**APPENDIXES To The Technical Regulations**

# INDEX



**ARTICLE 0: FOREWORD**

The present regulations apply to cars built both as bespoke race prototypes as well as to race cars built taken an original road going hypercar as a base.

Whenever an article applies to both categories, it will span across the whole page width:

| Common |
|---|

If an article only applies to one type, the following layout applies:

| Prototype | Hypercar |
|---|---|

## GENERAL – H1 FORM

2019 H1 LMH.doc

## ARTICLES 3.7 – 3.10 – PROCEDURE FOR HOMOLOGATION OF AERODYNAMIC PERFORMANCE

The LMH regulation is based on the principle of "Balance of Performance". Nevertheless, to be homologated, every car has to fulfil several criteria to ensure that the main performance parameters (engine, weight, aero, dimensions…) are within the defined ranges.
This document describes the process of Aerodynamic Performance Homologation.

### A. Wind tunnel specification

All the aerodynamic measurements held for aerodynamic homologation are processed in a full size reference wind tunnel chosen by FIA/ACO, which minimum characteristics are:

- Ground plane: coated steel moving belt, width > 3.2m
- Max speed: >65m/s
- Turntable: > +/-9°
- Working section: >15m
- Nozzle Area: >14m²

### B. Bodywork regulation

Aero requirements described in the Technical Regulations ensure the robustness of the Aero Performance Homologation process. The car to be homologated must fulfil these requirements.

### C. CAD, Scan and Photos

The full CAD of the bodywork is part of the homologation dossier. The CAD is used as a reference.
The complete bodywork including radiator ducts is scanned during the homologation process.
When overlaying the reference CAD and the scan, they must match within a tolerance of +/- 3 mm whatever the point considered on the bodywork (including underneath).
The photos taken during the Wind Tunnel measurements are used as references for future scrutineering too.

### D. Radiator

All the radiators (including protecting mesh) mounted on the tested car are sealed after the wind tunnel session. They are kept as reference parts for future scrutineering.

### E. Wind Tunnel preparation

Before wind tunnel testing, the car to be homologated is submitted to deep scrutineering to check that it fulfils all the preparation requirements. The attached document below describes the exact process:

2020-10-20 LMH
2020 WT Test Stand

### F. Aero Map

The car to be homologated is measured through an homologation aero map and through a full aero map and repeated as necessary to ensure consistent results.
In order to define these aero maps, the manufacturer supplies real or simulated data which represent the car attitudes around a lap of Le Mans (and possibly other circuits), values of:

- Throttle pedal position
- Total brake pressure
- Car Speed
- Ax and Ay @CoG
- Frond and rear ride heights @axle centrelines relative to reference plane
- Yaw / Sideslip angle @CoG
- Aerodynamic yaw angle of Front Axle
- Aerodynamic yaw angle of Rear Axle
- Roll angle
- Steering angle

The aero maps are derived from these manufacturer data, from FIA/ACO experience and from further track or simulation data.
The aero maps include ride height, roll, crosswind and weights for lift coefficients.
The aero maps are representative of known operating conditions at Le Mans (and other circuits) with rather equal distribution of the weights to accommodate the aero of all possible cars.
Both front and rear ride heights included in the aero map must not exceed 110 mm.
The aero maps are made of:

- a “Straight Line” part with no roll nor yaw
- a “Core” part with high weighted measurement points
- a “Peripheral” part with low weighted measurement points

Some additional aero map points are defined to explore any areas of potential instability, for example high nose up and crosswind attitudes.

2020-10-09 LMH
Aero Maps v7.1.xlsx

### G. Ride Height

The car must be used on track within the following ride height limits

- 110mm maximum dynamic axle ride height (front and rear)
- 100mm maximum static ride height (front and rear)

FIA/ACO will police these figures by checking the static ride heights at scrutineering. However, additional ride height measurement on track is required (Lasers, RH modelling based on hub displacement and pushrods, …)

### H. Aerodynamic Configuration

The car to be homologated is measured through the aero maps in many fixed aerodynamic configurations. An Aerodynamic configuration is defined by:

- An Adjustable Aerodynamic Device (AAD), e.g. Front or Rear wing, (see definition in Technical Regulations) and its range of setup
- Some aerodynamic devices (gurneys, fillers, dive planes, louvers …)
- Brake blanking

FIA/ACO homologates only one aero configuration by choosing:

- The adequate aerodynamic devices among the ones presented by the manufacturers at the wind tunnel tests
- A range of setup for the AAD

The selection of the aero configuration and the limitation of the wing angle range is done according to drag and downforce criteria and balance range adjustment (see next paragraph).

Notes:

- Only one AAD is permitted (e.g. one Front wing or one Rear wing)
- Whatever the track, the car must keep its unique homologated aero configuration
- The only way to setup the Aerodynamic (including balance) must be through changing the AAD setup when the car is stopped
- Powertrain cooling blanking is not permitted neither in Wind Tunnel nor on track.
- Brake blanking is set to a level which may be defined by FIA/ACO and above which it is not permitted to be used on track.
- FIA/ACO reserves the right to measure as many Aerodynamic configurations as necessary to ensure that the car can be homologated.

### I. Homologation Criteria

To select the unique aero configuration to be homologated and to limit the range of setup of the AAD, FIA/ACO checks that the Aerodynamic criteria are fulfilled through the wind tunnel measurements. FIA/ACO reserves the right to require further wind tunnel testing if deemed necessary. These criteria must ensure that:

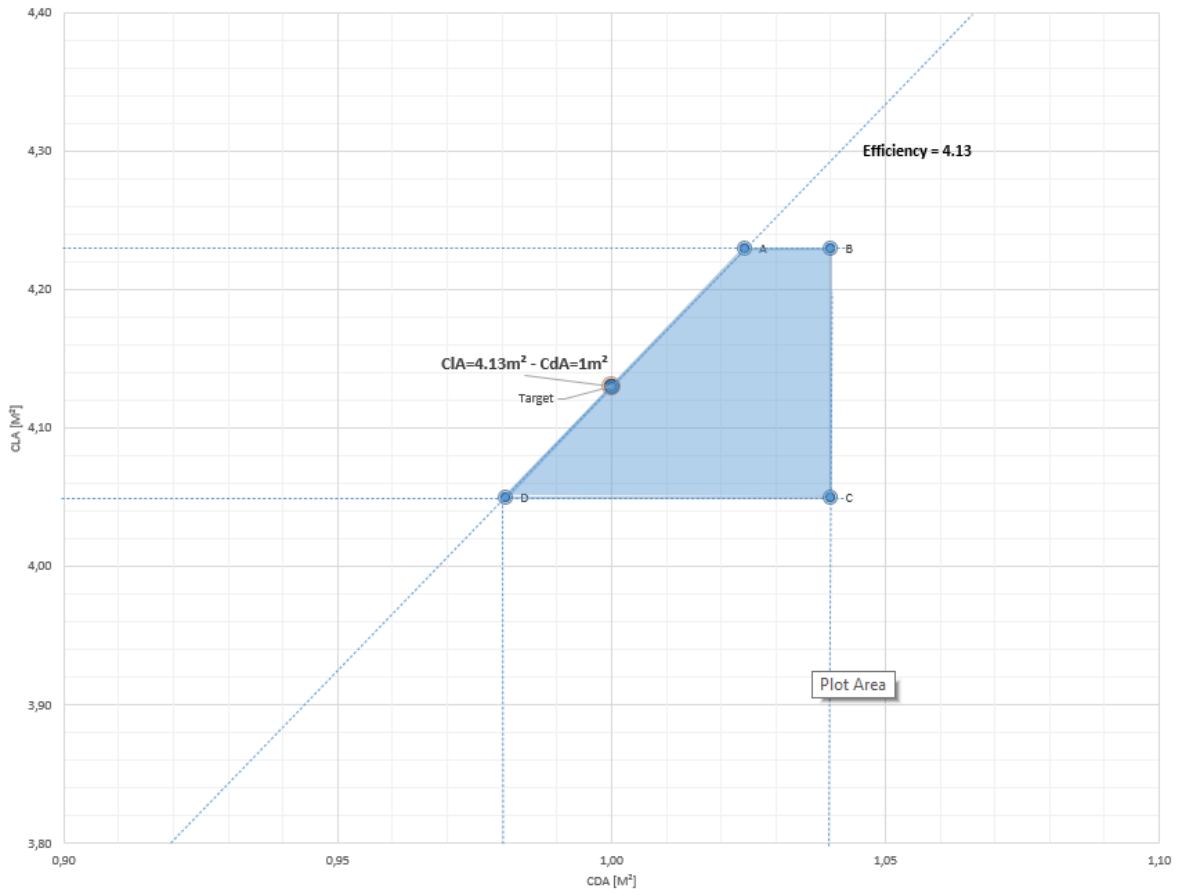
- The performance due to aerodynamics is identical for all the cars
- The cars are measured at attitudes through a representative operating envelope

- The main aero parts work in stable conditions (a stalled flow condition of parts such as wings or diffuser is avoided)

### a. Performance Criteria

The paragraph below describes the aerodynamic performance criteria, which must be fulfilled by the homologated Aero configuration:

- At all setups of the homologated aero configuration, the points defined by the weighted downforce and the minimum drag value must be within the performance window.
- The weighted downforce is computed according to the homologation aero map defined at paragraph F
- The minimum drag value is defined as the lowest drag that is measured considering all set points in the ~~full~~ homologation ride height map described at paragraph F
- The highest downforce must be achieved in straight line




### b. Safety Homologation Criteria

The paragraph below describes the minimum safety criteria, which must be fulfilled to homologate the car.

