FEDERATION INTERNATIONALE DE L' AUTOMOBILE

Appendix to the 2013 FIA Formula One Technical Regulations

The purpose of this Appendix is to provide information about the practices and procedures in use by the FIA when carrying out checks under the regulations. It is for information only and does not form part of the regulations themselves. In general, any changes deemed necessary by the FIA Technical Department will come into force 90 days after publication, or sooner in consultation with the Formula One Technical Working Group.

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Article 3.7.9

Non-structural fairing laminate specification

General laminate: 1 ply woven 200g carbon (0.2mm) / 3mm Nomex core / 1 ply woven 200g carbon.

Edge reinforcement: The edge of the laminate may be reinforced with a further 2 plys of woven 200g carbon (1 either side of the core) which may extend no further than 20mm in from the perimeter of the fairing.

Article 6.1.1

The following are the only materials approved by the FIA for use in the manufacture of fuel bladders to FIA/FT5-1999 specification :

Manufacturer	AERO TEC LABORATORIES
Materials	ATL-818-D ATL-818-D (Issue 2003)
Manufacturer	PREMIER FUEL SYSTEMS
Material	Kevlar F228
Manufacturer	PRONAL
Material	39387/02396

Article 6.1.4

The list of manufacturers approved to produce fuel bladders to the FIA/FT5-1999 specification are :

Aero Tec Laboratories
Spear Road Industrial Park
Ramsey
NJ 07446
USA

Tel + 1 201 825 1400
Fax + 1 201 825 1962

40 Clarke Road
Mount Farm Industrial Estate
Bletchley
Milton Keynes
MK1 1LG
United Kingdom

Tel + 44 1908 270590
Fax + 44 1908 270591

FPT Industries
The Airport
Portsmouth
Hants PO3 5PE
United Kingdom

Tel
Fax

Premier Fuel Systems Limited
Willow Road
Trent Lane Industrial Estate
Castle Donington
Derby DE7 2NP
United Kingdom

Tel + 44 1332 850515
Fax + 44 1332 850749

Pronal
Rue du Trieu du Quesnoy
ZI de Roubaix-Est
59115 Leers
France

Tel + 33 3 20 99 75 00
Fax + 33 3 20 99 75 20

Article 6.6.3

The fuel sampling hose comprises a tube approximately 2000mm long x 4.6 mm internal diameter with a “-2” female snap fit connector at one end and a valve at the other end attached to a 200 mm long piece of stainless steel tubing of 4.6 mm internal diameter.

Article 7.5

Details of the FIA approved water pressure relief valve are as follows :

Manufacturer	:	Circle Seal Controls, Inc.
Model Number	:	532A-2MP-3.75 Bar g
		SK703-3.75 Bar g
Seal Material	:	Viton
Temperature Range	:	-20°F to 400°F

Supplier :

TAMO LIMITED
22 Sarum Complex
Salisbury Road
Uxbridge
Middlesex UB8 2RZ

Tel + 44 (0)1895 200015
Fax + 44 (0)1895 252205
Contact : Robin Moses

Article 8

Guidelines for electronic systems

1) Sensor and Actuator Homologation

1.1 Parts to be homologated

In accordance with Article 8.2 of these regulations, the following components must be homologated:

a. Control sensors. A sensor will be designated a control sensor if its signal is used by any strategy of the FIA Standard ECU (SECU) other than the input handling, input failure detection or on-board functions used for logging only.

b. Monitoring sensors connected to the FIA Standard ECU.

c. Actuators: this includes all parts controlled electrically. For example:

- Moog valves
- Solenoid valves
- Ignition coils
- Solenoid injector valves
- Electrical pumps.

The homologation process will primarily focus on electrical and electronic characteristics. Variants due to packaging, mounting, connector and wiring may not require individual homologation.

All components homologated by the FIA must be uniquely identifiable.

1.2 Classification of parts

The classification for a part is a decision that rests solely with the FIA. The lists below are not necessarily exhaustive but are shown to given an indication of the choices we are likely to make.

The parts to be homologated will be classified in the following three categories:

'Category a':

- Sensors used for driver inputs
- Control sensors and actuators containing semiconductor devices

Sensors and actuators used during the 2007 racing season will, at FIA discretion, be considered to 'category b'.

A summary list of 'category a' parts ,including name, type and applications, will be published for all teams to view and a working reference sample of these parts will be retained by the FIA.

Teams will be allowed to inspect 'category a' components under the supervision of the FIA and the component's manufacturer or supplier.

'Category b':

- Control sensors and actuators containing no semiconductor device
- Sensors used by the engine and gearbox protection strategies
- Sensors used for the display of information to the driver

'Category b' components will be logged on a private list between the FIA and the team or supplier. A working reference sample of these parts will be retained by the FIA.

‘Category c’:

- Sensors used for monitoring / logging purpose only
- Sensors used during testing only

‘Category c’ components will be logged on a private list between the FIA and the team or supplier.

1.3 Request for homologation

a. A request to homologate a sensor or an actuator may be submitted to the FIA by a team or a supplier.

b. Requests received from a supplier will only be processed by the FIA if it is clear that the component to be homologated is used or will be used in races by at least one team.

c. Non-homologated parts may be used during testing or when in conformity with Article 8.11.1 of the Technical Regulations. A request to run non-homologated parts must be submitted to the FIA before use.

d. Non-homologated parts may be run during aerodynamics straight line testing without the approval of the FIA.

1.4 Homologation steps

The steps to homologate a sensor or an actuator are as follows :

a. The team or supplier submits a request to the FIA including :

- Denomination and identification of the component to be homologated.
- List of the teams using the component (if the request is from a supplier).
- Detailed specification of the component.
- One working reference sample of the component that will be retained by the FIA.

b. The FIA validates the conformity of the component with the technical regulations.

c. The FIA sends a homologation certificate to the team or supplier who submitted the request.

d. The summary list of homologated ‘category a’ components will be published for all teams to view.

The teams are responsible for verifying the compatibility of sensors, actuators and other electronic components with the FIA Standard ECU.

1.5 Sensor specification

For sensors, the specification should include (but is not limited to) the information listed below. Any inability to provide information specifically requested by the FIA must be justified.

a. Application :

- List of applications where the sensor will be used.

b. Electrical information :

- Schematic of any integrated electronic circuitry
- Supply voltage
- Maximum supply current
- Maximum output voltage
- Output type and range

- Output polarity
- Output non-linearity
- Output hysteresis
- Output resistance
- Accuracy
- Response time
- Thermal drift
- Cut-in threshold for speed sensors
- Short circuit protection
- Calibration conditions
- Calibration formula.

c. Cable and connection definition :

- Connection definition.

d. Mechanical information :

- Mechanical dimensions, including drawing
- Requirements for sensor orientation
- Operating range of air gap for speed sensors
- Guidelines for trigger wheel design for speed sensors.

e. Environmental information :

- Operating vibration range
- Operating humidity range
- Resistance to fluids
- Operating temperature range (for sensor body and sensor cable).
- Operating pressure range.

1.6 Actuator specification

For actuators, the specification should include (but is not limited to) the information listed below. Any inability to provide information specifically requested by the FIA must be justified.

a. Application :

- List of applications where the actuator will be used.

b. Hydraulic information:

- Flow rate characteristics
- Operating pressure

c. Electrical information:

- Schematic of any integrated electronic circuitry
- Voltage range
- Current range
- Output type and range

- Inductance information
- Accuracy
- Response time
- Short circuit protection.

d. Cable and connection definition:
   - Connection definition

e. Mechanical information:
   - Mechanical dimensions, including drawing
   - Requirements for actuator orientation
   - Mounting instructions.

f. Environmental information:
   - Operating vibration range
   - Resistance to fluids
   - Operating temperature range (for actuator body and actuator cable)
   - Operating pressure range.

2) <u>On-car wiring</u>

In addition to requirements listed in Article 8 of these regulations:

a. The connectivity of the control loom to the FIA Standard ECU is defined in *SCR3987_xx Electrical Specification* by the list of required FIA inputs and outputs. If any FIA Standard ECU input or output is not being used for the function designated to it in *SCR3987_xx Electrical Specification* then it will be configured in the ECU's FIA application as being not fitted (inputs), or not used by strategy (outputs).

   Spare inputs or inputs flagged as 'Not fitted' may be used to connect extra sensors for monitoring.

   The usage of any outputs which are operated by the 'Spare Output' processing must be confirmed with the FIA.

b. All wiring looms must be built to ensure that each control sensor and each control actuator connected to the FIA Standard ECU is electrically isolated from logging-only sensors connected to either the FIA Standard ECU or a team data acquisition unit. The following guidelines should be used to achieve an acceptable level of electrical isolation:
   - Follow the recommendations listed in *SCR3999_xx Electrical Installation Manual*,
   - Any measurement of resistance from the TAG310 main harness analogue ground connections to any analogue ground pin on any harness should not exceed 1 ohm,
   - With the exception of the IGP supply, regulated power supplies may not be shared between control and logging-only sensors.

c. The teams can decide which materials to use for the wiring looms and where to place connection breaks.

Modifications to the electrical harness to interface the Lemo connectors on the HIU to other types of connectors are accepted by the FIA with the following conditions:

d. The interface must not include any passive or active electronic component.

e. The interface will be homologated as part of the electrical harness.

f. The installation of the HIU and connector interface on the car must allow the FIA sticker to be visible on the HIU.

3) FIA Standard ECU connection to SDR, FIA marshalling unit and FOM FIU

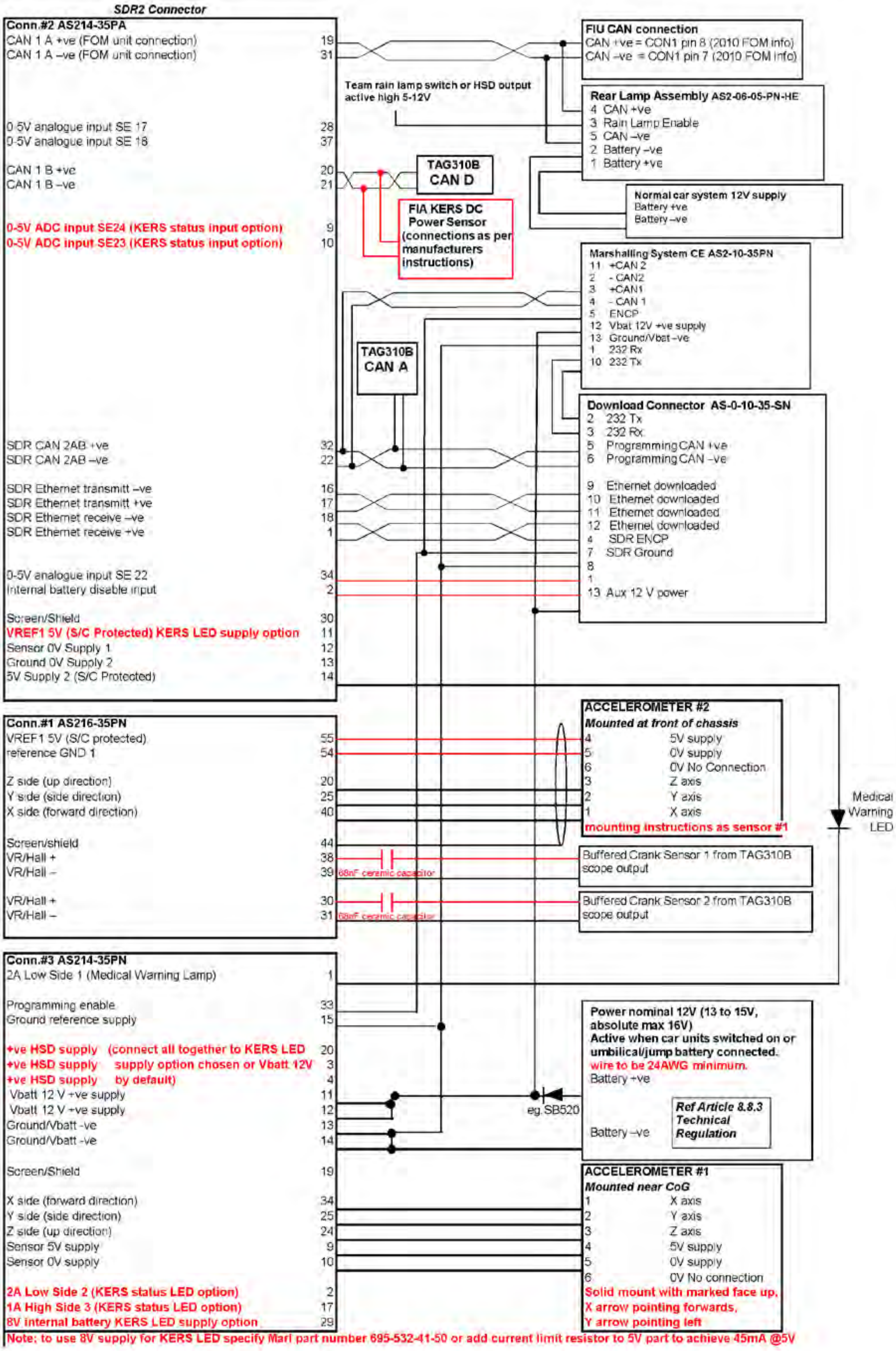
An overview of the connections to the SDR is provided hereafter. Note that the FOM interface unit and FIA Marshalling unit connect directly on to SDR CAN 1A and SDR CAN 2AB respectively.

It is a requirement to feed the crank speed signals from the TAG320 to the SDR. This is achieved by connecting the two scope outputs of the TAG320 to the crank inputs of the SDR via inline capacitors. Inductive crank 1 and inductive crank 2 outputs must be selected in the related TAG320 BIOS parameters to activate this function.

The SDR also operates as an ADR so please remember article 8.8.1; in particular, the recorder must be fitted :

- In a position within the cockpit which is readily accessible at all times from within the cockpit without the need to remove skid block or floor.
- In order that the download connector is easily accessible when the driver is seated normally and without the need to remove bodywork.

The SDR will also log raw channels sent by CAN from the TAG320 – the configuration is hard coded in any particular release. Teams must provide a means of verifying the calibration of the all pressure and temperature sensors. In the case of sensor types being used where modulation of the supply or reference voltage can cause a change in the output, the team must inform the FIA so that the particular voltage measurements can also be logged.



Pin Out SDR 2011 rev1.xls

4) Application of the maximum crankshaft rotational speed

In order to comply with Article 5.1.3 of the F1 Technical Regulations, the FIA hard rev-limit provided by the FIA Standard ECU will be set to 18,000rpm. In addition, the data and events logged by the FIA Standard ECU and SDR will be used to analyse occurrences of over-revving.
The SDR calculates the crankshaft rotational speed once per engine cycle (i.e. two revolutions) as an average over the last engine cycle.

5) Verification of team units

In order to comply with Article 8.1 of the F1 Technical regulations, all team electronic units containing a programmable device will be checked by means of :

5.1 FIA stickers

The FIA will seal and identify all electronic units on the car that contain a programmable device. All sealed units must be presented for inspection upon FIA request.

5.2 Software version verification

All programmable devices must have a mechanism that allows the FIA to accurately identify the software version or versions that are being used. In order to satisfy this requirement, a range of procedures are available.

a. The dynamic CRC logging methodology currently in use may be suitable; subject to filling unused code memory with an FIA supplied random filler sequence. Unless the design is a carry-over from previous seasons, an FIA supplied MD5 CRC algorithm must be used in place of the previous CRC32. Any microprocessor with access to non-code memory of sufficient size to store additional program images may not be considered suitable for this method.

   All units that can be reprogrammed via an external connector and that are connected to the FIA Standard ECU “control” CAN buses (A, B, C or D) are expected to provide this mechanism.

b. Restricted programming. Reprogramming of electronic units will be restricted by an approved mechanism that has been established before the electronic unit is first used. The following is a non-exhaustive list of possible techniques :

   i) Depending on the design, the FIA sticker or stickers may act as a seal.

      Examples: 1) where the reprogramming is via an internal connector, 2) the sticker seals some hatch that gives access to reprogramming.

   ii) Password protection.

   iii) Application list restriction: typically a list of CRCs or MD5s of all the allowed program versions that the unit can run. Updating the list requires knowledge of an FIA secret password.

   iv) Signed application code. An FIA private encryption key must be securely stored in each unit. The code will not run unless it has been digitally signed by the FIA.

In all cases there must be a mechanism available to determine the software version in any reprogrammable device. Examples would be: 'program image' verification, upload of 'program image', CRC or MD5 of ‘program image’. A simple version string communicated by the device is not sufficient. Security 'fuses' or other mechanisms that prevent access to stored 'images' should not be used.

One time programmable devices can be used but subject to the device having an acceptable mechanism for identifying the program version.

Any change in the team’s electronic unit software must be registered with the FIA in advance of use.

5.3 Setup data

All set up and calibration data must be verifiable by the FIA at any time. Appropriate communications equipment, software and analysis tools must be supplied by the team for FIA use.

5.4 Power Cycles

Cars with units containing microprocessors able to run code from RAM may be power cycled by the FIA immediately prior to the race. Thereafter no external computer may be connected to the car until parc ferme has finished or permission is granted by the FIA Technical Delegate.

6) FIA Standard ECU software versions

It is the FIA's policy to have a single version of software running on all cars.

When a new version of software is made available by the FIA Standard ECU supplier, it is expected that each team will use this software at the next Event. If a team has valid reasons for not using this new version then they should be submitted in writing to the FIA with justifications to support the claim.

The "version locking" scheme of the FIA Standard ECU allows the team to select which version of software to load from a list that is maintained by the FIA. This FIA list will contain a limited number of previous releases chosen by the FIA.

The FIA will publish, after each race, the software version (or versions) that were used by each team during the Event.

7) FIA Standard ECU software setup

Teams are reminded that they are responsible for ensuring that the FIA Standard ECU software setup provides functionality that is consistent with the FIA F1 Technical and Sporting Regulations.

For new software versions, the FIA will communicate the base FIA data version to be used during the Event.

8) Lap trigger transmitters

The FIA Standard ECU supplier will supply, set-up, locate on the track and service a set of lap trigger transmitters to be used by all teams during team tests and Events.

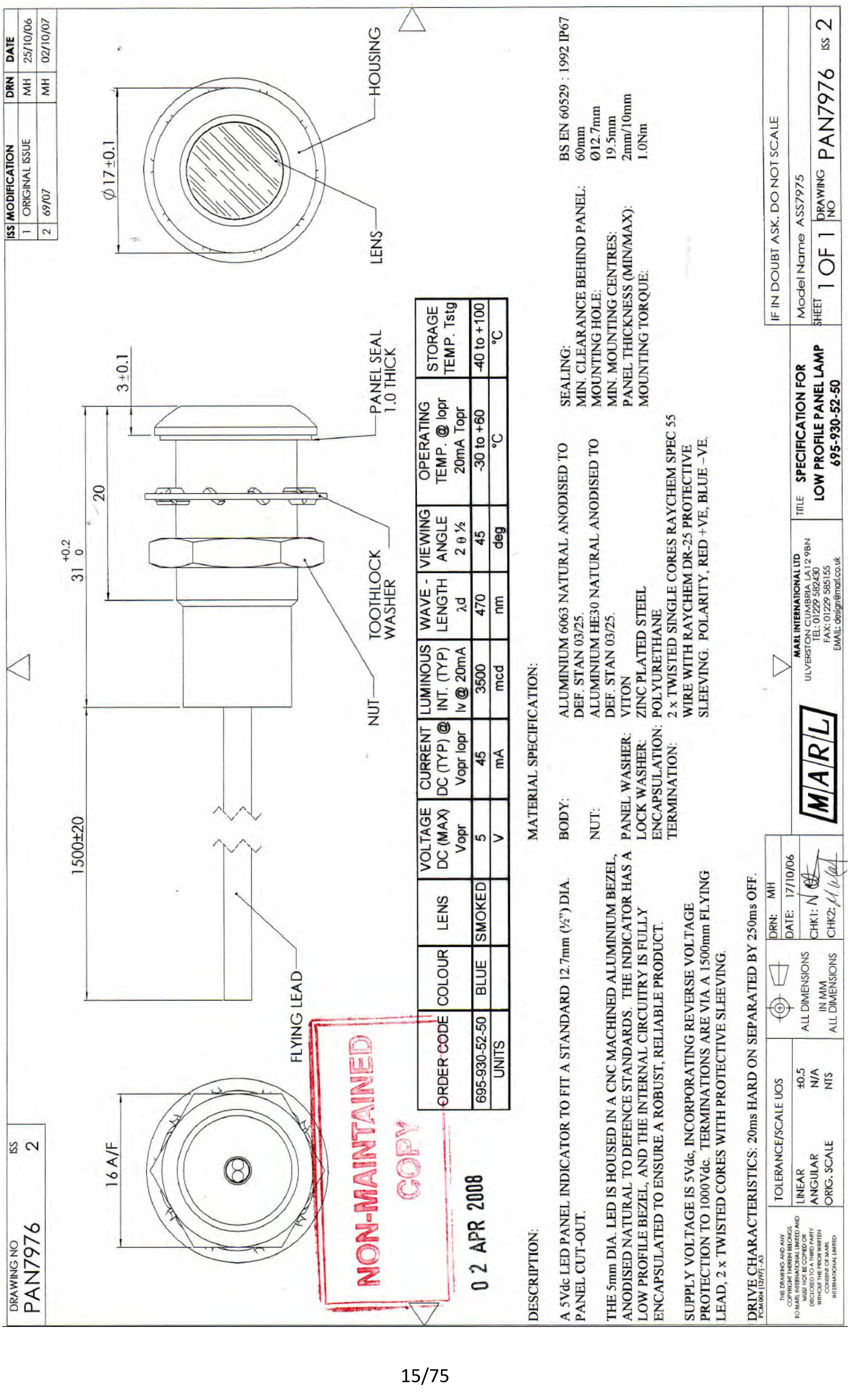
All lap trigger transmitters will be positioned on the pit lane side of the track for easy access during sessions and to minimise the service time in the event of failure.

