# Hydrogen Rules 2026

## version 1.0, 16.10.2025

## Preface & Foreword

This version of the Hydrogen Rules 2026 was published after the first season with Formula Student vehicles powered by hydrogen on track. This document replaces the Hydrogen Rules 2025 Version 1.1. If needed, a version 1.1 will be published after the Hydrogen Safety Officer Trainer (HSO) where the teams also have the chance for rules feedback.

In case of rules question or any other hydrogen-related topics please send a mail to: hydrogen@fs-world.org

In order to give an indication of where changes are most likely to be made for 26/27, these rules are labeled: TBD= to be discussed.

# Changelog

| Rule | Version | Change |
|---|---|---|
| G1.1.3 | 1.0 | Each team is allowed to convert existing FS vehicles to hydrogen once |
| G1.1.4 | 1.0 | Newest version of the Hydrogen Rules must be used for second year car |
| G1.1.5 | 1.0 | Chassis must not be older than 5 years |
| G3.1.4 | 1.0 | Updated deadline for concept paper submission |
| G3.1.6 | 1.0 | Limited teams at Hydrogen Concept Challenge |
| G4.1.2 | 1.0 | Updated deadline for H2SF submission |
| G4.1.5 | 1.0 | Deadline for submission of corrected H2SF is 168 hours |
| G5.1.4 | 1.0 | Updated deadline for VSV submission |
| G5.1.5 | 1.0 | Late submission of VSV |
| G6 | 1.0 | Add use of Structural Equivalency Spreadsheet |
| F1.1.2 | 1.0 | Add Nominal Working Pressure and update grade of hydrogen |
| F2.1.1 | 1.0 | Changed wording |
| F2.1.2 | 1.0 | Changed wording |
| F2.1.3 | 1.0 | Changed tubes between structural sidepodes and driver to T3.2.5 |
| F2.1.7 | 1.0 | Change to perforated material |
| F2.1.10 | 1.0 | Clarify how to attach structural parts to existing frame |
| F3.1.1 | 1.0 | Clarify how to deal with comparable standards to the hydrogen rules |
| F3.1.2 | 1.0 | Add form from the tank manufacturer for harmlessness of damage |
| F3.1.3 | 1.0 | Add 50 mm distance to surrounding primary structure |
| F3.1.4 | 1.0 | Add analogue pressure gauge in the high-pressure section |
| F3.1.8 | 1.0 | Add flexible protective cover for hydrogen tank |
| F3.1.9 | 1.0 | Rigid gripping devices for hydrogen tanks |
| F3.1.10 | 1.0 | Access to OTD without tools, operate the OTV only with tools |
| F3.1.11 | 1.0 | Add vent tower connection |
| F4.1.4 | 1.0 | Change fueling nozzle to fueling valve |
| F4.1.5 | 1.0 | The fuelling valve must be easily accessible with the fuel nozzle |
| F4.1.2 | 1.0 | Clarify combinations of coupling components |

| | | |
|---|---|---|
| C1.1.1 | 1.0 | Changed to any type of 4 stroke cycle internal combustion engine |
| C1.1.1 | 1.0 | Approval obtained for engine concept with over 1000 cc |
| C1.1.4 | 1.0 | Exceptions for higher injection pressure |
| C1.1.6 | 1.0 | Removed old rule |
| C1.1.6 | 1.0 | Add crankcase ventilation system |
| C4.1.4 | 1.0 | Changed wording |
| E2 | 1.0 | Removed old rule E2.1.5 |
| E3 | 1.0 | Removed old rule E3.1.1 |
| E5.1.2 | 1.0 | Changed wording |
| E5.1.4 | 1.0 | Changed wording |
| E6.1.1 | 1.0 | Add alternative place for Hydrogen System Measuring Points |
| E7 | 1.0 | Removed old rules: E7.1.1, E7.1.2 and E7.1.3 |
| E7 | 1.0 | Update the design of the discharge circuit |
| old E8 | 1.0 | Removed whole chapter about TSAL |
| E8.1.2 | 1.0 | Removed Fuel Cell Isolation Relays |
| E10.1.1 | 1.0 | Removed Fuel Cell Isolation Relays and update wording for fuse |
| E10.1.2 | 1.0 | Removed Fuel Cell Isolation Relays and TSAL's green light circuitry |
| E10.1.4 | 1.0 | Changed wording because no Fuel Cell Isolation Relays anymore |
| E10.1.5 | 1.0 | Simplify rule |
| E11.1.2 | 1.0 | Changed wording |
| E12.1.2 | 1.0 | Updated required parts inside the FC HV-Box |
| old E13 | 1.0 | Removed whole chapter about Fuel Cell Isolation Relays |
| E14 | 1.0 | Remove old rule E14.1.7 and add to chapter S10 |
| S1.1.6 | 1.0 | Removed 2025 |
| S1.1.7 | 1.0 | HSO certificate is valid for 2 years |
| S2.1.1 | 1.0 | HSMS only for FCEV |
| S3.1.2 | 1.0 | Updated list with Shutdown Circuit parts for H2CV and HYCV |
| S4.1.1 | 1.0 | Updated list with Shutdown Circuit parts for FCEV |
| S4.1.6 | 1.0 | Removed Fuel Cell Isolation Relays |
| S4.1.7 | 1.0 | Definition of OTV valve supply relay |

| | | |
|---|---|---|
| S5.1.2 | 1.0 | Definition of venting location |
| S6 | 1.0 | New chapter about grounding |
| S8.1.4 | 1.0 | Tools used to remove the hydrogen tank must store in the SHYTTA |
| S9.1.3 | 1.0 | Add refueling of the hydrogen tank |
| S9.1.5 | 1.0 | Clarify hand cart |
| S9.1.7 | 1.0 | Remove rule |
| S10 | 1.0 | New chapter about H2 Safety Measurement Device |
| H2.1.2 | 1.0 | Add handles to the dummy of the hydrogen tank |
| H2.1.3 | 1.0 | Tilt Test to both sides possible |
| H3.1.1 | 1.0 | Add leak detection spray according to DIN DVGW standard |
| H3.1.1 | 1.0 | Changed Sign to “H2 system discharged” |
| H4 | 1.0 | Removed old rule H4.1.1 |
| H4.1.1 | 1.0 | Changed procedure of the hydrogen leak test |
| H4.1.3 | 1.0 | Changed sign “H2 system discharged and inert” to “H2 system HOT” |
| H5.1.1 | 1.0 | Changed procedure |
| H6.1.1 | 1.0 | Update rule that it makes sense for removing the hydrogen tank |
| H7.1.1 | 1.0 | Add outside SHYTTA |
| H7.1.2 | 1.0 | Changed wording |
| D1 | 1.0 | Removed old rules D1.1.1 and D1.1.2 |
| D2 | 1.0 | Removed old rule D2.1.2 |
| D3 | 1.0 | New chapter about Efficiency Event |
| old J2 | 1.0 | Removes whole chapter about Business Plan |
| J2 | 1.0 | Removed old rule J3.1.1 |
| J2.1.4 | 1.0 | Hydrogen related parts can be part of the changelog |
| J3.1.1 | 1.0 | Changed wording |
| J3.1.2 | 1.0 | Changed wording |
| J3 | 1.0 | Removed old rule J3.1.3 |

# Abbreviations

| Shortcut | Full name |
|---|---|
| BOM | Bill of Material |
| BOTS | Brake Over Travel Switch |
| BSPD | Brake System Plausibility Device |
| CRD | Cost Report Documents |
| CV | Internal Combustion Engine Vehicle |
| CVMD | Cell Voltage Monitoring device |
| DI | Direct Injection |
| EDR | Engineering Design Report |
| EV | Electric Vehicle |
| FC | Fuel Cell |
| FCCU | Fuel Cell Control Unit |
| FCEV | Hydrogen Fuel-Cell Electric Vehicle |
| FCSC | Fuel Cell System Container |
| FS | Formula Student |
| HS | Hydrogen System |
| HSMP | Hydrogen System Measuring Point |
| HSMS | Hydrogen System Master Switch |
| HSO | Hydrogen Safety Officer |
| HV | High Voltage |
| HVD | High Voltage Disconnect |
| H2CV | Hydrogen Combustion Vehicle |
| H2HY | Hydrogen Combustion Hybrid Vehicle |
| H2SF | Hydrogen System Form |
| H2SMD | H2 Safety Measurement Device |
| LHV | Lower Heat Value |
| LVMS | Low Voltage Master Switch |
| LVS | Low Voltage System |

| | |
|---|---|
| MFP | Maximum Fueling Pressure |
| NWP | Nominal Working Pressure |
| OTD | On Tank Device |
| OTV | On Tank Valve |
| PFI | Port Fuel Injection |
| SDC | Shutdown Circuit |
| SES | Structural Equivalency Spreadsheet |
| SHYTTA | Safe Hydrogen Tank Transfer Area |
| TPRD | Thermal Activated Pressure Relief Device |
| TS | Tractive System |
| TSAL | Tractive System Active Light |

# G: General

## G1: Hydrogen vehicles

**G1.1.1** In addition to the existing CV / CV hybrid class and EV class categories, Formula Student vehicles powered by hydrogen are also allowed to participate.

