Annexe J - Article 275
2003 – Formula 3 Technical Regulations

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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 **###** 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 Engine and gearbox assembly :
The parts of the engine and gearbox that have to remain unchanged are :

- Gearbox casing
- Bell housing
- Cylinder block
- Cylinder head
- Oil sump
- Cam cover
- Complete intake system including the airbox
- Differential
- Final drive ratio

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 October at the latest, the FIA will publish all changes made to these regulations. All such changes will take effect on the third 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 :
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.
No car will be permitted to take part in an event unless the passport is available for inspection at initial scrutineering.

2.7 Changes to car design :
2.7.1) The survival cell, the frontal impact absorbing structure, the collapsible steering column, the front wing main plane, the engine-gearbox assembly, 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. The rolling chassis manufacturer must supply detailed drawings to identify the homologated parts in addition to a commercial price list.
Modifications to the homologated survival cell may be carried out by the chassis manufacturer in order to facilitate the installation of new ancillaries, provided this is the sole purpose.
2.7.2) From the date of homologation the survival cell, the frontal impact absorbing structure and the collapsible steering column must remain unchanged for three complete seasons.
2.7.3) From the date of homologation, 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 for a complete season. After this time, these parts may be changed after re-homologation. In this case, the rolling chassis manufacturer must supply detailed drawings to identify these re-homologated parts in addition to a price list. The manufacturer must also offer an upgrade kit which includes all the re-homologated parts and the price of the re-homologated parts may not differ from the price of the previously homologated parts.

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 with the car in normal racing trim with the driver aboard seated normally.

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 ahead of the rear edge of the front wheels :
3.4.1) The bodywork ahead of the rear edge of the complete front wheels is limited to a maximum width of 1300mm.
3.4.2) Except for fixation, the lateral extremities of any bodywork forward of the front wheels must be flat and, in order to prevent tyre damage to other cars, at least 10mm thick within a radius of 5mm on all edges.

3.5 Width between the rear edge of the front wheels and rear wheel centre line :
The maximum width of the bodywork behind the rear edge of the complete front wheels and in front of the centre line of the rear wheels is 1300mm.

3.6 Width behind the rear wheel centre line :
3.6.1) Bodywork behind the centre line of the rear wheels must not exceed 900mm in width.
3.6.2) Except for fixation, the lateral extremities of any bodywork behind the rear wheel centre line must be flat.

3.7 Overall height :
Except for the rollover structures, no part of the car can be higher than 900mm from the ground. However, any part of the rollover structures more than 900mm from the ground must not be shaped to have a significant aerodynamic influence on the performance of the car.

3.8 Front bodywork height :
No part of the bodywork in front of the rear edge of the complete front wheels and more than 250mm from the longitudinal centre line of the car may be closer than 40mm to the reference plane referred to in Article 3.13. or above the height of the front wheel rims.

3.9 Height in front of the rear wheels :
With the exception of engine airboxes, no part of the bodywork forward of the front edge of the complete rear wheels and extending above the height of the complete rear wheels may project beyond 450mm each side of the longitudinal axis of the car.

3.10 Height between the rear wheels :
No part of the bodywork between the front edge of the complete rear wheels and 250mm behind the rear wheel centre line and higher than the complete rear wheels may be more than 150mm from the centre line of the car.

3.11 Bodywork behind the front edge of the complete rear wheels
Behind the front edge of the complete rear wheels, a maximum of three aerofoil sections may be used. All aerofoil sections used in this area must conform to one of the three sets of dimensions given in Table 1. 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 trim tabs may be added to any of these aerofoil sections. However, devices to keep the space between sections constant may be used provided it is clear that this is their only purpose.
A tolerance of ± 1.0mm will be permitted on any stated dimension.

3.12 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 400mm and 900mm from the car centre line and two transversal lines, one 50mm forward of the front edge and one 200mm behind the rear edge of the complete front wheel.