In general, the transmitters will be configured as shown in the table below. The exact positioning may vary if the track layout requires it.

Transmitter name	Main lap trigger	Backup lap trigger	Pit-lane lap trigger
Position on the track	On or as close as possible to the control line	30m after the main lap trigger transmitter *Set sBackupLapTriggerOffset to 30m*	On or as close as possible to the pit-lane entry line
Configuration	External 6 Internal 6 *Set NTrackChannel to 6* *Set NTrackCustChannel to 6*	External 3 Internal 6 *Set NBackupChannel to 3* *Set NBackupCustChannel to 6*	External 1 Internal 6 *Set NPitLaneChannel to 1* *Set NPitLaneCustChannel to 6*
Frequency	2193Hz	1812Hz	1623Hz

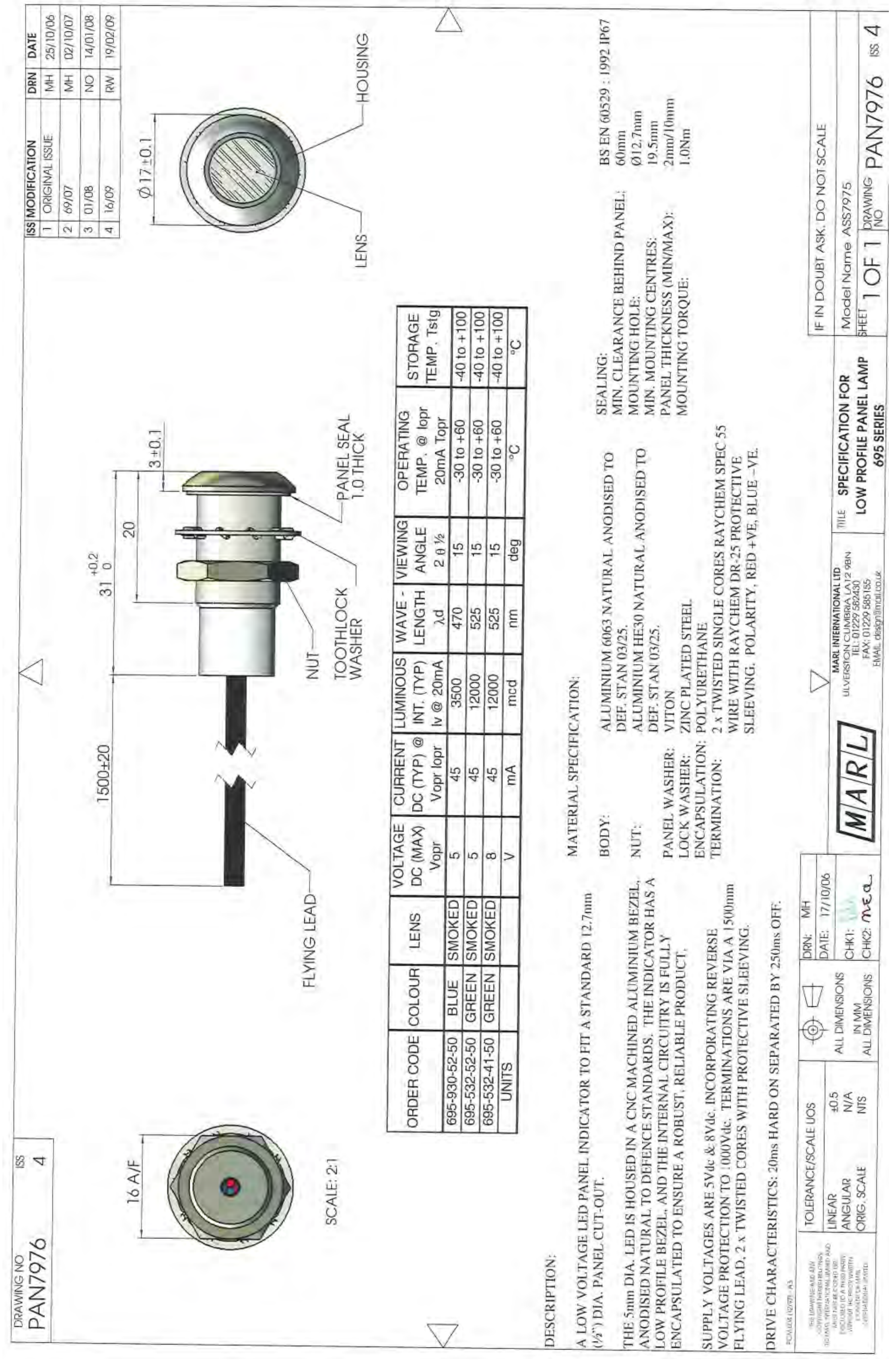
Article 8.10

Details of the FIA approved Medical Warning Light are as follows :



Article 9.9.5

The light shown below may be used for KERS status warning :



Article 10.3.6

Wheel tethers will be tested using the following test procedure :

FIA TEST SPECIFICATION 03/07

FOR

FORMULA ONE WHEEL RESTRAINT CABLES

1. SCOPE

Wheel restraint systems are important to improve protection to the drivers and the personnel (spectators and officials) within the proximity of the race event. It has been shown that during an accident a wheel may be ejected at velocities in excess of 150km/h (42m/s) relative to the car, which corresponds to a linear kinetic energy of 17kJ for a 20kg wheel assembly.

This specification provides test methods, criteria and limits to assess the performance of wheel restraint systems to ensure that the potential for wheel ejection is reduced.

During early development work, an advanced wheel restraint system was considered in two parts; an energy absorbing unit and a connecting tether. However, the latest research has demonstrated that an integrated tether can absorb the required energy without the need for a separate energy absorbing unit. And, therefore, an integrated tether is the preferred solution. Other designs may be acceptable, but the geometry and function must be approved by the FIA before submitting for certification.

A definition of the key components is provided below.

2. DEFINITIONS

2.1 Wheel Assembly

Those parts, likely to include the wheel, tyre, upright, brake calliper and brake disk, that are considered to be a single projectile during a wheel ejection event.

2.2 Wheel Restraint Cable (Tether)

Flexible load carrying element that connects the wheel assembly to the main structure of the car and that provides the required strength and energy absorbing capability.

2.3 Energy Absorber

The energy absorbing capability of the tether. A separate energy absorbing element may be permitted but must be approved by the FIA before submitting for certification.

2.4 Tether End Fitting
Feature at each end of the tether to facilitate attachment to the car and the wheel assembly. The tether end fitting may include a bobbin if this represents the in-car conditions.

The in-board-tether-end-fitting connects to the car chassis
The out-board-tether-end-fitting connects to the wheel assembly

2.5 Tether Attachment
Attachment between the tether end fitting and the main structure of the car that achieves the strength and geometrical requirements defined by the Technical Regulations.

2.6 Tether Sliding Surface
Rigid structure that represents the local structure of the car over which the tether must slide if the wheel is ejected in any direction normal to the axis of rotation of the rear wheels.

3. PERFORMANCE ASSESSMENT

3.1 Wheel Restraint Cable Test
The performance of the wheel restraint system shall be measured in accordance with the dynamic tests defined in Appendix A.

3.1.1. One Wheel Restraint Cable (per wheel assembly)
During the tensile tests and tether sliding surface tests, the following performance shall be achieved by all test samples;

The energy absorption shall not be less than 6kJ over the first 250mm of displacement.
The peak force shall not exceed 70kN (CFC 1000) over the first 250mm of displacement.

3.1.2. Two Wheel Restraint Cables (per wheel assembly)
During the tensile tests and tether sliding surface tests, the following performance shall be achieved by all test samples;

The energy absorption shall not be less than 3kJ over the first 250mm of displacement.
The peak force shall not exceed 70kN (CFC 1000) over the first 250mm of displacement.

APPENDIX A: WHEEL RESTRAINT CABLE TEST PROCEDURE

A1. Apparatus
An appropriate test apparatus is shown in Figures A1 and A2.

The aim of the test is to dynamically load the tether in a tensile direction, in order to determine the strength, elongation and energy absorbing characteristics. The tests shall be conducted using a dynamic sled apparatus based on the Formula One frontal impact test. The mass of the sled shall be 780kg ± 7.8kg.

Two tether attachments shall be provided; one fitted to the sled and one fitted to a ground anchor within a close proximity to the sled. The position of the sled tether attachment point relative to the CoG of the sled shall be chosen to prevent excessive torque loadings to the sled. The position of the ground anchor tether attachment point shall achieve the tether angle requirements defined in A1.1 and A1.2. The tether attachments shall reproduce the in-car fixing method as defined by the Technical Regulations. The tether manufacturer may provide a bobbin arrangement if this represents the in-car fixing method.
During the test, the entire kinetic energy of the sled shall be directed into the tether end fittings to load the tether in tension. The tether shall move with the sled during the pre-impact phase with the in-board tether end fitting engaged with the sled tether attachment. At the *point of impact*, the out-board tether end fitting shall engage with the ground anchor tether attachment. As the tether is loaded the sled will be decelerated. The motion of the sled shall be otherwise unrestrained until the displacement of the sled has exceeded 500mm from the *point of impact*. After this time, the sled may be arrested using crush tubes or any other appropriate device.

Two loading configurations are prescribed

A1.1 Tensile Test (0^o)
During the tensile test, the tether shall be loaded between two points only; the sled attachment point and the ground anchor attachment point. At the *point of impact,* the angle between the major axis of the tether and the axis of the sled shall not exceed 20^o.

A1.2 Tether Sliding Surface Test (90^o)
During the tether sliding surface test, the tether shall be loaded at three points; the sled attachment point, the tether sliding surface and the ground anchor attachment point. The tether sliding surface shall be a solid steel cylinder with a diameter of 25mm and a length of at least 100mm. The major axis shall be perpendicular to the axis of the tether. At the impact point, the distance between the in-board end of the tether and the centre of the Tether Sliding Surface shall be 115mm ± 15mm. The apparatus shall be configured such that the tether is flexed through 90^o ± 5^o around the tether sliding surface. At the *point of impact*, the angle between the out-board section of the tether and the axis of the sled shall not exceed 20^o.

A2. Test Samples
The test samples shall include the tether and the tether end fittings. The test samples shall have a length of 600mm ± 15mm measured between the centres of the tether end fittings.

A3. Environmental Conditioning
The FIA may require that polymeric tethers are conditioned before testing as follows;

Temperature:	100^{o}C for 24 hours
Moisture:	Immersed in water 25^{o}C for 48 hours
Ultra-violet:	250mm from 125V xenon-filled quartz lamp for 48hours

A4. Instrumentation
The apparatus shall be fitted with a single axis load cell to measure the force exerted at the out-board tether end fitting along the direction of the tether. The sensitive axis of the load cell must be aligned with the axis of the tether ± 5^o at the *point of impact*. It is understood that during the impact event, the angle of the tether will change as the tether extends. However, the sensitive axis of the load cell shall be fixed at the *point of impact* position.

A method of measuring the velocity of the sled immediately before the *point of impact* shall be provided. The sled shall be fitted with an accelerometer to measure the fore-aft acceleration during the impact event.

All instrumentation shall conform to SAE J211 (latest revision) with a channel frequency class (CFC) of 1000. The sampling frequency shall be at least 20,000Hz.

A5. Test Procedures

Test A5.1. Wheel Restraint Tensile Test
The test samples shall be fitted to the sled with the in accordance with the tensile test configuration as described in A1. The impact velocity shall be at least 14m/s. The tests shall be conducted on two test samples and the results shall be reported as defined in A6.

Test A5.2. Wheel Restraint Tether Sliding Surface Test
The test samples shall be fitted to the sled with the in accordance with the tether sliding surface test configuration as described in A1. The impact velocity shall be at least 14m/s. The tests shall be conducted on two test samples and the results shall be reported as defined in A6.

A6. Results
The results shall include:

(a) Length of test sample (mm)
(b) Diameter (or x-sectional area) of test sample (mm or mm^2)
(c) Mass of test sample (g) including end fittings
(d) Actual impact velocity (m/s)
(e) Acceleration-time history of the sled CFC60 (g, ms)
(f) Velocity[1]-time history of the sled (m/s, ms)
(g) Force-time history for tether showing peak force CFC1000 (N, ms)
(h) Force-displacement[2] history for tether CFC1000 (N, mm)
(i) Energy[3] absorbed over first 250mm

1. The velocity shall be calculated by single integration of acceleration
2. The displacement shall be calculated by double integration of acceleration
3. The energy shall be calculated by integration of force with respect to displacement

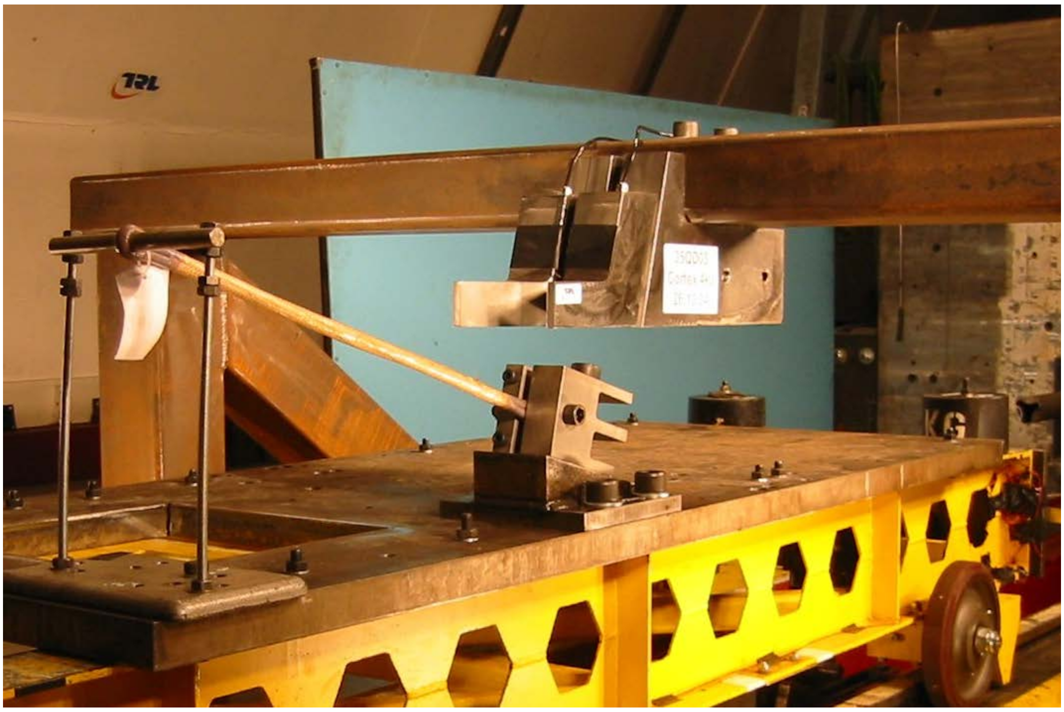


Figure A1. Test apparatus for 0^{o} (tensile) tests on wheel restraint cables

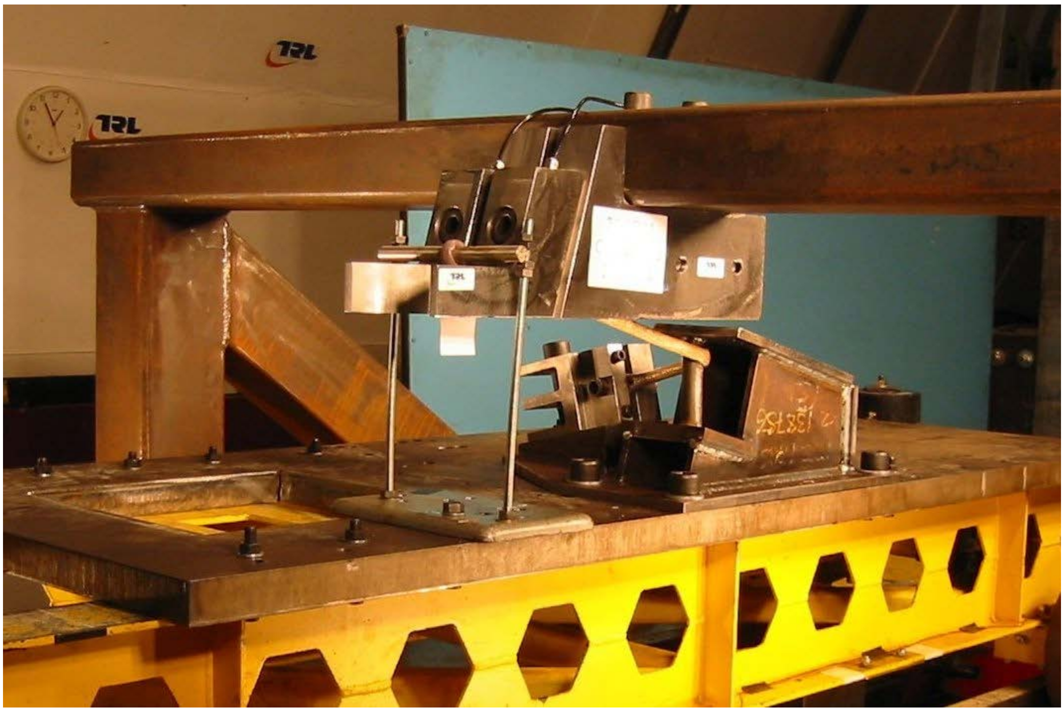


Figure A2. Test apparatus for 90^{o} (tether sliding surface) tests on wheel restraint cables

Article 14.1.2

The following extinguishants are approved for use in Formula One cars :

Company	Product
SPA Design	SPA Lite
Chubb Fire	Spray Lance
OMP	Ecolife
Total Walther	Microdrop Arc 3x6
Hi Tech	AFFF
Safety Devices	AFFF
Kingdragon	Hydral AFFF
Werner GmbH	Wema AFFF
Lifeline	Zero 2000
Sparco	Eco-Sir
AP Sport	Exteco
Taifun	Safetydrive III
BRB/QUELL	3M Light Water
FEV	AFFF
	FX G-TEC
Mistec	AFFF

Article 14.1.3

The following volumes (in litres) of extinguishant are required :

❶ : SPA Lite - Zero 2000 - Spray Lance - Eco-Sir - Ecolife – FEV AFFF - Safety Devices
❷ : HiTech - Mistec

	❶	FEV FX G-TEC	Wema AFFF	Exteco	Safetydrive 3	Arc 3x6	3M L. Water	Hydral AFFF	❷
Cockpit	1.65	n/a	4.7	2	4.8	5	same	4.7	2.20
Engine	3.30	n/a	4.7	4	engine +cockpit	5	same	4.7	3.30

With reference to the above Article, the following quantities (in kg) of extinguishant are required :

Cockpit	1.12	1.7	4	1.15	4	4	same	4	1.75
Engine	2.25	Engine +cockpit	4	2.3	engine +cockpit	4	same	4	3.0

Article 14.1.5

Depending upon the product, extinguishers should be pressurised as follows :

Product	Fill Pressure	Temperature limits
SPA Lite	7.0 bar	-15°C / +60°C *
Zero 2000	12.0 bar	-5°C / + 45°C *
Spray Lance	10.0 bar	-11°C / +55°C *
Wema AFFF A1, B1	14.0 bar	-15°C / +60°C
Wema AFFF A2, B2	14.0 bar	+4°C / +60°C
Eco-Sir	12.0 bar	+20°C /
Ecolife	12.0 bar	-20°C /
Exteco	12.0 bar	-20°C / +100°C
Safetydrive III	15.0 bar	0°C / +50°C
Arc 3x6	16.0 bar	+4°C / +60°C (without antifreeze)
		-20°C / +60°C (with antifreeze)
3M Light Water	10.3 bar	+4°C / +60°C
Hi Tech	12.0 bar	-6°C / +60°C
FEV AFFF	9.0 bar	-5°C / +60°C
		-10°C / +60°C
FEV G-TEC	n/a	
Safety Devices	9.0 bar	-5°C / +60°C
		-10°C / +60°C
Mistec	12.0 bar	-6°C / +60°C
Hydral AFFF	14.0 bar	-15°C / +60°C

* Special options available

PRODUCT SUMMARY

McLaren ELECTRONIC SYSTEMS

RAINLIGHT 2

HIGH INTENSITY LED LIGHT WITH CAN

The Rainlight 2 is a high intensity LED based light with CAN connectivity for use at the rear of an F1 car.

The light is activated via a control signal input. Flashing speed and intensity are adjustable and diagnostic information is available via the CAN bus.

Default mode (without CAN link): The light flashes at 4Hz when the Rain Light input pin is switched to supply voltage.

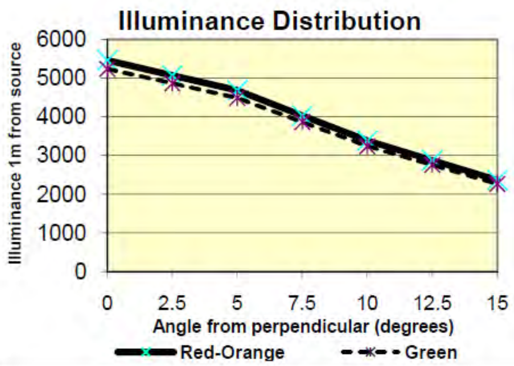
Red-Orange and Green versions are available.

