2012 FORMULA ONE TECHNICAL REGULATIONS

CONTENTS SUMMARY

1.12 Cockpit :

The volume which accommodates the driver.

1.13 Sprung suspension :

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

1.14 Survival cell :

A continuous closed structure containing the fuel tank and the cockpit.

1.15 Camera :

Television cameras the dimensions of which are defined in drawing 6.

1.16 Camera housing :

A device which is identical in shape and weight to a camera and which is supplied by the relevant competitor for fitting to his car in lieu of a camera.

1.17 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.

1.18 Brake caliper :

All parts of the braking system outside the survival cell, other than brake discs, brake pads, caliper pistons, brake hoses and fittings, which are stressed when subjected to the braking pressure. Bolts or studs which are used for attachment are not considered to be part of the braking system.

1.19 Electronically controlled :

Any command system or process that utilises semi-conductor or thermionic technology.

1.20 Kinetic Energy Recovery System (KERS) :

A system that is designed to recover kinetic energy from the car during braking, store that energy and make it available to propel the car.

1.21 Open and closed sections :
A section will be considered closed if it is fully complete within the dimensioned boundary to which it is referenced, if it is not it will be considered open.

ARTICLE 3 : BODYWORK AND DIMENSIONS

One of the purposes of the regulations under Article 3 below is to minimize the detrimental effect that the wake of a car may have on a following car.

Furthermore, infinite precision can be assumed on certain dimensions provided it is clear that such an assumption is not being made in order to circumvent or subvert the intention of the relevant regulation.

For illustrations refer to drawings 1A-17A in the Appendix to these regulations.

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, excluding tyres, must not exceed 1800mm with the steered wheels in the straight ahead position.

3.4 Width ahead of the rear wheel centre line :

3.4.1 Bodywork width between the front and the rear wheel centre lines must not exceed 1400mm.

3.4.2 In order to prevent tyre damage to other cars, any bodywork outboard of the most inboard part of the bodywork used to define the area required by Article 3.7.5, and which is more than 450mm ahead of the front wheel centre line, must be at least 10mm thick (being the minimum distance when measured normal to the surface in any direction) with a 5mm radius applied to all extremities.

3.4.3 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.

3.5 Width behind the rear wheel centre line :

3.5.1 The width of bodywork behind the rear wheel centre line and less than 150mm above the reference plane must not exceed 1000mm.

3.5.2 The width of bodywork behind the rear wheel centre line and more than 150mm above the reference plane must not exceed 750mm.

3.6 Overall height :

No part of the bodywork may be more than 950mm above the reference plane.

3.7 Front bodywork :

3.7.1 All bodywork situated forward of a point lying 330mm behind the front wheel centre line, and more than 250mm from the car centre line, must be no less than 75mm and no more than 275mm above the reference plane.

3.8.3 No bodywork between the rear wheel centre line and a line 400mm forward of the rear wheel centre line, which is more than 375mm from the car centre line, may be more than 300mm above the reference plane.

3.8.4 Any vertical cross section of bodywork normal to the car centre line situated in the volumes defined below must form one tangent continuous curve on its external surface. This tangent continuous curve may not contain any radius less than 75mm :

a) The volume between 50mm forward of the rear wheel centre line and 300mm rearward of the rear face of the cockpit entry template, which is more than 25mm from the car centre line and more than 100mm above the reference plane.

b) The volume between 300mm rearward of the rear face of the cockpit entry template and the rear face of the cockpit entry template, which is more than 125mm from the car centre line and more than 100mm above the reference plane.

c) The volume between the rear face of the cockpit entry template and 450mm forward of the rear face of the cockpit entry template, which is more than 350mm from the car centre line and more than 100mm above the reference plane.

d) The volume between the rear face of the cockpit entry template and 450mm forward of the rear face of the cockpit entry template, which is more than 125mm from the car centre line and more than 675mm above the reference plane.

The surfaces lying within these volumes, which are situated more than 55mm forward of the rear wheel centre line, must not contain any apertures (other than those permitted by Article 3.8.5) or contain any vertical surfaces which lie normal to the car centre line.