3.13 Bodywork facing the ground
Between the rear edge of the complete front wheels and the front edge of the complete rear wheels, all sprung parts of the car visible from underneath must 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 9000mm² when projected to a horizontal plane above the car. The step plane must be 50mm above the reference plane but this distance may be reduced by up to 5mm if wear occurs to the surface lying on the reference plane after contact with the ground.
The surface formed by all parts lying on the reference plane must extend from the rear edge of the complete front wheels to the front edge of the complete rear wheels, have a minimum width of 300mm (+/- 3mm), a maximum width of 500mm and must be symmetrical about the longitudinal centre line of the car.
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, a tolerance of **###** 5mm is permissible across these surfaces.
All sprung parts of the car behind the front edge of the complete rear wheels visible from underneath and more than 150mm (+/- 1.5mm) from the longitudinal centre line must be at least 50mm above the reference plane.

3.14 Overhangs :
No part of the car shall be more than 500mm behind the centre line of the rear wheels or more than 1000mm in front of the centre line of the front wheels.
No part of the bodywork more than 200mm from the longitudinal centre line of the car may be more than 900mm in front of the front wheel centre line.

3.15 Aerodynamic influence :
Any specific part of the car influencing its aerodynamic performance:
- Must comply with the rules relating to bodywork.
- Must be rigidly secured to the entirely sprung part of the car (rigidly secured means not having any degree of freedom).
- 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 may under any circumstances be located below the reference plane described in Article 3.13.

3.16 Wheelbase and track :
Minimum wheelbase : 2000mm.
Minimum track : 1200mm.

ARTICLE 4: WEIGHT

4.1 Minimum weight
The weight of the car must not be less than 550kg.

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

5.1 Types of engine permitted :
5.1.1) Engines with reciprocating pistons:
The maximum number of cylinders is 4.
Two stroke engines are forbidden.
5.1.2) Engines with rotary pistons:
Cars with rotary piston engines covered by NSU-Wankel patents will be admitted on the basis of a piston displacement equivalence. This equivalence is 1.5 the volume determined by the difference between the maximum and minimum capacity of the working chamber.

5.1.3) The use of magnesium is forbidden in any engines homologated after 01.01.94.

5.2 Maximum capacity :

Engine capacity must not exceed 2000cm^3.

5.3 Supercharging :

Supercharging is forbidden.

5.4 Engine modifications :

5.4.1) The engine block and engine head castings, machining completed, must be those of a car engine equipping a car model of which the FIA has ascertained the series production of at least 2500 units in 12 consecutive months.

Each engine must be homologated by the FIA, and described on an homologation form for Formula 3 engines.

5.4.2) The original engine block and cylinder head may be modified by the removal of material, but addition of material is not permitted. However, it is permitted to sleeve an engine block, by welding if necessary, that originally is not fitted with sleeves, to modify or close the lubrication holes in the cylinder head, close standard injector holes or to use helicoils.

Unused apertures in the cylinder head or block may be closed provided the only purpose is that of closing.

Any parts added to the intake system must be permanently attached only to the intake manifold, not to the cylinder head.

5.4.3) The type of crankshaft bearings may not be modified.

5.4.4) Mechanical components from the original engine do not have to be used.

5.4.5) The intake system is free but must be fitted with an air restrictor 3mm long and having a maximum diameter of 26mm.

All the air feeding the engine must pass through this air restrictor, which must be made of metal or metal alloy.

5.4.6) The material of the air box is free, provided that it is not porous.

The entire intake system including manifolds, injectors, airbox and restrictor 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.

5.4.7) Provided Article 5.2 is respected, the bore and stroke are free.

5.4.8) Internal and/or external spraying or injection of water or any substance whatsoever for the purpose of assisting combustion is forbidden (other than fuel for the normal purpose of combustion in the engine).

5.4.9) Inlet and exhaust valves must be the conventional poppet type and controlled by coil springs.

5.4.10) The use of ceramic materials is forbidden.

5.4.11) Connecting rods must be made from a conventional steel alloy.

5.4.12) Inlet and exhaust valves must be made from a conventional steel alloy.

5.4.13) No more than one fuel injector per cylinder is permitted.

5.4.14) Variable valve timing is forbidden.

5.5 Vacuum tightness control of the intake system :

5.5.1) Control of the intake system :

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 0.2 bar.

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 0.267 bar must be sustained.

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 0.734 bar to 0.867 bar for zero airflow.

5.6 Exhaust system :

5.6.1) Variable length exhaust systems are forbidden.