Electrical

- Supply 10 to 16V dc
- Supply not to exceed 17V continuous (the unit is protected against transients and reverse polarity)
- Current up to 3.0A at 13.8V
- Rain light input 5 to 17V dc
- Default Rain light flash rate 4Hz, 30% duty cycle
- Internal temperature sensor

Optical

- LED colour Red-Orange (617nm wavelength), or Green (530nm wavelength).
- Typical maximum light intensity distribution as shown on graph.
- CAN control of brightness and flash rate (No CAN termination fitted)



Connection Definition

- Connector ASL006-05PN-HE
- Connection

Pin 1	Supply
Pin 2	Ground
Pin 3	Rain Light Input
Pin 4	CAN+
Pin 5	CAN-

Mechanical

- Aluminium alloy body, hard anodised and dyed black
- Clear polycarbonate lens cover
- Black polyester surround
- Supplied with Q4 Flex-Loc A/V mounts
- Weight < 265g

Environmental

- Splash resistant to standard Motorsport fluids
- Maximum humidity 100%
- Operating temperature 0 to +85°C
- Storage temperature -10 to +85°C
- Shock tested to 50g, 11ms
- Vibration 100 to 1000Hz, 24 hours each axis

100Hz	$0.00797g^2/Hz$
200Hz	$0.17157g^2/Hz$
300Hz	$0.54279g^2/Hz$
650Hz	$0.00965g^2/Hz$
1000Hz	$0.02080g^2/Hz$

11/11/09

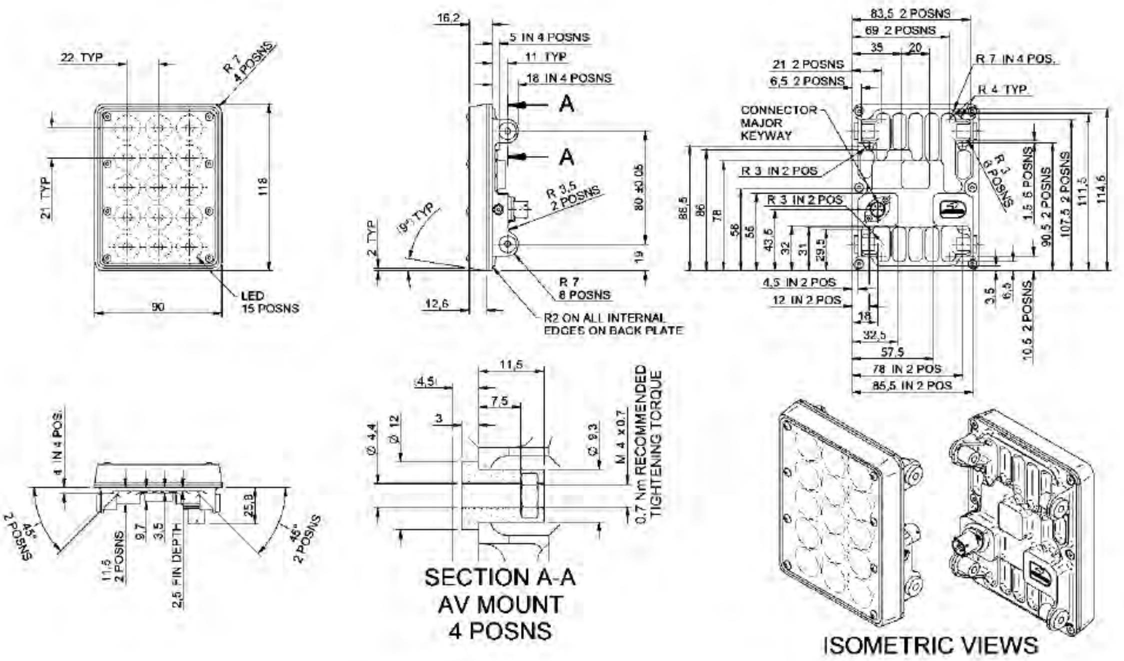
McLAREN TECHNOLOGY CENTRE
CHERTSEY ROAD, WOKING
SURREY GU21 4YH, UNITED KINGDOM
T: +44 (0) 1483 261400
F: +44 (0) 1483 261402
W: www.mclarenelectronics.com

USA: McLAREN ELECTRONICS INCORPORATED
T: +1 (704) 660 3181
Email: sales@mclarenelectronics.com

ASIA: TOKYO R&D CO. LTD
T: +81 (0) 46 226 5501
Email: mes@r-d.co.jp

RAINLIGHT 2

HIGH INTENSITY LED LIGHT WITH CAN



Description	Order Code
Rain Light CAN (Red LED's)	O 030 970 010 009
Rain Light CAN (Green LED's)	O 030 970 010 010

McLAREN TECHNOLOGY CENTRE
CHERTSEY ROAD, WOKING
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Email: sales@mclarenelectronics.com

ASIA: TOKYO R&D CO. LTD
T: +81 (0) 46 226 5501
Email: mes@r-d.co.jp

Article 14.6.1

The following materials are the only ones approved for head protection :

For ambient temperatures above 30°C (Type A)	'**Confor' CF45** (Blue)
For ambient temperatures between 15°C and 30ºC (Type B)	'**Confor' CF42** (Pink)
For ambient temperatures below 15°C (Type C)	'**Sunmate' medium soft grade** (Light blue)

Type A and B foams are available from :

E.A.R. Specialty Composites Corporation
7911 Zionsville Road
Indianapolis IN 46268 - USA
Tel + 1 317 692 1111
Fax + 1 317 692 0618

or

Dowty Energy Control Products
Unit C
The Beaver Centre
Ashburton Industrial Estate
Ross on Wye
Herefordshire HR9 7BW
United Kingdom

Tel + 44 1989 565 636
Fax + 44 1989 565 410

Type C foam is available from :

Dynamic Systems Inc
235 Sunlight Drive
Leicester
NC 28748
USA

Tel + 1 828 683 3523
Fax + 1 828 683 3511
E Mail dsi@sunmatecushions.com

Article 14.6.5

The head protection must be secured to the car in the following way :

Two horizontal pegs behind the driver’s head and one pin on each of the forward extremities, the latter must be clearly indicated and easily removable without the use of tools.

Article 14.6.7

The following material is the only one approved for leg protection :

For all ambient temperatures (Type B) : **Confor CF42** (Pink)

Type B foam is available from :

E.A.R. Specialty Composites Corporation
7911 Zionsville Road
Indianapolis IN 46268 - USA
Tel + 1 317 692 1111
Fax + 1 317 692 0618

or

Dowty Energy Control Products
Unit C
The Beaver Centre
Ashburton Industrial Estate
Ross on Wye
Herefordshire HR9 7BW
United Kingdom

Tel + 44 1989 565 636
Fax + 44 1989 565 410

Article 14.8.4

Details of the tool, belt receptacles and head stabilisation may be found in the specification below.

RECOMMENDED SPECIFICATION FOR EXTRACTABLE SEATS
IN SINGLE SEATER AND SPORTS CARS

Version 3 01-10-2005

In order that an injured driver may be immobilised and removed from the car in his seat under medical supervision following an accident, cars shall be fitted with a seat constructed according to the following principles.

1. The seat shall be in the form of a shell in non-metallic fibre composite material, suitable if necessary for receiving a liner formed to the driver, which should be positively located. The seat shall provide him with good lateral support at the hips and shall extend from coccyx to shoulder level (unless there is an integrated headrest as mentioned in 3).

2. The shape and fit of the seat in the cockpit will be such that:
- no head restraint worn by the driver may be less 25mm from any structural part of the car when he is seated in his normal driving position;
- removable shoulder supports can be fitted on either side if necessary.

3. Normally the seat shall be designed with a slot in the back to accept a head stabilising board which is issued to all extrication crews in the FIA Extrication Bag. The dimensions of this slot are given in Figures 1 and 2.

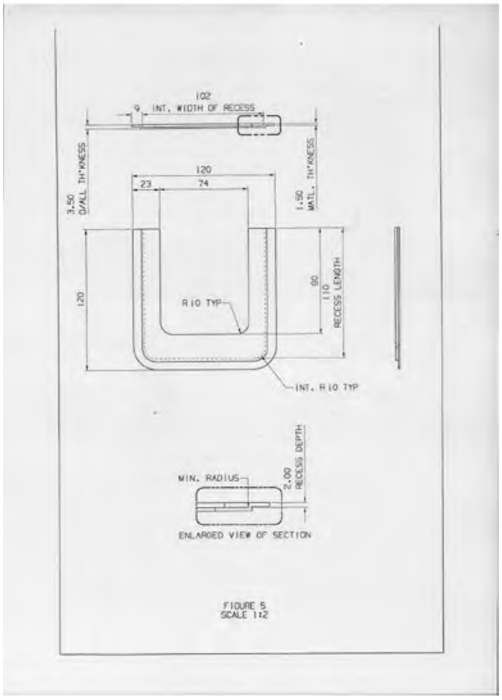


Figure 1. Receptacle for removable head board

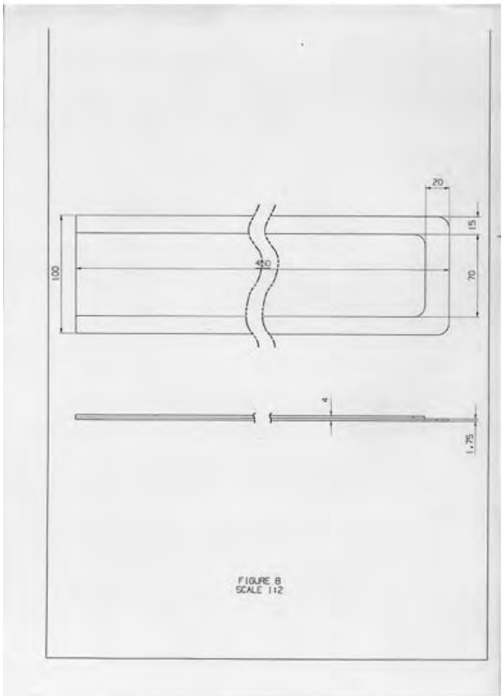


Figure 2. Removable head board

An alternative model, used in some existing formula cars, has an integral head support which extends upwards, with a minimum width of 90mm, as far as a horizontal tangent to the top of the driver's head.

4. The seat must be removable without the need to cut any of the seat belts or remove the harness buckle.
The shoulder and lap belts must fall away over the seat edges as it is withdrawn and the crotch straps must pass freely through the seat bottom hole or holes, which must be located in front of the driver's crotch.
Any seat liner must have the same holes as the seat shell, identical and perfectly aligned with them in order to prevent the harness straps being trapped.
However, if the lap straps have to pass through holes in the seat, it is necessary to fit the car with a harness having the buckle attached to a shoulder belt, given that the buckle will not pass between the driver's body and the side of the seat.

5. The seat shall be located in the chassis such that it is firmly fixed horizontally. It is important that the seat shall not be displaced or fractured by lateral or longitudinal accelerations. To achieve this it is recommended to eliminate any voids between seat and chassis.
If it is mechanically secured, this must be done with no more than two bolts. If bolts are used they must:
- be clearly indicated and easily accessible to rescue crews;
- be fitted vertically;
- be removable with a 4mm Allen key, issued to all extrication crews in the FIA Extrication Bag.

6. The seat must be equipped with the following straps and anchorages (see figures 3 and 4) for immobilising the driver and lifting the seat, with the help of the contents of the FIA Bag (see bag contents in Appendix).

Figure 3. Disposition of strap receptacles

Figure 4. Detail of lower straps

- 2 shoulder straps, diagonally crossed from right side of thorax to top left corner (red strap) and from left side of thorax to top right corner (blue strap), attached with plastic adjuster buckles. The female buckle receptacles at the shoulders are mounted on webbing loops in the corresponding colours, on to which 2 of the black lifting straps from the FIA Bag will also be clipped.

- 1 buckle receptacle***** on each side of the seat at hip level, to receive one of the orange immobilising straps from the FIA Bag.

- 1 buckle receptacle***** on each side at the bottom end of the seat, to receive the other orange immobilising strap from the FIA Bag and mounted on orange webbing loops onto which the other 2 black lifting straps from the FIA Bag will also be clipped.

**See buckle references in Appendix.*

The straps shall be :

- In 50mm wide seat belt webbing.
- Preferably in the colour corresponding to their function.
- Permanently exposed at the edges of the seat so as to be immediately visible and accessible to the extrication teams. The liner shall be trimmed accordingly.

7. The FIA training DVD showing the seat in action, as well as any further information, is available on request from the FIA, Geneva.

APPENDIX - CONTENTS OF THE "FIA EXTRICATION BAG"

One bag with FIA logo
One tool - 4mm Allen key
One headboard in carbon fibre with Velcro on both sides
4 cushions to place between head and headboard as necessary
2 red straps with Velcro for immobilising the head at forehead and chin
2 orange straps with plastic male buckles*, adjustable, for immobilising at hips and thigh
1 black strap with Velcro for tying hands together
1 blue strap with Velcro for tying feet together
4 black straps with snap hooks for lifting the seat out

*** BUCKLE: maker and references**:
Butonia (London) Ltd.
E-mail: bltd@butonia-group.com
Tel: +44 (020)7249 5141
Fax: +44 (020)7249 8859

Part n°: 960406-BA-50
Description: ACW CSR2 2" BLACK BUCKLES

Article 15.1.2

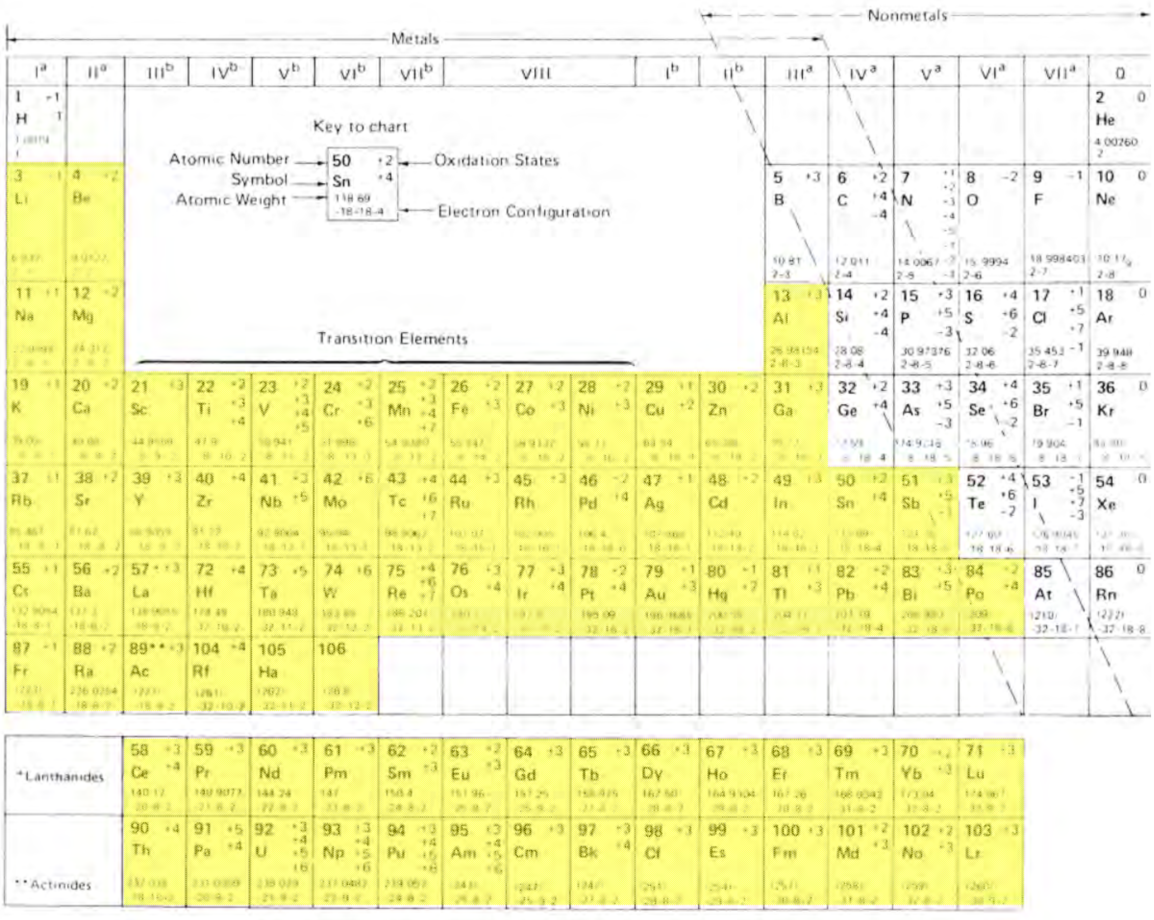
The definition of metallic materials and test procedure are detailed below.

DEFINITION OF METALLIC MATERIALS

A metallic material will be defined as a material that is made-up of metallic elements, whether that material is a pure metal, alloy of several metals or an inter-metallic. In the case of a composite this is designated a metallic material when the matrix or reinforcement, whatever phase proportion, is composed of metallic elements.

Metallic elements are those designated by the periodic table, shaded yellow below.

PERIODIC TABLE OF THE ELEMENTS



Numbers in parentheses are mass numbers of most stable isotope of that element.

Non-metallic materials will include pure and impure compounds such as oxides, nitrides, silicides etc, and material with organic matrices such as carbon and Kevlar reinforced composites.

FIA Test Procedure 03/03

Specific Modulus of Metallic Materials

1) All materials over 35GPa/gm/cm^3, and with a metallic content greater than 60% by mass, must be submitted for testing at the National Physical Laboratory, Teddington, UK.

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

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

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

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

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

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

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

9) The report for each materials type will normally include all relevant information, the stress-strain curves, Young's modulus values, density measurements and calculated specific modulus.

   Specific modulus results will be quoted to the nearest 0.1GPa/gm/cm^3. Any material found to be above 40GPa/gm/cm^3 (including total uncertainty) will be deemed not to comply with Article 15.1.2 of the 2003 F1 Technical Regulations.

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

May 2003

Article 15.4.1

Position of chassis transponders required by the above Article :

One transponder on the upper surface of the survival cell within a 150mm radius of the centre of the line A-A.

One transponder in each side of the cockpit rim anywhere between 300-850mm forward of the rear edge of the cockpit entry template.

Article 15.4.7

The additional side anti-intrusion panel lay-up details may be found below.

FIA Institute for Motor Sport Safety

Specification for 2008 Secondary Side Intrusion Panel

FINAL VERSION 1.0

General

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

Zylon HM – 300gsm

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

T1000G – 280gsm

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

Matrix System

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

Adhesive (to chassis)

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

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

Outer surface

1 ply T1000G (0/90)

16 plies Zylon $(\pm45, 0/90)_8$ or $(\pm45, 0/90, 0/90, \pm45)_4$

1 ply T1000G (0/90)

Inner surface

Thickness

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

Area Weight

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

Voids

The panel shall be essentially void free.

Examples of Compliant Materials

1. Supplied by Cytec

   Zylon HM-300gsm/2x2 twill with Cycom2020 epoxy resin (NOM 42% by weight)

   T1000G-12K 280gsm/2x2twill or 5 harness weave with Cycom2020 epoxy resin (NOM 42% by weight)

2. Supplied by ACG

   Zylon HM-300gsm/2x2 twill with MTM49-3 epoxy resin (NOM 43% by weight)

   T1000G-12K 280gsm/2x2twill or 5 harness weave with MTM49-3 epoxy resin (NOM 40% by weight)

Andrew Mellor 4 September 2006

Article 15.4.8

The additional front anti-intrusion panel lay-up details may be found below.

FIA Institute for Motor Sport Safety

Specification for 2011 Forward Side Intrusion Panel

FINAL VERSION 1.0

General

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

Zylon HM – 300gsm

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

T1000G – 280gsm

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

Matrix System

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

Adhesive (to chassis)

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

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

Outer surface

1 ply T1000G (0/90)

7 plies Zylon (±45, 0/90, ±45, 0/90, ±45, 0/90, ±45)

1 ply T1000G (0/90)

Inner surface

Thickness

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

Area Weight

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

Voids

The panel shall be essentially void free.

Examples of Compliant Materials

1. Supplied by Cytec

   Zylon HM-300gsm/2x2 twill with Cycom2020 epoxy resin (NOM 42% by weight)

   T1000G-12K 280gsm/2x2twill or 5 harness weave with Cycom2020 epoxy resin (NOM 42% by weight)

2. Supplied by ACG

   Zylon HM-300gsm/2x2 twill with MTM49-3 epoxy resin (NOM 43% by weight)

   T1000G-12K 280gsm/2x2twill or 5 harness weave with MTM49-3 epoxy resin (NOM 40% by weight)

Andrew Mellor   4 January 2011

Article 16.1.1

The test procedure is detailed below.

TYPE AND RANGE OF CHASSIS AND STEERING COLUMN TRANSDUCERS	**Single axis transducers** 2000g overload capacity (+/- 1000g). Low working range 200g (high linearity (2 % or better) of the accelerometer within the range of 0 – 200g)
DUMMY SUGGESTION	Hybrid III (size: 50% male)
TYPE AND RANGE OF DUMMY TRANSDUCER	**Three axis transducer** 2000g overload capacity (+/- 1000g). Low working range 200g (high linearity (2 % or better) of the accelerometer within the range of 0 - 200g)
TYPE OF SIDE IMPACT TRANSDUCER	TNC F1 Impact TR001.issue 1
FILTER FOR TRANSDUCER DATA	Front and rear test (peak deceleration) CFC 60 Front test (average deceleration) unfiltered Dummy chest CFC 180 Side (peak force) CFC 60 Side (average deceleration) unfiltered Steering column (peak deceleration) CFC 600 All filters specified SAE J211
SAMPLING RATE	20 kHz each test
TIME ZERO (T0)	T0 will be defined by electronic contact
VELOCITY AT T0	Velocity at T0 will be measured immediately before impact
VELOCITY CALCULATION	Single integration of unfiltered deceleration data
DISPLACEMENT CALCULATION	Displacement will be established by double integration of unfiltered deceleration data
FRONTAL IMPACT TEST : DATA PROCESSING PROCEDURE	<u>Peak deceleration over the first 150mm of deformation</u> Peak deceleration using deceleration data filtered to CFC60 Time for 150mm will be determined as the first instant that displacement exceeds 150mm <u>Peak deceleration over the first 60kJ energy absorption</u> Peak deceleration using deceleration data filtered to CFC60 Energy will be established by numerical integration (unfiltered deceleration x mass) x displacement Time for 60kJ will be determined as first instant that the energy exceeds 60kJ <u>Average deceleration of the trolley</u> Average deceleration from T0 to V0 using unfiltered deceleration data V0 will be determined as first instant that velocity is less than 0m/s

	<u>Peak deceleration in the chest of the dummy</u> Deceleration data filtered to CFC180
SIDE IMPACT TEST : DATA PROCESSING PROCEDURE	<u>Average deceleration</u> Average deceleration from T0 to V0 using unfiltered deceleration data V0 will be determined as first instant that velocity is less than 0m/s <u>Force applied to any one of the four impactor segments</u> Force data filtered to CFC60 <u>Energy absorbed by each of the four impactor segments</u> Energy will be established by numerical integration of force x displacement from T0 to V0 Force data per segment will be established using the sum of unfiltered data from four load cells V0 will be determined as first instant that velocity is less than 0m/s
REAR IMPACT TEST : DATA PROCESSING PROCEDURE	<u>Peak deceleration over the first 225mm</u> Peak deceleration using deceleration data filtered to CFC60 Time for 225mm will be determined as first instant that displacement exceeds 225mm <u>Maximum deceleration for cumulative 15ms</u> Cumulative period will be established by using deceleration data filtered to CFC60
STEERING COLUMN TEST : DATA PROCESSING PROCEDURE	<u>Maximum deceleration for cumulative 3ms</u> Cumulative period will be established by using deceleration data filtered to CFC600

Parts to be fitted to the crash structure for impact tests

Frontal impact test :

- Front impact structure including properly attached front wing hangers.
- A fully representative 500mm wide front wing section. If there is provision within the front wing to carry ballast the lightest version must be tested.
- Ventilation scoops.
- Any kind of externally fitted winglets including a dummy camera.
- Any kind of externally fitted brackets.
- Any part or component which is forward the front end of the survival cell such as the steering rack, hydraulic lines for the power steering, brake fluid containers etc., even if these fall outside the deformation zone.