#### *1. Definitions*

a. Overturning moment

Moment generated around an axis defined as:

- Being orthogonal to the wind direction
- Passing through the furthest point of the car touching the road with respect to the center of gravity, on the side opposed to the incoming wind

b. Critical speed

Speed of the car at which the overturning moment created by aero forces is equal to the overturning moment created by the weight.

c. Aerodynamic stability margin

In the co-ordinate system defined in Section 1.54 of the Technical Regulations the distance measured along the X axis between the theoretical point of application of the aerodynamic yawing moment defined as CoP X and the longitudinal position of the centre of gravity defined as CoG X such that Aerodynamic stability margin = CoP X – CoG X

### *2. Criteria*

- In the homologated aero configuration, the car must have critical speeds higher than the minimum critical speeds for the car attitudes described and listed in the following table (blue columns).
- In the homologated aero configuration the aerodynamic stability margin of the car must be equal to or greater than that of the reference car provided by the FIA such that CoP X - CoG X >= (CoP X - CoG X)ref car. when evaluated at the speeds and attitudes listed in the following table (orange columns).

| Criteria | Take-Off Speed Criterion | | | | | | | | | | | | Stability Margin Criterion | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Type | Yaw | | | | | | | | | | Quasi-Straight | | Yaw | |
| Front RH (mm) | FIA Reference Car study : 40 mm<br>Competitors'car : proper front RH @ 260kph End-Of-Straight | | | | | | | | | | 85 | 98 | FIA Reference Car study : 40 mm<br>Competitors'car : proper front RH @ 260kph End-Of-Straight | |
| Rear RH (mm) | FIA Reference Car Study : 50 mm<br>Competitors'car : proper rear RH @ 260kph End-Of-Straight | | | | | | | | | | 29 | 35 | FIA Reference Car Study : 50 mm<br>Competitors'car : proper rear RH @ 260kph End-Of-Straight | |
| Mass (kg) | FIA Reference Car Study : 955 kg<br>Competitors'car : 1110 kg | | | | | | | | | | | | FIA Reference Car Study : 955 kg<br>Competitors'car : 1110 kg | |
| Yaw angle $\alpha$ | 40° | 90° | 110° | 135° | 160° | 40° | 90° | 110° | 135° | 160° | 0° | 9.5° | 4° | 4° |
| Roll angle $\sigma$ | 0° | 0° | 0° | 0° | 0° | 2° | 2° | 2° | 2° | 2° | 0° | 0.7° | 0° | 2° |
| $V$ (in CFD) (kph) | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 260 | 330 | 216 | 260 | 260 |
| $V_{crit}$ (kph) | 368 | 331 | 327 | 232 | 259 | 285 | 223 | 248 | 207 | 248 | 400 | 370 | NA | NA |
| Rotating Wheels | No | No | No | No | No | No | No | No | No | No | Yes | Yes | Yes | Yes |

The manufacturer must supply enough evidences either through CFD or wind tunnel data that these requirements are fulfilled by design, and is responsible that the car remains above these safety thresholds at all times.
FIA/ACO reserves the right to compute on his own some specific cases with the manufacturer CAD in order to check that the safety criteria are fulfilled.

### *3. Methology for calculation*

a. Critical Speed

2020-10-16 Critical speed calculation m

b. Aerodynamic Stability Margin

The weight distribution for comparison will be the homologated value (before a tolerance is applied) according to article 4.2 of the Technical Regulations.

Using CFD simulation:
The same CFD simulation used for calculating the critical speed above and which has been calibrated by comparing critical speed and overturning moments must be used for the aerodynamic stability margin calculation.
Based on a full car simulation at the required conditions as per the table above and by integration of total pressure on windward and leeward sides of the vehicle the resulting lateral force, Fy, and moment Mz about the Z axis (in the defined co-ordinate system) at the CoG X are calculated. The moment arm, Mz / Fy defines the value of CoP X position.

Using WT measurement:
Direct measurement of the moment about the Z axis (referenced to the defined co-ordinate system), Mz and Force in the Y direction, Fy, at the required conditions are used to calculate the CoP X position as Mz / Fy.

## ARTICLE 5.1.1 – PARTS NAMING EQUIVALENCE FOR ROTARY ENGINES

| Parts in regulations | Equivalence for Rotary engines |
|---|---|
| Engine block | Rotor housing |
| Cylinder head | Side housing (If side exhaust)<br>Or<br>Rotor housing (if peripheral exhaust) |
| Piston | Rotor |
| Piston rings | Rotor seals |
| Crankshaft | Eccentric shaft |

**ARTICLE 5.1.2 – POWERTRAIN PERFORMANCE ASSESSEMENT**

On track POWER must be respected whatever the ambient conditions. It is the duty of the competitor to tune its engine in order to respect the Technical Regulations' prescriptions.

POWER check:

- The power will be monitored using the homologated torque sensors fitted on each driveshaft.
- For each sample the Left and Right torques will be summed.
- The Power=f(N) curve will be calculated with the following formula:

$$Power\ (t) = Power_{\ Front}\ (t) + Power_{\ Rear}\ (t)$$

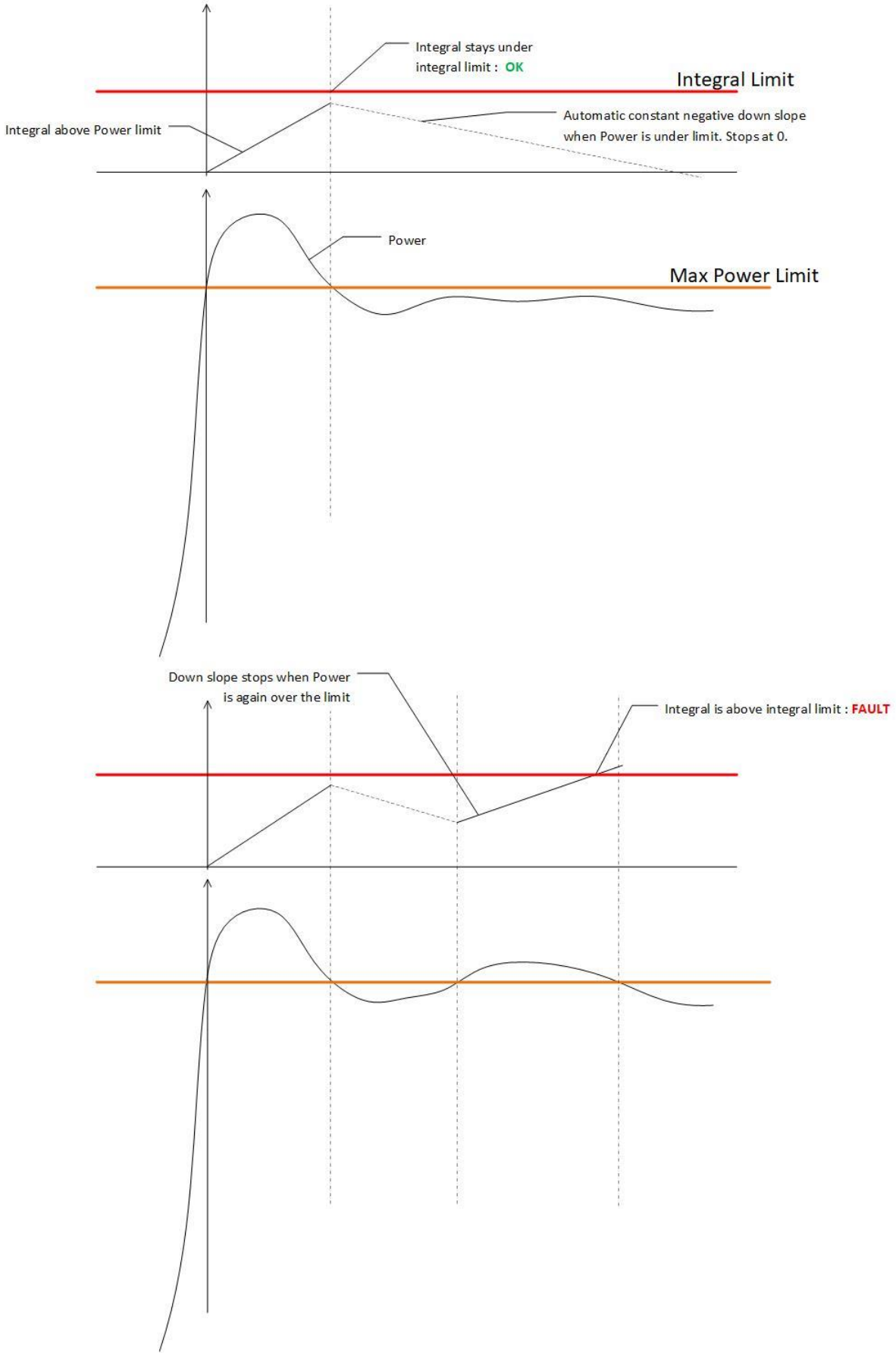
$$Power_{\ Front}\ (t) = \left(M_{FrontRightWheel}\ (t) \cdot N_{FrontRightWheel}\ (t) + M_{FrontLeftWheel}\ (t) \cdot N_{FrontLefttWheel}\ (t)\right) \cdot \frac{\pi}{30000}$$