3.8.5 Once the relevant bodywork surfaces are defined in accordance with Article 3.8.4, apertures, any of which may adjoin or overlap each other, may be added for the following purposes only:

a) Single apertures either side of the car centre line for the purpose of exhaust exits. These apertures may have a combined area of no more than 50,000mm^2 when projected onto the surface itself. No point on an aperture may be more than 350mm from any other point on the aperture.

b) Apertures either side of the car centre line for the purpose of allowing suspension members and driveshafts to protrude through the bodywork. Only one aperture may be added for each suspension member and no such aperture may have an area greater than 12,000 mm^2 when projected onto the surface itself. No point on an aperture may be more than 200mm from any other point on the aperture.

3.8.6 The impact absorbing structures defined by Article 15.5.2 must be fully enclosed by bodywork, such that no part of the impact structure is in contact with the external air flow. When cut by a longitudinal vertical plane, the bodywork enclosing these impact structures must not form closed sections in the region between 450mm and 875mm forward of the rear edge of the cockpit template.

3.8.7 With the exception of a transparent windscreen, antenna or pitot tubes, no bodywork higher than the top of the front roll structure will be permitted forward of it.

3.9 Bodywork between the rear wheels :

3.9.1 No bodywork situated between 50mm and 330mm forward of the rear wheel centre line may be more than 730mm above the reference plane.

3.9.2 No bodywork situated between 50mm forward of the rear wheel centre line and 150mm behind the rear wheel centre line, and which is between 75mm and 355mm from the car centre line, may be located between 400mm and 730mm above the reference plane.

- Be arranged so that any curvature occurs only in a horizontal plane (other than when this bodywork is adjusted in accordance with Article 3.18).
- Be between 2mm and 5mm thick.
- Be rigidly fixed to their respective sections.
- Be constructed from a material with modulus greater than 50GPa.

These supports will be ignored when assessing whether the car is in compliance with Articles 3.6, 3.9.2, 3.10.1, 3.10.2, 3.10.4 and 3.10.6.

3.10.4 No part of the car between 75mm and 355mm from the car centre line may be more than 350mm behind the rear wheel centre line.

3.10.5 Any parts of the car less than 75mm from the car centre line and more than 500mm behind the rear wheel centre line must be situated between 200mm and 400mm above the reference plane.

3.10.6 No part of the car less than 75mm from the car centre line and more than 350mm behind the rear wheel centre line may be more than 400mm above the reference plane.

3.10.7 No part of the car more than 375mm from the car centre line may be more than 350mm behind the rear wheel centre line.

3.10.8 In side view, the projected area of any bodywork lying between 300mm and 950mm above the reference plane and between the rear wheel centre line and a point 600mm behind it and more than 355mm from the car centre line must be greater than 330000mm².

3.10.9 Any horizontal section between 600mm and 730mm above the reference plane, taken through bodywork located rearward of a point lying 50mm forward of the rear wheel centre line and less than 75mm from the car centre line, may contain no more than two closed symmetrical sections with a maximum total area of 5000mm^2. The thickness of each section may not exceed 25mm when measured perpendicular to the car centre line.

Once fully defined, the section at 725mm above the reference plane may be extruded upwards to join the sections defined in Article 3.10.2. A fillet radius no greater than 10mm may be used where these sections join.

3.11 Bodywork around the front wheels :

3.11.1 With the exception of the air ducts described in Article 11.4 and the mirrors described in Article 3.8.1, in plan view, there must be no bodywork in the area formed by the intersection of the following lines :

- A longitudinal line parallel to and 900mm from the car centre line.
- A transverse line 450mm forward of the front wheel centre line.
- A diagonal line from 450mm forward of the front wheel centre line and 400mm from the car centre line to 750mm forward of the front wheel centre line and 250mm from the car centre line.
- A transverse line 750mm forward of the front wheel centre line.
- A longitudinal line parallel to and 165mm from the car centre line.
- A diagonal line running forwards and inwards, from a point 875mm forward of the rear face of the cockpit entry template and 240mm from the car centre line, at an angle of 4.5° to the car centre line.
- A diagonal line from 875mm forward of the rear face of the cockpit entry template and 240mm from the car centre line to 625mm forward of the rear face of the cockpit entry template and 415mm from the car centre line.

3.12.6 To help overcome any possible manufacturing problems, and not to permit any design which may contravene any part of these regulations, a horizontal tolerance of 3mm is permitted when assessing whether a surface is visible from beneath the car. In addition to this, an absolute vertical tolerance of +/- 3mm is permissible across the surfaces lying on the reference and step planes between a point lying 330mm behind the front wheel centre line and the rear wheel centre line.