**G1.1.2** Each event decides independently each year whether it will allow hydrogen-powered vehicles.

**G1.1.3** For the initial implementation of a hydrogen powertrain, each team is allowed to convert an existing CV or EV Formula Student vehicle to run on hydrogen. This rule can only be used once per team. Eligibility will be determined on a case by case basis. Contact the following e-mail: hydrogen@fs-world.org as early as possible.

**G1.1.4** A hydrogen vehicle may be used for two years, counting from the first day onsite of its first hydrogen competition. The newest version of the hydrogen rules must be used for any part that falls under the scope of the hydrogen rules.

**G1.1.5** **TBD:** From 2027, chassis according to the rule G1.1.3 must not be older than 5 years.

## G2: Scope

**G2.1.1** For teams building a hydrogen-powered vehicle, the Hydrogen Rules and the FS-Rules apply, whereby the Hydrogen Rules take precedence in the case of a conflict.

**G2.1.2** The Hydrogen Rules are aimed at teams in only one of the following classes:

- Hydrogen fuel cell technology within the existing EV class - short: [FCEV]
- Hydrogen combustion within the existing CV / CV hybrid class - short: [H2CV] / [H2HY]

**G2.1.3** **TBD:** Vehicles powered by hydrogen may be scored in existing or separate classes at the event organizers discretion.

## G3: Hydrogen Concept Challenge 2026

**G3.1.1** The Hydrogen Concept Challenges, which have been taking place since 2023, are used to introduce the teams to the topic of hydrogen.

**G3.1.2** The Hydrogen Concept Challenge is a static event in which a hydrogen-powered powertrain is to be presented to the judges. The judging will be separate for each team.

**G3.1.3** The judging lasts 30 minutes, with the team presenting their concept for the hydrogen-based powertrain in the first 15 minutes, followed by a 15-minute question and answer session similar to the Design Event. A video may also be used for the presentation, whereby the teams themselves are responsible for the equipment required to play the video.

**G3.1.4** Prior to the events, a concept paper in text form with images and/or diagrams must be submitted as a PDF (export Word file as PDF) (up to 10 pages) by Friday 2026-06-19 13:00 CEST at the latest. It is a separate document and not part of the Engineering Design Report (EDR).

**G3.1.5** Submission for all events takes place via the following e-mail: hydrogen@fs-world.org

**G3.1.6** Teams that have already built hydrogen-powered vehicles are not allowed to participate in the Hydrogen Concept Challenge.

## G4: Hydrogen System Form

**G4.1.1** All teams must submit a Hydrogen System Form (H2SF) using the H2SF template provided on the competition websites.

**G4.1.2** Deadline for the submission of the H2SF is 2026-02-15 13:00 CEST.

**G4.1.3** Submission for all events takes place via the following e-mail: hydrogen@fs-world.org

**G4.1.4** If no H2SF is submitted, the team can be deregistered and/or penalty points can be awarded.

**G4.1.5** If the officials request a correction of the H2SF, the corrected version has to be submitted within 168 hours (7days) following the request.

## G5: Vehicle Status Video

**G5.1.1** The team must submit the Vehicle Status Video (VSV) that meets all points from the rule A5.6 of the Formula Student Rules.

**G5.1.2** In the VSV it must be visible that the car is running on hydrogen and FCEV must verify the function of the fuel cell.

**G5.1.3** Submission for all events takes place via the following e-mail: hydrogen@fs-world.org

**G5.1.4** Deadline for the submission of the VSV is 2026-06-23 13:00 CEST.

**G5.1.5** If a rules conformal VSV submission on time is not possible, the team has to write an explanation of the current status to hydrogen@fs-world.org before the official deadline and ask for additional time. In parallel a submission of a short video is necessary, where the current status of the vehicle and the hydrogen components are shown.

## G6: Structural Equivalency Spreadsheet

**G6.1.1** The team must use the newest available Structural Equivalency Spreadsheet (SES).

**G6.1.2** Teams with a chassis according to the rule G1.1.3 or G1.1.4 are not allowed to use old SES-templates.

**G6.1.3** If a chassis according to the rule G1.1.3 or G1.1.4 is used the team has to explain in the SES the differences between the rules which have been used to build the vehicle and the current version of the Formula Student Rules. The team has to explain why their current design is a safe design or what must be updated in their vehicle.

# F: Fuel and Fuel System

## F1: Fuel

**F1.1.1** The permitted forms of power in addition to those covered by the Formula Student Rules (Gasoline, E85 and Electric) are specified as Hydrogen Combustion Vehicle [H2CV], Hydrogen Combustion Hybrid Vehicle [H2HY] and Hydrogen Fuel-Cell Electric Vehicle [FCEV].

**F1.1.2** Only hydrogen in the form of gaseous form compressed gas will be provided at the event with a maximum Nominal Working Pressure (NWP) of 350 bar. For EV-H2 it will be hydrogen according to ISO 14687: 2025 - at least grade D. Cryogen, liquid or cryo compressed hydrogen is not allowed.

**F1.1.3** Fuel supply of gaseous hydrogen at the event will be arranged in cooperation with participating teams.

## F2: Fuel System

**F2.1.1** All parts containing hydrogen, regardless of pressure, are considered critical components according to T9 in the Formula Student Rules.

**F2.1.2** All parts containing hydrogen including the hydrogen tank must be located behind a firewall as defined in T4.8 in the Formula Student Rules.

**F2.1.3** The hydrogen tank or other components containing hydrogen may be mounted in the side pod if it is built as a structural side pod. The structure of the structural side pod must comply with T3.2 of the Formula Student Rules and must protect against front, side and rear impacts. The original side impact structure (between driver and hydrogen tank) of the vehicle must comply with T3.2.5 of the Formula Student Rule and must be triangulated, if a structural sidepod is used.

**F2.1.4** If a structural side pod is used, a firewall must shield the driver both in a seated position and while exiting the vehicle. This side pod must be sufficiently ventilated. The formation of hydrogen pockets must be prevented. See chapter S5.

**F2.1.5** The hydrogen tank and other parts containing hydrogen must be shielded from any heat sources that can reach a temperature of more than 85 °C (e.g. brake discs or exhaust system) or the temperature rating of the hydrogen component - whichever is lower.

**F2.1.6** Accumulation of the hydrogen in insulation or shielding materials must be prevented (e.g. foam or other porous materials are prohibited).

**F2.1.7** The hydrogen tank, on tank device (OTD) and other parts containing hydrogen must be shielded from debris and other materials thrown up from the track and by the wheels. Shielding with a minimum thickness of 1 mm must cover any straight line between the wheels or the track and the aforementioned components. Shielding located less than 100 mm from the top of the firewall as defined in F2.1.4 must be perforated with a maximum hole diameter of 3 mm and a minimum hole spacing of 5 mm, measured center to center.

**F2.1.8** The lowest point of any part of the hydrogen system may only be lower than the line between the lowest point of the main hoop and the lowest chassis member behind the hydrogen system if it is protected from hitting the ground by a structure mounted directly to the chassis.

**F2.1.9** No excess volume in the hydrogen supply lines with the intent of buffering may be installed.

**F2.1.10** Wherever structural parts are attached to an existing frame structure, a minimum of four attachments compliant to T3.15 of the Formula Student Rules have to be used. Alternative joining methods may be used. Equivalency must be shown. Bonded joints are allowed according to T3.2.8 of the Formula Student Rules. Titan bolts are not allowed.

## F3: Hydrogen Tank

**F3.1.1** The hydrogen tank must be designed and manufactured for at least 350 bar nominal operating pressure of hydrogen. It must be certified by an accredited body (typically in the country of origin) and marked or stamped accordingly. e.g. according to ECE R134, HGV-2 or the old standard EC 79 or comparable. If a hydrogen tank with a comparable standard is to be used, the team must provide the relevant standard and work out the differences to the standards specified above. Both must be made available to the officials as early as possible by email (hydrogen@fs-world.org) so that a decision can be made on a case-by-case basis.

