

**SUMMARY**

**ARTICLE 1 : DEFINITIONS**

- 1.1 Formula 3 car
- 1.2 Automobile
- 1.3 Land vehicle
- 1.4 Bodywork
- 1.5 Wheel
- 1.6 Automobile make
- 1.7 Event
- 1.8 Weight
- 1.9 Racing weight
- 1.10 Cubic capacity
- 1.11 Supercharging
- 1.12 Intake system
- 1.13 Main structure
- 1.14 Sprung suspension
- 1.15 Active suspension
- 1.16 Cockpit
- 1.17 Survival cell
- 1.18 Composite structure
- 1.19 Telemetry
- 1.20 Semi-automatic gearbox
- 1.21 Cockpit padding
- 1.22 Car centre line

**ARTICLE 2 : REGULATIONS**

- 2.1 Role of the FIA
- 2.2 Publication date for amendments
- 2.3 Notice for change in the air restrictor
- 2.4 Permanent compliance with the regulations
- 2.5 Measurements
- 2.6 Technical passport
- 2.7 Changes to car design
- 2.8 Bodywork homologation
- 2.9 Homologated parts

**ARTICLE 3 : BODYWORK AND DIMENSIONS**

- 3.1 Wheel centre line
- 3.2 Height measurements
- 3.3 Overall width
- 3.4 Width behind the front wheels
- 3.5 Width behind the rear wheel centre line
- 3.6 Overall height
- 3.7 Front bodywork width
- 3.8 Front bodywork height
- 3.9 Front wing mainplane
- 3.10 Height in front of the rear wheels
- 3.11 Height between the rear wheels
- 3.12 Bodywork between and behind the rear wheels
- 3.13 Bodywork around the front wheels

- 3.14 Bodywork facing the ground
- 3.15 Skid block
- 3.16 Overhangs
- 3.17 Aerodynamic influence
- 3.18 Wheelbase and track
- 3.19 Bodywork flexibility
- 3.20 Engine cooling ducts

#### **ARTICLE 4 : WEIGHT**

- 4.1 Minimum weight
- 4.2 Ballast
- 4.3 Adding during the race

#### **ARTICLE 5 : ENGINE**

- 5.1 Engine homologation
- 5.2 General engine specification
- 5.3 Main engine dimensions
- 5.4 Engine weight and centre of gravity
- 5.5 Cranktrain dimensions and design
- 5.6 Valvetrain dimensions and design
- 5.7 Intake system dimensions and design
- 5.8 Control of the intake system
- 5.9 Exhaust system dimensions and design
- 5.10 Ignition system dimensions and design
- 5.11 Engine Control Unit
- 5.12 Fuel system
- 5.13 Lubricating system
- 5.14 Materials - General
- 5.15 Materials and construction – Definitions
- 5.16 Materials and construction – Components
- 5.17 Reciprocating and rotating components
- 5.18 Static components
- 5.19 Coatings
- 5.20 Specified coatings
- 5.21 Telemetry
- 5.22 Clutch and flywheel
- 5.23 Auxiliaries

#### **ARTICLE 6 : PIPING AND FUEL TANKS**

- 6.1 Fuel tanks
- 6.2 Fittings and piping
- 6.3 Crushable structure
- 6.4 Tank fillers
- 6.5 Refuelling

#### **ARTICLE 7 : OIL AND COOLING SYSTEMS**

- 7.1 Location of oil tanks
- 7.2 Longitudinal location of oil system
- 7.3 Catch tank
- 7.4 Transversal location of oil system
- 7.5 Oil replenishment
- 7.6 Cooling fluids

#### **ARTICLE 8 : ELECTRICAL SYSTEMS**

- 8.1 Starter
- 8.2 Starting the engine
- 8.3 Car battery

- 8.4 Accident data recorders
- 8.5 Alternator
- 8.6 Sensors, data logger, dashboard and /or steering wheel display

#### **ARTICLE 9 : TRANSMISSION TO THE WHEELS**

- 9.1 Four wheel drive
- 9.2 Type of gearbox
- 9.3 Reverse gear
- 9.4 Traction control
- 9.5 Driveshafts
- 9.6 Semi-automatic gear change system

#### **ARTICLE 10 : SUSPENSION AND STEERING**

- 10.1 Active suspension
- 10.2 Chromium plating
- 10.3 Suspension members
- 10.4 Suspension dampers
- 10.5 Sprung suspension
- 10.6 Steering

#### **ARTICLE 11 : BRAKES**

- 11.1 Separate circuits
- 11.2 Brake discs
- 11.3 Brake calipers
- 11.4 Air ducts
- 11.5 Liquid cooling
- 11.6 Brake pressure modulation

#### **ARTICLE 12 : WHEELS AND TYRES**

- 12.1 Location
- 12.2 Wheel material
- 12.3 Dimensions and weights
- 12.4 Maximum number of wheels
- 12.5 Wheel attachment
- 12.6 Pressure control valves
- 12.7 Aerodynamic influence

#### **ARTICLE 13 : COCKPIT**

- 13.1 Cockpit opening
- 13.2 Steering wheel
- 13.3 Internal cross section
- 13.4 Clutch, brake and throttle pedal

#### **ARTICLE 14 : SAFETY EQUIPMENT**

- 14.1 Fire extinguishers
- 14.2 Master switch
- 14.3 Rear view mirrors
- 14.4 Safety belts
- 14.5 Rear light
- 14.6 Headrests and head protection
- 14.7 Seat, seat fixing and removal
- 14.8 Head and neck supports
- 14.9 Towing device

## **ARTICLE 15 : CAR CONSTRUCTION**

- 15.1 Materials used for car construction
- 15.2 Roll structures
- 15.3 Survival cell specifications
- 15.4 Survival cell safety requirements

## **ARTICLE 16 : IMPACT TESTING**

- 16.1 Frontal test
- 16.2 Rear test
- 16.3 Steering column test

## **ARTICLE 17 : ROLL STRUCTURE TESTING**

- 17.1 Principal roll structure test
- 17.2 Secondary roll structure test

## **ARTICLE 18 : STATIC LOAD TESTING**

- 18.1 Conditions applicable to all static load tests
- 18.2 Survival cell side tests
- 18.3 Nose push off test
- 18.4 Side intrusion test
- 18.5 Rear impact structure push off test
- 18.6 Fuel tank floor test
- 18.7 Cockpit rim test

## **ARTICLE 19 : FUEL**

- 19.1 Fuel
- 19.2 Air

## **ARTICLE 20 : FINAL TEXT**

### **APPENDIX 1 : CHASSIS RELATED DRAWINGS**

### **APPENDIX 2 : ENGINE RELATED DRAWINGS**

### **APPENDIX 3 : APPROVAL OF SAFETY STRUCTURES**

### **APPENDIX 4 : ENGINE COSTS**

### **APPENDIX 5 : ENGINE HOMOLOGATION**

### **APPENDIX 6 : ENGINE REPAIRS**

## **ARTICLE 1 : DEFINITIONS**

### **1.1 Formula 3 car :**

Automobile designed solely for speed races on circuits or closed courses.

### **1.2 Automobile :**

Land vehicle running on at least four non aligned complete wheels, of which at least two are for steering and at least two for propulsion.

### **1.3 Land vehicle :**

A locomotive device propelled by its own means, moving by constantly taking real support on the earth's surface, of which the propulsion and steering are under the control of a driver aboard the vehicle.

### **1.4 Bodywork :**

All entirely sprung parts of the car in contact with the external air stream, except the rollover structures and the parts definitely associated with the mechanical functioning of the engine, transmission and running gear. Airboxes and radiators are considered to be part of the bodywork.

### **1.5 Wheel :**

Flange and rim. Complete wheel: Flange, rim and tyre.

### **1.6 Automobile make :**

In the case of Formula racing cars, an automobile make is a complete car. When the car manufacturer fits an engine which it does not manufacture, the car shall be considered a hybrid and the name of the engine manufacturer shall be associated with that of the car manufacturer. The name of the car manufacturer must always precede that of the engine manufacturer.

Should a hybrid car win a Championship Title, Cup or Trophy, this will be awarded to the manufacturer of the car.

### **1.7 Event :**

An event shall consist of official practice and the race.

### **1.8 Weight :**

Is the weight of the car with the driver, wearing his complete racing apparel, at all times during the event.

### **1.9 Racing weight :**

Is the weight of the car in running order with the driver aboard and all fuel tanks full.

### **1.10 Cubic capacity :**

The volume swept in the cylinders of the engine by the movement of the pistons. This volume shall be expressed in cubic centimetres. In calculating engine cubic capacity, the number  $\pi$  shall be 3.1416.

### **1.11 Supercharging :**

Increasing the weight of the charge of the fuel/air mixture in the combustion chamber (over the weight induced by normal atmospheric pressure, ram effect and dynamic effects in the intake and/or exhaust system) by any means whatsoever. The injection of fuel under pressure is not considered to be supercharging.

### **1.12 Intake system :**

All the elements between the cylinder head and the external side of the air restrictor.

**1.13 Main structure :**

The fully sprung structure of the vehicle to which the suspension and/or spring loads are transmitted, extending longitudinally from the foremost front suspension on the chassis to the rearmost one at the rear.

**1.14 Sprung suspension :**

The means whereby all complete wheels are suspended from the body/chassis unit by a spring medium.

**1.15 Active suspension :**

Any system which allows control of any part of the suspension or of the trim height when the car is moving.

**1.16 Cockpit :**

The volume which accommodates the driver.

**1.17 Survival cell :**

A continuous closed structure containing all fuel tanks and the cockpit.

**1.18 Composite structure :**

Non-homogeneous materials which have a cross-section comprising either two skins bonded to each side of a core material or an assembly of plies which form one laminate.

**1.19 Telemetry :**

The transmission of data between a moving car and anyone connected with the entry of that car.

**1.20 Semi-automatic gearbox :**

One which, when the driver calls for a gear change, takes over the control of one or more of the engine, clutch and gear selectors momentarily to enable the gear to be engaged.

**1.21 Cockpit padding :**

Non-structural parts placed within the cockpit for the sole purpose of improving driver comfort and safety. All such material must be quickly removable without the use of tools.

**1.22 Car centre line :**

The straight line running through the point halfway between the centres of the two forward skid block holes and the centre of the rear skid block hole (see Drawing 1.6).

## ARTICLE 2 : REGULATIONS

### 2.1 Role of the FIA :

The following technical regulations for Formula 3 cars are issued by the FIA.

### 2.2 Publication date for amendments :

Each year in December at the latest, the FIA will publish all changes made to these regulations. All such changes will take effect on the second 1st January following their publication.

Changes made for safety reasons may come into force without notice.

### 2.3 Notice for change in the air restrictor :

The FIA reserves its right to modify the dimensions of the air restrictor with one year's notice.

### 2.4 Permanent compliance with regulations :

Automobiles must comply with these regulations in their entirety at all times during an event.

### 2.5 Measurements :

All measurements must be made while the car is stationary on a flat horizontal surface.

### 2.6 Technical passport and FIA chassis test report :

All competitors must be in possession of a technical passport for their car which will be issued by the relevant ASN and must accompany the car at all times.

Furthermore, all competitors must be in possession of an FIA chassis test report (see Appendix 2 to the Formula 3 Technical Regulations) for their car which the relevant rolling chassis manufacturer must provide together with each survival cell.

No car will be permitted to take part in an event unless the passport and the FIA chassis test report are available for inspection at initial scrutineering.

### 2.7 Changes to car design :

Only those manufacturers registered and approved as FIA Formula 3 rolling chassis manufacturer will be eligible to homologate a rolling chassis. (Details may be found on the FIA website)

#### 2.7.1

The survival cell, the front and rear impact absorbing structures, the collapsible steering column, the gearbox, the front wing main plane, the steering rack assembly, the front and rear uprights including hubs, the fuel system and the fire extinguishing system must be homologated by the rolling chassis manufacturer before 31st March of the year during which they are intended for use (or the first competitive use if earlier). The rolling chassis manufacturer must supply detailed drawings and 3D CAD data to the FIA in order to identify the homologated parts.

The rolling chassis manufacturer may homologate only one survival cell, one frontal impact absorbing structure, one rear impact absorbing structure, one collapsible steering column and one gearbox between 1 January 2012 until 31 December 2019. However, modifications to the homologated survival cell may be carried out during this time by the chassis manufacturer in order to facilitate the installation of new ancillaries, provided this is the sole purpose.

From the date of homologation the rolling chassis manufacturer may homologate no further front wing main plane, steering rack assembly, front or rear upright including hubs, fuel tank or fire extinguishing system until the following 1st January.

#### 2.7.2

Engines must be homologated by their respective manufacturers according to the Article 5.1.

#### 2.7.3

The front wing main plane, the engine-gearbox assembly, the steering rack assembly, the front and rear uprights including hubs, the fuel tank and the fire extinguishing system must remain unchanged by a competitor for a complete championship season.

N.B: The application of Article 2.7.3 is left to the discretion of each ASN.

**2.7.4** Non-homologated parts may only be attached to homologated car components (e.g. rear roll structure) by bonding which does not change the surface or structure of the homologated component (like double sided tape, silicone but no 2-component bonding systems) and which allows the parts to be removed without the use of tools; or by bolting using existing bolt holes.

**2.7.5** The following parts of the gearbox are homologated and have to remain unchanged :

- a) Gearbox casing.
- b) Bell housing.
- c) Gear selection mechanism inside gearbox casing (including reverse gear).
- d) Shift lock mechanism (may be removed when using the paddle shift system following Article 9.6).
- e) Main shaft.
- f) Lay shaft.
- g) Bearings.
- h) Driveshaft output flange.
- i) Differential. (Other than the preload which may be adjusted)
- j) Final drive.

**2.7.6** Only homologated dampers may be used.

Only dampers used during the 2014 Formula 3 European Championship season may be homologated.

The operating principle, the product family and the housing of the dampers are homologated but the valving and stroke remains free.

For new chassis manufacturer only, dampers with different housings and installation requirements may be homologated, provided the dampers are from the same product family and have the same operating principle as existing homologated dampers.

**2.7.7** Only brake calipers homologated by the rolling chassis manufacturer may be used.

The rolling chassis manufacturer may homologate up to three different types of brake caliper and, unless specifically authorised by the FIA, no changes may be made to the original specification.

**2.7.8** Only brake discs and brake pads which are included in FIA Technical List 11 may be used during the Championship season. Unless specifically authorised by the FIA, no changes may be made to the original specification.

**2.7.9** Suspension members must be used exactly as designed by the car manufacturer. This restriction applies only to the main suspension components connecting the wheel upright with the survival cell.

The part numbers of the restricted components can be found in FIA Technical List 11.

The shape and weight of each suspension member described above must remain as originally designed by the car manufacturer.

The design of all parts described above may not be changed during a Championship season unless specifically authorised by the FIA.



## 2.8 Bodywork homologation :

- 2.8.1 The weight, shape and design of the each bodywork component described in the following Articles must remain as originally designed by the car manufacturer.

Only the surfaces visible in the areas described in the relevant Articles are concerned by these restrictions. Areas of the same part which are not visible may be modified, provided the weight of the modified part is not less than the weight of the original part.

It is not required to use parts supplied by the rolling chassis manufacturer unless specifically mentioned in the homologation documents.

The design of all parts described in the following Articles may not be changed during a Championship season unless specifically authorised by the FIA.

The rolling chassis manufacturer must supply detailed drawings and 3D CAD data to the FIA in order to identify the homologated parts.

- 2.8.2 With the exception of the engine airbox, the associated intake manifold shroud, floor stays and the windshield within the area of the cockpit opening any bodywork visible from outside of the car must be used exactly as designed by the car manufacturer.

Compliance with the above must be demonstrated with all unsprung parts of the car removed.

Floor stays will be considered parts whose sole function is to keep any bodywork facing the ground in place when a vertical load is applied. With the exception of their attachments floor stays must have a circular or rectangular cross section.

This does not apply to any parts of rear view mirrors which are visible, provided each of these areas does not exceed 9000mm<sup>2</sup> when projected to a horizontal plane above the car.

The engine cooling duct has to remain as designed by the rolling chassis supplier up to the plane defined by the front face of the originally designed radiator. Everything behind that plane remains free. The radiator itself remains free.

Stone guards or protection mesh, also different from the parts supplied by the rolling chassis manufacturer, may be added, provided they do not fulfil any additional or other function.

- 2.8.3 Any cross section of the intake manifold shroud described in 2.8.2 above, with a plane parallel to the base plate of the homologated airbox must follow the outer shape of the base plate of the airbox with a tolerance of +/- 5mm. A radius no greater than 100mm will be permitted at the junction of the intake manifold shroud and the homologated bodywork.

Furthermore, unless the make of the engine is changed, a competitor may use only one design of intake shroud during a complete Championship season.

The above defined tolerances may not be exploited in order to circumvent the requirements of the regulations. The purpose of the tolerances is to allow the throttle mechanism to be covered and to help overcome any possible manufacturing tolerances. The designed shape of the airbox shroud has to follow the shape of the airbox base plate.

- 2.8.4 Air ducts conforming with Article 11.4 must be used exactly as designed by the car manufacturer.

## 2.9 Homologated parts :

Only parts homologated in accordance with the FIA F3 Technical Regulations, and which are included in FIA Technical List 11, may be used during the Championship season.

## ARTICLE 3 : BODYWORK AND DIMENSIONS

### 3.1 Wheel centre line :

The centre line of any wheel shall be deemed to be half way between two straight edges, perpendicular to the surface on which the car is standing, placed against opposite sides of the complete wheel at the centre of the tyre tread.

### 3.2 Height measurements :

All height measurements will be taken normal to and from the reference plane.

### 3.3 Overall width :

The overall width of the car including complete wheels shall not exceed 1850mm, with the steered wheels in the straight ahead position.

### 3.4 Width behind the front wheels :

The maximum width of the bodywork situated behind a point lying 280mm behind the front wheel centre line and the rear wheel centre line is 1300mm.

### 3.5 Width behind the rear wheel centre line :

3.5.1 Bodywork behind the rear wheel centre line must not exceed 900mm in width.

3.5.2 Except for fixation, the lateral extremities of any bodywork behind the rear wheel centre line must be flat.

### 3.6 Overall height :

Except for the rollover structures, no part of the car can be higher than 860mm above the reference plane. However, any part of the rollover structures more than 860mm above the reference plane must not be shaped to have a significant aerodynamic influence on the performance of the car.

### 3.7 Front bodywork width :

3.7.1 The bodywork situated forward of a point lying 280mm behind the front wheel centre line is limited to a maximum width of 1600mm.

3.7.2 The lateral extremities of any bodywork forward of the front wheels must fit in the volume formed by planes running 650mm and 800mm parallel to the car centre line and normal to the reference plane, 330mm and 900mm forward and parallel to the front wheel centre line and normal to the reference plane and 40mm and 340mm above and parallel to the reference plane.

The inboard surface of the lateral extremities must be flat, vertical and parallel to the car centre line.

The lateral extremities must incorporate a flat, rectangular and vertical surface, parallel to the car centre line with a minimum length of 300 mm and a minimum height of 150 mm, which is visible from the side of the car.

3.7.3 In order to prevent tyre damage to other cars, the lateral extremities of any bodywork forward of the front wheels must be at least 10mm thick (being the minimum distance when measured normal to the surface in any direction) all extremities pointing forward, rearward, upwards or outboard must have a minimum radius of 5mm.

3.7.4 In order to avoid the spread of debris on the track following an accident, the outer skins of the front wing endplates and any turning vanes in the vicinity of the front wheels (and any similarly vulnerable bodywork parts in this area), must be made predominantly from materials which are included for the specific purpose of containing debris.

The FIA must be satisfied that all such parts are constructed in order to achieve the stated objective.

### **3.8 Front bodywork height :**

- 3.8.1** All bodywork situated forward of a point lying 280mm behind the front wheel centre line, and more than 250mm from the centre line of the car, must be no less than 40mm and no more than 340mm above the reference plane.
- 3.8.2** With the exception of the air ducts described in Article 11.4, no bodywork is permitted within the volume defined by the following six planes: a plane vertical to the reference plane and 65mm parallel to the car centre line, a plane vertical to the reference plane and 900mm parallel to the car centre line, a plane vertical to the reference plane and normal to the car centre line and 330mm forward of the front wheel centre line, a plane vertical to the reference plane and normal to the car centre line and 280mm behind the front wheel centre line, the reference plane and a plane 200mm above the reference plane.
- 3.8.3** No bodywork situated forward of the front wheel centre line, which is less than 250mm from car centre line, may extend above a diagonal line from a point 250mm forward of the front wheel centre line and 640mm above the reference plane to a point 50mm rearward of the forward-most point of the impact absorbing structure defined in Article 15.4.3 and 200mm above the reference plane. No bodywork less than 250mm from car centre line, and which is situated forward of the forward-most point of this diagonal line, may be more than 200mm above the reference plane.

