
# 2010 Formula Student Electric
# Rules

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# 2. General

The principle of Formula Student Electric is to allow the development of fully electric vehicles within the Formula Student framework. The competition for Formula Student Electric cars will be the same as Formula Student with some slight modifications due the special needs of fully electric vehicles.

The Formula Student Electric (FSE) competition will comply with the Formula SAE® 2009 rules, located here: http://students.sae.org/competitions/formulaseries/rules/2009fsaerules.pdf
The Formula Student Electric Rules include some specific rule changes and additions to allow the development of safe, fully electric vehicles with electro-chemical energy storage.

Those changes and additions are located within this document, which supersedes the specific sections of the published Formula SAE® rules for 2009. Any questions or ambiguities concerning the rules for Formula Student Electric will be resolved by the Formula Student Electric Rules Committee.

## 2.1 Official Language

The Formula Student Electric official language is English.

## 2.2 Official Time

The Formula Student Electric Official Time is Central European Time (CET). To convert CET to your local time you may use following website: http://www.timeanddate.com/worldclock/converter.html

## 2.3 Safety Responsible

Every participating team has to name at least one safety officer (SO) for the event. This person is responsible for all electrical operation of the vehicle during the whole event. The SO is also responsible for every kind of work on the car during the event. The SO is the only person in the team that is allowed to declare the car as electrically safe, so that work on other systems of the car may be performed by the team. The SO must be a graduated Engineer or equivalent and possess a certificate for working with high voltage systems in automotive vehicles. In order to register for the event, the SO must prove this certification to the event organization

## 2.4 Extension of the Rules

Due to continuous development of the FSE rules, extensions or additions may be integrated at any time.
Any significant rule changes or additions will only occur once per year and will be published before the 30th of November.
Small rule changes, additions or rules for event specific operations will be published on the FSE Homepage. Discussions about upcoming rule changes and additions will happen in the official FSE Forums.

## 2.5 Society Membership

Students must be a member of a FISITA Organization. (www.fisita.org)

## 2.6 Faculty Advisor

FSE recommends that all participating teams have a faculty advisor present with them at the competition. In the event that no Faculty Advisor is present during competition, the Team Captain will take over all responsibilities of the Faculty advisor.

# 3. Vehicle Requirements and Restrictions

## 3.1 Chassis

An older FS chassis may be used for 2010. This chassis must fulfill at least the FSAE rules of 2007. It must be proven that the chassis was used during the year that such rules were in place (SEF). New build chassis must conform to the current FSAE rules.

## 3.2 Firewall

A firewall must separate the driver compartment from all high voltage (HV) component and any oil or liquid cooling systems.
In case of using a non-metal material for the firewall (i.e. carbon fiber, fiberglass, etc.) a fire resistant heat protection shield with a metal surface must be fitted to the HV side of the firewall. The metal surface part of the firewall must have a low resistance electrical connection to the common earth of the insulation monitoring device.

## 3.3 Brake System

### 3.3.1 Brake System Components mounting

Nylon lock nuts are not allowed for mounting brake calipers or brake discs. All critical bolts, nuts, and other fasteners on the brake system must be secured from unintentional loosening by the use of FSE approved positive locking mechanisms.

### 3.3.2 Brake System Master Cylinder actuation

The use of Bowden cables or Push Pull Bowden cables for activating the hydraulic brake system is not allowed.
The first 50% of the brake pedal travel may be used to regenerate brake energy. The brake energy recovery is only permitted when the brake pedal is actuated by the driver. Automatic brake energy recovery is prohibited.
The remaining brake pedal travel must actuate the hydraulic brake system.

### 3.3.3 Brake Light

The brake light must turn on when the driver actuates the brake pedal.

### 3.3.4 Brake Test

During the brake test the car must be accelerated on a short straight. Afterwards the HV system has to be switched off by the driver and the brake pedal must be actuated as far as possible. The brake test is successful if all four wheels are locked.

### 3.3.5 Brake Over-Travel Switch

Instead of switching off the ignition and fuel pumps the brake pedal over-travel switch must shut down all HV systems by opening the accumulator isolation relays.

## 3.4 Powertrain

### 3.4.1 Replacement of FSAE Rules

Articles 8.1 until 8.9, articles 9, 10 and 11 of the FSAE 2009 rules are superseded by the following FSE rules. Articles 8.10 and 8.11 are only valid if a cooling system is in use.