$$Power_{\ Rear}\ (t) = \left(M_{RearRightWheel}\ (t) \cdot N_{RearRightWheel}\ (t) + M_{RearLeftWheel}\ (t) \cdot N_{RearLefttWheel}\ (t)\right) \cdot \frac{\pi}{30000}$$

The reference engine speed "N" [rpm] will also be taken at time "t". M refers to the torque [Nm].
Power(t) [kW], N(t) and the remainder channels sampling and filtering as detailed in the Electronic General Information (Article 8 of these Appendixes).

This power curve will be compared to the data from the Technical Regulations using the logic described in the graphs below. A maximum integral above this limit of 10 kJ will be permitted with a down slope of 0.2 kJ/s. This integral will be reset at the start of each lap.
The main channel used for monitoring will be PowerIIIlegal: Integral of the instances of power above limit, decreased by a constant slope when Power is under the limit.

# MAXIMUM POWER CONTROL



## ARTICLES 5.4.1 and 5.4.2 – ENGINE WEIGHT AND CENTER OF GRAVITY ASSESSMENT

The engine must, at any time, respect the weight and centre of gravity height declared in the datasheet.

WEIGHT check:

- List all parts in the perimeter
- Weight them
- Sum of the weight must be within -0 / +2 kg of the declared weight.

COG height check:

- Remove all parts that are not “included” in the corresponding table of Appendix 2 of the Technical Regulations.
- If some parts are included in the perimeter but not fitted to the engine, secure them on the engine at a Z position corresponding to the actual position in the car.
- Fit jigs on both sides of the engine that allow the engine to rotate around an axis parallel to the crankshaft and located as per article 5.4.2 of the Technical Regulations. These jigs must be provided by the manufacturer and be present at every event. A CAD of the jigs must be provided to the FIA/ACO in order to be able to check their dimensions.

## ARTICLE 8 – ELECTRONIC GENERAL INFORMATION

https://fiabox.fia.com/views/public/lienPublic.xhtml?id=3319&hash=5ec957af1175ab59c872ef17270e301083500c77

**Following article not applicable until further notice:**

***ARTICLES 8.3.3 – SIDE DISPLAY***

*The side display is intended to provide spectators with enhanced information.*
*The purpose is to have a text/graphic display to be able to impart more information (eg driver ID, pitstop times, Trap Speed, etc) in addition to position in class.*

***Physical dimensions and mounting***

*370mm x 200mm x 5mm*
*Visible area: 363mm x 158mm*
*Mounting method: TBC*
*Mounting position: One unit per side, between front and rear axle.*
*There must be a clear/transparent protective cover (lexan or similar) in front of the LED panel.*

***Cooling requirements***

*A forced air cooling on the rear face of the panel is required.*

***Power supply***

*Max current 17A at 12v nominal (pair of panels) TBC*

***Connections***

*4 power (2 +12V , 2 ground)*
*1 CAN bus.*
*Connector or wires TBD*

## ARTICLE 8.4 – LIST OF FIA/ACO MANDATORY LOGGING SENSORS

Connected Directly to FIA/ACO logger:
- Wheel Speeds
- ICE Speed
- Driveshaft Torquemeters
- Fuel Flow Meter (FFM)
- Drivers Throttle Pedal Sensor (1 track of 3 track sensor)
- Lap Trigger (Transponder)
- Lambda Sensors
- Boost Pressure/Manifold Pressure (depending on engine spec)
- Air Charge Temperature (PT1000)
- Fuel Temperature (PT1000)
- Fuel Pressure before Fuel Flow Meter
- Refueling Coupling Sensor
- Oil catch tank level sensor
- Cockpit Internal Temperature (PT1000)
- Command Current and Voltage of the MGU with an additional measurement providing global redundancy (IVT on CAN)

Mandatory Sensors for which data must be sent via CAN to FIA/ACO Logger:
- Fuel Pressure (one for each independent flow post FFM)
- Pitot Pressure (exception can be made in rain conditions)
- Damper Travel
- Pushrod Load Cells
- Laser Ride Heights (3 in total, 2 Front-1 Rear or 1 Front-2 Rear)
- Headrest Locking Sensors
- Engine Throttle Position
- Any other sensor deemed necessary by FIA/ACO

All sensors measured by FIA/ACO logger will be available via CAN.

**ARTICLE 8.5 – LIST OF LIMITED DATA ACQUISITION SENSORS**

List of Sensors that may be homologated on the car (Any sensor on the car may be required to be sent to FIA/ACO Logger)

- ICE torque (may be used in case of single rear driveshaft torque failure to synthesize failed sensor value)
- Wheel speeds
- Accelerometers for ICE knock control
- Any temperature sensors
- Any pressure sensors (except of in-cylinder pressure sensors)
- Any voltage and/or current sensors
- Any electrical insulation measurement sensors
- Any switches or dials used by the driver
- Pedal box locking sensor
- Emotor position and speed
- Throttle Position
- Engine crankshaft and camshaft position and speed
- Waste gate position
- Gearbox barrel position
- Gearbox mainshaft and layshaft speeds
- Gearbox, driver control input (upshift, downshift)
- Steering angle
- 3 axis accelerometer
- Internal accelerometers included in electronic boxes (subject to FIA/ACO approval)
- Yaw sensors
- Any linear position sensors
- Any liquid level sensors
- Load cell
- Lambda sensors
- Turbo speed sensors

## ARTICLE 8.6 – LIST OF COMMON TELEMETRY CHANNELS

As per files included in the Electronic General Information packages (Article 8 of these Appendixes).

## ARTICLE 14.32 – HIGH SPEED ACCIDENT CAMERA INSTALLATION REQUIREMENTS

The camera shall be installed in the car as per the following requirements, and respecting the LMH Technical Regulations and Appendixes.
It is not allowed to dismount or modify any part of the camera assembly as provided by the manufacturer.

**Position**
Either integrated on/within the dashboard or to the front hoop to allow good view of driver's helmet and upper body.

X Position
No further rearward than the steering wheel and than the rearward face of the rollover structure, such that the driver's helmet is unlikely to hit it during an accident.
Y Position
Aligned with seat Central-Vertical-Plane ±100mm (taking the lens as reference)
Z Position
Adequate so as to ensure good view of helmet and upper body

If the camera is integrated on/within the dashboard, it shall be ensured that the lens is not obstructed and that the dashboard is unlikely to hit the camera during an accident.
If the camera is pointing through a hole of the dashboard, there shall be 20mm MIN of clearance around the lens.

**Orientation**
The camera shall point rearward to the driver's helmet and upper body.

Pitch: parallel to Reference Plane or, if not possible, as close as possible
Roll: vertical (relative to Reference Plane of car)
Yaw: aligned with seat Central-Vertical-Plane or, if not possible, as close as possible

Note: if this simplifies the installation, the camera can be inverted vertically (180deg rotation in roll)

**Fixation**
The camera shall be bolted as per the manufacturer's prescriptions, on a rigid support.

**Loom**
The looms connecting the camera to the logger and to the power supply should be routed in such a way to limit the risk of damage during normal running and incidents.