With the exception of a transparent windscreen or antenna, no bodywork situated between the front wheel centre line and the secondary roll structure may lie more than 640mm above the reference plane.

### **3.9 Front Wing Main Plane :**

- 3.9.1** The front wing main plane is homologated and may not be modified in any way.
- 3.9.2** At least 90% of the total surface of the homologated front wing main plane must be in contact with the external air stream when the car is running on the track.
- 3.9.3** The lateral extremities of the front wing assembly (the front wing end plates) must be orientated vertically to the reference plane, parallel to the car centre line and directly attached to the homologated front wing main plane (meaning no other parts are allowed between the homologated front wing main plane and the front wing end plate).
- 3.9.4** With the exception of the lateral extremities (the front wing end plates) and the fixation points (inserts / holes) for the homologated front wing hangers (including spacers or shims between the hangers and the main plane) and for the non homologated front bodywork, the front wing main plane must be a single, smooth, rigid, continuous element without any slots, gaps, attachments or dividers in order that only one single continuous section may be contained within any cross section taken parallel to the car centre line and normal to the reference plane.
- 3.9.5** Within 15 mm from the trailing edge of the homologated main plane Gurney flaps may be attached and for this purpose inserts / holes are permitted in this area.

- 3.9.6** Additional bodywork forward of a point lying 280mm behind the front wheel centre line is permitted in a box either side of the car centre line formed by planes running 250mm and 700mm parallel to the car centre line and normal to the reference plane, 330mm and 660mm forward and parallel to the front wheel centre line and normal to the reference plane, 40mm and 340mm above and parallel to the reference plane and a plane running through a straight line parallel to and 465mm forward of the front wheel centre line and 340mm above the reference plane and another straight line parallel to and 660mm forward of the front wheel centre line and 210mm above the reference plane.

Additional bodywork within these boxes may only be fitted by using the original fixation points (inserts / holes) on the homologated front wing main plane.

- 3.9.7** No bodywork is allowed inside a volume formed by the reference plane, two longitudinal planes which run normal to the reference plane and 250mm parallel to the car centre line either side and two planes which run normal to the reference plane and parallel to and 330mm and 1000mm forward of the front wheel centre line, except for the following components :
- a) Homologated frontal impact absorbing structure.
  - b) Homologated front wing hangers.
  - c) Homologated front wing hanger covers.
  - d) Homologated front wing main plane (as per homologation drawing).
- 3.9.8** Spacers or shims between the front wing hangers and the front wing main plane or the frontal impact absorbing structure are allowed for the sole purpose to bring the front wing to its legal position.

### **3.10 Height in front of the rear wheels :**

- 3.10.1** With the exception of engine airboxes, intake manifold shrouds joining directly the engine airbox with the bodywork and rear view mirrors (including their supports), no part of the bodywork lying 280mm forward of the rear wheel centre line and more than 550mm above the reference plane may project more than 310mm each side of the car centre line.
- 3.10.2** With the exception of engine airbox and the associated intake manifold shroud, any vertical to the reference plane cross section of the bodywork which is taken normal to the car centre line within a volume defined by a plane vertical to the reference plane and normal to the car centre line and 330mm forward of the rear wheel centre line, a plane vertical to the reference plane and normal to the car centre line and 650mm forward of the rear edge of the cockpit entry template as described in Drawing 1.1, a plane vertical to the reference plane and 310mm parallel to the car centre line, a plane vertical to the reference plane and 650mm parallel to the car centre line, a plane 100mm above the reference plane, a plane 550mm above the reference plane and a plane running through a straight line parallel to and 630mm forward of the rear wheel centre line and 100mm above the reference plane and another straight line parallel to and 330mm forward of the rear wheel centre line and 200mm above the reference plane must form one continuous line on its external surface with a radius of no less than 75mm. Within the described volumes devices in order to keep the floor in the correct position are permitted as long as the cross section of these devices is circular or rectangular.

The surfaces lying within this volume, which are situated more than 335mm forward of the rear wheel centre line, must not contain any apertures (other than those permitted by Article 3.10.3) or contain any vertical surfaces which lie normal to the car centre line.

**3.10.3** Once the relevant bodywork surfaces are defined in accordance with Article 3.10, apertures may be added for the following purposes only :

- a) A single aperture either side of the car centre line for the purpose of the exhaust exit. The bodywork edge of this aperture may have a maximum distance of 10mm to any point lying on the circumference of the exhaust pipe.
- b) Rectangular apertures either side of the car centre line for the purpose of allowing suspension members and driveshafts to protrude through the bodywork. No such aperture may have an area greater than 5,000mm<sup>2</sup> when projected onto the surface itself. No point of such an aperture may be more than 100mm from any other point on the aperture.

### **3.11 Height between the rear wheels :**

**3.11.1** No part of the bodywork between points lying 280mm forward of and 150mm behind the rear wheel centre line and more than 550mm above the reference plane may be more than 150mm from the car centre line.

The rear wing endplates must be a flat plate with no steps.

Furthermore, the minimum dimensions as shown in Drawing 1.7 must be respected.

Holes, apertures or slots are permitted only for the fixation and adjustment of the aerofoil sections mentioned in Article 3.12.

### **3.12 Bodywork between and behind the rear wheels :**

No bodywork behind a point lying 280mm forward of the rear wheel centre line may incorporate more than three aerofoil sections. All aerofoil sections used in this area must conform to one of the three sets of dimensions given in Drawings 1.3, 1.4 or 1.5.

Only the aerofoil section defined in Drawing 1.4 may be used as lower rear wing element.

Each of the dimensions given must remain nominally at the same height above the reference plane over the entire width of the relevant aerofoil section.

No holes, apertures or slots are permitted in any of these aerofoil sections.

No trim tabs may be added to any of these aerofoil sections. However, when two upper rear wing elements are fitted, a central support must also be fitted. This support must :

- a) Fully enclose each complete section such that its inner profiles match that of each section.
- b) Be made from aluminum based alloy.
- c) Have a minimum thickness of 2mm, a maximum thickness of 10mm.
- d) Be rigidly fixed to both rear wing elements on the car centre line.
- e) Not allow any displacement (except normal to car centre line) of one rear wing element relative to the other one.

These supports will be ignored when assessing whether the car is in compliance with Articles 3.6, 3.12 and 3.16.

A tolerance of +/-1.0mm will be permitted on any stated dimension.

### 3.13 Bodywork around the front wheels :

With the exception of brake cooling ducts, in plan view, there must be no bodywork in the area formed by two longitudinal lines parallel to and 200 mm and 900mm from the car centre line and two transversal lines, one 330 mm forward and one 280 mm behind the front wheel centre line.

In plan view no bodywork is permitted within an area defined by a line normal to the car centre line and 280mm behind the front wheel centre line, a line normal to the car centre line and 850mm ahead of the rear edge of the cockpit entry template, a line 650 parallel to the car centre line and a line running through a point 200mm from the car centre line and 280mm behind the front wheel centre line and a point 290mm from the car centre line and 850 mm ahead of the rear edge of the cockpit entry template.

This does not apply to any parts of the rear view mirrors (including their supports), which are visible in the described area, provided each of these areas does not exceed 9000mm<sup>2</sup> when projected to a plane above the car which is parallel to the reference plane. The rear view mirror supports must have a circular cross section.

### 3.14 Bodywork facing the ground :

All sprung parts of the car situated more than 280mm behind the front wheel centre line and more than 600mm forward of the rear wheel centre line, and which are visible from underneath, must form surfaces which lie on one of two parallel planes, the reference plane or the step plane. This does not apply to any parts of rear view mirrors which are visible, provided each of these areas does not exceed 9000mm<sup>2</sup> when projected to a horizontal plane above the car. The step plane must be 50mm above the reference plane.

Additionally, the surface formed by all parts lying on the reference plane must :

- a) Extend from a point lying 280mm behind the front wheel centre line to a point lying 280mm forward of the rear wheel centre line.
- b) Have minimum and maximum widths of 300mm and 500mm respectively.
- c) Be symmetrical about the car centre line.
- d) Be made of wood at least 5mm thick.

All parts lying on the reference and step planes, in addition to the transition between the two planes, must produce uniform, solid, hard, continuous, rigid (no degree of freedom in relation to the body/chassis unit), impervious surfaces under all circumstances.

The peripheries of the surfaces formed by the parts lying on the reference and step planes may be curved upwards with maximum radii of 25 and 50mm respectively. The surface formed by the parts lying on the reference plane must be connected at its extremities vertically to the parts lying on the step plane and any radius which forms the transition between the two planes may have a maximum radius of 25mm.

To help overcome any possible manufacturing problems, and not to permit any design which may contravene any part of these regulations, dimensional tolerances are permitted on bodywork situated more than 280mm behind the front wheel centre line and more than 600mm forward of the rear wheel centre line.

A vertical tolerance of +/- 3 mm is permissible across the surfaces lying on the reference and step planes and a horizontal tolerance of 3 mm is permitted when assessing whether a surface is visible from beneath the car.

All sprung parts of the car situated less than 600mm and more than 280mm forward of the rear wheel centre line, which are visible from underneath and more than 250mm from the car centre line, must be at least 50mm above the reference plane.

All sprung parts of the car situated less than 600mm and more than 280mm forward of the rear wheel centre line, which are visible from underneath and between 150mm and 250mm from the car centre line, must be either on the reference plane or at least 50mm above the reference plane.

All sprung parts of the car situated behind a point lying 280mm forward of the rear wheel centre line, which are visible from underneath and more than 150mm from the car centre line, must be at least 50mm above the reference plane.

In an area lying 650mm or less from the car centre line, and from 450mm forward of the rear face of the cockpit entry template to 245mm rearward of the rear wheel centre line, any intersection of any bodywork visible from beneath the car with a lateral or longitudinal vertical plane should form one continuous line which is visible from beneath the car.

Compliance with Article 3.14 must be demonstrated with the panels referred to in Articles 15.3.8 and 15.3.9 and all unsprung parts of the car removed.

### **3.15 Skid block :**

**3.15.1** Beneath the surface formed by all parts lying on the reference plane, a rectangular skid block must be fitted. This skid block may comprise more than one piece but must :

- a) Extend longitudinally from a point lying 280mm behind the front wheel centre line to a point lying 280mm forward of the rear wheel centre line.
- b) Be made from wood.
- c) Have a width of 300mm with a tolerance of +/- 2mm.
- d) Have a minimum thickness of 2.0 mm.
- e) Have a uniform thickness of at least 5mm when new.
- f) Have no holes or cut outs other than those necessary to fit the skid block to the car.
- g) Have four precisely placed 80mm diameter holes the positions of which are detailed in Drawing 1.6.
- h) Be fixed symmetrically about the centre line of the car in such a way that no air may pass between it and the surface formed by the parts lying on the reference plane.

**3.15.2** The front and rear edge of a new skid block may be chamfered over a distance of 50mm to a depth of 3mm.

**3.15.3** In order to establish the conformity of the skid block after use it's thickness will only be measured around the four 80mm diameter holes, the minimum thickness must be respected in at least one place on the circumference of all four holes.

### **3.16 Overhangs :**

With the exception of the structure required by Article 15.4.2 and the FIA approved rear light and any jacking point attached to this structure, no part of the car shall be more than 500mm behind the rear wheel centre line or more than 1100mm in front of the front wheel centre line.

No part of the bodywork more than 200mm from the longitudinal car centre line may be more than 900mm in front of the front wheel centre line.

### 3.17 Aerodynamic influence :

Any specific part of the car influencing its aerodynamic performance (with the exception of non-structural shrouds protecting wheel tethers which are being used solely for this purpose):

- a) Must comply with the rules relating to bodywork.
- b) Must be rigidly secured to the entirely sprung part of the car (rigidly secured means not having any degree of freedom).
- c) Must remain immobile in relation to the sprung part of the car.

Any device or construction that is designed to bridge the gap between the sprung part of the car and the ground is prohibited under all circumstances.

No part having an aerodynamic influence and no part of the bodywork, with the exception of the skid block in Article 3.15 above, may under any circumstances be located below the reference plane.

### 3.18 Wheelbase and track :

Minimum wheelbase : 2000mm.

Minimum track : 1200mm.

### 3.19 Bodywork flexibility :

3.19.1 Bodywork may deflect no more than 5mm vertically when a 50 kg load is applied vertically to it 700mm forward of the front wheel centre line and 575mm from the car centre line, this point being the centre of the below described adapter. The load will be simultaneously applied on both sides of the front wing main plane in a downward direction using a rectangular adapter 300mm long and 150mm wide with the 300mm edges running parallel to the car centre line. The adapter must follow the shape of the front wing in the above defined area and the teams must supply the latter when such a test is deemed necessary. During the test the car must sit on the skid block and the deflection is measured on both sides of the front wing main plane and at the car centre line, the car centre line figure being deducted from the LHS and RHS figures.

3.19.2 Any bodywork facing the ground must remain in compliance with Article 3.14 when a load of 20kg is applied vertically to it at its outermost point directly in front of the rear wheels. The load will be simultaneously applied on both sides of the car in a downward direction.

3.19.3 In order to ensure that the requirements of Article 3.17 are respected, the FIA reserves the right to introduce further load/deflection tests on any part of the bodywork which appears to be (or is suspected of), moving whilst the car is in motion.

### 3.20 Engine cooling ducts :

The area of the air ducts used for cooling the engine must exceed 90,000mm<sup>2</sup> in total. This will be measured to a projection onto a plane vertical to the reference plane and normal to the car centre line and must be maintained up to the radiator surface. Further any intersection taken normal to the car centre line and vertical to the reference plane must form a continuous line up to the radiator.

All air entering the ducts must pass through an oil cooler, a water radiator or an air duct fitted for the sole purpose of cooling a specific car component.

Devices for the sole purpose of connecting the floor to the chassis and to protect the radiators are allowed within the radiator duct and may pass through the bodywork. The devices and passages through the bodywork must have a circular cross section with a diameter no greater than 5mm and 7mm respectively.



## **ARTICLE 4 : WEIGHT**

### **4.1 Minimum weight :**

The weight of the car must not be less than 580.0kg.

### **4.2 Ballast :**

Ballast can be used provided it is secured in such a way that tools are required for its removal. It must be possible to fix seals if deemed necessary by the scrutineers.

### **4.3 Adding during the race :**

The adding to the car during the race of any liquid or other material whatsoever or the replacement during the race of any part with another materially heavier is forbidden.

## ARTICLE 5: ENGINE

### Preamble :

- a) The principal purpose of the regulations detailed within Article 5 below is to ensure that :
  - i) The running costs for one engine per driver throughout a calendar year do not exceed € 65,000 (see Appendix 4 to these regulations), and ;
  - ii) The engine life between rebuilds, where practicable, exceeds 10,000km.
  - iii) The running cost for mileage beyond 10,000km during the lease period do not exceed 6.1 euros/km. Teams must purchase the equivalent of 500km from the first km.
  - iv) Any agreement to access a non-dedicated spare engine must be on substantially the same terms as those entered into between the engine supplier and the teams to whom the access to a non-dedicated spare engine was granted during the previous lease period.

### **5.1 Engine homologation :**

- 5.1.1** The first homologation period will start on 1 January 2014 and end on 31 December 2019. A further four year homologation period will start on 1 January 2020.

Any engine manufacturer or supplier wishing to provide engines during this homologation period must announce their intention to do so before 31 March of the year prior to the year in which they intend to compete.

- 5.1.2** An homologated engine is an engine identical in every respect to either :

- (a) An engine delivered to the FIA prior to its first use in an Event.

Any such engine must include all the parts described in Appendix 5. However, parts solely associated with engine installation in different types of car, and which have no performance benefit, may be changed from time to time during the homologation period with the consent of the FIA.

Once homologated in accordance with the above, and subject to (b) below, no changes may be made to the design or construction of the homologated parts for the duration of the homologation period. Exceptional changes for the purpose of improving reliability, safety and cost saving may be approved by the FIA after full consultation with all other engine suppliers.

For engines homologated in 2013 only, an exceptional and single batch of changes for performance upgrade may be approved by the FIA between the 2017 and 2018 championship seasons.

Certain main engine components may be repaired in accordance with the provisions of Appendix 6.

- (b) An engine delivered to the FIA after 31 March 2013, which the FIA is satisfied, in its absolute discretion and after full consultation with all other engine suppliers, could fairly and equitably be allowed to compete with other homologated engines.

All such engines should be delivered in such a condition that the seals can be fitted. Engines will be held by the FIA throughout the homologation period.

If an engine supplier is unable to provide an actual engine, alternative arrangements may be made with the FIA in order to ensure that a complete record of every engine component is held on file by the FIA throughout the homologation period.

- 5.1.3** The supplier of an homologated engine and/or the team using the homologated engine must take and/or facilitate such steps as the FIA may at any time and in its absolute discretion determine in order to satisfy the FIA that an engine used at an Event is indeed identical to the corresponding engine delivered to and held by the FIA.

- 5.1.4** Only engines which have been homologated in accordance with the above may be used during an Event.

5.1.5 The homologated block, sump and head casting must be available for purchase on normal commercial terms throughout the homologation period, a maximum of six months will be allowed between the order and the delivery.

## 5.2 General engine specification :

5.2.1 Only 4-stroke (Otto principle) engines with reciprocating pistons and a maximum capacity of 2000cm<sup>3</sup> are permitted.

5.2.2 Only engines with 4 cylinders in-line and DOHC with 4 valves per cylinder are permitted.

5.2.3 Direct fuel injection is mandatory.

5.2.4 The engine must run clockwise.

5.2.5 The firing order must be 1-3-4-2.

5.2.6 The compression ratio may not be variable and must not exceed 15:1.

5.2.7 The crankshaft rotational axis must be parallel to the car centre line and the reference plane.

5.2.8 The engine-to-chassis mounting points must be arranged in accordance with Drawing 2.1.

5.2.9 [The gearbox-to-engine mounting points must be arranged in accordance with Drawing 2.2.\*]

5.2.10 The cylinder axis must be normal to the reference plane.

## 5.3 Main engine dimensions :

5.3.1 The length of the engine, measured between front and rear mounting flanges, must be 500mm ± 0.5mm (see Drawing 2.3).

5.3.2 The minimum distance between the axis of cylinder 1 and front face of the engine is 130mm (see Drawing 2.3).

5.3.3 The minimum distance between the crankshaft rotational axis and bottom of the bedplate is 100mm.

5.3.4 The cylinder bore must be 87.0mm (+0mm/-1mm). (See Drawing 2.3)

5.3.5 The minimum distance between cylinder axes is 92.9mm. (See Drawing 2.3)

## 5.4 Engine weight and centre of gravity :

5.4.1 The minimum weight of the engine is 87kg.

5.4.2 The centre of gravity of the engine may not lie less than 110mm above crankshaft centreline.

The longitudinal and lateral position of the centre of gravity of the engine must fall within a region that is the geometric centre of the engine, +/- 50mm. The geometric centre of the engine in a lateral sense will be considered to lie on the crankshaft rotational axis and on the mid point between the centres of the forward and rear most cylinder bores longitudinally.

If called upon to do so, each manufacturer must be able to demonstrate, by means of a physical test, that his engine complies with the above requirements.

5.4.3 No more than 5kg of ballast may be fitted to the engine.

**5.4.4** When establishing conformity with Articles 5.4.1 and 5.4.2 above the engine will include the following parts :

- a) Engine wiring loom including actuators and sensors up to first connector.
- b) Coolant pumps including inlet and outlet housings, without pipes or hoses.
- c) Oil pressure and oil scavenge pumps without pipes.
- d) Engine mounted fuel system including injector rail, injectors, high pressure pump and high pressure pipes.
- e) Ignition coils.
- f) Spark plugs.
- g) Ballast mounted to the engine.
- h) Complete cylinder head, cylinder block, dry sump.
- i) Complete timing face: belts, rollers, gears and timing cover.
- j) Pulleys and gears on the crankshaft side for those ancillaries not included in the weight perimeter.
- k) First union permanently fitted on the engine of any fluid connection.
- l) All pins, screws, washers and nuts used for attaching those parts not included.
- m) Engine to chassis dowels fitted on the engine.

