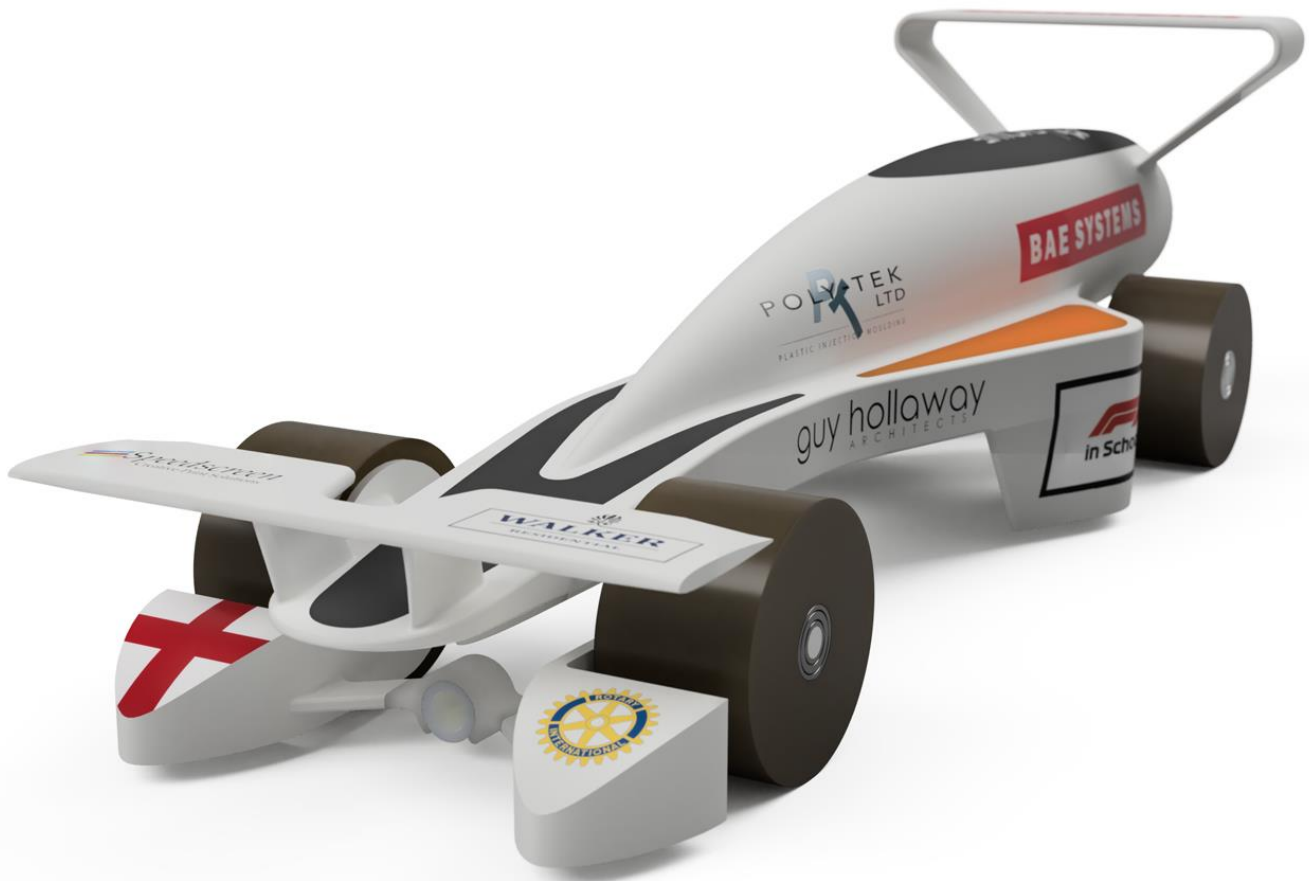


# **in Schools** World Finals



**2020 TECHNICAL REGULATIONS**

## Front Cover - TEAM EVOLVE, UK, 2019 World Champions

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**Please note:** any amendments made prior to the event will be indicated using red underlined text.

# TECHNICAL REGULATIONS

The 2020 technical regulations have been rewritten and renumbered. The basic regulations are the same however the interpretation, scrutineering methods and penalty points allocation are different. Please read the whole document without assumptions from previous rules documents.

## HELP TEXT

*When you see green italic text, this is intended to help clarify a regulation or diagram.*

*When you see the PP+ symbol  in the margin, this means a rule carries a Proportional Penalty. Find out more about Proportional Penalties and the classification of rules in T2.5.*

# TECHNICAL REGULATIONS

<b>Definitions:</b>	<b>07</b>
<b>General Principles:</b>	<b>12</b>
<b>Car Design: Compliance &amp; Penalties:</b>	<b>15</b>
<b>Appendix:</b>	<b>38</b>



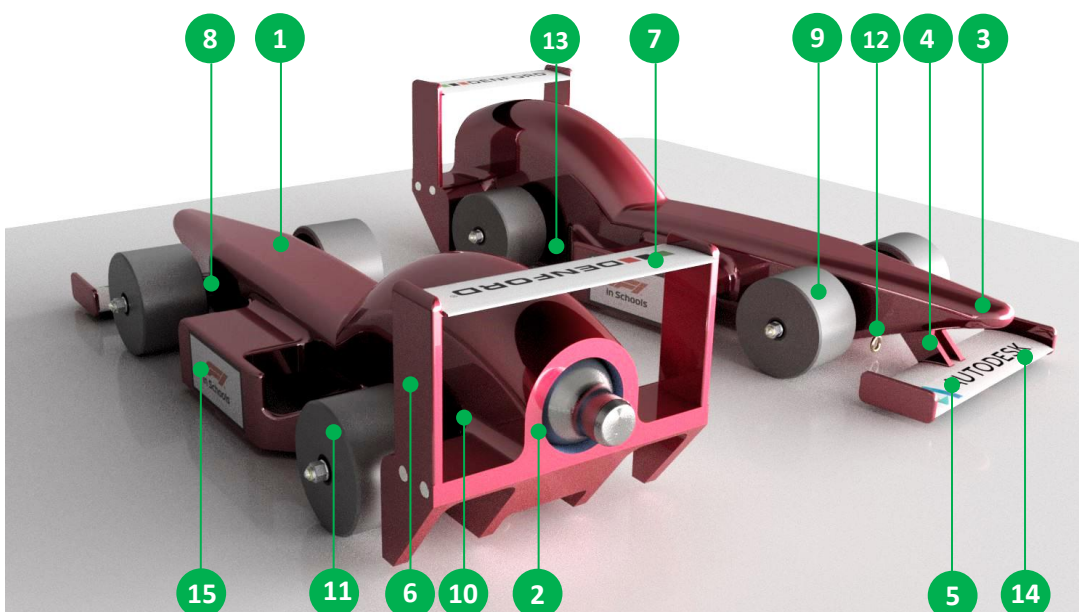
## ARTICLE T1 - DEFINITIONS

### T1.1 F1 in Schools™ car

This is also referred to as 'the car'. Designed and manufactured according to these regulations for the purpose of participating in races on the F1 in Schools track at the World Finals event, powered only by a single 8 grams compressed air cartridge. F1 in Schools cars are designed to travel the 20 metre race distance as quickly as possible, whilst withstanding the forces of launch acceleration, track traversing and physical deceleration after crossing the finishing line.

An F1 in Schools car assembly must only consist of the following components:

1. A body encompassing a virtual cargo *and*
2. A compressed air cartridge chamber *machined from a single piece of F1® Model Block Material*
3. Nose cone assembly
4. Front wing support structure
5. Front wing(s)
6. Rear wing support structure
7. Rear wing
8. Front wheel support system(s)
9. Front wheels (2)
10. Rear wheel support system(s)
11. Rear wheels (2)
12. Front tether line guide
13. Rear teather line guide
14. Surface finishing and decals
15. F1 in Schools™ Logo Decal



Adhesives with no dimensional impact are permissible for joining components

**T1.2 Fully assembled car**

An F1 in Schools car, without a compressed air cartridge inserted, presented ready for racing, resting on all four wheels on the track surface, free of any external force other than gravity.

**T1.3 Body**

The body is a single uninterrupted piece of F1® Model Block Material existing rear of the front axle centre line and encompassing both the virtual cargo and compressed air cartridge chamber. For dimensional purposes the body also includes any attached decals and surface finishes. Any F1® Model Block forward of the front axle centre line is not defined as car body.

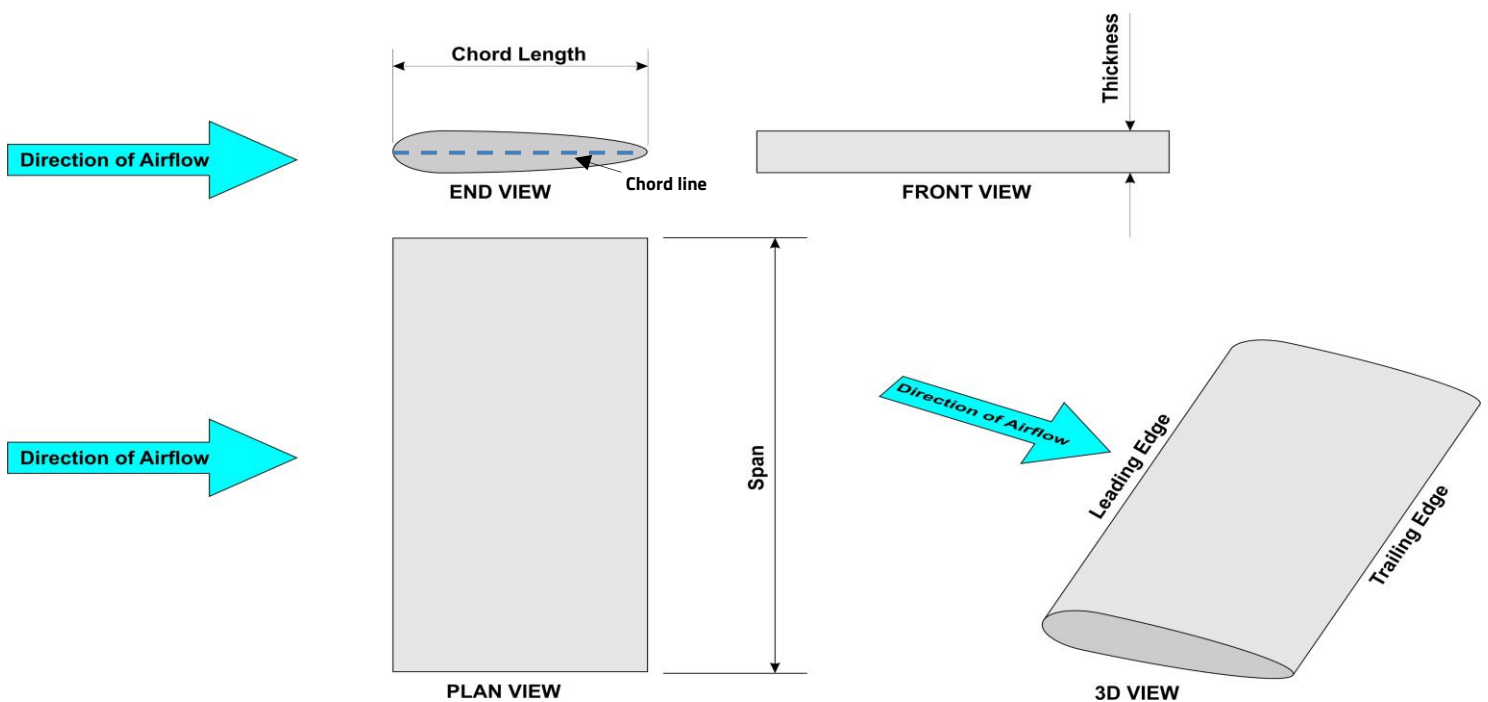
**T1.4 Compressed air cartridge chamber**

The compressed air cartridge chamber is a cylindrical clear space bounded around its inner circumference and one end by car body only. This is where the compressed air cartridge is placed for racing.

**T1.5 Wing**

A wing on an F1 in Schools car is an aerodynamic feature that permits airflow around its minimum required chord surface including its features of a leading and trailing edge across its minimum required span width. A wing is dimensionally defined by the span, chord and thickness. The vertical cross-sectional shape of the wing, parallel to the direction of car travel, is referred to as an aerofoil.