3.12.7 No bodywork which is visible from beneath the car and which lies between the rear wheel centre line and a point 350mm rearward of it may be more than 125mm above the reference plane. With the exception of the aperture described below, any intersection of the surfaces in this area with a lateral or longitudinal vertical plane should form one continuous line which is visible from beneath the car.

An aperture for the purpose of allowing access for the device referred to in Article 5.16 is permitted in this surface. However, no such aperture may have an area greater than 3500mm^2 when projected onto the surface itself and no point on the aperture may be more than 100mm from any other point on the aperture.

Additionally, any bodywork in this area must produce uniform, solid, hard, continuous, rigid (no degree of freedom in relation to the body/chassis unit), impervious surfaces under all circumstances).

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

3.12.9 In an area lying 450mm or less from the car centre line, and from 450mm forward of the rear face of the cockpit entry template to 350mm 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. When assessing the compliance of bodywork surfaces in this area the aperture referred to in Article 3.12.7 need not be considered.

3.12.10 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 350mm forward 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.

3.12.11 Compliance with Article 3.12 must be demonstrated with the panels referred to in Articles 15.4.7 and 15.4.8 and all unsprung parts of the car removed.

3.13 Skid block :

3.13.1 Beneath the surface formed by all parts lying on the reference plane, a rectangular skid block, with a 50mm radius (+/-2mm) on each front corner, must be fitted. This skid block may comprise no more than three pieces, the forward one of which may not be any less than 1000mm in length, but must :

a) Extend longitudinally from a point lying 330mm behind the front wheel centre line to the rear wheel centre line.

b) Be made from an homogeneous material with a specific gravity between 1.3 and 1.45.

c) Have a width of 300mm with a tolerance of +/- 2mm.

d) Have a thickness of 10mm with a tolerance of +/- 1mm.

e) Have a uniform thickness when new.

f) Have no holes or cut outs other than those necessary to fit the fasteners permitted by 3.13.2 or those holes specifically mentioned in g) below.

3.16 Upper bodywork :

3.16.1 With the exception of the opening described in Article 3.16.3, when viewed from the side, the car must have bodywork in the area bounded by four lines. One vertical 1330mm forward of the rear wheel centre line, one horizontal 550mm above the reference plane, one horizontal 925mm above the reference plane and one diagonal which intersects the 925mm horizontal at a point 1000mm forward of the rear wheel centre line and the 550mm horizontal at a point lying 50mm forward of the rear wheel centre line.

Bodywork within this area must be arranged symmetrically about the car centre line and, when measured 200mm vertically below the diagonal boundary line, must have minimum widths of 150mm and 50mm respectively at points lying 1000mm and 50mm forward of the rear wheel centre line. This bodywork must lie on or outside the boundary defined by a linear taper between these minimum widths.

3.16.2 Bodywork lying vertically above the upper boundary as defined in 3.16.1 may be no wider than 125mm and must be arranged symmetrically about the car centre line.

3.16.3 In order that a car may be lifted quickly in the event of it stopping on the circuit, the principal rollover structure must incorporate a clearly visible unobstructed opening designed to permit a strap, whose section measures 60mm x 30mm, to pass through it.

3.17 Bodywork flexibility :

3.17.1 Bodywork may deflect no more than 20mm vertically when a 1000N load is applied vertically to it 800mm forward of the front wheel centre line and 795mm from the car centre line. The load will be applied in a downward direction using a 50mm diameter ram to the centre of area of an adapter measuring 300mm x 150mm, the 300mm length having been positioned parallel to the car centre line. Teams must supply the adapter when such a test is deemed necessary.

The deflection will be measured along the loading axis at the bottom of the bodywork at this point and relative to the reference plane.

3.17.2 Bodywork may deflect no more than 10mm vertically when a 500N load is applied vertically to it 450mm forward of the rear wheel centre line and 650mm from the car centre line. The load will be applied in a downward direction using a 50mm diameter ram and an adapter of the same size. Teams must supply the latter when such a test is deemed necessary.

3.17.3 Bodywork may deflect by no more than one degree horizontally when a load of 1000N is applied simultaneously to its extremities in a rearward direction 925mm above the reference plane and 20mm forward of the forward edge of the rear wing endplate.

