with 120kN applied through the IA area" Is this test still a requirement for cars built to the 2020 regulations, as we cannot find this test in the regulations or the SES? If it is a requirement, does our 2mm thickness folded sheet aluminium design, which can be seen in the PowerPoint below, qualify as a thin wall IA, even though it is not a structural nose?

Answer: We believe we can clear up your concerns with the following response rather than addressing the detail of each question.

The IAD Report from 2019 is not required for 2020 as all of the required material is included in Tab F.8.4 of the SES.
The 2019 Report with its requirements does not correlate with the 2020 rules and clause numbering and we have now removed it from the web site and updated the link in the latest issue of the Local Rules Addendum (Version v04).
This we think eliminates most of your areas of concern.

The 50 mm minimum spacing rule is intended to ensure the load is spread around the mounts **between the IA and the IA Plate** and **the IA plate and the Bulkhead**. Your design appears to achieve this and while you submitted a drawing with no dimensions on it (as would have been expected) it appears with their placement on the IA they seem to be well spaced around the perimeter. You can regard the bolts on the IA as being part of the IA Assembly, and not part of the fixing of the IA to the IA plate. Therefore they do not come under the rule application for the attachment spacing.

Adhesive is not required and it appears there may be a glitch in your SES. When you type in "No" against adhesive in Cell BM-BN 47 of Tab F.8.4, it should give an immediate EQ reading. We have checked this on the latest version and when we included all your data as per your PowerPoint picture you submitted, it gave an EQ reading in all boxes.
Please check you have the latest version or your copy may have become corrupted such that you need to download again.
We have placed this on the local FSAE website.

TS Connections - Compressible Materials – RE:41-2020 – 19/08/2020

Question: To comply with part c of this rule, are we allowed to use composite materials such as Kevlar or FR4 in the stack up? If not, does the use of a spring mechanism (such as a spring washer) negate the need to satisfy this rule, as they maintain compression even if material creeps?

Answer: Neither composite materials (e.g. Kevlar or other), nor spring washers, are acceptable to use as electrical connections. The former can creep and the latter cannot guarantee the clamping pressure will be evenly maintained across the entire contact face, to thereby ensure that the joint will remain low resistance.

Rain Test Sealing – RE:38-2020 – 13/08/2020

Question: We interpreted the intent of this rule as; taping up openings in the accumulator container only to pass rain test, then removing the tape for dynamic events is unacceptable. Hence, is taping the accumulator, and keeping it taped for the entire duration of the competition as an extra security allowed?

Answer: The intent of the rule is in part per your interpretation but also to ensure that teams use sound engineering methods in order to achieve protection of systems from exposure to water. Tape is not regarded as good engineering practice.

If you have tape for other purposes (you do not define as to whether the tape is extra security against water or component movement or other) then it may be acceptable. In this case, for it to be acceptable, it would have to be shown that the vehicle is capable of passing the water test without relying on the tape. If this cannot be done, the tape would have to be removed for the water test.

Lap Belt and Submarine Belt Mounting by Welding of Bolt onto Chassis – RE: 34-2020 – 16/07/2020

Question: If we are running a snap-hook and eyebolt harness are we allowed to cut off the thread of the bolt and weld the eye directly to the chassis if we can prove that it can withstand the required load given under F.7.10.1? The eyebolts are metric grade 8.8. It is unclear whether this is against the rules as it seems to violate T.2.2.6 but it can support the required loads in F.7.10.1 with no damage to the test piece.

Answer: In this case the rule T.2.2.6 must be complied with. Modifying proven Supplier parts can lead to strength deterioration or other adverse effects. Clause T2.4 is also relevant in describing

allowable mounting. Welding Critical Fasteners will also generally reduce their properties below the indicated grade.

Accordingly, you will need to select a suitable available belt and mounting method that can be installed in your vehicle without requiring modification.

TS Accumulator Plate Thicknesses – RE: 33-2020 – 17/07/2020

Question: We'd like to confirm that 1/8" and plate still satisfies this rule, as the imperial equivalent numbers have been removed from the wording in the 2019 rules, as the imperial equivalent is technically less than 3.2mm, but is much more easily obtained: a. The floor or bottom of the accumulator container must be constructed of steel 1.25 mm (0.049 inch) minimum thickness or aluminum 3.2 mm (0.125 inch) minimum thickness.

Answer: While not still listed in the rules, 1/8 inch Aluminium is still an acceptable alternative for use as the Accumulator Container floor. The SES still shows both dimensions.

To ensure you can submit using Metric only dimensions in the SES, then you should round up the metric equivalent to two decimal places and use 3.2 mm in any future SES submission.
Notate that you have done this in the SES submission and it will be accepted.

Accumulator Segment Material Choice – RE:32-2020 – 15/07/2020

Question: While there is no rule that directly mentions this, our team has always had a general consensus that 3d printed materials could not be used in accumulator segments. I have been developing a new accumulator segment housing design which makes use of a combination of acrylic and 3d printed TPU (with a melting point of >200°C). Would this 3d printed material be suitable for use in the segment housing? The whole segment would be placed into a solid aluminium box as well. The design has been tested to meet all of the required strength ratings.

Answer: You are correct that specific materials are not proscribed from use in Accumulator Containers, however, wherever alternative materials are used they must comply with the following areas as defined in the rules. You did not identify exactly where/how you were proposing to use 3D printing of a non-metallic material but it obviously cannot be for the container floor, external walls, cover or the walls dividing the segments.

- the material must be Non-Flammable material per EV.1.1.6
- the material must be robust and of sufficient strength to meet the loads imposed by the defined acceleration forces
- importantly, any thermo-plastic material, must have adequate strength at any of the possible temperatures it may encounter during vehicle operation
- all of the material properties and strength calculations at defined temperatures must be included in the SES submission.

Centralised AMS Fusing – RE: 31-2020 – 16/07/2020

Question: Our team use a distributed AMS, and plan on using a PCB with soldered fuses for the voltage sense wiring. A small spring connector on the underside of the PCB reaches down and contacts a clamp for the cell tabs. Our exact design is hopefully clear in the photos provided below. Please note that the items labelled clamp are made from stainless steel, and so are at the same potential as the cell tab. My confusion was in the specific meaning of: 'The fusing must occur in the conductor, wire or PCB trace which is directly connected to the cell tab.' as specified in rule EV.6.1.5. Would the PCB trace which immediately follows the

connector be regarded as 'directly connected to the cell tab'? Essentially I am asking whether our design complies with EV.6.1.5?

Answer: In your query you said you were using a Distributed AMS but then raised your question against Clause EV.6.1.5, which relates to a Centralised AMS. We presume that your reference to Distributed AMS was a mistake and you are using a Centralised AMS with EV.6.1.5 applicable, and are responding on that basis.
Your design should be acceptable but is dependent on adequate size of the pcb traces. If these are too thin and/or too long, they may curl off the pcb during a fault, and potentially short somewhere.

Provided the fuses are as close as practical to the contacts, and the PCB traces are of an appropriate size, they would be acceptable.
You should verify and document the adequacy of your design through analysis and any necessary testing.

HV PCB Electrical Clearance – RE: 30-2020 – 11/06/2020

Question: We are making a 4-layer PCB on FR4 substrates with an isolated section to connect to GLV systems. The GLV components are all surface mount and placed on the top layer (red in the attached images). There are HV traces (connected to voltage taps) passing directly underneath on the bottom layer (blue in the attached images). This section has no holes or vias passing through the layers and there is no copper on either on either of the two internal layers under this section. Do the clearance requirements relate only to components/traces on the same layer and if not, is the 2 fibreglass layers sufficient protection to allow the HV traces to pass underneath?

Answer: In response to your query regarding separation of circuits per EV.7.1.7, this rule primarily relates to items on the same side of the board but also includes around board edges or through holes in the board.

Where HV and GLV traces are on opposite sides of a board (or separated by more than one board thickness) then the clearance rules will apply only as defined in the foregoing relative to holes in the board and edge proximity.

You should, however, ensure that the thickness and di-electric strength of the PCB material (such as FR4) is adequate.

Shutdown Loop – RE: 29-2020 – 25/06/2020

Question: Regarding EV.8.2.13, we have had lots of issues with getting the required current & voltage to our contractors. This year we were planning on having a very short single wire run from the our PDM/PDU, to our shutdown board/system, then the TSMP on to the AMU/Contactors, with a single relay breaking & contacting that line. Every other device/loop in the car would be operating in a star topology leading back to 1 or 2 central boards that would control this singular relay (as outlined in the Shutdown System Overview). This as far as we are aware would still satisfy all rules, requirements and spirit section EV8.2 outlines, except for EV 8.2.13. In our opinion, having the IMD, BSPD PDOC etc break the line with a relay is the same architecture as we are purposing as it would be functionally and electrically equivalent (as outlined in the Shutdown System Equivalency). The system designed is that any failure of any component would cause the system to shutdown, and demonstrable to EV judges.

Answer: It appears our response to your prior query #29 got lost somewhere in the system, for which we apologise.

We advise that while an adequately designed interpose relay is acceptable, a programmable logic, such as an off the shelf PDM or similar is not acceptable.

The reliability of a system is drastically changed, usually negatively, by adding programmable or other items (mosfets; solid state relays; etc.) in the signal path. It is impractical for the scrutineers to assess if such a system is appropriately reliable if anything more than a simple interpose relay is used. The scrutineers can readily assess a good quality and appropriately sized relay as being a negligible decrease in the overall shutdown circuit safety, however, assessing semiconductor or programmable devices with unknown failure modes is impractical in the time available during scrutineering.

It should also be noted that queries like this are also much easier to assess if good quality diagrams, details and other engineering analysis or justification are provided with the query by the teams.

BSPD Loss of Signal – RE: 28-2020 – 09/06/2020

Question: We are unsure as to what is referred to as being a "loss of signal". Does this refer to an open circuit situations and are short circuit conditions being considered too?

Answer: In response to your query, “Loss of signal” shall be considered to be any situation in which the signal being received by the throttle module/motor controller differs from the actual position of the accelerator pedal. This should consider all possible failure modes, short circuit, open circuit, signal to chassis, etc.

Positive Locking of PCBs in Accumulator – RE: 27-2020 – 09/06/2020

Question: Having looked over the rules and not finding anything conclusive, can I please clarify that fasteners used to mount PCBs in the accumulator do not require positive locking.