## ARTICLE 15.1.3 – PROCEDURE FOR THE APPROVAL OF SAFETY STRUCTURES FOR LE MANS HYPERCAR CARS

### ARTICLE 1: PROCEDURE FOR THE APPROVAL OF SAFETY STRUCTURES

#### 1.1 Safety Structures and Cars concerned

The following safety structures must be approved by the FIA:

- Survival cell
- Frontal impact-absorbing structure
- Main front and rear rollover structures
- Steering column
- Rear impact-absorbing structure
- Headrest support(s)
- Shoulder and pelvis supports
- ES compartment
- Seat Belt Anchorage Points

#### 1.2 Approval procedure

- In order to obtain FIA approval for one of the above-mentioned safety structures, the FIA must first of all receive a written request from the manufacturer at the following address:

**FIA Technical Department**
Chemin de Blandonnet 2
CH1215 Geneva 15
Switzerland
**email: sportscarstesting@fia.com**

**The minimum notice is 12 weeks prior to the foreseen test dates.**

- On receipt of this request, the FIA will send a technical questionnaire to the manufacturer, to be filled in, signed and sent back to the FIA.
- On receipt of this dossier, the FIA will decide if the necessary tests may be carried out.
- All approval tests required (see Article 2) must be carried out by a "Testing centre for crash tests and static tests recognised by the FIA" (Technical List n°4), with an FIA Technical Delegate and a manufacturer's representative in attendance.

  All measurements necessary for the checking of the acceptance criteria must be carried out by the test house (acceleration, load, displacement sensors, weight scales).

  If necessary, measuring equipment verified by the FIA may be used in addition to the equipment of the test house.

- For each trip made by an FIA Technical Delegate, the manufacturer will be charged according to a fee decided annually by the FIA (2000 euros per trip of the TD + 1000 euros per day of presence). The FIA reserves the right to adjust the amount of each trip if the travel expenses prove to be more than the predetermined amount (new amount invoiced = actual travel expenses + amount indicated above).

- On receipt of the report from the Technical Delegate, the FIA will confirm to the manufacturer in writing that the structures successfully tested are approved.
- In order to draw up the Certification Dossier containing the approval certificate for each safety structure, the manufacturer shall register the detailed drawings of the structures with the FIA, in accordance with the FIA requirements.

- The manufacturer will provide all complementary information and documents that the FIA deems necessary for drawing up the certificates.

- Any modification of a safety structure previously approved by the FIA must be submitted by the car manufacturer to the FIA Technical Department.
  The latter reserves the right to require that new tests be carried out to proceed with the approval of the modification.

## ARTICLE 2: APPROVAL TESTS FOR SAFETY STRUCTURES

### 2.1 SURVIVAL CELL

**Important:** The survival cell must be the same for all static load tests of the present procedure.
A 3D CAD drawing (.igs file) of the survival cell (ready for car assembly) must be provided to the FIA with the PRELIMINARY QUESTIONNAIRE, for the Certification Dossier.

The survival cell must be **successively** subjected to the static load tests defined in Articles 2.1.1 and 2.1.2.
The survival cell used for the tests must be in its final stage of manufacture, excluding the supplementary side intrusion panels.

The survival cell, dismounted from the test rig, must be made available to the Technical Delegate for photos and weighing at the time that is the most suitable for the test house.

**2.1.1 Static side load tests:**

2.1.1.a Front static side load test:
A constant transverse and horizontal load must be applied through a ball-joint at the centre of area of a pad on a vertical plane passing halfway between the front axle centreline and the top of the front rollover structure.

2.1.1.b Central static side load test:
A constant transverse and horizontal load must be applied through a ball-joint at the centre of area of a pad in the cockpit area on a vertical plane passing through the centre of the seat belt lap strap fixings (middle position if several positions are possible).

2.1.1.c Rear static side load test:
A constant transverse and horizontal load must be applied through a ball-joint at the centre of area of a pad in the fuel tank area on a vertical plane passing through the centre of area of the fuel tank in side elevation.

2.1.1.d Load to be applied:
30 kN.

2.1.1.e Conditions for the load application:
The pads must:
- be 100 mm wide and 300 mm high
- conform to the shape of the survival cell at that section
- be placed against the outermost sides of the survival cell with the lower edge of the pad at the lowest part of the survival cell at that section.

For the test 2.1.1.a, the centre of the pads must be situated vertically in the middle of the volumes for the driver's and passenger's legs.

The edges in contact with the survival cell must be rounded with a radius of 3 mm maximum.
It is permissible to place rubber, maximum 3 mm thick, between the pads and the survival cell.
The survival cell must be fixed onto the test device in such a way that its transverse displacement is left free and its rigidity not modified.
This transverse displacement must be blocked through a pad identical to the one used to apply the load and positioned symmetrically relative to it.
The load must be applied in less than 3 minutes and maintained for a minimum of 30 seconds.

2.1.1.f Acceptance criteria :
1. No structural failure of the inner or outer surfaces of the survival cell.
2. The permanent deformation, measured over the load axis at the level of the top of the pads across the inner surfaces of the survival cell, must be less than 1 mm after the load has been released for 1 minute.
The displacement sensor must be positioned in between the inner surfaces.
If measurement across the inner surfaces is not possible (2.1.1.c), the measurement shall be taken on the external surfaces as close as possible to the top of the pads.

The test house must provide the load / deformation graph for each test.

### 2.1.2 Static vertical load tests on the fuel tank floor:

2.1.2.a Conditions for the load application:
A constant vertical load of 17 kN shall be applied upward through a pad of 200 mm (+/-1 mm) diameter in the centre of area of the fuel tank external floor during at least 30s.

2.1.2.b Acceptance criteria:
1. No structural failure of the inner or outer surfaces of the survival cell.
2. The permanent deformation, measured over the load axis at the level of the top of the pads across the inner surfaces of the survival cell, must be less than 1 mm after the load has been released for 1 minute.

The displacement sensor must be positioned between the inner surfaces.
If measurement across the inner surfaces is not possible (2.1.1.c), the measurement shall be taken on the external surfaces as close as possible to the top of the pads.

The test house must provide the load / deformation graph for each test.

## 2.2 FRONTAL IMPACT-ABSORBING STRUCTURE

The frontal impact-absorbing structure, mounted on the survival cell, must be subjected successively to a static side load test (Art. 2.2.1) and an impact test (Art. 2.2.2).
The frontal impact-absorbing structure and the survival cell used for the tests must be in their final stage of manufacture.

The possible assembly of the impact-absorbing structure with bodywork or mechanical parts must be submitted to the FIA for approval through the preliminary questionnaire for safety tests.

The FIA will define the components to be imperatively installed for these tests.

A 3D CAD drawing (.igs file) of the frontal impact-absorbing structure (ready for car assembly) must be provided to the FIA with the PRELIMINARY QUESTIONNAIRE, for the Certification Dossier.

### 2.2.1 Static side load test:

Prior to the test, the frontal impact absorbing structure must be made available to the technical delegate for photos, weighing and inspection.

2.2.1.a Load to be applied:
A constant transverse and horizontal load of 40 kN, passing through a vertical and transverse plane situated 500 mm forward of the front axle centreline, must be applied through a pad to one side of the frontal impact-absorbing structure fixed to the complete* survival cell.

| | |
|---|---|
| | If the pad cannot be located in the position above due to the construction of the car, an alternative position may be agreed with the FIA. |

2.2.1.b Conditions for the load application:
The pad is identical to the one used in the static side load tests on the survival cell (see Article 2.1.1).
The centre of area of the pad must pass through the vertical and transverse plane mentioned above and the midpoint of the height of the structure at that section.
The complete* survival cell must be solidly secured to a flat plate without increasing the strength of the attachments being tested, and must be blocked laterally through a pad of identical dimensions to the one used to apply the load, positioned before the junction with the frontal impact-absorbing structure.

The load must be applied in less than 3 minutes and maintained for a minimum of 30 seconds.

2.2.1.c Acceptance criteria:
The structure must be able to be normally dismounted and mounted back after the test.

There must be no failure of the structure or of any attachment between the structure and the survival cell, or of the survival cell itself.

**2.2.2 Impact test:**

The frontal impact-absorbing structure, mounted on the complete* survival cell, must be subjected to an impact test against a solid, vertical barrier placed at right angles to the longitudinal axis of the car.
The frontal impact-absorbing structure and the complete* survival cell must previously have been subjected to the static side load test described in Article 2.2.1.
Any mechanical component normally situated between the structure and the survival cell (braking system, steering, etc.) must be installed for the impact test.