### 3.4.2 Motors

All types of electrical motors are allowed. From a safety point of view the usage of AC motors is recommended.
Hybrid systems are prohibited.

### 3.4.3 Torque encoder (throttle pedal position sensor)

Drive by wire is permitted.
The torque encoder must be actuated by a foot pedal.
The foot pedal must return to its original position when not actuated.
At least two sensors, located in different positions, must be fitted as the torque encoder. The purpose of the second sensor is redundancy. Both sensors must have different supply and ground wiring. A plausibility check is recommended to verify the both sensors give the same pedal position.

# 4. Electrical Rules

All teams must supply clearly structured documentation of their entire electrical system (including LV and HV system) similar to the SEF called electrical safety form (ESF). It is recommended that the SAE Standard J1673 for "High Voltage Automotive Assembly Wiring Design" is complied with.
It must visualize the interconnection of all components including the voltage level, the topology and the wiring in the car.
It is recommended that the teams present the data sheets with rated specifications for all HV parts used and that none of these ratings are exceeded (including wiring components).
Teams must submit a completed Failure Modes and Effects Analysis (FMEA) of the HV system.

## 4.1 High-Voltage (HV) and Low Voltage (LV)

Whenever a circuit carries more than 60V DC or 25V AC RMS under any circumstances it is defined as part of the High Voltage system. 600V DC or AC RMS is the maximum permitted voltage under any condition in the High Voltage System that may occur between any two electrical connections. The HV system must be completely insulated from the chassis or any other conductive parts of the car.
Low voltage is defined as any voltage below 60V DC. The Low Voltage System must be grounded to the chassis. The entire HV and LV systems must be completely galvanically isolated.

The electrical layout of self developed devices must be documented accurately.
It is allowed to charge a LV battery with the HV system.

The LV and HV systems of the car must be separated.

- Using the same cable channel(s) for both systems is prohibited.
- If a housing contains parts of the HV and LV system, an isolation boundary such as Nomex, Formex or a similar humidity resistant material must separate both systems.
- If a printed circuit board (PCB) contains both HV and LV systems, they must be separated by sufficient space to avoid accidental flashover and they must be galvanically segregated. Furthermore the HV and LV areas have to be clearly marked on the PCB. All self developed PCBs containing HV must be easily accessible during the scrutineering.

## 4.2 Isolation Monitoring Device

Every car with a high-voltage system must have an isolation monitoring device installed. This must be a Bender IR486, IR475LY3 or a FSE approved equivalent. In the case of an isolation failure, the output of the isolation monitoring device must break the holding current flow of the isolation relays of the accumulators to shut down the HV system.

The isolation monitoring device must be visible or have an easily visible indicator light to show its status.

## 4.3 Isolation Monitoring Device Test

If the car must be equipped with an isolation monitoring device it will be tested during scrutineering. This is done by connecting a resistor between several parts of the HV system and grounded vehicle parts while the HV system is active. (See example in Figure 1) The size of the resistor is defined as 500 Ohm/V related to the maximum HV system voltage. The test is passed if the isolation monitoring device shuts down the HV system whenever the resistor connects the HV system to ground.
The isolation monitoring device test may be repeated any time during the event. After the car passes the test for the first time, critical parts of the High Voltage system will be sealed. The vehicle is not

allowed to take part in any dynamic event if any of the seals are broken until the isolation monitoring device is successfully retested.

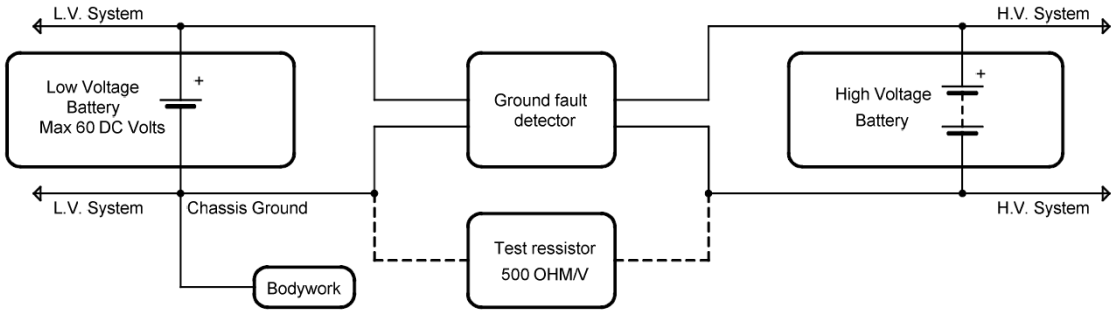


**Figure 1 Isolation monitoring device test.**

## 4.4 Rain Test

Every car must pass a special rain test during scrutineering to be allowed to compete in any dynamic event under damp or wet conditions. The car has to pass the isolation monitoring test, rule 4.3, before the rain test can be done.