The solution shown in the attached images uses a threaded spacer to attach a bolt from either direction meaning the PCB and protective cover attachment is independent. This will allow the cover to be removed while leaving the PCB in place to facilitate maintenance.
Although I recognise it is good practice to positively lock all fasteners wherever possible I believe in this instance the proposed solution is preferable for the reason outlined above.
Is this a suitable justification from the perspective of the scrutineers?

Answer: As PCB’s are usually retained by multiple fasteners, such that a single loose fastener does not represent a risk of movement or detachment, they would not be defined as critical fasteners. However, if less than four bolts or other positive attachment are used for the PCB, and there is a risk of compromising the tractive systems if it came loose, the attachments will then be defined as Critical and require a positive locking mechanism.

Segment Construction Method – RE: 26-2020 – 11/06/2020

Question: Image 1 attached shows the primary structure of our accumulator segment. It consists of acrylic sheet that is bonded together using a adhesive that fuses the plastic together and involves no fasteners.

Image 2 shows the outer covers of our segment that are attached with countersunk screws (and Kapton tape as a secondary method of attachment).
Image 3 shows a cross section of the blind threaded bosses that these countersunk screws attach through.
Image 4 & 5 show that once installed in the accumulator container, these fasteners and external segment walls are in contact with the walls of the accumulator and thus the fasteners are captive in place.
Given that these fasteners do not form part of the primary cell holding structure is it fair to assume that the minimum fastener size and positive locking requirements of F.10.2.3 do not apply and the solution proposed is valid?

Answer: As you did not submit dimensions on the drawings and did not give a full description of how the segments are to be constrained in order to comply with the defined acceleration forces, we assume that

they are retained by being a very close fit within the accumulator container and constrained from movement by the Floor, the Cover and the Internal Walls of the container. Obviously if this is the case, then there must be very small gaps to prevent added dynamic impact loads being incurred due to any movement.

If the above is the intended design, then any fasteners used for the Cover, Floor and Walls would be regarded as critical fasteners and must meet F.10.2.2.d. If the fasteners on the segment itself are not a part of the restraint path for the segments, then they would not be regarded as Critical Fasteners.

The SES would need to include a full description of the retention system and calculations to show that the container with its fasteners is able to ensure compliance with the acceleration loads of 40/40/20g for both the overall container and the segments per clauses F.10.2.2.i and F.10.2.3.a.

Shutdown Circuit Rule Inquiry – RE: 25-2020 – 29/06/2020

Question: Does the current driving the AIR's have to come directly from the shutdown circuit? Some of the senior members of my team have said it would be better to use the shutdown loop as a signal line for the AIR's, with the power coming instead from the standard LV lines. They have said this would avoid issues with high impedance in the shutdown circuit.

What would the best approach to this be?

Answer: Based on prior practice, it is allowed to use an interpose relay installed between the emergency stop buttons and the AIRs.

If this is done, your team must demonstrate you have a robust design and with appropriate ratings for the interpose relay in your ESF submission.

Monitoring – RE: 22-2020 – 28/04/2020

Question: What frequency satisfies continuous monitoring and is EV.6.1.8 or EV.9.1.9 to be followed?

Answer: The rules clauses are complementary and apply to different aspects of temperature monitoring and refer to what is mandatory as well as what is a desirable target.

EV6.1.3 requires continuously monitor to detect cell temperatures rising above the defined temperature limit.
'Continuously' in this context means sufficiently often to ensure you detect such a temperature rise as soon as reasonably possible.
In this context, 'often' is determined by the thermal time constant of the cells. It is up to the teams to ensure they check temperature sufficiently often to be sure they would detect a cell rising towards or above max temperature. Generally we would expect this sampling to be in the 1-5 second sampling rate.

EV6.1.3 also requires temperatures to be monitored at "critical points". Per 6.1.8 this would mean at least 20% of cells for a Lithium cell pack, evenly spread throughout the pack to provide the best coverage. Any other obvious potential hot spot points that are identified should also be included.

EV6.1.9 says if you can determine a satisfactory method, you can monitor multiple cells with one sensor, provided each cell so measured has its temperature determined at the negative terminal, as per EV6.1.4.

The reference to "should" in monitoring all cells is a reference to the optimum situation for Lithium cells but it is not mandatory.

Provided at least 20% of cells are monitored per EV.6.1.8, then rules compliance is achieved. Monitoring more than 20% is obviously better but that is up to the teams to decide on what they pursue for maximum reliability and their optimum design.

Vertical Edge Radius – RE: 21-2020 – 14/05/2020

Question: Do the vertical forward facing faces of endplates need to have a radius of 3mm or is it allowed to be flat as shown in the attached CAD photo?

Answer: The rules are quite specific and very clear in this regard. All forward facing vertical surfaces, including end plates, must have a minimum radius of 3mm. It can be greater of course which can be readily achieved when the vertical plate is wider than 6mm.

Chain Guard – RE: 20-2020 – 21/04/2020

Question: In the attached CAD photo, the scatter shield is centered on the chain. However, it is hitting the structure used to hold our differential (diff hanger). Is it acceptable to have cutouts in the scatter shield to fit to the shape of the diff hanger given that the diff hanger is also made of scatter shield compliant material and thickness?

Answer: Your solutions is perfectly acceptable as equivalent protection is maintained.

Steering Rack and Arm Attachment Fastener – RE: 19-2020 – 24/04/2020

Question: Does the bolt shown in the photo count as a critical fastener. The bolt is a round head but can be swapped out for a socket head cap screw and is fastened by a tapped thread in the steering rack. It is used to attach a clevis to the steering rack. This clevis is used to mount the steering rack to the steering arm.

Answer: In accord with the Steering System requirements, all fasteners in this system are critical (and this one obviously would cause loss of control with a failure). Therefore a round head bolt may not be used and one of the defined fasteners per T.8.2.2 must be used and must use a positive locking mechanism per T.8.3. Note that Bolts/Screws named as Flat Headed or Countersunk do not meet the definition of T.8.2.2 Hexagonal recessed drive (Socket Head Cap Screws or Allen screws/bolts).

Structural rear hatch – RE: 17-2020 – 27/03/2020

Question: In reference to rules F.11.2 which require that a composite monocoque adhere to the strength of a spaceframe chassis, when cutting out a section of the rear of the monocoque for a opening for the accumulator, does the door/hatch that will fasten to the monocoque have to follow the monocoques strength requirements, and if so would the bolting/fastening system that joins the hatch to the monocoque have to mimic the structural aspect with a arrangement of 10 m8 bolts.

Answer: If there is an opening in areas of the vehicle that are not defined as structural as specified in the rules (Side Impact Structure: MRH Mounts; Bracing/Supports; etc), and it appears your access and cover at the rear would not fall into those specific areas, then the cover does not need to be a structural item. Obviously the team will need to ensure that any cut outs or holes in general areas of the monocoque do not weaken the basic strength of the body below your design intent.

Front Hoop Brace SES – RE: 16-2020 – 28/04/2020

Question: Which region of the chassis counts as the forward Front Hoop Brace in a monocoque structure? Is it the part of the monocoque that is directly to the front of the Front Hoop (as shown in blue)?

Which measurement does the Flat Panel Width refer to (is the measurement taken for the red line acceptable)?

Answer: It is difficult to provide a complete response as there is very little context with your query.

We presume you are referring to section 3.7 of the 2020 SES? The intent of the monocoque is to provide both a Front Bulkhead Support as well as a Front Roll Hoop brace.
On a tube frame car, the top tube of the Bulkhead Support (as described in F.6.2) often also provides compliance with the Front Hoop Brace required in F.6.3. Similarly in a monocoque, if following the combined approach, you have to show equivalence to the three tubes on each side or the single straight tube acting as the Front Roll Hoop Brace on each side.
You can define which parts of your monocoque are being used to comply.
If the front side of the monocoque is continuous between the Front Hoop and Bulkhead and is being used to meet both the requirements then it must reach up to the defined support height as defined in the rules. If so, then the whole of the side panel vertical height up to the required height at Bulkhead and Hoop should be used as the "width".
Alternatively, teams can use the upper horizontal OR curved section of monocoque between the Hoop and Bulkhead as the nominal brace to compare to the steel tube. In this case it would be ½ the actual width across the vehicle per side.

Front Bulkhead Supports SES – RE: 15-2020 – 27/03/2020

Question: Does the Composite Panel Height cell (highlighted in red) as shown in Figure 1 refer to the vertical side of the Front Bulkhead Supports as measured in Figure 2 or does it refer the flat panel equivalent of the whole structure as measured in Figure 3?

Answer: With regards to the height, or distance, of monocoque structure that should be used for the panel height to be used in the Front Bulkhead support calculations, it is the dimension of the vertical side only of the Front Bulkhead. It does not include the section of monocoque that continues horizontally to be part of the floor. Only the calculations for the Side Impact Structure include the section of floor as well as the vertical panel.

Main Roll Hoop Mounts – RE: 14-2020 – 27/03/2020

Question: What exactly counts as 'bottom' 'top' and 'a location near the midpoint' in reference to the location of the Main Hoop Mounts? Do both 'bottom' mount locations (highlighted in red) on "Q1 Figure 1" acceptable?

If it is the case that submitting the 2019 SES is fine, we are going to make other design changes anyway, (impact attenuator design, adding front and rear wings). Because they are new changes for 2020, but still on our 2019 car, will it still be ok to add these to our 2019 SES and make sure they are legal, or will these mean that we need to fill in the relevant sections of the 2020 SES form?

Answer: With regards to the first part of your question, it is reasonably simple as to the locations required for the three mounts.

The bottom mount obviously must be adjacent to the bottom of the Roll Hoop which is required to extend down to the floor level on both sides of the vehicle. Your image appears to comply with this requirement for location but you must ensure that the mount meets the requirements defined in the SES and does not have bending loads on parts of the plate. It Is not clear from your image but there may be concerns. The type of mount shown for your upper two mounts appear to meet the SES guidelines and you should consider using that design for your bottom mount.

With regards to the second part of your question, we cannot answer at this time as we consider how we will hold the 2020 event in the Covid19 environment. We may have a virtual event and may allow prior year cars instead of new 2020 cars, as the majority of teams will probably be restricted by the government requirements and university restrictions. Accordingly, there will likely be a special set of directions regarding any SES submissions, We hope to resolve this with formal announcements in the next few weeks. In the meantime, please hold your SES questions and then resubmit, as new questions any issues, which may be present after the announcements have been made.

Bodywork and Aerodynamic Devices – RE: 13-2020 – 27/03/2020

Question: Following the rules clarification regarding nosecone limits in July 2019, if a nosecone has specifically shaped aerodynamic features located within the 700mm limit stated in T.7.3.1 but a simple shaped tip acts as an IA cover (in red) outside the limit, do the tip and the bodywork need to be two separate pieces?