Rear impact test :

- Rear impact structure including inserts for the attachment of components.
- A fully representative 500mm wide lower rear wing section.
- Fully machined gearbox (the part number and weight must be supplied at the test).
- Differential (real or dummy).
- Any structural shrouds.
- Rear light (SLC dummy rear light possible).
- Any brackets situated behind the rear wheel centre line.
- Any rear suspension members which are fitted to the structure behind the rear wheel centre line.
- Jack hook (if fitted).

Side impact test :

- Impact structures including any brackets.
- All components such as electronic boxes which fall within the area of the impactor, allowing for the tolerances permitted by Article 16.3 and the 1mm between the impactor tiles, this area is 407mm x 551mm (its centre lying 300mm above the reference plane and 500mm forward of the rear edge of the cockpit opening template).

Article 16.2

With reference to the above Article, the test procedure is detailed below.

TYPE AND RANGE OF FRONTAL IMPACT LOADCELL WALL TRANSDUCERS	FTSS FIA load cell system : Array of 20 single axis 600kN load cells, each 125mm x 125mm, arranged 4 wide x 5 high.
FILTER FOR TRANSDUCER DATA	Front test (peak force) CFC60

Article 16.3

Details of the impactor which must be used during the side impact test are as follows :

TNC ELECTRONICS
STRAIN MEASUREMENT TECHNOLOGY

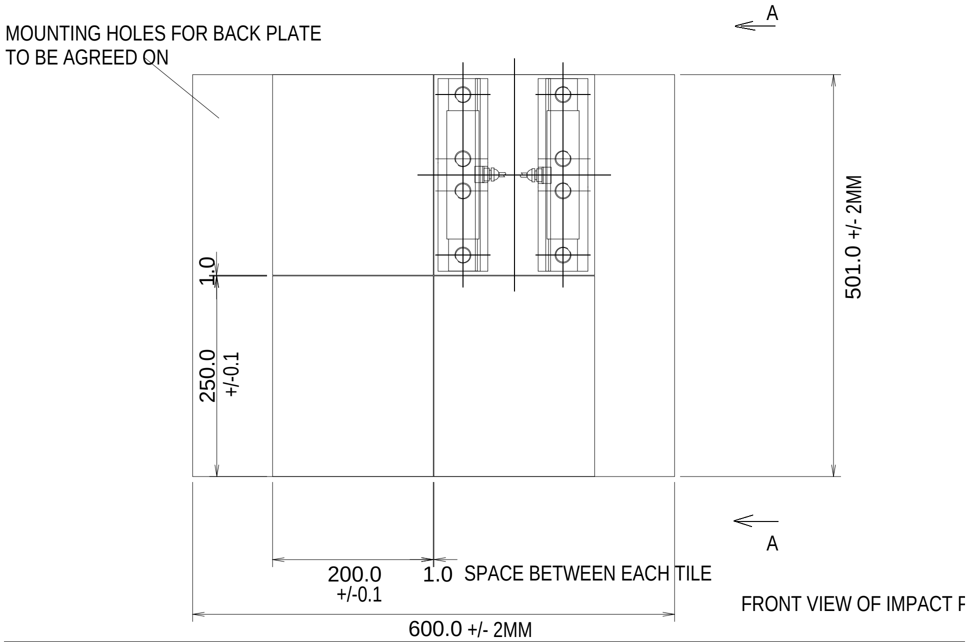
Unit C3, Acre Business Park
Acre Road, Reading
Berkshire RG2 0SA
Telephone : 01189 314107
Facsimile: 01189 314971

F1 2001 Impact Load measuring plate

TNC F1 Impact TR001 issue 1(8/5/00)

Description:

The Impact load measuring plate will be manufactured in such a way that 4 off Impact faces (Tiles) of 200 mm x 250 mm x 38 mm will be mounted via the load cells to a single back plate manufactured from 38 mm thick Aluminium 600 mm × 501 mm.



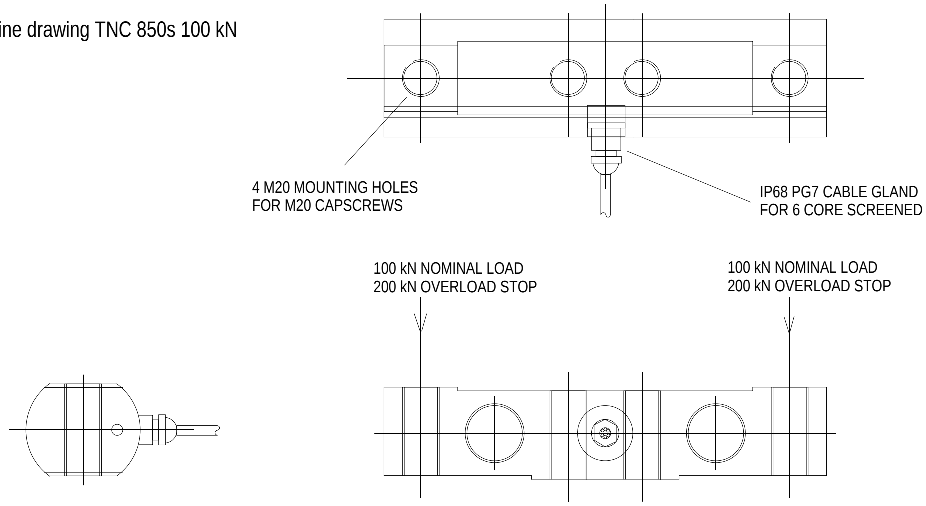
(Drawing 1153a)

Each Impact Tile will be mounted on a 4 off Load Cell system which will comprise of 2 Off Double Shear Beam style Load Cells designed in such a way that each end of the beam is wired as an independent Load Cell.

(See attached out line drg. and spec for TNC 850s).

Each Load cell will be manufactured so that an over load stop will be provided at approx. 200% of rated load. Therefore no load cell will suffer damage if loaded up to 400% of rated load

Outline drawing TNC 850s 100 kN

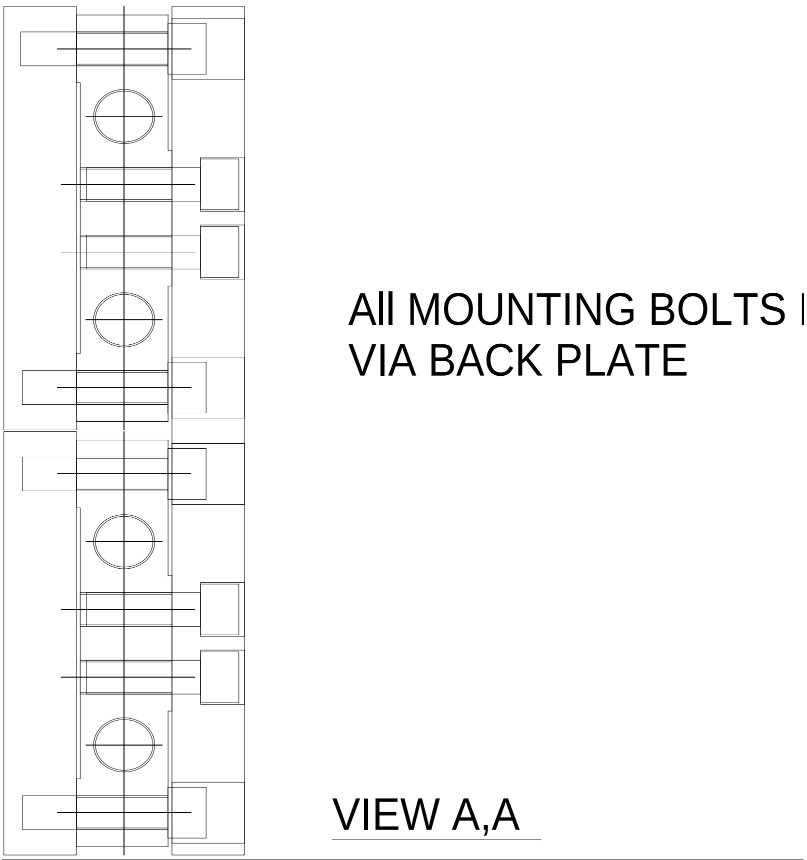


(Drawing 1153)

Each load cell will be individually calibrated up to 200% of rated load, and the outputs rationalised to 1.5 mV/V +/-0.25%.

Load cell mounting:

<u>The plate will be designed and manufactured in such a way that all fixing bolts will be accessed via the back plate, thus leaving the font Tile faces clear of holes.</u>



Impact plate Technical Details:

Nominal Tile loading 4×100 KN=400KN.

Obtainable measuring accuracy of each Tile:< 0.25% Nominal load

Total Load per Tile up to overload 4 × 200KN= 800KN.

Static Calibration Certification traceable to NAMAS will be provided for each Impact Tile.

Single Lifting Eye for assembly will be provided.

Maximum overall weight estimated at: 91 Kg. (Including all fixing bolts)

150 KN Rated Load Cells can be provided at no extra cost as an option.

Materials used:

<u>Load cell : 174/PH precipitation hardened.</u>

Impact plates: HS 30 TF.

Fixing bolts: High Tensile steel BZP.

Cable: 6 core poly insulated overall screen braid 5.5 dia.

TNC 850s

Technical Data

Standard load ranges	kN	100, 150
Full Load output	mV/V	1.5 +/-0.25%
Excitation voltage (recommended) dc or ac	V	10 - 15
Excitation voltage (maximum) dc or ac	V	18
Safe service load	%	400
Safe side load	%	150
Combined error (non-linearity & hysteresis)	%	<+/- 0.08
Repeatability	%	<+/- 0.05
Output at zero load	%	<+/- 1.0%
Input resistance	ohms	350 +20/ -0
Output resistance	ohms	350 +/-2
Creep after 30 minutes (20 deg C)	%	<+/- 0.02
Operational temperature range	deg C	-20 to +80
Compensated temperature range	deg C	-10 to +40
Temperature coefficient of zero	%/C	<+/-0.0017
Temperature coefficient of span	%/C	<+/-0.0010
Environmental protection		IP65

Cable length standard m 5
Insulation G ohms >2 at 50V.dc

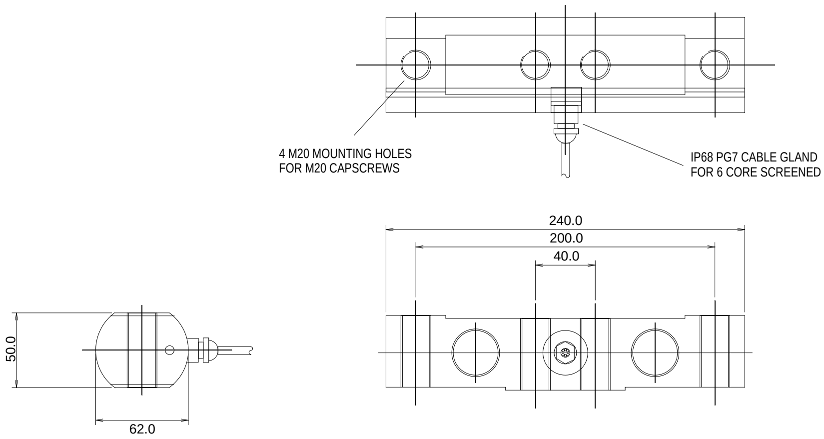
NOTE: All percentages related to Full Rated Load

		LC1	LC2
Electrical Connections	**Red + input**	**Green + output**	**White + output**
Blue - input	**Yellow – output**	**Black – output**	

Screen not connected to load cell

All Dimensions in mm.

Outline drawing TNC 850s 100,150kN



Article 18.6.1

Side intrusion panels will be tested using the following test procedure :

FEDERATION INTERNATIONALE DE L' AUTOMOBILE

SIDE INTRUSION TEST PROCEDURE 02/05

1. SCOPE

This document defines the test methodology and performance specification for Formula One Survival Cell Penetration Resistance. The penetration resistance is evaluated by testing flat samples which are constructed with the same lay-up configuration as the survival cell. The test method aims to represent the conditions by which the survival cell structure is loaded during a side impact.

2. DEFINITIONS

2.1 Test sample

Flat panel with lay-up configuration corresponding to the side wall of the survival cell. The size of the test sample is 550mm x 550mm with a rigid 25mm border. The sample will be supplied with 28 mounting holes, of diameter 9.0mm, which are equally spaced around the perimeter of the sample, and positioned 15mm from the edge.

2.2 Rigid nosecone

A conical impactor which represents the loading conditions of a Formula One deformable nosecone during a side impact accident. The rigid nosecone is a truncated cone with an enclosed angle of 25^{o} ± 1^{o}, a length of at least 200mm, and a 138mm ± 1mm diameter flat face which has a radius of 10mm (± 1mm).

3. PERFORMANCE ASSESSMENT

The performance of the survival cell panel shall be tested by the method described in 4) below The results shall be presented to the FIA in accordance with 5) below.

The maximum load shall exceed 250kN and the energy absorption shall exceed 6,000J.

4. TEST PROCEDURE AND INSTRUMENTATION

4.1 Apparatus

A rigid frame shall be provided to which the four sides of the test specimen may be clamped in order to simulate in-vehicle boundary conditions whilst preventing any spurious damage to the test specimen. The frame shall support the perimeter of the sample with an overlap of 25mm, thus providing an unsupported central area of 500mm x 500mm.

The inside lower edge of the frame may have a 5mm radius. The sample should be placed with the side which represents the outer skin of the survival cell uppermost and be fastened by a clamping plate and 28 M8 screws which have been tightened to a torque of 20Nm.

The sample will be tested using the rigid nosecone described in 2.2 above.

A method of forcing the nosecone through the test sample at a rate of 2mm ± 1mm per second to a maximum load of 300 kN shall be provided.

4.2 Specification of test samples

The lay-up configuration of the test sample shall correspond to the side wall of the survival cell. The test sample shall be flat and measure 550mm x 550mm, and the thickness shall correspond to the thickness of the survival cell. A rigid border of width 25mm shall be provided, in order to fasten the test sample to the test apparatus, thus providing a central test area of 500mm x 500mm.

4.3 Instrumentation

The apparatus shall provide a means for measuring the applied load and the displacement of the nosecone. The instrumentation shall conform to the requirements of the NAMAS Accreditation Standard and the NAMAS regulations (or equivalent). The load and displacement shall be continuously measured at a sampling frequency of 10Hz.

4.4 Test Procedure

The test sample shall be fastened to the rigid frame and positioned on the compression testing machine. The rigid nosecone shall be positioned on the centre of the panel and a load shall be applied, to force the nosecone through the panel, until the displacement of the nosecone has exceeded 150mm. The applied load and the deflection shall be continuously measured during the test. The ambient temperature shall be 25^{o}C (+/-5^{o}C).

5. RESULTS

The results shall be presented on A4 size paper and shall include:

(a) Chassis reference number
(b) Thickness of test sample
(c) Graphical trace to show load (kN) versus displacement (mm)
(d) Graphical trace to show energy [1] (J) versus displacement (mm)
(e) Maximum load [2] (kN)
(f) Energy absorbed [3] (J)

1. The energy shall be calculated by single integration of the load with respect to displacement with an interval no greater than 1mm.

2. The maximum load over the first 100mm of displacement.

3. The energy absorbed over the first 100mm of displacement.

Article 19.8.1

Fuel samples will be taken and handled in the following way :

At any time during an Event a fuel sample can be taken from a car, a fuel drum or from a fuel rig by the FIA. A representative of the team should be present during sampling.

SAMPLING

When sampling from a car or a fuel rig the fuel is sampled with the fuel sampling hose mentioned in Article 6.6.3 of the 2009 FIA Formula One Technical Regulations. This comprises a tube approximately 2000 mm long x 4.6 mm internal diameter with a "-2" female snap fit connector at one end and a valve at the other end attached to ca. 200 mm of 4.6 mm internal diameter stainless steel tubing. Fuel drums are sampled by siphoning using approximately 1500 mm of rubber fuel piping.

Before sampling the sampling hose is flushed with the fuel to be sampled using a volume of fuel approximately equal to three times the volume of the hose. The fuel is then sampled sequentially into three tinplate cans. Therefore at least one litre of fuel has to be on board a car at any time during the Event. The tinplate cans should be filled to at least 85 % of their total volume with fuel. During the sampling the fuel temperature may be measured. A fire extinguisher should be present.

LABELLING

After sampling all three cans are labelled and sealed with a numbered seal. On the label the following is recorded: the Event, date, team, car number, seal number, team representative including signature and FIA delegate including signature.

SAMPLES

One sample remains with the team, two samples remain with the FIA. One of these two FIA samples is used for the "Track-side" analysis. The other is kept refrigerated and used in the case of a dispute.

Initial comparisons are carried out by careful manual inspection of peak height ratios in the GC traces of the sample and that of the approved reference fuel. The fuel traces are also overlaid and compared using facilities available in an appropriate software package. If an apparent discrepancy is observed, computer generated peak areas are compared with those obtained on the reference fuel (using the same integration parameters). To avoid any effects due to evaporation, comparisons will be made with the change in peak area of similar sized peaks either side of (and, if possible, close to) the peak in question. For example, if the peaks either side of the peak in questions have each increased in relative area by 5% and the peak in question has increased by 15%, it will be considered that the relevant increase in area on the peak in question is 10%. Only increases in the relative areas of individual peaks will be examined.

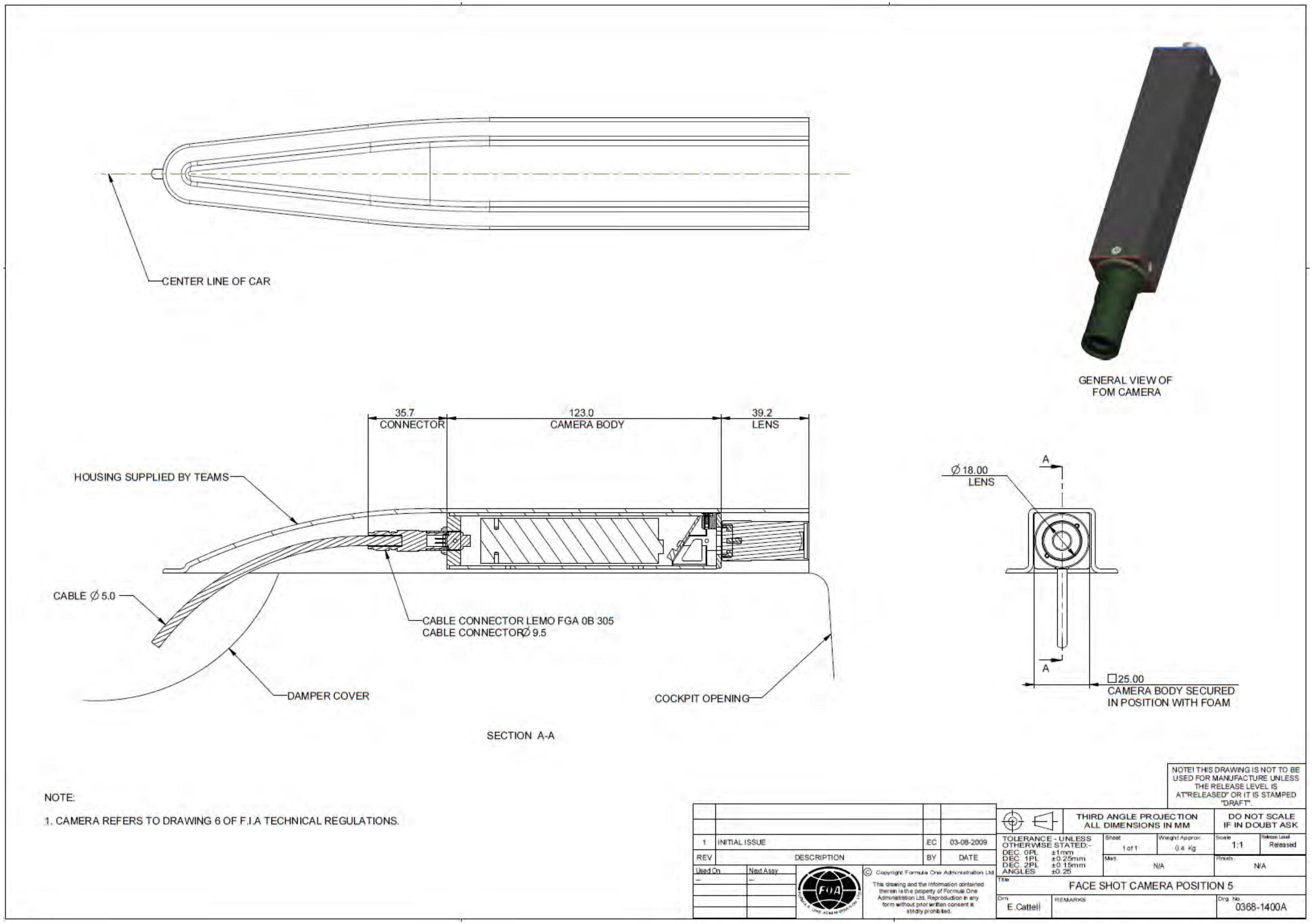
No action will normally be considered necessary unless the relevant increase in peak area is greater than 12%. This value is considerably greater than the established repeatability for peak area measurements on the FIA instrument in the mobile laboratory (3 x relative standard deviation is usually less than 5%). Increases greater than 12% will be highlighted in the report I from the fuel analyst to the technical delegate. For compounds present at concentrations below 0.80%, the peak area criteria is replaced by an absolute maximum change of 0.10% peak area.

