

RULES EXTENSION



F S C V HYBRID RULES 2022

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FS CV Hybrid Rules Extension 2022

Version: 0.9

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0.9	15th Sept. 2021	Initial release	-

Introduction

FSA, FSEast, FSN and FSCzech are excited to announce a hybrid concept for CV cars for 2022. With this concept, we want to give CV teams more flexibility and make the class more relevant to today's standards. Furthermore, hybrid cars also allows teams to experiment with power electronics on a simpler level compared to EV cars.

This document is based on **FS Rules 2022 V0.9** ([link](#)) and it is applicable for CV class teams intending to design Formula Student cars with a hybrid powertrain system consisting of an internal combustion engine and an electric tractive system. The rules listed below are specific rule changes and additions to the FS Rules 2022. In case of a conflict between the FS Rules 2022 and the FS CV Hybrid Rules Extension 2022, the FS CV Hybrid Rules Extension 2022 supersedes the FS Rules 2022.

In case of any questions or feedback, please contact us at hybrid@fs-world.org.

Concept outline

The hybrid concept is aimed to be a relatively low-level entry for CV cars. This means that only **low-voltage solutions (<60 V)** are allowed. This reduces the need for the safety measures relevant to high-voltage systems. The energy storage rules aim for a capacity of around **500 Wh** and a maximum average power of **5 kW**. The electrical characteristics will not be checked, however, the maximum weight of the HSC is limited to **3 kg** and will be checked during inspection. The teams are free to determine where and how to apply the energy, as well as how to recuperate the energy.

The energy must be stored in a battery. Fuel cells, flywheels and pressure containers are prohibited. A BMS will be required for all batteries used in hybrid cars. Battery will be "stickered" in Tech and has to be used (IN1.5.1). If multiple HSCs are to be used during the event, they all have to be stickered and need to be within e.g. 10 % of each other in weight. All HSCs must have a UL-94-v0 compatible casing.

Due to the low power requirements, additional APPS and brake test are not needed. The low power can be easily overcome by the brakes. As there is no need to shield the driver from a high voltage, an additional fuse is sufficient. Electronic throttle control is not mandatory.

These rules are not yet fully fleshed out, and we would like to ask you for feedback on these rules. The proposed rules will be integrated into the future CV rules book. The draft rules are based upon the FS-Rules 2022 V0.9 and are referring to those rules. Unless mentioned otherwise, all rules stated in FS-Rules 2022 V0.9 also apply to hybrid cars.

Abbreviations:

HSC: Hybrid Storage Container

HMS: Hybrid Monitoring System

HSD: Hybrid System Description

1. Eligibility

- 1.1. The FS Hybrid class is an extension of the CV class.
- 1.2. Hybrid vehicles will compete against / together with “regular” CV cars.
- 1.3. Unmodified FS-CV Vehicles are still eligible to run under FS hybrid rules.

2. Definitions

- 2.1. The Electric system is a Low Voltage System, T11 is applied for all System Components.
- 2.2. If there is a conflict between T11 and the Hybrid rules, the Hybrid rules apply.
- 2.3. Energy must be stored only in purely electrical energy storage systems such as batteries. Other solutions, such as flywheels or compressed air energy storage are prohibited.
- 2.4. The HSC is defined as the storage system that can be used to introduce mechanical energy into the powertrain.

3. Additional technical rules

- 3.1. A firewall must be present between the low voltage battery and the fuel tank.
- 3.2. Hybrid cars will be identified by an additional sticker (TBD).
- 3.3. Hybrid components other than the LV battery must be positioned in the surface envelope (T1.1.16).

4. Additional CV rules

- 4.1. The entirety of the CV - rules from the FS 2022 rules apply.
- 4.2. The hybrid system will be incorporated into the CV shutdown circuit (CV 4.1).
- 4.3. The HSC AIR must be part of the Shutdown circuit.
- 4.4. Precharge Circuits are allowed.
- 4.5. EV 2.1 applies also for hybrid cars
- 4.6. T 7.3.4 is also applicable for Hybrid vehicles.
- 4.7. The Hybrid System may only be deployed if the Combustion Engine is running or when the Starter Button is pushed.

5. Additional inspection rules

- 5.1. Hybrid cars will follow the respective applicable CV procedure.
- 5.2. Hybrid cars will have an additional HSC and HSD inspection during the CV scrutineering procedure.

6. Energy Storage Container

- 6.1. The HSC must comply to T11.7 rules.
- 6.2. The HSC must comply to T11.7.7 regardless of chemistry type.
- 6.3. The HSC must include overcurrent protection that trips at or below the maximum specified charge current of the cells.
- 6.4. The disconnection mechanism must be designed as an AIR internal to the HSC, disconnecting the positive pole of the HSC.

- 6.5. A fuse rated for the maximum specified discharge current of the cells must be implemented as required in T11.7.7.
- 6.6. The maximum weight of the HSC is 3 kg including casing.
- 6.7. The HSC must be removable to be evaluated at scrutineering.
- 6.8. All electrical parts of the hybrid system must be IPxxB compliant when energized.
- 6.9. Moving energy into the HSC from a different electrical storage system is prohibited.
- 6.10. If multiple HSCs are used, their total weight is limited to 3 kg.

7. Technical Documentation

- 7.1. The team has to submit a Hybrid System Description, which contains the
 - Hybrid System Wiring diagram;
 - Energy Storage electrical and mechanical configuration;
 - Used Electrical actuators placement and mechanical drawings, power and rpm limits.
- 7.2. **The HSD is subject to approval.** Deadline is TBD, but submissions are accepted as of now (and will get feedback).