During the rain test the HV system has to be active and none of the driven wheels are touching the ground. It is not allowed to have a driver seated in the car during the rain test.
Water will then be sprayed at the car from any possible direction for 120 seconds. The water spray will be rain like. Therefore there will be no direct high-pressure water jet shot at the car. The test is passed if the isolation monitoring device does not react during the test.

If any of the seals of the isolation monitoring device test is broken, the rain test must be redone after the isolation monitoring device test was successfully passed again.

## 4.5 No Exposed HV Connections except for measuring points

All parts of the HV system need to be isolated by non-conductive material or covers reaching a protection degree of at least IP45. A protection degree of at least IP67 is recommended for the rain test.
Two high-voltage measuring points must be installed on the car next to each other in an easy to reach position (without removing bodywork or other parts of the car). These measuring points must be circular and must have a minimum diameter of 6mm. The measuring points must be made of conductive material and must be sealed in a housing that can easily be removed. They must be connected to the positive and negative inverter supply lines with a maximum wire diameter of 0,35mm². The connection wires must be fused with a fast acting fuse of 0,5A maximum.
These measuring points will be used to check that the HV system is shut down properly in the given time during scrutineering, see rule 4.8. They are also needed to ensure the safety of the vehicle for possible rescue operations after an accident.

## 4.6 HV Insulation, Wiring and Conduit

Only insulation material that is appropriate for the expected ambient temperatures shall be used. All wires and terminals used must be reasonable sized and the wires must be marked with wire gauge, temperature rating and insulation voltage rating. Datasheets documenting material data for the used insulation materials and wires must be brought to scrutineering.

The complete HV wiring harness must be professionally built and secured against loosing or mechanical stress. All HV wires that are not protected by housings or enclosures must run in orange non-conductive cable channels. The cable channels must be securely attached. Mounting wires lower then the lowest chassis point is prohibited. The HV wiring system must be shielded against damage by rotating and / or moving parts. If external heat sinks are used, they must be properly grounded.

## 4.7 High Voltage Running Light

It must clearly visible when the HV system is set to active (ready to drive). The car is defined as active when voltage outside the accumulator containers exceeds 60V DC or 25V AC rms. For this the car must be equipped with a light mounted on the highest point of the main roll hoop which lights if the car is active. This light must be clearly visible from every horizontal direction in very bright sunlight.

## 4.8 Master Switches

A system of three shut-down buttons must be installed in the vehicle.
Pressing one of the shut-down buttons must separate the HV system from the accumulator block.
After separating the system, the voltage in the HV system must decrease to under 60V DC or 25V AC in less than five seconds.
Each shut-down button must be a push-pull emergency switch where pushing the button is opening the holding current of the accumulator isolation relays.
One of the buttons must be located on each side of the vehicle behind the driver's compartment at approximately the level of the driver's head.
One shut-down button is equivalent to the cockpit-mounted Master Switch.
The LV Master Switch is equivalent to the Primary Master Switch.
The HV Master Switch must be located near the LV Master Switch and break the current flow holding the accumulator isolation relays. The function of both switches must be clearly marked. The "ON" position of both switches must be on the horizontal position.