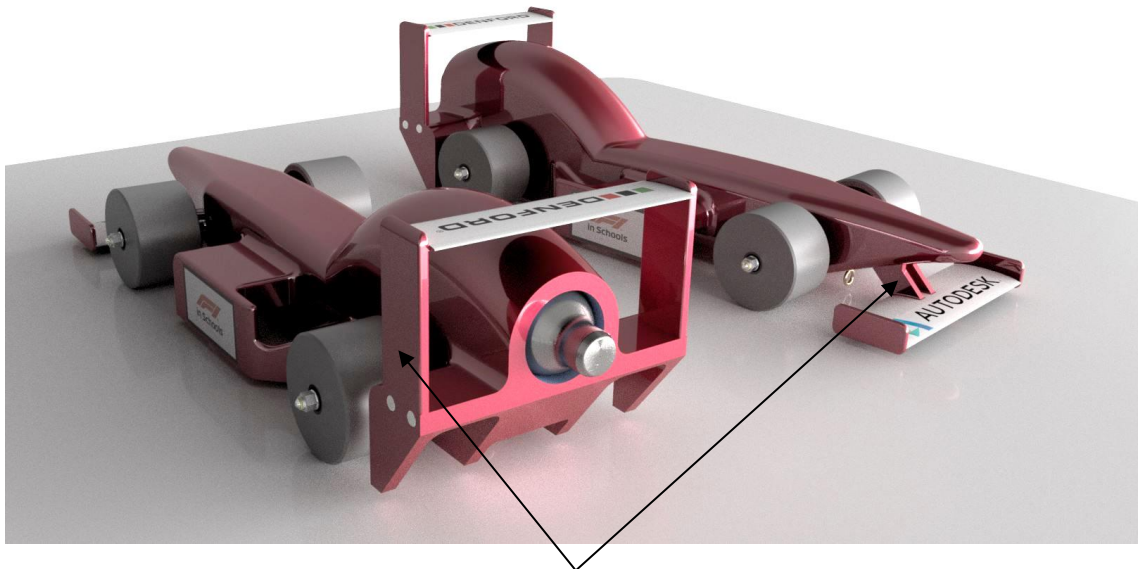
Wing cross-section / aerofoil nomenclature:





## T1.6 Wing support structure

A wing support structure is a feature, other than car body, nose cone or wing(s) that join a wing(s) surface to another component of the car assembly.



Wing support structures

## T1.7 Nose cone

The nose cone is a component of the car, which may be used as a wing support structure, that only exists forward of the front axle centre line. This includes any F1® Model Block material or any other materials that continue forward of the front axle centre line.

## T1.8 Wheel

A wheel is a single part or assembly of components, cylindrical in form, with its maximum circumference contacting the track surface, allowing forward motion of the car through rotation. All material existing within the volume of the actual wheel diameter and actual wheel width is considered to be part of the wheel.

## T1.9 Wheel support system

Wheel support systems are single parts or an assembly of components that connect a wheel to any other part of the car, they MUST be contained within a theoretical cylindrical extrusion defined by the actual diameter of the relative wheels across each axle. These may be sourced from a supplier or manufactured wholly or in part by the team.

## T1.10 Tether line guide

A tether line guide is a key safety component which completely surrounds the track tether line so as to safely connect the car to the tether line during races. A tether line guide can be a component sourced from a supplier or manufactured wholly or in part by the team.

## T1.11 Surface finish and decals

A surface finish on an F1 in Schools car is considered to be any applied visible surface covering, of uniform thickness over the profile of an F1 in Schools car assembly component. A decal is material adhered to a component or surface finish. To be defined as a decal, 100% of the area of the adhering side must be attached to a surface. Surface finishes and decals are included when measuring the dimensions of any components they feature on.

### T1.12 F1 in Schools™ logo decal

Teams must use a labelled decal to identify Car A and Car B and a blank decal to identify display car(s). The official decals are supplied by F1 in Schools Ltd at event registration.

This consists of the F1 in Schools logo graphic printed on a black or a white adhesive vinyl with a 1mm contrast keyline border, with a horizontal dimension of 30mm and vertical dimension of 15mm. Teams choose to use either the black or white outlined decal so as to provide maximum contrast to the surface colour the decal is being adhered to.

A team can manufacture and fit their own decals, provided they use the official F1 in Schools logo decal artwork which can be downloaded from the F1 in Schools website:

<https://www.f1inschools.com/downloads.html>

#### Decal designs:



### T1.13 Hand finishing

Hand finishing is defined as use of a hand powered device (e.g. abrasive paper) for removing only the irregularities that may remain on a CNC machined surface of the car body. These irregularities are often referred to as 'machined marks', any hand finishing must be kept to a minimum.

### T1.14 Official F1® Model Block

The official F1® Model Block Material is a rigid, closed cell foam block processed to the dimensional features as shown by diagrams in the appendix of this document.

**IMPORTANT:** all cars entered into the 2020 World Finals must be manufactured from F1® Model Blocks. The official F1® Model Blocks can be sourced directly from Denford Limited or an official Denford Limited distributor.

### T1.15 Engineering drawings

Engineering drawings are CAD produced drawings which should be detailed such that, along with relevant CAM programs, could theoretically be used to manufacture the fully assembled car by a third party. Such drawings **MUST** include all relevant dimensions and material information.

Where stated, F1 in Schools engineering drawings of a readable scale **MUST** be clearly dimensioned and **identified by hatching, shading, block colour or boundary line within the engineering drawings to specifically identify and prove compliance for the virtual cargo, front and rear wheel support structures, nose, front and rear wing support structures and front and rear wing surfaces.**

Clearly labeled construction or boundary lines are acceptable to define the boundaries between components such as nose cone, wheel support and wing support structures.

Engineering drawings can include: orthographic projection, auxiliary projection, section views, isometric projection, oblique projection, perspective and annotated renderings.

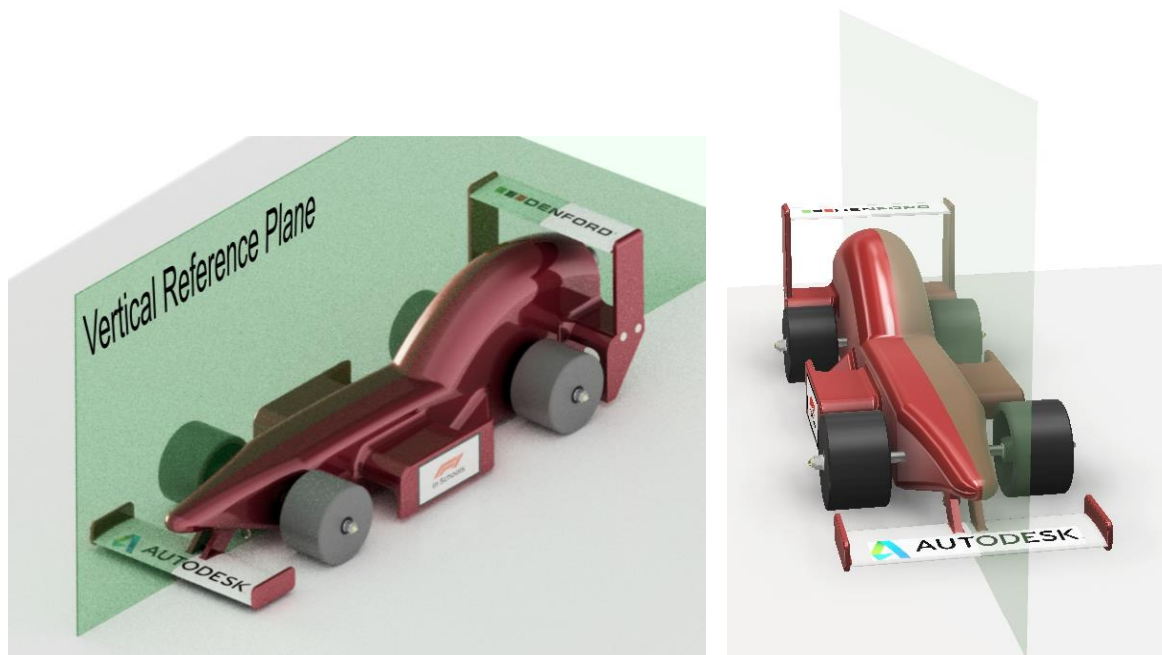
*It is recommended to label the relevant technical regulations where appropriate (e.g T10.5.1: 25.0mm) throughout your Engineering drawings; this makes the job of the scrutineer much easier in identifying the different features of your car.*

### T1.16 Renderings

Renderings are images intended to illustrate the three dimensional form of an object. These can be generated in isometric projection, oblique projection or perspective.

### T1.17 Vertical reference plane

To assist with describing dimensions, it is assumed that a two dimensional invisible plane exists along the length of the compressed air cartridge chamber centre axis and normal to the track surface. This is known as the vertical reference plane.



### T1.18 Additional Components

Any component other than those listed in T1.1 will be considered an additional component.

### T1.19 Normal

The term 'normal' can be used in geometry to describe a line or object that is perpendicular or at 90 degrees to another given object. When referring to the term normal in these regulations it is considered to mean:

- a. Being at right angles; perpendicular.
- b. Perpendicular to the direction of a tangent line of a curve or a tangent plane to a surface.

### T1.20 Full 8 gram compressed air cartridge

A metallic cartridge which contains a 8 gram charge of compressed air. For weights and dimensions refer to appendix v. Official Denford Race Power Pack dimensions.

## ARTICLE T2 - GENERAL PRINCIPLES

### T2.1 Regulations documents

**T2.1.1** F1 in Schools Ltd. issues the regulations, their revisions and amendments made.

**T2.1.2** Technical Regulations - this document. The Technical Regulations document is mainly concerned with those regulations that are directly related to F1 in Schools car design and manufacture. Technical regulation article numbers have a 'T' prefix.

**T2.1.3** Competition Regulations – a document separate to this one which is mainly concerned with regulations and procedures directly related to judging and the competition event. Competition Regulation article numbers have a 'C' prefix.

### T2.2 Interpretation of the regulations

**T2.2.1** The final text of these regulations is in English should any dispute arise over their interpretation. The text of a regulation and any related definitions should be considered together for the purpose of interpretation.

**IMPORTANT:** Diagrams and or images are for illustration purposes only and do not contribute to regulatory compliance.

**T2.2.2** Text clarification - any questions received that are deemed by F1 in Schools Ltd. to be related to regulation text needing clarification will be answered by F1 in Schools Ltd. The question received, along with the clarification provided by F1 in Schools Ltd., will be published to all competing teams at the same time via the official F1 in Schools World Finals Facebook page and F1 in Schools website.

### T2.3 Amendments to the regulations

Any amendments will be announced and released by F1 in Schools Ltd. by email notification to all In-Country Coordinators (ICC) as well as being posted on the website [www.f1inschools.com](http://www.f1inschools.com).

Any amended text will be indicated **thus** (using red underlined text).

### T2.4 Classification of regulations

**T2.4.1** The technical regulations are classified as either: **GENERAL**, **SAFETY**, **PERFORMANCE**.

GENERAL	SAFETY	PERFORMANCE
Regulations that shape the way the car fundamentally looks and works, vital to the style of an F1 in Schools car.	Mandatory rules that govern the safe running of the car. Cars must meet these rules to be considered 'safe to race'.	Rules that have a direct impact on the performance of the vehicle, these typically carry the heaviest penalties.

**T2.4.2** If a race car is judged as being NON-COMPLIANT with any Performance regulation they will be INELIGIBLE for the awards of: 'Fastest Car' and 'Best Engineered Car'. All Performance regulations are highlighted in yellow throughout this document.

### T2.5 Compliance with regulations

**T2.5.1** Points are deducted for non-compliance with the technical regulations as per the penalties as defined in this document.. Both race cars are assessed during Specification Judging and points will be deducted for any infringements on either car. These penalties are only applied once, per infringement, per car.

After initial Specification Judging any team with technical infringements will be given a single 20 minute car service session. See competition regulations for more information.

**T2.5.2** Proportional penalties will be applied to the following regulations:

**T3.4, T3.5, T3.6, T3.7, T3.8, T5.2, T5.6, T7.2, T7.3, T7.4, T7.5, T7.11, T9.5, T10.5**

The penalty applied increases proportionally as the margin of non-compliance with the absolute minimum/maximum dimension increases by rounding up the non-compliance to the next complete unit of measure (1.0mm or 1.0g). The penalty is applied once for every complete unit outside of the absolute minimum/maximum dimension. For example:



## T2.6 Design ideas and regulation compliance questions

Teams are not permitted to seek a ruling from F1 in Schools Ltd. or any competition officials or judges before the event as to whether a design idea complies with these regulations, any regulatory communication between teams and ICCs or teachers is only for guidance, rulings will only be made by the official judges at the World Finals event. Design compliance to the regulations forms part of the competition. As in Formula 1® innovation is encouraged and F1 in Schools teams may also find ways of creating design features that push the boundaries of the regulations in order to get an extra competitive edge.

## T2.7 Measurements

**T2.7.1** All dimensions and weights are presented as absolute minimum or maximum, unless stated otherwise. For example:

MIN Weight	MIN Dimension	MAX Dimension
Absolute Min: 50.0g	Absolute Min: 26.0mm	Absolute Max: 34.0mm
50.0g - PASS	26.0mm - PASS	34.0mm - PASS
49.9g - FAIL	25.9mm - FAIL	34.1mm - FAIL

**T2.7.2** Dimensional measures - all car component dimensions or weight are inclusive of any applied paint finish or decal. A series of specially manufactured gauges will be used to broadly verify dimensional compliance. Accurate measuring tools, such as vernier calipers, will then be used to closely inspect any dimensions found to be close to the dimensional limits per the initial gauge inspection.

**IMPORTANT:** Some regulations are assessed with a full 8g race cartridge fully inserted into the cartridge chamber. For compliance with these regulations, the static weight distribution of the car must be such that the car is capable of **resting on all four (4)** wheels without any outside assistance.

**T2.7.3** Weight measures – all weight measurements will be made using the F1 in Schools Ltd. calibrated electronic competition scales.