Answer: While a strict interpretation of the rule would imply that as the tip is part of the aerodynamic device and it would contravene the rule as one piece. However, we will give a ruling based on intent of the rule (which was originally established considering separate add on devices rather than the central bodywork) and noting that the functional effect would be no different for a one piece front body with integral attenuator cover or a separate cover with close fitting attenuator cover. Accordingly, provided the front section forward of the 700 mm mark does not provide part of the aerodynamic design/function, a one piece front bodywork section is acceptable.

Bender IMD use at 100V – RE: 11-2020 – 20/03/2020

Question: Our car system runs at 100V nominal. Our understanding of the IMD board is that our Tractive System voltage will be out of spec for what the board is intended for, as when completing the calculation you have provided us (500Ohms per volt) we arrive at 50kOhms, half of the minimum order-able value from Bender. Hence a) Should we continue to use the lowest specified IMD (100kOhms) or b) Can you provide us with a suitable alternative we can purchase

Answer: A higher sensitivity (higher resistance) on the Bender makes it more sensitive for tractive system to chassis faults.

Accordingly, you may utilize a higher detection resistance then the minimum specified in the rules. It is acceptable for you to select a 100k ohm rated Bender IMD for this application as you planned.

It is not acceptable for the team to use an alternative model from Bender or another brand.

Main fuse & AIR Isolation – RE: 10-2020 – 20/03/2020

Question: My interpretation of this rule is that it is both to stop an arc from either a breaking fuse or a switching contact from igniting a flame and to inhibit contact between people and HV components. The fuse we are using is a FWH-500V and the element is surrounded by sand and a non-conductive housing while our relay TE 2098372-1 has its contacts surrounded by epoxy and a plastic enclosure. Therefore no one will be able to come into contact with any switching arcs or HV elements internal to these components, would it be correct to assume that this satisfies the rule

Answer: The requirement for electrical and fire isolation of the main pack fuse from the battery compartment applies to all types of fuses and relays, and to the electrical terminals of the fuses and relays.

AIR/fuse housings do not generally constitute an acceptable electrical insulated barrier. They can fracture allowing arcing or other issues via a crack, hence the rule calling for a defined insulation barrier.

You may only rely on the factory supplied plastic covers if you can demonstrate that they comply with the electrical insulating and fire protection requirements in the rules, otherwise additional protection must be provided.

Coin Cell Lithium Battery Usage – RE: 08-2020 – 08/03/2020

Question: We require clarification on the following rules with respect to the CR1220 coin cell lithium battery (12mm watch battery). We would like to have it on our data logging circuit board so that the internal clock is persistent. This will mean our data can be timestamped with the correct time. We are unsure whether or not these rules apply to a very low power battery.

T.9.1.5 Battery packs based on Lithium chemistry must:
a. Have a rigid, sturdy and flame resistant casing
b. Be separated from the driver by a Firewall as specified in T.1.8

IC.8.4.3 The Primary Master Switch must meet the following:
a. Disable power to ALL electrical circuits, including the battery, alternator, lights, fuel pump(s), ignition and electrical controls.
b. Be direct acting, not act through a relay or logic.
c. All battery current must flow through this switch d. Be located on the right side of the vehicle, in proximity to the Main Hoop, at the driver's shoulder height

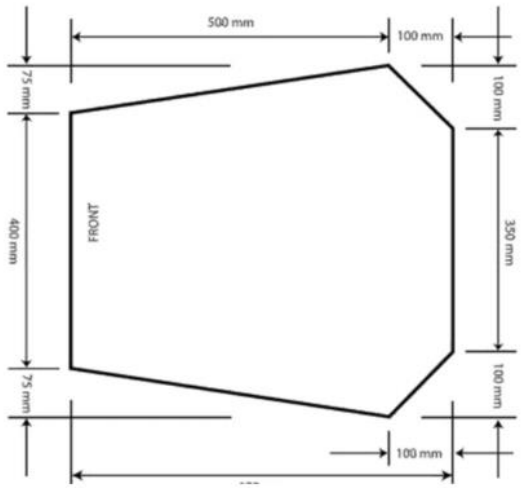
Answer: The rules clause T.9.1.5 and IC.8.4.3 refer to Battery Packs and It is not the intention of rule these rules to restrict usage of small coin cell batteries (or similar watch batteries) in FSAE cars as these do not pose any appreciable risk to personnel or equipment when used for small electronics backup power supplies.

These small coin cells may be utilized without needing to meet the requirements of rules T9.1.5 or IC.8.4.3

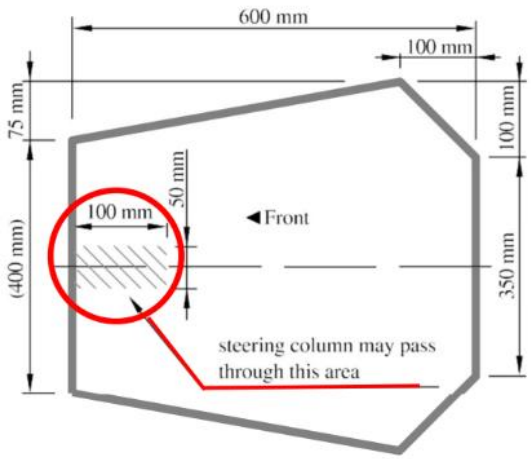
For the avoidance of doubt, batteries with current supplying capacity not exceeding 100 mA, not exceeding 5 volts and not exceeding 1 watt hour of total capacity do not need to meet the requirements of T9.1.5. or IC 8.4.3.

Question about template – RE: 07-2020 – 08/03/2020

Question: FSAE rules T1.1.1 - cockpit opening template. We are designing our machine for it.
On attached picture left one shows Fomula SAE Rules 2020.Right one shows local rule of Formula Student Germany 2020. A cockpit template of FSG has steering column pass through area.
In Australasia competition. Is it same or not?



Cockpit opening template of FSAE Rules 2020



Cockpit opening template of FSG local rule

Closing both AIRs simultaneously before precharge – RE: 06-2020 – 11/03/2020

Question: EV.7.9.1 A rule specifies that the intermediate circuit must be pre-charged *before* closing the second AIR. I am enquiring if it would be acceptable to close both AIRs simultaneously if the pre-charge circuitry would still charge the intermediate circuit to 90% of the accumulator voltage.

Answer: Based upon our review of your desired approach, the proposed circuit has full load current passing through what is called the pre-charge relay, thus creating two sets of relay contacts in series - the AIR and the pre-charge relay.

In principle, we do not see a problem with this approach, however, the rating of the pre-charge relay will have to be sufficient for full load current.
Subject to the foregoing, It would therefore be acceptable.
We note, however, this will require it to be a large and relatively expensive relay and thus potentially a suboptimal approach, adding complexity for little value.

Clarification of stand-alone in reference to BSPD Circuitry – RE: 05-2020 – 08/03/2020

Question: What is the definition of standalone in rule EV.8.6.1? Is it acceptable for BSPD circuitry to be on the same board as other components so long as they do not influence each other? And is it acceptable for the BSPD circuitry to be spread over multiple boards?

Answer: For the purposes of this rule, the definition of “standalone” is

No component of the BSPD should share components or a common failure mode such that a failure or incorrect operation of the another circuit will not affect the function of the BSPD.

It is acceptable to have the BSPD circuit on the same PCB as other circuits, and it is also acceptable to have the BSPD components spread across multiple PCBs if required.

Clarification of routing radiator exhaust under the vehicle – RE: 04-2020 – 06/03/2020

Question: Does T.7.2.2 rule prohibit the routing of a radiator & fan ducting outlet under the vehicle, into the low pressure region of the diffuser, as shown in the diagram supplied.

Answer: Your drawing is not really adequate to properly describe the design of your proposed system, however, if it operates as indicated by having a fan to draw air through a radiator core which is then blown underneath the vehicle into the diffuser area, and any related ductwork does not show indications of trying to manage the airflow under the vehicle, or remove air, it will be deemed to be in compliance with the rules of allowing fans used exclusively for cooling.

Accumulator Segment Wall Separation – RE: 03-2020 – 08/03/2020

Question: The segments are almost completely covered with a panel above them (except for access to connectors) and the segments are all below the separating walls, so, are the separating walls 75 percent to the panel covering the segments or to the top of the whole accumulator casing?

Answer: The segment walls must meet the requirements of 75% wall exterior wall height unless you can demonstrate that the intermediate panel meets the rules requirements of the container lid. If so, then you can consider the compartment in which the batteries live to be a separated container.

In order for it to be considered a container lid, you will need to limit the size of the penetrations, and you will also need to be able to demonstrate the panel meets the structural and fire resistance requirements.

EV Technical inspection grounding location – RE: 73-2019 – 25/11/2019

Question: EV 6.3.1 states that: “All electrically conductive parts of the vehicle (parts made of steel, (anodized) aluminum, any other metal parts, etc.) which are within 100 mm of any tractive system component must have a resistance below 300 mOhms (measured with a current of 1 A) to GLV system ground.” The EV technical inspection sheet states that: “All electrically conductive parts of the vehicle (e.g. parts made of steel, (anodized) aluminium, any other metal parts, etc.) which are within 100mm of any tractive system or GLV component” We would like clarification that only parts that are within 100mm of a tractive system components will be measured for their resistance to ground during the scrutineering process.

Answer: We confirm that there is an incorrect reference to GLV components within the TI sheets (which will be corrected) and that only parts as defined in both clauses EV.6.3.1 and EV.6.3.2 within 100 mm of the Tractive System, will be tested for resistance compliance.

iButton placement clarification – RE: 71-2019 – 15/11/2019

Question: EV.5.1.12 states "The iButton sensor is to be located within the Accumulator Pack, mounted to thermally connect to the negative cell terminal of the accumulator. The sensor must be mounted on a thermally conductive surface, with a flat area at least the size of the iButton footprint, that is either in direct contact with this terminal or no more than 30mm away from it". We are proposing to mount the iButton to a wall of the accumulator less than 30mm away from the negative terminal.

It is mounted on a thermally conductive surface, has a flat area large enough and is no more than 30mm away from the terminal. However the proposed mounting surface does not have a direct thermal connection with the most negative cell terminal. Does this satisfy the rule?

Answer: The requirement is for the ibutton to be thermally bonded to the negative terminal so that it can be reasonably assumed to be reading the temperature of the battery, not the potentially significantly cooler air around it.