2.2.2.a Test conditions:

The complete* survival cell must be solidly fixed to the trolley through its engine mounting points, without increasing its impact resistance.
An additional retaining device between the survival cell and the trolley is permitted (e.g. strap).

- The fuel tank must be installed and must be full of water.
- A dummy weighing at least 75 kg must be installed in the survival cell with the safety belts, as defined in the Le Mans Hypercar technical regulations, fastened. With the safety belts unfastened, the dummy must be able to move forwards freely in the cockpit.
- The extinguishers, as described in the Le Mans Hypercar technical regulations, must be installed.
- The battery must be installed according to the Le Mans Hypercar technical regulations.
- Any ballast fitted in the cockpit must be installed according to the technical regulations.
- Any component of the ERS housed within the survival cell must be fixed inside the chassis during the crash test (all ES, energy store, must be discharged). Upon request, it is allowed to replace the ERS components by dummy components.

Prior to the test, the battery and the extinguishers must be dismounted and made available to the technical delegate for photos and weighing.
The dummy will be installed once the technical delegate has inspected the safety belt fixings.

The total mass MT of the trolley and the structures to be tested must be at least W+MA, (+1%/0) and the impact speed must be equal to Vi.

| **Min. weight "W"** | **Additional mass "$M_A$"** | **Impact speed "$V_i$"** |
|---|---|---|
| Cf. Le Mans Hypercar Technical Regulations | +80 kg (driver)<br>+50 kg (BOP ballast)<br>+ maximum fuel tank volume x 0.75 (fuel) | 14 m/s |

Note: The Impact speed is measured immediately before impact.

2.2.2.b Acceptance criteria:

The average deceleration of the trolley must not exceed 25 g.
It is calculated from the unfiltered deceleration data, from the instant of impact (T0 defined by electronic contact) to the first instant the trolley speed is less than 0 m/s (V0).

Unfiltered deceleration of the trolley:
Average of unfiltered decelerations, measured by at least two single axis sensors located symmetrically about its longitudinal centreline (direction of impact).
Compulsory complementary information:
The test house must provide the graph of the deceleration of the trolley filtered with channel frequency class CFC 60.

The deceleration in the chest of the dummy must not exceed 60 g for a cumulative time of more than 3 ms (∑ti measured at 60g ≤ 3 ms).

The deceleration in the chest of the dummy (the resultant of the decelerations measured along the three axes) must be measured with channel frequency class CFC 180.

There must be no damage to the survival cell or to the mountings of the safety belts or fire extinguishers or battery.

After the test, the frontal impact-absorbing structure must be dismounted from the survival cell.

Note: After the test, the FIA Technical Delegate must void the FIA homologation labels of the safety belts.
The safety belts used for the test will not be re-usable for racing.

## 2.3 MAIN ROLLOVER STRUCTURES

Each rollover structure must be subjected successively to the static load tests defined hereunder.
The rollover structures must be secured to the survival cell.

The rollover structures, the devices securing them to the survival cell, and the survival cell must be in their final stage of manufacture.
Prior to any test, the rollover structures must be made available to the technical delegate for photos and weighing (if dismountable from the survival cell).

### 2.3.1 Front structure:

A vertical load of 75 kN must be applied on top of the structure, downward and within a longitudinal plane passing through the centreline of the driver's seat.

### 2.3.2 Rear structure:

The rear rollover structure must be successively subjected to the following tests:

<table>
<tr><td colspan="2">2.3.2.a Static combined load test:<br>The resultant of the following loads must be applied on top of the structure.<br>The point for application must be situated behind the driver, within a longitudinal plane passing through the centreline of the driver's seat.<br><br>Load<br>Longitudinally rearward 60 kN<br>Transversally inward 50 kN<br>Vertically downward 90 kN</td></tr>
<tr><td>2.3.2.b Static longitudinal load test:<br>A longitudinal load of 60 kN must be applied forward or rearward (at the discretion of the technical delegate), on one side or the other relative to the longitudinal axis of the car (at the discretion of the FIA technical delegate) The centre of the pad is 100 mm below the top of the structure, within a longitudinal plane passing through the centreline of the driver's seat.</td><td>2.3.2.b Static longitudinal load test:<br>A longitudinal load of 125 kN must be applied forward or rearward (at the discretion of the technical delegate), on one side or the other relative to the longitudinal axis of the car (at the discretion of the FIA technical delegate) The centre of the pad is 100 mm below the top of the structure, within a longitudinal plane passing through the centreline of the driver's seat.</td></tr>
</table>

### 2.3.3 Between Front and Rear structure:

| | |
|---|---|
| | A vertical load of 75 kN must be applied on top of the structure, downward and within a longitudinal plane passing through the centreline of the car, halfway between front and rear structures. |

### 2.3.4 Conditions for the load application (for 2.3.1, 2.3.2 and 2.3.3):

The resultant of these loads shall be applied through a circular rigid flat pad with a diameter of 200 mm, positioned perpendicularly to the axis of this resultant.
The pad must have no degree of freedom about the load generating device (e.g. jack) onto which it is secured.

It is permitted to place rubber, maximum 3 mm thick, between the pad and the survival cell.
If the rollover structure is not directly accessible, the load may be applied straight onto the survival cell, through a plate fitting the cell's local shape, the surface of which when projected onto the plane of the flat pad must be within the flat pad's 200 mm diameter.

The survival cell must be lying on its underside on a flat surface, fixed to the test rig though its engine mounting points and wedged laterally by pads 100 mm wide by 300 mm high.

For closed cars with rollover structures that are part of the survival cell, any additional device the purpose of which is to maintain the load application plate and to prevent its sliding from the surface of the cell must be part of the test rig only.

**2.3.5 Acceptance criteria (for 2.3.1, 2.3.2 and 2.3.3):**

| | |
|---|---|
| The deformation must be less than 50 mm when the target load is reached, measured along the axis of load application, and any structural failure must be limited to 100 mm below the top of the rollover structure when measured vertically. | The deformation must be less than 20 mm when the target load is reached, measured along the axis of load application, and any structural failure must be limited to 100 mm below the top of the rollover structure when measured vertically. |

The test house must provide the load / deformation graph for each test.
The Technical Delegate may require any complementary deformation measurement (e.g. deformation of test rig) if he deems it necessary.

## 2.4 STEERING COLUMN

A 3D CAD drawing (.igs file) of the steering column (ready for car assembly) must be provided to the FIA with the PRELIMINARY QUESTIONNAIRE, for the Certification Dossier.

The steering column (including the steering wheel) must be subjected to the following impact test.
Prior to the test, all components of the steering column as well as the steering wheel must be made available to the technical delegate for photos and weighing.
In particular, the energy-absorbing device must be available as a spare.

**2.4.1 Impact testing of the steering column:**
A solid hemispherical object with a diameter of 165 mm (+ 1 mm) and a mass of 8 kg (+1/-0%) must be projected onto the steering wheel at a velocity of at least 7 m/s along the axis of the main part of the steering column (rotation axis of the wheel).
The centre of the hemisphere must impact the centre of the steering wheel (situated between the plane of the steering wheel and the axis of the steering column).
2.4.1.a Test conditions:
The steering wheel, the steering column and its supports, the steering rack assembly and any part which could materially affect the outcome of the test must be mounted on a test structure firmly fixed to the ground which reproduces exactly the mounting of the steering system in the car.
All components used for this test must be in their final stage of manufacture.
The test structure may not modify in any way the impact resistance of the parts being tested.
During the test, the hemispherical object may not pivot about any axis.
2.4.1.b Acceptance criteria:
During the test, the peak deceleration of the object, measured over the direction of impact with channel frequency class CFC 600, must not exceed 80 g for more than a cumulative 3 ms ($\sum$ti measured at 80 g ≤ 3 ms).
After the test, all substantial deformation must be limited to the steering column and the steering wheel.
The steering wheel quick-release mechanism must still function normally for dismounting the steering wheel from the steering column.

## 2.5 REAR IMPACT-ABSORBING STRUCTURE

The rear impact-absorbing structure must be subjected successively to a static side load test (Art. 2.5.1) and an impact test (Art. 2.5.2).
The rear impact-absorbing structure used for the tests must be in its final stage of manufacture.

The possible assembly of the impact-absorbing structure with bodywork or mechanical parts must be submitted to the FIA for approval through the preliminary questionnaire for safety tests.

The FIA will define the components to be imperatively installed for these tests.