**5.4.5** When establishing conformity with Articles 5.4.1 and 5.4.2 above the engine will not include the following parts :

- a) Flywheel.
- b) The entire intake system including manifolds, airbox and restrictor
- c) Oil filter
- d) Exhaust manifold.
- e) Liquids.
- f) ECU.
- g) Oil tank including its support and associated hoses and/or pipes.
- h) Alternator and its supports.
- i) Clutch.
- j) Oil exchanger and associated hoses and/or pipes.
- k) Starter and its support.
- l) Balancing shafts including dedicated drive system parts and cover.
- m) Chassis to engine and gearbox to engine mounting studs.
- n) Header tank (removable parts from engine).

## **5.5 Cranktrain dimensions and design :**

**5.5.1** The minimum piston pin outer diameter is 18.9mm.

**5.5.2** The piston pin length must be 50mm ± 0.5mm.

**5.5.3** The minimum main journal diameter is 54.9mm.

**5.5.4** The minimum main bearing width is 20.0mm. Each bearing may incorporate a 45° chamfer on each edge to a maximum depth of 1.5mm and an oil groove no wider than 4.5mm. (See Drawing 2.4)

- 5.5.5 The minimum connecting rod weight is 450g (complete with small end bearing, big end bearing shells and bolts).
- 5.5.6 The minimum connecting rod crank pin diameter is 45.9mm.
- 5.5.7 The minimum connecting rod big end bearing width is 20.0mm. Each bearing may incorporate a 45° chamfer on each edge to a maximum depth of 1.5mm. (See Drawing 2.5)
- 5.5.8 Roller bearings for connecting rods are not permitted.  
Sharing of bearings between connecting rods is not permitted.
- 5.5.9 Cylinders and pistons must be circular.
- 5.5.10 The minimum compression height of the pistons is 32.0mm. (See Drawing 2.6)
- 5.5.11 The minimum piston weight, including piston pin, all circlips and all piston rings, is 350g.
- 5.5.12 Each piston must be fitted with three piston rings. The minimum heights of the top, second and oil scraper piston rings are 0.92mm, 1.12mm and 1.92mm respectively.
- 5.5.13 No cooling ducts are permitted within the piston structure.
- 5.5.14 The minimum crankshaft weight is 10kg.  
The moment of inertia of the crankshaft and flywheel assembly (including the trigger wheel but without clutch studs) must exceed 0.016kg.m<sup>2</sup>.
- 5.5.15 Roller bearings are not permitted.
- 5.5.16 The crankshaft must have five bearing journals.
- 5.5.17 The crankshaft rear flange must use conventional bolts and nuts located at a minimum pitch diameter of 45mm [55mm\*].
- 5.5.18 The main crankshaft, connecting rod to crankshaft and connecting rod to piston pin bearings must be approved by FIA.
- 5.5.19 The crankshaft rotational axis must be no less than 115mm above the reference plane.
- 5.6 Valvetrain dimensions and design :**
- 5.6.1 Each camshaft must have at least five bearing journals.  
Roller bearings for the camshafts are not permitted.
- 5.6.2 Camshafts may be driven by belt, chain or gears located at either the front or the back of the engine.  
The minimum width of any camshaft drive gear is 8.0mm when measured across the gear tooth at the root diameter or any point 1mm above or below the root diameter.
- 5.6.3 The minimum camshaft journal diameter is 22.9mm.
- 5.6.4 The minimum camshaft lobe base circle radius is 15.0mm.
- 5.6.5 The minimum camshaft weight, without drive gear, is 1200g.
- 5.6.6 Only reciprocating poppet valves are permitted and the sealing interface between the moving valve component and the stationary engine component must be circular.  
Valve springs must be wire coil spring design.
- 5.6.7 Valves may only be actuated by finger followers or tappets (flat or with a radius). [Finger followers only\*]
- 5.6.8 Both intake valves must be parallel to each other and the angle between them and a plane normal to the cylinder head surface must be 16.0° +/-3.5° [17.0° +/-1.0°\*]. See Drawing 2.7 (Angle A).

5.6.9 Both exhaust valves must be parallel to each other and the angle between them and a plane normal to the cylinder head surface must be  $17.5^\circ \pm 5.0^\circ$  [ $18.0^\circ \pm 1.0^\circ$ ]. See Drawing 2.7 (Angle B).

[The exhaust ports must be situated on the right hand side of the cylinder head (right hand side of the car.\*)]

5.6.10 The minimum valve outer diameter below cotter clamping groove is 5.9mm.

5.6.11 The maximum inlet and exhaust valve diameters are 35.0mm and 31.0mm respectively.

5.6.12 Hollow structures are not permitted.

5.6.13 The maximum valve lift is 13.0mm.

5.6.14 Variable valve timing and variable valve lift systems are not permitted.

## 5.7 Intake system dimensions and design :

5.7.1 The intake system must be fitted with an air restrictor through which all the air feeding the engine must pass.

The restrictor must be at least 3mm long, have a maximum diameter of 28mm and be made of aluminium.

5.7.2 The airbox must be manufactured by an FIA designated supplier to a specification determined by the FIA.

With the exception of the diffuser, the length of which may be shortened by a maximum of 90mm and a simple ring added (the sole purpose of which is to locate the air filter on the end of the diffuser), the airbox must be used exactly as supplied by the designated supplier.

The intake manifold must comprise four single ports which lead up to an adapter plate which is directly fitted to the airbox. Only inlet trumpets and air filter may encroach upon the inner airbox volume.

The trumpets must be fitted within a volume, the base of which is formed by the aperture in the airbox, to a height of 80mm measured perpendicular to the aperture inside the airbox. (See Drawing 2.7)

The entire intake system including manifolds, airbox and restrictor, but excluding the fasteners used to hold it to the engine and the throttle cable, may not weigh less than 5.5kg and must fit into a box 1000mm long x 500mm wide x 500mm high.

It must be possible to remove the entire intake system from the engine as one unit with the cylinder head.

5.7.3 No more than one throttle per cylinder is permitted.

Only butterfly throttles are permitted.

[The throttle centre axis must have a fixed distance from the centre of the cylinder fire face of 280mm ( $\pm 20$ mm)\*]. See Drawing 2.7 (Length D).

[The intake duct from the cylinder head connection surface to the airbox flange must be straight.]

5.7.4 Throttle command must be mechanical. Hydraulic or electrical drive is not permitted. A pneumatic valve acting on throttle for the sole purpose of semi-automatic shifting is allowed.

5.7.5 The inlet ports must be circular in the throttle area. [50mm  $\pm 2.0$ mm diameter\*]

5.7.6 Variable geometry inlet systems are not permitted.

5.7.7 Injectors are considered part of the homologated ECU but their spray pattern may vary for each engine manufacturer or supplier. The spray pattern of the injectors must be homologated by the manufacturer or supplier and may not be changed during the homologation period.

Only one fuel injector per cylinder is permitted.

5.7.8 The angle between the fuel injectors and a plane normal to the cylinder head surface must be  $63.5^\circ \pm 6.5^\circ$  [ $65.0^\circ \pm 1.0^\circ$ ]. See Drawing 2.7 (Angle C).

#### **5.8 Control of the intake system :**

5.8.1 With at least one valve in each cylinder shut and the engine throttles open, the complete intake system must be capable of sustaining a vacuum of 0.2bar.

5.8.2 Alternatively, if all the valves are shut, either by removing the camshaft(s) or following a repair carried out under the supervision of the scrutineers, a vacuum of 0.267bar must be sustained.

5.8.3 Any device used for checking the vacuum must have a maximum nominal output of 35 litres per minute and be capable of obtaining a vacuum of 0.734bar to 0.867bar for zero airflow.

#### **5.9 Exhaust system dimensions and design :**

5.9.1 The exhaust system must incorporate at least one functioning catalytic converter through which all exhaust gases must pass. All converters must be approved by the FIA and incorporate a matrix of at least 100cpsi.

The noise generated by the car must not exceed 110dB(A).

5.9.2 The minimum weight of the complete exhaust system is 11kg (including all parts from the cylinder head port exit to the exhaust gas exit including silencer and catalytic converter, but excluding any brackets used to mount the exhaust system to the car).

5.9.3 Variable geometry exhaust systems are not permitted.

5.9.4 No part of the exhaust system (except for the exhaust manifold) may be less than 110mm from the car centre line and less than 210mm forward of the rear wheel centre line.

#### **5.10 Ignition system dimensions and design :**

5.10.1 Only one spark plug per cylinder with a minimum thread outer diameter of 9.5mm is permitted.

5.10.2 Ignition is only permitted by means of a single ignition coil and single spark plug per cylinder. The use of plasma, laser or other high frequency ignition techniques is forbidden.

5.10.3 Ignition coils must be manufactured by an FIA designated supplier to a specification determined by the FIA.

5.10.4 Ignition coil parts solely associated with ignition coil installation to suit different types of engines and which have no performance benefit, may be locally modified.

#### **5.11 Engine Control Unit :**

5.11.1 The only engine control unit (including the complete chassis wiring loom) which may be used for engine management is that specified by the FIA and supplied by the appointed manufacturer. This engine control unit must be used in accordance with the manufacturer's instructions.

#### **5.12 Fuel Systems :**

5.12.1 The pressure of the fuel supplied to the injectors may not exceed 200bar.

5.12.2 High pressure fuel pump must be manufactured by an FIA designated supplier to a specification determined by the FIA. High pressure fuel pump parts solely associated with pump installation to suit different types of engines and which have no performance benefit, may be locally modified.

### **5.13 Lubricating system :**

**5.13.1** Only one oil pressure pump is permitted.

[Oil pressure and scavenge pumps must be conventional external gear pumps.\*]

[Oil scavenge pumps must be mounted on the right hand side of the oil sump (right hand side of the car).\*]

[Only two openings for oil jets per cylinder are permitted. The opening for an oil jet must be circular with a diameter "A" and a sharp edge (see Drawing 2.9).\*]

**5.13.2** Powered oil separators are not permitted.

### **5.14 Materials - General :**

**5.14.1** No composite materials are permitted with the following exceptions (unless explicitly allowed for defined engine components) :

- a) Non structural covers.
- b) Brackets for the purpose of mounting ancillaries or sensors.
- c) Intake system parts with the exception of the throttle body.

**5.14.2** Unless explicitly permitted, the following materials must not be used for engine components and components mounted to the engine :

- a) Magnesium-based alloys.
- b) Titanium-based alloys.
- c) Metal Matrix Composites.
- d) Intermetallic materials.
- e) Alloys containing more than 5% by weight of beryllium, iridium or rhenium.

### **5.15 Materials and Construction – Definitions :**

**5.15.1** X-based alloy (e.g. Ni-based alloy) – X must be the most abundant element in the alloy on a %w/w basis. The minimum possible weight percentage of the element X must always be greater than the maximum possible percentage of each of the other individual elements present in the alloy.

**5.15.2** X-Y-based alloy (e.g. Al-Cu-based alloy) – X must be the most abundant element. In addition, element Y must be the second highest constituent (%w/w) after X in the alloy. The mean content of Y and all other alloying elements must be used to determine the second highest alloying element (Y).

**5.15.3** Intermetallic materials (e.g. TiAl, NiAl, FeAl, Cu<sub>3</sub>Au, NiCo) – These are materials where the material is based upon intermetallic phases, i.e. the matrix of the material consists of more than 50%v/v intermetallic phase(s). An intermetallic phase is a solid solution between two or more metals exhibiting either partly ionic or covalent, or metallic bonding with a long range order, in a narrow range of composition around the stoichiometric proportion.

**5.15.4** Composite materials – These are materials where a matrix material is reinforced by either a continuous or discontinuous phase. The matrix can be metallic, ceramic, polymeric or glass based. The reinforcement can be present as long fibres (continuous reinforcement) or short fibres, whiskers and particles (discontinuous reinforcement).

**5.15.5** Metal Matrix Composites (MMCs) – These are composite materials with a metallic matrix containing a phase of more than 2%v/v which is not soluble in the liquid phase of the metallic matrix.

**5.15.6** Ceramic materials (e.g. Al<sub>2</sub>O<sub>3</sub>, SiC, B<sub>4</sub>C, Ti<sub>5</sub>Si<sub>3</sub>, SiO<sub>2</sub>, Si<sub>3</sub>N<sub>4</sub>) – These are inorganic, non-metallic solids.



## **5.16 Materials and construction – Components :**

**5.16.1** Unless explicitly permitted for a specific application, ceramic materials may not be used anywhere on the engine.

**5.16.2** The crankcase must be manufactured from cast or wrought aluminium alloy or cast grey iron.  
The crankcase may be re-sleeved to obtain the required bore. The cylinder sleeve must be manufactured from either aluminium alloy or iron based alloy.

**5.16.3** The sump and bedplate must be manufactured from cast or wrought aluminium alloy or cast grey iron.

**5.16.4** Cylinder heads must be manufactured from cast or wrought aluminium alloy.

**5.16.5** The crankshaft bearing cap must be manufactured from cast or wrought aluminium alloy or cast grey iron.

Crankshafts must be manufactured from an iron based alloy and from a single piece; no welded or joined assemblies (except timing gear or auxiliary drive) are permitted.

No material with a density exceeding  $9,000\text{kg/m}^3$  may be assembled to the crankshaft.

**5.16.6** Connecting rods must be manufactured from iron-based alloys with a density not greater than  $8.9\text{kg/dm}^3$  and must be machined from a single piece of material with no welded or joined assemblies (other than a bolted big end cap or an interfered small end bush).

Titanium-based materials are forbidden.

Screws may be made from cobalt or nickel-based alloy.

**5.16.7** Pistons must be manufactured from an aluminium alloy which is either Al-Si, Al-Cu, Al-Mg or Al-Zn-based.

Piston pins must be manufactured from an iron-based alloy and must be machined from a single piece of material.

**5.16.8** Camshafts must be manufactured from iron based alloys and must be machined from a single piece of material with no welded or joined assemblies (with the exception of a timing gear, an auxiliary drive, a camshaft sensor trigger or plug to close lubrication holes).

**5.16.9** Valves must be manufactured from alloys based on iron, nickel or cobalt and from a single piece.

**5.16.10** All shafts, gears and connecting rods must be manufactured from an iron-based alloy with a density not higher than  $8.9\text{kg/dm}^3$ .

Shafts used in throttle actuator and engine ancillaries are not subject to this material restriction.

**5.16.11** All threaded fasteners must be manufactured from iron-based alloy or aluminium based alloy.

**5.16.12** Exhaust manifolds must be manufactured from alloys based on iron or nickel.

For the fixing of the exhaust manifold to the cylinder, a nickel-based alloy may be used.

**5.16.13** Ceramic bearings are not permitted; rolling elements must be manufactured from an iron-based alloy.

**5.16.14** Valve seats, guides and bearings (bushes) manufactured from alloy containing beryllium are permitted.

**5.16.15** Spark plugs are not subject to the materials restrictions described in Article 5.16.1.

## **5.17 Reciprocating and rotating components :**

- 5.17.1 Reciprocating and rotating components must not be manufactured from graphitic matrix, metal matrix composites or ceramic materials; this restriction does not apply to the clutch or any seals. Ceramic bearings are not permitted in ancillaries which are included when assessing the weight of the engine, e.g. alternator, coolant pumps and oil pumps.
- 5.17.2 Timing gears between the crankshaft and camshafts (including hubs) must be manufactured from an iron-based alloy with a density not higher than 8.9 kg/dm<sup>3</sup>. In case of a timing belt, the timing gears may be manufactured from aluminium alloys.

## **5.18 Static components :**

- 5.18.1 No composite materials or metal matrix composites are permitted either for the whole component or locally.
- 5.18.2 Any part whose primary or secondary function is to retain lubricant or coolant within the engine will be considered structural and must be manufactured from an iron-based alloy or an aluminium alloy from among the Al-Si, Al-Cu, Al-Zn or Al-Mg alloying systems.
- 5.18.3 Valve seat inserts, valve guides and any other bearing component may be manufactured from metallic infiltrated pre-forms with other phases which are not used for reinforcement.

## **5.19 Coatings :**

- 5.19.1 All coatings must be approved by the FIA.
- 5.19.2 The total coating thickness must not exceed 25% of the section thickness of the underlying base material in all axes. In all cases, the relevant coating thickness must not exceed 0.8mm.
- 5.19.3 Coatings for the purpose of corrosion prevention and wear reduction will be approved by the FIA.
- 5.19.4 Coatings for the main purpose of friction reduction will be approved by the FIA if a relevance to high volume production engines is arguable or identified.
- 5.19.5 Coatings are not permitted on the connecting rods or crankshaft.

## **5.20 Specified coatings :**

- 5.20.1 DLC coatings may only be applied to the following components :
  - a) Tappets/finger followers.
  - b) Camshaft.
  - c) Piston rings.
  - d) Piston pin.
- 5.20.2 Coatings may also be approved on a case-by-case basis by the FIA on the following components :
  - a) Piston ring groove and piston crown for the purpose of ring groove wear reduction.
  - b) Cylinder wall coatings used in high volume production engines.
  - c) Graphal or Molybdenum based piston skirt coatings used in high volume production engines.
  - d) Valve coatings in the area of the valve seat for the main purpose of wear reduction.
  - e) Coatings on rotating bearing elements for the main purpose of wear reduction or "state-of-the-art" friction-reduction coatings.

## **5.21 Telemetry :**

- 5.21.1 The use of telemetry is forbidden.

## **5.22 Clutch and flywheel :**

**5.22.1** The clutch must have a minimum of two driven plates and the diameter of the clutch assembly must not be less than 165mm.

[Only clutches that were fitted to 2013 homologated engines may be used.\*]

**5.22.2** The rotational axis of the clutch assembly must be in line with the rotational axis of the crankshaft.

**5.22.3** Pull clutches are not permitted.

**5.22.4** The flywheel must be made of steel and must not form an integral part of the crankshaft.

## **5.23 Auxiliaries :**

**5.23.1** With the exception of electrical fuel pumps engine auxiliaries must be mechanically driven directly from the engine with a fixed speed ratio to the crankshaft.

**5.23.2** The oil pump gears must be manufactured from an iron based alloy.

**5.23.3** The alternator must be fitted directly to the engine.

## ARTICLE 6 : PIPING AND FUEL TANKS

### 6.1 Fuel tanks :

6.1.1 The fuel tank must be a single rubber bladder conforming to or exceeding the specifications of FIA/FT3 or FT3-1999.

6.1.2 All the fuel stored on board the car must be situated between the front face of the engine and the driver's back when viewed in lateral projection.

Furthermore, no fuel can be stored more than 300mm forward of the highest point at which the driver's back makes contact with his seat.

However, a maximum of two litres of fuel may be kept outside the survival cell, but only the quantity which is necessary for the normal running of the engine.

6.1.3 Fuel must not be stored more than 400mm from the longitudinal car centre line.

6.1.4 All rubber bladders must be made by manufacturers recognised by the FIA. In order to obtain the agreement of the FIA, the manufacturer must prove the compliance of his product with the specifications approved by the FIA. These manufacturers must undertake to deliver to their customers exclusively tanks complying with the approved standards. A list of approved manufacturers is available from the FIA.

6.1.5 All rubber bladders shall be printed with the name of the manufacturer, the specifications to which the tank has been manufactured and the date of manufacture.

6.1.6 No rubber bladders shall be used more than five years after the date of manufacture, unless inspected and recertified by the manufacturer for a period of up to another two years.

### 6.2 Fittings and piping :

6.2.1 All apertures in the fuel tank must be closed by hatches or fittings which are secured to metallic or composite bolt rings bonded to the inside of the bladder.

The bolt holes edges must be no less than 5mm from the edge of the bolt ring, hatch or fitting.

All hatches and fittings must be sealed with the gaskets or "O" rings supplied with the tank.

6.2.2 All fuel lines between the fuel tank and the engine must have a self sealing breakaway valve. This valve must separate at less than 50% of the load required to break the fuel line fitting or to pull it out of the fuel tank.

6.2.3 No lines containing fuel, cooling water or lubricating oil may pass through the cockpit.

6.2.4 All lines must be fitted in such a way that any leakage cannot result in the accumulation of fluid in the cockpit.

6.2.5 No hydraulic fluid lines may have removable connectors inside the cockpit.

6.2.6 When flexible, all lines must have threaded connectors and an outer braid which is resistant to abrasion and flame.

6.2.7 All fuel and lubricating oil lines must have a minimum burst pressure of 41bar at the maximum operating temperature of 135°C.

6.2.8 All hydraulic fluid lines which are not subjected to abrupt changes in pressure, with the exception of lines under gravity head, must have a minimum burst pressure of 408bar at the maximum operating temperature of 204°C when used with steel connectors and 135°C when used with aluminium connectors.

6.2.9 All hydraulic fluid lines subjected to abrupt changes in pressure must have a minimum burst pressure of 816 bar at the maximum operating temperature of 204°C.