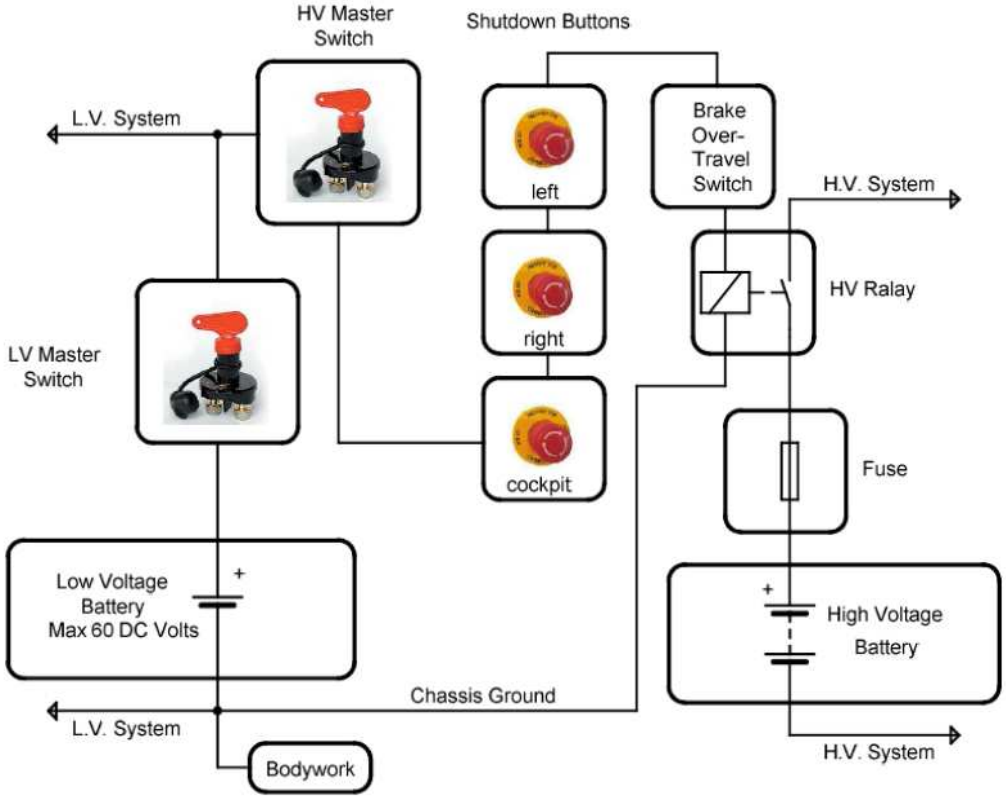


**Figure 2 Following circuit must be installed on the car.**

## 4.9 Fusing

The low and high voltage system must be appropriately fused. Any protected wiring must be fused with a smaller value than the maximum rated value for this wiring.

## 4.10 Energy Storage

All types of accumulators. e.g.: Batteries, Supercaps are allowed.
Fuel cells are prohibited.
The data sheets with rated specifications of the used accumulators must be part of the ESF.
The used accumulators must be enclosed in a accumulator containment
In every accumulator container must be a fuse as shown in Figure 2 Following circuit must be installed on the car..

Each accumulator container must have a prominent indicator, such as an LED that will illuminate whenever a voltage greater than 60 volts is applied to the connector. For alternative to the LED it can be used an analog volt meter which is clearly visible from outside of the container.

## 4.11 Accumulator isolation relays

In every accumulator containment at least one isolation relay must be installed. It is recommended to limit the switch on current. If the relay is open, no HV may be present outside of the accumulator containment. The isolation relays must be of a “normally open” type, they must be able to switch the short circuit current. If a failure occurs in the signal or data of the accumulator containment the isolation relay must be opened. E.g. Tyco EV200
(http://relays.tycoelectronics.com/datasheets/ev200.pdf)

## 4.12 Wiring of HV Supply

All accumulator containments must be wired to a single point. It does not matter if they are wired in series or parallel but all the energy must flow through this point and must pass through a FSE defined connector.

## 4.13 Energy meter

In the HV supply wire, see article 4.13, a black box must be inserted at the event. The type and size of the connector and the energy meter will be published soon. The energy meter is used to calculate the efficiency score by measuring the energy consumption.
The energy meter is sealed before the event by officials. The recorded data is downloaded by the officials after the endurance event to calculate the efficiency score. The recorded data is only accessible by the officials and is available for the team on request.

## 4.14 Accumulator Containment

All accumulator containments must be rugged and rigidly mounted to the chassis to prevent the containments from loosening during the dynamic events or possible accidents.
All accumulator containments must lie within the surface defined by the top of the roll bar and the outside edge of the four tires (See Figure 13 in the FSAE rules).
All accumulator containments must be protected from side or rear impact collisions,
Any accumulator containment which is located outside of the Side Impact Structure required by FSAE rules 3.24, 3.25, or 3.26 must be shielded by a structure built to FSAE rules 3.24, 3.26, or 3.26.