**F3.1.2** Hydrogen tanks with visible defects, e.g. abrasion, cuts or chemical damage may not be used. In case any kind of damage is detected, the tank must be flushed with inert gas and emptied to low pressure. After that the team must then contact the manufacturer and submit a form from the manufacturer to the event organizer, where the harmlessness of the damage is confirmed. A questionable tank will be confiscated until the end of the event or until there is a written clarification with the manufacturer. The hydrogen tank should be visually checked for damage before and after each use.

**F3.1.3** The hydrogen tank must be securely mounted to the primary structure and must be assembled according to the manufacturer's specifications. The hydrogen tank has to be protected from mechanical stresses introduced by e.g. chassis deformation or engine vibration (e.g. flexible mounts). The hydrogen tank itself and its mounting to the chassis must adhere to T3.3.1 of the Formula Student Rules. Any components containing tank pressure must be mounted at a minimum distance of 50 mm from the inside of the surrounding outward facing parts of the primary structure except the floor.

**F3.1.4** The OTD must be mounted directly to the hydrogen tank - it must include an on tank valve (OTV) and a thermal activated pressure relief device (TPRD). All these must vent to a “safe venting location” (see S5.1.2). All OTD must be certified according to ISO 19881, UN GTR No.13 or UN regulation No. 134. Safety against overpressure during the fueling procedure is being reached through safety measures of the fueling system. The risk of overpressure in the vehicle due to excessive temperature is being managed through the mandatory TPRD. An analogue pressure gauge must be installed between the OTD and the pressure regulator.

**F3.1.5** A pressure regulator that limits the downstream pressure of the hydrogen to a maximum of 40 bar or the maximum operating pressure of the lowest rated component and must be mounted as close as possible to the OTD. Every pressure level in the system must be protected against overpressure by mechanical means (e.g. burst plate venting to a safe venting location see S 5.1.2). Excess pressure must also trigger the Shutdown Circuit using a N/C switch.

**F3.1.6** The hydrogen tank must be equipped with a connector that is designed to be repeatedly reconnected. This has to be installed after all tank mounted components (see F3.1.4 and F3.1.5).

**F3.1.7** The hydrogen tank must be protected against subcooling, i.e. if the temperature in the hydrogen tank falls below -40 °C due to gas extraction. If the temperature falls below this value, the OTD must close.

**F3.1.8** The hydrogen tank and all permanently attached components must be protected when the hydrogen tank is handled outside the car. The use of a flexible protective cover (e.g neoprene sleeve) for the hydrogen tank is mandatory. F2.1.6 does not apply to this cover.

**F3.1.9** Each hydrogen tank must be equipped with means to be lifted from the vehicle by two people with both hands each (e.g. handles or easily accessible structural tubes). These means may be removable without tools. Gripping surfaces have to be clearly marked in orange.

**F3.1.10** Access to the OTD must be possible without tools. It must **NOT** be possible to operate the OTV without tools. A label must be placed next to the access point indicating which tool is required and indicate the direction to close the OTV with an arrow.


**Figure 1:** Example: A 6 mm Allen key is needed to close the OTV clockwise

**F3.1.11** A connection point for bleeding the tank after the first pressure regulator and a 4 m hose rated to at least the pressure of the regulator has to be provided by the team. The vent tower side connection is specified by the respective event handbook.

## F4: Lines and Fittings

**F4.1.1** All lines, fittings, tanks, regulators, solenoid valves and other equipment exposed to pressurized hydrogen must be certified accordingly. Exceptions for fuel injectors can be granted on request by event organizers.

**F4.1.2** Compression fittings certified to ANSI CSA HGV 3.1, HGV 3.1, ISO 19887 or ISO 12619 are recommended. The certification generally relates to the entire fitting + line system. If fittings are used with third-party lines, the certification may expire. All combinations of fittings may only be used according to either manufacturer's documentation.

**F4.1.3** Lines carrying the unregulated tank pressure must be as short as possible in order to connect the hydrogen tank with the components of the rules F3.1.4, F3.1.5 and F3.1.6.

**F4.1.4** The fuelling valve must be H35 (normal flow or designed for a maximum mass flow of 60 g/s) and specified in accordance with ISO 17268 - Connecting devices for refuelling gaseous hydrogen for land vehicles.

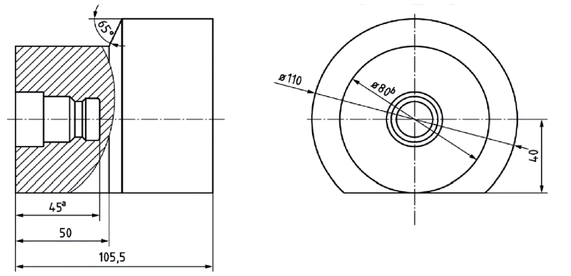
**F4.1.5** The fuelling valve must be positioned in a way that it is protected but easily accessible with a fueling nozzle according to ISO 17268.

**ISO/DIS 17268-1:2023(en)**

**Annex A**
(normative)

**Receptacle/nozzle interface envelope**

Dimensions in millimetres




a Minimum length of the receptacle that shall be clear of provisions for attachment of receptacle or protective cap.

b For minimum coupling clearance only. System designers shall ensure that the dust or protective cap operates freely in the provided space.

NOTE 1 Depending on the vehicle design, the overall depth of the fuelling cavity doesn't need to be as large as indicated here.

NOTE 2 The flat side of the clearance should be downward toward the ground.

**Figure 2:** Screenshot of ISO 17268 with receptacle/nozzle interface envelope

# C: Hydrogen Combustion Vehicles [H2CV] & [H2HY]

## C1: Engine

**C1.1.1** **TBD:** The vehicle may be driven by any four stroke internal combustion engine, irrespective of its mechanical layout (eg. reciprocating piston, Wankel, ...). The number of combustion chambers are not limited. The total displaced volume of the engine must not exceed 1600 cc. If an engine concept utilizing over 1000 cc is being considered, the concept must be submitted via email to hydrogen@fs-world.org by Friday 2026-12-19 13:00 CEST at the latest and approval must be obtained.

**C1.1.2** It is allowed to inject water or other non combustible substances into the intake and/or combustion chamber with the goal of reducing the tendency of abnormal combustion phenomena. This applies to H2CV/H2HY only.

**C1.1.3** Direct injection (DI) and port fuel injection (PFI/MPI) is allowed.

**C1.1.4** The injection pressure is generally limited to 40 bar. Exceptions may be requested with a full system documentation by Friday 2026-12-19 13:00 CEST at the latest to hydrogen@fs-world.org.

**C1.1.5** The pressure at direct injection must be below the limit specified by the manufacturer for the injection system used. The rail, the injector and any necessary connector must be properly dimensioned, designed, manufactured and assembled in order to withstand the expected loads, be positively locked and directly attached to the engine block or cylinder head using metal parts. Certification in accordance with ISO 19887, ISO 12619 or HGV 3.1 could also be useful for the injector.

**C1.1.6** The crankcase must be equipped with an open crankcase ventilation system and it must vent to a safe location as described in S5.2.1.

## C2: Boosting

**C2.1.1** Boosting is permitted.

**C2.1.2** Boosting systems may be driven by any means e.g. belts, gears, electrically or any combination of drive systems.

**C2.1.3** In case of an even partially electrically power boosting system, electrical energy may only be supplied from a system that complies with the current Hybrid Rules.

**C2.1.4** Belts, gears, chains etc. need a scatter shield as defined in T7.3 of the Formula Student Rules.

## C3: Hybrid

**C3.1.1** Building a combination of CV hybrid with hydrogen combustion is allowed, this is called H2HY.

## C4: Power Limitation

**C4.1.1** **TBD:** Currently there is no power limitation for H2CV/H2HY powertrains.

**C4.1.2** **TBD:** The hydrogen mass flow is unlimited.

**C4.1.3** The air mass flow is unlimited.

**C4.1.4** **TBD:** The maximum overall fuel tank capacity for H2CV/H2HY is 2 kg.

# E: Hydrogen Fuel Cell Electric Vehicles [FCEV]

## E1: Hydrogen System definition

**E1.1.1** Hydrogen System (HS) – every part that is related to the fuel cell. This includes the hydrogen tank, the Fuel Cell (FC), the fuel cell cooling system and the fuel cell HV electrical components.

## E2: General Requirements

**E2.1.1** The maximum allowed voltage that may occur between any two electric connections is 600 V DC and for internal low power control signals 630 V DC. See EV4.1.1 in the Formula Student Rules.