The proposal locating the ibutton 30mm away from the terminal on the accumulator wall does not have a direct thermal connection to the negative thermal cell terminal and is therefore not acceptable.

Definition of short circuit detection for electric vehicle BSPDs – RE: 70-2019 – 5/11/2019

Question: What short-circuits does the BSPD need to detect? Does it need to detect short-circuits to the supply voltage, or GND, or both? If our LV battery provides a 12 V supply, but our BSPD board steps that down to 5 V using a voltage regulator, do we need to detect a short circuit to both 12 V and 5 V?

Answer: The intent of the rules for the BSPD is to only detect short circuits in the sensor inputs. The power supplies are not considered to be sensor inputs and therefore the requirements of this rule clause do not relate to them.

MSDS – RE: 69-2019 – 14/11/2019

Question: Is the MSDS of the oils and fats used during production necessary? Example: MSDS for paints, thinners and hardeners used to paint frames and cowls? Do I need to submit an MSDS for gasoline to be distributed at the event?

Answer: The MSDS sheet is to primarily identify chemicals that will be brought into the site by teams in containers. Some of these may be potentially hazardous and some may require spill kits or other special precautions by the competition track officials or the Formula SAE-A personnel.

Chemicals that are used in manufacturing or embodied in coatings or parts of the vehicle are not required to be included in the MSDS.

Fuel of course is prohibited to be brought by the teams.

Any significant quantities of fluids that are carried in the vehicle (such as special coolants; brake fluids; spillable battery fluids) should be included, as well as workshop consumables, spare containers and items such as degreasers, lubricants, etc.

AMS Voltage Sense Wiring – RE: 68-2019 – 31/10/2019

Question: In order to relieve mechanical strain on the fuse for the voltage sense wire, is it acceptable for the fuse be part of the way along a wire that is directly connected to the cell tab, which then leads to the centralised AMS?

Answer: You did not define a distance from the cell tab but it is expected that the fusible link or fuse be located as close as possible to the cell terminals, in order that the likelihood of an unprotected short circuit is reduced. Any design where it is likely that unfused wiring could rub, or be damaged, thereby causing a short circuit would not be acceptable.

BSPD Throttle Position – RE: 65-2019 – 18/10/2019

Question: Is the condition regarding throttle position an absolute value of throttle position, or 10% greater than idle position? For the Monash vehicle, the starting and idle position of the throttle is often greater than 10%, due to the small size of the throttle body. Therefore, any hard braking, even at idle will trip the BSPD and open the shutdown circuit. The Formula Student Germany equivalent rule regarding the BSPD conditions state the throttle position condition being 10% above the idle position: T 11.6.1 A standalone non-programmable circuit, the BSPD, must open the shutdown circuit, see EV 6.1 and CV 4.1, when hard braking occurs, whilst · [EV ONLY] ≥5 kW power is delivered to the motors. · [CV ONLY] the throttle position is more than 10 % over idle position. We would like to know if the intention of IC.4.8.1a is to have the BSPD trip at 10% absolute throttle position or 10% over idle throttle position.

Answer: We confirm that an interpretation of 10% above the idle throttle position can be used to comply with the requirement. The idle position is that to which the throttle returns when “closed” so opening to 10% above this position is the intent of the rule.

This is on the assumption that the idle position/speed are not elevated above a usual and reasonable range.

Use of an excessive idle position/speed would not be acceptable for compliance with the requirement.

Current path for fuse connections – RE: 51-2019 – 18/10/2019

Question: Would the attached fuse blocks violate this rule if the cable lug is bolted directly onto the fuse itself? Would it violate this rule even though it is current rated?

Answer: The fuse blocks as shown in the attachment are acceptable as the plastic is not under compression when the nut is tightened. They are designed to the Rules intent so that the tightening force is born only on the metal components via the ridge at the base of the stud.

Tractive System PCB trace spacing – RE: 46-2019 – 26/08/2019

Question: Does the spacing constraints given in EV.6.1.7 c) apply to a PCB with ONLY tractive system traces? Attached is a conformal coated PCB that is placed over a segment to pass BMS voltage taps. Segment maximum voltage difference 75V. 1mm trace separation shown.

Answer: Even though higher voltage differential may be likely to be present to a GLV circuit, the spacing requirements for increased spacing as the voltage differential increases still applies within the PCB, even if no GLV traces are located on the circuit board.

The potential for breakdown under the conformal coating is still present as the voltage differential increases above 50 Volts.

ESA presence at comp – RE: 44-2019 – 23/08/2019

Question: Is the ESA required to attend the competition?

Answer: The Electrical Safety Advisor is not required to attend the event whereas the ESO must attend per the rules. Teams may wish to bring their ESA to the event but it is not mandatory.

Individual overcurrent protection rating – RE:43-2019 – 23/08/2019

Question: I interpret the rule as intending to avoid the individual over current protection device tripping in a whole pack over current situation, ie “an overcurrent protection device greater than or equal to three times lower than the sum of the parallel fusible links”. For example, we wish to use a 150A main pack fuse in a 90s8p pack, so each individual fuse would have to be rated for 56.25A. We want to use a 63A fuseable link which, following my interpretation, would still break in a cell overcurrent situation but allow the main pack fuse to blow in a pack overcurrent situation.

Answer: Your interpretation of the rule and calculation method is correct at 56.3 Amp and the use of a 63 Amp fuse would be acceptable in this application.

Fusing of Individual Cells – RE:39-2019 – 25/07/2019

Question: Earlier in the year a colleague sent in a rules request (see attached) and I believe it could easily have been misinterpreted. I would like to make sure it was clearly understood that the intention is to only have a pack fuse and the 8 cells would not be individually fused, but instead attached straight to a busbar connection in parallel. Is this allowed in respect to EV8.1.5?

Answer: Your more detailed explanation of your circuitry design and fusing. You are correct in that the prior acceptance per Rules Enquiry 09-2019, was incorrectly based and the set up shown is not acceptable. The design should ensure that when cells are paralleled, each cell must be provided with some form of over current protection. When doing so, teams should carefully consider the interrupting current and voltage rating of the fuses, as well as how the protection is coordinated. They should also note that these are

required in addition to the main pack fuse, which must be rated to break the full pack voltage as well as have an appropriate current rating.

Composite Anti-Intrusion Plate Test Requirements – RE:37-2019 – 02/08/2019

Question: Rule T.2.39.3 states that "Composite laminate materials must be tested under T.2.31.4 and T.2.31.2". Firstly, I suspect that this reference to rule T.2.31.2 should actually be referencing rule T.2.31.1, as this is the rule concerning testing of representative composite panels. However, this is not the main subject of my enquiry: Rule T.2.31.1a (presuming my previous assumption is correct) states that "Test panels must: Measure 275 mm x 500 mm; Be supported by a span distance of 400 mm". However, rule T.2.39.4 states: "Analysis of the AIP under 3 point bending must show the AIP does not fail under a static load of 120 kN distributed over 150 mm of length.

Answer: You have the choice of either physically testing the Composite AIP to prove acceptability or doing the bending test. You would have to test unless you are using the Standard Impact Attenuator, so this physical test of the assembly would seem to be the simplest approach.

If you are using the Standard Impact Attenuator, then we would accept two approaches (we assume your IAP is of different thickness and construction to your other monocoque panels): Either test at the nominated 275 mm dimension and do a simple ratio calculation to show the load capability at a 150 mm dimension, or do a test with the test piece at the 150 mm dimension.

State of Charge – RE: 36-2019 –23/07/2019

Question: 1. Is it necessary to display the SOC on the dashboard of the vehicle, while it is running? 2. Do we have to calculate the SOC of a single "battery" or the entire "battery pack"? Please, clarify upon this

Answer: While teams must be able to identify the SOC of their battery pack at Technical Inspection, the teams are free to choose how they will do this.

At Technical Inspection, we will measure pack voltage and calculate SOC based on the battery datasheet, which can be done using the standard Tractive System Measuring Points

There is no requirement at all to display SOC on the dashboard, or monitor while the car is running, however, teams are free to do so if they want.

PDOC Temperature Monitoring – RE: 35-2019 –22/07/2019

Question: If a power resistor is fixed to a heatsink do both the heatsink and resistor need to be monitored? Must all monitoring be done inside the accumulator? How far away on a heatsink is acceptable to monitor the temperature of a power resistor?

Answer: The intention is to monitor the temperature of the resistor. The measurement should preferably be on the resistor case. If this is not practical it should be monitored on the heat sink as close as is practically possible to the resistor. The resistor should be soundly affixed d to ensure that any temperature difference between the resistor and the heat sink should be minimal.

iButton Location with Multiple Accumulator Packs – RE: 34-2019 – 21/07/2019

Question: Question: EV.5.1.12 The internal temperature of the accumulator pack will be monitored at the Australian Competition, via a Maxim iButton (DS1922T-F5) sensor supplied by the organisers at the event. The iButton sensor is to be located within the Accumulator Pack, mounted to thermally connect to the negative cell terminal of the accumulator. The sensor must be mounted on a thermally conductive surface, with a flat area at least the size of the iButton footprint, that is either in direct contact with this terminal or no more than 30mm away from it. Teams will be required to install the sensor during EV Technical Inspection (Step5) into a holder that has been installed by the team prior to the event, using either the

appropriate Maxim iButton holder (DS 9093S), or an alternative mounting approach, that is to the satisfaction of the Technical Inspection scrutineers. More details relating to the installation and reading of the iButtons will be available from the Formula SAE-Australasia website and in the Event Handbook.

Answer: In response to your request for clarification of the mounting requirements for iButtons where the vehicle design utilises two (or more) accumulators, only a single iButton is required and this should be mounted on the most negative bus bar of the accumulator system.

EV Firewall Thickness – RE: 33-2019 –10/07/2019

Question: According to T.3.6.3a, the maximum EV firewall thickness is 0.7mm. Based on previous year's rules enquiries, firewalls with a thickness of 1mm were allowed. We are entering a 2nd year car under the token system. Due to difficulties in sourcing the 0.7mm Aluminium, we would like to continue using 1mm Aluminium for the firewalls. Is it allowed to use 1mm aluminium for EV firewalls?

Answer: In line with prior years' acceptance, 1.0 mm Aluminium firewalls will be accepted at the 2019 FSAE-A event.

HV Cable Temperature Requirements – RE: 32-2019 – 12/07/2019

Question: The datasheet for the cable we are using (35mm2 OLFLEX) was rated with an IEC Standard test for a maximum of 70 degrees Celsius but is UL certified up to 90 degrees Celsius. Is this cable still rules compliant in regards to EV.6.5.5c?