The accumulator containment must be built of mechanically robust and fireproof material. If the material is not electrically conductive the containment must have a low-resistance connection to ground.

Breakthroughs or holes in the containment are only allowed for the wiring-harness and for ventilation. These holes must be sealed according to rule 4.5.
A sticker with an area of at least 750mm² and a red or black lightning bolt on yellow background or red lightning bolt on white background must be applied on every accumulator containment. The sticker must also contain the text “High Voltage” or something similar e.g. Figure 3.


**Figure 3**

All kinds of accumulators that may vent explosive gas must have a ventilation system to prevent the vented gas from reaching an explosive concentration.
Every accumulator containment which is completely sealed must have an equalizing valve to prevent high-pressure in the containment.

## 4.15 High-Voltage Enclosures

Every housing or enclosure containing parts of the high-voltage system except motor housings and accumulator containments, see rule 4.14, must be labeled with a reasonable sized sticker with a red or black lightning bolt on yellow background or red lightning bolt on white background. The sticker must also contain the text “High Voltage” or something similar. All of the housings or enclosures, again except motor housings and accumulator containments, must be orange in color. If the housing material is electrically conductive it must have a low-resistance connection to chassis ground.

## 4.16 Charging

On the event site are defined charging areas. Only in this area it is allowed to charge the accumulators. The accumulator containments must have a label with the following data: Team name, name of SO and approximate time the charging period ends.

Charging accumulators is allowed at all times during the event in the charging areas.

Only certificate chargers are allowed and must be marked with a HV sticker. All connections must be isolated and covered. No open connections are allowed.

If the accumulator remains in the car during charging then no other work on the car is allowed.
The HV system of the car must be turned off during charging.
The accumulators may also be charged outside of the car, but they have to stay in the accumulator containment at all times.

# 5. Technical Inspection

## 5.1 Inspection & Testing Requirement

Technical Inspectors will mark or seal various different approved parts (i.e. isolation monitoring device, accumulator containment, energy meter, tires, rims etc.). The car can be disqualified from any dynamic event by using, or substituting unmarked parts. Parts with broken seals are equivalent to being unmarked.

## 5.2 Noise Test

For FSE no noise test is intended.

## 5.3 Isolation test

The isolation test is composed of Isolation Monitoring Device Test and Rain Test
Composed couponed compounded compound

## 5.4 Equipment

For the electric part of the technical inspection each team must have following equipment:

- HV proofed tools
- HV isolating gloves
- HV isolated blankets at least 1,5m²

## 5.5 Car Weighing

All cars will be weighed prior to Engineering Design Judging. All cars are to be weighed in ready to race condition. The fuel tank must be filled to the fuel level line (Formula SAE® Rule 3.5.3.3 Fuel Level Line). All lubricants and coolant must be in the car. This weight will be the car's Official Technical Inspection weight. There will be a penalty if the car weight changes during Dynamic Competition. The allowable weight tolerance is ± 5.0 kg. In the case of overweight or underweight in comparison to the Technical Inspection weight, the team will be penalized -20 (twenty) points for each kg (or portion of a kg) of additional or missing weight. This point penalty will be deducted from the Engineering Design Event score. (Each 0.1 to 1.0 kg = -20 points)
Example:
If the car is 5.3 kg underweight: 5.3 kg minus the 5.0 kg tolerance = 0.3 kg equals -20 Points
If the car is 7.8 kg overweight: 7.8 kg minus the 5.0 kg tolerance = 2.8 kg equals -60 Points
If the car weight changes due to replacement of broken parts, the car must be presented for tech inspection and then re-weighed. It is the team's responsibility to have the car re-weighed before entering a dynamic event after changing parts.