**E2.1.2** All components in the HS must be rated for the maximum voltage in both HS and Tractive System (TS).

**E2.1.3** All HS related PCB's shall be compliant with the rules applied to TS PCB's. See EV4.3.6 in the Formula Student Rules.

**E2.1.4** All components must be rated for the maximum possible temperature that may occur during usage.

**E2.1.5** Same rules for grounding and for overcurrent protection as for TS, see EV3.1 in the Formula Student Rules.

## E3: Positioning of Hydrogen System Parts

**E3.1.1** Any part of the HS that is less than 350 mm above the ground must be protected from impacts, see T3.15 in the Formula Student Rules. Impact protection must follow T3.16 when having bolted attachments. HS wiring in front of the front hoop may alternatively be shielded by the front bulkhead support structure according to T3.15 in the Formula Student Rules.

## E4: Insulation and cabling of the hydrogen system

**E4.1.1** Same rules as for TS, see EV4.5 in the Formula Student Rules.

## E5: Power Limitation

**E5.1.1** The hydrogen mass flow and the air mass flow are unlimited.

**E5.1.2** **TBD:** The maximum overall fuel tank capacity is 2 kg.

**E5.1.3** The capacity of the HV accumulator is not limited, supercapacitors are allowed.

**E5.1.4** Maximum power output of the e TSAC must not exceed 80 kW (see EV2.2 in the Formula Student Rules) and is recorded with a data logger.

**E5.1.5** Tractive energy is defined as the time integral over the Endurance run of the electrical power measured at the input of the inverter(s). This will be supervised by a second data logger placed at the TS motor-controller(s) input.

**E5.1.6** Both data loggers will be identical to the current EV infrastructure.

**E5.1.7** For the Endurance, a minimum of 40% of the tractive energy must come from the fuel cell.

## E6: Hydrogen System Measuring Point

These measuring points must be connected to the HS circuit (between the FC and the DC/DC).

**E6.1.1** Two Hydrogen System Measuring Points (HSMPs) must be installed directly next to the master switches, see T11.2 in the Formula Student Rules. Alternatively, the HSMP's can be located on the FCSC (or on the fuel cell HV box respectively) if available from outside the car. The HSMPs must be directly connected, see T1.3.1 in the Formula Student Rules, to the intermediate circuit capacitors even if the fuel cell is disconnected.

**E6.1.2** 4 mm shrouded banana jacks rated for 600 V CAT III or better must be used for the HSMPs. The HSMPs must be marked “HS+” and “HS-” and mounted on an orange background.

**E6.1.3** The HSMPs must be protected by a non-conductive cover that can be opened without tools. The cover must always be mechanically linked to the vehicle.

**E6.1.4** Each HSMP must be secured with a current limiting resistor according to the following table. Fusing the TSMPs is prohibited. The resistor’s power rating must be chosen such that they can continuously carry the current if both HSMPs are short-circuited.

| Maximum HS Voltage | Resistor Value |
|---|---|
| Umax < 200 V DC | 5 kΩ |
| 200 V DC < Umax ≤ 400 V DC | 10 kΩ |
| 400 V DC < Umax ≤ 600 V DC | 15 kΩ |

**E6.1.5** All electric connections needed to connect the HSMP to the intermediate circuit capacitors, including bolts, nuts, and other fasteners, must be secured from unintentional loosening by the use of positive locking mechanisms. Bolted connections must follow T10.2, soldered connections EV4.5.15 in the Formula Student Rules.

**E6.1.6** Next to the HSMPs an Low Voltage System (LVS) ground measuring point must be installed. A 4 mm black shrouded banana jack must be connected to LVS ground and must be marked “GND”. It could be the same as the one used for TS, see EV4.7.8 in the Formula Student Rules.

## E7: Discharge Circuit

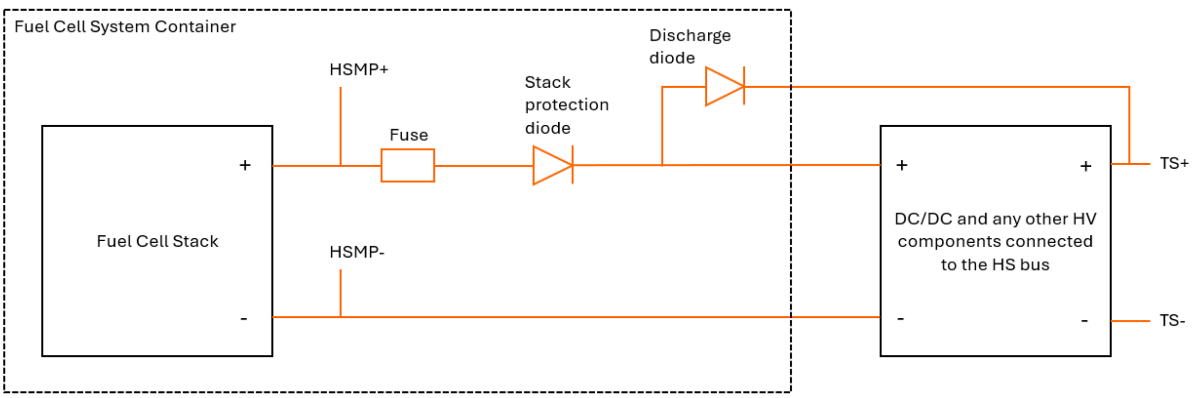



**Figure 3:** Schematic representation of discharge circuit

**E7.1.1** The discharge circuit shall be designed to discharge (depolarize) the fuel cell stack. Stack voltage must drop below 60 VDC in less than 30 sec.

**E7.1.2** It shall not be possible to activate (polarize) the fuel cell if the discharge circuit is not ready (temperature conditions, …).

**E7.1.3** Fuel Cell Control Unit (FCCU) shall open the shutdown circuit if nominal working conditions are not satisfied.

**E7.1.4** The stack current fuse must be rated for the maximum of HS and TS voltage and for the maximum stack current.

**E7.1.5** The stack protection diode must be rated for the maximum of HS and TS voltage and for the maximum stack current.

**E7.1.6** The discharge diode must be rated for the maximum of HS and TS voltage.

**E7.1.7** A current limiting resistor can be added to limit the current through the discharge diode. In case of emergency shutdown, stack voltage must decrease below 60 V within 5 s.

**E7.1.8** It shall be possible to check both diodes during scrutineering.

## E:8 Activating the Hydrogen System

**E8.1.1** It shall not be possible to activate the HS if TS is not active.

**E8.1.2** The HS may only be activated if all of the following conditions are met:

- Fuel Cell Stack is polarized
- Hydrogen supply is enabled and active
- Air supply is enabled and active

**E8.1.3** Closing the Shutdown Circuit (SDC) by any part defined in the Formula Student Rule EV6.1.2 must not (re-) activate the TS.

## E9: Fuel Cell System – General Requirements

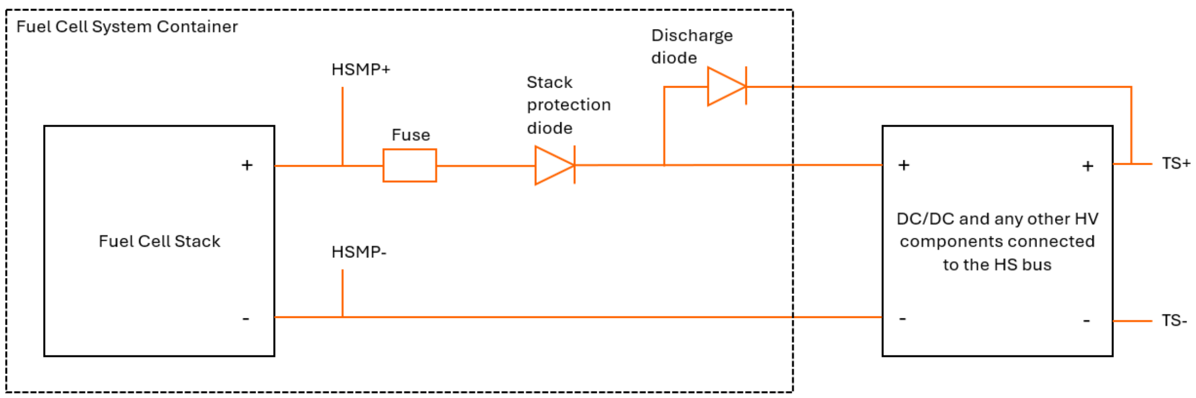



**Figure 4:** Schematic representation of fuel cell system

**E9.1.1** The fuel cell stack must be enclosed in the Fuel Cell System Container (FCSC).

**E9.1.2** The FCSC shall be actively ventilated to avoid any accumulation of hydrogen. Minimum air mass flow shall be guaranteed. Ventilation mass flow shall be measured.