5.6.2) The outlet orifices of the exhaust pipes, when directed to the rear, must be less than 600mm from the ground.

5.6.3) The exhaust system must incorporate at least one approved and functioning catalytic converter through which all exhaust gases must pass. The matrix of each converter must have at least 100cpsi, be 105mm in diameter and 120mm long.

Each type of converter must be specifically approved by the FIA before use in an event.

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

5.6.4) The noise generated by the car must not exceed 98dbA at 3800rpm measured at 0.5m and 45° to the exhaust outlet.

All measures which are taken to ensure that the maximum noise limits are not exceeded must be permanent in nature, and must not be removed by the exhaust gas pressure.

N.B.: The application of this article is left to the discretion of each ASN.

5.7 Telemetry :

The use of telemetry is forbidden.

5.8 Crankshaft and clutch :

5.8.1) The rotating axis of the crankshaft must be no less than 115mm above the reference plane.

5.8.2) The diameter of the clutch assembly must not be less than 165mm.

5.9 Oil and water pumps :

Electrically driven engine oil and water pumps are forbidden.

5.10 Inlet trumpets :

Any system modifying the geometry (length or section) of the intake orifices, of the intake system or of the exhaust system, is prohibited, with the exception of the throttle valve.

5.11 Engine Control Unit :

The only engine control unit 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.

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 2 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 axis of the car.

6.1.4) The fuel bladder must be fitted with the fuel resistant polyurethane foam baffling with which it is supplied.

6.1.5) 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.

6.1.6) 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.

6.1.7) No rubber bladders shall be used more than 5 years after the date of manufacture, unless inspected and recertified by the manufacturer for a period of up to another 2 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 408 bar 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/cm² (25lb/in²). 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/mm² (14 tons/in²).
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 2 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 SYSTEM

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.

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.

7.4 Transversal location of oil system :
No part of the car containing oil may be more than 550mm from the longitudinal centre line of the car.

7.5 Oil replenishment :
No oil replenishment is allowed during a race.

ARTICLE 8: STARTING

8.1 Starter :
A starter must be fitted 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.

ARTICLE 9: TRANSMISSION TO THE WHEELS

9.1 Four wheel drive :
Four wheel drive cars are forbidden.

9.2 Type of gearbox :
All cars must have no more than six forward gears.
Transversal gearboxes or gearboxes forward of the rear wheel axis are forbidden.
Semi automatic and automatic gearboxes and differentials with electronic, pneumatic or hydraulic slip control are forbidden.
Viscous differentials are not considered to have hydraulic slip control, provided outside control is not possible when the car is in motion.

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.

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 prevent intrusion of suspension parts into the survival cell during a side impact, each member of every front suspension component with two inboard mountings must be joined by a link as close to the survival cell as practical. This link must be circular with a minimum diameter of 10mm, and any slip joint must be bolted or pinned and located in the centre of the span.
10.3.3) In order to help prevent a wheel becoming separated in the event of all suspension members connecting it to the car failing, two cables, each with separate attachments, must be fitted to connect each wheel/upright assembly to the main structure of the car. The cables and their attachments must be designed in order to help prevent a wheel making contact with the driver's head during an accident.
The length of each cable should be no longer than that required to allow normal suspension movement.
Each complete cable restraint system, including their attachments, must have a minimum tensile strength of 50kN and each cable must be flexible with a minimum diameter of 8mm.

10.4 Sprung suspension :
Cars must be fitted with sprung suspension.
The springing mediam must not consist solely of bolts located through flaxible bushes or mountings.
There must be movement of the wheels to give suspension travel in excess of any flexibility in the attachments.

10.5 Steering :
10.5.1) The steering must consist of a mechanical link between the driver and the wheels.
10.5.2) Four wheel steering is forbidden.
10.5.3) The steering wheel, steering column and steering rack assembly must be subjected to an impact 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 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.
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 4 grooves per side. Additionally, all solid discs must have a minimum thickness of 9.5mm and ventilated discs 15.0mm when new.
11.3 Brake callipers :
11.3.1) All brake calipers must be made from an homogeneous metallic material.
11.3.2) There must be no more than four brake caliper pistons on each wheel.
11.4 Air ducts :
Air ducts for the purpose of cooling the front brakes shall not protrude beyond :
- A plane parallel to the ground situated at a distance of 140mm above the horizontal centre line of the wheel.
- A plane parallel to the ground situated at a distance of 140mm below the horizontal centre line of the wheel.
- A vertical plane parallel to the inner face of the front rim and displaced from it by 120mm toward the centre line of the car.
- The periphery of the tyre forwards or the wheel rim backwards, when viewed from the side of the car.