# 6. Static Events

## 6.1 Business Plan Presentation (75 Points)

### 6.1.1 Executive Summary

Judging will start with an Executive Summary before the FSG Competition. The principal document submitted prior to the Business Plan Presentation is an Executive Summary. The Executive Summary must not exceed one (1) page, team name and car number must be written on the Executive Summary. The Executive Summary should contain a brief description of the team's Business Plan. Included in the Summary the two most outstanding technical features of the car have to be listed. The Summary has to include the prototype car costs (as they will be presented to the cost judges) and the anticipated production cost, per vehicle, in a production run of 1000 cars per year.
The Executive Summary must relate to the specific prototype car entered in the FSG competition. The costs of the prototype car entered will not be considered as part of the Business Plan judging. Even though the Executive Summary is only judged by the presentation judges, all Engineering Design and Cost judges will have access to the file and may refer to it.
The Executive Summary must be submitted in Adobe Acrobat® format (*.pdf file) online, no later than the specified date.
Late submission and non submission will be penalized. It is at the discretion of the judges to deduct between -5 (five) points from the Presentation Judging score.
Note: Consider your Executive Summary to be the first impression of your Business Plan to the Executive Board of a major auto manufacturing company.

### 6.1.2 Deep dive topic

After submission of the Executive Summary the teams will receive a specific deep dive topic from the presentation judges prior the competition. The task will be sent via email on the date specified in the Action Deadlines, to the team's responsible person's email address.
Every team has to present this special deep dive topic in a detailed way as a part of the team's business plan presentation to the judges.
NOTE: A team must not describe only this deep dive topic in the business plan presentation. It's important that a team presents the business plan.

### 6.1.3 Data Projection Equipment

Video Projectors will be provided by Formula Student Germany. These Projectors will have VGA Input Connectors.
The organizers will, not provide any other presentation equipment needed. Teams planning to use other presentation equipment, as a part of their presentation, are responsible for bringing, or otherwise arranging for their own equipment.

### 6.1.4 Scoring Formula

The scoring of the event is based on the average of the two or three presentation judging forms. There is a maximum of seventy-five (75) points from the FSE Presentation Judging Form.

$$\text{Presentation Score} = 75x\frac{P_{your}}{P_{\max}}$$

Where:
"**Pmax**" is the highest score awarded to any team
"**Pyour**" is the score awarded to your team

It is intended that the scores will range from near zero (0) to seventy-five (75) to provide good separation. The Presentation Event Captain may at his/her discretion; normalize the scores of different judging teams.

## 6.2 Engineering Design Event (150 Points)

### 6.2.1 Engineering Design Report Files File Format and Size

The Engineering Design Report must be submitted in Adobe Acrobat® format (*.pdf file) online, no later than the specified date. The size of the document must not exceed 5MB. A responsibly sized document will be much smaller than 5MB in file size. Please ensure that photos within the Acrobat file are of an appropriate resolution.

### 6.2.2 Engineering Design Spec Sheet File Format and Units

The Engineering Design Spec Sheet must be submitted in Microsoft Excel® format (*.xls file) online, no later than the specified date. The Formula Student Electric Engineering Design Spec Sheet template can be found on the FSE website at:
http://www.formulastudent.de/electric/important-documents/
The template is for metric units only. DO NOT alter or re-format the template prior to submission.

### 6.2.3 Penalty for late submission

Penalties for late/non submission of the Engineering Design Reports and/or Engineering Design Spec Sheets is as follows:
Late arrival of one or both documents: -10 (ten) points for each working day.
Failure to submit one or both documents will automatically result in zero points for the Engineering Design Event.
The penalty points will be deducted from your final Engineering Design Scores. The minimum allowable Engineering Design Score will be 0 Points. (Points will not go negative.)

## 6.3 Cost Event (100 Points)

### 6.3.1 Cost Event Scoring (Specific FSG change of Formula SAE® 2009 Part C Rule 3.7)

The points for the Cost and Manufacturing Event will be broken down as follows

| | | |
|---|---|---|
| $20\ x\ \frac{(P_{\max}/P_{your})-1}{(P_{\max}/P_{\min})-1}$ | 20 Points | Lowest cost - each of the participating schools will be ranked by total adjusted retail cost from the BOM and given 0-20 points based on the formula on the left. Pyour is the adjusted cost of your car and Pmin is the adjusted cost of the lowest cost car. Pmax is the cost of the most expensive car. |
| | 40 Points | Real Case Situation – Teams will receive a task covered a "Real Case in Industry" |
| | 40 Points | Event Day/Visual Inspection - The cars will be reviewed for part content and manufacturing feasibility. The submitted process descriptions will be discussed. |
| **Total** | **100 Points** | |

### 6.3.2 Late submission of Cost Report (Specific FSE change of Formula SAE® 2009 Part C Rule 5.15)

Teams that submit reports later than the specified date will be penalized -10 (ten) points per working day, with a maximum penalty of -80 points. Teams that do not submit a Cost Report will receive 0 (zero) points for the Cost & Manufacturing Analysis score. Minimum Event score is 0 (zero) points.