### 6.3 Crushable structure :

The chassis must include a crushable structure surrounding the fuel tank with the exception of the access hatches, this structure being an integral part of the car main structure and of the survival cell, and conforming to the following specifications :

**6.3.1** The crushable structure must be a honeycomb sandwich construction based on a fire resistant core of a minimum crushing strength of 18N/cm<sup>2</sup> (25lb/in<sup>2</sup>). It shall be permitted to pass water pipes through this core, but not fuel, lubricating oil or electrical lines.

The sandwich construction must include two skins of 1.5mm thickness having a tensile strength of minimum 225N/mm<sup>2</sup> (14 tons/in<sup>2</sup>).

**6.3.2** The minimum thickness of the sandwich construction must be 10mm.

#### **6.4 Tank fillers :**

**6.4.1** Tank fillers must not protrude beyond the bodywork. Any breather pipe connecting the fuel tank to the atmosphere must be designed to avoid liquid leakage when the car is running and its outlet must not be less than 250mm from the cockpit opening.

All tank fillers must be designed to ensure an efficient locking action which reduces the risk of accidental opening following a crash impact or incomplete locking after refuelling.

**6.4.2** All cars must be fitted with a self sealing connector which can be used by the scrutineers to obtain fuel from the tank.

This connector must be the type approved by the FIA.

#### **6.5 Refuelling :**

**6.5.1** Refuelling during the race is forbidden.

**6.5.2** Refuelling the car on the grid by any other means than by gravity from a maximum head of two metres above the ground is forbidden.

**6.5.3** Any storage of fuel on board the car at a temperature of more than ten degrees centigrade below the ambient temperature is forbidden.

**6.5.4** The use of any specific device, whether on board or not, to decrease the temperature of the fuel below the ambient temperature is forbidden.

## **ARTICLE 7 : OIL AND COOLING SYSTEMS**

### **7.1 Location of oil tanks :**

All oil storage tanks must be situated between the front wheel axis and the rearmost gearbox casing longitudinally, and if situated outside the main structure of the car they must be surrounded by a 10mm thick crushable structure.

No part of the oil reservoir for engine lubrication may be situated more than 200mm laterally from the car centre line. The oil reservoir must be located between the rear face of the engine and the rear wheel centre line longitudinally.

### **7.2 Longitudinal location of oil system :**

No other part of the car containing oil may be situated behind the complete rear wheels.

### **7.3 Catch tank :**

When a car's lubrication system includes an open type sump breather, this breather must vent into a catch tank of at least 2 litres capacity.

The use of additional vent pipes for the purpose of venting a catch tank rearwards to the back of the car is not permitted. Measures must be taken to ensure that no liquid can leak from any aeration system.

### **7.4 Transversal location of oil system :**

No part of the car containing oil may be more than 550mm from the car centre line.

### **7.5 Oil replenishment :**

No oil replenishment is allowed during a race.

### **7.6 Cooling fluids :**

Only ambient air, water, anti-freeze and oil are permitted in the car cooling systems.

## **ARTICLE 8 : ELECTRICAL SYSTEMS**

### **8.1 Starter :**

A starter must be fitted to the gearbox housing/bellhousing with electrical or other source of energy carried aboard the car, and able to be controlled by the driver when seated normally.

The starter must be capable of starting the engine at all times.

### **8.2 Starting the engine :**

A supplementary device temporarily connected to the car may be used to start the engine both on the grid and in the pits.

### **8.3 Car battery :**

The car battery must be installed within the survival cell on the floor behind the driver's seat.

Only batteries approved by the FIA, and which are included in FIA Technical List 11, may be used during the Championship season.

### **8.4 Accident data recorders :**

The recorder must be fitted and operated :

- a) By being rigidly attached to the survival cell using the fixation holes provided.
- b) In accordance with the instructions of the ADR manufacturer.
- c) Symmetrically about the car centre line and with its top facing upwards.
- d) With each of its 12 edges parallel to an axis of the car.
- e) Less than 50mm above the reference plane.
- f) In a position within the cockpit which is readily accessible at all times from within the cockpit without the need to remove the skid block or floor.
- g) In a position which is normally accessible at the start and finish of an Event.
- h) In order that the entire unit lies between 40% and 60% of the wheelbase of the car.
- i) With its main connector facing forwards.
- j) In order that its remote status light is visible when the driver is in the cockpit.
- k) In order that the download connector is easily accessible without the need to remove bodywork.

The recorder must be selected from those within the FIA Institute ADR programme.

### **8.5 Alternator :**

Alternator must be manufactured by an FIA designated supplier to a specification determined by the FIA. Alternator parts solely associated with alternator installation to suit different types of engines and which have no performance benefit, may be locally modified.

## 8.6 Sensors, data logger, dashboard and /or steering wheel display :

The following sensors must be manufactured by an FIA designated supplier to a specification determined by the FIA. Only those sensors may be used.

- Crank shaft rotation.
- CAM shaft rotation.
- Throttle position.
- Lambda.
- Knock sensors.
- Oil temperature.
- Water temperature.
- Fuel temperature.
- Exhaust temperature.
- Manifold air temperature.
- Oil pressure.
- Fuel low pressure.
- Fuel rail high pressure.
- Pneumatic pressure.
- Ambient air pressure.
- Crankcase pressure.
- Clutch pressure.
- Gear position.
- Gear box shaft speed.
- Lap marker beacon.
- Front wheel speed.
- Steering angle.
- Brake pressure.
- Accelerometers (lateral and longitudinal).
- Damper travel potentiometers.

Data logger, dashboard and /or steering wheel display must be manufactured by an FIA designated supplier to a specification determined by the FIA.



## ARTICLE 9 : TRANSMISSION TO THE WHEELS

### 9.1 Four wheel drive :

Four wheel drive cars are forbidden.

### 9.2 Type of gearbox :

9.2.1 All cars must have no more than six forward gears.

9.2.2 Cars may only be fitted with the following gear ratios during all Events and official test days :

1st 12/31	Hub 2nd 13/30	Standard 16/30
	Hub 2nd 15/33	Standard 17/31
	Hub 2nd 15/31	Standard 17/30
	Hub 2nd 15/30	Standard 17/29
	Hub 2nd 15/29	Standard 15/25
		Standard 16/26
		Standard 17/27
		Standard 17/26
		Standard 17/25
		Standard 19/27
		Standard 17/23
		Standard 19/25
		Standard 18/23
		Standard 20/25
		Standard 19/23
		Standard 23/27
		Standard 21/24
		Standard 19/21
		Standard 24/26
		Standard 18/19
		Standard 25/26
		Standard 24/24
		Standard 25/24
		Standard 26/24

9.2.3 No forward gear ratio pair must be :

- Less than 12.75mm wide when measured across the gear tooth at the root diameter or any point 1mm above or below the root diameter. Above this area each side of the gear teeth may be chamfered by a maximum of 10°. In addition, a chamfer or radius not exceeding 2.0mm may be applied to the sides and the tip of the teeth.
- Less than 78.9 mm between centres.
- Less than 670g (excluding any integral shaft or collar). If an integral shaft or collar is to be excluded the mass of this may be shown by calculation assuming the gear to be 12.75mm wide and the shaft geometry to be the same as that where slide-on gears are used.

9.2.4 Gear ratios must be made from steel.

9.2.5 The rotational axis of the layshaft must be in line with the crankshaft's rotational axis. All other rotational axes must also be parallel to the reference plane.

- 9.2.6 From the clutch to the rear wheels there are only two pairs of reduction gears allowed per ratio (except for the reverse gear).
- 9.2.7 Transversal gearboxes or gearboxes forward of the rear wheel axis are forbidden.
- 9.2.8 Automatic gearboxes and differentials with electronic, pneumatic or hydraulic slip control are forbidden.
- 9.2.9 A single automatic ignition cut which is completely controlled by the homologated single ECU is permitted during one manual gear change. A different cut time for each gear may be homologated once during the ECU homologation period by the engine manufacturer/tuner.
- 9.2.10 A device which prohibits driver downshift attempts, if the calculated engine rpm for the destination gear would be higher than the maximum engine rpm allowed by the engine manufacturer, is permitted and must be controlled by the homologated single ECU.
- 9.2.11 Viscous differentials are not considered to have hydraulic slip control, provided outside control is not possible when the car is in motion.
- 9.2.12 The weight of the dry differential assembly without crown wheel must not be less than 3800g.
- 9.2.13 The weight of the crown wheel including bolts and lockwire must not be less than 1850g.
- 9.2.14 Forced lubrication is forbidden
- 9.2.15 Cars may only be fitted with a final drive ratio of 12/34 during all Events and official test days.
- 9.2.16 Any spacer used to adjust the preload of the differential must be flat, rigid plates made of steel. The spacer may not fulfil any other function than setting a certain level of preload.

### **9.3 Reverse gear :**

All cars must have a reverse gear which, at any time during the event, can be selected while the engine is running and used by the driver when seated normally.

### **9.4 Traction control :**

The use of traction control is forbidden.

### **9.5 Driveshafts :**

Driveshafts must be made from steel. They must have an outside diameter no less than 24mm and an inside diameter no more than 12.2mm.

The CV joint assembly must not form an integral part of the drive shaft assembly.

### **9.6 Semi-automatic gear change system :**

Semi-automatic gear change system (paddle shift system) must be manufactured by an FIA designated supplier to a specification determined by the FIA.

## ARTICLE 10 : SUSPENSION AND STEERING

### 10.1 Active suspension :

Active suspension is forbidden.

### 10.2 Chromium plating :

Chromium plating of any steel suspension components is forbidden.

### 10.3 Suspension members :

10.3.1 All suspension members must be made from an homogeneous metallic material.

10.3.2 In order to help prevent a wheel becoming separated in the event of all suspension members connecting it to the car failing, flexible tethers each with a cross sectional area greater than 110mm<sup>2</sup> must be fitted. The sole purpose of the tethers is to prevent a wheel becoming separated from the car, they should perform no other function.

The tethers and their attachments must also be designed in order to help prevent a wheel making contact with the driver's head during an accident.

Each wheel must be fitted with one tether which complies with FIA standard 8864-2013 providing a minimum energy absorption of 6kJ (FIA Technical List N°.37).

Each tether must have its own separate attachment which :

- a) Is able to withstand a tensile force of 70kN.
- b) Is able to accommodate a tether end fitting with a minimum inside diameter of 15mm.

Each tether must exceed 450mm in length and must utilise end fittings which result in a tether bend radius greater than 7.5mm.

10.3.3 The overall cross-sections of each member of every suspension component (with any non-structural shroud for wheel tethers included) must have an aspect ratio no greater than 3.5:1 and be symmetrical about its major axis. All suspension components may however have sections with an aspect ratio greater than 3.5:1, and be non-symmetrical, provided these are adjacent to their inner and outer attachments and form no more than 25% of the total distance between the attachments of the relevant member.

All measurements will be made perpendicular to a line drawn between the inner and outer attachments of the relevant member.

10.3.4 No major axis of a cross section of a suspension member may subtend an angle greater than 5° to the reference plane when measured parallel to the car centre line.

10.3.5 Shrouds and covers on any suspension member must be non-structural and will be permitted for the sole purpose of protecting wheel tethers and brake lines. Shrouds and covers may not be permanently attached to suspension members. It must therefore be possible to remove them without the use of tools.

### 10.4 Suspension dampers :

10.4.1 Only conventional hydraulic, single tube dampers with one piston and maximum two-way adjustment are permitted in any position.

10.4.2 Damper fluid may be pressurised.

10.4.3 Damper characteristics may only vary as a function of damper piston speed, created only by suspension movement. Any other variation of damper characteristics, such as those which vary as a function of position, frequency or acceleration, are not permitted.

10.4.4 The use of blow-off valves, inertia valves, external electronic inputs, the storage of energy or any hydraulic connections between dampers are not permitted.

## **10.5 Sprung suspension :**

Cars must be fitted with sprung suspension.

In order to avoid mass dampers, the suspension system must be so arranged that its response results only from changes in load applied to the wheels.

The springing medium must not consist solely of bolts located through flexible bushes or mountings.

There must be movement of the wheels to give suspension travel in excess of any flexibility in the attachments.

## **10.6 Steering :**

**10.6.1** The steering must consist of a mechanical link between the driver and the wheels.

**10.6.2** Four wheel steering is forbidden.

**10.6.3** The steering wheel, steering column and steering rack assembly must be subjected to an impact test. Details of this test procedure may be found in Article 16.3.

**10.6.4** No part of the steering wheel or column, nor any part fitted to them, may be closer to the driver than a plane formed by the entire rear edge of the steering wheel rim. All parts fixed to the steering wheel must be fitted in such a way as to minimise the risk of injury in the event of a driver's head making contact with any part of the wheel assembly.

## **ARTICLE 11 : BRAKES**

### **11.1 Separate circuits :**

All cars must have a brake system which has at least two separate circuits operated by the same pedal. This system must be designed so that if leakage or failure occurs in one circuit, the pedal shall still operate the brakes on at least two wheels.

Only a sole mechanical brake bias adjustment is permitted.

### **11.2 Brake discs :**

**11.2.1** Brake discs must be made from ferrous material.

**11.2.2** Brake discs must not be drilled, and must have a maximum of four grooves per side. Additionally, all solid discs must have a minimum thickness of 9.5mm and ventilated discs 15.0mm when new.

**11.2.3** The weight of a used brake disc must not be less than 1900g. The weight of a complete but used brake disc assembly must not be less than 2300g.

### **11.3 Brake calipers :**

**11.3.1** All brake calipers must be made from aluminium materials with a modulus of elasticity no greater than 80Gpa.

**11.3.2** There must be no more than four brake caliper pistons on each wheel.

**11.3.3** The weight of a brake caliper must not be less than 1200g.

### **11.4 Air ducts :**

**11.4.1** Air ducts for the purpose of cooling the front and rear brakes shall not protrude beyond:

- a) A plane parallel to the ground situated at a distance of 180mm above the horizontal wheel centre line.
- b) A plane parallel to the ground situated at a distance of 180mm below the horizontal wheel centre line.
- c) A vertical plane parallel to the inner face of the wheel rim and displaced from it by 120mm toward the car centre line.
- d) A vertical plane through the inner face of the rim away from the car centre line.

Furthermore, when viewed from the side the ducts must not protrude forwards beyond a radius of 280mm from the centre of the wheel or backwards beyond a radius of 180mm from the centre of the wheel.

The only exception to the above is one single tube which may be situated between the flat plate as defined by Article 11.4.2 and the inner face of the brake disc. The inner and outer of any cross section of the tube with a vertical plane, parallel to the car centre line must be circular or semi-circular. The maximum outer diameter of the tube is 80mm.

All measurements will be made with the inner face of the rim normal to the reference plane.

**11.4.2** In addition, the following restrictions will apply :

- a) For the fixation of air ducts to the upright, a maximum of four studs may be used. The studs must have a circular cross section with a maximum diameter of 15 mm.
- b) Except for fixations, each air duct must comprise a flat rigid plate, parallel to a vertical plane through the inner face of the rim, of a maximum thickness of 5 mm. A radius of maximum 5 mm at the edges of the plate is permitted.
- c) Each air duct may also incorporate one simple scoop for the sole purpose of guiding air into the rim.

The following restrictions apply for the scoop:

- The scoop must comprise two apertures:
  - The first aperture must face in driving direction with the steered wheels in the straight ahead position
  - The second aperture must face into the rim within a radius of 180mm from the centre of the wheel
  - The scoop may not comprise any other apertures or apertures outside of or larger than the above prescribed area
- Viewed from the top, the entire scoop must be between the flat rigid plate, as described in Article 11.4.2b), and a vertical plane parallel to the inner face of the wheel rim and displaced from it by 120mm toward the car centre line.
- Viewed from the side, no part of the scoop may protrude beyond the flat rigid plate, as described in Article 11.4.2b).
- The internal height of the first aperture, measured normal to the reference plane, must be at least 20.0 mm.
- The scoop must be solidly attached to the flat rigid plate over its entire length
- The scoop must be symmetrical to a plane normal to inner face of the wheel rim. The symmetrical plane may have a maximum angle of 15 degree to the reference plane.
- The plane defined by the above mentioned first aperture must be normal to the symmetrical plane of the scoop and normal to the car centre line

#### **11.5 Liquid cooling :**

Liquid cooling of any part of the braking system is forbidden.

#### **11.6 Brake pressure modulation :**

Anti-lock brakes and power braking are forbidden.

## **ARTICLE 12 : WHEELS AND TYRES**

### **12.1 Location :**

Complete wheels must be external to the bodywork in plan view, with the rear aerodynamic device removed.

### **12.2 Wheel material :**

All wheels must be made from homogeneous metallic materials.

### **12.3 Dimensions and weights :**

**12.3.1** Maximum complete wheel width : 295mm

Wheel bead diameter : 330mm (+/-2.5mm)

**12.3.2** These measurements will be taken horizontally at axle height.

**12.3.3** The weight of a front rim must not be less than 3700g.

The weight of a rear rim must not be less than 4200g.

### **12.4 Maximum number of wheels :**

The number of wheels is fixed at four.

### **12.5 Wheel attachment :**

A safety spring must be in place on the wheel nut throughout the event and must be replaced after each wheel change. These springs must be painted dayglo red or orange.

Alternatively, another method of retaining the wheels may be used, provided it has been approved by the FIA.

### **12.6 Pressure control valves :**

Pressure control valves on the wheels are forbidden.

### **12.7 Aerodynamic influence :**

Any device, construction or part of the wheel that is designed for the purpose of guiding or influencing the airflow through the wheel, or whose purpose is anything other than transferring load from the tyre to the wheel hub, is forbidden.

## **ARTICLE 13 : COCKPIT**

### **13.1 Cockpit opening :**

In order to ensure that the opening giving access to the cockpit is of adequate size, the template shown in Drawing 1.1 will be inserted into the survival cell and bodywork.

During this test the steering wheel, steering column, seat and all padding may be removed and:

- a) The template must be held horizontal and lowered vertically from above the car until its lower edge is 525mm above the reference plane.
- b) Referring to Drawing 1.1, the rear edge of the template must be no less than 1500mm behind the front wheel centre line.

Any measurements made from the cockpit entry template (when referred to in Articles 3.10.2, 3.13, 3.14, 13.1, 14.3.3, 15.2.2, 15.3.6, 15.3.8 and 18.7), must also be made whilst the template is held in this position.

Furthermore, the forward extremity of the cockpit opening, even if structural and part of the survival cell, must be at least 50mm in front of the steering wheel.

The driver must be able to enter and get out of the cockpit without it being necessary to open a door or remove any part of the car other than the steering wheel. When seated normally, the driver must be facing forwards and the rearmost part of his crash helmet may be no more than 125mm forward of the rear edge of the cockpit entry template.

From his normal seating position, with all seat belts fastened and whilst wearing his usual driving equipment, the driver must be able to remove the steering wheel and get out of the car within 5 seconds and then replace the steering wheel in a total of 10 seconds.

For this test, the position of the steered wheels will be determined by the scrutineer and after the steering wheel has been replaced steering control must be maintained.

### **13.2 Steering wheel :**

**13.2.1** The steering wheel must be fitted with a quick release mechanism. Its method of release must be by pulling a concentric flange installed on the steering column behind the wheel.

**13.2.2** The steering wheel rim must be continuously closed but the shape is free.

### **13.3 Internal cross section :**

The internal cross section of the cockpit from the soles of the driver's feet to behind his seat shall at no point be less than 70000mm<sup>2</sup>.

A free vertical cross section which allows the template shown in Drawing 1.2 to be passed vertically through the cockpit, must be maintained over its entire length.

The only things that can encroach on these two areas are the steering wheel and padding.

The driver, seated normally with his seat belts fastened and with the steering wheel removed must be able to raise both legs together so that his knees are past the plane of the steering wheel in the rearward direction. This action must not be obstructed by any part of the car.

### **13.4 Clutch, brake and throttle pedal :**

The clutch, brake and throttle pedal may only be operated by the driver's foot. Any device or construction that is designed to influence the clutch or brake pressure or the throttle opening by any other means is forbidden.

Furthermore, any device or construction the purpose and or effect of which is to provide non-linear brake system pressures (other than any inherent mechanical non-linearity) is forbidden.

The only exception to the above is the homologated blipper cylinder when used as designed by the FIA designated supplier.