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 :
12.3.1) Maximum complete wheel width : 11.5 inches.
Compulsory wheel diameter : 13.0 inches.
12.3.2) These measurements will be taken horizontally at axle height.
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.

ARTICLE 13: COCKPIT

13.1 Cockpit opening :
The opening giving access to the cockpit must allow the horizontal template, shown in Drawing 1, to be inserted vertically, from above the car into the survival cell and bodywork, with the steering wheel, steering column, seat and all padding removed.
The front tip of the template must be no less than 625mm from the front wheel centre line and it must be possible to lower the template 25mm below the lowest point of the cockpit opening.
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 or cockpit padding. Sitting at his steering wheel, the driver must be facing forward.
The cockpit must be so conceived that the maximum time necessary for the driver to get out from his normal driving position does not exceed 5 seconds with all driving equipment being worn and starting with the safety belts fastened.
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 70000mm².
A free vertical cross section which allows the template shown in Drawing 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.

ARTICLE 14: SAFETY EQUIPMENT

14.1 Fire extinguishers :
14.1.1 All cars must be fitted with a fire extinguishing system which must discharge into the cockpit and into the engine compartment.
14.1.2) Any extinguishant which has been specifically approved by the FIA is permitted.
14.1.3) The quantity of extinguishant may vary according to the type of extinguishant used, a list is available from the FIA.
14.1.4) When operated, the fire extinguishing system must discharge 95% of its contents at a constant pressure in no less than 10 seconds and no more than 30 seconds.
If more than one container with extinguishant is fitted, they must be released simultaneously.
14.1.5) Each pressure vessel must be equipped with a means of checking its pressure which may vary according to the type of extinguishant used. A list is available from the FIA.
14.1.6) The following information must be visible on each container with extinguishant :
- Type of extinguishant ;
- Weight or volume of the extinguishant ;
- Date the container must be checked which must be no more than two years after the date of filling.

14.1.7) All parts of the extinguishing system must be situated within the survival cell and all extinguishing equipment must withstand fire.
14.1.8) 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 100mm diameter with a red edge.

14.1.9) The system must work in any position, even when the car is inverted.
14.1.10) 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.

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 reflective surface may be less than 250mm from the car centre line or more than 750mm from the rear of the cockpit entry template.

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:
- Is a model approved by the FIA.
- Faces rearwards at 90° to the car centre line.
- Is clearly visible from the rear.
- Is not mounted more than 100mm from the car centre line.
- Is at least 350mm above the reference plane.
- Is no less than 450mm behind the rear wheel centre line, measured to the face of the lens and parallel to the reference plane.
- Can be switched on by the driver when seated normally in the car.

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

14.6 Headrest :

All cars must be equipped with headrests made from a material specified by the FIA.
The headrests must consist of one at least 75mm thick over an area of 40000mm² behind the driver's helmet and one at least 75mm thick over an area of 40000mm² along each side of the driver's helmet.
The headrests must be so installed that if movement of the driver's head was to fully compress the foam at any point over their area, his helmet would not make contact with any structural part of the car.
They must be so positioned as to be the first point of contact for the driver's helmet in the event of an impact projecting his head backwards or sideways when he is seated normally.