Action may also be considered necessary if a peak is detected in a fuel sample that was absent in the corresponding reference fuel and its peak area represents more than 0.10% of the summed peak areas of the fuel.

Article 20.2

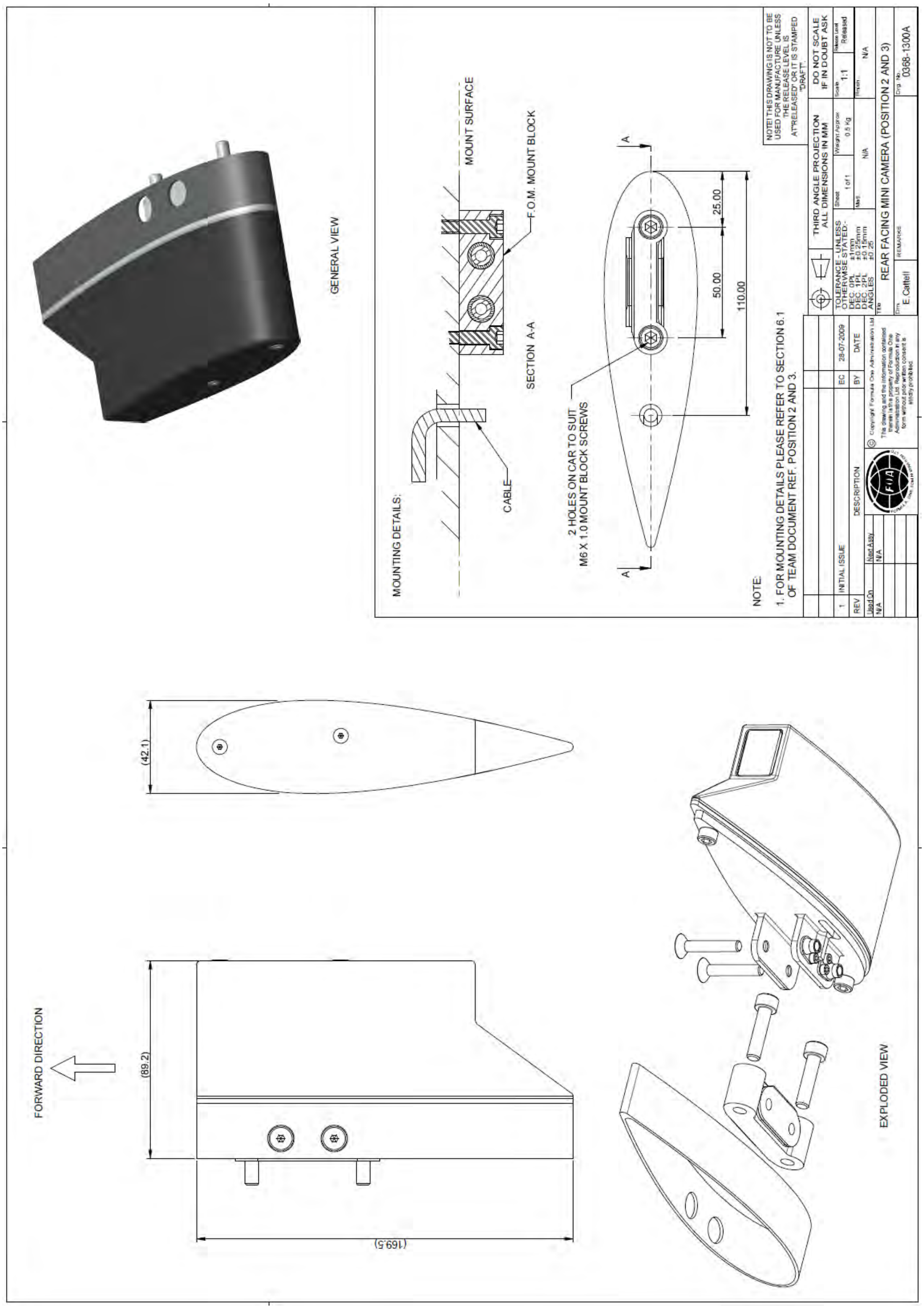
The weight of the cameras in the relevant positions is as follows :

Position 1	**0.140kg**
Position 2 – Forward facing	**0.609kg**
Position 2 – Rear facing	**0.422kg**
Position 3 – Forward facing	**0.609kg**
Position 3 – Rear facing	**0.422kg**
Position 4 – Forward and rear facing	**1.860kg**
Position 5 – Face shot	**0.120kg**
Power conditioner	**0.900kg**
Formula One Interface Unit (FIU)	**0.500kg**



NOTE:

1. CAMERA REFERS TO DRAWING 6 OF F.I.A TECHNICAL REGULATIONS.


FORWARD DIRECTION
(89.2)
(169.5)
(42.1)
GENERAL VIEW
EXPLODED VIEW
MOUNTING DETAILS:
MOUNT SURFACE
CABLE
SECTION A-A
F.O.M. MOUNT BLOCK
2 HOLES ON CAR TO SUIT
M6 X 1.0 MOUNT BLOCK SCREWS
A
A
50.00
25.00
110.00
NOTE:
1. FOR MOUNTING DETAILS PLEASE REFER TO SECTION 6.1
OF TEAM DOCUMENT REF. POSITION 2 AND 3.
NOTE! THIS DRAWING IS NOT TO BE USED FOR MANUFACTURE UNLESS THE RELEASE LEVEL IS AT"RELEASED" OR IT IS STAMPED "DRAFT".
THIRD ANGLE PROJECTION
ALL DIMENSIONS IN MM
DO NOT SCALE
IF IN DOUBT ASK
TOLERANCE - UNLESS OTHERWISE STATED:-
DEC. 0PL ±1mm
DEC. 1PL ±0.25mm
DEC. 2PL ±0.15mm
ANGLES ±0.25
1 of 1
0.5 Kg
1:1
Released
N/A
N/A
1 INITIAL ISSUE EC 28-07-2009
REV DESCRIPTION BY DATE
Used On N/A
Next Assy N/A
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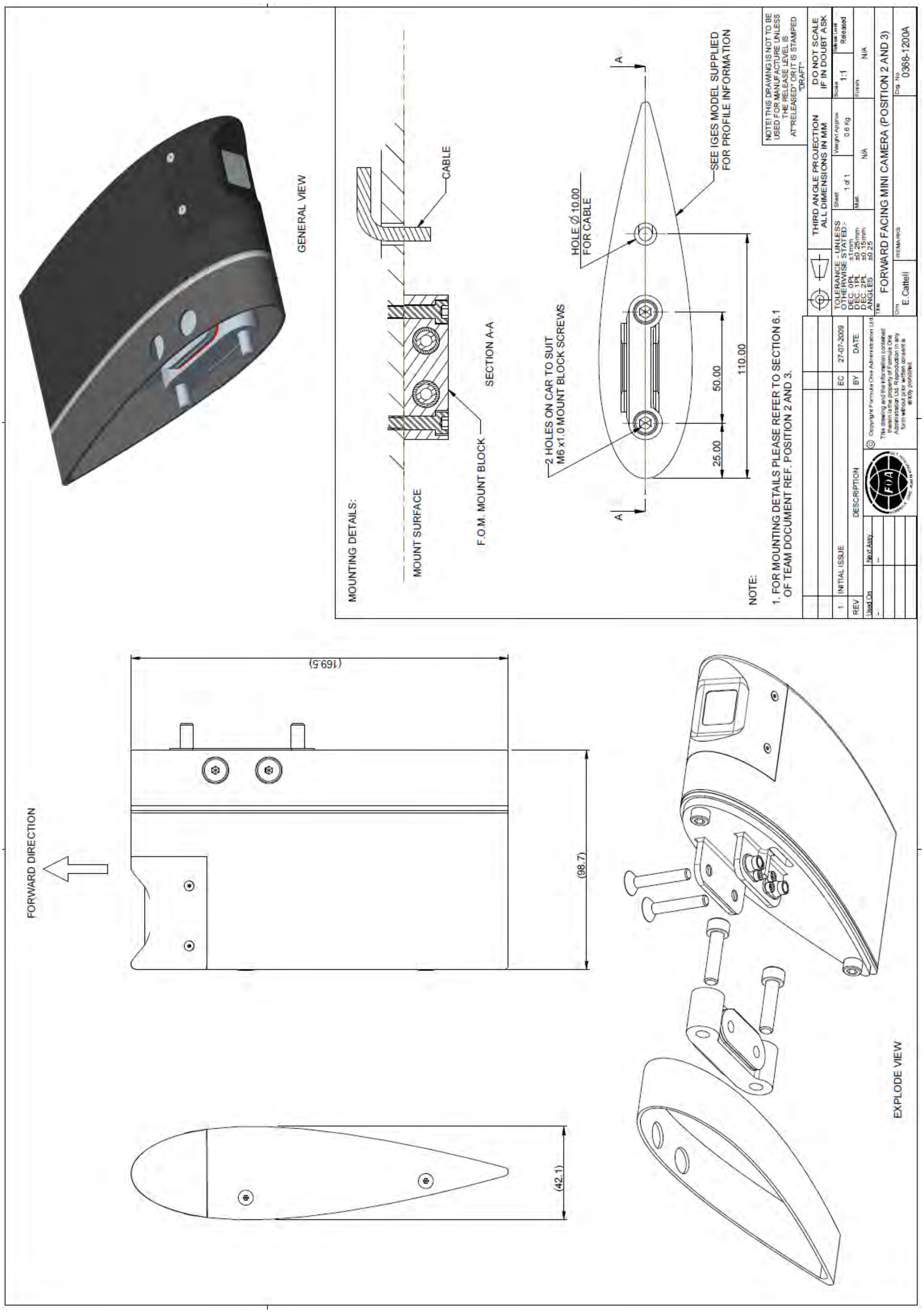
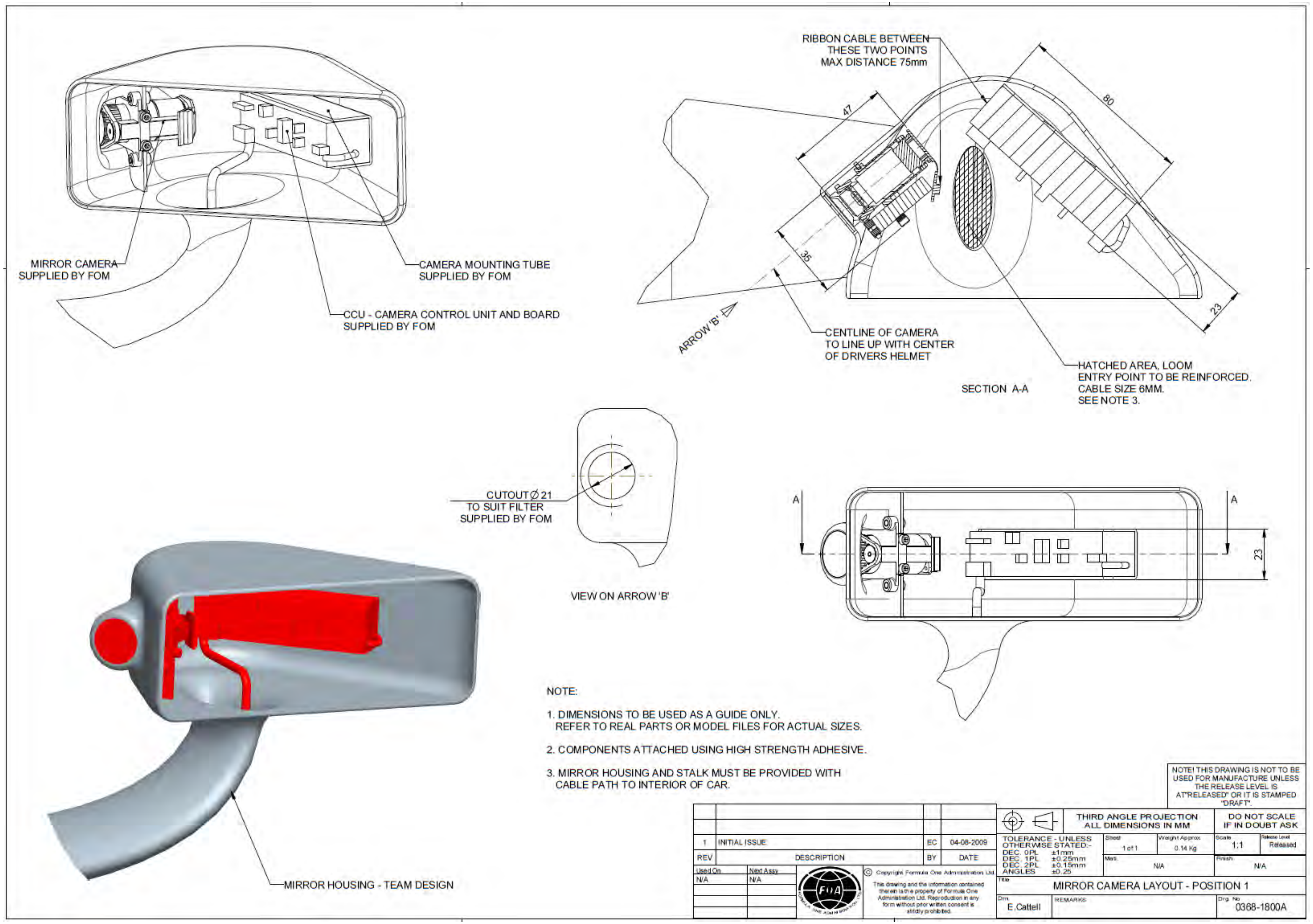
REAR FACING MINI CAMERA (POSITION 2 AND 3)
E.Cattell
REMARKS
0368-1300A


GENERAL VIEW
MOUNTING DETAILS:
MOUNT SURFACE
CABLE
F.O.M. MOUNT BLOCK
SECTION A-A
2 HOLES ON CAR TO SUIT
M6 x1.0 MOUNT BLOCK SCREWS
HOLE Ø 10.00
FOR CABLE
SEE IGES MODEL SUPPLIED
FOR PROFILE INFORMATION
25.00
50.00
110.00
A
A
NOTE:
1. FOR MOUNTING DETAILS PLEASE REFER TO SECTION 6.1
OF TEAM DOCUMENT REF. POSITION 2 AND 3.
NOTE! THIS DRAWING IS NOT TO BE USED FOR MANUFACTURE UNLESS THE RELEASE LEVEL IS AT "RELEASED" OR IT IS STAMPED "DRAFT"
THIRD ANGLE PROJECTION
ALL DIMENSIONS IN MM
DO NOT SCALE
IF IN DOUBT ASK
TOLERANCE - UNLESS OTHERWISE STATED -
Sheet 1 of 1
Scale 1:1
Released
0.6 Kg
N/A
N/A
FORWARD FACING MINI CAMERA (POSITION 2 AND 3)
0368-1200A
E. Cattell
1 INITIAL ISSUE EC 27-07-2009
REV DESCRIPTION BY DATE
FORWARD DIRECTION
(169.5)
(98.7)
(42.1)
EXPLODE VIEW


MIRROR CAMERA
SUPPLIED BY FOM
CAMERA MOUNTING TUBE
SUPPLIED BY FOM
CCU - CAMERA CONTROL UNIT AND BOARD
SUPPLIED BY FOM
RIBBON CABLE BETWEEN
THESE TWO POINTS
MAX DISTANCE 75mm
47
80
35
23
ARROW 'B'
CENTLINE OF CAMERA
TO LINE UP WITH CENTER
OF DRIVERS HELMET
HATCHED AREA, LOOM
ENTRY POINT TO BE REINFORCED.
CABLE SIZE 6MM.
SEE NOTE 3.
SECTION A-A
CUTOUT Ø 21
TO SUIT FILTER
SUPPLIED BY FOM
VIEW ON ARROW 'B'
A
A
23
MIRROR HOUSING - TEAM DESIGN
NOTE:
1. DIMENSIONS TO BE USED AS A GUIDE ONLY.
REFER TO REAL PARTS OR MODEL FILES FOR ACTUAL SIZES.
2. COMPONENTS ATTACHED USING HIGH STRENGTH ADHESIVE.
3. MIRROR HOUSING AND STALK MUST BE PROVIDED WITH
CABLE PATH TO INTERIOR OF CAR.
NOTE! THIS DRAWING IS NOT TO BE USED FOR MANUFACTURE UNLESS THE RELEASE LEVEL IS AT "RELEASED" OR IT IS STAMPED "DRAFT".
1 INITIAL ISSUE EC 04-08-2009
REV DESCRIPTION BY DATE
Used On N/A
Next Assy N/A
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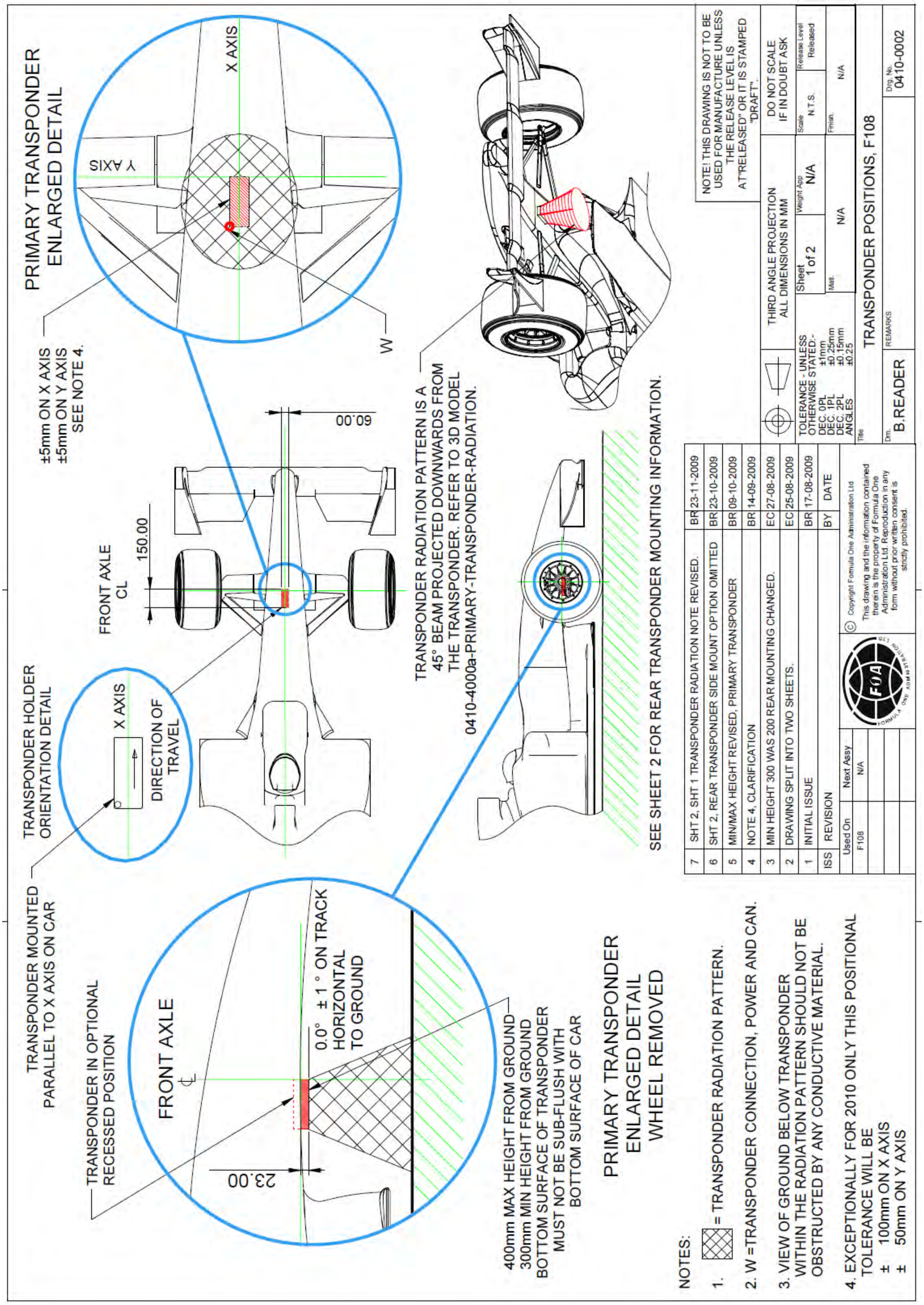
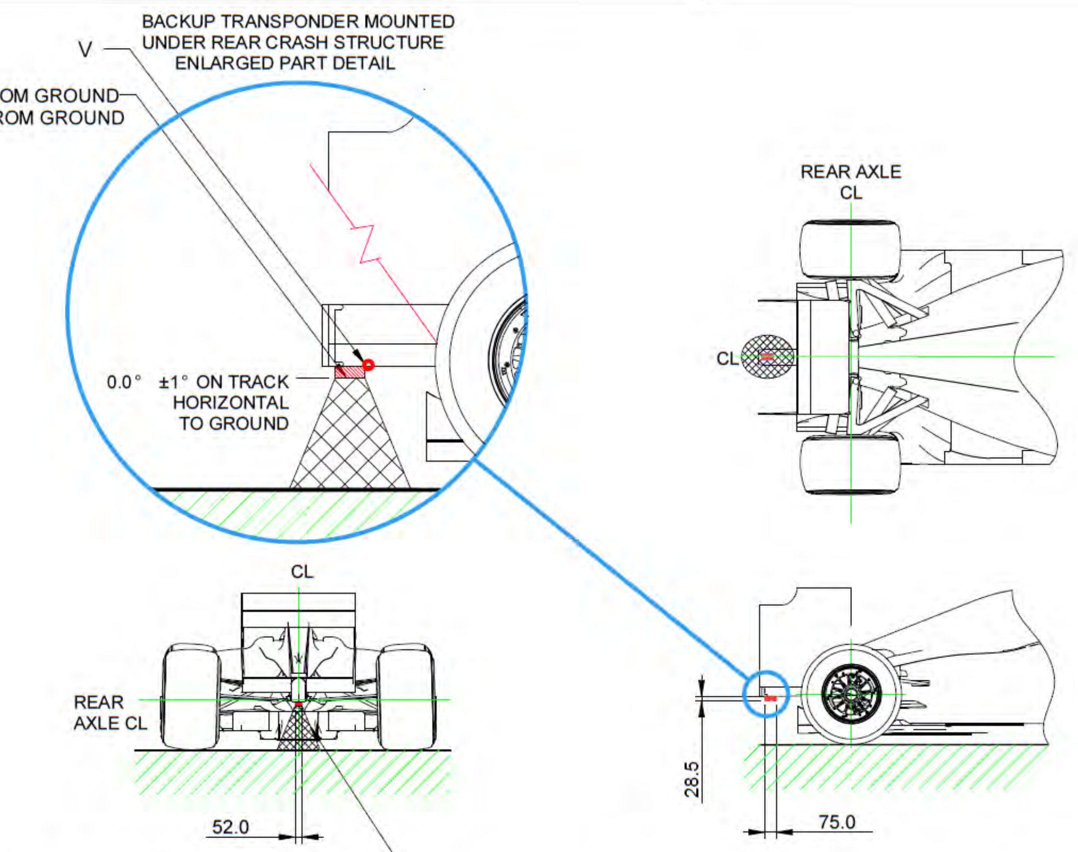
THIRD ANGLE PROJECTION
ALL DIMENSIONS IN MM
DO NOT SCALE
IF IN DOUBT ASK
TOLERANCE - UNLESS OTHERWISE STATED:-
DEC 0PL ±1mm
DEC 1PL ±0.25mm
DEC 2PL ±0.15mm
ANGLES ±0.25
Sheet 1 of 1
Weight Approx 0.14 Kg
Scale 1:1
Release Level Released
Mat'l N/A
Finish N/A
Title MIRROR CAMERA LAYOUT - POSITION 1
Drn E.Cattell
REMARKS
Drg No 0368-1800A

Article 20.4

The timing transponders must be fitted in accordance with the instructions given in the following drawings :





TRANSPONDER RADIATION PATTERN IS A 45° BEAM PROJECTED DOWNWARDS FROM THE TRANSPONDER REFER TO 3D MODEL 0410-4000a-SECONDARY-TRANSPONDER-RADIATION.