Answer: As the rules clause does not require a specific standard to be used, compliance to an internationally recognised authority's rating will be acceptable. Therefore, as UL is a recognised testing and standards authority, your proposed cable with a UL rating of 90 degrees C, meets the requirements.

Nosecone limits – RE: 30-2019 – Wednesday 03/07/2019

Question: Do nosecones count as an aerodynamic device, because our IA exceeds 700mm and so our nosecone has to go beyond the 700mm limit?

Answer: Provided that your nosecone does not have any specifically shaped aerodynamic features on its surface or devices attached to it, beyond it acting as a simple shaped cover over the Impact Attenuator, then it would not be subject to the rules regarding forward limits for the position of aerodynamic devices.

LV Labels & HV Labels – RE: 29-2019 Monday 01/07/2019

Questions:
(a) Can the "LV" label be incorporated into the >50mm red circle area?
(b)Can the "HV" or "TS" label be incorporated into the >50mm orange circle area?

Answer: Regarding your questions on the incorporation of the LV and HV or TS designation within the >50mm Red or Orange circles surrounding the switches, this could be acceptable provided that clarity of reading is maintained and the designation text is not obscured in any position of the switches or the switch handle when inserted. This may require the colour circles to be >>50 mm. Please submit a drawing or other depiction of your proposal (referring to this Rules Question number) so that a more definitive answer can be given.

Front Hoop – RE: 27-2019 – 29/06/2019

Question: Does the front hoop require additional bracing if it the hoop leans towards the front of the chassis more than 10 degrees from the vertical? Is there a requirement to have front hoop bracing if using a monocoque chassis?

Answer: As the Front Roll Hoop is already required to be braced per T.2.14 and T.2.20, the angle of any forward inclination is irrelevant.

Obviously it requires to be braced in accordance with these rule clauses and for a monocoque, equivalence to the tubular structure must be proven, as referred to in T.2.28 but additional tubular bracing is not required unless your monocoque strength is inadequate.

Enquiry Regarding APPS Rule as Specified in Rule Book – RE: 22-2019 03/07/2019

Question: What is specified through "short circuit" from the line: The intent is that in a short circuit the APPSs will only agree at 0% pedal position.

Answer: With regards to correctly interpreting the meaning of T.6.2.2, we assume you are not asking as to the meaning of the words Short Circuit but, rather, the relative parts of the APPS circuit to which it applies. It must ensure that any short circuit occurring between the signal lines will always result in an implausibility according to T.6.2.3.

Second Year Car Eligibility – RE: 21-2019 Thursday 06/06/2019

Answer: In addition to prior year vehicles admitted to the FSAE-Australasia competition under the "Token" rules in GR.7.4, Second Year Vehicles that have competed during any one (1) previous Formula SAE year may compete provided

i. that they have been substantially modified from their prior year entry. Photographic and design documentation detailing the modifications are required, along with a statement from the team's Faculty Advisor.

ii. that the vehicle complies with all current year rules.

Penalties for insufficient redesign or insufficient knowledge by the team will be applied during the Design Event. A minimum penalty of 25 points will be applied but may be higher depending on the level of redesign.

MAIN ROLL HOOP ATTACHMENT FOR HYBRID OR MONOCOQUE VEHICLES

Answer: In the 2019 International Rules the intention was that the Main Roll Hoop must be attached in three places but the present US rule wording is confusing and the defined location restrictive and does not allow teams to place the intermediate mount to optimise their design and load spreading through the monocoque.

A dispensation is given for two attachments, provided the loads it will support are increased significantly.

This was foreshadowed in our local communications in advance of the 2018 event.

Therefore, the following is issued in advance of the local SAE-A Addendum to give all teams adequate time to ensure compliance.

Under T2.35.3 paragraphs (a) and (b), delete the existing US words and instead insert the following new paragraphs (a) and (b), such that the rule reads:

"T.2.35.3 The Main Hoop must be mechanically attached to the monocoque and must meet T.2.40.

a) Three attachments are required on each side. They must be located at the bottom, top, and an intermediate location. Each attachment must meet the load requirements specified in T.2.40.1.
b) Designs may combine the top of monocoque attachment and the Intermediate attachment but must then show attachment load strength of 45 kN in all directions (1.5 times the requirements of T.2.40.1) for both the combined upper attachment and the lower attachment, on each side.

Fuel Filler Neck RE: 18-2019 – 21/04/2019

Question: *We would like to use a clear filler neck tube as our sight tube to avoid requiring a separate sight tube. We will be using fuel safe specifically designed fuel hose which we have used in the past. We are seeking approval to run this as requested in IC.5.5.3.*

Answer: A clear Filler Neck may be used as the sight tube provided that:

- It is manufactured from a suitable fuel resistant material
- It meets the neck requirements of IC.5.5.1
- It meets the vertical readable height of IC.5.5.2 and
- The marking and visibility requirements of IC.5.5.4/5

Token: Carry Over Car Compliance RE: 16-2019 – 21/04/2019

Question: *In line with the 2018 Version of this regulation (Then Referenced T.3.4.1, Image Attached) Our 2018 Chassis has components with a 25.4x1.6mm cross section. 2019 Regulation T.2.5.1 (Image attached) has omitted this profile from the allowed options. Will our team be required to remove these tubes from the already constructed and painted chassis?*

Answer: As your 2018 vehicle complied with the published rules for 2018 it will be accepted under the Token rule for 2019 without change to the affected tubes. The 2019 SES should accept this tube size.

Main Hoop Attachment RE: 10-2019 - 20/04/2019

Question: *The proposed intermediate attachment location shown (269mm above the ground) is below the specified attachment location (300-350mm above the ground) however given that it is located at the midpoint between the upper and lower attachment locations I believe it will provide a better load distribution into the monocoque. Is this suitable or must it be moved into the 300-350mm range?*

Answer: Your question was covered in the note sent to all teams on February 15 this year, and then confirmed in the Local Rules Addendum, where three locations were made mandatory and the specified location of the US Rules for the intermediate mount was removed to enable teams to position them at their most suitable location for load sharing. Accordingly, your preferred mid-point location is fully acceptable and meets the intent of the Addendum.

The upper and lower locations should be placed as close as possible to the top and bottom of the monocoque side structure while maintaining sound structural positioning. Please ensure all queries are reviewed with your Faculty Advisor before submitting.

Accumulator Cooling/Cooling Ducts Running Through the Cockpit RE: 14-2019 – 18/04/2019

Question: *I understand the rules state that there must be no openings through the body work into the driver. However I have an inquiry about our cooling duct design for out accumulator. The ducts that have been designed are for cooling purposes only for our accumulator. The ducts were designed to run through the front of the chassis, under the seat (protected from the driver), through the fire wall, facing up against the accumulator (but not attached). Although the ducts are passing through the fire wall, they will be made out of the same material as the firewall, using the same fire retardant material, and sealed against the fire wall. the front of the ducts will be mounted on top of the floorpan, so they will secured into place. In*

addition to this, the holes in the front of the chassis where the ducts run through will be sealed with a duct not an open, exposed hole. Is it possible for our team to still run these ducts or is it still a breach against the rules?

Answer: Your proposed duct would be acceptable to pass through the driver compartment if it is fully sealed from the compartment with no external holes open to the compartment and, as they are an extension of the firewall, made out of the same two piece materials as the firewall, using the same fire retardant material, and sealed against the fire wall.

International Student Driver's License RE: 15-2019 – 18/04/2019

Question: *We have a new member this year with a full Pakistani license and an international license. We would just like to confirm that these satisfy rule AD.3.3.*

Answer: As defined in the local Rules Addendum, the only licence required to compete at our competition is a CAMS Speed Licence and the possession, or type, of road licence held by the team member is irrelevant for the 2019 FSAE-A competition.

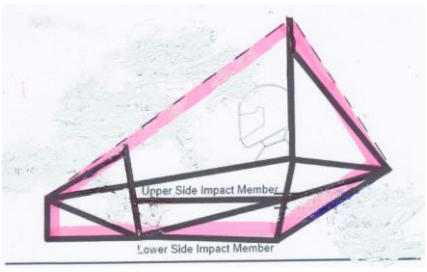
Aerodynamic Mounting Off Main Roll Hoop Bracing RE: 11-2019 - 07/04/2019

Question (part1): *I was planning to mount a bracket on the backside of the main roll hoop bracing that will then attach to the upper side of the rear wing as a mount (swan neck mount). However, I am confused as to what "additional bracing" must be added to the roll hoops to prevent bending loads in the braces in any rollover attitude?*

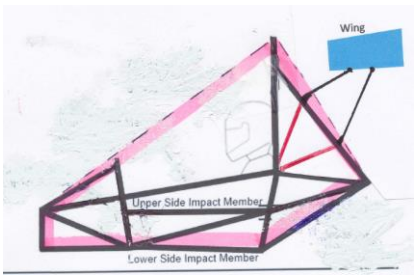
Question (part 2): *The rear wing was designed to have a bracket that is attached to the Main roll hoop bracing and top side of the rear wing. However, I am unsure what is classified as "additional bracing" and if there is any particular requirements that need to be met; such as specific areas where there needs to be additional mounting or specific bracing types.*

Answer: To avoid bending loads from anything mounted to the rear braces (such as a wing) from inputting a bending load to them, an additional tube would usually be required at the point where the wing mount attaches to the brace, creating a node which would then attach at the other end to a node on the Primary Structure, thereby creating triangulation and avoiding bending loads.

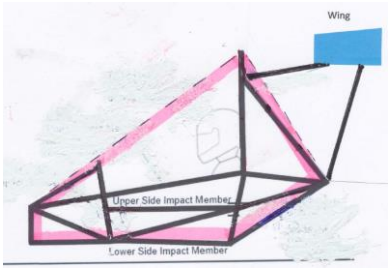
The three attached rough sketches should assist understanding the application of the rule, whereby the first shows a typical PS Envelope; the second shows a wing outside the PSE, mounted to the MRH Brace in a way that would require triangulation with additional tubes; the third shows an approach to mounting which does not load the Brace in bending and would avoid the need for additional tubes.