**E9.1.3** There must be ventilation holes in the FCSC. These holes must follow the EV rules to avoid any access to the HV components and also S5.1.2.

**E9.1.4** It must be possible to open the FCSC for technical inspection.

**E9.1.5** FSCS must be labeled with reasonably sized stickers according to "ISO 7010-W012" (triangle with a black lightning bolt on a yellow background). Fuel cell container stickers must contain text ‘Fuel Cell Inside’. If the voltage is more than 60 V DC, the sticker must also contain the text “High Voltage”.

## E10: Fuel Cell System Container – Electrical Configuration

**E10.1.1** Every FCSC must contain at least one fuse on the stack current path (see Figure 4).

**E10.1.2** LVS must not be included in the FCSC except where inherently required. Exceptions include the FCCU (if located within the FCSC) and cooling fans.

**E10.1.3** Every wire used in a FCSC, regardless of whether it is part of the LVS or HS, must follow EV4.5.2, EV4.5.3, and EV4.5.5 in the Formula Student Rules.

**E10.1.4** Each FCSC must have one prominent voltage indicator, voltmeter, or red LED visible even in bright sunlight that will continuously illuminate whenever a voltage greater than 60 V DC is present at the stack poles (before the fuse and the stack protection diode). This indicator must be clearly marked with "Stack Voltage Indicator”.

**E10.1.5** The indicator must be hard-wired electronics without software control, directly and only supplied by the HS, and always working, even if disconnected from the LVS.

## E11: Fuel Cell System Container – Mechanical Configuration

**E11.1.1** The FCSC must be located behind a firewall as defined in T4.8 of the Formula Student Rules or must be made of these materials and must fulfill all other requirements of a firewall.

**E11.1.2** The fuel cell itself and its mounting to the FCSC must adhere to T3.3.1 of the Formula Student Rules. The fuel cell must be mounted according to manufacturer's specifications.

**E11.1.3** The FCSC itself and its mounting to the chassis must adhere to T3.3.1 of the Formula Student Rules. The FCSC must be protected from impacts, see T3.15. Impact protection must follow T3.15 when having bolted attachments. The FCSC must not be part of this structure.

**E11.1.4** All FCSC materials as well all structural parts used must be fire retardant, see T1.2.1 of the Formula Student Rules. All calculations must be conducted for an ambient temperature of 60° except for metallic materials and continuous fiber-reinforced laminates.

**E11.1.5** The design of the FCSC and its contents, calculations and/or tests must be documented in the H2SF. This includes materials used, drawings, images, fastener locations, segment weight, cell, and segment position.

**E11.1.6** The FCSC must be constructed of steel or aluminium. With the following requirements:

- The bottom of the FCSC must be at least 1.25 mm thick if made from steel or 3.2 mm if made from aluminium
- The internal and external vertical walls, covers, and lids must be at least 0.9 mm thick if made from steel or 2.3 mm if made from aluminium.

**E11.1.7** Alternative materials are allowed with proof of equivalency per T3.4 or for composite materials per EV5.5.6 of the Formula Student Rules. When alternative materials are used, test samples must be presented at technical inspection.

**E11.1.8** Composite FCSC must satisfy the following requirements:

- Data obtained from the laminate perimeter shear strength test and three-point bending test, see T3.6, should be used to prove adequate strength is provided.
- Each attachment point requires steel backing plates with a minimum thickness of 2 mm. Alternate materials may be used for backing plates if equivalency is approved.
- The calculations and physical test results must be included in the H2SF.

**E11.1.9** All fasteners used within or to mount the FCSC must comply with T10. Fasteners within the FCSC used for non-structural parts, e.g. PCBs, do not have to follow T10.1.2. Fasteners made of electrically non-conductive material within the FSCS used for non-structural parts do not have to follow T10 of the Formula Student Rules.

**E11.1.10** The mounting of the FCSC requires a minimum of 4 attachment points. Any brackets used to mount the FCSC must be made of steel 1.6 mm thick or aluminium 4 mm thick and must have gussets to carry bending loads.

**E11.1.11** The FCSC needs venting holes as described in S5.1.2.

## E12: OEM Fuel Cell System Container

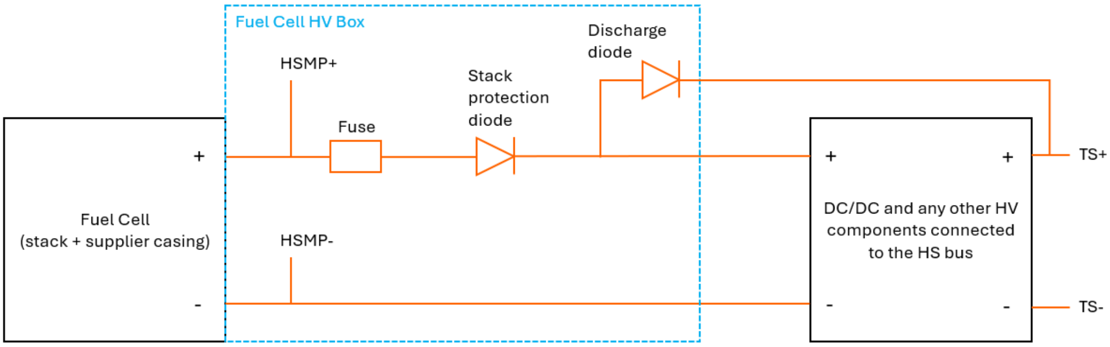



**Figure 5:** Alternative schematic representation of fuel cell system

**E12.1.1** If the fuel cell is supplied with a casing (and in this case only), this casing (without any modification) can be considered to be the FCSC. This casing must fulfill all FCSC mechanical rules from E11.

**E12.1.2** A FC HV Box is required to contain the fuse, the stack protection diode and the discharge diode. The stack voltage indicator must be on this box.

**E12.1.3** The FC HV Box must be secured against the FCSC using positive locking. The FC HV Box must satisfy the same rules as any other powerbox.

**E12.1.4** No HV wires and no HV connectors shall be apparent between the FCSC and the FC HV Box.

*Note : Interface between the FCSC and the FC HV Box must be sealed during scrutineering.*

## E13: Cooling

**E13.1.1** Dedicated fuel cell coolant may be used (must refer to stack supplier requirements).

**E13.1.2** Fuel cell coolant electrical conductivity must be measured at any time by the fuel cell control unit. The officials can ask for the value at any time. Teams have to show the value with a laptop.

## E14: Fuel Cell System Management

**E14.1.1** The FCCU must continuously measure the following parameter of the hydrogen tank:

- Hydrogen detection sensor at the top of the FCSC

**E14.1.2** The FCCU must continuously measure the following HS electrical parameters (this is often done by a CVMD supplied with the stack from the stack supplier):

- All cell voltages
- Cells with minimum and maximum voltages position shall be identified
- Stack current shall be measured (if information not given by the DCDC)
- Stack voltage shall be measured (if information not given by the DCDC)

**E14.1.3** The FCCU must continuously measure the following anode parameters:

- Stack inlet pressure
- Stack outlet pressure (optional)

**E14.1.4** The FCCU must continuously measure the following cathode parameters:

- Stack inlet pressure
- Stack outlet pressure (optional)

**E14.1.5** The FCCU must continuously measure the following cooling and ventilation parameters:

- Coolant electrical conductivity
- Temperature at stack inlet
- Temperature at stack outlet
- Air mass flow dedicated to ventilation of containers

**E14.1.6** The FCCU must open the HS related SDC, if any measurement reaches critical values according to the stack manufacturer's datasheet.

**E14.1.7** FCCU signals are System Critical Signals, see T11.9 in the Formula Student . The loss of any safety or control related signal must result in an HS SDC opening.

**E14.1.8** It must be possible to individually disconnect the current sensor during technical inspection if any wire is used.

**E14.1.9** The FCCU must be able to read and display all measured values according to EV5.8.3 of the Formula Student Rules in a single overview e.g. by connecting a laptop to the FCCU at any place and any time e.g. inside the dynamic area.

**E14.1.10** If CAN communication is used to communicate with the FCCU or the CVM, a dbc file must be available.

## E15: Insulation Monitoring Device

**E15.1.1** The vehicle shall be equipped with a tunable isometer. When performing the EV testing, the isometer shall be set to a 500 Ohm per Volt (to be calculated with the highest embedded voltage) measured between the powertrain and driver compartment.