A 3D CAD drawing (.igs file) of the rear impact-absorbing structure (ready for car assembly) must be provided to the FIA with the PRELIMINARY QUESTIONNAIRE, for the Certification Dossier.

A vertical flange reproducing the rear face of an engine must be solidly fixed to the ground.
Parts which must be solidly fixed to this flange are: the clutch bell housing, the gearbox housings, the rear impact structure, the rear wing pillars, the jacks and the towing eye.

### 2.5.1 Static side load test:

Prior to the test, the rear impact absorbing structure must be made available to the technical delegate for photos, weighing and inspection.

2.5.1.a Load to be applied:
A constant transverse and horizontal load of 40 kN must then be applied to one side of the impact-absorbing structure, using a pad described in Article 2.1.1e, at a point 400 mm behind the rear wheel axis.

| | |
|---|---|
| | If the pad cannot be located in the position above due to the construction of the car, an alternative position may be agreed with the FIA. |

2.5.1.b Conditions for the load application:
The centre of area of the pad must pass through the plane mentioned above and the midpoint of the height of the structure at the relevant section. After 30 seconds of application, there must be no failure of the structure or of any attachment between the structure and the gearbox housing.
During the test the gearbox housing and the structure must be solidly fixed to the flange but not in a way that could increase the strength of the attachments being tested, and the gearbox housing must be blocked laterally through a pad of identical dimensions to the one used to apply the load, positioned before the junction with the rear impact-absorbing structure.

The load must be applied in less than 3 minutes and maintained during at least 30 seconds.

2.5.1.c Acceptance criteria:
The structure must be able to be normally dismounted and mounted back after the test.
There must be no failure of the structure or of any attachment between the structure and the gearbox housing, or of the gearbox housing itself.

### 2.5.2 Impact test:

The rear impact absorbing structure and the gearbox housing must previously have been subjected to the static side load test described in Article 2.5.1.

2.5.2.a Test conditions:
The structure and the gearbox housing must be solidly fixed to the ground and a solid object, having a mass of MT and travelling at a velocity of not less than 11 metres/second, will be projected into it.

All parts which will be fitted behind the front face of the gearbox housing and which could materially affect the outcome of the test must be fitted to the test structure. If suspension members are to be mounted on the structure they must be fitted for the test.

The total mass MT of the trolley and the structures to be tested must be at least W+MA, (+1%/0) and the impact speed must be equal to Vi.

| Min. weight "W" | Additional mass "$M_A$" | Impact speed "$V_i$" |
|---|---|---|
| Cf. Le Mans Hypercar technical regulations | +80 kg (driver)<br>+50 kg (BOP ballast)<br>+ maximum fuel tank volume x 0.75 (fuel) | 11 m/s |

Note: The Impact speed is measured immediately before impact.

The object used for this test must be flat, measure 450 mm (+/-3 mm) wide by 550 mm (+/-3 mm) high and may have a 10 mm radius on all edges. Its lower edge must be at the same level as the car reference plane (+/-3 mm) and must be so arranged to strike the structure vertically and at 90° to the car centreline.

During the test, the striking object may not pivot in any axis and the crash structure may be supported in any way, provided that this does not increase the impact resistance of the parts being tested.

**2.5.2.b Acceptance criteria:**
The average deceleration of the trolley must not exceed 25 g.
It is calculated from the unfiltered deceleration data, from the instant of impact (T0 defined by electronic contact) to the first instant the trolley speed is less than 0 m/s (V0).

Unfiltered deceleration of the trolley:
Average of unfiltered decelerations, measured by at least two single axis sensors located symmetrically about its longitudinal centreline (direction of impact).
Compulsory complementary information:
The test house must provide the graph of the deceleration of the trolley filtered with channel frequency class CFC 60.

There must be no damage to the clutch bell housing or the gearbox housings.

After the test, the rear impact-absorbing structure must be dismounted from the gearbox housing.

## 2.6 HEADREST SUPPORT(S)

A 3D CAD drawing (.igs file) of the headrest support(s) (ready for car assembly) must be provided to the FIA with the PRELIMINARY QUESTIONNAIRE, for the Certification Dossier.

The headrest support(s) must be subjected to static load tests.

The headrest support(s) used for the test must be in their final stage of manufacture.

They must be installed in the survival cell in accordance with Article 17.6 of the Le Mans Hypercar Technical Regulations.

Prior to the test, the headrest support(s) must be made available to the technical delegate for photos, weighing and inspection.

2.6.a1 Load to be applied:
The headrest support(s) on the car must be stressed according to the FIA 8862-2009 standard (7 kN transverse inward, transverse outward and rearward load tests), each direction's load test being applied separately.

The point of application of the rear load must be situated at the middle height of head support.
The point of application of the transverse loads must be situated, at the middle height of head support at X=150mm from the forward face of the headrest.

2.6.a2 Load to be applied:
The headrest support(s) on the car must be stressed according to 5 kN transverse inward and transverse outward load tests), each direction's load test being applied separately.

The point of application of the transverse loads must be situated at the middle height of head support, 450 (150+300) mm from the forward face of the headrest.

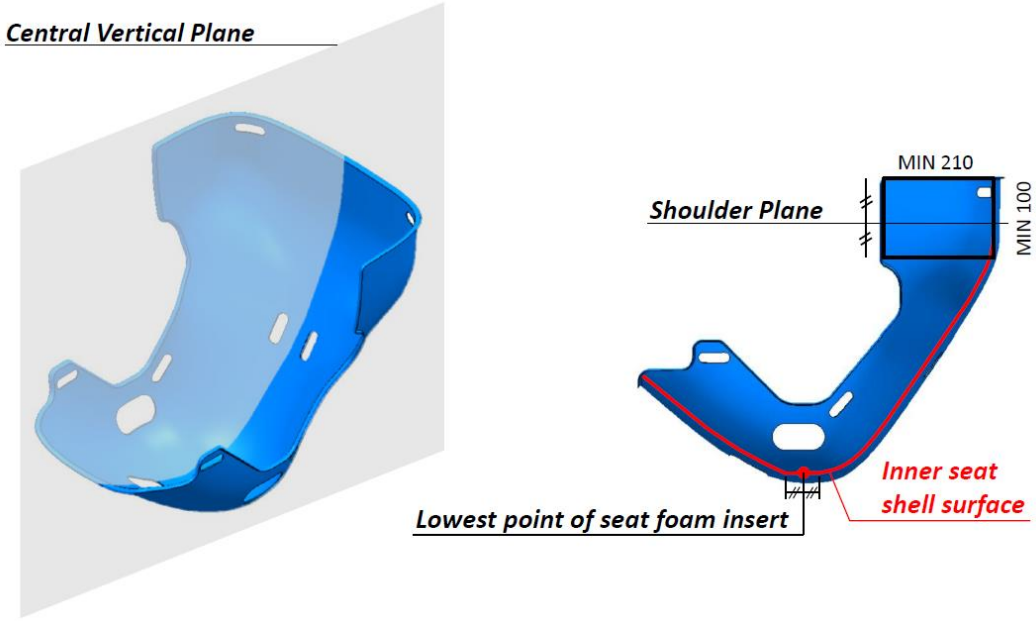
2.6.b Conditions for the load application:
Appendices B and C of the FIA 8862-2009 standard, as described for Seat-Side-Head and Seat-Back-Head.

2.6.c Acceptance criteria:
The maximum deflection under load (displacement of the applied load) must be no more than 40 mm.
If the structure is removable, it must be able to be normally dismounted and mounted back after the test.
There must be no failure of the structure.

## 2.7 SHOULDER AND PELVIS SUPPORTS

A 3D CAD drawing (.igs file) of the shoulder and pelvis supports (ready for car assembly) must be provided to the FIA with the PRELIMINARY QUESTIONNAIRE, for the Certification Dossier.

The shoulder and pelvis supports must be subjected to static load tests and calculated according to the *Finite Element Method*.
The shoulder and pelvis supports used for the test must be in their final stage of manufacture.




They must be installed in the survival cell in accordance with Article 14.10 of the Le Mans Hypercar Technical Regulations.

It is permissible to place rubber, maximum 3 mm thick, between the pads and the load application point.