3.17.4 Bodywork may deflect no more than 2mm vertically when a 500N load is applied simultaneously to each side of it 200mm behind the rear wheel centre line, 325mm from the car centre line and 970mm above the reference plane. The deflection will be measured at the outer extremities of the bodywork at a point 345mm behind the rear wheel centre line.

The load will be applied in a downward direction through pads measuring 200mm x 100mm which conform to the shape of the bodywork beneath them, and with their uppermost horizontal surface 970mm above the reference plane. The load will be applied to the centre of area of the pads. Teams must supply the latter when such a test is deemed necessary.

3.17.5 Bodywork may deflect no more than 5mm vertically when a 2000N load is applied vertically to it at three different points which lie on the car centre line and 100mm either side of it. Each of these loads will be applied in an upward direction at a point 380mm rearward of the front wheel centre line using a 50mm diameter ram in the two outer locations and a 70mm diameter ram on the car centre line. Stays or structures between the front of the bodywork lying on the reference plane and the survival cell may be present for this test, provided they are completely rigid and have no system or mechanism which allows non-linear deflection during any part of the test.

- Any alteration of the incidence of the uppermost closed section may only be commanded by direct driver input and controlled using the control electronics specified in Article 8.2.

3.18.2 Subject to any special conditions relevant to a specific Event, details of which the FIA will provide to each competitor at least one week before the start of an Event, the adjustable bodywork may be activated by the driver at any time prior to the start of the race. In conditions of poor visibility however the race director may, at his absolute discretion, disable all such systems until conditions improve.

If the adjustable bodywork is disabled in this way at the start of any of the three periods of the qualifying practice session (Q1, Q2 or Q3) it will remain disabled for the remainder of the relevant period.

3.18.3 For the sole purpose of improving overtaking opportunities during the race the adjustable bodywork may be activated by the driver after he has completed two laps after the race start or following a safety car period.

The driver may only activate the adjustable bodywork in the race when he has been notified via the control electronics (see Article 8.2) that it is enabled. It will only be enabled if the driver is less than one second behind another at any of the pre-determined positions around each circuit. The system will be disabled by the control electronics the first time the driver uses the brakes after he has activated the system. In conditions of poor visibility however the race director may, at his absolute discretion, disable all such systems until conditions improve.

The FIA may, after consulting all competitors, adjust the above time proximity in order to ensure the stated purpose of the adjustable bodywork is met.

ARTICLE 5 : ENGINES AND KINETIC ENERGY RECOVERY SYSTEMS

5.1 Engine specification :

5.1.1 Only 4-stroke engines with reciprocating pistons are permitted.

5.1.2 Engine capacity must not exceed 2400cc.

5.1.3 Crankshaft rotational speed must not exceed 18,000rpm.

5.1.4 Supercharging is forbidden.

5.1.5 All engines must have 8 cylinders arranged in a 90º "V" configuration and the normal section of each cylinder must be circular.

5.1.6 Engines must have two inlet and two exhaust valves per cylinder.

Only reciprocating poppet valves are permitted.

The sealing interface between the moving valve component and the stationary engine component must be circular.

5.2 Other means of propulsion :

5.2.1 The use of any device, other than the 2.4 litre, four stroke engine described in 5.1 above and one KERS, to power the car, is not permitted.

5.2.2 With the exception of one fully charged KERS, the total amount of recoverable energy stored on the car must not exceed 300kJ. Any which may be recovered at a rate greater than 2kW must not exceed 20kJ.

5.2.3 The maximum power, in or out, of any KERS must not exceed 60kW.

Energy released from the KERS may not exceed 400kJ in any one lap.

Measurements will be taken at the connection to the rear wheel drivetrain.

5.2.4 The amount of stored energy in any KERS may not be increased whilst the car is stationary during a race pit stop.

Release of power from any such system must remain under the complete control of the driver at all times the car is on the track.

5.2.5 Cars must be fitted with homologated sensors which provide all necessary signals to the SDR in order to verify the requirements above are being respected.

5.3 Engine dimensions :

5.3.1 Cylinder bore diameter may not exceed 98mm.

5.3.2 Cylinder spacing must be fixed at 106.5mm (+/- 0.2mm).

5.3.3 The crankshaft centre line must not be less than 58mm above the reference plane.

5.4 Weight and centre of gravity :

5.4.1 The overall weight of the engine must be a minimum of 95kg.

5.4.2 The centre of gravity of the engine may not lie less than 165mm above the reference plane.

5.4.3 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 centre of the crankshaft and at the mid point between the centres of the forward and rear most cylinder bores longitudinally.