Primary Structure Envelope



P S E With Wing on Brace



P S E With Wings to Nodes

Attachment Points to Monocoque Chassis RE:13-2019 - 07/04/2019

Question: *Rule T.2.40.1 states that the attachment points between the monocoque and primary structure have to withstand a certain load (30kN). However what is the rules for attachment points from the monocoque to other components (for example, Vehicle Dynamics components such as wishbones and suspension). It seems as though T.2.40.2 seeks to clarify this, (referring to inserts, backing plates, etc) but then leads back to Rule T.2.40.1, again stating 30kN. Is it correct to assume that this means that all of the attachments, not just the ones to the Primary Structure, or is there another rule allowing us to use loads that we need for certain components rather than a predetermined amount?*

Answer: As noted, the rule T.2.40.1 applies only to the mounts between the monocoque and the Primary Structure. Other mounts (such as for wings; suspension items; etc.) should therefore be designed by teams to carry the anticipated design operating loads. They should of course be designed in accordance with sound engineering practice, with anti-crush inserts/backing plates/mounting brackets/fasteners/shear area/etc., as appropriate for the particular application.

Driver foot protection provided by Front Bulkhead RE: 05-2019 – 14/03/2019

Question: *Driver foot protection provided by Front Bulkhead*

Answer: To clarify the intent of the rule. It is aimed at providing adequate protection for the feet and legs of a driver in the event of a major impact – particularly a frontal one. It intends that the Bulkhead structure will absorb the impact force with the Impact Attenuator and the Attenuator Plate mounted on the front of the bulkhead, closing any forward facing gaps and providing penetration protection.

We presume that the thin red line on your two sketches indicate the front plane of the Bulkhead where the IA Plate will mount. Also that in the second case the area below the IA Plate mounting is fully enclosed by the monocoque (or a metal plate), with equivalent penetration and yield strength to the IA plate. If so, either of your designs should meet the above described intent of the rules.

Accumulator Fusing Query RE: 09-2019 - 14/03/2019

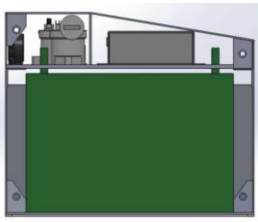
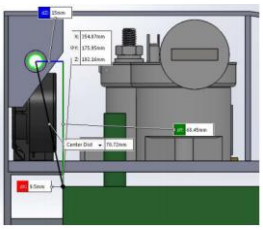
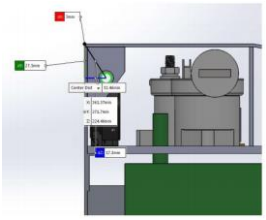
Question: *Rule EV.8.1.5 requires that "If multiple parallel battery cells, capacitors, strings of battery cells, strings of capacitors, or conductors are used then each parallel element must have individual overcurrent protection".*

Our proposed cell arrangement is 90s8p. This is made of six segments of 15s8p connected in series. Within each segment, each series step is joined by a bus bar, such that the parallel strings are not separated.

In this arrangement, the parallel cells behave as one cell, and are subject to the overall pack over current protection.

Our interpretation is that the rule applies to series-parallel configurations where the bus bar is not present. Given the above details, does the fuse placement in the circuit diagram below satisfy the requirements of the rule?

Answer: In respect to your question regarding the compliance of your proposed fusing design with EV,8.1.5, your proposed fusing arrangement is acceptable.

Accelerator Pedal Position Sensor Query RE: 04-2019 – 27/02/2019

Question: *Is the sensor described in the attached data sheet considered "Separate Sensors" with regards to T.6.2.2? It is a non-contact rotary sensor with inbuilt dual redundancy. It is contained within a single housing and uses a single input shaft, however features independent ground, supply and signal wires. The intended application of this sensor would ensure that each of the signals read by our control system would be offset from each other. The 2019 Formula Student ruleset defines separate sensors as not sharing supply or signal lines (T11.8.5). We are wanting to ensure that the FSAE-A ruleset shares the same definition.*

Answer: The sensor you have selected meets the requirements for separate sensors with separate supplies, but does not appear to be able to meet the requirement for different transfer functions. As such, the sensor would not be appropriate for use by itself.

Baseline Steel Tube Dimensions RE:01-2019 – 15/02/2019

Question: *Should we use the minimum dimensions for the baseline tube as stated in section T.2.5. or should we trust what the Structural Equivalency Spreadsheet proves as an equivalent baseline tube for this test?*

Answer: You appear to have uncovered an anomaly in the SES and we have raised this with the Formula personnel in SAE USA to look into/correct this. In any event, as the rule is quite specific on the required dimensions for the Side Impact Tubes, this is what you must use as your reference for equivalency, that is, if Round Tube, 25 x 1.75 mm or 1 inch x .065 inch.

Internal cross section- Steering column supports RE: - 02-2019 – 14/02/2019

Question: *With regards to T.3.2.1, are universal joints included in the definition of "steering column"? Furthermore, do steering column supports, as pictured in (Figures 1,2,3), fit within the definition of "steering column". As a more specific example, we have attached an image of two proposed steering column configurations. (Figures 1,2,3) detail a configuration in which the column supports are contained within the "slot for steering column clearance" (red), while (Figures 4,5) contains only a universal joint. We are seeking clarification if these configurations meet the intent of rule T.3.2.1.*

Answer: The key points in the rule are not so much defining exactly what is thought of the steering column (and normally the column would be regarded as including any joints in the column) but

a) that the template can pass through without being impeded by the column and supports (hence the larger clearance at the top to allow for supports) and
b) that there is nothing that can catch on the driver's clothing or injure his/her legs per the requirements of T4.9 with any shields not impeding the movement of the template through the footwell area.

While the designs you show may be able to comply with the template, you do not show any shielding. You must ensure that any shielding per T4.9 will still allow free passage of the template.

Side Impact Structure RE: 03-2019 – 14/02/2019

Question: *When combining tubes with a panel, can the tubes be placed in any location within the structure or must they align where a relevant tube in a tube structure would be positioned? Can the tube in red be combined with the side impact vertical structure to prove equivalence? In the SES spreadsheet it is not clear how to add a tube in a hybrid structure that does not align with a standard tube position and have it count towards equivalence, prompting this enquiry.*

Answer: The SES is set up to simplify input by teams with the embedded equivalency formulae. In the case of the side impact, it makes the assumption that as you are replacing one or all beams, then the beam/beams being replaced would have been in the location specified in the rules. So it assumes if you are using a combination monocoque and tube, you have replaced either one or two beams. If of monocoque structure, the floor is calculated as having to replace the lower beam and the vertical monocoque has to equate to the other two beams. You thus have the choice of either using the SES input and locations, or preparing and submitting a separate analysis and calculation if you wish to locate a complementary beam in some other location. This would have to prove the equivalency of that combination for strength and energy absorption to the baseline three tubular beams. This approach will obviously entail more calculation work.

Front Wing Mounting Query RE: 91-2018 – 14/11/2018

To clarify the rules; They are intended to ensure that any item that may affect the load in a frontal impact, beyond that transmitted directly to the Impact Attenuator, has that load added to the calculations.

You reference to your actual attachments being mounted behind the crushed attenuator is irrelevant. This paragraph T3.22.2(c) does not mean where the attachment is made but where the components are mounted and your two brackets and wing are mounted in the impact zone. Accordingly, the load to crush them must be derived by physical test or calculation and added to the load from your IA test in order to establish acceptability. Your diagram shows that the main foil of your wing is also mounted in front of the impact attenuator plate which will stop the wing moving rearward even without being bonded to the brackets. You thus must add the crush load for the wing section and brackets to your IA test load, apart from the fact that if bonded together then the combined load must be considered.

We cannot advise teams on recommended design approaches. You must choose whatever is the best in your circumstances to complete your design and build and meet the test load criteria. You must derive the forces for all wing sections, brackets, etc. that will increase the impact load via calculation or test to finalise your overall data submission. We would advise that wings that mount below the IA Plate and bulkhead will not influence the impact if they shear or slide off at low load.

EV Catch Can RE: 89-2018 – 25/10/2018

Question: *Does this require the bottom of the catch can to be in plane with the bottom of the frame? We would like to know the intent of this rule.*

Answer: Did you check this with your Faculty Advisor as required before submitting this question? The rule is quite simple and we are not sure what aspect of intent for it you are querying.

The catch can does not have to be mounted flush with the bottom of the frame but the breather hose must extend to the bottom of the frame.

Catch cans are required to avoid fluids being spilled onto the track during the event and the vent tube location is to ensure fumes/vapour are not directed towards the driver.

Steering Belt Mechanism Width RE: 88-2018 – 24/10/2018

Question: *In 2016 our team was warned if the steering belt mechanism width was greater than a specific value, we would not pass inspection. Looking at the rules I could only find the above template that states a 50mm clearance, however this is only for the steering column and could not find any other rule specifying the max width of this mechanism. I just want to verify that there is no required maximum dimension for the steering belt mechanism and furthermore, that our width of 65mm, will pass inspection.*

Answer: Firstly, addressing your question on dimensions and clearances: Clearly anything wider than 50 mm will not pass through the slot. The template must pass unimpeded right through the cockpit area and not be obstructed by anything, not just steering columns.

Secondly, it appears that you are proposing to use a belt connection. Apart from being poor engineering practice, this does not meet the requirement of a mechanical connection.

If you were proposing to use Clause T6.5.8 relating to cable connections, then you should have already submitted an FMEA with your SES which showed how it would fail in a safe mode, and also obtained approval for the design. If you have not done this, you must change to a mechanical installation. This may already be required by your width problem in the first part of this response.

BSPD Test Circuit: RE: 84-2018 24/10/2018

Question: *Will the test current source for this test be provided by the organizers?*

Answer: The device for providing the test current to demonstrate correct function of the BSPD must be provided by the FSAE team.

EV TSAL Flashing Frequency: RE: 87-2018 – 22/10/2018

Question: *We would like to clarify if we can flash the TSAL light between 2Hz and 5Hz with non-equal time interval between flashes.*

Answer: It is required that the TSAL flash continuously, and with consistent frequency, as such your proposal as presented is not acceptable.

Insulation of Metallic Accumulator Container: RE: 79-2018 12/10/2018

Question: *To isolate our cells we use polyamide tape from 3M(98-C1, link to datasheet: http://www.cvspl.com/3M-Electrical/Polyimide-Tapes/3M-98C-1-Polyimide-Tape.pdf).*

I just fear if it goes hand in hand with EV4.5.4. It is widely used by teams but still I wanted to remove any doubt because it is not a simple insulation tape.

Answer: EV4.5.4 is intended to ban the use of standard PVC insulating tape, self-amalgamating tape or ‘paint on’ insulation in areas where it would be considered the primary insulation. This is because with such insulators, it is impossible to be sure how effectively the insulation was applied. The safety of the insulation is heavily reliant on the thickness of the coating, which is usually impossible to check. These insulations are also usually very soft and easily damaged, making them not appropriate for use in FSAE vehicles.