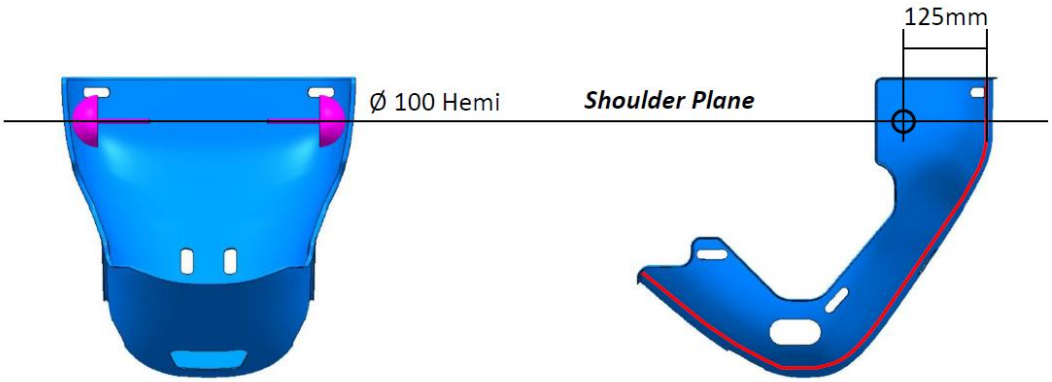
Prior to the test, shoulder and pelvis supports must be made available to the Technical Delegate for photographing, weighing and inspection.

2.7.a Seat-side shoulder, load to be applied:
The shoulder support(s) on the car must be subjected to 11kN transverse inward and transverse outward load tests, each direction's load test being applied separately.

The point of application of the load must be situated at the mid-height of the shoulder support, 125mm from the forward face of the seat shell.

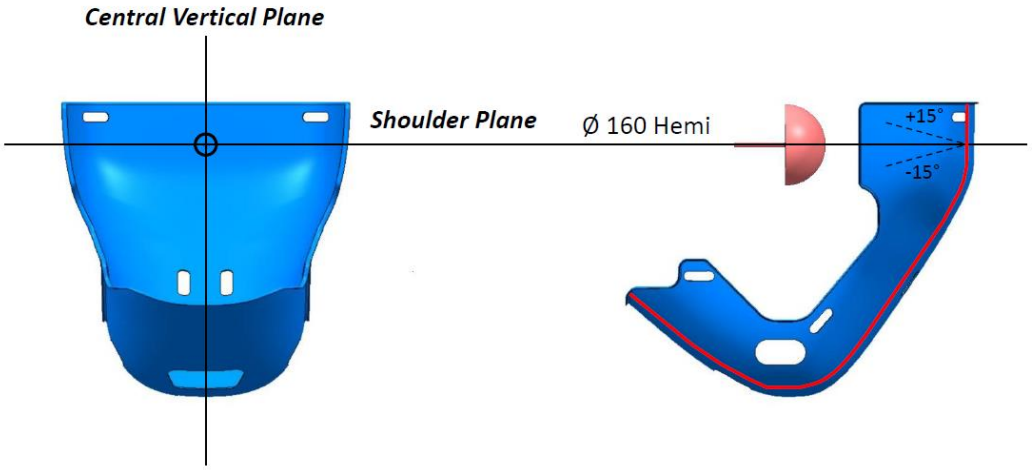
Conditions for the load application:
Through a hemispherical pad of Ø 100mm

The pad shall be fitted to the end of each ram via a ball joint. The ball joint shall permit an angular displacement from the initial position of at least 30° in any direction. The pivot point of the ball joint shall be 40mm from the outside surface of the pad.




Acceptance criteria:
The maximum deflection under load (displacement of the applied load) must be no more than 30 mm.
If the structure is removable, it must be able to be normally dismounted and mounted back after the test.
There must be no failure of the structure.

2.7.b Seat Back Shoulder, load to be applied:
The seat back support on the car must be subject to 14kN rearward load tests.
The point of application of the rear load must be situated as follows:
Intersection Central-Vertical-Plane with Shoulder-Plane with an angle of ±15°, aligned with the Central-Vertical-Plane, normal to the seat shell surface.




Through a hemispherical pad of Ø 160mm

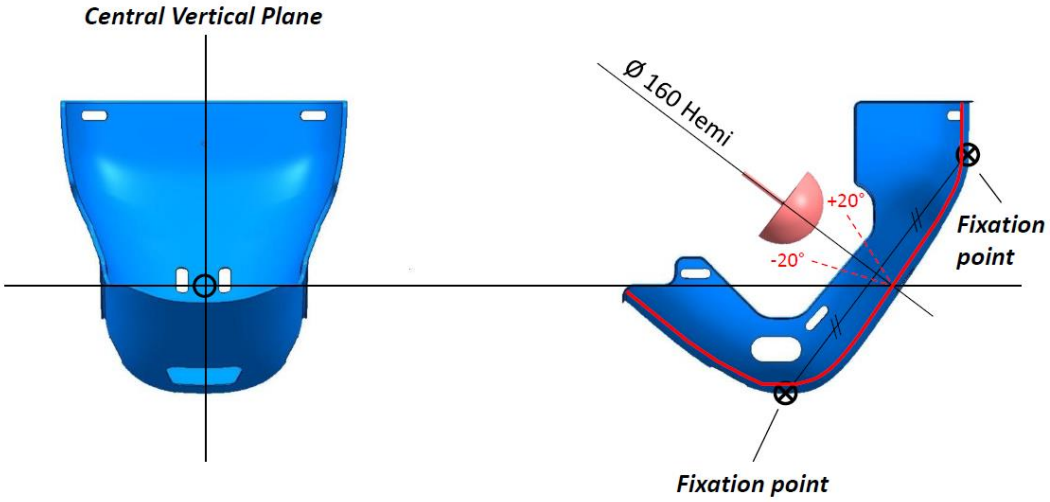
The pad shall be fitted to the end of each ram via a ball joint. The ball joint shall permit an angular displacement from the initial position of at least 30° in any direction.
The maximum deflection under load (displacement of the applied load) must be no more than 30 mm.

There must be no failure of the structure.

2.7.c Seat Back Middle, load to be applied:

The seat back support on the car must be subject to 14kN rearward load tests.
The point of application of the rear load must be situated as follows:
Intersection Central-Vertical-Plane with mid-distance between fixation points.
The application load must be projected to the seat shell in a direction perpendicular to the line which connects both fixation points. The direction of the load is within the Central-Vertical-Plane. The tolerance angle of +/-20° is around Y axis.

The load direction to be perpendicular to the seat shell surface at this point (remaining within the vertical central plane).




The load must be aligned with the Central-Vertical-Plane.
Through a hemispherical pad of Ø 160mm

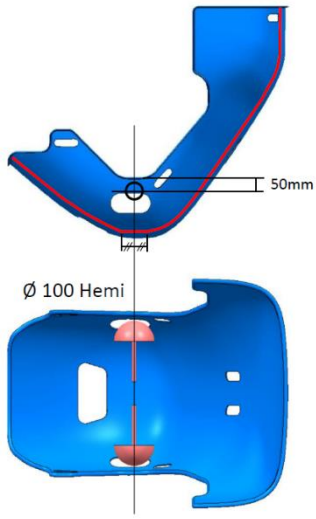
The pad shall be fitted to the end of each ram via a ball joint. The ball joint shall permit an angular displacement from the initial position of at least 30° in any direction.
The maximum deflection under load (displacement of the applied load) must be no more than 25 mm.
There must be no failure of the structure.

2.7.d Seat Side Pelvis, load to be applied:

The side pelvis support(s) on the car must be subjected to 14kN transverse inward and transverse outward load tests, each direction's load test being applied separately.

The point of application of the load must be situated above the lowest point of the driver's foam insert, 50mm below the top edge of the seat shell through a hemispherical pad of Ø 100mm.

The pad shall be fitted to the end of each ram via a ball joint. The ball joint shall permit an angular displacement from the initial position of at least 30° in any direction.
The maximum deflection under load (displacement of the applied load) must be no more than 20 mm.
There must be no failure of the structure.




## 2.8 ES COMPARTMENT

A 3D CAD drawing (.igs file) of the ES compartment (ready for car assembly) must be provided to the FIA with the PRELIMINARY QUESTIONNAIRE, for the Certification Dossier.

The ES compartment, which includes all air ducting and, fluid lines which must be replaced by blanking plugs of equal diameter, to the outside of the survival cell must be subjected to a static pressure test from inside.
The ES compartment used for the test must be in its final stage of manufacture.
It must be installed in the survival cell in accordance with Article 13.16 of the Le Mans Hypercar Technical Regulations.
Prior to the test, the ES compartment must be made available to the Technical Delegate for photographing, weighing and inspection**.**

Load to be applied:
A constant pressure of 0.5 bar will be applied to the structure through a bag which fits the local shape of the ES compartment and which must be provided by the competitor.

Conditions for the load application:
All interfaces for looms between ES Compartment and cockpit must correspond to the final installation on the car. All other interfaces can be closed with plates which are able to withstand the test pressure.