## **T2.8 Benefit of doubt**

The chair of judges will, where appropriate, seek to use 'benefit of doubt' when the assessment of compliance is marginal or unclear. In this situation, teams will be given the benefit of doubt rather than a firm penalty if a penalty cannot be clearly measured or identified.

## **T2.9 Spirit of the competition**

Teams are expected to act in the spirit of the competition, both before and during the F1 in Schools World Finals. Any team deemed by the chair of judges to be acting outside of the spirit of the competition, can be removed from certain or all aspects of the competition. For example, a team attempting to abuse the technical regulations to their advantage may, at the discretion of the chair of judges, be removed from racing and receive no points for this activity. A team deemed to be acting in an unsportsmanlike manner towards another team or other persons may be removed from some or all judging areas.

The spirit of the competition is simple; embrace and respect the rules and regulations, do your very best to compete legally and fairly, while contributing positively to the F1 in Schools World Finals. Make friends, create positive relationships, network professionally and enjoy yourselves.

## **T2.10 Originality of Work**

F1 in Schools LTD welcomes and endorses innovation and does not consider that plagiarism should play any part in any of the disciplines that make up the competition.

Competing teams at all levels of the competition that intentionally plagiarise any part of their assessed work, undermines the credibility and integrity of the F1 in Schools challenge and the spirit of the competition. At the 2020 World Finals F1 in Schools shall be implementing various originality detection methodologies and requesting all competing teams to submit an originality declaration.

**Further details and associated penalties will be explained in detail in the 2020 World Finals competition regulations.**

# **CAR DESIGN: COMPLIANCE AND PENALTIES**

<b>Article 3:</b>	<b>Fully assembled car</b>	<b>16</b>
<b>Article 4:</b>	<b>Car body</b>	<b>19</b>
<b>Article 5:</b>	<b>Cartridge chamber</b>	<b>21</b>
<b>Article 6:</b>	<b>Tether line guides</b>	<b>23</b>
<b>Article 7:</b>	<b>Wheels</b>	<b>25</b>
<b>Article 8:</b>	<b>Nose cone</b>	<b>29</b>
<b>Article 9:</b>	<b>Front Wings/support</b>	<b>30</b>
<b>Article 10:</b>	<b>Rear Wings/support</b>	<b>33</b>
<b>Article 11:</b>	<b>Additional Components</b>	<b>37</b>



## ARTICLE T3 - FULLY ASSEMBLED CAR

### T3.1 Design and manufacture - [GENERAL - Penalty - 5pts each]

**T3.1.1** All F1 in Schools cars must be designed and engineered using CAD (Computer Aided Design) and CAM (Computer Aided Manufacture) technology. CAD software used should provide for 3D part modelling, assembly and 3D realistic rendering. We recommend the use of Autodesk Fusion 360 software. The CAM package should allow students to simulate CNC machining processes so they can show evidence of these in their portfolio. We recommend the use of Denford QuickCAM PRO software.

**T3.1.2** The body of all F1 in Schools cars must be manufactured via material removal using a CNC router/milling machine. We recommend all teams use a Denford CNC Router. This manufacturing process should occur at your school/college or at a designated manufacturing centre/partner site.

**T3.1.3** An official F1 in Schools holographic sticker from the official F1® Model Block for each car must be submitted on the project element submission sheet at the World Finals event registration.

**T3.1.4** The individual components of both race cars must be designed with identical geometry.

### T3.2 Safe Construction [SAFETY | Penalty - 10pts each]

**T3.2.1** Specification judging - all submitted cars will be inspected closely to ensure that they are engineered and constructed safely for the purpose of racing. If the judges rule an aspect of either race car to be unsafe for racing, the team will be required to carry out repairs / modifications to the car(s). Any such repair work will result in a penalty of 10 points per unsafe car.

**T3.2.2** During racing – the race officials will routinely inspect cars for safety during scheduled races. If the officials rule a car to be unsafe, a penalty of 10 points will be imposed at the discretion of the Chair of Judges. The team may repair the car as per the Competition Regulations – C10 Car Repairs and Servicing.

### T3.3 Undefined features - [PERFORMANCE | Penalty - 20pts]

The car assembly must only consist of components listed in ARTICLE T1.1.



### T3.4 Total length - [GENERAL | Penalty - 5pts per millimetre]

Total length is measured parallel to the track surface and vertical reference plane, between the front and rear extremities of the assembled car.

**Absolute Min: 170.0mm / Absolute Max: 210.0mm**



### T3.5 Total width - [GENERAL | Penalty - 5pts per millimetre]

Total width is the maximum assembled car width, measured normal to the vertical reference plane, between the outer edges of the widest feature of the car assembly.

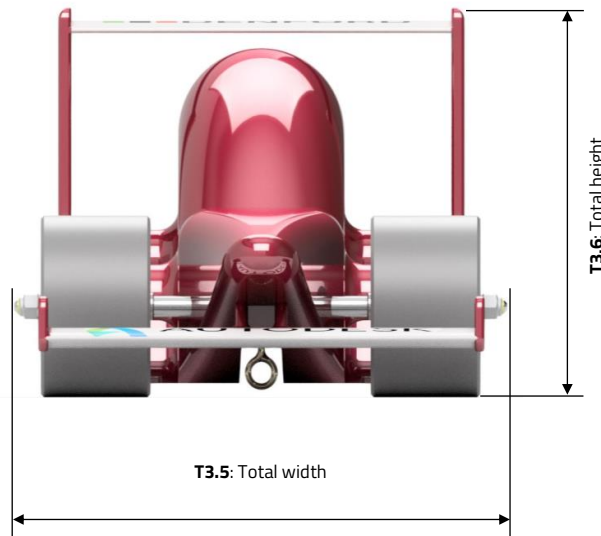
**Absolute Max: 85.0mm**



**PP + T3.6 Total height - [GENERAL | Penalty - 5pts per millimetre]**

Total height is the maximum assembled car height, normal to the vertical reference plane, between the track surface and the highest feature of the car assembly. This is measured with a full 8g compressed air cartridge inserted into the cartridge chamber with the car sitting on all four (4) wheels with no outside assistance.

**Absolute Max. 65.0mm**



**PP + T3.7 Total weight - [PERFORMANCE | Penalty - 10pts per gram]**

Total weight is the weight of the car excluding a compressed air cartridge. If ruled underweight at registration and confirmed during initial scrutineering the above points penalty will be applied.

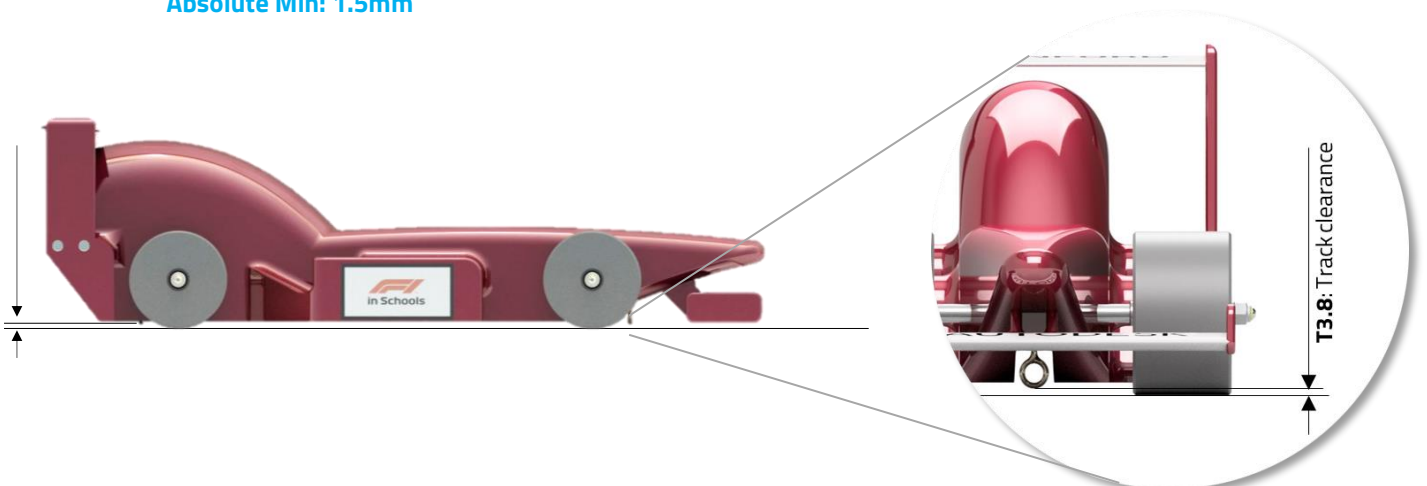
No car will race underweight and ballast will be added to the underside of the car at 0.2g for every 0.1g underweight.

**Absolute Min: 50.0g**

**PP + T3.8 Track clearance - [GENERAL | Penalty - 10pts per millimetre]**

Track clearance is the distance between track surface and any car component as listed in T1.1, except wheels. Measured normal to the track surface. This is measured with a full 8g compressed air cartridge inserted into the cartridge chamber with the car sitting on all four (4) wheels with no outside assistance.

**Absolute Min: 1.5mm**



### **T3.9 Status during racing - [GENERAL | Penalty - 5pts]**

The car assembly must be designed so that no items other than those listed in T3.10, or compressed air cartridges are removed, replaced or added to the assembly during scheduled race events.

### **T3.10 Replacement Components**

Any spare / replacement components should be identical in design and geometry to those fitted to the car and must be submitted with the cars at registration. Only the following spare / replacement components are permitted:

- Nose cone – maximum of (2)
- Front wing support structure – maximum of (2)
- Front wing(s) – maximum of (2 car set(s))
- Rear wing support structure – maximum of (2)
- Rear wing – maximum of (2)
- Front wheel support structure maximum (2)
- Front wheels maximum of (4)
- Rear wheel support structure maximum (2)
- Rear wheels maximum of (4)

#### **T3.10.1**

Only submitted replacement components that are determined by the judges to be identical in design and geometry to those fitted to the cars will be allowed to be used during track repairs or post race servicing.

#### **T3.10.2**

If any other items need to be introduced for car repairs a **5pt penalty** will be incurred per individual item.

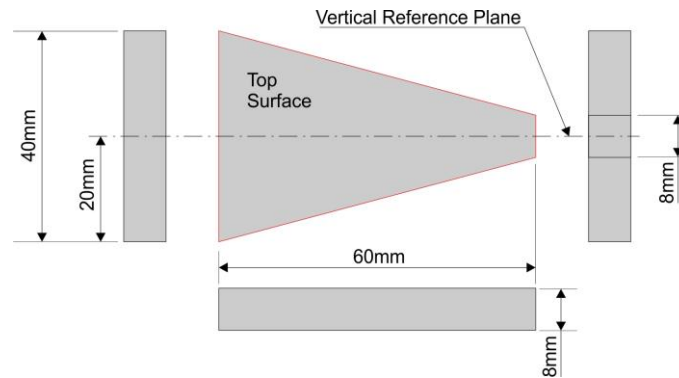
# ARTICLE T4 - BODY

## T4.1 Body construction - [GENERAL | Penalty - 20pts]

A single continuous piece of CNC manufactured F1® Model Block material must exist rear of the front axle centre line, encompassing both the virtual cargo and compressed air cartridge chamber.

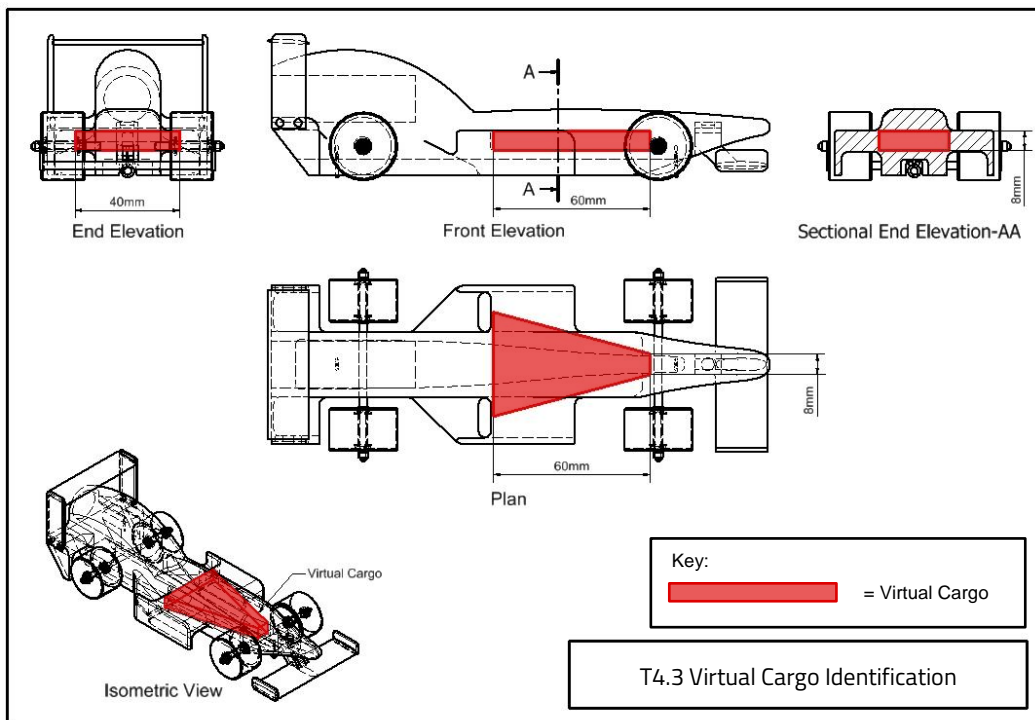
## T4.2 Virtual cargo - [PERFORMANCE | Penalty - 25pts]

A virtual cargo must be completely encompassed by the body and be wholly positioned between the front and rear wheel centre lines. The virtual cargo must have minimum dimensions as shown below, with its top surface located symmetrical about and positioned normal (90 degrees) to the vertical reference plane. The virtual cargo may be intersected by the FRONT wheel support system and may also share common faces with the car body. All dimensions shown are absolute minimum.