Primary insulation is wherever it is the only insulation separating any live component from potentially touching another component, the chassis (considering potential impacts) or being touched by a person. Secondary insulation is anything that might prevent unexpected contact under unusual circumstances, such as the internal lining of the battery box.

Polyimide tape may be used a secondary insulation inside a FSAE vehicle, provided the application does not expose it to abrasion or a risk of puncture. Polyamide, alone, is not appropriate for insulating items inside a battery box but may be used in conjunction with a tougher material such as electrical Nomex of an appropriate rating for sealing areas such as corners and seams.

BMS Outside the Accumulator: RE38-2018 – 11/05/2018

Question: *We want to confirm if it is allowed to have the BMS outside the accumulator container. We are using a 132 cells model Orion BMS 2. It is equipped with 2.5kV isolation for every 36 cells and 100V isolation for every 12 cells.*

Answer: It is the intention of the rules that when the AIRs are open, no tractive system voltage should be present outside of the accumulator enclosure. The proposed arrangement will not be acceptable as there will be live conductors at tractive system voltages outside of the battery enclosure when the AIRs are open

Wires in Accumulator Container: RE39-2018 – 11/05/2018

Question: *Rules Reference EV4.5.11and EV3.3.8. Is orange GLV system wire allowed in the accumulator container?*

Answer: In response to your recent question on GLV wiring colour, Per EV 4.5.1, even inside the accumulator container, orange wiring may not be used for GLV wiring which is not part of the tractive system.

SES QUERY; EV 3.4.6 ALT MAT'L EQUIVALENCY: RE35-2018 – 10/05/2018

Question: *SES. EV 3.4.6 Alt Material - Shear. Given the inherent advantage of being able to tailor the mechanical properties of a composite materials to suit an application, does the required "proof of equivalency" dictate the entire alternative material panel must meet the same shear strength as the steel baseline or is there scope to meet shear equivalency only in regions where such shear strength is required?*

Answer: With regard to your question regarding equivalence of a composite material accumulator container to steel and if the equivalence requirement applied to the complete panel surface, we advise that it must be equivalent to 0.09/1.25 mm thick steel over the whole panel surface area, not just at load bearing points. Steel also provides localised impact/penetration protection for the Li batteries over the whole panel surface, therefore the composite must be equivalent to the nominated thickness steel over the full area.

SES Query: EV3.4.6 Alt Matl – Shear: RE35-2018 – 10/05/2018

Question: *Alternate Frame Accumulator Container Perimeter Shear Test. Given the inherent advantage of being able to tailor the mechanical properties of a composite materials to suit an application, does the required "proof of equivalency" dictate the entire alternative material panel must meet the same shear strength as the steel baseline or is there scope to meet shear equivalency only in regions where such shear strength is required?*

Answer: Similar to how monocoque structures only need to show equivalent shear strength within the front bulkhead support and side impact structures, and how hard points are expected where necessary to distribute loads through the panel.

With regard to equivalence of a composite material accumulator container to steel and if the equivalence requirement applied to the complete panel surface, we advise that it must be equivalent to 0.09/1.25 mm thick steel over the whole panel surface area, not just at load bearing points.

Steel also provides localised impact/penetration protection for the Li batteries over the whole panel surface, therefore the composite must be equivalent to the nominated thickness steel over the full area.

SES QUERY: RE27-2018 09/05/2018

Question: *T3.19/T3.32. The UTSS (N)" in the FBH Support Structure fails SES. The guidance notes within the SES gives an alternate method to prove the equivalence provided that the value is >33%. Do we need to provide equivalent calculations for: 1. ONLY "UTS (N)" because that is the only criteria we fail, or 2. All the three properties "Moment of Inertia", "Buckling Modulus", "UTS (N)".*

Answer: In response to your request regarding the completion of the SES (T3.29 T3.32) we wanted to verify the response with our SES reviewers. In providing equivalent calculations, you should provide all of the calculations as per the following:

- Show area of monocoque skins, A.
- Calculate Moment of Inertia of skins, I, derived from the cross-section of the skins to the chassis centre line, comparing to derivation of baseline tubes.
- Show EI is greater than three baseline tubes.
- Multiply A by UTS value from panel testing to prove equivalent strength.

FASTENER EDGE DISTANCE: RE32-2018 - 03/05/2018

Question: *Regarding Rule T11.1.3 Does the second bolt hole on the same bracket (and therefore the chassis) count as a free edge?*

Answer: The edge distance is intended to be the distance from any bolt hole within the mounting plate / reinforcement to a neighbouring free edge of the monocoque. The distance to an additional bolt hole within the mounting plate / reinforcement itself may be less than this dimension.

LV FAN INSTALLED IN ACCUMULATOR: RE33-2018 - 03/05/2018

Question: *Rules EV 4.1.4 & EV 4.1.5: We are designing a cooling system in the accumulator container which involves fan in the accumulator. We would like to clarify if fans are allowed in the accumulator container if they are powered by the LV battery but galvanically isolated.*

Answer: LV equipment within the battery container should be avoided wherever possible. If an LV system must be installed within the battery compartment it must be galvanically isolated from the chassis and be physically protected from the tractive system by either an insulating barrier or the defined air gap.

Electronic Throttle Control: RE37-2018 - 03/05/2018

Question: *What is the meaning of "Notice of Intent to use deadline" on Electronic Throttle Control (ETC)? We are confused with the deadline for ETC on 14 Sept for IC vehicles.*

Answer: The Notice of Intent is a specific form available on the US FSAE website and is as required per the rules. This is all clearly spelled out in Clauses IC1.11 through IC1.18 and their related sub-clauses. It must be agreed to by the officials in advance for you to be allowed to use an ETC. The September 14 date is for the submission of the FMEA. Very few teams attempt to use ETC and we would recommend that any new team not attempt to adopt ETC in their early years.

Head Restraint Width: RE36-2018 - 03/05/2018

Question: *Rule Reference T5.6.2 c. Does the total head restraint width have to be greater than 15cm or can the head restraint at one point be less than this?*

Answer: The width of the head restraint must be a minimum of 150 cm over the complete restraint if an adjustable restraint, or over the full minimum height of 28 cm for a fixed restraint. A fixed restraint of greater than 28 cm height could have the width reduced outside the 28 cm height.

WHAT IS "BRAKING HARD": RE30-2018 27/04/2018

Question: *EV5.6 Brake System Plausibility Device (BSPD). 1.Can you please give a clearer definition of "braking hard"? Is there a certain pressure value at which we consider as braking hard? 2. Regarding the following section: "The action of opening the AIRs must occur if the implausibility is persistent for more than 0.5 sec." Does it mean we need to open the AIR within 0.5sec after the BSPD fault is detected?*

Answer: The pressure required to be considered 'braking hard' needs to be determined by the team as it is dependent on the design of the braking system. It should be close to the point of locking the wheels. At technical scrutineering the scrutineer will select one of your drivers (usually the smallest) and ask them to demonstrate that they are strong enough to active the protection system. As such, you should seek to strike a balance between too high a braking force that the drivers cannot active the system in an actual emergency and too low where it causes nuisance trips. The action of opening the AIRs must occur if the implausibility is persistent for more than 0.5 sec." should be taken to mean that the driver panics and depresses the brake pedal hard, the AIR must trip. It is allowable for you to have a timer which checks for a consistent brake press for up to 0.5 seconds before tripping to reduce nuisance trips.

EV; SUPPLY OF POWER FROM TSMS: RE31-2018 – 27/04/2018

Question: *Rule EV4.11.2 requires any pre-charge circuitry must be supplied directly from the TSMS. 1. Can AIR be supplied by 12V voltage line before the TSMS?*

Answer: It is a requirement that the actual current flowing through the AIRs passes through the TSMS, such that when the TSMS key is removed, the current path to the AIRs is physically broken. As such the arrangement suggested is not acceptable.

MONOCOQUE MAIN ROLL HOOP MOUNTING: RE34-2018 – 27/04/2018

Question: *Regarding Rule T3.34.2. Given the rule states the hoop must be attached at the top, and the bottom, and at an intermediate location: are three attachment points required on each side to attach a main hoop to a monocoque chassis, as shown in the following diagram?*

Answer: Your interpretation of the rule T3.4.2 is a correct interpretation of the intent of the rule. A tube frame structure would usually have three welded mounts; one at the top of the body structure; another at the Upper Side Impact Tube; and one at the bottom of the body structure. The drawing you included showing mounts at the top, bottom and adjacent to the height of the USI tube would be in full compliance. This rule will be clarified in the 2019 US FSAE Rules and/or 2019 Local Addendum.

FIRST YEAR VEHICLE DEFINITION: RE29-2018 - 19/04/2018

Question: *A6.8. First Year Vehicles: In the 2017 competition, a car was run with a chassis that was mostly aluminium honey-comb monocoque with a steel space frame rear section. For the 2018 competition, if the front monocoque section is significantly redesigned but we reuse the rear section with minor modifications of brackets, suspension mounts and engine mounts, will the vehicle be classified as a first-year car?*

Answer: Provided the front monocoque is significantly different, plus there are some modifications to the rear structure and not a carryover rear suspension, the vehicle will be accepted as 1st Year Car. You may not gain the maximum points in Design because of the lack of new design approach to the rear structure.

HEADREST PADDING DIMENSIONS: RE25-2018 – 13/04/2018

Question: *Rule T5.6.2. Does this rule require the energy absorbing foam to be a minimum of 1.5 inches thick or is the rule only requiring the assembled thickness of the restraint to be a minimum of 1.5 inches thick?*

Answer: The foam padding must be a minimum thickness of 38 mm. If the dimension were applied to the total head restraint, inadequate thicknesses of foam could result.

FRONT RADII ON WING SECTIONS: RE26-2018 – 13/04/2018

Question: *Rule T9.5 & T9.5.1. 1. Does this rule assume the front radius of aerodynamic devices in a 'normally operating' configuration i.e. the running configuration of the vehicle? 2. How will front radii be measured given the radius of an aerofoil is constantly changing? 3. Will the secondary flap of a front wing and by extension any other forward facing aerodynamic device be measured?*

Answer: All forward facing edges are potentially contactable by a pedestrian so must comply unless protected by a grille or some other guarding. The radius could be measured in any operating position so if devices are adjustable, your design must ensure compliance throughout the range of movement.