NOTE:

1. BACKUP TRANSPONDER TO BE MOUNTED UNDERNEATH THE CRASH STRUCTURE AS SHOWN.

2. [crosshatch symbol] = TRANSPONDER RADIATION PATTERN.

3. V = BACKUP TRANSPONDER CONNECTION, POWER.

4. TRANSPONDER TO BE MOUNTED WITHIN 100mm OF REAR LIGHT.

5. VIEW OF GROUND BELOW TRANSPONDER WITHIN THE RADIATION PATTERN SHOULD NOT BE OBSTRUCTED BY ANY CONDUCTIVE MATERIAL.

NOTE! THIS DRAWING IS NOT TO BE USED FOR MANUFACTURE UNLESS THE RELEASE LEVEL IS AT"RELEASED" OR IT IS STAMPED "DRAFT".

ISS	REVISION	BY	DATE
7	SHT 2, SHT 1 TRANSPONDER RADIATION NOTE REVISED.	BR	23-11-2009
6	SHT 2, REAR TRANSPONDER SIDE MOUNT OPTION OMITTED	BR	23-10-2009
1	INITIAL ISSUE	BR	17-08-09

Used On	Next Assy
F108	N/A

THIRD ANGLE PROJECTION
ALL DIMENSIONS IN MM

DO NOT SCALE
IF IN DOUBT ASK

TOLERANCE - UNLESS OTHERWISE STATED:-

DEC. 0PL	±1mm
DEC. 1PL	±0.25mm
DEC. 2PL	±0.15mm
ANGLES	±0.25

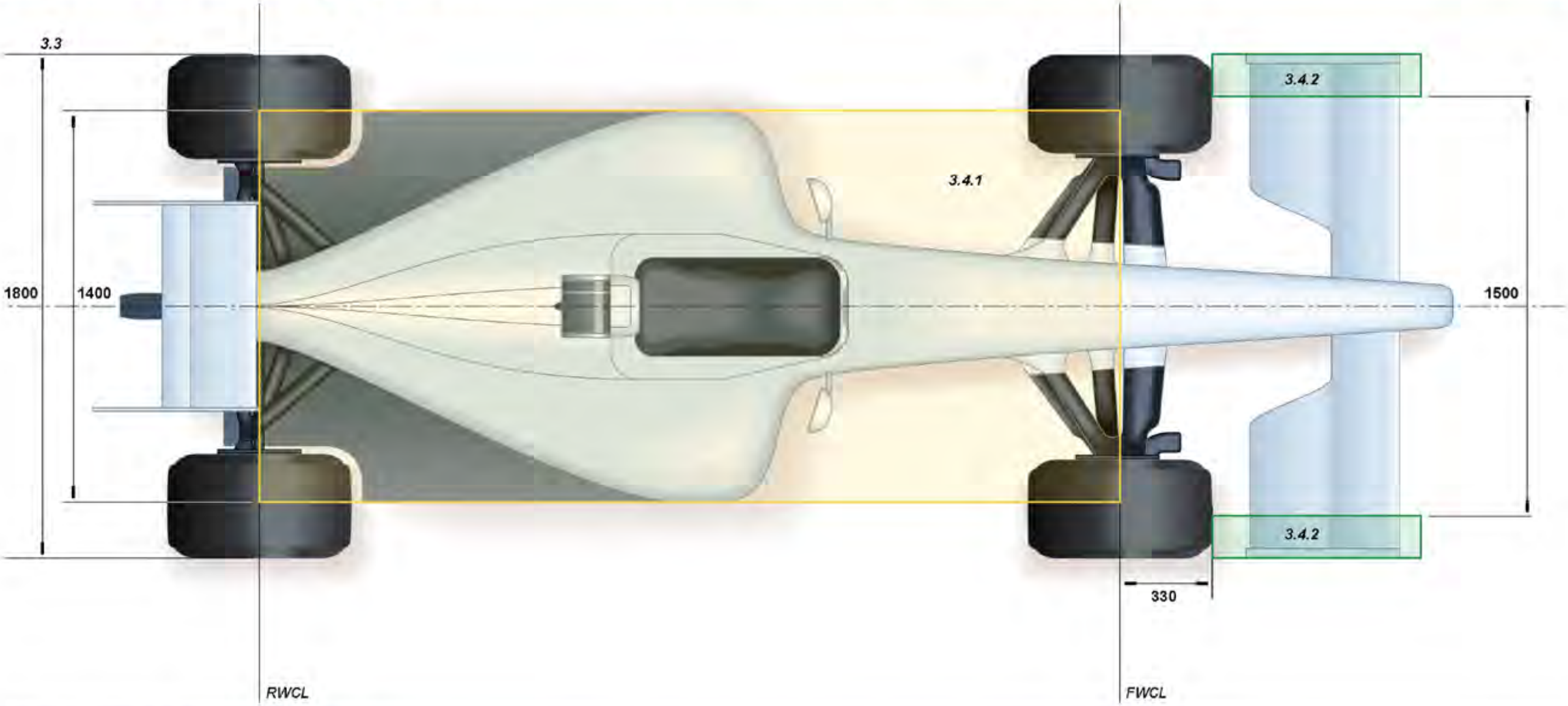
Sheet	Weight App	Scale	Release Level
2 of 2	N/A	N.T.S	Released

Matl.	Finish.
N/A	N/A

Title: TRANSPONDER POSITIONS, F108

Drn.	REMARKS	Drg. No.
B.Reader		0410-0002

Drawing 1a — 3.3: Overall Width - 3.4: Width Ahead of Rear Wheel Centre Line



3.3 - Overall width :

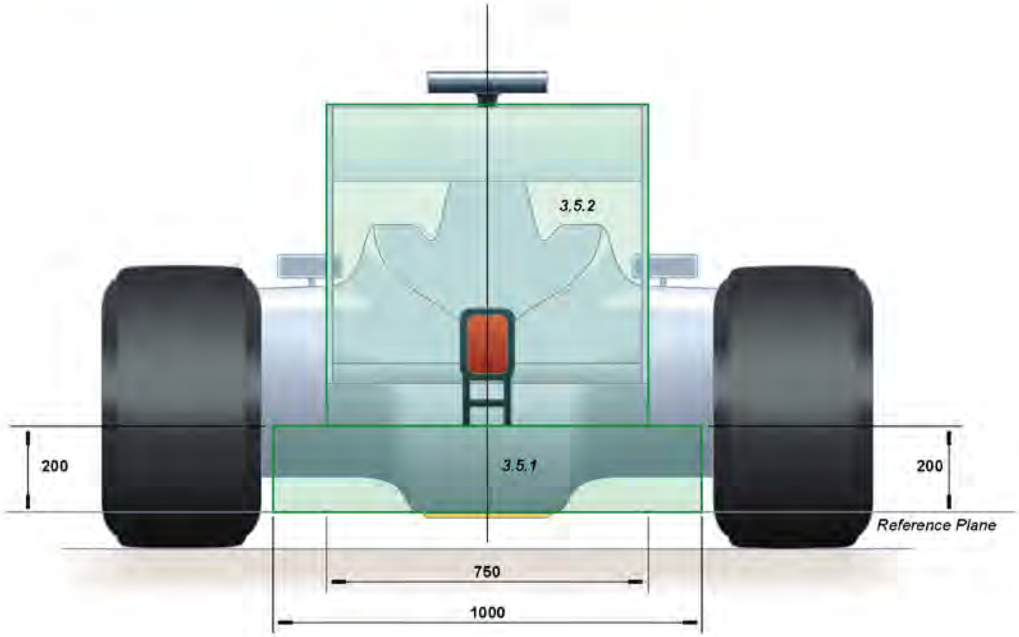
The overall width of the car, including complete wheels, must not exceed 1800mm with the steered wheels in the straight ahead position. Overall width will be measured when the car is fitted with tyres inflated to 1.4 bar.

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 ahead of the complete front wheel and more than 750mm from the car centre line visible from the side or the front must be at least 10mm thick with a radius of at least 5mm.

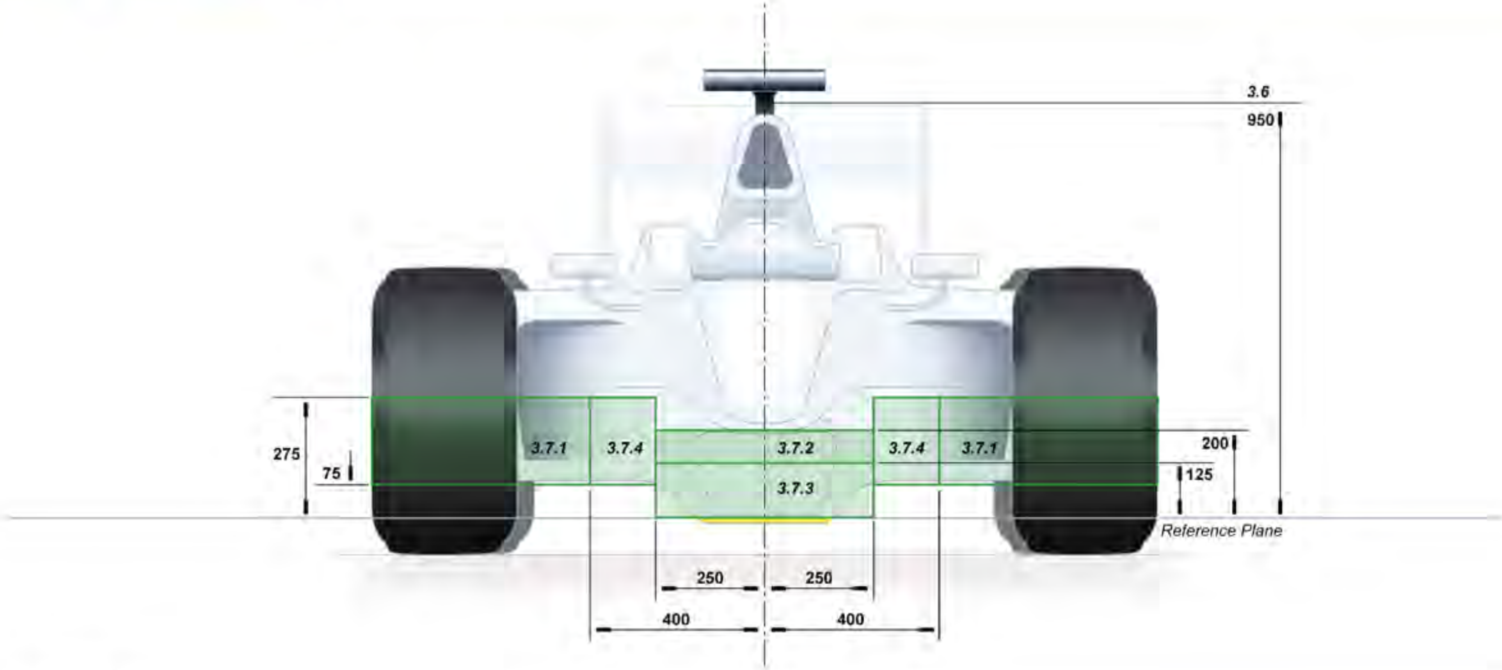
Drawing 2a 3.5: Width Behind the Rear Wheel Centre Line



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 200mm above the reference plane must not exceed 1000mm.

3.5.2 The width of bodywork behind the rear wheel centre line and more than 200mm 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 :

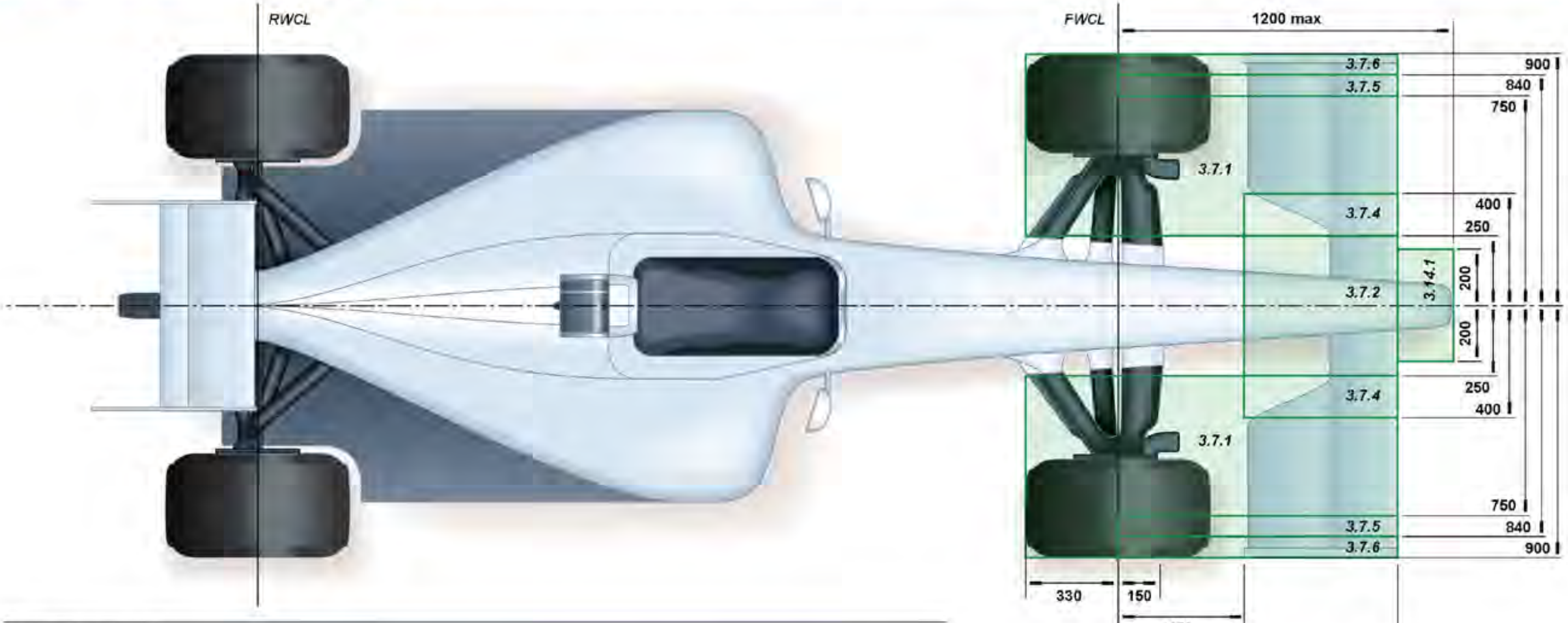
3.7.1 All bodywork situated forward of a point lying 330mm behind the front wheel centre line, and more than 250mm from the car centre line, must be no less than 75mm and no more than 275mm above the reference plane.

3.7.2 Any horizontal section taken through bodywork located forward of a point lying 450mm forward of the front wheel centre line, less than 250mm from the car centre line, and between 125mm and 200mm above the reference plane, may only contain two closed symmetrical sections with a maximum total area of 5000mm2 The thickness of each section may not exceed 25mm when measured perpendicular to the car centre line.
Once fully defined, the sections at 125mm above the reference plane must be projected vertically to join the profile required by Article 3.7.3. A radius no greater than 10mm may be used where these sections join.

3.7.3 Forward of a point lying 450mm ahead of the front wheel centre line and less than 250mm from the car centre line and less than 125mm above the reference plane, only one single section may be contained within any longitudinal vertical cross section parallel to the car centre line. Furthermore, with the exception of local changes of section where the bodywork defined in Article 3.7.2 attaches to this section, the profile, incidence and position of this section must conform to Drawing 7. This section may not contain any closed channel the effect of which is to duct air directly or indirectly to or from the external air stream for any purpose other than data acquisition.

3.7.4 In the area bounded by lines between 450mm and 1000mm ahead of the front wheel centre line, 250mm and 400mm from the car centre line and between 75mm and 275mm above the reference plane, the projected area of all bodywork onto the longitudinal centre plane of the car must be no more than 20,000mm2.

Drawing 4a — 3.7: Front Bodywork - 3.14: Overhangs



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.

3.7.2 Any horizontal section taken through bodywork located forward of a point lying 450mm forward of the front wheel centre line, less than 250mm from the car centre line, and between 125mm and 200mm above the reference plane, may only contain two closed symmetrical sections with a maximum total area of 5000mm2 The thickness of each section may not exceed 25mm when measured perpendicular to the car centre line.
Once fully defined, the sections at 125mm above the reference plane must be projected vertically to join the profile required by Article 3.7.3. A radius of 10mm may be used where these sections join.

3.7.4 In the area bounded by lines between 450mm and 1000mm ahead of the front wheel centre line, 250mm and 400mm from the car centre line and between 75mm and 275mm above the reference plane, the projected area of all bodywork onto the longitudinal centre plane of the car must be no more than 20,000mm2.

3.7.5 Ahead of the front wheel centre line and between 750mm and 840mm from the car centre line there must be bodywork with a projected area of no less than 95,000mm2 in side view.

3.7.6 Ahead of the front wheel centre line and between 840mm and 900mm from the car centre line there must be bodywork with a projected area of no less than 28,000mm2 in plan view. Furthermore, when viewed from underneath, the bodywork in this area must form one continuous surface which may not be more than 100mm above the reference plane.