## T4.3 Virtual cargo identification - [GENERAL | Penalty - 5 pts]

The virtual cargo location and compliance MUST be clearly dimensioned and identified by hatching, shading or block colour within the engineering drawings submitted for scrutineering. Please refer to the example diagram below, showing the virtual cargo clearly highlighted in red:



**T4.4 F1 in Schools™ logo decal location - [GENERAL | Penalty - 5pts]**

An F1 in Schools logo decal (refer ARTICLE T1.12) must be wholly adhered to each side of the car, positioned between the front and rear wheels and being 100% visible in the respective side view within a tolerance of  $\pm 10$  degrees in any direction measured parallel to the vertical reference plane. Teams may manufacture their own decals but must use the artwork supplied by F1 in Schools.



T4.4: F1 in Schools™ logo decal location

**T4.5 Decal thickness - [GENERAL | Penalty - 5pts]**

This is measured as the total thickness of any decal, excluding any surface finishes.

**Absolute Max: 0.5mm**

# ARTICLE 5 - COMPRESSED AIR CARTRIDGE CHAMBER

**T5.1 Diameter - [SAFETY | Penalty - 5pts]**

This is the diameter of the compressed air cartridge chamber, measured at any point through its minimum depth.

**Absolute Min: 18.0mm / Absolute Max: 18.5mm**



**T5.2 Distance from track surface - [GENERAL | Penalty - 5pts per millimetre ]**

This is measured with a full 8g compressed air cartridge inserted into the cartridge chamber, from the rear centre of the compressed air cartridge to the track surface, measured normal to the track surface. This is measured with a full 8g compressed air cartridge inserted into the cartridge chamber with the car sitting on all four (4) wheels with no outside assistance.

**Absolute Min: 30.0mm / Absolute Max: 40.0mm**

**T5.3 Depth - [SAFETY | Penalty - 5pts]**

The depth of the chamber is measured parallel to the vertical reference plane anywhere around the chamber circumference from the opening to the chamber end.

**Absolute Min: 45.0mm / Absolute Max: 58.0mm**

**T5.4 Max angle of chamber - [SAFETY | Penalty - 5pts]**

The absolute maximum angle of the chamber, parallel to the track surface. This is measured with a full 8g compressed air cartridge inserted into the cartridge chamber with the car sitting on all four (4) wheels with no outside assistance.

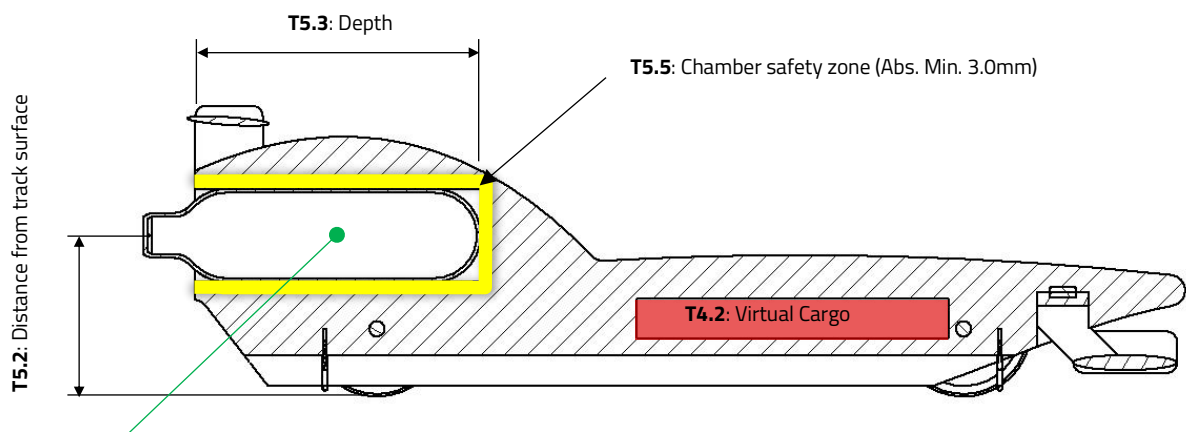
**Absolute Min: -3° Absolute Max: 3°**

**T5.5 Chamber safety zone - [SAFETY | Penalty - 10pts]**

A safety zone of F1 Model Block material with a minimum thickness of 3.0mm must be maintained around the minimum chamber volume. The chamber safety zone and connection to the car body will be assessed and if determined below the minimum thickness, may be considered a safety issue at the judges discretion, see ARTICLE T3.2.

**IMPORTANT:** the entire circumference and depth of the compressed air cartridge chamber must not be intersected by any object.

**Absolute Min: 3.0mm**

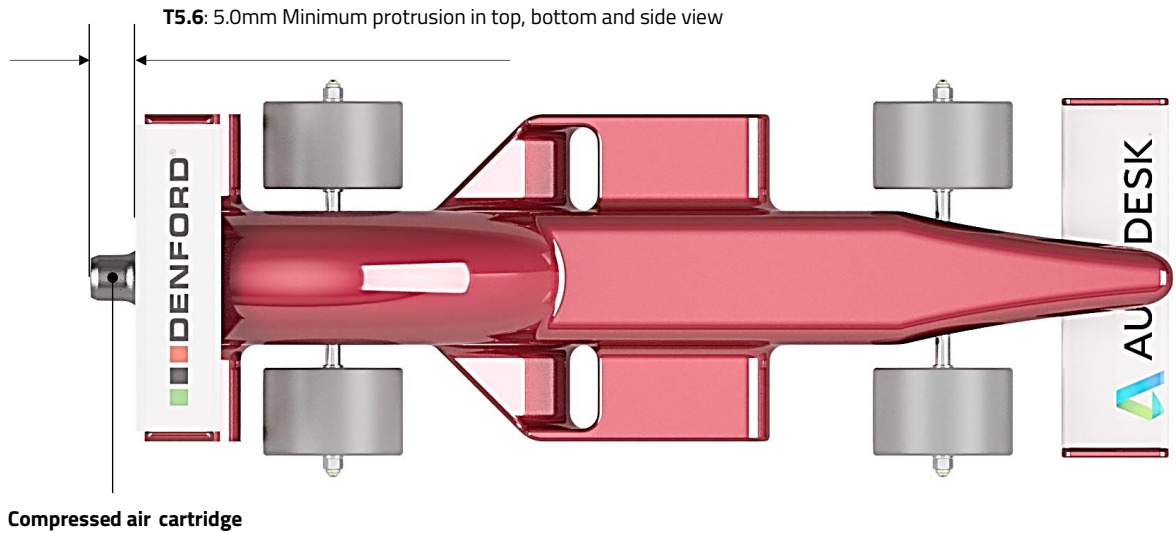


*(Cartridge chamber should be free of any paint)*

**PP + T5.6 Compressed air cartridge visibility - [PERFORMANCE | Penalty - 10pts per millimetre]**

When fully inserted, the compressed air cartridge must protrude a minimum of 5.0mm from the rear of the car and be visible in it's entirety when viewed radially around the longitudinal centerline of the compressed air cartridge.

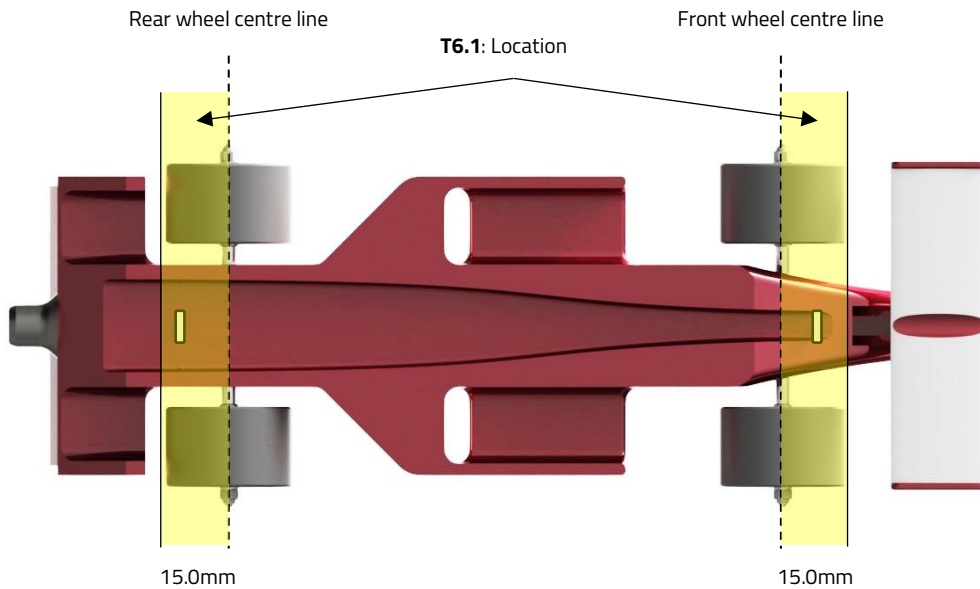
**Absolute Min: 5.0mm**



# ARTICLE T6 - TETHER LINE GUIDES

## T6.1 Location - [SAFETY | Penalty - 10pts]

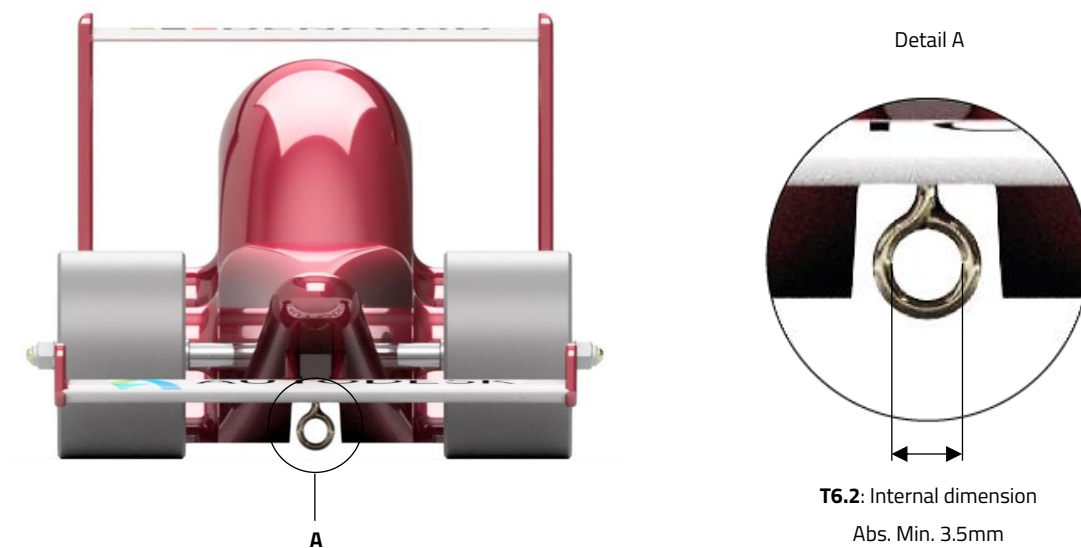
Each car must have only two (2) firmly secured tether line guides, one on or up to 15.0mm in front of the front axle centre line and one on or up to 15.0mm behind the rear axle centre line of the car. The track tether line must **only** pass through the two tether line guides during racing.