**E15.1.2** The IMD response may be tunable.

- If a non-tunable IMD is used, the IMD response value must be set to ≥500 Ω/V, related to the maximum voltage in the vehicle.
- If a tunable IMD is used, its response must be set to ≥500 Ω/V, related to the maximum voltage in the vehicle until the electrical inspection is finished. (Bender ISO 175C for example.) Once the team has been allowed to start their fuel cell, the response value shall be set to a lower value (150 kΩ whatever the maximum voltage in the vehicle).

**E15.1.3** The response value must not be changed after electrical inspection.

**E15.1.4** If a tunable IMD is used, the team shall be able to show the response threshold to any judge at any time (connected to a laptop is possible).

# S: Safety

## S1: Hydrogen Safety Officer

**S1.1.1** Every participating team has to appoint two to four Hydrogen Safety Officers (HSO) for the competition. ESO and HSO may be the same person.

**S1.1.2** The HSOs are responsible for all work on the hydrogen system carried out on the vehicle during the competition. The HSOs are responsible for all work on the vehicle that is carried out with the hydrogen tank installed.

**S1.1.3** The HSOs are the only persons in the team who may declare the vehicle hydrogen safe and discharged, in order for work to be performed on any system of the vehicle by the team.

**S1.1.4** A HSO must always be with the vehicle when the hydrogen tank is installed and must carry out the installation and removal themselves and then declare the vehicle safe for further work. At least one HSO per team must be included in the four members per team, if the vehicle is on track or in the dynamic area.

**S1.1.5** At least one HSO must be reachable by phone at all times during the competition.

**S1.1.6** The HSOs must be valid team members and must have a student status, see rule A4.2.6 of the Formula Student Rules. For 2026 the HSOs may also be somebody employed at the university.

**S1.1.7** The HSOs must attend practical and theoretical training for working on hydrogen like DGUV FBHM-99 level E2 or comparable which must be held by an external expert. A certificate of the training must be shown at scrutineering. The certificate is valid for 2 years, after which a refresher course is required.

**S1.1.8** The vehicle number, the university name and the HSOs phone numbers must be displayed and written in Roman Sans-Serif characters of at least 20 mm height on the hydrogen tank or its cover. The characters must be clearly visible and placed on a high-contrast background.

## S2: Hydrogen System Master Switch (HSMS)

**S2.1.1** An Hydrogen System Master Switch (HSMS) according to T11.2 must be part of the SDC of FCEV , see EV6.1.2 of the Formula Student Rules.

**S2.1.2** The HSMS must be fitted with a “lockout/tagout” capability to prevent accidental activation of the Hydrogen System.

**S2.1.3** The HSMS must be mounted in the middle of a completely orange circular area of ≥50 mm diameter placed on a high contrast background.

**S2.1.4** The HSMS must be marked with “HS” and a symbol according to “ISO 7010-W012” (triangle with a black lightning bolt on a yellow background).

## S3: Shutdown Circuit for H2CV and H2HY

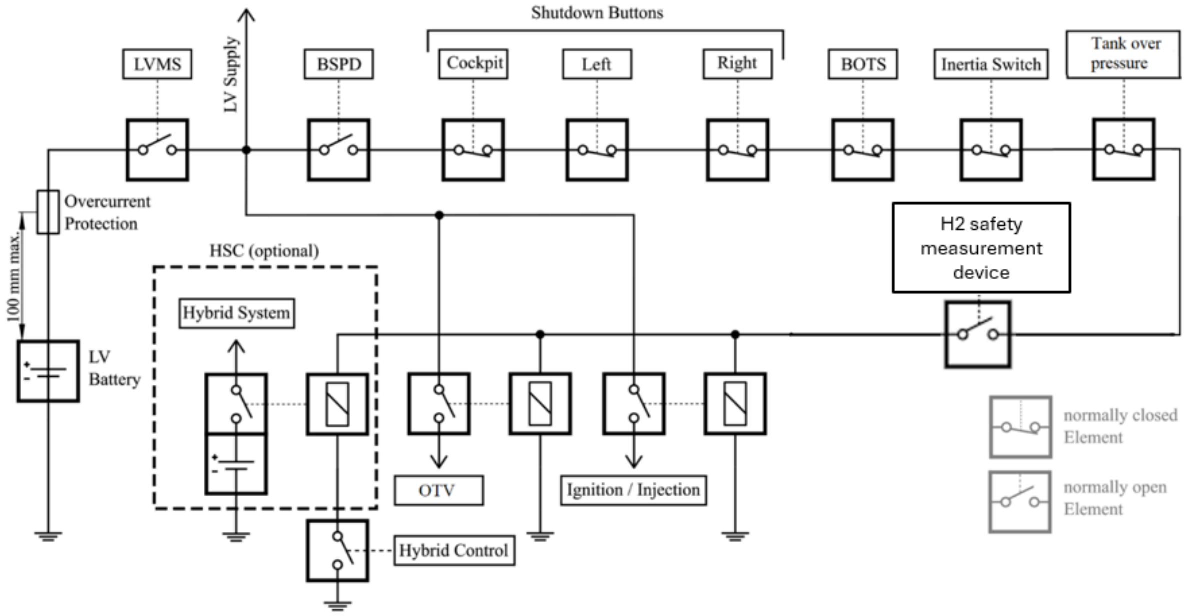



**Figure 6:** Schematic representation of a Shutdown Circuit for H2CV and HYCV

**S3.1.1** The Shutdown Circuit (SDC) directly controls all electric power to the ignition, fuel injectors and OTV. It must act through a minimum of two mechanical relays. One relay for the OTV and at least one relay for injection and ignition.

**S3.1.2** The SDC is defined as a series connection of at least the following:

- LVMS
- BSPD, see T11.6 of the Formula Student Rules
- three shutdown buttons, see T11.4 of the Formula Student Rules
- BOTS, see T6.2 of the Formula Student Rules
- inertia switch, see T11.5 of the Formula Student Rules
- H2 Safety Measurement Device, see S10

**S3.1.3** All circuits that are part of the SDC must be designed in a way that in the de-energized/ disconnected state they open the SDC.

**S3.1.4** When the Shutdown Circuit is triggered, no more gas may flow from the hydrogen tank into the low pressure part of the fuel system immediately. This must be ensured with the OTV being normally closed.

**S3.1.5** When the Shutdown Circuit is triggered, the ignition of the engine must be switched off.

## S4: Shutdown Circuit for FCEV

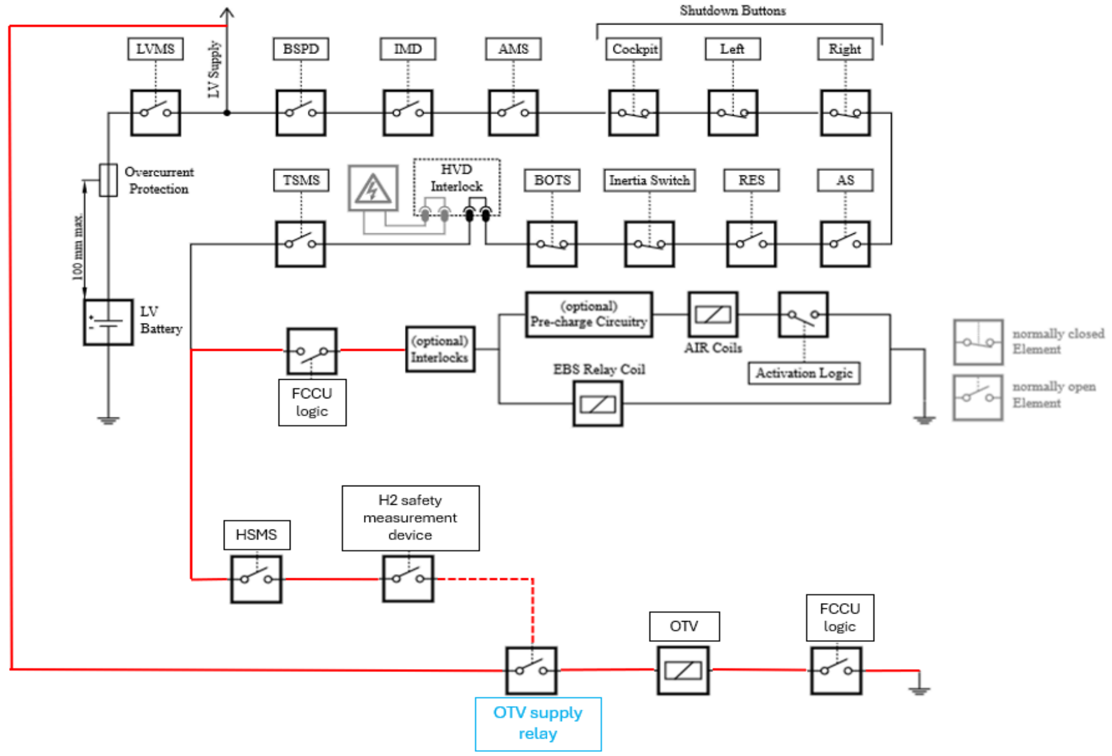



**Figure 7:** Alternative schematic representation of a Shutdown Circuit for FCEV.

Note: The part of the SDC in red is related to the HS and is denoted as the HS related SDC.