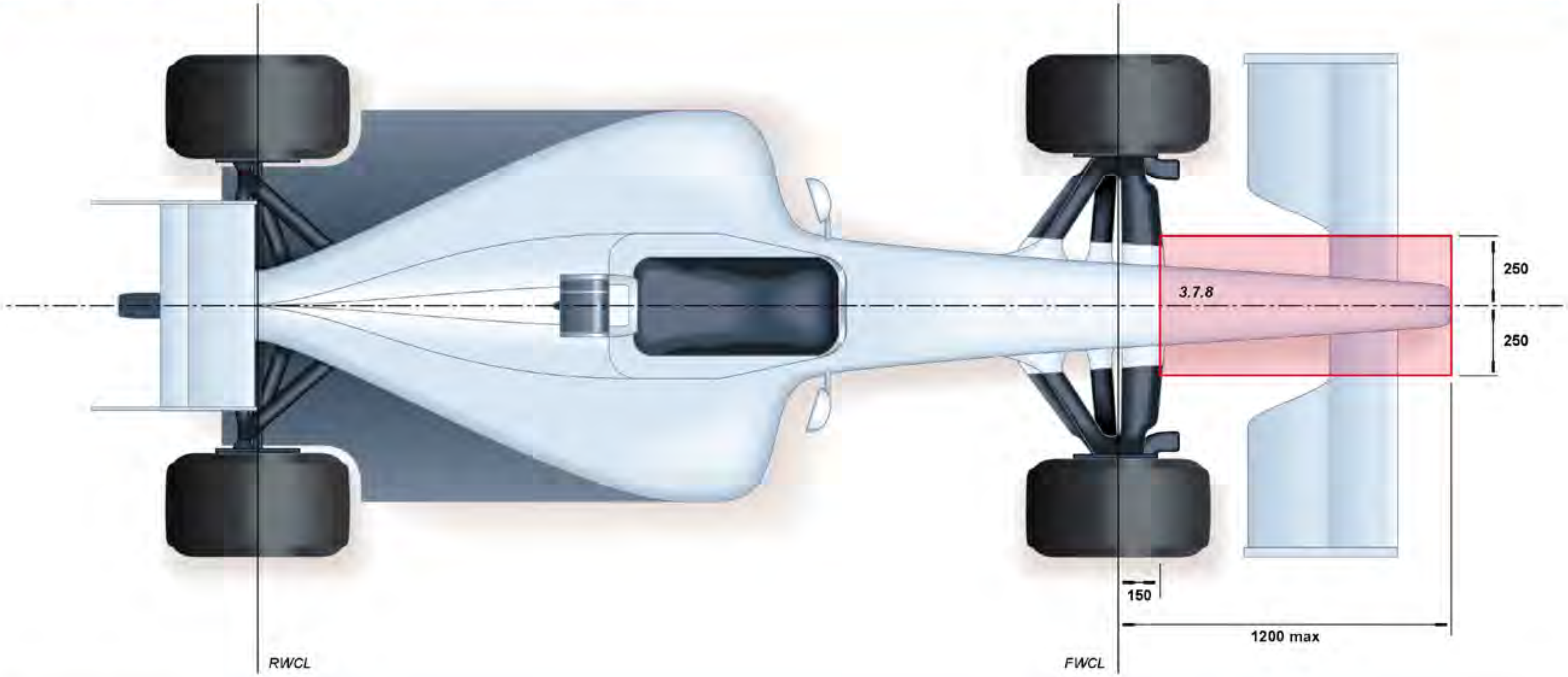
3.14 - Overhangs :

3.14.1 No part of the car may be more than 600mm behind the rear wheel centre line or more than 1200mm in front of the front wheel centre line.

3.14.2 No part of the bodywork more than 200mm from the car centre line may be more than 1000mm in front of the front wheel centre line.

3.14.3 All overhang measurements will be taken parallel to the reference plane.

Drawing 5a — 3.7: Front Bodywork



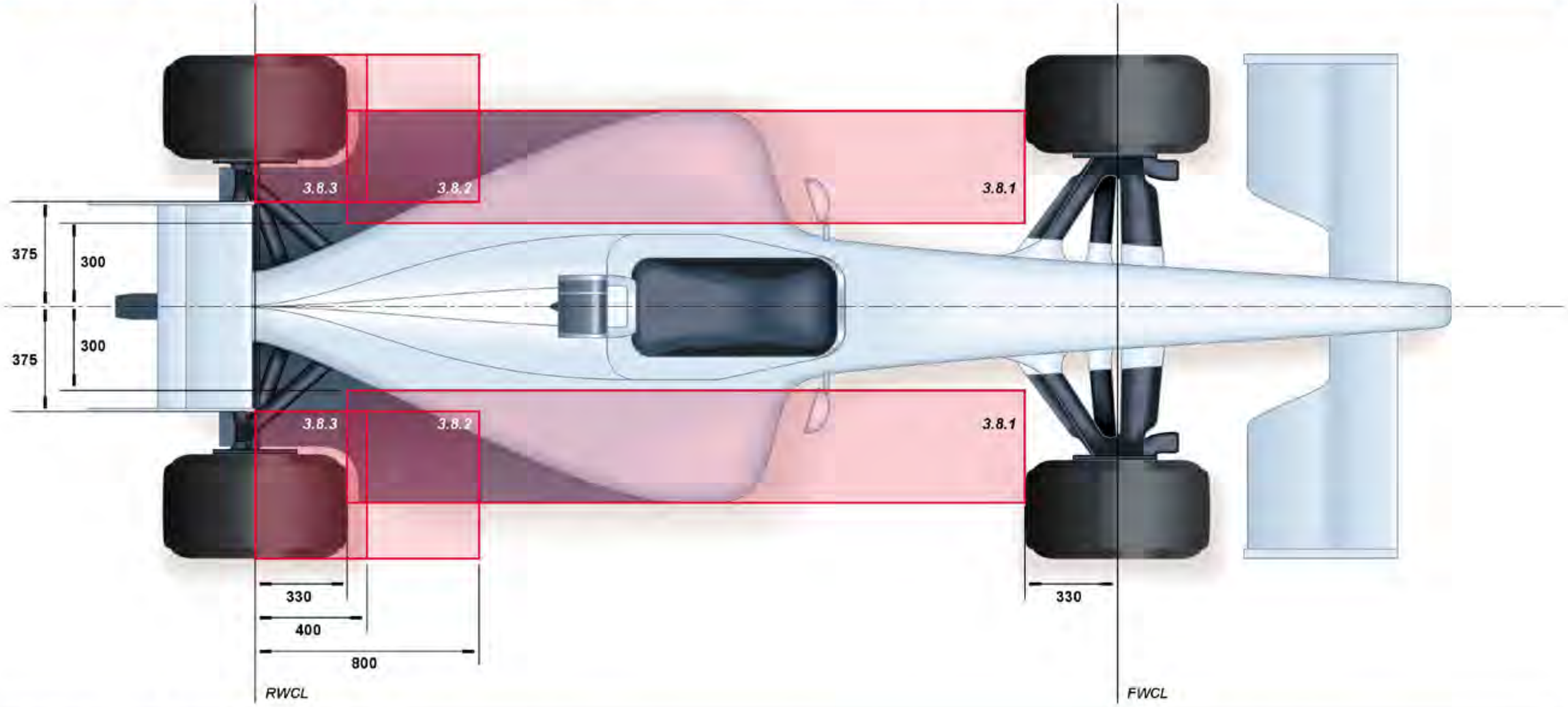
3.7 - Front Bodywork :

3.7.8 Only a single section, which must be open, may be contained within any longitudinal vertical cross section taken parallel to the car centre line forward of a point 150mm ahead of the front wheel centre line, less than 250mm from the car centre line and more than 125mm above the reference plane.

Any cameras or camera housings approved by the FIA in addition to a single inlet aperture for the purpose of driver cooling (such aperture having a maximum projected surface area of 1500mm2 and being situated forward of the section referred to in Article 15.4.3) will be exempt from the above.

Drawing 6a

3.8: Bodywork in Front of the Rear Wheel Centre Line



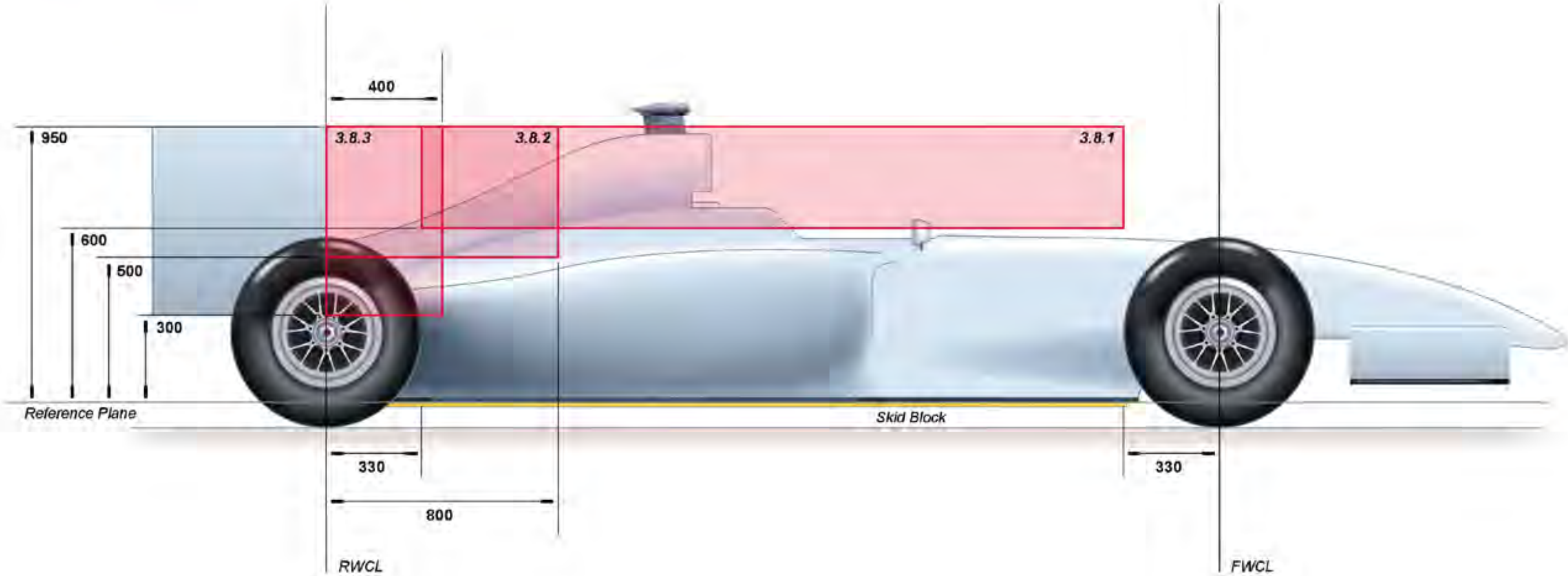
3.8 - Bodywork in front of the rear wheels :

3.8.1 Other than the rear view mirrors (including their mountings), each with a maximum area of 12000mm" and 14000 mm2 when viewed from directly above or directly from the side respectively, no bodywork situated more than 330mm behind the front wheel centre line and more than 330mm forward of the rear wheel centre line, which is more than 600mm above the reference plane, may be more than 300mm from the car centre line.

3.8.2 No bodywork between the rear wheel centre line and a line 800mm forward of the rear wheel centre line, which is more than 375mm from the car centre line, may be more than 500mm 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.

Drawing 7a — 3.8: Bodywork in Front of the Rear Wheel Centre Line



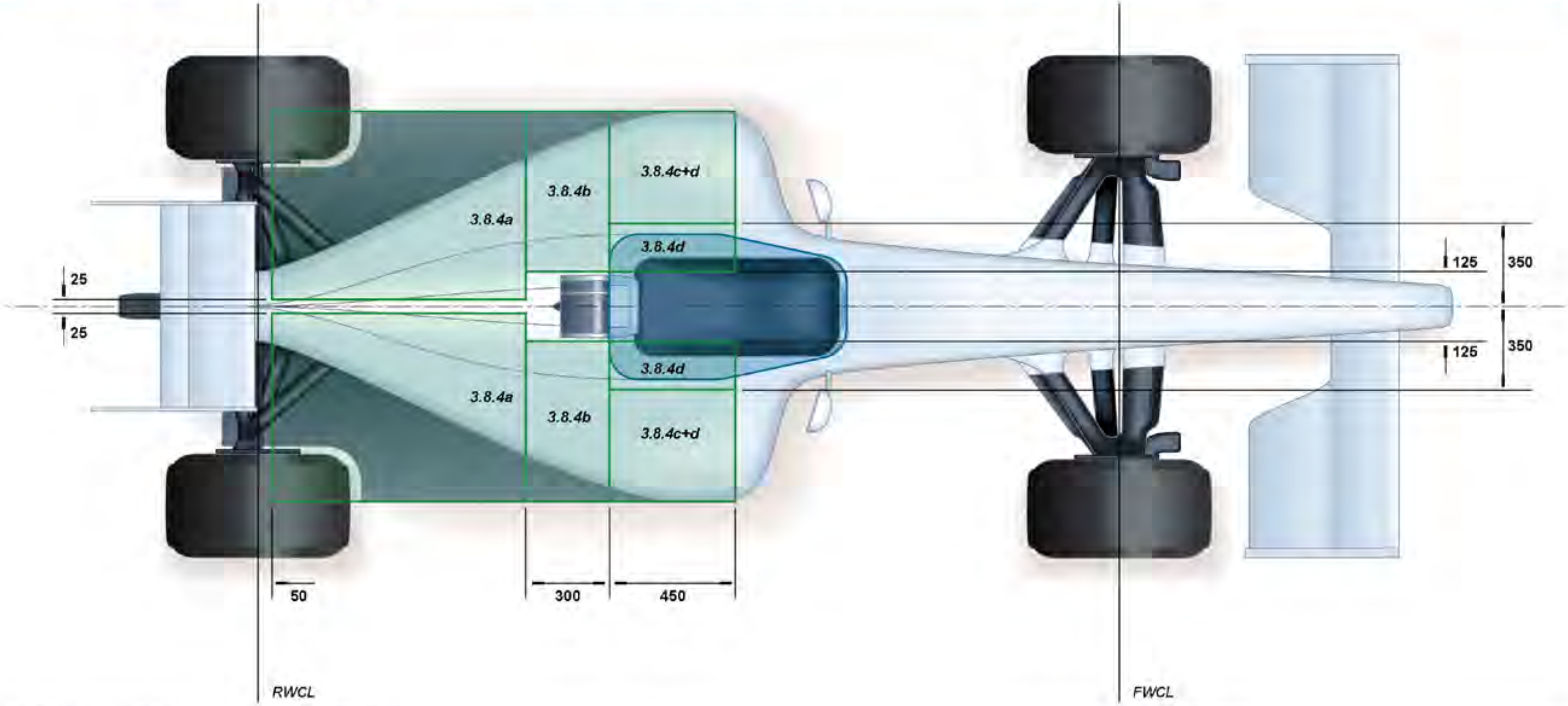
3.8 - Bodywork in front of the rear wheels :

3.8.1 Other than the rear view mirrors (including their mountings), each with a maximum area of 12000mm" and 14000 mm2 when viewed from directly above or directly from the side respectively, no bodywork situated more than 330mm behind the front wheel centre line and more than 330mm forward of the rear wheel centre line, which is more than 600mm above the reference plane, may be more than 300mm from the car centre line.

3.8.2 No bodywork between the rear wheel centre line and a line 800mm forward of the rear wheel centre line, which is more than 375mm from the car centre line, may be more than 500mm 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.

Drawing 8a — 3.8: Bodywork in Front of the Rear Wheel Centre Line

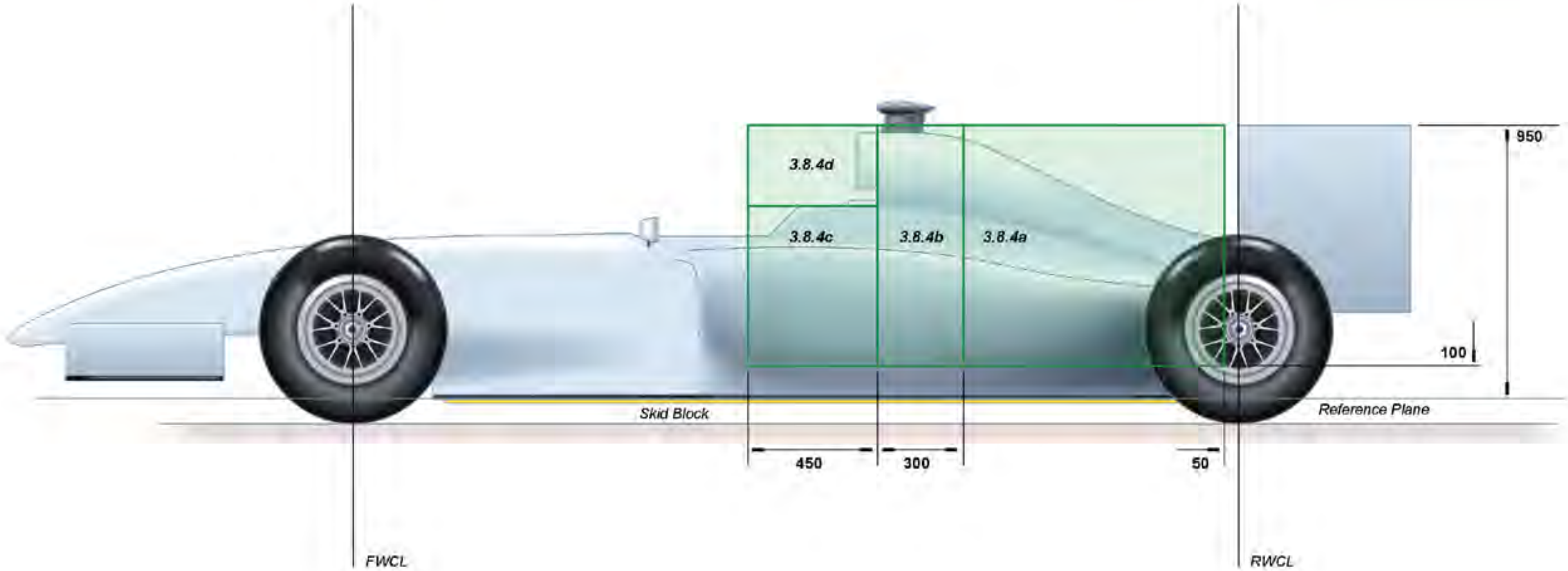


3.8 Bodywork in Front of the Rear Wheels

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.



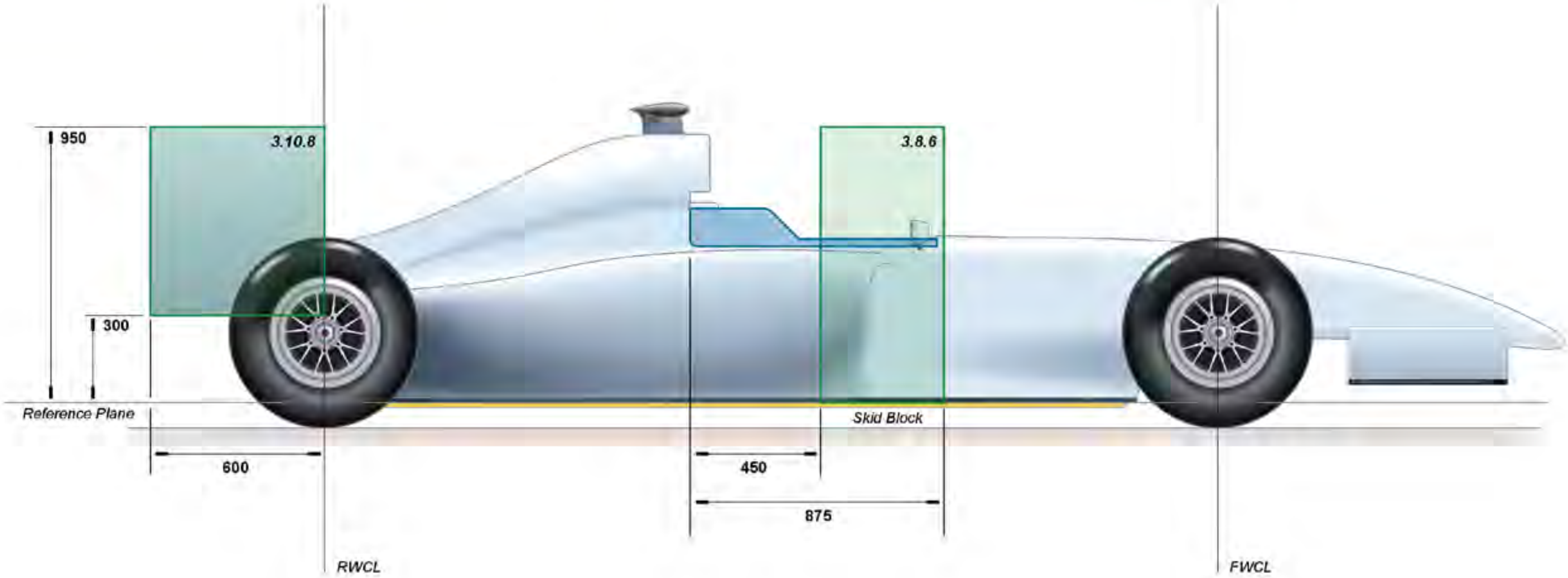
3.8 Bodywork in Front of the Rear Wheels

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.

Drawing 10a — 3.8: Bodywork in front of the Rear Wheels - 3.10: Bodywork Behind the Rear Wheel Centre Line



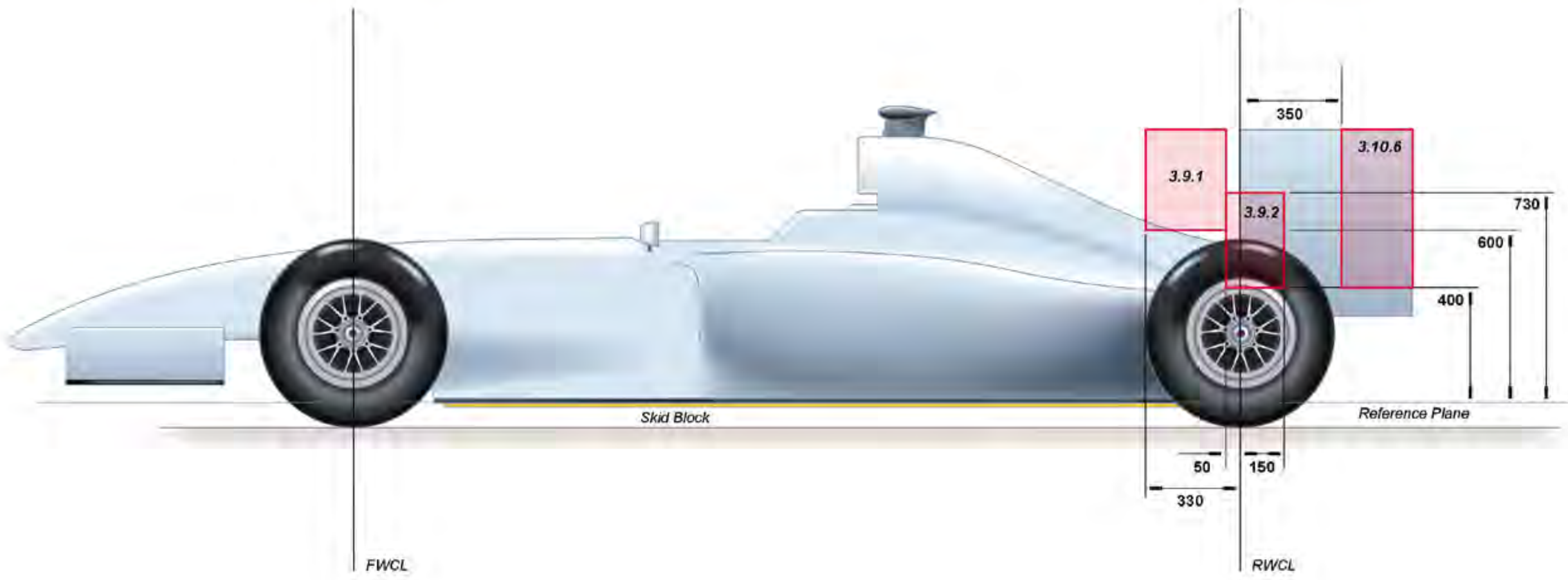
3.8 - Bodywork in front of the rear wheels :

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.