5.4.4 When establishing conformity with Articles 5.4.1, 5.4.2, 5.4.3 and Appendix 4 of the F1 Sporting Regulations, the homologated engine will include the intake system up to and including the air filter, fuel rail and injectors, ignition coils, engine mounted sensors and wiring, alternator, coolant pumps and oil pumps.

5.5.5 At any given engine speed the driver torque demand map must be monotonically increasing for an increase in accelerator pedal position.

5.5.6 At any given accelerator pedal position and above 5,000rpm, the driver torque demand map must not have a gradient of less than – (minus) 0.030Nm / rpm.

5.6 Engine control :

5.6.1 The maximum delay allowed, computed from the respective signals as recorded by the ADR or ECU, between the accelerator pedal position input signal and the corresponding output demand being achieved is 50ms.

5.6.2 Teams may be required to demonstrate the accuracy of the engine configurations used by the ECU.

5.6.3 The maximum throttle target map in the ECU may only be used to avoid throttle target oscillations when the change of torque is small for a change of throttle position. It must not be used to artificially reduce the maximum engine torque.

The selection of the maximum throttle target map will be fixed during qualifying and race.

5.6.4 Engine control must not be influenced by clutch position, movement or operation.

5.6.5 The idle speed control target may not exceed 5,000rpm.

5.6.6 Except when anti-stall or idle speed control are active, ignition base offsets may only be applied above 80% throttle and 15,000rpm and for the sole purpose of reducing cylinder pressure for reliability.

5.6.7 A number of engine protections are available in the ECU.

A minimum of nine seconds hold time should be configured for the engine protections enabled during qualifying and race. The configuration of the air tray fire detection and throttle failsafe are exceptionally unrestricted in order to allow each team to achieve the best level of safety.

5.7 Engine high rev limits :

Engine high rev limits may vary for differing conditions provided all are significantly above the peak of the engine torque curve. However, a lower rev limit may be used when :

- The gearbox is in neutral.
- Stall prevention is active.
- The driver clutch request is greater than 95% of the total available travel of the driver clutch actuation device, used only to protect the engine following a driver error.
- An engine protection is active.
- The bite point finder strategy is active.
- The safety car is deployed or during the formation lap.

Except for the above conditions, ignition, fuelling and throttle may not be used to artificially control the engine speed or alter the engine response in a rev range more than 1,000rpm below the final rev limit.

5.8 Exhaust systems :

5.8.1 With the exception of incidental leakage through exhaust joints (either into or out of the system), no fluids, other than those which emerge from the engine exhaust ports, may be admitted into the engine exhaust system.

5.8.2 Engine exhaust systems may incorporate no more than two exits, both of which must be rearward facing tailpipes, through which all exhaust gases must pass.

With the exception of any KERS or capacitor circuitry or coils being used solely to provide ignition, any device with a current requirement greater than 50mA or a power requirement greater than 1W may only be supplied at or below the primary regulated voltage.

Only capacitor discharge ignition systems (those which generate a spark by means of closing a switch which then discharges a capacitor through the primary side of the ignition coil), are permitted to provide a voltage higher than the primary regulated voltage to an ignition coil.

Other than any parts being used to supply a higher voltage to devices such as those described in the previous paragraphs, no device may step up or increase the primary regulated voltage.

5.12 Engine actuators :

With the following exceptions hydraulic, pneumatic or electronic actuation is forbidden :

a) Electronic solenoids uniquely for the control of engine fluids.

b) Components providing controlled pressure air for a pneumatic valve system.

c) A single actuator to operate the throttle system of the engine.

d) Any components required as part of a KERS.

5.13 Engine auxiliaries :

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.

5.14 Engine intake air :

5.14.1 Other than injection of fuel for the normal purpose of combustion in the engine, any device, system, procedure, construction or design the purpose or effect of which is any decrease in the temperature of the engine intake air is forbidden.

5.14.2 Other than engine sump breather gases and fuel for the normal purpose of combustion in the engine, the spraying of any substance into the engine intake air is forbidden.

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 percent of the element X must always be greater than the maximum possible 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 as in 5.15.1 above. 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_3Au, NiCo) – These are materials where the material is based upon intermetallic phases, i.e. the matrix of the material consists of greater then 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 (MMC's) – These are composite materials with a metallic matrix containing a phase of greater than 2%v/v which is not soluble in the liquid phase of the metallic matrix.