Acceptance criteria:
The maximum deflection under load (displacement of the applied load) must be no more than 25 mm.
If the structure is removable, it must be able to be dismounted and mounted back as standard after the test.
There must be no failure of the structure.

## 2.9 ERS COMPARTMENT

A 3D CAD drawing (.igs file) of the ERS compartment (ready for car assembly) must be provided to the FIA with the PRELIMINARY QUESTIONNAIRE, for the Certification Dossier.

The ERS compartment, which includes all air ducting and, fluid lines which must be replaced by blanking plugs of equal diameter, to the outside of the survival cell must be subjected to a static pressure test from inside.
The ERS compartment used for the test must be in its final stage of manufacture.
Prior to the test, the ERS compartment must be made available to the Technical Delegate for photographing, weighing and inspection**.**

Load to be applied:

A constant pressure of 0.5 bar will be applied to the structure through a bag which fits the local shape of the ERS compartment and which must be provided by the competitor.

Conditions for the load application:
All interfaces for Looms between ERS Compartment and Cockpit must correspond to the final installation on the car. All other interfaces can be closed with plates which are able to withstand the test pressure.

Acceptance criteria:
The maximum deflection under load (displacement of the applied load) must be no more than 5 mm.
If the structure is removable, it must be able to be dismounted and mounted back as standard after the test.
There must be no failure of the structure.

## 2.10 SEAT BELT ANCHORAGE POINTS STRENGTH REQUIREMENTS

The chassis manufacturer shall ensure that all seat belt anchorage points (including their brackets, supports) are able to withstand 15kN in any accident direction.

The strength load requirements are based on the FIA standard 8853-2016 for harnesses.

### 2.10.1 Finite Elements Analysis (FEA) for all anchorage points

The anchorages strength must be verified within a cone of 15° around the 'nominal static direction'

As a minimum requirement, the following FEA calculations shall be performed and provided:

| | |
|---|---|
| Shoulder: | 15kN at nominal static direction |
| Lap: | 15kN at nominal static direction |
| Crotch: | 15kN at nominal static direction |
| Z-strap (if any): | 15kN at nominal static direction |

The 'nominal static direction' is defined as the load direction when the driver is normally seated and tightened within the car in their normal driving position. If several drivers drive the same car, the average orientation should be used.

Each 'nominal static direction' must be declared in the Preliminary Questionnaire.

Each anchorage shall be tested independently. Only one test is required per side, unless the design is not symmetrical relative to the car centre line.

### 2.10.2 Physical tests

Two quasi-static tests on the shoulder anchorage points shall be conducted as described below.

The tests shall be performed with the monocoque, the webbing from a FIA 8853-2016 harness and generally all parts that could materially affect the outcome of the tests. All components must be in their final manufacturing stage. Prior to the test, all components must be made available to the technical delegate for photos and weighing.

The tests shall be considered passed if, when under the prescribed load for a cumulative period of no less than 5 seconds, there is no visible failure of any of the components tested and less than 5mm of deflection under load. Plastic deformation of a core material without fibre failure is allowed.

The loading rate shall be such that each test is completed within 60 seconds.

TEST 1
The load is to be applied to both shoulder strap anchorage points simultaneously.

| | |
|---|---|
| Load | 15kN on each shoulder anchorage |
| Orientation | Parallel (+10/0 degrees) to the XY plane and parallel (+/- 5 degrees) to the XZ plane) |
| Direction | Pull forward |

TEST 2

The load is to be applied to both shoulder strap anchorage points simultaneously.

| | |
|---|---|
| Load | 15kN on each shoulder anchorage |
| Orientation | Parallel (+10/0 degrees) to the XY plane and 30 degrees (+/- 5 degrees) from the XZ plane) |
| Direction | Pull forward-inward |

TEST 3

At FIA's discretion during homologation test, following all information given in the Preliminary Questionnaire and within a minimum of 4-week notice, the FIA reserves the right to perform one additional physical test on any anchorage points (shoulder, lap, crotch or Z-strap).

## ARTICLE 16.2 – FIA TEST PROCEDURE 03/03: SPECIFIC MODULUS OF METALLIC MATERIALS

1) All materials over 35GPa/gm/cm3, and with a metallic content greater than 60% by mass, must be submitted for testing at the National Physical Laboratory, Teddington, UK.

2) All tests will be carried out at 20-25ºC and by using test procedure ASTM E 111 as a basis for analysis.

3) Ten test samples of each material type must be supplied.

4) Flat specimens FTSB, FTSD or FTSE must be supplied. Drawings of the specimens are attached to this test procedure.s

5) Data will normally be analysed using the tangent and secant moduli to calculate Young's modulus.

6) The tests will not normally be carried out to failure, only the early (linear) part of the stress-strain curve will be measured.

7) The modulus measurements will normally be made only from the first loading cycle unless there are problems in obtaining a linear part to the curve. In this case some pre-loading or repeat load cycling will be carried out.

8) Archimedes Principle will be used to assess the density of the samples.

9) The report for each materials type will normally include all relevant information, the stress-strain curves, Young's modulus values, density measurements and calculated specific modulus. Specific modulus results will be quoted to the nearest 0.1GPa/gm/cm3. Any material found to be above 40GPa/gm/cm3 (including total uncertainty) will be deemed not to comply with Article 16.2 of the Le Mans Hypercar Technical Regulations.

10) If a dispute arises the car component(s) in question will undergo quantitative chemical analysis according to UKAS standards. The National Physical Laboratory will compare the component chemical analysis to that of the specimens previously submitted for specific modulus testing to ensure they are manufactured from the same material.

## ARTICLE 19 – HOMOLOGATION FEES

| | |
|---|---|
| Car homologation | 22230 € |
| Bodywork homologation (Single Wind Tunnel Session)* | 40000 € |
| Power unit performance homologation** | TBD |
| Erratum | 5550 € |
| Safety/Reliability/Cost saving evolution | 3300 € |

* Fee per Single Wind Tunnel Session. Additional Wind Tunnel Sessions may be required by FIA/ACO.
** Power unit performance homologation tests may be required by FIA/ACO.

Car preparation, hardware and additional expenses required by FIA/ACO for the homologation are not included in these fees.
Fees are subject to annual revision according to FIA and/or ACO Governance rules.

## ARTICLE 19.4 – CAR HOMOLOGATION FORM TEMPLATE AND MANUAL

HOMOLOGATION FORM LMH Templat

## ARTICLE 19.2.2 – CAD FILES FOR HOMOLOGATION

All the CAD files must be supplied both in *.stp and *.igs formats.
All the files should be positionned in the same coordonate reference as per Technical Regulations.
The naming of the CAD file should be: MAKE_MODEL_ CADFilenumber_ITEM_DATE.*
DATE being YYMMDD (e.g. 201024 for the 24th October 2020).

The list of CAD files:

| CAD File number | Item | Description |
|---|---|---|
| 01 | SURVIVAL | Complete bare survival cell |
| 02 | SURVIVAL_TEMPLATE | Survival cell templates in position |
| 03 | SURVIVAL_ROAD | Complete bare survival cell from road car (if applicable) |
| 04 | COCKPIT | Complete cockpit internal installation<br>*including the assemblies: pedals/master cylinders,steering system, seat, headrest, battery, fire extinguisher, electronic boxes, AC, dashboard…* |
| 05 | BODYWORK | Complete Bodywork |
| 06 | BODYWORK_FT | Complete front bodywork (to front axle) |
| 07 | BODYWORK_RR | Complete rear bodywork (from rear axle) |
| 08 | FUEL | Complete fuel system<br>*fuel cell, pumps, filter, collector, fuel lines, filling pipes…* |
| 09 | SUSP_FT | Complete front suspension<br>*from complete upright, braking system, wishbones, suspensions pickup points, dampers, ARB…* |
| 10 | SUSP_RR | Complete rear suspension<br>*from complete upright, braking system, wishbones, suspensions pickup points, dampers, ARB…* |
| 11 | WHEEL | Wheels (4) |
| 12 | COOLING | Complete cooling system<br>*Internal ducting, radiator, heat exchnagers… for complete power unit* |
| 13 | GEARBOX | Complete gearbox and bellhousing |
| 14 | TEMPLATE | Templates |

## ARTICLE 19.3 – ENGINE HOMOLOGATION FORM TEMPLATE AND MANUAL

ENGINE_Homologat
ion_Template_v03.d

## ARTICLE 19.4 – ERS HOMOLOGATION FORM TEMPLATE AND MANUAL

ERS_Homologation
_Template_v05.docx