3.10 - Bodywork 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 must be greater than 330000mm".

Drawing 11a — 3.9: Bodywork Between the Rear Wheels - 3.10: Bodywork behind the Rear Wheel Centre Line



3.9 - Bodywork between the rear wheels :

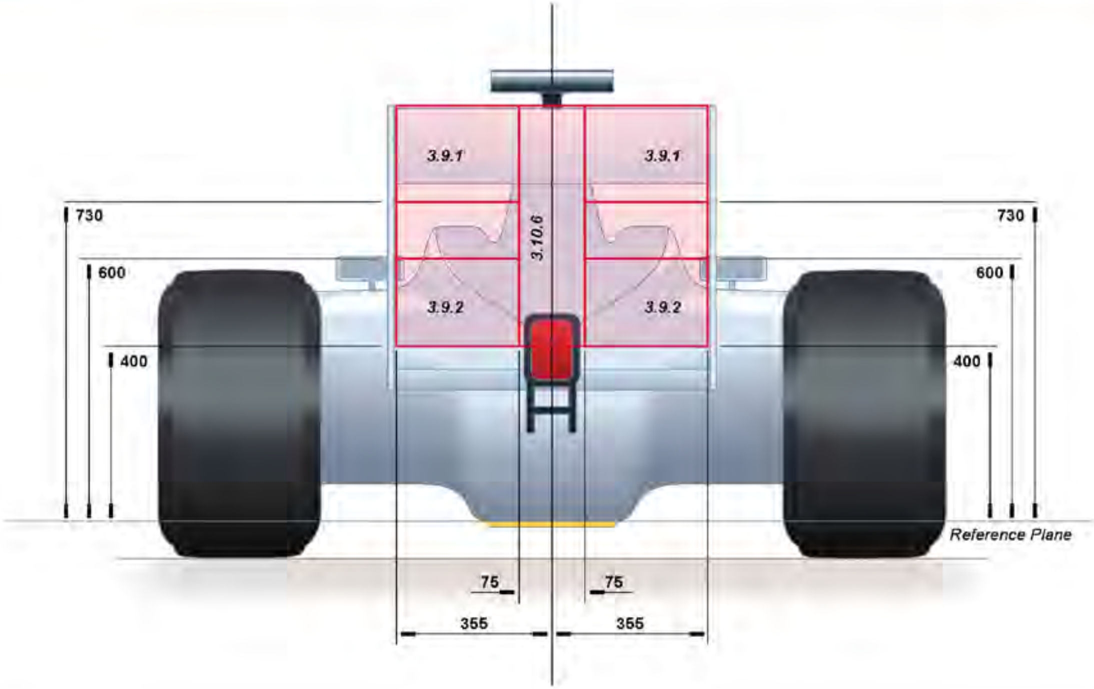
3.9.1 No bodywork situated between 50mm and 330mm forward of the rear wheel centre line, and which is more than 75mm from the car centre line, may be more than 600mm above the reference plane.

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.

3.10 - Bodywork behind the rear wheel centre line :

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.

Drawing 12a **3.9**: Bodywork Between the Rear Wheels - **3.10**: Bodywork Behind the Rear Wheel Centre Line



3.9 - Bodywork between the rear wheels :

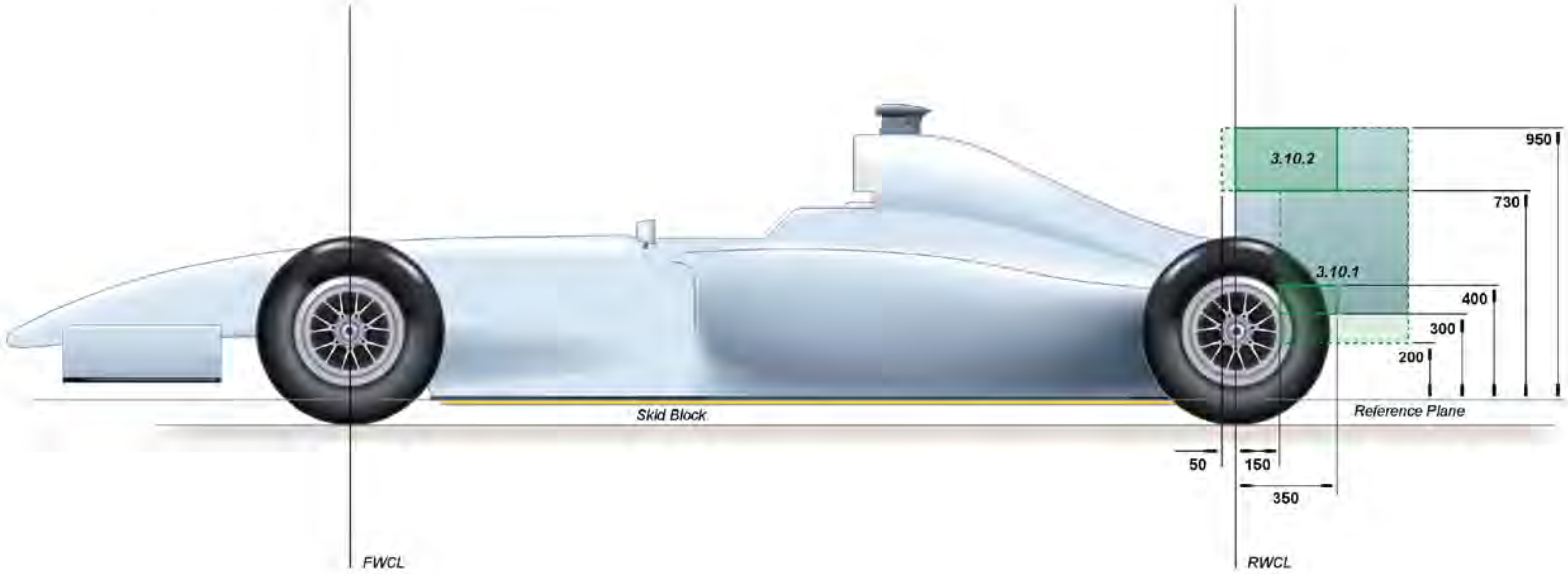
3.9.1 No bodywork situated between 50mm and 330mm forward of the rear wheel centre line, and which is more than 75mm from the car centre line, may be more than 600mm above the reference plane.

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.

3.10 - Bodywork behind the rear wheel centre line :

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.

Drawing 13a — 3.10: Bodywork Behind the Rear Wheel Centre Line

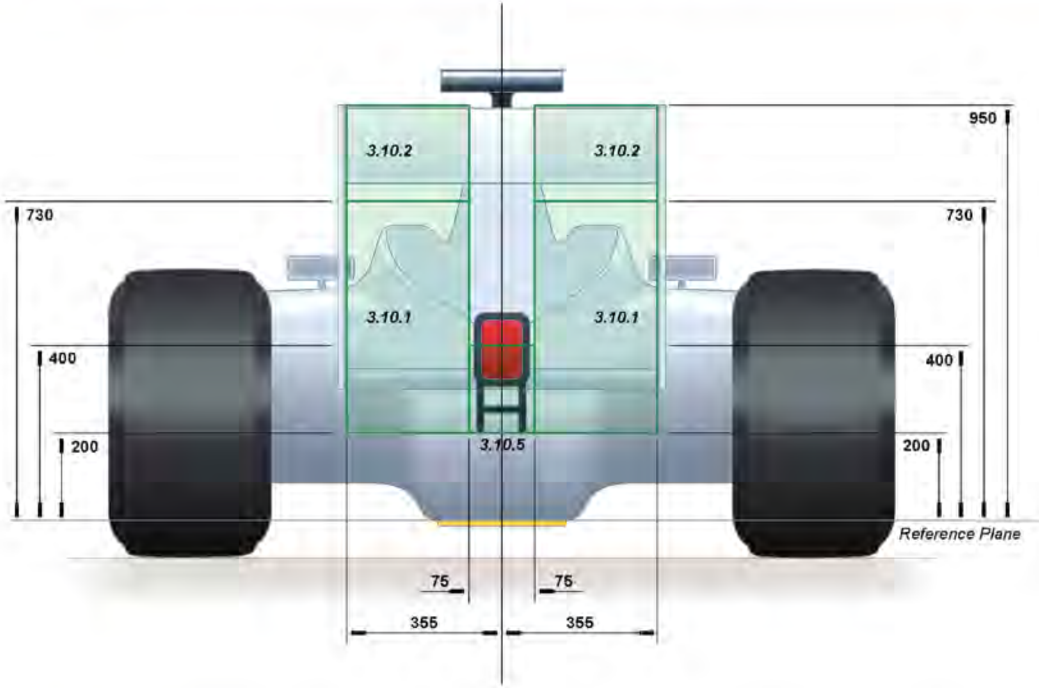


3.10 Bodywork behind the rear wheel centre line

3.10.1 Any bodywork more than 150mm behind the rear wheel centre line which is between 200mm and 730mm above the reference plane, and between 75mm and 355mm from the car centre line, must lie in an area when viewed from the side of the car that is situated between 150mm and 350mm behind the rear wheel centre line and between 300mm and 400mm above the reference plane. When viewed from the side of the car no longitudinal cross section may have more than one section in this area.

3.10.2 Any bodywork behind a point lying 50mm forward of the rear wheel centre line which is more than 730mm above the reference plane, and between 75mm and 355mm from the car centre line, must lie in an area when viewed from the side of the car that is situated between the rear wheel centre line and a point 350mm behind it. When viewed from the side of the car, no longitudinal cross section may have more than two closed sections in this area.
Furthermore, the distance between adjacent sections at any longitudinal plane must not exceed 15mm at their closest position.

Drawing 14a — 3.10: Bodywork Behind the Rear Wheel Centre Line



3.10 - Bodywork behind the rear wheel centre line :

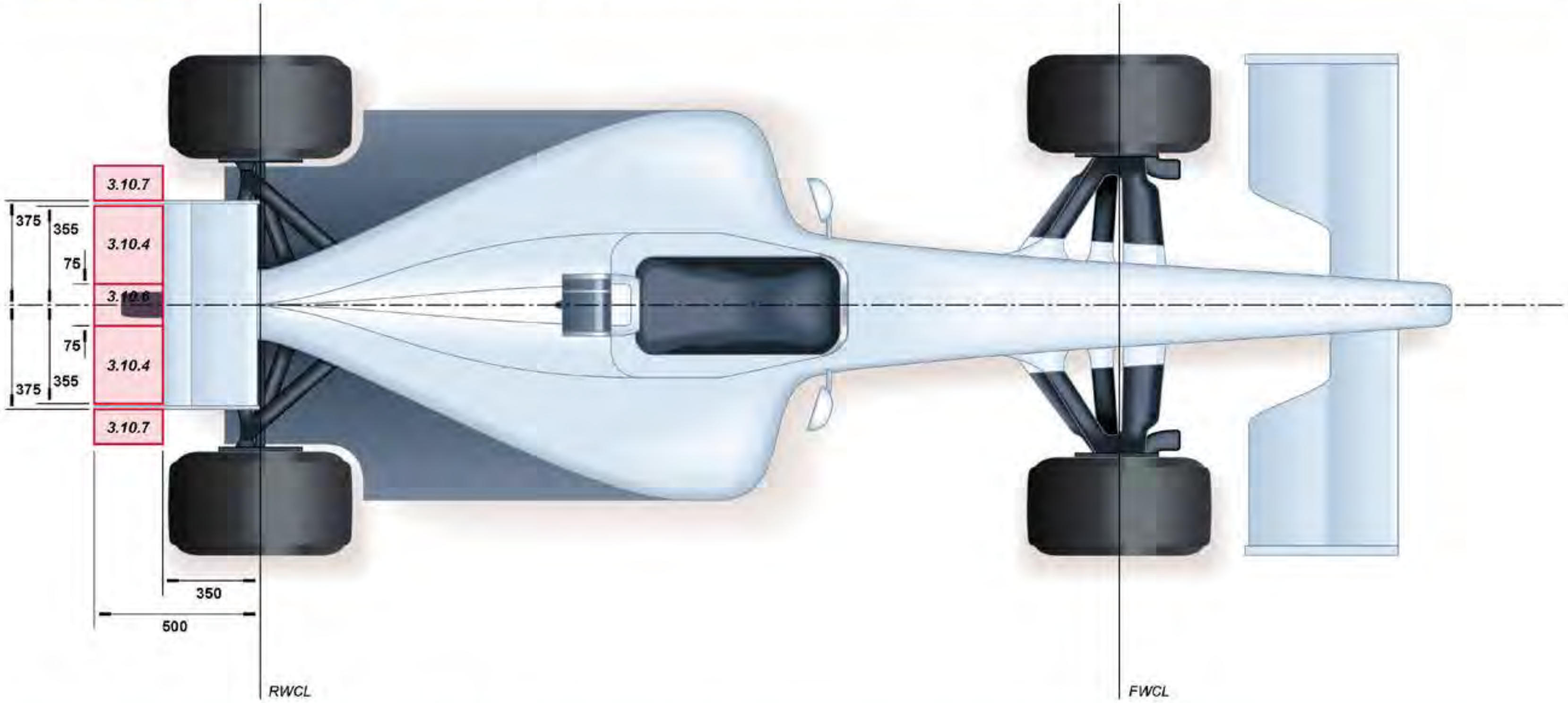
3.10.1 Any bodywork more than 150mm behind the rear wheel centre line which is between 200mm and 730mm above the reference plane, and between 75mm and 355mm from the car centre line, must lie in an area when viewed from the side of the car that is situated between 150mm and 350mm behind the rear wheel centre line and between 300mm and 400mm above the reference plane. When viewed from the side of the car no longitudinal cross section may have more than one section in this area.

3.10.2 Any bodywork behind a point lying 50mm forward of the rear wheel centre line which is more than 730mm above the reference plane, and between 75mm and 355mm from the car centre line, must lie in an area when viewed from the side of the car that is situated between the rear wheel centre line and a point 350mm behind it. When viewed from the side of the car, no longitudinal cross section may have more than two closed sections in this area.
Furthermore, the distance between adjacent sections at any longitudinal plane must not exceed 15mm at their closest

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.

Drawing 15a

3.10: Bodywork behind the Rear Wheel Centre Line

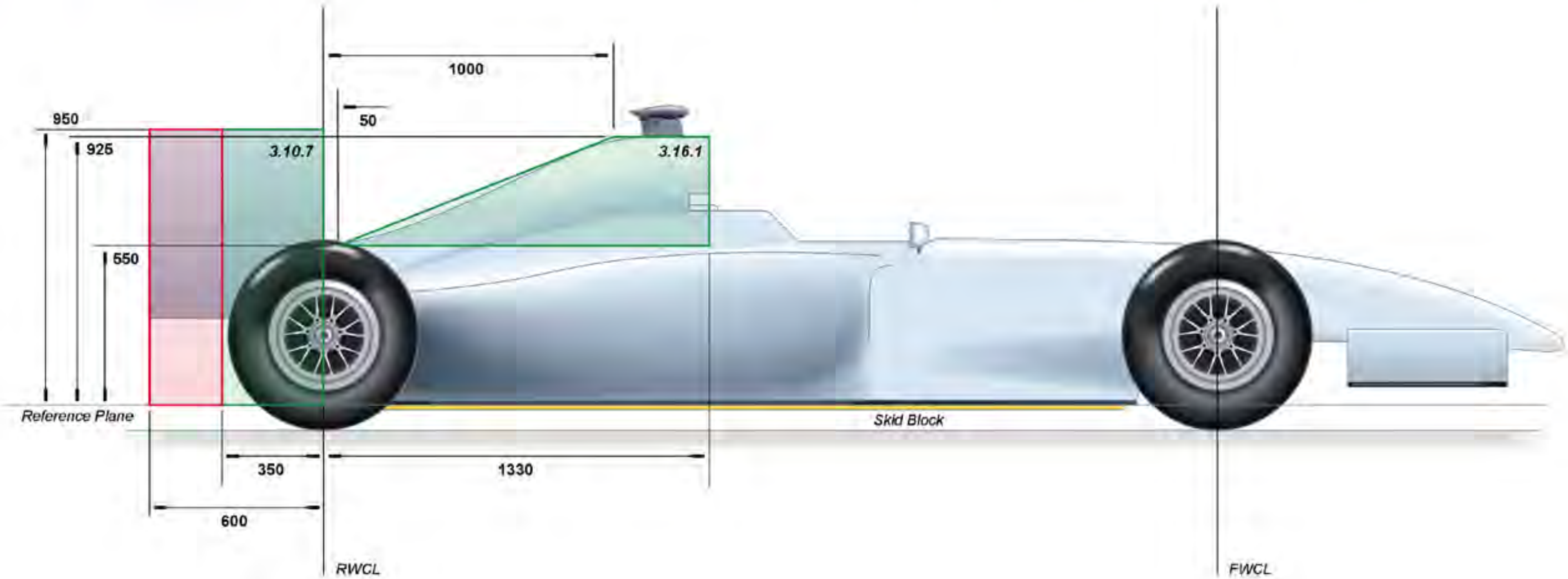


3.10 - Bodywork behind the rear wheel centre line :

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.

3.10.6 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 Bodywork behind the rear wheel centre line :

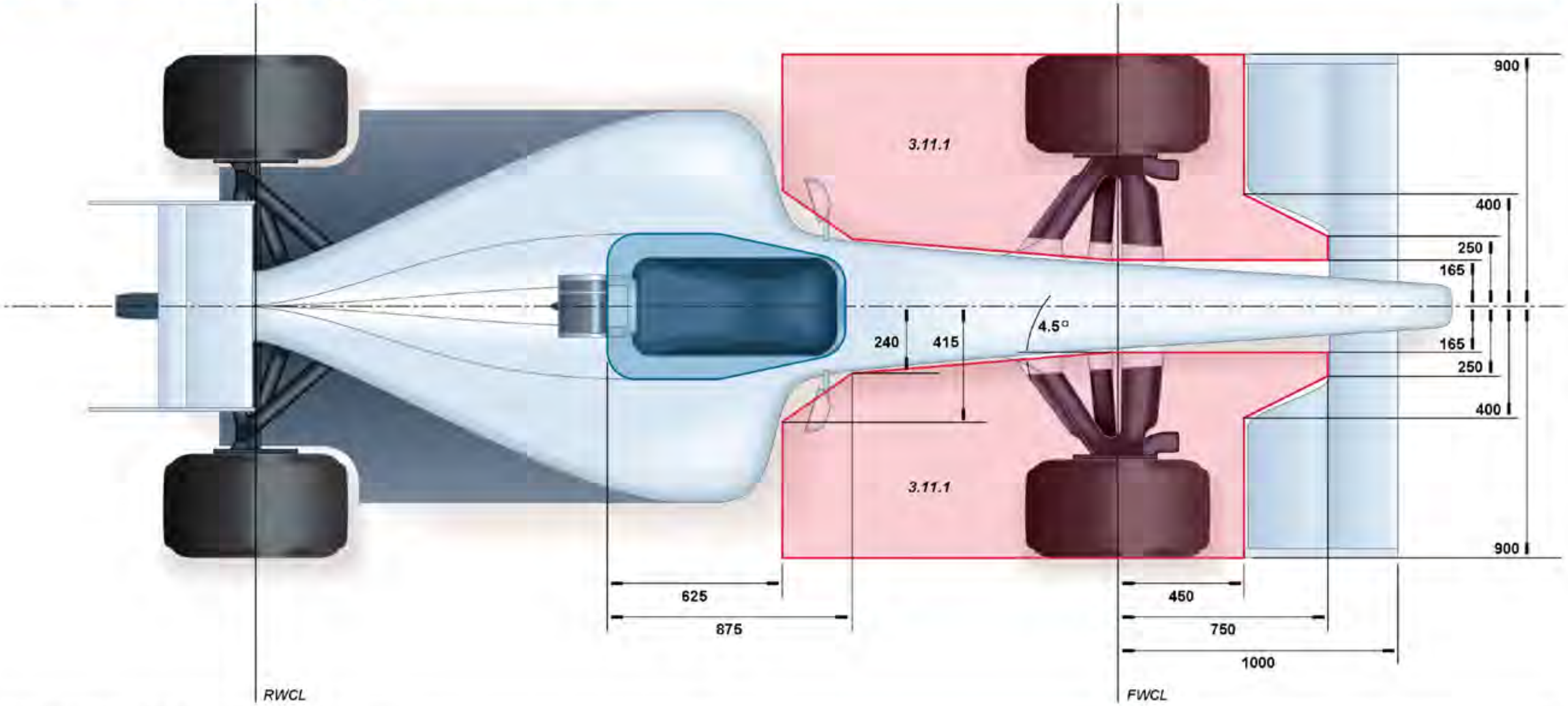
3.10.7 No part of the car more than 375mm from the car centre line may be more than 350mm behind the rear wheel centre line.

3.16 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 and at the rear wheel centre line. This bodywork must lie on or outside the boundary defined by a linear taper between these minimum widths.

Drawing 17a **3.11:** Bodywork Around the Front Wheels



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 degrees 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 ;
- a transverse line 625mm forward of the rear face of the cockpit entry template.

For reference this area is shown in Drawing 17a.