**S4.1.1** There must be a Shutdown Circuit which must include the same equipment and parts as the Shutdown Circuit in EV6 of the Formula Student Rules. Additionally, it must contain the following hydrogen related components:

- HSMS, see T11.3 of the Formula Student
- H2 Safety Measurement Device, see S10
- FCCU activated relays
- OTV

**S4.1.2** All circuits that are part of the HS related SDC must be designed in a way that in the de-energized/disconnected state they open the HS related SDC.

**S4.1.3** When the Shutdown Circuit is triggered, no more gas may flow from the hydrogen tank into the low pressure part of the fuel system. This must be ensured with the OTV being normally closed.

**S4.1.4** When the HS related Shutdown Circuit is triggered the hydrogen system must be switched off, all valves shall return to their default position and the fuel cell HV-bus(es) shall be passively or actively discharged.

**S4.1.5** When any other part of the shutdown circuit (that is not HS related) is triggered, the hydrogen system and the HV-accumulator must be switched off.

**S4.1.6** It is allowed to supply the OTV valves through an external normally open relay (with the command coming from the HS related SDC), no software shall be involved.

**S4.1.7** An OTV supply relay can be added. This must be a normally open mechanical relay. This can be a market available timed relay (saying closed for a maximum of 2 s after the command is removed).

## S5: Ventilation

**S5.1.1** In case of leakage all hydrogen components must be safely vented and hydrogen may not accumulate.

**S5.1.2** All compartments containing hydrogen components that do not have an opening of at least 1900 mm² (e.g. 50 mm circle) in all high points have to be connected to a safe venting location. The connection from all these high points must be a sealed path of at least 1900 mm² internal cross section. Venting locations have to be:

- unobstructed from above
- be outside the cockpit
- behind the main hoop
- point away from the driver
- be clearly marked with a red circle and "H2 vent"
- must not terminate any lower than 100 mm from the highest point of the vehicle

Several connections may terminate in a common venting location.

**S5.1.3** Any active ventilation system must push the air and not suck it and must be powered by LV and no software shall be involved.

## S6: Grounding

**S6.1.1** All hydrogen components must be grounded to the low voltage system ground according to EV3.1 of the Formula Student Rules.

**S6.1.2** A metal tab of at least 30x30x2 mm has to be connected to the grounding path of the tank system for connecting a grounding clamp during refueling or venting. Access must be not obstructed in a ready to race state. This grounding connection point has to be clearly marked with the earthing symbol according to IEC 60417.

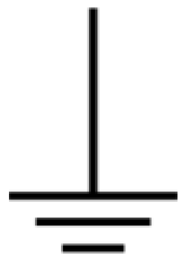


**Figure 8:** Earthing symbol according to IEC 60417

## S7: Arrival and departure to the event

**S7.1.1** From departure, during transport and until arrival the hydrogen tank must be at a low positive pressure (lowest pressure permitted by the manufacturer). Keep positive pressure against humidity intrusion or corrosion. The hydrogen tank should not be transported in the passenger compartment of the car, lorry or other vehicle but can be mounted to the formula student vehicle during transport.

**S7.1.2** The teams must comply with the laws and regulations for securing loads, in particular for hydrogen tanks, of the respective country. The transport regulations of dangerous goods must also be checked and adhered to by the teams.

**S7.1.3** The teams must store the hydrogen tank at Safe Hydrogen Transfer Tank Area (SHYTTA) as soon as they reach the campsite or the event site.

## S8: Pits and tools

**S8.1.1** No hydrogen tanks or other devices containing hydrogen are allowed inside the pits. Vehicles have to be in the "H2 system discharged" state to enter any enclosed structure.

**S8.1.2** The hydrogen tank has to be removed and stored at the SHYTTA prior to the vehicle entering the pits.

**S8.1.3** Each team has to bring 2 hydrogen detectors to the event. Both have to actively suck in the gas, passive detectors are not sufficient. The correct operation of these detectors has to be demonstrated during Hydrogen Scrutineering with calibration gas of a known concentration (provided by the team).

**S8.1.4** Teams must provide a complete set of tools needed to remove the hydrogen tank during Hydrogen Scrutineering. This set has to remain at the SHYTTA at all times during the event. It will only be returned after the venting of the tank following endurance.

## S9: Storage of the hydrogen tank and refueling

**S9.1.1** Hydrogen tanks must always be stored according to the manufacturer's requirements.

**S9.1.2** The refueling of the hydrogen tanks is carried out by the event organizer outside the vehicle in the SHYTTA. At least one HSO from the team must be present.

**S9.1.3** The hydrogen tanks will only be fitted into the vehicle for:

- hydrogen-specific scrutineering
- refueling with hydrogen (optional)
- dynamic disciplines
- dynamic testing in the testing area
- static testing in the engine test area

**S9.1.4** After any of the cases from S9.1.3 the tank has to be removed from the vehicle at a designated area and be returned to the SHYTTA as soon as possible. In any case the vehicle has a hydrogen tank on board, the vehicle will be accompanied by an official.

**S9.1.5** Each team must provide a handcart according to EV8.1.2 to EV8.1.5 of the Formula Student Rules. The hand cart must comply with the following Formula Student Rules for transporting the hydrogen tank: EV8.1.6, EV8.1.8 to EV8.1.10. The cart may not contain any electronics to safely move the hydrogen tank on the event site. The vehicle number, the university name, and the HSOs phone number(s) must be displayed and written in Roman Sans-Serif characters of at least 20 mm high on the cart. The characters must be clearly visible and placed on a high-contrast background.

**S9.1.6** If a team uses more than one hydrogen tank, they must all be safely stored on one hand cart or there must be as many hand carts as there are hydrogen tanks.

## S10: H2 Safety Measurement Device (H2SMD)

**S10.1.1** The H2 Safety Measurement Device (H2SMD) must be a standalone non-programmable circuit that opens the H2 related SDC under the following conditions:

- Tank temperature is too high (+80 °C or lower depending on tank specifications) or too low (-40 °C or higher depending on tank specifications)
- Tank pressure is too high or too low (depending on tank specifications)
- Excess pressure in low pressure system (40 bars or lower depending of the low pressure system expected pressure)

Standalone is defined as there is no additional functionality implemented on all required PCBs.

**S10.1.2** If one or more sensor is disconnected from the H2 Safety Measurement Device, SDC must be and remain open.

**S10.1.3** If the SDC is opened by the H2 Safety Measurement Device, it has to be latched open by a non-programmable logic that can only be manually reset by a person at the vehicle who is not the driver (same as for the AMS and the IMD, see EV6.1.6 of the Formula Student Rules.).

**S10.1.4** The action of opening the SDC by the H2 Safety Measurement Device must occur if the implausibility is persistent for more than 500 ms.

**S10.1.5** The H2 Safety Measurement Device must be directly supplied, see T1.3.1, from the LVMS, see T11.3.

**S10.1.6** The interfaces must be reduced to the minimum necessary signals, i.e. power supply, required sensors and the SDC. Supply and sensor signals must not be routed through any other devices before entering the H2 Safety Measurement Device.

**S10.1.7** It must be possible to separately disconnect each sensor signal wire from the H2 safety measurement device for technical inspection.

**S10.1.8** All necessary signals for the H2 Safety Measurement Device are System Critical Signal (SCS), see T11.9 of the Formula Student Rules.

**S10.1.9** A red indicator light in the cockpit that is easily visible from inside and outside the cockpit even in bright sunlight and clearly marked with the lettering “H2SMD” must light up if and only if the H2SMD opens the SDC. It must stay illuminated until the error state has been manually reset, see EV6.1.6. Signals controlling this indicator are SCS, see T11.9 in the Formula Student Rules.

**S10.1.10** It shall be possible to connect the tank pressure and temperature sensors to a dedicated device during scrutineering and refueling (instead of connecting them to the H2 safety measurement device).