ARTICLE 15: SAFETY STRUCTURES

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 is forbidden.
15.1.3) Within composite structures, the strain-to-failure of any fibrous reinforcing material must not be less than 1.5%.
15.1.4) The use of carbon or aramid fibre reinforcing materials in composite structures is forbidden except in the survival cell, frontal impact absorbing structure, roll over structures, non-structural components on the engine, bodywork ahead of the front edge of the complete front wheels and bodywork more than 200mm behind the rear wheel centre line.
For the purposes of this Article, any parts which are used for the installation of the engine to the gearbox, the engine to the survival cell or which are used for load transfer from the rear suspension to the survival cell cannot be considered non-structural.
15.1.5) The surface formed by all the parts lying on the reference plane referred to in Article 3.13 must be made of wood.
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 Rollover 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 principal structure must be positioned behind the driver. The second 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 50mm 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 15.2 4.
The second structure must be capable of withstanding three loads applied simultaneously to the top of the structure which are 12kN laterally, 45kN longitudinally, and 60kN vertically.
15.2.4) The principal roll structure shall be subjected to a static load test. A load equivalent to 12kN laterally, 45kN longitudinally in a rearward direction and 60kN 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.
Furthermore, each car manufacturer must supply detailed calculations which clearly show that the 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 above but carried out in a forward direction,
15.2.5 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 10000mm², across a horizontal plane passing 50mm lower than it's highest point.

15.3 Survival cell and frontal protection :

15.3.1) 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.
15.3.2) 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 centre line of the front wheels.
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.
15.3.3) 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.
15.3.4) 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. The

minimum height of the survival cell between the two rollover structures is 550mm.
The minimum height of the survival cell behind the driver is 750mm.
Furthermore, the parts of the survival cell which are situated each side of the driver's helmet must be no more than 550mm apart and at least as high as a line parallel to and 220mm below the line between the tops of the two roll structures.
In order to maintain good lateral visibility, the driver when seated normally with his seat belts fastened and looking straight ahead must have his eyes above the top of the sides of the survival cell.
15.3.5) Furthermore, at least that part of the survival cell forward of a transversal section 200mm to the rear of the front wheel axis, shall be subjected to an impact test against a solid vertical barrier placed at right angles to the centre line of the car.
If such a part is tested separately from the rest of the survival cell it must be attached to the trolley in such a way that it does not increase the impact resistance of the structure being tested.
For the purposes of this test, the total weight of the trolley and test structure shall be 560kg and the velocity of impact 10 metres/sec.
The resistance of the test structure must be such that during the impact the average deceleration of the trolley does not exceed 25g.
Furthermore, all structural damage must be contained in the zone ahead of the front wheel axis.
This test must be carried out in the presence of an FIA technical delegate in an approved testing centre.
15.3.6) In addition, the survival cell must be subjected to three separate static lateral 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.

For he tests described above, 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.
15.3.7) 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 15.3.6. 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.
15.3.8) 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.
15.3.9) Two further static load tests must be carried out on the survival cell on each side of the cockpit opening. A pad of 100mm diameter must be placed with its upper edge at the same height as the top of the cockpit side with its centre at a point 200mm forward of the rear edge of the cockpit opening template longitudinally. A constant transverse horizontal load of 10kN 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 these load conditions, there must be no structural failure of the inner or outer surfaces of the survival cell, there must be no more than 10mm total deformation and 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.
15.3.10) The static load tests in Article 15.2.4; 15.3.6; 15.3.7,15.3.8 and 15.3.9 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.
15.3.11) 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 15.3.6; 15.3.7, 15.3.8 and 15.3.9. 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 Article 15.2.4, 15.3.6, 15.3.7, 15.3.8 and 15.3.9 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%.

15.4 Lateral protection :

In order to give additional protection to the driver in the event of a side impact, the outer skin laminates of the survival cell, over the areas described below, must be at least 3.5mm thick and must incorporate panels as specified in a) – e) below.
The outer skin laminates must :

- be at least 250mm high at the front wheel centre line ;
- taper 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 ;
- be 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 the laminates must be of the minimum size to allow access to mechanical components.
Each panel within the outer skin laminates must be at least 2mm thick and be constructed (and have features) as follows :

a) each ply must consist of continuous aramid fibres reinforcing an epoxy matrix with a resin density between 1.20 – 1.40 kg/m³ and resin content between 47% - 53% ;
b) the basic fibre properties must meet or exceed the following :

- axial tensile strength	:	2.6 GPa
- axial tensile modulus	:	114 GPa
- axial tensile strain-to-failure	:	2.3 %

c) each ply of material must feature the aramid fibres specified above woven in the following style :
- DuPont style 285 (160-180 g/m², 4-harness satin) giving a panel nominal thickness of 0.25mm

d) the laminate must consist of at least 8 consecutive plies of the aramid/epoxy material specified above ;
e) the laminate must have its plies oriented to give quasi-isotropic in-plane properties, at least four being arranged at 0°/90° and at least four at 45°/45°.