## T6.2 Internal dimension - [SAFETY | Penalty - 5pts]

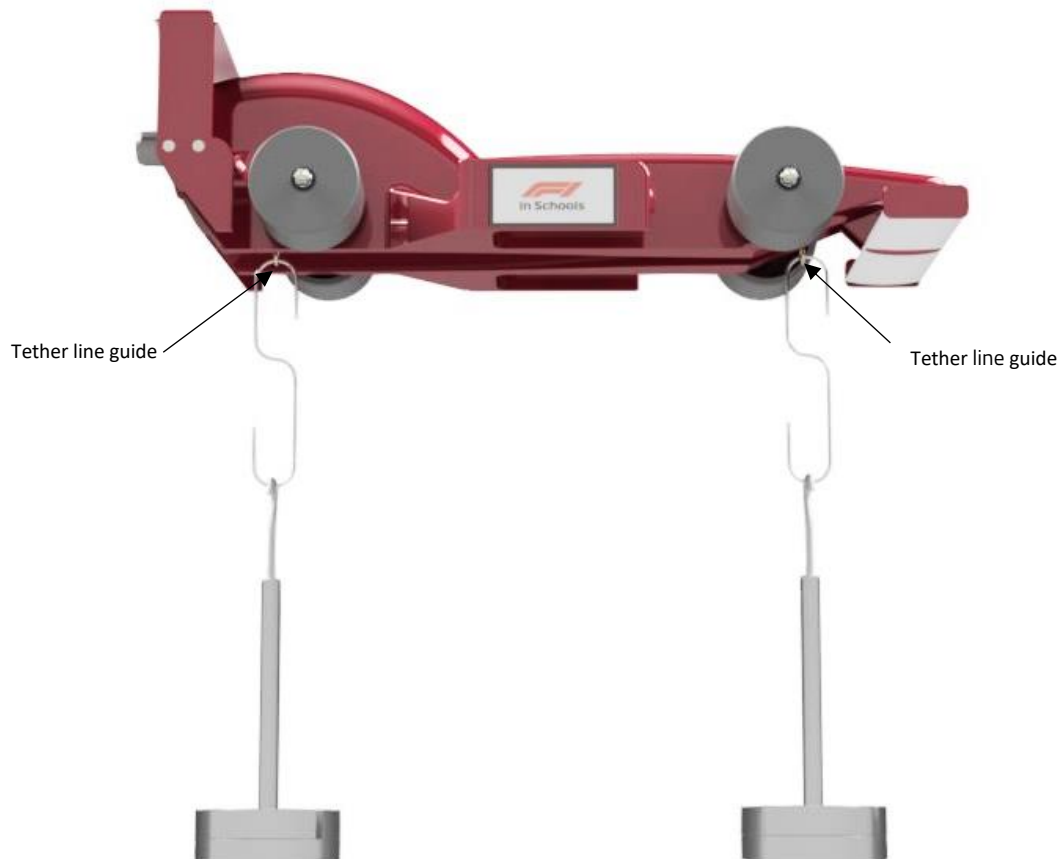
This is the minimum and maximum internal measurement of the opening within the guide, which the tether line passes through. This will be measured using a 3.5mm and/or 6.0mm diameter tool.

**Absolute Min: 3.5mm / Absolute Max: 6.0mm**



**T6.3 Tether line guide safety - [SAFETY | Penalty - 10pts]**

The guide holes must be completely closed to prevent the tether line from slipping out during racing. The construction of the tether line guides will be closely examined in relation to safety, please refer to ARTICLE T3.2 for more information. The guides must be robust so as to prevent the diameter or shape changing during racing. The below tether line guide test will be conducted during scrutineering. A 200g weight will be suspended from each tether line guide to check the guides are securely fitted to the car and safe to race.





# ARTICLE T7 - WHEELS AND WHEEL SUPPORT STRUCTURES

## T7.1 Number and location - [GENERAL | Penalty - 25pts]

The car assembly must include four (4) cylindrical wheels, a maximum of two (2) at the front and a maximum of two (2) at the rear. Opposing wheels must share a common centre line / axis.

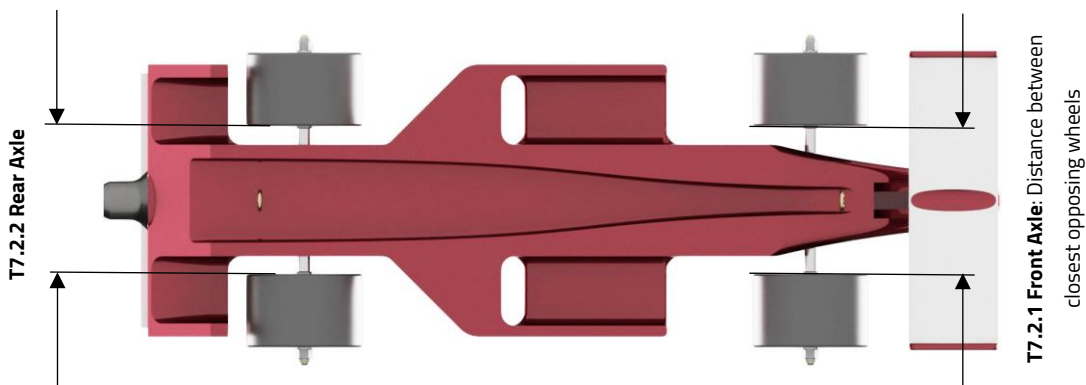


## T7.2 Distance between opposing wheels - [PERFORMANCE | Penalty - 2.5pts per millimetre per axle ]

This is measured as the innermost distance of the rotating wheel components (other than a rotating axle) between the two (2) opposing wheels measured parallel to the track surface.

**T7.2.1 Front Axle - Absolute Min: 30.0 mm**

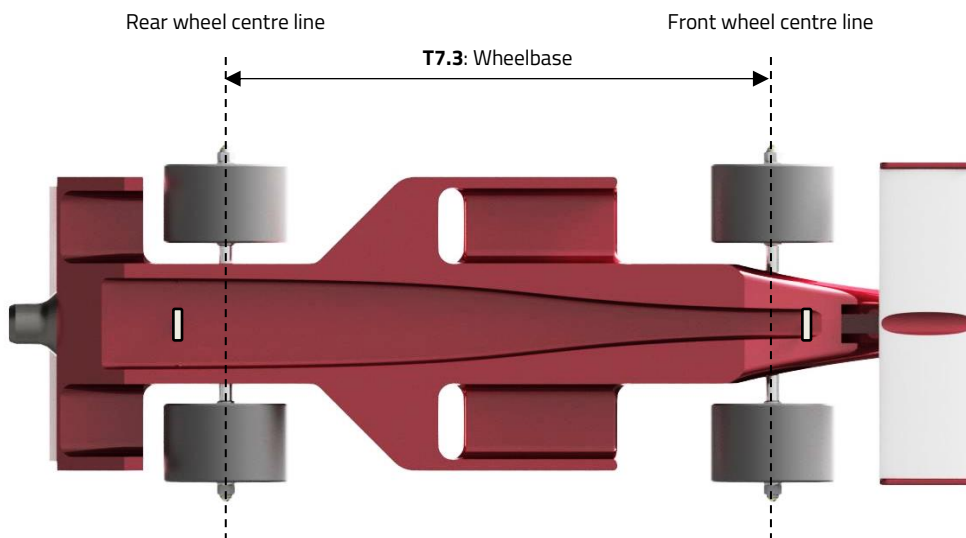
**T7.2.2 Rear Axle - Absolute Min: 30.0 mm**



## T7.3 Wheelbase - [PERFORMANCE | Penalty - 5pts per millimetre]

The wheelbase of the vehicle is the distance between the centre line of the front and rear wheels as viewed in the side view.

**Absolute Min: 100.0mm**

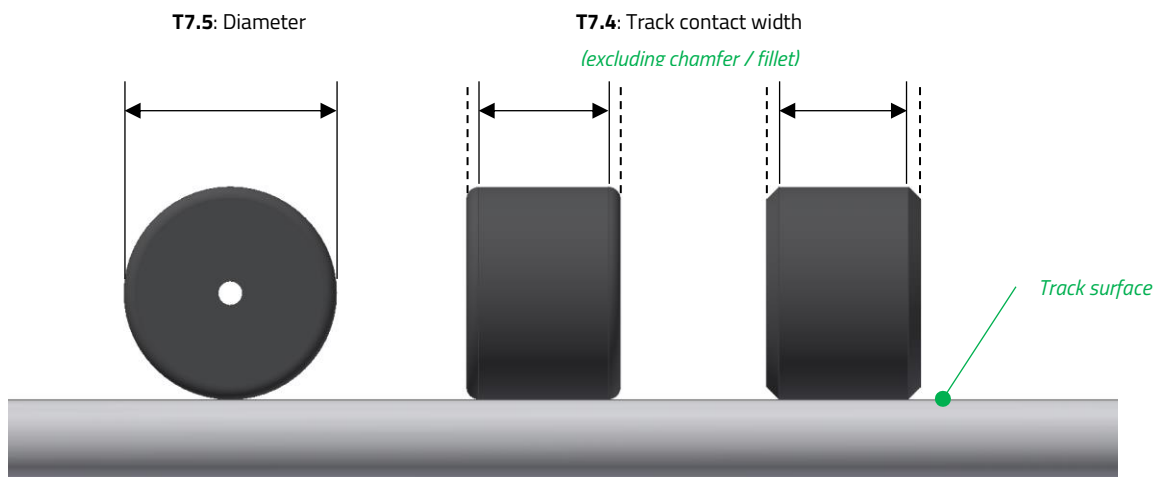


**PP + T7.4 Track contact width - [PERFORMANCE | Penalty - 2.5pts per millimetre per wheel]**

This is measured along the surface of the wheel that makes constant contact with the track surface, excluding any chamfers or fillets.

**T7.4.1 Front Wheels - Absolute Min: 12.0mm**

**T7.4.2 Rear Wheels - Absolute Min: 15.0mm**



**PP + T7.5 Diameter - [PERFORMANCE | Penalty - 2.5pts per millimetre per wheel]**  
This is the wheel diameter measured across the minimum track contact width rolling surface.  
**Absolute Min: 26.0mm / Absolute Max: 34.0mm**

**T7.6 Race track contact - [PERFORMANCE | Penalty - 2.5pts per wheel]**

All four (4) wheels must touch the racing surface at the same time across the full track contact width, measured with a full compressed air cartridge inserted with the car sitting on all four (4) wheels with no outside assistance. Race track contact must be maintained prior to car launch and during racing.

**T7.7 Rolling surface - [PERFORMANCE | Penalty - 2.5pts per wheel]**

The wheel diameter must be consistent across the track contact width. *(i.e. no tread like features are permitted)*

**T7.8 Rotation - [PERFORMANCE | Penalty - 5pts per wheel]**

All four (4) wheels must rotate freely about their own centre axis to facilitate forward motion of the car during racing. The scrutineering judge must be able to validate this with reasonably minimal effort, using a 2° incline test during scrutineering.

**Absolute Min rolling incline: 2°**

**T7.9 Visibility in top and bottom views - [PERFORMANCE]**

The visibility of all wheels must not be physically obscured by any component of the car in the car's top and bottom elevation views. Car body or any other components must not exist within the dimensions illustrated below. These dimensions must exist from the inside edges of each wheels' track contact width to the extreme width of the car assembly and a height from track surface of 65.0mm. This is measured, parallel to the vertical reference plane and track surface. *Please also refer to T9.6 and T10.6 – Clear Airflow.*

**T7.9.1 – In front of front wheels | Penalty – 2.5pts**

**Absolute Min: 3.0mm**

**T7.9.2 – Behind front wheels | Penalty – 5pts**

**Absolute Min: 15.0mm**

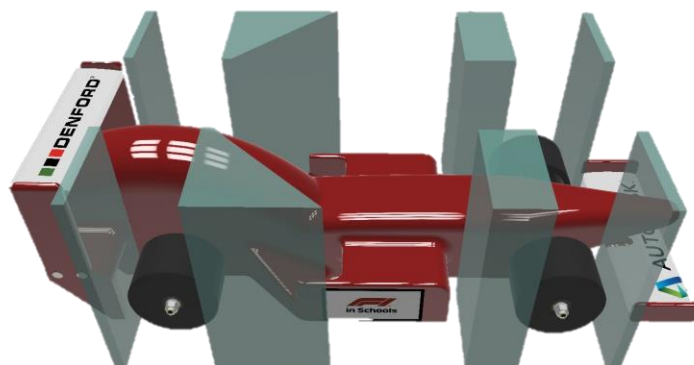
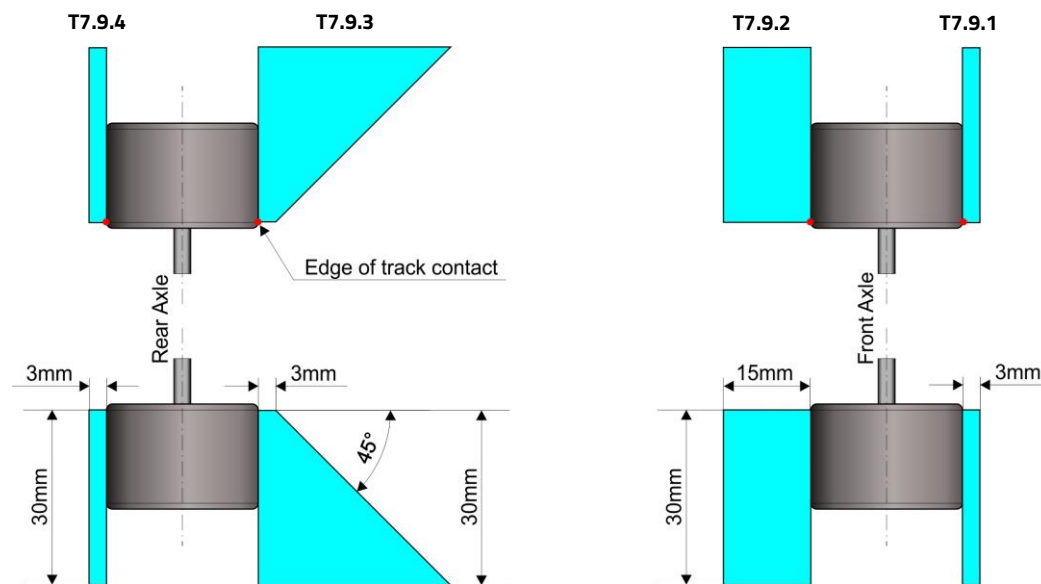
**T7.9.3 – In front of rear wheels | Penalty – 5pts**

**Absolute minimum dimensions on diagram below**

**T7.9.4 – Behind rear wheels | Penalty – 2.5pts**

**Absolute Min: 3.0mm**

*Scrutineering tools used to define these clearances will be manufactured to dimensions as illustrated below.*



**T7.10 Visibility in side views - [PERFORMANCE | Penalty - 10pts per wheel]**

The visibility of all wheels must not be physically obscured by any component of the car with the exception of any wheel support systems, in the car’s side elevation views.