# H: Hydrogen Scrutineering

## H1: Scrutineering Procedure for hydrogen-powered vehicles

**H1.1.1** The technical inspection for a hydrogen combustion vehicle is divided into the following parts:

- Pre-Scrutineering
- Mechanical-Scrutineering
- Tilt Test
- Hydrogen Scrutineering
- Noise Test
- Brake Test

**H1.1.2** The technical inspection for a hydrogen fuel cell vehicle is divided into the following parts:

- Pre-Scrutineering
- Electrical- and Accumulator-Scrutineering
- Mechanical-Scrutineering
- Tilt Test
- Hydrogen Scrutineering
- Rain Test
- Brake Test

## H2: Differences to Scrutineering as from FS Rules

**H2.1.1** Mechanical-, Electrical- and Accumulator Scrutineering is done without a mounted hydrogen tank.

**H2.1.2** For the Tilt Test a dummy of the hydrogen tank must be supplied by the teams and mounted to the vehicle. The dummy must have the same mass and center of gravity as the real hydrogen tank system (+-1%). The dummy must have handles so that at least two people can handle it safely.

**H2.1.3** Tilt Test may be performed on either or both sides of the vehicle.

**H2.1.4** There are two Rain Tests for H2EVs:

- The 1st rain test is done as EV only (hydrogen system OFF). If the team is using a tunable isometer, the threshold value must be set to the same limit as EV cars (500 Ω per volt).
- The 2nd rain test is done with the hydrogen system ON. If the team is using a tunable isometer, the threshold may be lowered (minimum limit is 150 kΩ).

**H2.1.5** In case the team needs to empty their accumulator before this 2nd rain test, they may be allowed to drive in the practice area as EV if all EV scrutineering, Brake and Tilt Tests are passed.

**H2.1.6** The Brake Test may be done with the fuel cell switched off.

## H3: Hydrogen Scrutineering

**H3.1.1** The following items must be presented at Hydrogen Scrutineering:

- Training certificates from all HSOs
- Copies of the H2SF and SES
- Datasheets and documentation for all hydrogen components
- Manufacturer's specifications for installation (installation position, torques, commissioning procedures)
- Copies of communications with officials and manufactures (if applicable)
- Tools needed for the (dis)assembly of parts for Hydrogen Scrutineering
- Tools to install and remove the hydrogen tank to the vehicle (to remain at the SHYTTA)
- [EV-H2] EV tools
- IT device for checking every mandatory sensors
- 2 hydrogen leak detectors with a pump
- Leak detection spray according to DIN DVGW standard
- Calibration gas, with less than 2% H2
- New seals for all H2 connectors
- Signs “H2 system discharged” and “H2 system HOT”
- Hose for connecting the tank to a hydrogen vent

## H4: Hydrogen system leak test

**H4.1.1** Procedure of the hydrogen leak test:

- Flush the system with hydrogen from the tank connection until only hydrogen is detected at the furthest end of the hydrogen system
- Check all hydrogen components and connections with a hydrogen detector
- Apply seal stickers to all tested hydrogen components and connections

**H4.1.2** The TS-System must be off during the hydrogen system leak test.

**H4.1.3** After passing the hydrogen system leak test a sign “H2 system HOT" has to be installed on the main hoop. The sign must be readable from the the front and the back of the vehicle and the TSAL must be still visible.

**H4.1.4** The hydrogen system leak test is part of the Hydrogen Scutineering and will be executed by Officials.

**H4.1.5** The hydrogen system status signs must be visible from the front and the back of the vehicle. TSAL visibility can not not be impeded. See also rule S9.1.3 and S9.1.4.

## H5: Installing the hydrogen tank and making vehicle ready to drive

**H5.1.1** Procedure of mounting the hydrogen tank and making the “H2 system HOT":

- Team brings the vehicle to the SHYTTA
- Break the tank connection seal
- HSO and max. one helper install the tank under an officials supervision
- Close valve after pressure regulator, open tank valve
- Official checks for leaks in the hydrogen system with hydrogen detector
- The system is slowly flushed with hydrogen from the tank to the farthest most end of the hydrogen system. Test with hydrogen detector
- The vehicle is now confirmed, leak free and 100% filled with hydrogen
- Close tank valve
- Put sign “H2 system HOT” on the main hoop

**H5.1.2** Vehicles in the state “H2 system HOT” must be escorted by an official at all times and must not be moved into any buildings or enclosed structures. (This includes for example: pushing the vehicle to dynamic disciplines, dynamic testing in the testing area, static testing in the engine test area).

## H6: Removing hydrogen tank and making vehicle safe for work

**H6.1.1** Procedure of removing the hydrogen tank and making the “H2 system discharged”:

- Team brings the vehicle to the SHYTTA
- The hydrogen system in the car is depressurized through a vent line connected to a stationary vent tower
- The tank is disconnected from the hydrogen system in the car
- Replace sign on the main hoop with “H2 system discharged”

**H6.1.2** After the steps from H6.1.1 there must be a sign “H2 system discharged” attached to the main hoop.

## H7: Modifications and Repairs

**H7.1.1** Working on the hydrogen system is only allowed if the vehicle is in a “H2 system discharged and inert” state outside the SHYTTA. All tests done by the team must utilize an inert gas.

**H7.1.2** The following steps must be followed for work on the hydrogen system (in this order only!)

1. Notify the responsible officials about what kind of work is planed
2. Official will remove the H2 inspection sticker (only after this point is the team allowed to start any work on the H2 system)
3. Perform the repairs
4. Hydrogen system leak test as written in the rule H4 will be repeated and H2 inspection sticker reapplied.

**H7.1.3** If any seals from the hydrogen system are broken, the team will lose the inspection stickers for Hydrogen Scrutineering.

# D: Dynamics

## D1: General

**D1.1.1** Driverless vehicles powered by hydrogen are not allowed.

## D2: Endurance

**D2.1.1** A tank change or refueling during the driver change is not permitted.

**D2.1.2** **TBD:** The driving distance may be adjusted at the event organizers discretion.

## D3: Efficiency Event

**D3.1.1** Efficiency points based on the formula given in D9.4.1 in the Formula Student Rules.

**D3.1.2** The efficiency factor is calculated similarly to D9.4.2 in the Formula Student Rules with differences defined in the following rules.

**D3.1.3** **TBD**: The efficiency for Hydrogen Combustion Vehicles [H2CV] & [H2HY] will be measured and calculated as following:

- Notice the size of the hydrogen tank
- The pressure and internal temperature of the hydrogen tank is measured before the Endurance at the SHYTTA
- The pressure and internal temperature of the hydrogen tank is measured after the Endurance at the SHYTTA
- Calculate the different between the two measurements to get the consumption of hydrogen
- The determined hydrogen consumption in kg is divided through 3,748 to get equivalency to RON98. This factor includes the different properties of the fuels regarding lower heat value (LHV) and density.

**D3.1.4** **TBD**: The efficiency factor for Hydrogen Fuel Cell Electric Vehicles [FCEV] will be measured and calculated as following:

- The tractive energy which is defined in E5.1.5 gives the database for the factor E
- This tractive energy is measured by the second data logger
- Each % that is more than 40% of the total tractive system energy which was produced by hydrogen, gives 1% reduction in the overall energy consumption
- Example: 43% of the tractive energy comes from the fuel cell -> E*0,97

# J: Judging of the Statics

## J1: General

**J1.1.1** Vehicles may only be presented in the “H2 system discharged” state.

## J2: Cost and Manufacturing Event

**J2.1.1** In the Bill of Material (BOM) there is no special category for hydrogen related parts.

**J2.1.2** All hydrogen related parts should be put in the category Engine and Tractive System of the BOM. For sensors and other electric parts the category Grounded Low Voltage System is also possible.

**J2.1.3** **TBD:** If an existing old vehicle is used, it is allowed to use old and new prices in the BOM. For old parts it is allowed to put behind each old price the year, where the vehicle was manufactured. e.g. 56,20 € (2022).

**J2.1.4** **TBD:** A changelog of the vehicle since the submission deadline of the Cost Report Documents (CRD) can be presented to the Judges at the beginning of the BOM discussion. Missing hydrogen related parts are allowed to be part of the changelog. The changelog must be a printed table.

## J3: Engineering Design Event

**J3.1.1** There will be no special additional category for hydrogen-based powertrain or similar in the Engineering Design Event.

**J3.1.2** The events try to provide Design Judges with hydrogen expertise as Hydrogen Judges to evaluate the hydrogen-based powertrain.