ARTICLE 16: FUEL

16.1 Fuel :

The fuel must be commercial petrol which is available from service stations and must contain no additive other than that of a lubricant on current sale.
The fuel must have the following characteristics:

- 102RON/90MON maximum; 95RON/85MON minimum for unleaded fuels and 100RON/92MON maximum; 97RON/86MON minimum for leaded fuels, the measurements being made according to the standards ASTMD2699-86 and D2700-86, the fuel being accepted or rejected according to ASTMD3244 with a confidence limit of 95%.
- Specific gravity between 720 and 785kg/m³ at 15°C (measured according to ASTMD4052).
- A maximum of 2.8% oxygen for leaded fuel or 3.7% if the lead content is less than 0.013g/l, and 0.5% nitrogen by weight, the remainder of the fuel consisting exclusively of hydrocarbons and not containing any power boosting additives.
  The measurement of the nitrogen content will be carried out according to the standard ASTMD3228, and that of the oxygen by elemental analysis with a tolerance of 0.2%.
- Maximum content of peroxides and nitrooxide compounds : 100ppm (ASTMD3703).
- Maximum lead content : 0.40g/l or the standard of the country of the event, if this is lower (ASTMD3341 or D3237).
- Maximum benzene content : 5% in vol. (ASTMD3606)
- Maximum Reid vapour pressure : 900hPa (ASTMD323)
- Distillation at 70°C : 10% - 47% (ASTMD86)
- Distillation at 100°C : 30% - 70% (ASTMD86)
- Distillation at 180°C : 85% min (ASTMD86)
- Maximum final boiling point : 225°C (ASTMD86)
- Maximum residue : 2% volume (ASTMD86)

16.2 Air :
Only air may be mixed with the fuel as an oxidant

ARTICLE 17: 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.

ARTICLE 18 : CHANGES FOR 2005

18.1 Changes to Article 3.14
3.14 Overhangs :
With the exception of the structure required by Article 15.5.1, no part of the car shall be more than 500mm behind the centre line of the rear wheels or more than 1000mm in front of the centre line of the front wheels.
No part of the bodywork more than 200mm from the longitudinal centre line of the car may be more than 900mm in front of the front wheel centre line.

18.2 Changes to Article 15.3.5 :
15.3.5) Furthermore, at least that part of the survival cell forward of a transversal section 200mm to the rear of the front wheel axis, shall be subjected to an impact test against a solid vertical barrier placed at right angles to the centre line of the car.
If such a part is tested separately from the rest of the survival cell it must be attached to the trolley in such a way that it does not increase the impact resistance of the structure being tested.
For the purposes of this test, the total weight of the trolley and test structure shall be 560kg and the velocity of impact ~~10 metres/sec~~ **12 metres/sec**.
The resistance of the test structure must be such that during the impact the average deceleration of the trolley does not exceed 25g.
Furthermore, all structural damage must be contained in the zone ahead of the front wheel axis.
This test must be carried out in the presence of an FIA technical delegate in an approved testing centre.

18.3 Changes to Article 15.4 :

15.4 ~~Lateral protection~~ Side intrusion test :
~~In order to give additional protection to the driver in the event of a side impact, the outer skin laminates of the survival cell, over the areas described below, must be at least 3.5mm thick and must incorporate panels as specified in a) - e) below.~~
~~The outer skin laminates must~~ :

- ~~be at least 250mm high at the front wheel centre line~~ ;
- ~~taper 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~~ ;
- ~~be 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 the laminates must be of the minimum size to allow access to mechanical components~~.
~~Each panel within the outer skin laminates must be at least 2mm thick and be constructed (and have features) as follows~~ :
~~a) each ply must consist of continuous aramid fibres reinforcing an epoxy matrix with a resin density between 1.20 - 1.40 kg/m³ and resin content between 47% - 53%~~ ;
~~b) the basic fibre properties must meet or exceed the following~~ :