5.15.6 Ceramic Materials (e.g. Al_2O_3, SiC, B_4C, Ti_5Si_3, SiO_2, Si_3N_4) – These are inorganic, non metallic solids.

b) Any metallic structure whose primary or secondary function is to retain lubricant or coolant within the engine must be manufactured from an iron based alloy or an aluminium alloy of the Al-Si, Al-Cu, Al-Zn or Al-Mg alloying systems.

c) All threaded fasteners must be manufactured from an alloy based on Cobalt, Iron or Nickel.

Composite materials are not permitted.

d) 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.

5.18 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.

5.19 Stall prevention systems :

If a car is equipped with a stall prevention system, and in order to avoid the possibility of a car involved in an accident being left with the engine running, all such systems must be configured to stop the engine no more than ten seconds after activation.

The sole purpose of such systems is to prevent the engine stalling when a driver loses control of the car. If the car is in second gear or above when the system is activated multiple gear changes may be made to either first gear or neutral, under all other circumstances the clutch alone may be activated.

Each time such a system is activated the clutch must be fully disengaged and must remain so until the driver de-activates the system by manually operating the clutch with a request greater than 95% of the total available travel of the drivers clutch actuation device.

5.20 Replacing engine parts :

The parts in lists A and B below may be changed without incurring a penalty under Article 28.4 of the F1 Sporting Regulations. If changing any of these parts involves breaking a seal this may be done but must carried out under FIA supervision. The parts in List B may only be replaced by identical homologated parts in accordance with Appendix 4 of the F1 Sporting Regulations.

List A

- Clutch.
- Clutch basket.
- Hydraulic pumps.
- Engine electronic boxes (ECU's, power modules, control boxes).
- Fuel filters.
- Fuel pumps.
- Oil filters.
- Oil tank systems.
- Pneumatic bottles, regulators, pumps and pipes for valve actuation.
- Exhaust systems.
- Supports and brackets related to the auxiliaries, mentioned above.
- Screws, nuts, dowels or washers related to the auxiliaries, mentioned above.
- Cables, tubes or hoses related to the auxiliaries, mentioned above.
- Oil or air seals related to the auxiliaries, mentioned above.

ARTICLE 6 : FUEL SYSTEM

6.1 Fuel tanks :

6.1.1 The fuel tank must be a single rubber bladder conforming to or exceeding the specifications of FIA/FT5-1999, the fitting of foam within the tank however is not mandatory. A list of approved materials may be found in the Appendix to these regulations.

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. When establishing the front face of the engine, no parts of the fuel, oil, water or electrical systems will be considered.

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 that 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 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 to the approved standards.

A list of approved manufacturers may be found in the Appendix to these regulations.

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 5 years after the date of manufacture.

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 total area of any such hatches or fittings which are in contact with the fuel may not exceed 30000mm².

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

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 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 fuel in the cockpit.

6.3 Crushable structure :

The fuel tank must be completely surrounded by a crushable structure, which is an integral part of the survival cell and must be able to withstand the loads required by the tests in Articles 18.2.1 and 18.3.

6.4 Fuel tank fillers :

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

ARTICLE 7 : OIL AND COOLANT 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 must be no further than the lateral extremities of the survival cell are from the longitudinal axis of the car.

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 :

In order to avoid the possibility of oil being deposited on the track, the engine sump breather must vent into the main engine air intake system.

7.4 Transversal location of oil system :

No part of the car containing oil may be more than 700mm from the car centre line.

7.5 Coolant header tank :

The coolant header tank on the car must be fitted with an FIA approved pressure relief valve which is set to a maximum of 3.75 bar gauge pressure, details of the relief valve may be found in the Appendix to these regulations. If the car is not fitted with a header tank, an alternative position must be approved by the FIA.

7.6 Cooling systems :

The cooling systems of the engine must not intentionally make use of the latent heat of vaporisation of any fluid.

7.7 Oil and coolant lines :

7.7.1 No lines containing coolant or lubricating oil may pass through the cockpit.

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

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

8.2.5 Pneumatic valve pressure may only be controlled via a passive mechanical regulator or from the ECU and its operation will be monitored by the ECU.