BENT TUBE SUPPORT: RE19-2018 - 06/04/2018

Question: *Per T3.5.5. If the bent tube in question is the upper side impact member, is this it required to have a support tube of the same diameter and thickness (1.375'' x 0.047'') as stated in the rule above or is this already accounted for in the increased diameter of the tube?*

Answer: If your Upper Side Impact tube is bent, then it must have at least one tube of the same diameter and thickness running from where the furthest deviation due to the bend is located back to a node on the chassis. If of the correct dimensions, a tube running from the centre of your USI tube back to the node at either the base of the Main Roll Hoop or Front Roll Hoop would meet this requirement.

EV OVERCURRENT PROTECTION - 1/3 RULE: RE22-2018 - 06/04/2018

Question: *We would like to ask clarification for the first item in rule EV6.1.5. Specifically, requiring a "three time lower" requirement on the external overcurrent protection device? If we put 7 cylindrical cells (where each cell has 2 fusible links, rated at 22.5A each) in parallel and form a battery block. Then we connect 110 of these cell blocks in series to form the accumulator pack. The sum of parallel fusible links rate will be 22.5 * 2 * 7 = 315A, does this mean we have to connect in series an external fuse with a rating lower than 105A?*

Answer: You are correct in your assumption that a fuse rated at 105 Amps or less will be required to protect the battery pack in that configuration. The 3x rule (EV6.1.5.1) is an attempt to make sure that 2 scenarios don't happen; A: If a single fusible link blows there is time for the AMS to detect it and shutdown the vehicle and we don't have a chain reaction where as soon as one link blows the rest blow because the remaining set of fuses has an overall smaller ampacity) and B: If the entire pack is subject to an over-current the main pack fuse which is rated for full TS voltage blows before the parallel cell fuses which are not voltage rated. Given the different shapes of the time current curves, the 3x factor was adopted as a reasonable way to have a simple requirement for the teams to follow but make sure we keep adequate spacing at all points on the time current curve between the main pack fuse and the cell fuses.

SHUTDOWN BUTTON ELECTRIC SYMBOL: RE23-2018 - 06/04/2018

Question: *Can you provide us a close picture of the button or model name of the button mentioned in EV5.3.4? I was unable to find the button with a red spark on a white-edged blue triangle.*

Answer: You appear to have misunderstood the rule. It does not require the Shut Down Button to carry the symbol but it be clearly located adjacent to the button. You could draw and produce your own symbol or they can be located on line.

ELECTRIC MOTORS LOCATION & PROTECTION: RE08-2018 - 05/04/2018

Question: *The team wished to apply the Wheel Mounted motor exemption for a motor mounted in an exposed position outside the main frame.*

Answer: The intent of this rule EV 4.2.3 was to allow wheel embedded motors without the obvious incompatibility with frame protection. Apart from ensuring adequate electrical disconnection protection for your motor, the mounting must also fully comply with EV4.2.2 with surrounding tubular structure per T3.4. It appears that your motor is mounted in a position subject to this rule but no surrounding structure is shown, as will be required.

ACCUMULATOR COOLING LIQUIDS: RE14-2018 - 01/04/2018

Question: *For accumulator cooling is silicone oil permitted given it is defined as an oil? We're attempting to implement an active cooling system for our accumulator and require a dielectric heat transfer material with a viscosity similar to water. This is the safest material we have found to meet our needs.*

Answer: By the Safety Data Sheet, the material is classified flammability level 2 "moderate". Despite the rules requirements that the battery pack be operated at or below 60 degrees C, there will be insufficient margin between the operating temperature and the flash point of the fluid. There are likely to be localized hot spots within the pack, so it is possible that flammable gasses could accumulate in the air spaces within your battery pack. Due to the high energy content of the battery pack, it will not be possible to demonstrate that ignition sources are not present within the battery, so the fluid must be assumed to be unsafe for this purpose. As there are currently no rules specifically governing cooling fluids for battery packs, the rules committee suggests the following for guidance:

- The fluid should be non-flammable, or at least self-extinguishing.
- The fluid should be stable at any temperatures up to at least 90 degrees C to prevent localized boiling or off gassing.
- The fluid should not be listed as dangerous goods.

ACCUMULATOR MOUNTING DESIGN: RE12-2018 – 12/03/2018

Question: *The mounting point makes use of an 8mm Metric Grade 8.8 stud to fasten the accumulator to the car. Due to the inherently unserviceable nature of studs, the use of a slot in plate has been conceptualised. The plate must be located with other fasteners to both react the torque of the stud and to locate the plate longitudinally during the fastening of the accompanying M8 nut.*

The smaller fasteners serve only for locating and torque reacting purposes. They are not intended to carry any impact load. Does the use of smaller-than M8 fasteners to locate this bracket contravene EV3.4.8 c ii?

Answer: The proposed arrangement as shown in your component drawing appears not to be acceptable as a replacement for the required M8 mounting bolts. Per Clause 3.4.8 c, the mounting must *"Be able to withstand 20kN in any direction"* and thus are intended to secure the battery box in three dimensions against forces generated during an impact or possible rollover event. As presented, the pins indicated in your design would provide adequate restraint in one or two dimensions only so are not an adequate replacement for the required bolts.

ACCUMULATOR HOLES PROTECTION: RE07-2018 – 26/02/2018

Question: *Ducts are being added to our accumulator for cooling. They are made of non-conductive material and are in contact with the cells and accumulator walls, however the smallest duct (shown) is 60mm from cell to wall. There is no opportunity for anyone to contact the Tractive Path of the system. Does the current design meet the intent of the rules?*

Answer: The intention of rule EV4.5.1 is to prevent accidental contact of fingers or tools to live parts of the accumulator, either with the car assembled, or during maintenance. You should also consider the insulation on the battery pack itself. If you are able to demonstrate that the insulation on the battery pack itself is adequate for the full tractive system voltage, and a probe cannot be inserted from the exterior to contact the cells or internal HV items, then your design should be compliant. You should be able to check this for yourselves with a sample probe. If either the insulation on the cells is not suitable for your full pack voltage, or contact can be made with the probe, you should consider adding additional insulation or an additional means of preventing the insertion of the test probe.

GROUND PROTECTION FOR WIRING & FUEL LINES: RE09-2018 – 26/02/2018

Question: *Given that the triangulated lower face of our monocoque, will not impact the ground under any circumstances. Will routing brake lines and LV wiring through this area satisfy rule T7.1.7?*

Answer: The intention of rule T7.1.7 is to protect the electrical and brake hardware on the vehicle from impacts, both from the ground and from foreign bodies. As the exposed equipment will still be susceptible to damage from foreign bodies, the proposal is not acceptable.

HV CONNECTOR CLAMPING: RE10-2018 – 26/02/2018

Question: *On our cell stack PCB, we are using a Radlok connector. This connector is fastened to the PCB by an M6 cone lock nut, one of the material layers of the PCB is an FR-4 standard fire retardant composite material. Given the strength of this material is this considered to be compressible and therefore not meet rule EV4.5.8?*

Answer: PCBs being made of fiberglass are considered to be compressible and so are not allowed to be included in a bolted high current path connection. This is because once compressed, the resin can gradually flow, causing a relaxation of the joint. Note also, nyloc nuts are not suitable for securing high current connections, as the nylon has a relatively low softening temperature, making them ineffective when the joints get hot.

GRADE 8.8 BOLT REQUIREMENTS: RE03-2018 – 11/09/2017

Question: *Does an OE combination satisfy the conditions listed in rule number T11.1.1. The stud is not 8.8 grade bolt and we have difficulty understanding the extent of the mentioned rule to whether or not the bolts used to attach the wheels to the hub must be 8.8 grade. Furthermore, does the fact that they are flat head contradicts with rule number T11.1.2 or not?*

Answer: The Fastener requirements in clause section T11.1 relate to the Metric Class and head type for nuts and bolts used to retain clevises, hubs, uprights, wishbones etc. They do not apply to the pressed in wheel studs and where OE wheel studs/lug nuts would be satisfactory. The example shown would appear to be more than adequate for a Formula type vehicle.

FUEL LINE CLAMPING: RE02-2018 - 08/09/2017

Question: *Attached is a picture of the OEM fuel rail on which our fuel lines are to be clamped, we were wondering whether or not this fuel rail fuel entry satisfies the condition of being barbed or not.*

Furthermore, are the clamps whose picture is attached in the enquiry satisfies the three conditions of required clamps per this rule or not.

Answer: The spigot with the exterior circular beads qualify as satisfying the barbed or bulb requirement, provided the tube is clamped between the two raised beads. A wire clamp would definitely cut into a hose and therefore the double wire clamp you show is unacceptable. A flat band clamp with rolled edges is what is expected. Examples are shown on the USA FSAE website Frequently Asked Questions.

DUEL FUEL INJECTION: RE01-2018 – 17/08/2017

Question: *Since there is no mention of dual stage injection in the rules, we were wondering if it is allowed to use engines with such capabilities. For example, our selected engine is Honda CBR 600 2009 which uses a dual stage injection system and in addition to the 4 injectors that inject the fuel into the cylinder head, another 4 inject fuel into the intake manifold.*

Answer: Dual Stage, or dual injector location, systems are permitted. If the system is wholly a Low Pressure System it must meet all of the requirements of Clause IC1.91 or, if High Pressure or Direct Injection, the requirements of Clause IC1.9.2. If the system is a hybrid of Low and High Pressure, then all requirements of both clauses must be met.

Disconnection of BMS before Maintenance Plugs

Question: Rules Reference EV3.3.3.2 and EV8.1.2. We are advised by our BMS manufacturer, Orion that we must disconnect the BMS voltage tap sensing connector on the BMS side before the maintenance plugs are disconnected. Otherwise, the BMS will be damaged. Our BMS will be packaged inside the accumulator container. We'd like to clarify that for maintenance of the accumulator and whenever accumulator segments are removed from the container, is it allowed to disconnect the BMS side voltage sensing connector before disconnecting the maintenance plugs.

Li BATTERIES FUSING IN IC CARS

Question: *In regards to the regulations on the use of Batteries based on Lithium Chemistry & specifically the Discharge current cut off switch: I have been unable to locate a battery on the market with a built in cut out for high discharge. The battery we are proposing to use has high and low voltage protection. Is the voltage cut off enough to satisfy safety concerns or is a Fuse in the line is required. The battery proposed (SSB Power Sport LH7B-4-GK) is rated to 150A discharge and has a cut of 8.2 Volts.*

Answer: A fuse or other overcurrent protection is required. The low voltage cut- off does not satisfy the requirement for which the overcurrent protection is intended and is to protect not just for thermal runaway but more to protect the wiring/personnel. Lithium Ion batteries of all chemistries have a significantly higher short circuit current than lead acid, and are likely to be in the range of thousands of amps.