## **ARTICLE 14 : SAFETY EQUIPMENT**

### **14.1 Fire extinguishers :**

- 14.1.1** All cars must be fitted with a fire extinguishing system from the FIA Technical List N°16 : "Extinguisher systems homologated by the FIA".
- 14.1.2** The number of nozzles in the cockpit and engine compartment must be the same as described in the installation manual (the manuals are listed on the FIA website).
- 14.1.3** Each pressure vessel must be equipped with a means of checking its pressure which may vary according to the type of extinguishant used.  
The fill pressure is indicated on the FIA label.
- 14.1.4** All parts of the extinguishing system must be situated within the survival cell and all extinguishing equipment must withstand fire.
- 14.1.5** Any triggering system having its own source of energy is permitted, provided it is possible to operate all extinguishers should the main electrical circuits of the car fail.  
The driver must be able to trigger the extinguishing system manually when seated normally with his safety belts fastened and the steering wheel in place.  
Furthermore, a means of triggering from the outside must be combined with the circuit breaker switch. It must be marked with a letter "E" in red inside a white circle of at least 50mm diameter with a red edge.
- 14.1.6** The system must work in any position, even when the car is inverted.
- 14.1.7** Extinguisher nozzles must be suitable for the extinguishant and be installed in such a way that they are not directly pointed at the driver's face.

### **14.2 Master switch :**

- 14.2.1** The driver, when seated normally with safety belt fastened and steering wheel in place, must be able to cut off all electrical circuits to the ignition, all fuel pumps and the rear light by means of a spark proof circuit breaker switch.  
This switch must be located on the dashboard and must be clearly marked by a symbol showing a red spark in a white edged blue triangle.
- 14.2.2** There must also be an exterior switch, with a horizontal handle, which is capable of being operated from a distance by a hook. This switch must be situated at the base of the main rollover structure on the right hand side. It must be clearly marked by a symbol showing a red spark in a white edged blue triangle of at least 50 mm.

### **14.3 Rear view mirrors:**

- 14.3.1** All cars must have at least two mirrors mounted so that the driver has visibility to the rear and both sides of the car.
- 14.3.2** The reflective surface of each mirror must be at least 150mm wide, this being maintained over a height of at least 50mm. Additionally, each corner may have a radius no greater than 10mm.
- 14.3.3** No part of the mirror reflective surface may be less than 250mm from the car centre line, less than 550mm forward or more than 750mm forward of the rear edge of the cockpit entry template.  
No part of the rear view mirrors, the mirror housings or the mirror mountings may be situated more than 500mm from the car centre line.

**14.3.4** The scrutineers must be satisfied by a practical demonstration that the driver, when seated normally, can clearly define following vehicles.

For this purpose, the driver shall be required to identify any letter or number, 150mm high and 100mm wide, placed anywhere on boards behind the car, the positions of which are detailed below :

- Height : From 400mm to 1000mm from the ground.  
Width : 2000mm either side of the centre line of the car.  
Position : 10m behind the rear axle line of the car.

#### **14.4 Safety belts:**

The wearing of two shoulder straps, one abdominal strap and two straps between the legs is mandatory. These straps must be securely fixed to the car and must comply with FIA standard 8853/98.

#### **14.5 Rear light:**

All cars must have a red light, in working order throughout the event, which:

- a) Is a model approved by the FIA for F3 cars.
- b) Faces rearwards at 90° to the car centre line.
- c) Is clearly visible from the rear.
- d) Is not mounted more than 100mm from the car centre line.
- e) Is at least 280mm above the reference plane.
- f) Is no less than 450mm behind the rear wheel centre line, measured to the face of the lens and parallel to the reference plane.
- g) Can be switched on by the driver when seated normally in the car.
- h) Must have a minimum peak intensity of 800 Lux covering a minimum angle of 8° vertically and 25° horizontally, when measured at a distance of 1m from the centre of the rear face at 23°C ambient temperature after 15 minutes warm up duration powered from a 12V DC supply.
- i) Should flash at maximum 4Hz frequency with a minimum 40% duty cycle.

The measurements being taken to the centre of area of the lens.

The performance of any design will be verified by the FIA Technical Department before approval.

#### **14.6 Headrests and head protection:**

**14.6.1** All cars must be equipped with three areas of padding for the driver's head which :

- a) Are so arranged that they can be removed from the car as one part.
- b) Are located by two horizontal pegs behind the driver' head and two fixings, which are clearly indicated and easily removable without tools, at the front corners.
- c) Are made from a material which is corresponding to the specification : CONFOR CF45 (Blue) or CONFOR CF45M (Blue) (FIA Technical List n°17)
- d) Are covered, in all areas where the driver's head is likely to make contact, with two plies of Aramid fibre/epoxy resin composite pre-preg material in plain weave 60gsm fabric with a cured resin content of 50% (+/-5%) by weight.  
Alternatively, one ply of 60 gsm and one ply of 170 gsm may be used.
- e) Are positioned so as to be the first point of contact for the driver's helmet in the event of an impact projecting his head towards them during an accident.

**14.6.2** The first area of padding for the driver's head must be positioned behind him and be between 75mm and 90mm thick over an area of at least 40000mm<sup>2</sup>. If necessary, and only for driver comfort, an additional piece of padding no greater than 10mm thick may be attached to this headrest provided it is made from a similar material which incorporates a low friction surface.

**14.6.3** The two further areas of padding for the driver's head must be installed each side of him. The upper surfaces of these areas of padding must be at least as high as the survival cell over their entire length.

Each area of padding must be between 75mm and 90mm thick over an area of at least 40000mm<sup>2</sup>, at least 25000mm<sup>2</sup> of which must lie directly alongside the driver's helmet. The thickness will be measured perpendicular to the car centre line.

Furthermore, any void between these areas of padding and the area described in Article 14.6.2 must also be completely filled with the same material.

If necessary, and only for driver comfort, an additional piece of padding no greater than 10mm thick may be attached to this headrest provided it is made from a similar material which incorporates a low friction surface.

**14.6.4** All of the padding described above must be so installed that if movement of the driver's head, in any expected trajectory during an accident, were to compress the foam fully at any point, his helmet would not make contact with any structural part of the car.

Furthermore, for the benefit of rescue crews the method of removal must also be clearly indicated.

**14.6.5** In order to minimise the risk of leg injury during an accident, additional areas of padding must be fitted each side of, and above, the driver's legs.

These areas of padding must :

- a) Are made from a material which is corresponding to the specification :  
CONFOR CF45 (Blue) or CONFOR CF45M (Blue) (FIA Technical List n°17)
- b) Be covered with non-flammable and non-combustible material.
- c) Be no less than 25mm thick where possible respecting the requirements of Article 13.3. Exceptions may be made in the area of bulkheads and the steering column, where the maximum thickness possible respecting the requirements of Article 13.3 must be applied.
- d) Cover the area situated between points lying 50mm behind the centre of the point at which the second roll structure test is carried out and the point of the following two, which is situated further backwards:
  - i) 425mm forward of the above mentioned point or
  - ii) 100mm behind the face of the rearmost pedal when in the inoperative position.
- e) Cover the area above the line A-A shown in Drawing 1.2.

## **14.7 Seat, seat fixing and removal :**

**14.7.1** In order that an injured driver may be removed from the car in his seat following an accident, all cars must be fitted with a seat complying with the FIA Specification for Extractable Seats in Open Cockpit Cars.

**14.7.2** If the seat is secured, it must be done so with no more than two bolts. If bolts are used they must :

- a) Be clearly indicated and easily accessible to rescue crews.
- b) Be fitted vertically.
- c) Be removable with the same tool for all teams and which is issued to all rescue crews.

**14.7.3** The seat must be equipped with receptacles which permit the fitting of belts to secure the driver and one which will permit the fitting of a neck support.

**14.7.4** The seat must be removable without the need to cut or remove any of the seat belts.

A test must be carried out on the seat when fitted to a fully representative car with the driver present. Once the buckle has been released it must be possible to extract the seat from the car without any further adjustment of the harness. The seat must be moved in a direction following the vertical axis of the car.

**14.7.5** Any seat made from foam must be covered with a non-flammable and non-combustible material.

**14.8 Head and neck supports :**

No head and neck support worn by the driver may be less 25mm from any structural part of the car when he is seated in his normal driving position.

**14.9 Towing device :**

Each car must be equipped at the rear with a sturdy towing device which must be marked in fluorescent red.

## ARTICLE 15: CAR CONSTRUCTION

### 15.1 Materials used for car construction :

- 15.1.1 The use of magnesium sheet less than 3mm thick is forbidden.
- 15.1.2 The use of titanium and ceramic materials is forbidden. Ceramic Materials (e.g. Al<sub>2</sub>O<sub>3</sub>, SiC, B<sub>4</sub>C, Ti<sub>5</sub>Si<sub>3</sub>, SiO<sub>2</sub>, Si<sub>3</sub>N<sub>4</sub>) – These are inorganic, non metallic solids.

In exception to the above, the use if ceramic materials is allowed for brake pad friction materials.

- 15.1.3 No parts of the car may be made from metallic materials with a beryllium content greater than 3%w/w.
- 15.1.4 Within composite structures, the strain-to-failure of any fibrous reinforcing material must not be less than 1.5%.
- 15.1.5 The use of carbon or aramid fibre reinforcing materials in composite structures is forbidden except in the survival cell, frontal impact absorbing structure, rear impact absorbing structure, roll over structures, air ducts following Article 11.4, car battery housing, bodywork more than 280mm forward the front wheel centre line and bodywork more than 150mm behind the rear wheel centre line.
- 15.1.6 Any repairs to the survival cell or nosebox must be carried out in accordance with the manufacturer's specifications, in a repair facility approved by the manufacturer.
- 15.1.7 The car may not be used in another event until the technical passport has been completed satisfactorily.

### 15.2 Roll structures :

- 15.2.1 The basic purpose of safety structures is to protect the driver. This purpose is the primary design consideration.
- 15.2.2 All cars must have two roll structures.

The highest point of the principal roll structure may be no more than 30mm behind the rear edge of the cockpit entry template. The secondary structure must be in front of the steering wheel but no more than 250mm forward of the top of the steering wheel rim in any position.

The two roll structures must be of sufficient height to ensure the driver's helmet and his steering wheel are at least 70mm and 50mm respectively below a line drawn between their highest points at all times.

- 15.2.3 The principal structure must pass a static load test details of which may be found in Article 17.1.

Furthermore, each car manufacturer must supply detailed calculations which clearly show that the principal structure is capable of withstanding the same load when the longitudinal component is applied in a forward direction. Alternatively, and only following a request from the car manufacturer, the principal roll structure may be subjected to a further static load test using the same procedure as laid out in Article 17.1, but carried out in a forward direction.

The secondary structure must be capable of withstanding a vertical load of 75kN applied to the top of the structure. Each car manufacturer must supply detailed calculations which clearly show that the structure is capable of withstanding the vertical load of 75kN. Alternatively, and only following a request from the car manufacturer, the secondary roll structure may be subjected to a static load test, details of which may be found in Article 17.2.

- 15.2.4 The design concept of the roll structures required by Article 15.2.2 shall be free. However, the principal roll structure must have a minimum structural cross section, in vertical projection, of 10000mm<sup>2</sup>, across a horizontal plane passing 50mm lower than it's highest point.
- 15.2.5 An additional structure must be fitted underneath the principal roll structure on top of the survival cell. The highest point of this structure must be at least 825mm above the reference plane.

The additional structure must have minimum structural cross sections, in vertical projection, of 14,000mm<sup>2</sup> and 9,000mm<sup>2</sup> respectively across horizontal planes passing 800mm and 825mm above the reference plane. The cross section of the structure, in vertical projection, may not diminish below the horizontal plane 825mm above the reference plane.

Each car manufacturer must supply detailed calculations which clearly show that this additional structure is capable of withstanding the static load test details of which may be found in Article 17.1.

### **15.3 Survival cell specifications :**

**15.3.1** In order that every survival cell is readily identifiable by scrutineers, each one produced must incorporate three permanently embedded FIA approved transponders which are accessible for verification at any time.

**15.3.2** The survival cell must extend from behind the fuel tank in a rearward direction to a point at least 150mm in front of the driver's feet, with his feet resting on the pedals and the pedals in the inoperative position.

The survival cell must have an opening for the driver, the minimum dimensions of which are given in Article 13.1. Any other openings in the survival cell must be of minimum size to allow access to mechanical components.

The safety structures described in Article 15.2 must be a part of the survival cell or solidly attached to it.

**15.3.3** All engine fixation points on the survival cell as shown in Drawing 2.1 must lie in one plane which is normal to the reference plane and normal to the car centre line. A tolerance of 2 mm in X-direction (along the car centre line) is permitted for manufacturing tolerances and the use of steel bushes.

**15.3.4** When he is seated normally, the soles of the driver's feet, resting on the pedals in the inoperative position, shall not be situated to the fore of the vertical plane passing through the front wheel centre line.

Should the car not be fitted with pedals, the driver's feet at their maximum forward extension shall not be situated to the fore of the above mentioned vertical plane.

**15.3.5** In front of the survival cell, an impact absorbing structure must be fitted. This structure need not to be an integral part of the survival cell but must be solidly attached to it.

No part of this structure may lie more than 625mm above the reference plane and its forward-most point must not be less than 1050mm forward of the front wheel centre line.

It must have :

- a) A single external vertical cross-section, perpendicular to the car centre line, of more than 9000mm<sup>2</sup> at a point 50mm behind its forward-most point. No part of this cross-section may lie less than 130mm above the reference plane and its overall width must not exceed 155mm.
- b) A single external vertical cross-section, perpendicular to the car centre line, of more than 20000mm<sup>2</sup> at a point 150mm behind its forward-most point. The overall width of this cross-section must not exceed 330mm.

When measuring these sections, only parts between the highest point of the section and 100mm vertically below this point, may be considered.

Each external vertical cross-section, taken perpendicular to the car centre line between points 150mm behind the forward-most point of the structure and 250mm forward of the front wheel centre line, must be a single section with an area which exceeds a value given by a linear taper from 20000mm<sup>2</sup> to 80000mm<sup>2</sup> respectively. The only exception that may be made is for its attachment to the survival cell.

The first 150 mm behind its forwardmost point must be exchangeable and/or repairable without exchanging the complete impact-absorbing structure.

**15.3.6** The minimum external width of the survival cell is 340mm. This width must be maintained for a minimum height of 250mm along the whole length of the survival cell. Measured from the reference plane the minimum height of the survival cell between the two rollover structures is 550mm.

When the test referred to in Article 13.1 is carried out and the template is in position with its lower edge 525mm above the reference plane, the shape of the survival cell must be such that no part of it is visible when viewed from either side of the survival cell and from behind the survival cell.

The parts of the survival cell which are situated each side of the driver's head must be no more than 550mm apart.

In order to ensure that the driver's head is not unduly exposed and for him to maintain good lateral visibility he must, when seated normally and looking straight ahead with his head as far back as possible, have his eye visible when viewed from the side. The centre of gravity of his head must lie below the top of the survival cell at this position. When viewed from the side of the car, the centre of gravity of the driver's head will be deemed to be the intersection of a vertical line passing through the centre of his ear and a horizontal line passing through the centre of his eye.

The minimum height of the survival cell behind the driver is 750mm from the reference plane. This height must be maintained for at least 100mm either side of the car centre line and from the rear edge of the cockpit opening to a point at least 150 mm rearwards on the car centre line. Outside this prescribed minimum area of 200mm x 150mm the height may decrease at a linear rate to a height of 655mm from the reference plane with a maximum angle of 70° measured parallel to the reference plane and normal to the car centre line and must join the horizontal line at 655mm with a radius of at least 20mm.

The surfaces joining the prescribed minimum area of 200 mm x 150 mm at a height of 750mm from the reference plane and the area of the survival cell at the height of 655mm from the reference plane must be flat or may have a concave radius, this radius being applied after the straight line with the correct angle connecting the two areas has been defined.

From the rear edge of the cockpit entry template until the rear end of the survival cell, each cross section of the survival cell taken normal to the car centre line must :

- a) Be symmetrical about the car centre line on its external shape.
- b) Have a minimum height of 655mm maintained over a total width of at least than 520mm.

Exception to this might be made for any opening in this area accessing the fuel tank and /or refuelling connectors.

**15.3.7** In order to give additional protection to the driver in the event of a side impact a flat test panel of uniform construction, which is designed and constructed in order to represent a section of the survival cell sides, must pass a strength test. Details of the test procedure may be found in Article 18.4.

With the exception of local re-enforcement and/or inserts, the lateral parts of the survival cell must be manufactured to the same specification as a single panel which satisfies the requirements of Article 18.4. Parts to this tested specification must cover an area which :

- a) Begins at least 250mm high at the front wheel centre line.
- b) Tapers at a linear rate to at least 350mm high at the front of the cockpit opening and remain at this height to the rear of the survival cell.
- c) Is no less than 100mm above the reference plane between the front of the cockpit opening and the rear of the survival cell.

Any openings or cut outs in this area must be of the minimum size to allow access to mechanical components.



15.3.8 Once the requirements of Articles 15.2.3, 15.3.2, 15.3.4, 15.3.6, 15.3.7, 15.4.1, 15.4.3, 15.4.4, 16.1, 17.1, 17.2, 18.1, 18.2, 18.3, 18.4, 18.6 and 18.7 have been met, panels no less than 6.2mm thick must then be permanently attached to the survival cell sides. These panels must :

- a) In a longitudinal sense, cover the area lying between two vertical planes, one 125mm forward of the cockpit entry template and one 50mm to the rear of the template. A 50mm horizontal linear taper may be included at both ends.
- b) In a vertical sense, cover an area which has been constructed in accordance with Article 15.3.7.
- c) Be constructed from 16 plies of Zylon and two plies of carbon according to the following precise lay-up details :

The panel shall be constructed from Torayca T1000G or a FIA approved substitute and Toyobo High Modulus Zylon (PBO) fibres, impregnated with a toughened, elevated cure temperature, epoxy resin system. If different resins are used for the T1000G or the FIA approved substitute and Zylon reinforced plies, they must be co-curable. The construction of the panel shall be quasi isotropic and shall avoid darts, joins or gaps in any ply, apart from those required to cover complex geometry, cut outs for wiring and side impact structures. Rebates shall be permitted in the outer four Zylon plies only, for the attachment of external bodywork. Any joins required in each  $\pm 45$  degree ply, to cater for a finite material roll width, shall overlap by at least 10mm and be staggered through the laminate, to avoid super-imposing. The panel must be cured to the manufacturer's recommended cure cycle. The panel will be bonded to the chassis over the entire surface area with the prescribed film or paste adhesive.

Zylon HM – 300gsm :

Minimum average weight [285]gsm, 6K fibres per tow, in a 2 X 2 twill weave style, impregnated with an epoxy resin.

T1000G or FIA approved substitute – 280gsm :

Minimum average weight [269]gsm, 12K fibres per tow, 2 X 2 twill weave or 5 harness satin weave, impregnated with an epoxy resin.

Matrix System :

MTM49-3 or Cycom 2020 epoxy resin. Alternatively, it is permissible to replace the approved resin system with the primary matrix system used for the homologated side intrusion panel.

Adhesive (to chassis) :

Film adhesive 150gsm 3M AF163-2 or paste adhesive 3M 9323 B/A

Stacking Sequence (0 degree represents longitudinal axis of the chassis) :

- *Outer surface.*
- 1 ply T1000G or FIA approved substitute (0/90)
- 16 plies Zylon ( $\pm 45, 0/90$ )<sub>8</sub> or ( $\pm 45, 0/90, 0/90, \pm 45$ )<sub>4</sub>
- 1 ply T1000G or FIA approved substitute (0/90)
- *Inner surface*

Thickness :

The minimum thickness of the cured panel, excluding the adhesive, shall be [6.2]mm.

Area Weight :

The minimum area weight of the cured panel, excluding the adhesive, shall be [8700]gsm.

Voids :

The panel shall be essentially void free.

Examples of Compliant Materials :

1. Supplied by Cytec :  
Zylon HM-300gsm/2x2 twill with Cycom2020 epoxy resin (NOM 42% by weight).  
T1000G-12K or FIA approved substitute 280gsm/2x2twill or 5 harness weave with Cycom2020 epoxy resin (NOM 42% by weight).
2. Supplied by ACG :  
Zylon HM-300gsm/2x2 twill with MTM49-3 epoxy resin (NOM 43% by weight).  
T1000G-12K or FIA approved substitute 280gsm/2x2twill or 5 harness weave with MTM49-3 epoxy resin (NOM 40% by weight).
3. Supplied by TenCate  
Zylon HM-300gsm/2x2 twill with E750-02 epoxy resin (NOM 42% by weight)  
T1000G-12K 280gsm/2x2twill or 5 harness weave with E750-02 epoxy resin (NOM 42% by weight).
4. Supplied by Delta Tech S.p.a  
Zylon HM-300gsm/2x2 twill with DT195N epoxy resin (NOM 42% by weight)  
T1000G-12K 280gsm/2x2twill or 5 harness weave with DT195N epoxy resin (NOM 42% by weight).