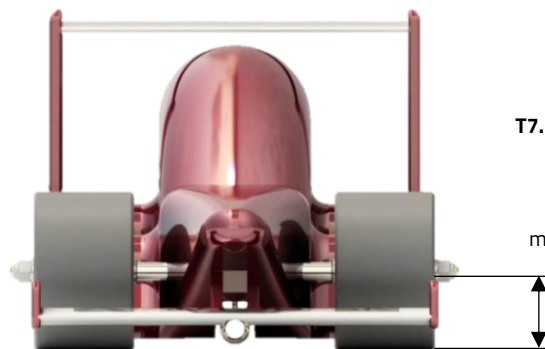


View of wheels only obstructed by wheel support system (circled in yellow)

**PP+ T7.11 Visibility in front view - [PERFORMANCE | Penalty - 10pts per millimetre]**

The visibility of the front wheels in the car’s front view may only be physically obstructed to a height of 15.0mm from the track surface. This is measured with a full 8g compressed air cartridge inserted into the cartridge chamber with the car sitting on all four (4) wheels with no outside assistance.

**Absolute Max: 15.0mm**

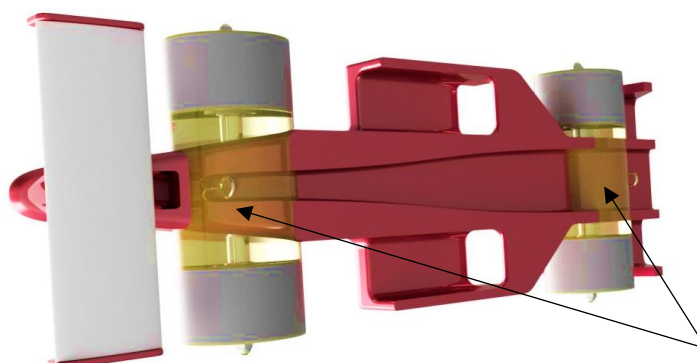


T7.11: Visibility in front view physically obstructed up to a maximum of 15.0mm

**T7.12 Wheel support - [GENERAL | Penalty - 5pts each]**

**T7.12.1 Wheel support systems:** Wheel support systems may only exist within the cylindrical volume generated through the diameter of the two (2) opposing wheels. Refer to ARTICLE T3.8 Track clearance.

**T7.12.2 Wheel support systems identification:** The surfaces defining the wheel support structures MUST be dimensioned and identified clearly by hatching, shading or block colour within the engineering drawings submitted for scrutineering. *(Construction lines are acceptable to define the boundaries between components such as nose cone and wing support structures.) Also refer to the definition in ARTICLE T1.15 for guidance on annotating these features in your Engineering Drawings.*



T7.12: Cylindrical volume generated through the maximum diameter of two opposing wheels, shown highlighted yellow

## ARTICLE T8 - NOSE CONE

### T8.1 Construction

The nose cone can be manufactured from any material.

### T8.2 Nose cone identification - [GENERAL | Penalty - 5pts]

The surfaces defining the nose cone structure MUST be dimensioned and identified clearly by hatching, shading or block colour within the engineering drawings submitted for scrutineering. *(Clearly labeled construction lines are acceptable to define the boundaries between components such as wheel support and wing support structures.) Also refer to the definition in ARTICLE T1.15 for guidance on annotating these features in your Engineering Drawings.*

# ARTICLE T9 - FRONT WING AND WING SUPPORT STRUCTURES

## T9.1 Front wing and wing support structure identification - [GENERAL | Penalty - 5pts]

The surfaces defining the front wing(s) and wing support structures **must** be dimensioned and identified clearly by hatching, shading or block colour within the engineering drawings submitted for scrutineering. *(Clearly labeled construction lines are acceptable to define the boundaries between components such as nose cone and wheel support structures). Also refer to the definition in ARTICLE T1.15 for guidance on annotating these features in your Engineering Drawings.*

## T9.2 Front wing(s) description and placement - [GENERAL | Penalty - 5pts]

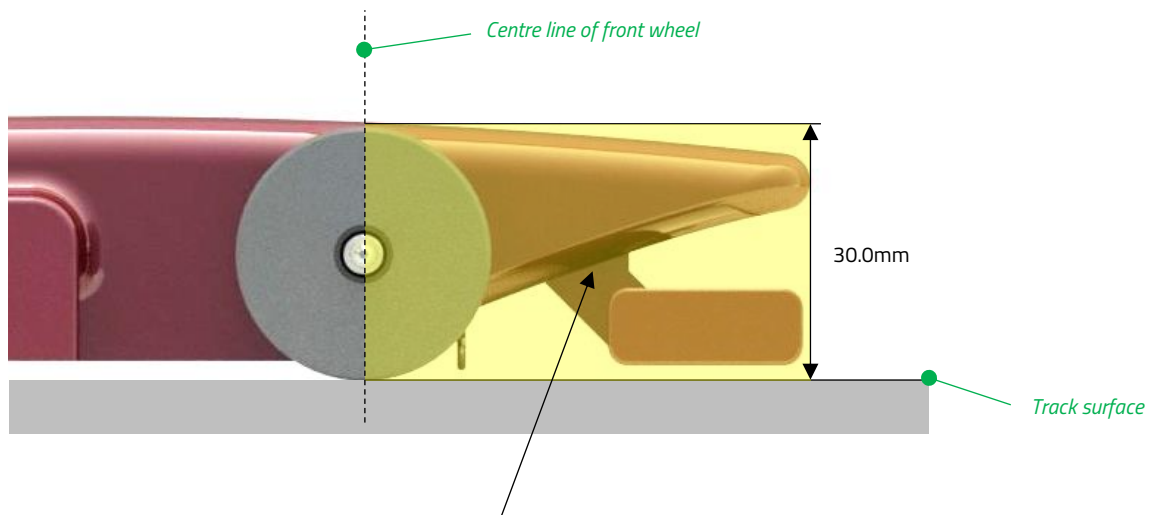
The design of the car should resemble an actual F1 car through the inclusion of a wing(s) on the nose of the car and a wing at the rear of the car. Each wing section must have a leading edge and a trailing edge across its full span. *Refer to the definition in ARTICLE T1.5.*

## T9.3 Front wing(s) construction and rigidity - General - Penalty - 5pts]

The front wing(s) and any support structures may be manufactured from any separate materials. The wing span dimension must remain unchanged during races *(i.e. wings must be rigid, ruled at the judge's discretion).*

## T9.4 Front wing and wing support structure location - General - Penalty - 10pts

The whole of the front wing(s) and any support structure and nose cone **must** be in front of the centre line of the front wheel and no more than 30.0mm above the track surface when viewed in the side elevation.



T9.4: Front wing and wing support structure location, shown highlighted yellow

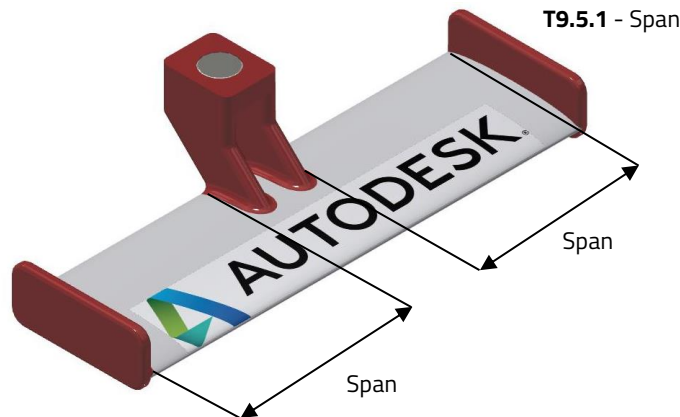
**PP + T9.5 Front Wing Dimensions - [PERFORMANCE]**
**T9.5.1 Front wing span – [PERFORMANCE | Penalty – 2pts per millimetre]**

The front wing span will be measured at right angles to the vertical reference plane along the leading edge, trailing edge, top surface and bottom surface of the wing, whichever is shortest will be considered as the maximum span. Where the front wing span is intersected by another part of the car, the total span is the sum of a maximum of two (2) wing segments, which **must** be no less than 25.0mm each.

*(See illustration below)*

**Absolute Min: 25mm x 2 = 50.0mm**

**or 50mm x 1 = 50mm**


**T9.5.2 Front wing chord - [PERFORMANCE | Penalty – 1pt per millimetre]**

The front wing chord minimum to maximum dimensions **must** exist throughout the existing wing span. The chord is the distance between the leading edge and trailing edge (chord line) measured parallel to the vertical reference plane. Front wing chord compliancy does not depend on span.

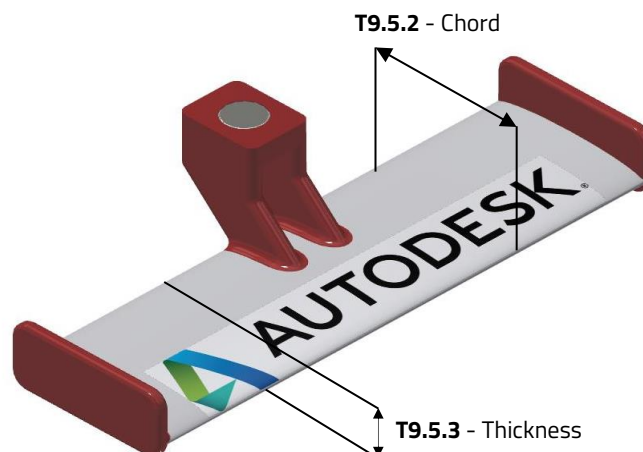
*(See illustration below)*

**Absolute Min: 15.0mm / Absolute Max: 25.0mm**

**T9.5.3 Front wing thickness - [PERFORMANCE | Penalty – 1pt per millimetre]**

The wing thickness minimum to maximum dimensions **must** exist throughout the wing's existing span and at a point along the existing chord, measured perpendicular to the chord line. Front wing thickness compliancy does not depend on span and / or chord. *(See illustration below)*

**Absolute Min: 2.0mm / Absolute Max: 6.0mm**



**T9.6 Front wing clear airflow - [PERFORMANCE | Penalty - 5pts]**

The front wing(s), measured across its / their minimum existing span, must have a minimum of 5.0mm of clear 'air' space to any other part of the car or track surface, measured normal from any part of the wings surface.

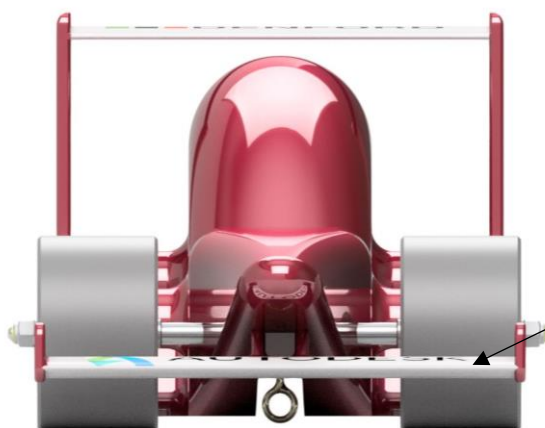
**Absolute Min: 5.0mm**

*(To allow for fillet rads where a wing joins a support structure this will be checked with a 5.0mm diameter spherical ball on the end of a 2mm diameter rod.)*



**T9.7 Front wing visibility - [PERFORMANCE | Penalty - 10pts]**

Visibility of the front wing(s) must not be physically obstructed by any other component when viewed in the front view



T9.7: Visibility of front wing not physically obstructed in front view



## ARTICLE T10 - Rear wing and wing support structures.

### T10.1 Rear wing and wing support structure identification - [General - Penalty - 5pts]

The surfaces defining the rear wing and wing support structure(s) **must** be dimensioned and identified clearly by hatching, shading or block colour within the engineering drawings submitted for scrutineering. *(Clearly labeled construction lines are acceptable to define the boundaries between components such as nose cone and wheel support structures). Also refer to the definition in ARTICLE T1.15 for guidance on annotating these features in your Engineering Drawings.*

### T10.2 Rear wing description and placement - [General - Penalty - 5pts]

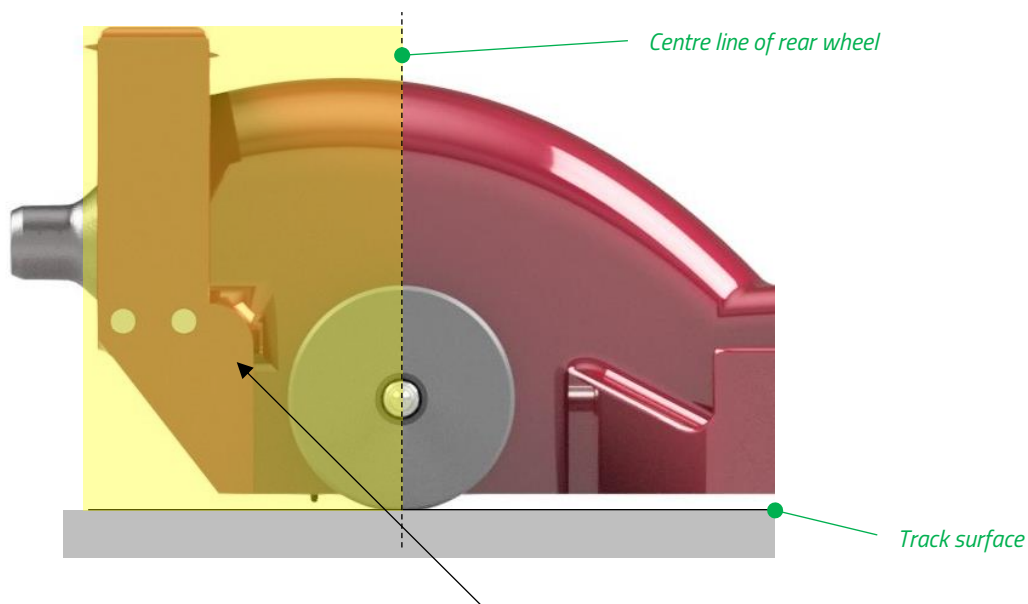
The design of an F1 in Schools car should resemble an actual F1 car through the inclusion of a wing at the rear of the car. To be considered a wing section it must have a leading edge and a trailing edge across its required span. *Refer to the definition in ARTICLE T1.5*

### T10.3 Rear wing construction and rigidity - [General Penalty - 5pts]

The rear wing and any support structures may be manufactured from any separate materials. The wing span dimension must remain unchanged during races *(i.e. wings must be rigid, ruled at the judge's discretion).*

### T10.4 Rear wing and wing support structure location - [General - Penalty - 10pts]

The whole of the rear wing and any support structure **must** be behind the centre line of the rear wheel and no more than 65.0mm above the track surface when viewed in the side elevation.



