

Formula SAE-A Rules Inquiries

Questions and Answers

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MAIN ROLL HOOP ATTACHMENT FOR HYBRID OR MONOCOQUE VEHICLES

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 - Sunday 21 April 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 - Sunday 21 April 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 - Saturday 20 April 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?*

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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 - Thursday 18 April 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 our 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 be 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 - Thursday 18 April 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 - Sunday 7 April 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.*

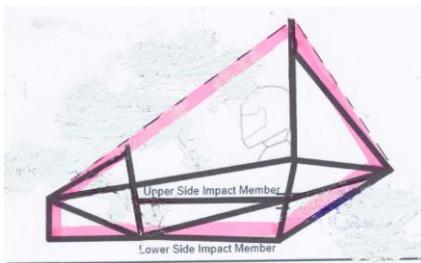
Answer: To avoid bending loads from anything mounted to the rear braces (such as a wing) from inputting a bending load to them, an additional tube would usually be required at the point where the wing mount

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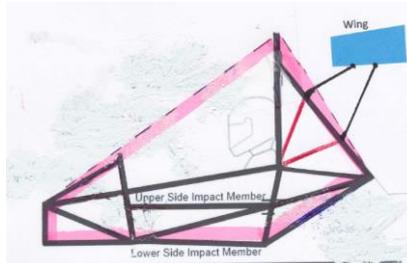
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attaches to the brace, creating a node which would then attach at the other end to a node on the Primary Structure, thereby creating triangulation and avoiding bending loads.

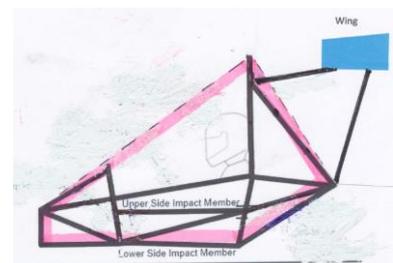
The three attached rough sketches should assist understanding the application of the rule, whereby the first shows a typical PS Envelope; the second shows a wing outside the PSE, mounted to the MRH Brace in a way that would require triangulation with additional tubes; the third shows an approach to mounting 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 - Sunday 7 April 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 - Thursday 14 March 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 - Thursday 14 March 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".

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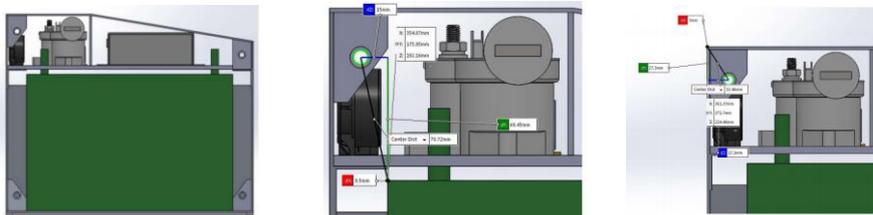
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Our proposed cell arrangement is 90s8p. This is made of six segments of 15s8p connected in series. Within each segment, each series step is joined by a bus bar, such that the parallel strings are not separated.

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 - Wednesday 27 February 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 - Friday 15 February 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 - Thursday 14 February 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*

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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 - Thursday 14 February 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 - Wednesday 14 November 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.

Your 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

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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 - Thursday 25 October 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 - Wednesday 24 October 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 Wednesday - 24 October 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 - Monday 22 October 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 Friday 12 October 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>).*

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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 as 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 - Friday 11 May 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 - Friday 11 May 2018

Question: *Rules Reference EV4.5.11 and 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 - THURSDAY 10 MAY 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.

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SES Query: EV3.4.6 Alt Matl – Shear: RE35-2018 - Thursday 10 May 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 WEDNESDAY 9 MAY 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 - THURSDAY 3 MAY 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 - THURSDAY 3 MAY 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.

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Electronic Throttle Control: RE37-2018 - Thursday 3 May 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 - Thursday 3 May 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 FRIDAY 27 APRIL 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 - FRIDAY 27 APRIL 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 - FRIDAY 27 APRIL 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?*

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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 THURSDAY 19 APRIL 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 - FRIDAY 13 APRIL 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 - FRIDAY 13 APRIL 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 - FRIDAY 6 APRIL 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 - FRIDAY 6 APRIL 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*

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** 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 - FRIDAY 6 APRIL 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 - Thursday 5 April 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 - SUNDAY 1 APRIL 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.

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ACCUMULATOR MOUNTING DESIGN: RE12-2018 - MONDAY 12 MARCH 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 - Monday 26 February 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 - Monday 26 February 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 - Monday 26 February 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.

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GRADE 8.8 BOLT REQUIREMENTS: RE03-2018 - Monday 11 September 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 - Friday 8 September 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 - Thursday 17 August 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.

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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.