~~- axial tensile strength~~	:	~~2.6 GPa~~
~~- axial tensile modulus~~	:	~~114 GPa~~
~~- axial tensile strain to failure~~	:	~~2.3 %~~

~~c) each ply of material must feature the aramid fibres specified above woven in the following style~~ :
~~DuPont style 285 (160-180 g/m², 4 harness satin) giving a panel nominal thickness of 0.25mm~~
~~d) the laminate must consist of at least 8 consecutive plies of the aramid/epoxy material specified above.~~ ;
~~e) the laminate must have its plies oriented to give quasi-isotropic in-plane properties, at least four being arranged at 0°/90° and at least four at 45°/45°~~.
15.4.1) 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.
15.4.2) 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.

18.4 Creation of an Article 15.5 :
15.5 Rear impact structure
15.5.1) 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 9000mm² 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.
This structure must be designed in order to pass an impact test and must 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 15.5.2.
15.5.2 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 :

- **the average deceleration of the object does not exceed 25g ;**
- **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.

TABLE 1

Points for aerofoil section number 1, all dimensions are in millimetres (see Drawing 4) :

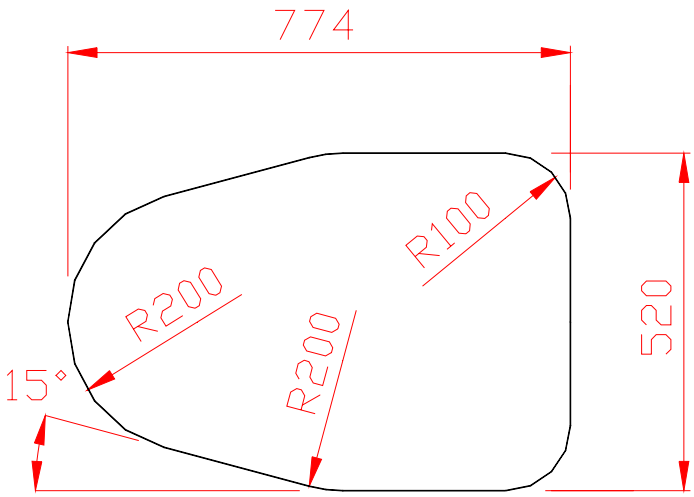
1	94.44	-01.37	**14**	01.22	-00.97	**27**	08.18	-13.18	**40**	56.49	-13.87
2	93.90	-00.00	**15**	00.61	-01.68	**28**	09.80	-14.02	**41**	60.76	-12.68
3	91.57	-00.89	**16**	00.20	-02.54	**29**	11.81	-14.86	**42**	65.02	-11.43
4	89.20	-01.78	**17**	00.00	-03.48	**30**	14.38	-15.70	**43**	69.27	-10.11
5	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			

Points for aerofoil section number 2, all dimensions are in millimetres (see Drawing 5) :

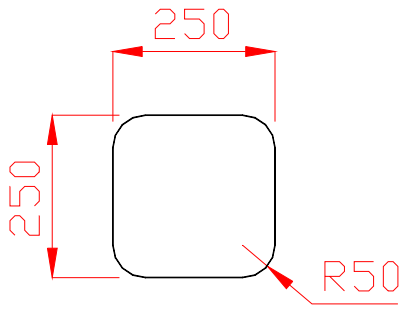
1	14.78	-02.90	**17**	69.72	-00.05	**33**	145.80	-04.19	**49**	15.49	-22.56
2	16.66	-02.67	**18**	74.32	-00.10	**34**	151.41	-04.47	**50**	10.01	-19.41
3	18.80	-02.41	**19**	79.60	-00.20	**35**	154.10	-04.50	**51**	05.41	-15.77
4	23.34	-01.93	**20**	85.24	-00.36	**36**	155.07	-04.27	**52**	02.67	-12.90
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			

Points for aerofoil section number 3, all dimensions are in millimetres (see Drawing 6) :