**15.3.9** Once the requirements of Articles 15.2.3, 15.3.2, 15.3.4, 15.3.6, 15.3.7, 15.4.1, 15.4.3, 15.4.4, 16.1, 17.1, 17.2, 18.1, 18.2, 18.3, 18.4, 18.6 and 18.7 have been met one further panel, which may be made in a maximum of three parts but which is no less than 3.0mm thick, must then be permanently attached to the survival cell.

This panel must :

- a) In a longitudinal sense, cover the area lying between a vertical plane 100mm forward of the front wheel centre line and a vertical plane 950mm forward of the rear edge of the cockpit entry template. A 25mm horizontal linear taper may be included at both ends.
- b) In a vertical sense, cover every part of the outer skin of the survival cell in the area lying between two horizontal planes 225mm and 550mm above the reference plane.
- c) If made in more than one part, have all adjacent parts overlapping by a minimum of 25mm. These overlaps may include linear tapers in the thickness of both parts.
- d) Overlap the panel defined by Article 15.3.8 along all joining edges by a minimum of 25mm. These overlaps may include linear tapers in the thickness of both parts.
- e) Be constructed from seven plies of Zylon and two plies of carbon according to the following precise lay-up details :

The panel shall be constructed from Torayca T1000G and Toyobo High Modulus Zylon (PBO) fibres, impregnated with a toughened, elevated cure temperature, epoxy resin system. If different resins are used for the T1000G and Zylon reinforced plies, they must be co-curable. The construction of the panel shall be quasi isotropic and shall avoid darts, joins or gaps in any ply, apart from those required to cover complex geometry, cut outs for wiring and side impact structures. Rebates shall be permitted in the outer three Zylon plies only, for the attachment of external bodywork. Any joins required in each  $\pm 45$  degree ply, to cater for a finite material roll width, shall overlap by at least 10mm and be staggered through the laminate, to avoid super-imposing. The panel must be cured to the manufacturer's recommended cure cycle. The panel will be bonded to the chassis over the entire surface area with the prescribed film or paste adhesive.

Zylon HM – 300gsm :

Minimum average weight [285]gsm, 6K fibres per tow, in a 2 X 2 twill weave style, impregnated with an epoxy resin.

T1000G or FIA approved substitute – 280gsm :

Minimum average weight [269]gsm, 12K fibres per tow, 2 X 2 twill weave or 5 harness satin weave, impregnated with an epoxy resin.

Matrix System :

MTM49-3 or Cycom 2020 epoxy resin. Alternatively, it is permissible to replace the approved resin system with the primary matrix system used for the homologated side intrusion panel.

Adhesive (to chassis) :

Film adhesive 150gsm 3M AF163-2 or paste adhesive 3M 9323 B/A

Stacking Sequence (0 degree represents longitudinal axis of the chassis) :

- *Outer surface*
- 1 ply T1000G or FIA approved substitute (0/90)
- 7 plies Zylon ( $\pm 45$ , 0/90,  $\pm 45$ , 0/90,  $\pm 45$ , 0/90,  $\pm 45$ )
- 1 ply T1000G or FIA approved substitute (0/90)
- *Inner surface*

Thickness :

The minimum thickness of the cured panel, excluding the adhesive, shall be [3.0]mm.

Area Weight :

The minimum area weight of the cured panel, excluding the adhesive, shall be [8700]gsm.

Voids :

The panel shall be essentially void free.

#### Examples of Compliant Materials :

1. Supplied by Cytec  
Zylon HM-300gsm/2x2 twill with Cycom2020 epoxy resin (NOM 42% by weight)  
T1000G-12K 280gsm/2x2twill or 5 harness weave with Cycom2020 epoxy resin (NOM 42% by weight)
2. Supplied by ACG  
Zylon HM-300gsm/2x2 twill with MTM49-3 epoxy resin (NOM 43% by weight)  
T1000G-12K 280gsm/2x2twill or 5 harness weave with MTM49-3 epoxy resin (NOM 40% by weight)
3. Supplied by TenCate  
Zylon HM-300gsm/2x2 twill with E750-02 epoxy resin (NOM 42% by weight) T1000G-12K 280gsm/2x2twill or 5 harness weave with E750-02 epoxy resin (NOM 42% by weight).
4. Supplied by Delta Tech S.p.a  
Zylon HM-300gsm/2x2 twill with DT195N epoxy resin (NOM 42% by weight) T1000G-12K 280gsm/2x2twill or 5 harness weave with DT195N epoxy resin (NOM 42% by weight).

f) Be permanently attached to the survival cell with an appropriate adhesive which has been applied over its entire surface including all overlapping joints.

Cut-outs in this panel from the rear of the panel to the front wheel centre line totalling 15000mm<sup>2</sup> per side and from the front wheel centre line to the front of the panel totalling 4000mm<sup>2</sup> per side will be permitted for fitting around wiring loom holes and essential fixings.

#### **15.4 Survival cell safety requirements :**

- 15.4.1 The survival cell and the frontal impact absorbing structure described in Article 15.3.5 must pass an impact test against a solid vertical barrier placed at right angles to the car centre line. Details of the test procedure may be found in Article 16.1.
- 15.4.2 An impact absorbing structure must be fitted behind the gearbox symmetrically about the car centre line with its rearmost point between 550mm and 620mm behind the rear wheel centre line. It must also have a minimum external cross section, in horizontal projection, of 9000mm<sup>2</sup> at a point 50mm forward of its rearmost point. When calculating this area only those parts situated less than 100mm from the car centre line may be considered and the cross section may not diminish forward of this point.

The structure which was subjected to the test described in Article 18.5 must pass an impact test and be constructed from materials which will not be substantially affected by the temperatures it is likely to be subjected to during use. Details of this test procedure may be found in Article 16.2.

**15.4.3** The survival cell must be subjected to three separate lateral static load tests :

- 1) In the cockpit area on a vertical plane passing through the centre of the seat belt lap strap fixing.
- 2) In the fuel tank area on a vertical plane passing through the centre of area of the fuel tank in side elevation.
- 3) On a vertical plane passing halfway between the front wheel axis and the top of the first rollover structure.

Details of the test procedures may be found in Article 18.2.

**15.4.4** To test the attachments of the frontal and rear impact absorbing structures static side load tests must be carried out. Details of these test procedures may be found in Articles 18.3 and 18.5.

**15.4.5** In order that every frontal impact absorbing structure is readily identifiable by scrutineers, each one produced must incorporate one permanently embedded FIA approved transponders which are accessible for verification at any time.

## ARTICLE 16 : IMPACT TESTING

### 16.1 Frontal test :

All parts which could materially affect the outcome of the test must be fitted to the test structure which must be solidly fixed to the trolley through its engine mounting points but not in such a way as to increase its impact resistance.

The fuel tank must be fitted and must be full of water.

A dummy weighing at least 75kg must be fitted with safety belts described in Article 14.4 fastened. However, with the safety belts unfastened, the dummy must be able to move forwards freely in the cockpit.

The extinguishers, as described in Article 14.1 must also be fitted.

For the purposes of this test, the total weight of the trolley and test structure shall be 600kg and the velocity of impact 14 metres/sec.

The resistance of the test structure must be such that during the impact :

- a) The average deceleration over the first 150mm of deformation does not exceed 5g.
- b) The average deceleration of the trolley does not exceed 25g.
- c) The peak deceleration in the chest of the dummy does not exceed 60g for more than 3ms.
- d) The average deceleration over the first 150mm of deformation exceeds 2.5g.

Furthermore, there must be no damage to the survival cell or to the mountings of the safety belts or fire extinguishers.

This test must be carried out in the presence of an FIA technical delegate in an approved testing centre on the survival cell subjected to the tests described in Articles 17.1, 17.2, 18.2, 18.3, 18.4, 18.6 and 18.7, and on a frontal impact absorbing structure identical to the one which was subjected to the test described in Article 18.3.

### 16.2 Rear test :

All parts which will be fitted behind the rear face of the engine 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 structure and the gearbox must be solidly fixed to the ground and a solid object, having a mass of 560kg and travelling at a velocity of 10m/s, will be projected into it.

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

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

The resistance of the test structure must be such that during the impact :

- a) The average deceleration of the object does not exceed 35g.
- b) The maximum deceleration does not exceed 60g for more than a cumulative 3ms, this being measured only in the direction of impact.

Furthermore, all structural damage must be contained within the area behind the rear wheel centre line.

### **16.3 Steering column test :**

For the purposes of this test, these parts must be fitted to a representative test structure, any other parts which could materially affect the outcome of the test must also be fitted. The test structure must be solidly fixed to the ground and a solid object, having a mass of 8kg and travelling at a velocity of 7m/s, will be projected into it.

The object used for this test must be hemispherical with a diameter of 165mm.

For the test, the centre of the hemisphere must strike the structure at the centre of the steering wheel along the same axis as the main part of the steering column.

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

The resistance of the test structure must be such that during the impact the peak deceleration of the object does not exceed 80g for more than 3ms.

After the test the steering wheel quick release mechanism must still function normally.

## **ARTICLE 17 : ROLL STRUCTURE TESTING**

### **17.1 Principal roll structure test :**

The principal roll structure shall be subjected to a static load test. A load equivalent to 13.2kN laterally, 49.5kN longitudinally in a rearward direction and 66kN vertically, must be applied to the top of the structure through a rigid flat pad which is 200mm in diameter and perpendicular to the loading axis.

During the test, the roll structure must be attached to the survival cell which is supported on its underside on a flat plate, fixed to it through its engine mounting points and wedged laterally, but not in a way as to increase the resistance of the structure being tested.

Under the load, the deformation must be less than 50mm, measured along the loading axis and any structural failure limited to 100mm below the top of the roll structure, measured vertically.

This test must be carried out in the presence of an FIA technical delegate and using measuring equipment verified by the FIA.

### **17.2 Secondary roll structure test :**

The secondary roll structure may be subjected to a static load test (see Article 15.2.3). A vertical load of 75kN must be applied to the top of the structure using a rigid flat pad which is 100mm in diameter and perpendicular to the loading axis.

Under the load, the deformation must be less than 50mm, measured along the loading axis and any structural failure limited to 100mm below the top of the roll structure, measured vertically.



## **ARTICLE 18 : STATIC LOAD TESTING**

### **18.1 Conditions applicable to all static load tests :**

**18.1.1** The static load tests in Articles 18.2, 18.3, 18.4, 18.5, 18.6 and 18.7 must be carried out in the presence of an FIA technical delegate and using measuring equipment verified by the FIA.

Any significant modification introduced into any of the structures tested shall require that part to undergo a further test.

**18.1.2** In order to ensure all survival cells are manufactured in the same way, each constructor must submit the weight of every survival cell produced. These weights will be compared with that of the survival cell which was subjected to the tests in Articles 18.2, 18.3, 18.4, 18.6 and 18.7. If any survival cell weighs less than 95% of the one previously tested, it will then have to be subjected to the tests above.

The FIA reserves the right to carry out the static load tests in Articles 17.1, 18.2, 18.3, 18.4, 18.6 and 18.7 at random on any other chassis produced by the manufacturer.

These tests will be carried out with 80% of the load referred to in these Articles and during these tests the deflection of the reference chassis may not be exceeded by more than 20%.

### **18.2 Survival cell side tests :**

For the tests described in Article 15.4.3, a pad 100mm long and 300mm high, with a maximum radius on all edges of 3mm and conforming to the shape of the survival cell, shall 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. Rubber 3mm thick may be used between the pads and the survival cell.

A constant transverse horizontal load of 20kN shall be applied, in less than 3 minutes, to the pads at their centre of area through a ball jointed junction, and maintained for a minimum of 30 seconds.

Under these load conditions, there shall be no structural failure of the inner or outer surfaces of the survival cell and permanent deformation must be less than 1mm after the load has been released for 1 minute. The deformation will be measured at the top of the pads across the inner surfaces. In test 1, deflection across the inner surfaces of the survival cell must not exceed 20mm.

### **18.3 Nose push off test :**

To test the attachments of the frontal impact absorbing structure to the survival cell, a static side load test shall be performed on a vertical plane passing 400mm in front of the front wheel axis.

A constant transversal horizontal load of 30kN must be applied to one side of the impact absorbing structure using a pad identical to the one used in the lateral tests in Article 18.2. The centre of area of the pad must pass through the plane mentioned above and the mid point of the height of the structure at that section.

After 30 seconds of application, there must be no failure of the structure or of any attachment between the structure and the survival cell.

During the test the survival cell must be resting on a flat plate and secured to it solidly but not in a way that could increase the strength of the attachments being tested.

### **18.4 Side intrusion test :**

**18.4.1** The test must be carried out in accordance with FIA Test Procedure 02/00, in the presence of an FIA technical delegate and by using measuring equipment which has been calibrated to the satisfaction of the FIA technical delegate.

**18.4.2** The test panel must be 500mm x 500mm and will be tested by forcing a rigid truncated cone through the centre of the panel at a rate of 2mm (+/-1mm) per second until the displacement exceeds 150mm.

During the first 100mm of displacement the load must exceed 150kN and the energy absorption must exceed 6000J. There must be no damage to the fixture or border before these requirements have been met.

#### **18.5 Rear impact structure push off test :**

To test the attachments of the rear impact structure to the gearbox, a static side load test shall be performed. During the test the gearbox and the structure must be solidly fixed to the ground but not in a way that could increase the strength of the attachments being tested.

A constant transversal horizontal load of 30kN must then be applied to one side of the impact absorbing structure, using a pad identical to the ones used in the lateral tests in Article 18.2, at a point 470mm behind the rear wheel centre line.

The centre of the pad area must pass through the plane mentioned above and the mid point 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.

#### **18.6 Fuel tank floor test :**

A further static load test must be carried out on the survival cell from beneath the fuel tank. A pad of 200mm diameter must be placed in the centre of area of the fuel tank and a vertical upwards load of 10kN applied in less than 3 minutes through a ball jointed junction. The load must be maintained for a minimum of 30 seconds.

Under these loads conditions, there must be no structural failure of the inner or outer surfaces of the survival cell and permanent deformation must be less than 0.5mm after the load has been released for 1 minute the measurement being taken at the centre of area of the pad.

#### **18.7 Cockpit rim test :**

A further static load test must be carried out on the survival cell. Two pads, each of which is 100mm in diameter, must be placed on both sides of the cockpit rim with their upper edges at the same height as the top of the cockpit side with their centres at a point 250mm forward of the rear edge of the cockpit entry template longitudinally. A constant transverse horizontal load of 15kN will then be applied at 90° to the car centre line, in less than 3 minutes, through a ball jointed junction. The load must be maintained for a minimum of 30 seconds.

Under the load, there must be no structural failure of the inner or outer surfaces of the survival cell and the total deflection must not exceed 20mm. The permanent deformation must be less than 1.0mm after the load has been released for 1 minute, the measurements being taken at the centre of area of the pad.

## **ARTICLE 19 : FUEL**

### **19.1 Fuel :**

The fuel must comply with ISC Appendix J Article 252.9.1.

### **19.2 Air :**

Only air may be mixed with the fuel as an oxidant.

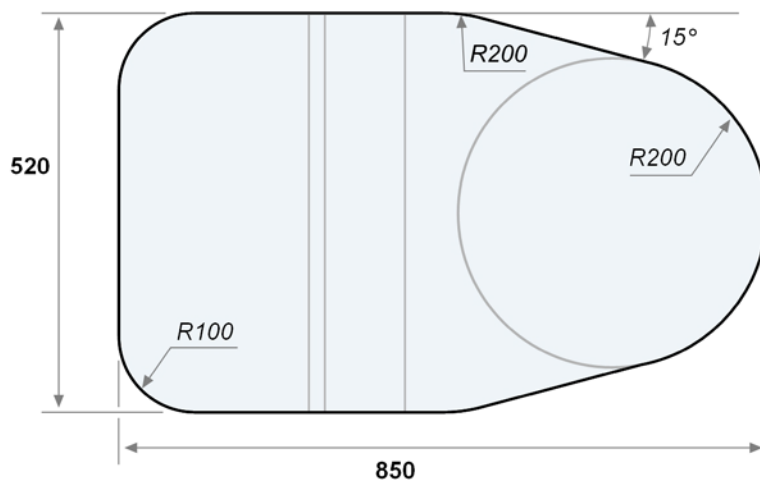
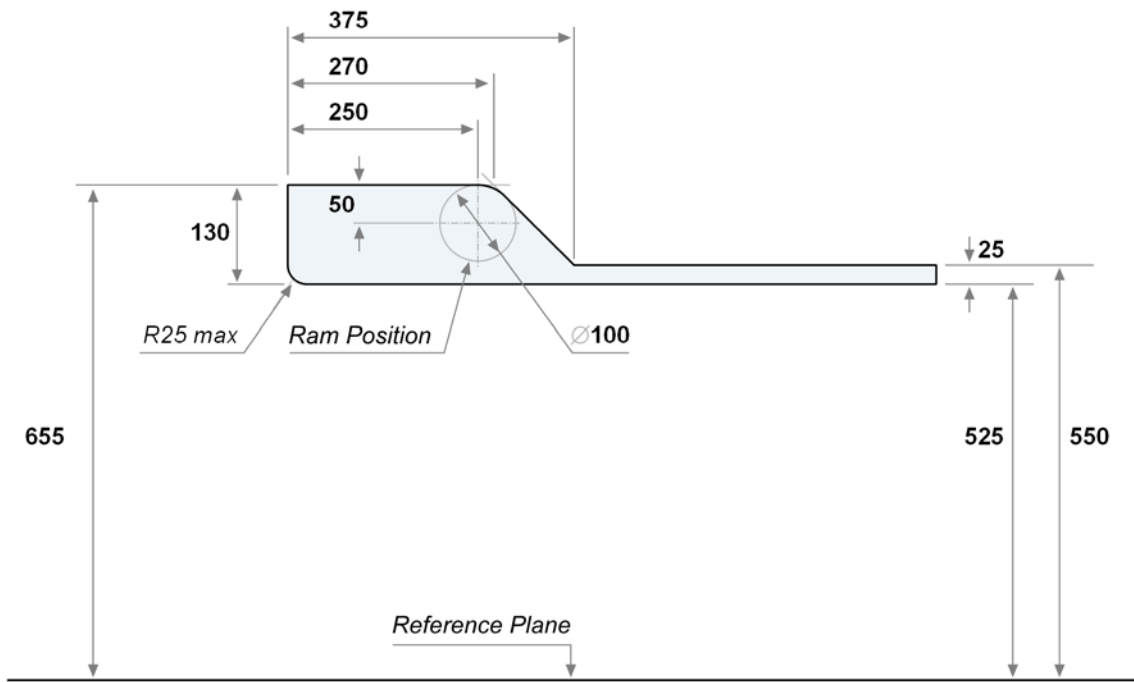
## **ARTICLE 20 : FINAL TEXT**

The final text for these regulations shall be the English version which will be used should any dispute arise over their interpretation.

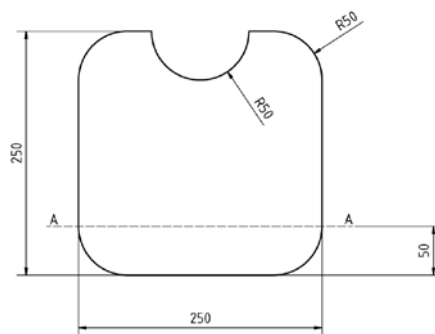
Headings and typeface in this document are for ease of reference only and do not form part of these Technical Regulations.