8.2.6 The ECU will be designed to run from a car system supply voltage of 12V nominal provided by a homologated voltage regulator.

8.3 Start systems :

Any system, the purpose and/or effect of which is to detect when a race start signal is given, is not permitted.

The ECU will implement a "lockout" period after each race start or pit stop during which a number of engine and clutch related functions will be frozen or disabled. Details of the strategy may be found in the Appendix to these regulations.

8.4 Data acquisition :

8.4.1 To assist scrutineering, the FIA requires unlimited access to the following ECU information before, during and after any track session :

- Application parameter configurations.
- Logged data and events.
- Real-time telemetry data and events.

Throughout the Event, the logging memory and events buffer may only be cleared by an FIA engineer.

The FIA must have the ability to connect to the ECU via a jump battery using an FIA laptop. The teams should make a jump battery available at all times during the Event.

The teams should transfer the real-time telemetry data and events on the FIA network as requested by, and in the format defined by, the FIA.

Prior to the race, the ECU data logger must be configured in such a way that allows logging of data for at least two hours and fifteen minutes without exceeding the size of the logger memory.

8.4.2 Any data acquisition system, telemetry system or associated sensors additional to those provided by the ECU and ADR must be physically separate and electrically isolated from any control electronics with the exception of :

- The primary regulated voltage supply.
- The car system ground.
- Communication links to the ECU, telemetry unit and ADR.
- Power supplies, provided they are not used to power any control electronics, control sensors or actuators.
- Time synchronisation lines.
- Engine synchronisation lines.
- An umbilical loom whose connector will remain disconnected when the car is moving.

No junction box or break-out box may be shared between the ECU system and a team data acquisition system.

8.5 Telemetry :

8.5.1 Telemetry systems must operate at frequencies which have been approved by the FIA.

8.5.2 Pit to car telemetry is prohibited.

Details of the light control system, which must be fitted to every car, may be found in the Appendix to these regulations.

8.10 Medical warning system :

In order to give rescue crews an immediate indication of accident severity each car must be fitted with a warning light which is connected to the FIA data logger.

The light must face upwards and be recessed into the top of the survival cell no more than 150mm from the car centre line and the front of the cockpit opening and as near to the clutch disengagement system, as described in Article 9.4, as is practical.

Details of the light and its control system may be found in the Appendix to these regulations.

8.11 Installation of electrical systems or components :

8.11.1 Exceptionally, each car may be equipped with a maximum of five test sensor installations, which do not comply with the Technical Regulations, during P1 and P2, provided :

- They could not materially affect the outcome any of the impact tests described in articles 16.2, 16.3, 16.4 and 16.5.
- They comply with Articles 3.3, 3.4.1, 3.6, 3.14.1 and 3.14.2.
- They do not reduce or affect driver visibility.
- They do not obstruct on-board camera views.

Any such test sensor installations do not need to be homologated.

The FIA technical delegate must be notified of any intended test sensor installations prior to the Event at which they are first used.

8.11.2 Competitors must be notified of any changes to the installation instructions for any FIA specified systems or components before 30 June of the previous season.

9.4 Clutch disengagement :

All cars must be fitted with a means of disengaging the clutch for a minimum of fifteen minutes in the event of the car coming to rest with the engine stopped. This system must be in working order throughout the Event even if the main hydraulic, pneumatic or electrical systems on the car have failed. This system must also disconnect any KERS system fitted to the car.

In order that the driver or a marshal may activate the system in less than five seconds, the switch or button which operates it must :

- face upwards and be recessed into the top of the survival cell no more than 150mm from the car centre line ;
- be designed in order that a marshal is unable to accidentally re-engage the clutch ;
- be less than 150mm from the front of the cockpit opening ;
- Be marked with a letter "N" in red at least 40mm tall, with a line thickness of at least 4mm, inside a white circle of at least 50mm diameter with a red edge with a line thickness of at least 2mm.

9.5 Gearboxes :

9.5.1 A gearbox is defined as all the parts in the drive line which transfer torque from the engine crankshaft to the drive shafts (the drive shafts being defined as those components which transfer drive torque from the sprung mass to the un-sprung mass). It includes all components whose primary purpose is for the transmission of power or mechanical selection of gears, bearings associated with these components and the casing in which they are housed.