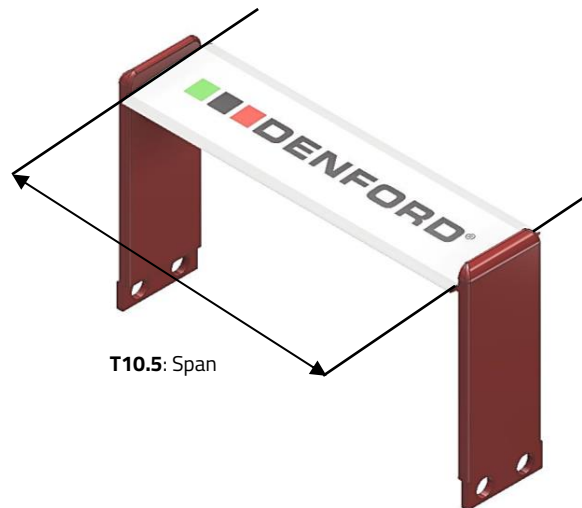
T10.4: Rear wing and wing support structure location, shown highlighted yellow

**PP + T10.5 Rear wing dimensions - [PERFORMANCE]**
**T10.5.1 Rear wing span: [PERFORMANCE | Penalty - 2pts per millimetre]**

The rear wing span will be measured at right angles to the vertical reference plane along the leading edge, trailing edge, top surface and bottom surface of the wing, whichever is shortest will be considered as the maximum span. The rear wing **must** exist as a single, unbroken minimum span of 50.0mm.

*(See illustration below)*

**Absolute Min: 50.0mm**


**T10.5.2 Rear wing chord: [PERFORMANCE | Penalty - 1pt per millimetre]**

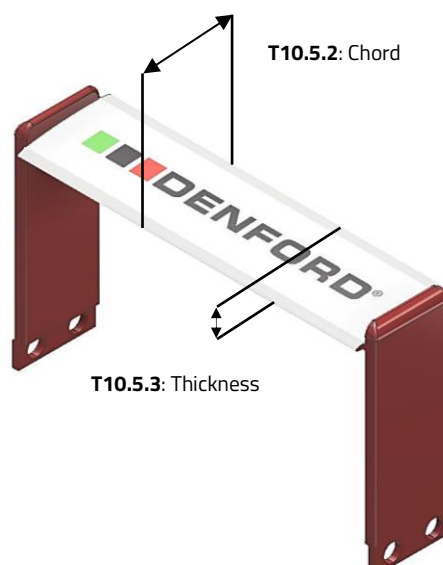
The rear wing chord minimum to maximum dimensions must exist throughout its existing wing span. The chord is the distance between the leading edge and trailing edge (chord line) measured parallel to the vertical reference plane. Rear wing chord compliance does not depend on span. *(See illustration below)*

**Absolute Min: 15.0mm / Absolute Max: 25.0mm**

**T10.5.3 Rear wing thickness: [PERFORMANCE | Penalty - 1pt per millimetre]**

The wing thickness minimum to maximum dimensions **must** exist throughout the wing's **existing** span and at a point along the existing chord, measured perpendicular to the chord line. Rear wing thickness compliance does not depend on span and / or chord. *(See illustration below)*

**Absolute Min: 2.0mm / Absolute Max: 6.0mm**

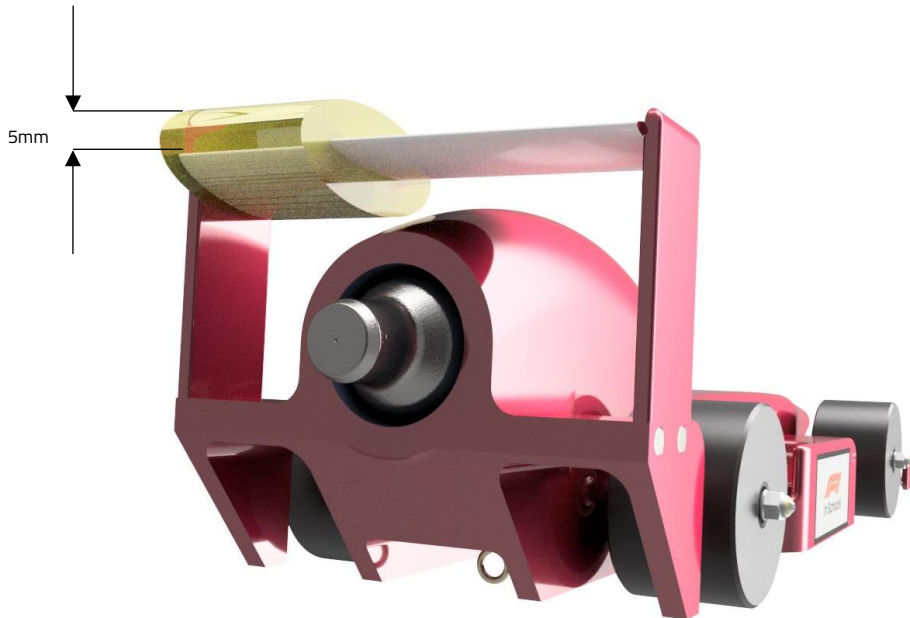


**T10.6 Rear Wing Clear airflow - [PERFORMANCE | Penalty - 5pts]**

The rear wing, measured across its existing span, must have a minimum of 5.0mm of clear 'air' space to any other part of the car or track surface, measured normal from any part of the wings surface.

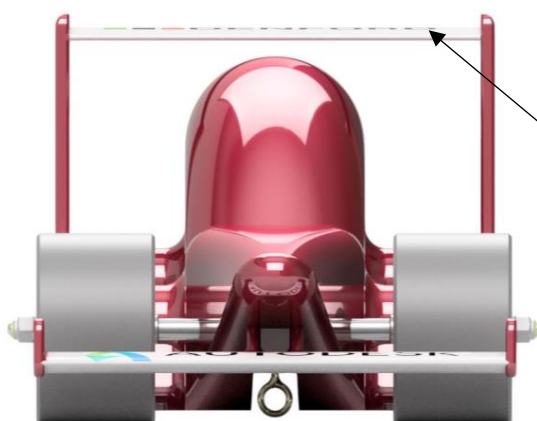
**Absolute Min: 5.0mm**

*This will be checked with a 5.0mm diameter spherical ball on the end of a 2mm diameter rod.*



**T10.7 Rear wing visibility - [PERFORMANCE | Penalty - 10pts]**

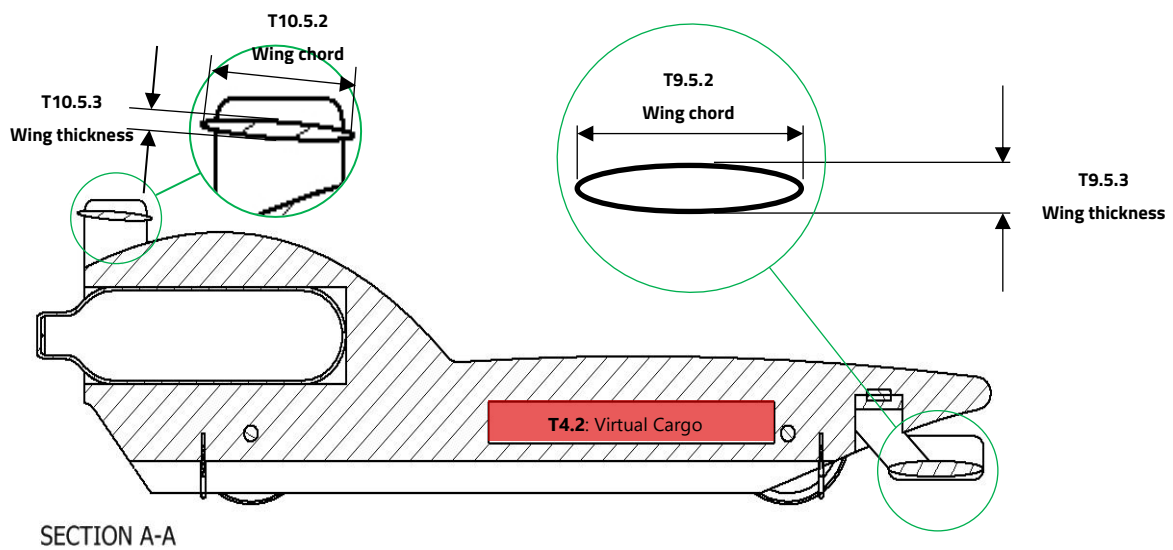
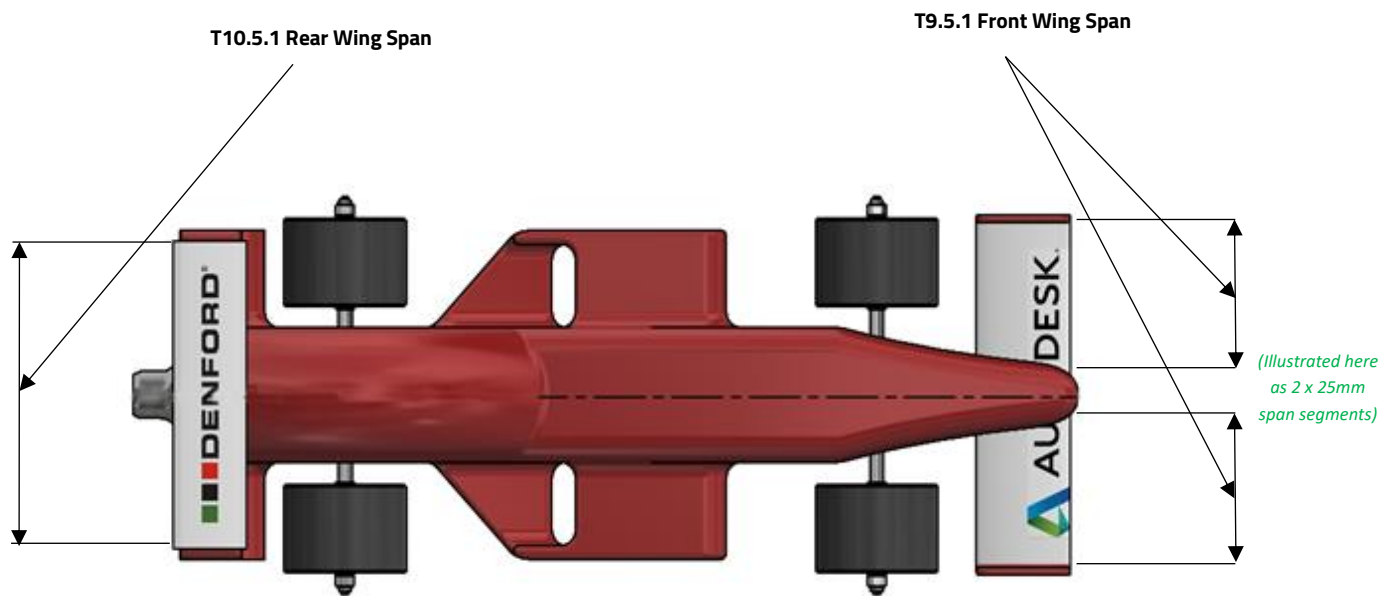
Visibility of the rear wing must not be physically obstructed by any other component when viewed in the front view.