### 6.3.3 Addenda (Specific FSE change of Formula SAE® 2009 Part C Rule 5.15)

For changes in your corrections made after the submission of the cost report please use the FSE cost addendum. For all new parts, which are manufactured, a drawing must be attached to the addendum form.

### 6.3.4 Cost Report Penalties Process (Specific FSG change of Formula SAE® 2009 Part C Rule 5.17)

Only penalty method A will use for FSE, described in Part C Rule 3.18 “Penalty Method A- Fixed Point Deductions” of the Formula SAE® 2009 Rules. The Formula SAE® 2009 Rules 3.19 “Penalty Method B – Adjusted Cost Deductions” is not valid for the FSE competition.

# 7. Dynamic Events

## 7.1 Dynamic Events and Maximum score (Specific FSE change of Formula SAE® 2009 Part D Article 1)

| | |
|---|---|
| Skid Pad | 75 |
| Acceleration | 75 |
| Autocross | 100 |
| Fuel Efficiency | 100 |
| Endurance | 325 |
| **Total** | **675** |

## 7.2 Skid Pad Scoring (Specific FSE change of Formula SAE® 2009 Part D Rule 6.8.2)

The following equation is used to determine the scores for the skid-pad event:

$$Skid\ Pad\ Score = 71{,}5x\frac{\left(6.184/T_{your}\right)^2-1}{\left(6.184/T_{\min}\right)^2-1}+3{,}5$$

Where:
"**Tyour**" is the average of the left and the right timed laps on your best run including penalties.
"**Tmin**" is the elapsed time of the fastest car

## 7.3 Autocross Scoring (Specific FSE change of Formula SAE® 2009 Part D Rule 7.8.1)

The following equation is used to determine the scores for the autocross event:

$$Autocross\ Score = 95{,}5x\frac{\left(T_{\max}/T_{your}\right)-1}{\left(T_{\max}/T_{\min}\right)-1}+4{,}5$$

Where:
"**Tmin**" is the lowest corrected elapsed time recorded for any competitor in either heat
"**Tmax**" is 125% of Tmin
"**Tyour**" is the lowest corrected elapsed time in either heat for the team being scored.

## 7.4 Endurance Scoring (Specific FSE change of Formula SAE® 2009 Part D Rule 7.8.1)

The following equation is used to determine the scores for the endurance event:

$$Endurance\ Score = 275\ x\ \frac{\left(T_{\max}/T_{your}\right)-1}{\left(T_{\max}/T_{\min}\right)-1}+50$$

Where:
"**Tmin**" will be the lowest corrected time of the fastest team of the event.
"**Tyour**" will be the combined corrected times of both of your team's drivers in the heat.
"**Tmax**" will be 1.333 times "**Tmin**".

## 7.5 Efficiency Scoring (Specific FSG change of Formula SAE® 2009 Part D Rule 7.8.1)

The following equation is used to determine the scores for the endurance event

$$Efficiency = 100x\frac{\left(EfficiencyFactor_{\min} / EfficiencyFactor_{your}\right)-1}{\left(EfficiencyFactor_{\min} / EfficiencyFactor_{\max}\right)-1}$$

$$EfficiencyFactor = \left(\frac{T_{\min \text{ per } lap}}{T_{your \text{ per } lap}}\right)x\left(\frac{E_{\min \text{ per } lap}}{E_{your \text{ per } lap}}\right)$$

Where:
"**Tmin**" per Lap is the fastest endurance time (including penalties) normalized per lap
"**Tyours**" per Lap is the team endurance time (including penalties) normalized per lap

"**Emin**" per Lap is the lowest consumed endurance energy normalized per lap
"**Eyours**" per Lap is the team consumed endurance HV energy normalized per lap

The energy is calculated as the time integrated value of the measured voltage multiplied by the measured current logged by the energy meter.

Efficiency factor min is the minimum factor reached by a team.
Efficiency factor max is the maximum factor reached by a team.

Before the endurance event, every energy meter memory storage is cleared by an official and read out when the car is in Parce Fermé.