9.5.2 In this context the following parts are not considered part of the gearbox and may be changed without incurring a penalty under the F1 Sporting Regulations. If changing any of these parts involves breaking an FIA applied seal this may be done but must be carried out under FIA supervision :

- The clutch assembly and any shaft connecting the clutch to the crankshaft or first motion shaft of the gearbox, provided this is located prior to any mechanical speed reduction from the engine.
- The clutch actuator and clutch release bearing(s).
- Inboard driveshaft joints and seals but not their housing if that housing is integral with the gearbox output shaft and therefore part of the sprung mass.
- The hydraulic system prior to the point at which it produces direct mechanical movement of the gear selection mechanism by means of hydraulic actuator(s).
- Oil, oil pumps, oil filters, oil seals, oil coolers and any associated hoses or pipes.
- Electrical sensors, actuators, servo valves and wiring.
- Any parts associated with the suspension or functioning of the sprung suspension that are attached to the gearbox casing.
- The rear impact structure provided it can be separated from any gearbox casing.
- Any other component mounted to the casing whose primary purpose is unconnected with the transmission of power or selection of gears.

9.6 Gear ratios :

9.6.1 The maximum number of forward gear ratios is 7.

9.8.4 The maximum permitted duration for down changes and up changes is 300ms and 200ms respectively. The maximum permitted delay for the latter is 80ms from the time of the driver request to the original gear being disengaged.

The duration of a gear change is defined as the time from the request being made to the point at which all gear change processes are terminated. If for any reason the gear change cannot be completed in that time the car must be left in neutral or the original gear.

9.8.5 Distance channel or track position is not considered an acceptable input to gearbox control.

9.9 Torque transfer systems :

9.9.1 Any system or device the design of which is capable of transferring or diverting torque from a slower to a faster rotating wheel is not permitted.

9.9.2 Any device which is capable of transferring torque between the principal axes of rotation of the two front wheels is prohibited.

9.10 Kinetic Energy Recovery System :

9.10.1 The KERS must connect at any point in the rear wheel drivetrain before the differential.

9.10.2 The system will be considered shut down when all energy is contained within the KERS modules and no high voltage is present on any external or accessible part of any KERS module.

The shutdown process must take no longer than two seconds from activation.

9.10.3 It must be possible to shut down the KERS via the following means :

- The switch required by Article 14.2.1.
- The switches required by Article 14.2.2.
- The switch or button required by Article 9.4.

9.10.4 The KERS must shut down when the ECU required by Article 8.2 initiates an anti-stall engine shut off.

9.10.5 All cars fitted with a KERS must be fitted with a KERS status light which :

- Is in working order throughout the Event even if the main hydraulic, pneumatic or electrical systems on the car have failed.
- Is located in the same general location s the light required by Article 8.10.
- Is green only when the system is shut down and no electrical insulation fault has been detected.
- Remains powered for at least 15 minutes if the car comes to rest with its engine stopped.
- Is marked with a “HIGH VOLTAGE” symbol according to ISO3864 of at least 30mm along the triangle side.

- On the survival cell or gearbox are separated by at least 100mm measured between the centres of the two attachment points.
- On each wheel/upright assembly are separated by at least 90° radially with respect to the axis of the wheel and 100mm measured between the centres of the two attachment points.
- Are able to accommodate tether end fittings with a minimum inside diameter of 15mm.

Furthermore, no suspension member may contain more than one tether.

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

10.4 Steering :

10.4.1 Any steering system which permits the re-alignment of more than two wheels is not permitted.

10.4.2 Power assisted steering systems may not be electronically controlled or electrically powered. No such system may carry out any function other than reduce the physical effort required to steer the car.

10.4.3 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.

10.4.4 The steering wheel, steering column and steering rack assembly must pass an impact test, details of the test procedure may be found in Article 16.6.

10.5 Suspension Uprights :

10.5.1 The suspension uprights must be made from a permitted aluminium alloy. Particulate reinforced aluminium alloy matrix composites are forbidden.

10.5.2 The loads from the suspension members and wheel bearings must individually and entirely be carried by the suspension upright. Exceptionally up to three suspension members may be connected together by titanium, aluminium alloy or steel components before their load is passed into the upright.

10.5.3 Suspension uprights may not protrude beyond :

- A vertical plane parallel to the inner face of the wheel rim and displaced from it by 120mm toward the car centre line.
- A radius of 180mm from the centre of the wheel when viewed from the side.

The above measurements will be made with the wheel held in a vertical position.