# **APPENDIX 1**

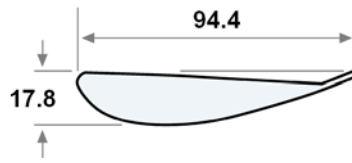
## **CHASSIS RELATED DRAWINGS**



Drawing 1.1



Drawing 1.2



**Drawing 1.3**

Points for aerofoil section number 1, all dimensions are in millimetres (see Drawing 1.3):

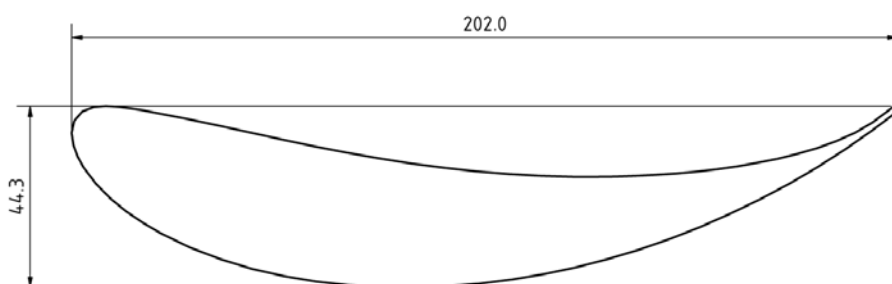
1	94.44	-01.37	14	01.22	-00.97	27	08.18	-13.18	40	56.49	-13.87
2	93.90	-00.00	15	00.61	-01.68	28	09.80	-14.02	41	60.76	-12.68
3	91.57	-00.89	16	00.20	-02.54	29	11.81	-14.86	42	65.02	-11.43
4	89.20	-01.78	17	00.00	-03.48	30	14.38	-15.70	43	69.27	-10.11
5	86.84	-02.64	18	00.08	-04.42	31	17.65	-16.53	44	73.48	-08.76
6	84.48	-03.51	19	00.41	-05.28	32	21.51	-17.22	45	77.70	-07.37
7	83.67	-03.73	20	00.84	-06.10	33	25.76	-17.65	46	81.92	-05.94
8	82.86	-03.91	21	01.27	-06.81	34	30.18	-17.78	47	86.11	-04.45
9	82.02	-03.99	22	01.91	-07.62	35	34.62	-17.60	48	90.27	-02.92
10	81.18	-03.99	23	02.97	-08.81	36	39.04	-17.17	49	94.44	-01.37
11	03.84	-00.03	24	04.22	-10.08	37	43.43	-16.56			
12	02.90	-00.10	25	05.49	-11.23	38	47.83	-15.80			
13	02.01	-00.43	26	06.78	-12.27	39	52.17	-14.91			



**Drawing 1.4**

Points for aerofoil section number 2, all dimensions are in millimetres (see Drawing 1.4):

1	14.78	-02.90	17	69.72	-00.05	33	145.80	-04.19	49	15.49	-22.56
2	16.66	-02.67	18	74.32	-00.10	34	151.41	-04.47	50	10.01	-19.41
3	18.80	-02.41	19	79.60	-00.20	35	154.10	-04.50	51	05.41	-15.77
4	23.34	-01.93	20	85.24	-00.36	36	155.07	-04.27	52	02.67	-12.90
5	28.12	-01.45	21	90.88	-00.53	37	155.91	-03.78	53	00.53	-09.91
6	32.87	-01.04	22	96.52	-00.76	38	160.99	00.00	54	00.13	-08.94
7	37.34	-00.71	23	102.13	-01.02	39	161.75	-00.94	55	00.03	-07.93
8	40.62	-00.53	24	107.77	-01.32	40	139.24	-15.60	56	00.18	-06.96
9	43.89	-00.36	25	113.41	-01.65	41	114.15	-25.63	57	00.56	-06.20
10	47.17	-00.23	26	119.02	-02.01	42	98.96	-29.16	58	01.25	-05.54
11	50.44	-00.10	27	124.66	-02.41	43	83.67	-30.91	59	02.29	-04.95
12	53.67	-00.05	28	130.28	-02.85	44	72.57	-31.32	60	04.01	-04.45
13	56.79	00.00	29	135.89	-03.33	45	61.44	-31.27	61	06.78	-03.94
14	59.79	00.00	30	138.58	-03.56	46	50.34	-30.71	62	10.44	-03.43
15	62.66	00.00	31	140.97	-03.79	47	39.27	-29.67	63	14.78	-02.90
16	65.84	00.00	32	143.53	-04.01	48	27.15	-27.18			

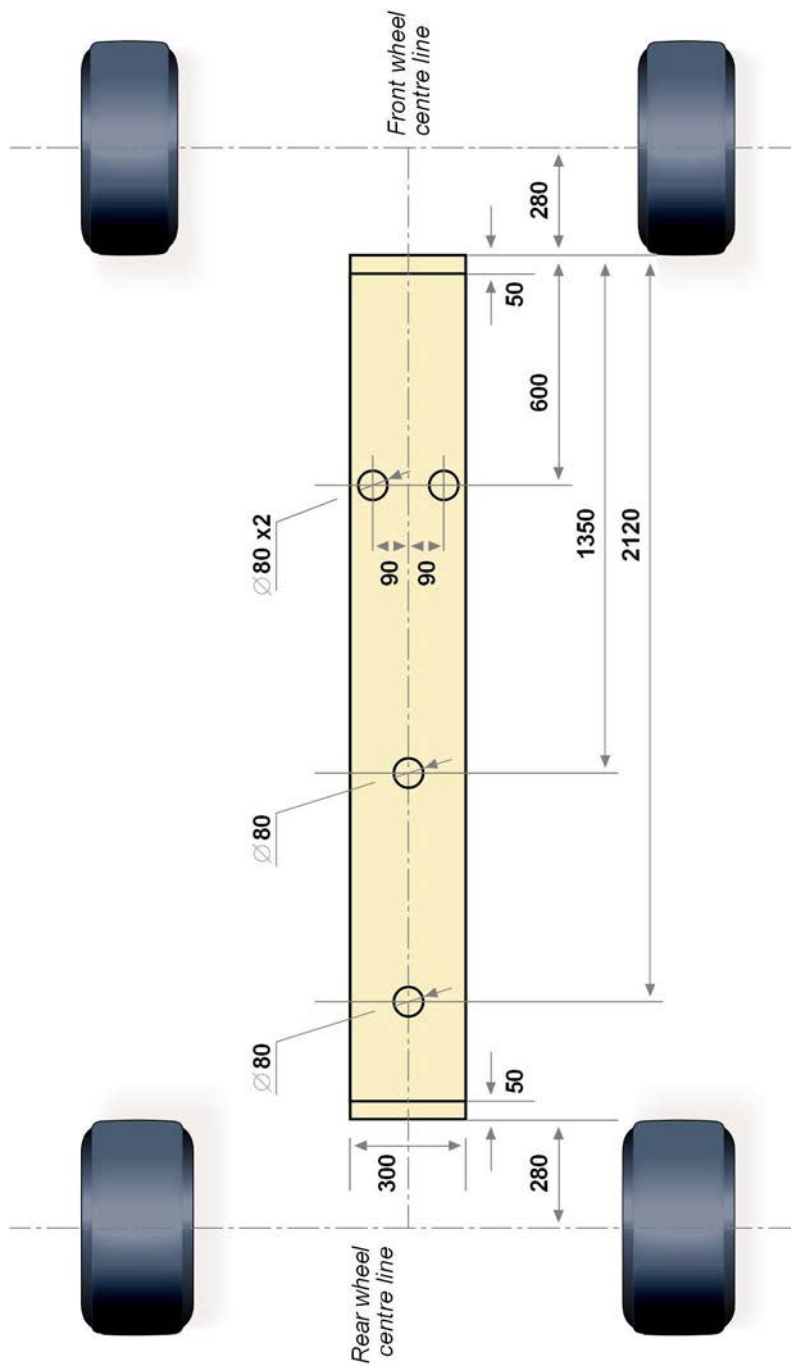


**Drawing 1.5**

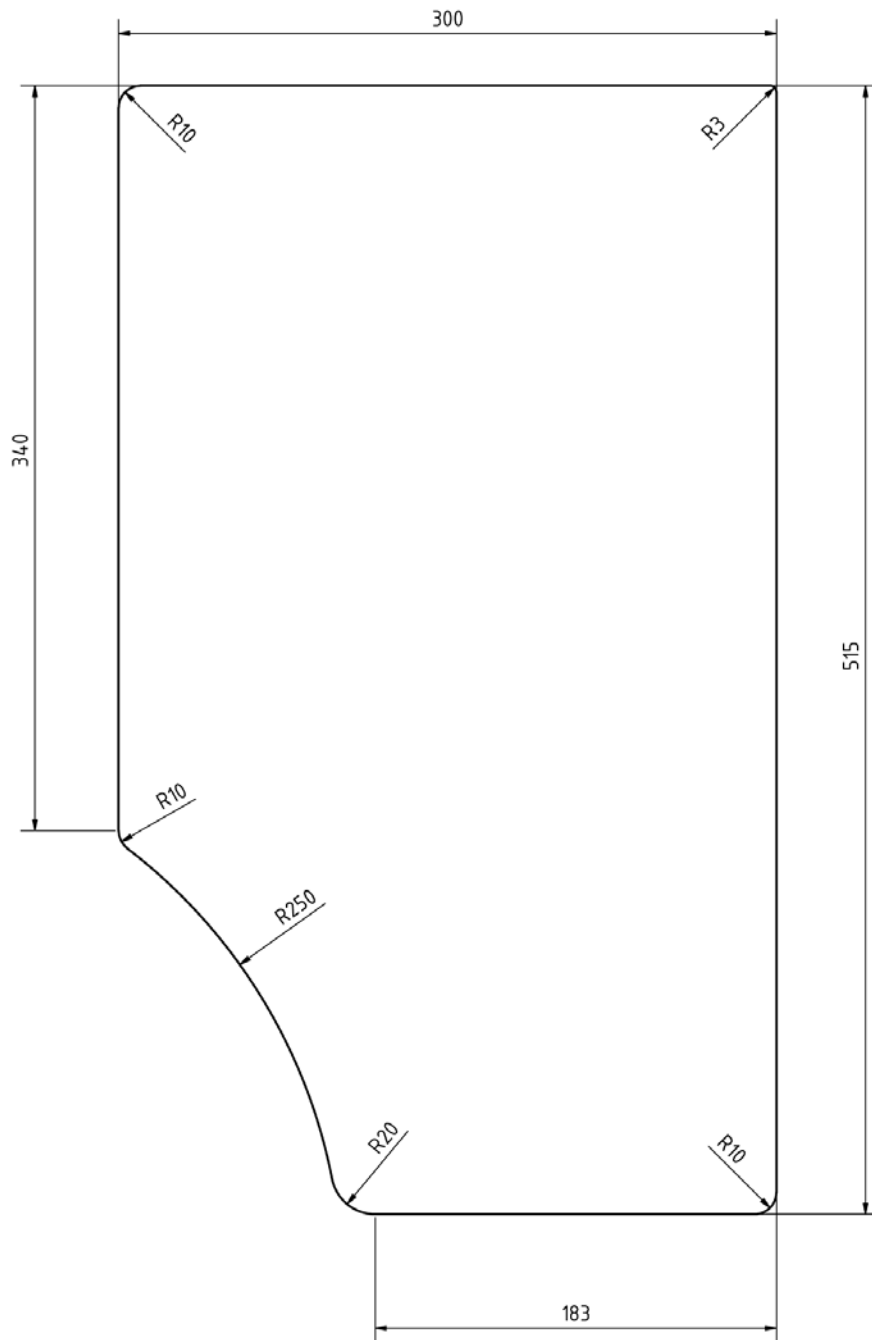
Points for aerofoil section number 3, all dimensions are in millimetres (see Drawing 1.5):

1	00.00	-06.55	19	98.89	-15.93	37	195.79	-03.99	55	91.74	-44.02
2	00.60	-03.61	20	106.87	-16.58	38	198.61	-01.92	56	83.74	-44.31
3	02.57	-01.35	21	114.85	-17.02	39	201.15	00.00	57	75.73	-44.23
4	05.37	-00.27	22	122.85	-17.24	40	202.05	-01.20	58	67.74	-43.75
5	08.36	00.00	23	127.85	-17.26	41	195.65	-06.01	59	59.78	-42.85
6	11.36	-00.16	24	132.85	-17.19	42	189.08	-10.59	60	51.89	-41.51
7	14.33	-00.53	25	137.85	-17.03	43	182.33	-14.90	61	44.08	-39.71
8	17.29	-01.01	26	142.84	-16.78	44	175.42	-18.95	62	36.42	-37.40
9	20.25	-01.55	27	147.83	-16.42	45	168.37	-22.74	63	28.94	-34.54
10	28.09	-03.11	28	152.81	-15.96	46	161.17	-26.24	64	21.73	-31.06
11	35.91	-04.78	29	157.78	-15.39	47	153.83	-29.46	65	17.41	-28.52
12	43.73	-06.48	30	162.73	-14.69	48	146.38	-32.38	66	13.30	-25.69
13	51.55	-08.17	31	167.66	-13.86	49	138.81	-35.01	67	09.43	-22.51
14	59.38	-09.80	32	172.56	-12.86	50	131.15	-37.33	68	05.92	-18.95
15	67.23	-11.34	33	177.41	-11.68	51	123.39	-39.33	69	02.92	-14.96
16	75.11	-12.75	34	182.21	-10.27	52	115.56	-41.01	70	01.47	-12.33
17	83.01	-14.00	35	186.92	-08.58	53	107.67	-42.36	71	00.43	-09.51
18	90.94	-15.06	36	191.47	-06.52	54	99.72	-43.37			