1	163.07	00.00	**21**	59.33	-40.21	**41**	01.91	-17.91	**61**	113.59	-01.70
2	164.08	-01.19	**22**	53.95	-40.11	**42**	03.45	-16.76	**62**	120.07	-02.33
3	160.86	-03.91	**23**	48.67	-39.85	**43**	06.86	-15.04	**63**	126.34	-03.02
4	157.66	-06.63	**24**	43.43	-39.45	**44**	10.31	-13.39	**64**	132.59	-03.78
5	154.56	-09.14	**25**	38.20	-38.81	**45**	15.32	-11.20	**65**	137.90	-04.47
6	151.54	-11.46	**26**	33.00	-37.95	**46**	20.42	-09.22	**66**	143.20	-05.18
7	147.47	-14.30	**27**	27.53	-36.78	**47**	24.00	-07.95	**67**	147.47	-05.77
8	143.26	-16.99	**28**	22.17	-35.38	**48**	27.58	-06.81	**68**	151.77	-06.38
9	138.86	-19.56	**29**	17.32	-33.86	**49**	33.35	-05.18	**69**	151.94	-06.40
10	134.26	-22.02	**30**	12.55	-32.16	**50**	39.14	-03.73	**70**	152.12	-06.42
11	128.27	-24.94	**31**	09.50	-30.96	**51**	46.86	-02.21	**71**	153.01	-06.50
12	122.10	-27.69	**32**	06.55	-29.69	**52**	54.64	-01.12	**72**	153.90	-06.43
13	116.76	-29.79	**33**	05.08	-29.03	**53**	60.71	-00.53	**73**	154.76	-06.25
14	111.38	-31.70	**34**	03.71	-28.40	**54**	66.80	-00.20	**74**	155.60	-05.94
15	103.48	-34.11	**35**	02.34	-27.51	**55**	73.18	-00.03	**75**	156.39	-05.51
16	95.48	-36.22	**36**	01.22	-26.29	**56**	79.55	00.00	**76**	157.12	-05.00
17	87.17	-37.92	**37**	00.43	-24.82	**57**	86.31	-00.10	**77**	163.07	00.00
18	78.77	-39.12	**38**	00.05	-23.22	**58**	93.09	-00.33			
19	71.75	-39.78	**39**	00.13	-21.29	**59**	100.10	-00.66			
20	64.72	-40.13	**40**	00.76	-19.48	**60**	107.16	-01.14			



Drawing 1



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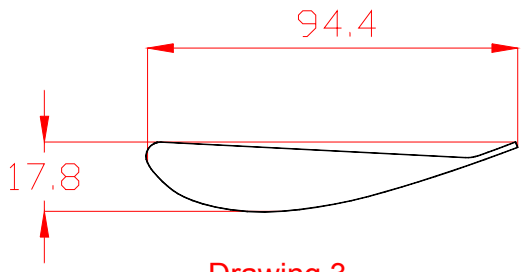

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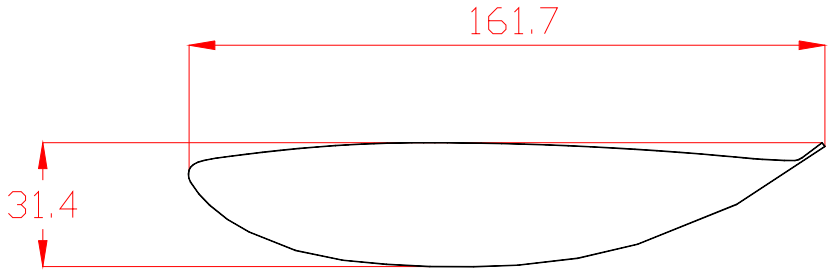

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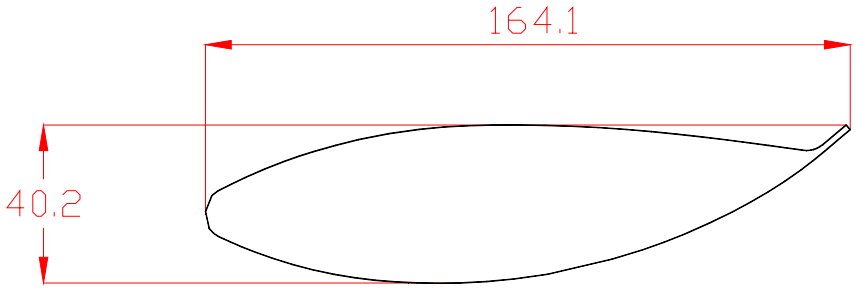

Drawing 5