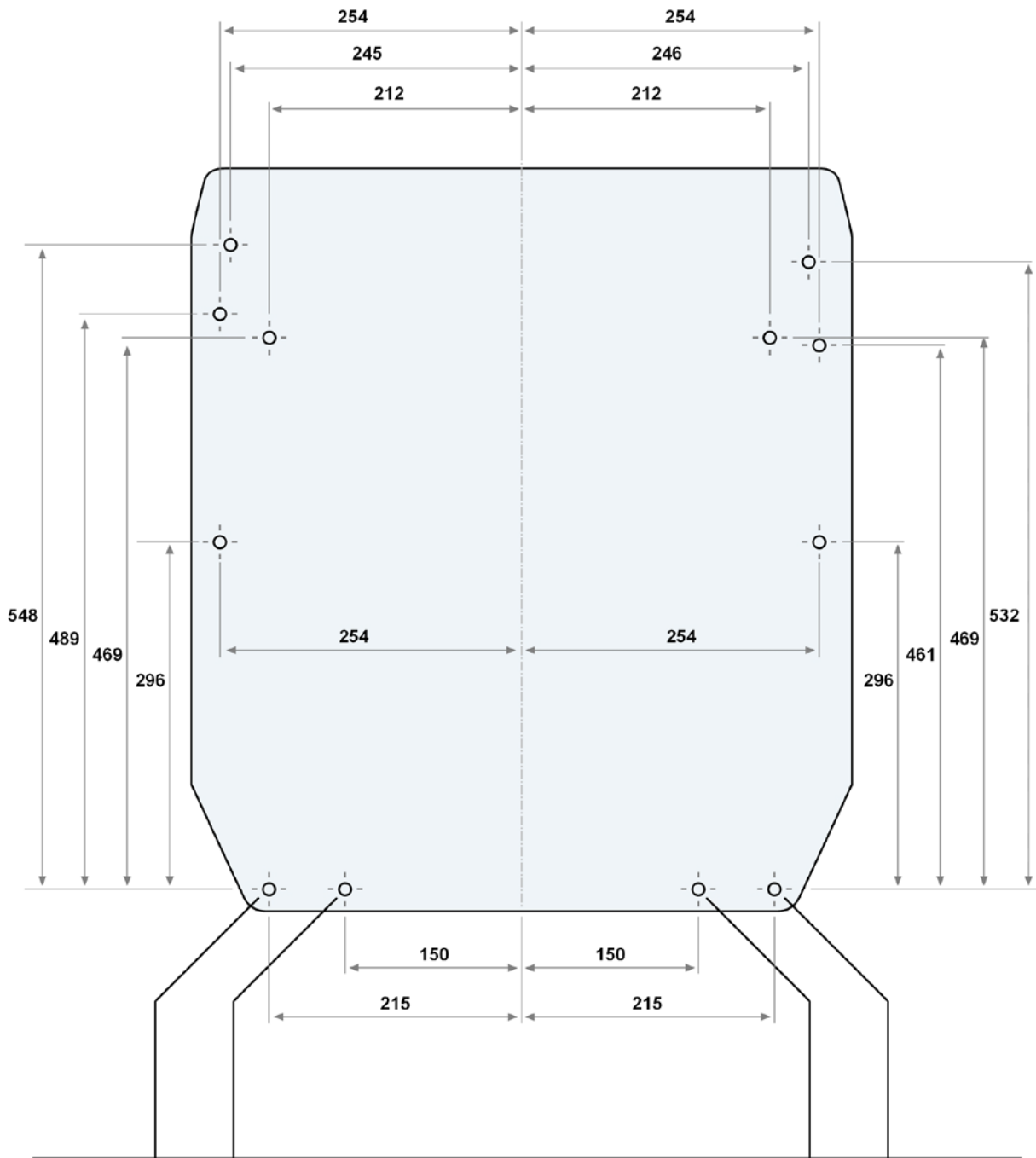
Drawing 1.6



Drawing 1.7

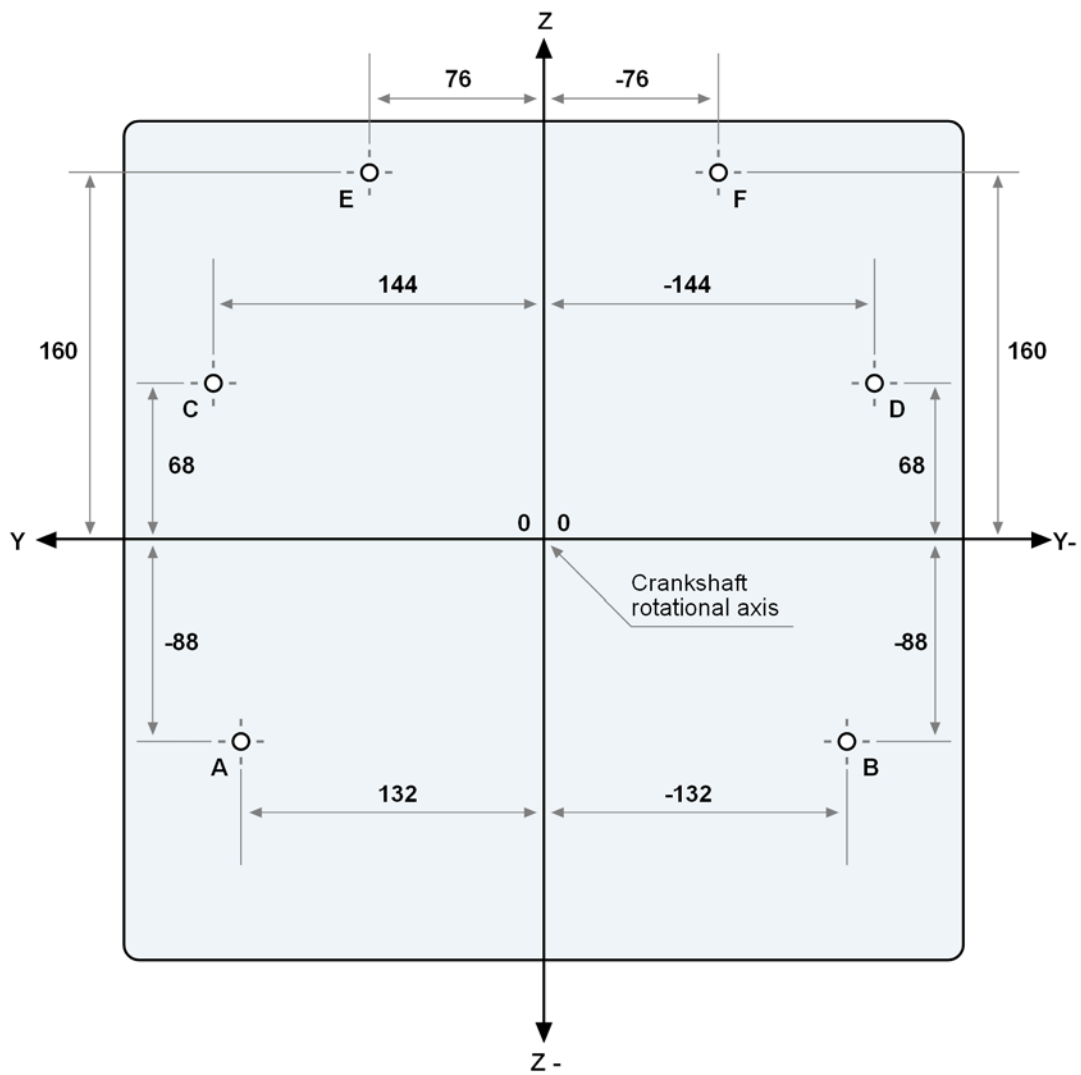
# **APPENDIX 2**

## **ENGINE RELATED DRAWINGS**



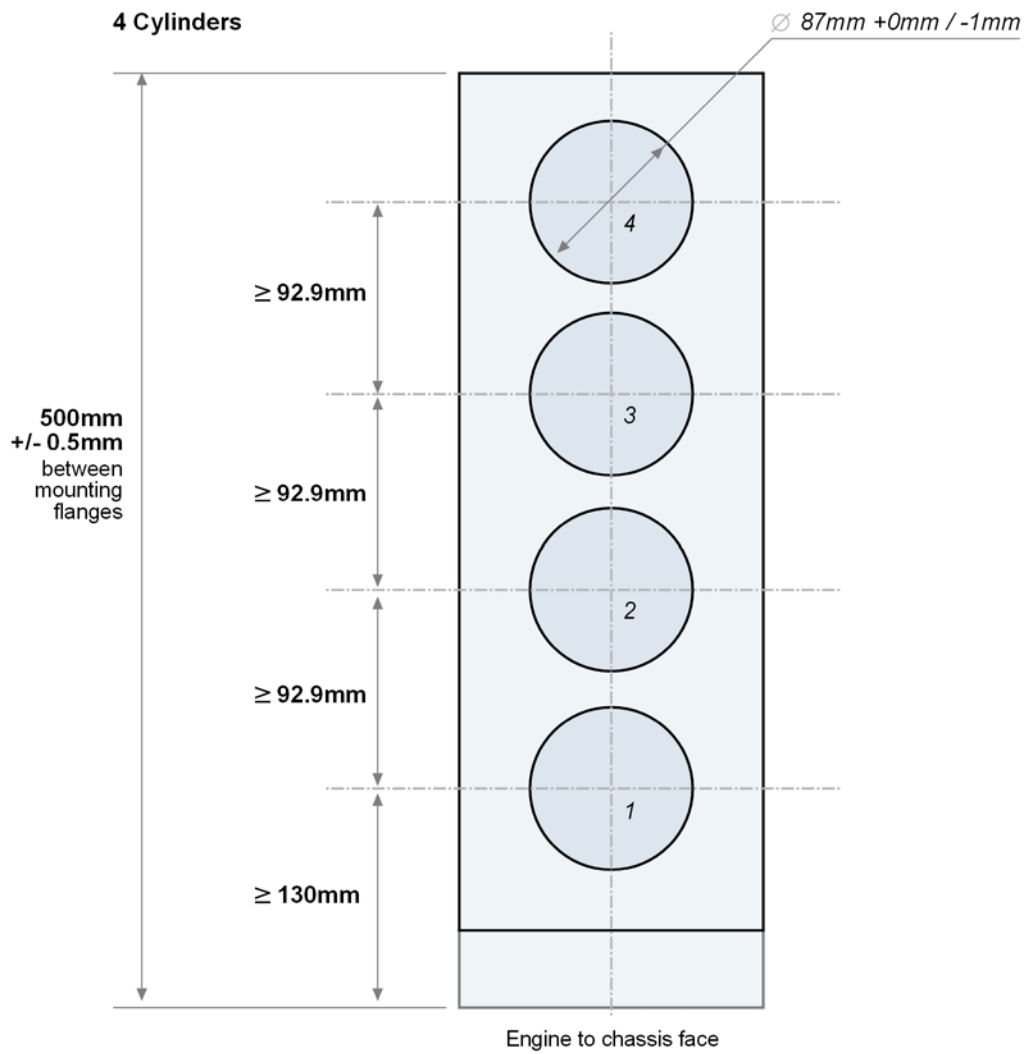
Engine-to-chassis fixation points (lower 4 mounting points  $\varnothing 10\text{mm}$  - all other points  $\varnothing 8\text{mm}$ )

Drawing 2.1

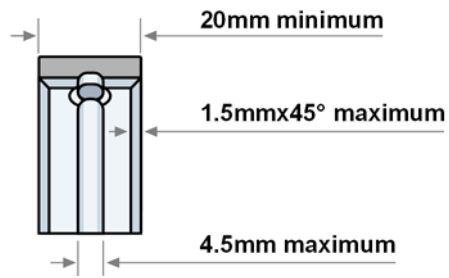


Engine-to-gearbox fixation points

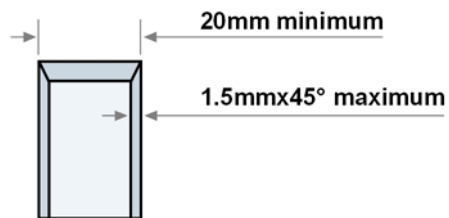
Drawing 2.2



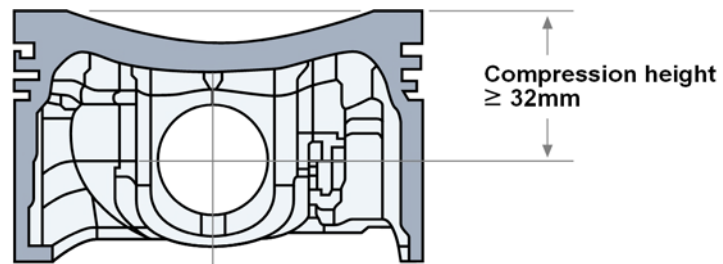
Drawing 2.3



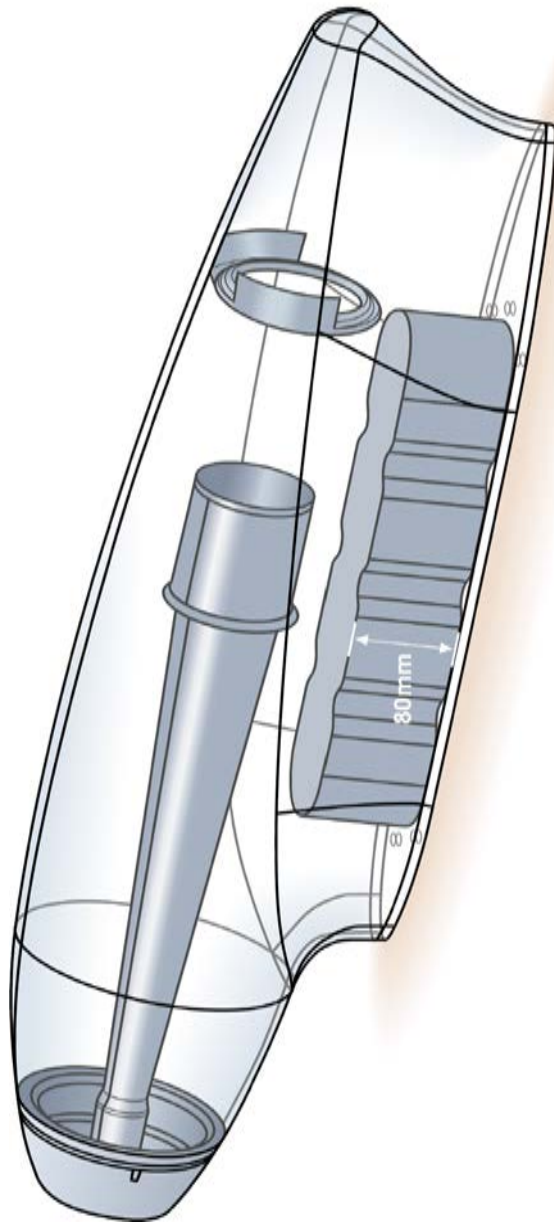
Drawing 2.4



Drawing 2.5

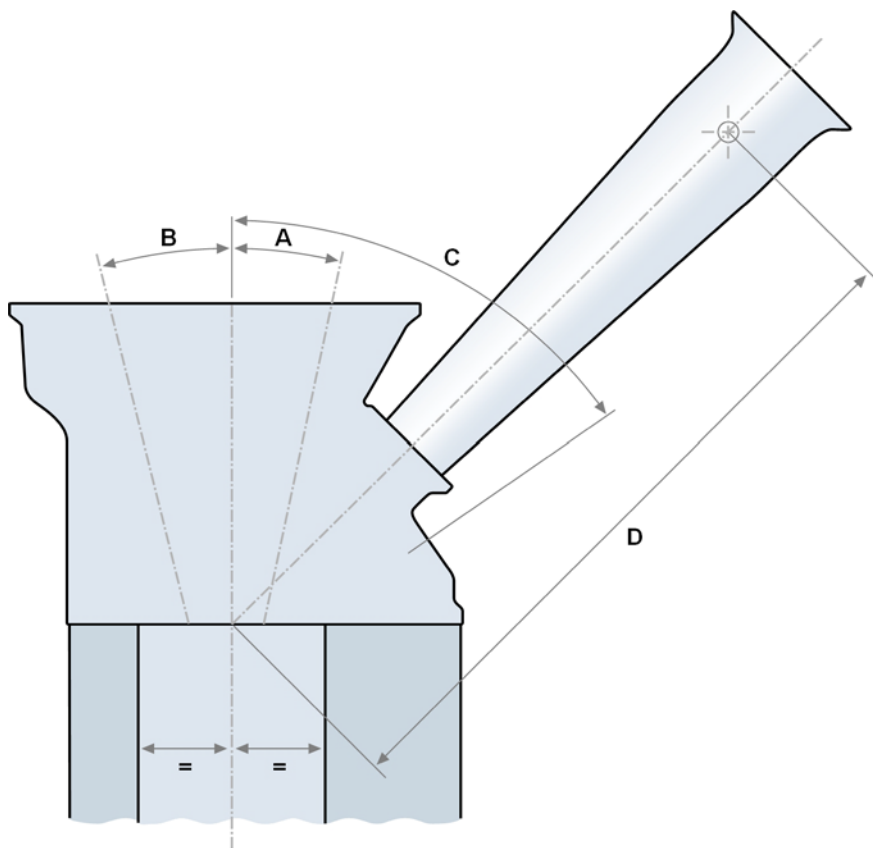


Drawing 2.6

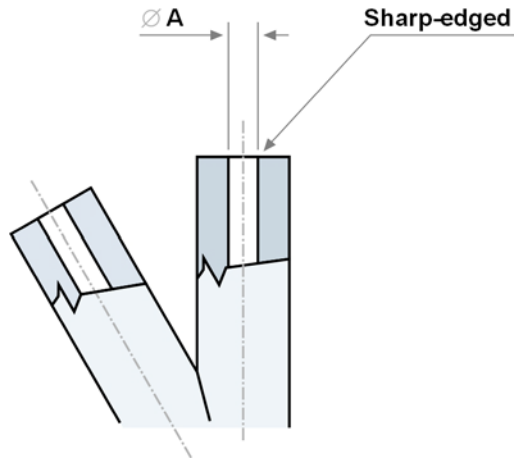


Drawing 2.7





Drawing 2.8



Drawing 2.9

## **APPENDIX 3**

# **APPROVAL OF SAFETY STRUCTURES**

## **Approval of Safety Structures for Formula 3 cars**

### **1) Safety structures**

The following safety structures need to be approved by the FIA :

- a) Survival cell.
- b) Front and rear rollover structures.
- c) Frontal impact absorbing structure.
- d) Rear impact absorbing structure.

To approve any of the above structures, the presence of an FIA technical delegate is necessary. The static load tests need to be carried out with a measuring equipment verified by the FIA; the dynamic impact tests need to be carried out at an FIA approved institute.

### **2) Request for approval**

To get the approval of one of the above mentioned safety structures, the FIA must receive a request from the rolling chassis manufacturer at the following address beforehand:

FIA Technical Department  
2 Chemin de Blandonnet  
CH 1215 Geneva 15  
Switzerland  
Tel : +41 22 544 4400  
Fax : +41 22 544 4450

### **3) Approval procedure**

Having received a request for any of the above mentioned tests, the FIA will arrange a date and venue with the rolling chassis manufacturer and will appoint a technical delegate to supervise these scheduled tests.

For each trip made by an FIA technical delegate to supervise any scheduled tests, the manufacturer will be charged a fee, which is annually levied by the FIA ([€2574 for 2018](#)).

When all the safety structure tests are carried out successfully and the manufacturer has settled the FIA fee, he will receive the FIA chassis test report for his car.

The rolling chassis manufacturer is obliged to supply all his customers with a copy of the FIA chassis test report together with the survival cell.

# **APPENDIX 4**

## **ENGINE COSTS**

**Costs to be included in € 65,000 annual engine budget :**

- 1x engine + engine loom + sensors (mounted on engine / intake system) ;
- flywheel ;
- alternator
- lease period for one season including tests (max. 1 year);
- 10,000km mileage ;
- ontrack service for all championship Events including official tests sessions. This must also include all expenses needed for the ontrack service (for example but not limited to: travel, food, hotel, salaries...)

**Costs to be excluded from the € 65,000 annual engine budget :**

- ECU ;
- starter motor ;
- exhaust system including silencer / catalytic converter ;
- clutch system ;
- water and oil pipe kit ;
- water and oil radiators ;
- airbox/intake cover ;
- spare engine ;
- ontrack service for private and unofficial testing sessions ;
- engine failures due to team or driver mistake (overrevving, wrong maintenance etc.) ;
- transport costs from engine tuner / manufacuter's facilities to Team's base or racetrack ;
- damage or loss of engine during lease contract period when engine leaves engine tuner / manufacuter's facilities ;

# **APPENDIX 5**

## **ENGINE HOMOLOGATION**

All parts or drawings must be supplied in a "ready to use state". For example, crankcase is to be shown with liners and all inserts.

Categories	Parts	
Engine Core		
	Sump / Bedplate	
	Crankcase	
	Cylinder Head	
	Cam cover	
	Camshaft drive cover	
	Crankshaft bearing cap	
	Camshaft bearing cap	
	Cylinder Head gasket	
	Ballast mounted to the engine	
	Screws, nuts, dowels or washers, supports, brackets, cables, tube and hoses related to the parts mentioned above.	
Inlet		
	Complete inlet from restrictor to cylinder head inlet ports	
	Inlet valves	
	Screws, nuts, dowels or washers, supports, brackets, cables, tube and hoses related to the parts mentioned above.	
Exhaust		
	Exhaust valves	
	Exhaust line	
	Silencer	
	Catalytic converter	
	Screws, nuts, dowels or washers, supports, brackets, cables, tube and hoses related to the parts mentioned above.	
Timing		
	Camshaft drive elements from Crankshaft to Camshafts	
	Camshafts	
	Valve command from cam to valve including springs	
	Screws, nuts, dowels or washers, supports, brackets, cables, tube and hoses related to the parts mentioned above.	
Lubrication		
	Oil pressure pump	
	Oil scavenge pumps	
	Oil lines from oil supply to oil scavenge pumps	
	Oil filter	
	Oil air separator	
	Oil tank	
	Catch tank	
	Screws, nuts, dowels or washers, supports, brackets, cables, tube and hoses related to the parts mentioned above.	
Cooling		
	Coolant pumps	
	Coolant lines from engine inlet to engine outlet	



	☒Screws, nuts, dowels or washers, supports, brackets, cables, tube and hoses related to the parts mentioned above.	
Electric and Electronic parts		
	Engine electronic boxes (ECU's, power modules, control boxes).	
	Engine mounted sensors and wiring	
	Engine loom	
	Alternator	
	Screws, nuts, dowels or washers, supports, brackets, cables, tube and hoses related to the parts mentioned above.	
	Starter	
Ignition system		
	Ignition coils	
	Spark plugs	
	Screws, nuts, dowels or washers, supports, brackets, cables, tube and hoses related to the parts mentioned above.	
Fuel system		
	High pressure fuel pump	
	Injectors	
	Fuel lines from High pressure pump to injectors	
	Screws, nuts, dowels or washers, supports, brackets, cables, tube and hoses related to the parts mentioned above.	
Transmission		
	Pistons	
	Rings	
	Piston pins	
	Connecting rods + bearings	
	Crankshaft + bearings	
	Crankshaft flange	
	Complete Flywheel including trigger wheel if not integrated in Flywheel	
	Clutch	
	Screws, nuts, dowels or washers, supports, brackets, cables, tube and hoses related to the parts mentioned above.	

The tolerances which will be applied to the dimensions of homologated parts are specified in the table below.

Tolerances mentioned in the homologation form take precedence over any tolerances shown in this table.

All tolerances are for dimensions relative to a reference point detailed in the drawings deposited by each manufacturer.

Part	Parameter	Tolerance
General	External Skin	+/- 2mm
	Machined areas for liquid location / dimensions	+/- 1mm
	Cast holes for liquid location / dimensions	+/- 2mm
	Depth of drilled holes	+/- 2mm
	Machined bores for location pins location / dimensions	+/- 1mm
	Tapped holes location / dimensions (External or internal)	+/- 1mm
	Machining for seals location / dimensions	+/- 1mm
	Casting plugs location and dimensions	+/- 2mm
Cylinderhead cover	All dimensions - Casted	+/- 2mm
	All dimensions - Machined	+/- 1mm
Cylinder block	Cylinders location / dimensions	+/- 1mm
	Bearings dimensions - Casted	+/- 2mm
	Bearings dimensions - Machined	+/- 1mm
	Bearing shell - All dimensions	+/- 1mm
	Water jacket	+/- 2mm
	Timing face locations / dimensions	+/- 1mm
	Oil jets injector location	+/- 1mm
	Oil jets injector dimensions	+/- 1mm
	Cylinder block height	+/- 1mm
Valves	All dimensions	+/- 0.5mm
Crankshaft bearing caps	Bearings dimensions	+/- 1mm
Sleeves	Length	+/- 1mm
	Thickness	+/- 0.5mm
	All other dimensions	+/- 1mm
Piston	All dimensions. - Machined (Except adjustment for compression ratio and valve pockets)	+/- 0.5mm
	All dimensions. - Casted (Except adjustment for compression ratio)	+/- 2mm
Connecting Rod	All dimensions. - Machined	+/- 0.5mm
	All dimensions. - Casted	+/- 2mm
Crankshaft	All dimensions. - Machined	+/- 1mm
	All dimensions. - Casted	+/- 2mm
	Areas for balancing	Free
	Areas for weight adjustment	Free
Cylinder Head	All combustion chamber dimensions	+/- 1mm
	Fuel injector angle	+/- 0.5°
	Bearings dimensions - Machined	+/- 1mm
	Bearings dimensions - Casted	+/- 2mm
	Timing face locations / dimensions	+/- 1mm
	Valve guiding bush location / dimensions	+/- 1mm
Cam shafts	All external dimensions - Machined	+/- 1mm
Rockers/tappets	All dimensions	+/- 0.5mm

	Valve clearance adjustment	Free
Timing	Gears / Pulley location / dimensions	+/- 1mm
Throttle unit	All dimensions	Supplier spec
Exhaust	All dimensions of manifold	+/- 5mm
Coolant	Water pump internals	
	Water pump moving parts	
	Casted	+/- 2mm
	Machined	+/- 1mm
Sump / bedplate	Casted	+/- 2mm
	Machined	+/- 1mm
Oil	Pump housings-Casted	+/- 2mm
	Pump housings-Machined	+/- 1mm
	Oil separator internals	+/- 5mm
	Oil tank dimensions	+/- 10mm
Ballast	All dimensions	+/- 1mm
Fuel Injection	Injectors	Supplier spec
	High pressure fuel pump	Supplier spec
Flywheel	All dimensions	+/-1 mm

# **APPENDIX 6**

## **ENGINE REPAIRS**

The following repairs are permitted :

a) Cylinder block main bearing tunnel :

To increase of the outer diameter of the main bearing shells in order to re-machine the bearing tunnel. Crankshaft bearing diameter must remain unchanged.

b) Cylinder head camshaft bearing :

To increase of the outer diameter of the bearing shells in order to re-machine the bearing tunnel. Camshaft bearing diameter must remain unchanged.

c) Cylinder head rocker arm bearing shaft mounting hole :

To increase the diameter of the Rocker arm bearing shaft mounting hole in order to insert a bush of the same material than the original bearing journal.

d) Cylinder head valve seat and valve guide :

To increase the diameter of the valve seat and valve guide mounting holes (max. 0,2mm) in order to insert new oversize parts.

e) Cylinder head gasket :

To increase the cylinder head gasket thickness in order to re-machine the cylinder head gasket face / cylinder block gasket face.

f) Timing drive bearing :

To increase the diameter of the bearing shaft mounting hole in order to insert a bush (in case of wear).

g) Dowels :

A damaged dowel bore can be repaired using a bush with a maximum wall thickness of 4 mm and a maximum length of 2 mm longer than the original bore depth.

h) Oil pump :

To sleeve the oil pump housing provided the oil pump housing forms an integral part of one of the main components (head, block, sump) and the material and the functional dimensions are maintained.

i) Thread inserts for all threads.

j) Welding or cold welding :

It is possible to repair the following parts by welding or cold welding :

Cylinder head, cylinder head cover, engine block, oil pan, intake and exhaust manifolds.

The weld must be limited strictly to the repair area, must respect the shape and must not change the function or performance of the part.