**T10.7:** Visibility of rear wing not physically obstructed in front view

Illustrations for T9 and T10

(See Appendix iii for more detail, examples and penalties relating to wing span, chord and thickness)



## **ARTICLE T11 - Additional Components**

### **T11.1 Description and placement**

Only the compressed air cartridge, as positioned by race officials, is permitted to make contact with the launch pods and/or cars prior to and/or during racing. Any car alignment tools must be approved by race officials prior to use. Please refer also to the World Finals Competition Regulations.

# APPENDIX

## OTHER INFORMATION & ILLUSTRATIONS

<b>Appendix i:</b>	<b>Start Box / Finish Gate</b>	<b>39</b>
<b>Appendix ii:</b>	<b>Official F1® Model Block dimensions</b>	<b>39</b>
<b>Appendix iii:</b>	<b>Front wing compliance examples</b>	<b>40</b>
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<b>Appendix v:</b>	<b>Official Power Pack dimensions</b>	<b>42</b>
<b>Appendix vi:</b>	<b>Car Deceleration System</b>	<b>42</b>



# APPENDIX - OTHER INFORMATION & ILLUSTRATIONS

## i. Start Box and Finish Gate

The start boxes are designed to sit centrally within each lane of the track

The distance from the emitter centre line to the race track surface on both lanes is ~7mm

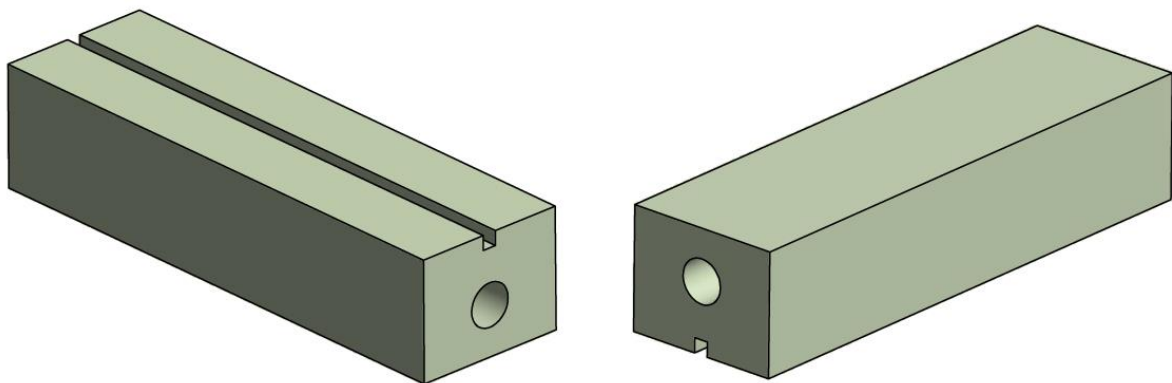
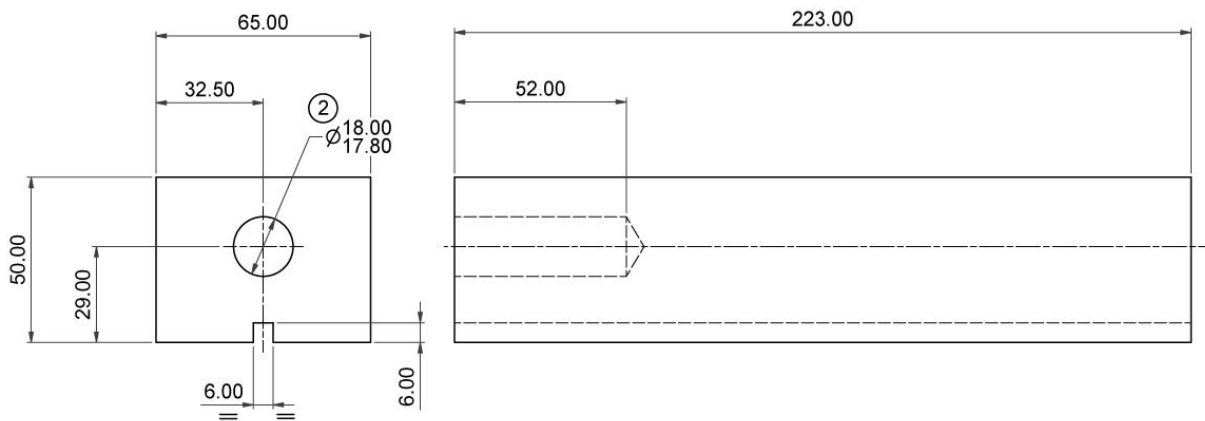
## ii. Official F1® Model Block Dimensions

Below: orthographic projection of F1® Model Block. All dimensions shown in millimetres



This component is available to download as a universal 3D part from the F1 in Schools website. For this part and more free downloads, please visit

<https://www.f1inschools.com/downloads.html>



### iii. Front wing compliance examples

The following table shows how penalty points are awarded for front wing span, chord or thickness dimensions that do not meet the specifications set out in **T9.5.1, T9.5.2 and T9.5.3**.

This is not an exhaustive list of all possible wing configurations.

Wing Example	T9.5.1 Span -2pts per mm	T9.5.2 Chord -1pts per mm	T9.5.3 Thickness -1pts per mm	Remarks
<p>Central Wing Support</p>	<b>PASS</b>	<b>PASS</b>	<b>PASS</b>	<p><b>Wing span is split by double mounted central wing support.</b></p> <p>Wing span segments are minimum length (25mm+25mm), therefore <b>PASS</b></p> <p>Wing chord is minimum throughout the existing span, therefore <b>PASS</b>.</p> <p>Wing thickness is minimum throughout the wing's existing span and at a point along the existing chord, therefore <b>PASS</b>.</p>
<p>Front of Car</p>	<b>FAIL</b>	<b>PASS</b>	<b>PASS</b>	<p><b>Wing span is split by nose.</b></p> <p>Wing span segments are less than minimum length at trailing edge (rear of wing), therefore <b>FAIL</b></p> <p>Wing chord is minimum throughout the existing span, therefore <b>PASS</b>.</p> <p>Wing thickness is minimum throughout the wing's existing span and at a point along the existing chord, therefore <b>PASS</b>.</p>
<p>Front of Car</p> <p>Central Wing Support</p>	<b>FAIL</b>	<b>PASS</b>	<b>FAIL</b>	<p><b>Wing span is split by central wing support.</b></p> <p>Wing span segments are less than minimum length at leading and trailing edge, therefore <b>FAIL</b>.</p> <p>Wing chord is minimum throughout the existing span, therefore <b>PASS</b>.</p> <p>Wing thickness is less than minimum, therefore <b>FAIL</b>.</p>



**v. Rear wing compliance examples**

The following table shows how penalty points are awarded for rear wing span, chord or thickness dimensions that do not meet the specifications set out in **T10.5.1, T10.5.2, T10.5.3**:

This is not an exhaustive list of all possible wing configurations.

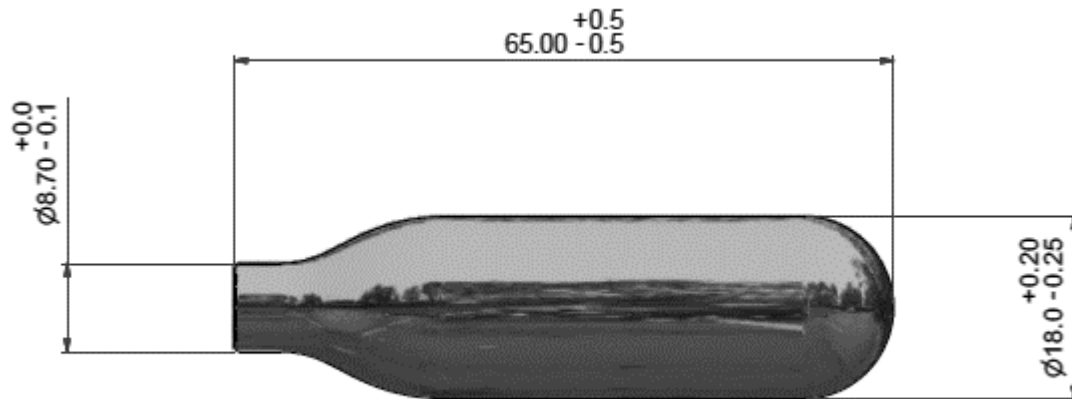
Wing Example	T10.5.1 Span -2pts per mm	T10.5.2 Chord -1pt per mm	T10.5.3 Thickness -1pt per mm	Remarks
	<b>PASS</b>	<b>PASS</b>	<b>PASS</b>	<p>Wing span is minimum length, therefore <b>PASS</b>.</p> <p>Wing chord is minimum throughout the existing span, therefore <b>PASS</b>.</p> <p>Wing thickness is minimum throughout the wing's existing span and at a point along the existing chord, therefore <b>PASS</b>.</p>
	<b>PASS</b>	<b>FAIL</b>	<b>FAIL</b>	<p>Wing span is minimum length, therefore <b>PASS</b>.</p> <p>Wing chord is less than minimum width at ends, therefore <b>FAIL</b>.</p> <p>Wing thickness is less than minimum, therefore <b>FAIL</b>.</p>
	<b>FAIL</b>	<b>PASS</b>	<b>PASS</b>	<p>Wing span is less than minimum because it is split by wing support, therefore <b>FAIL</b>.</p> <p>Wing chord is minimum throughout the existing span, therefore <b>PASS</b>.</p> <p>Wing thickness is minimum throughout the wing's existing span and at a point along the existing chord, therefore <b>PASS</b>.</p>
	<b>FAIL</b>	<b>FAIL</b>	<b>PASS</b>	<p>Wing span is less than minimum because it is split by double wing mount support, therefore <b>FAIL</b>.</p> <p>Wing chord is less than minimum width at ends, therefore <b>FAIL</b>.</p> <p>Wing thickness is minimum throughout the wing's existing span and at a point along the existing chord, therefore <b>PASS</b>.</p>

### v. Official Denford Race Power Pack dimensions



This component is available to download as a universal 3D part from the F1 in Schools website. For this part and more free downloads, please visit

<https://www.f1inschools.com/downloads.html>

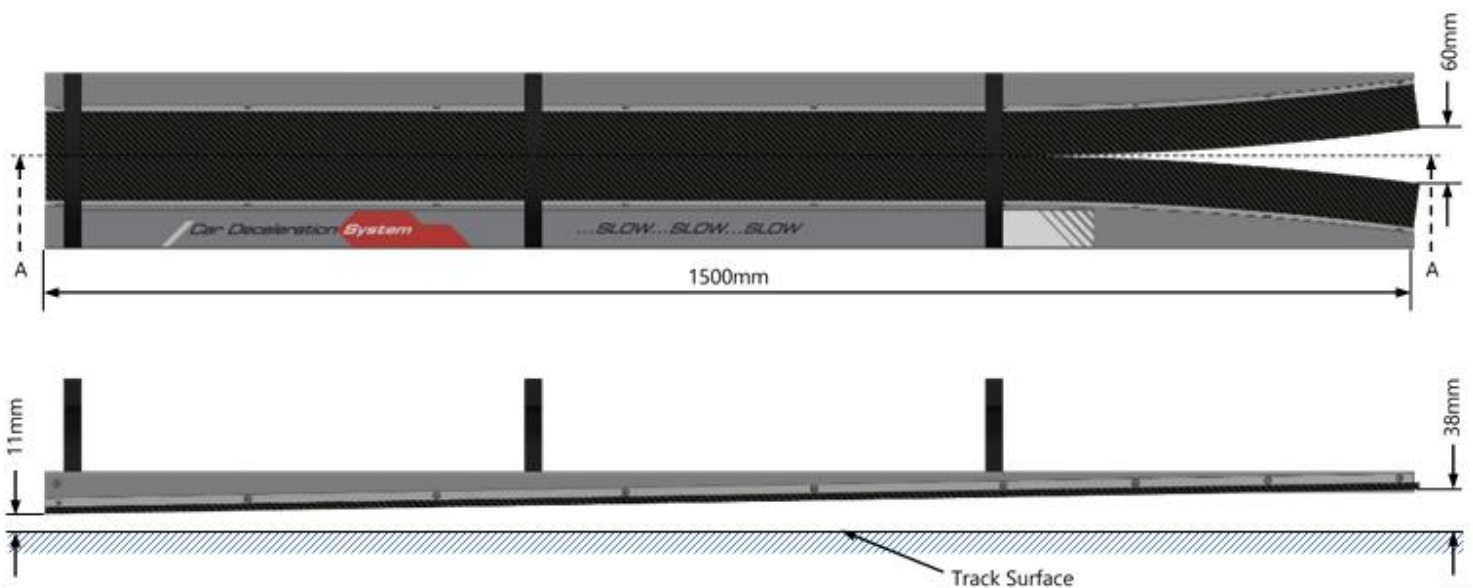


Full weight of RACE Power Pack: between: 28.9g and 29.4g

### vi. Car Deceleration System dimensions

The following diagram shows the important dimensions of the Official F1 in Schools Car Deceleration System, which will be used at the F1 in Schools World Finals. The dimensions shown indicate the relative spacing between the integrated brushes and the track surface.

*Please note: teams have the option to use their own car deceleration systems.*





**Please make sure you have also read the  
F1 in Schools World Finals 2020 Competition Regulations**

**Work hard, see  
you in the  
World Finals!**

If you need any help at all, just get in touch with us:

**F1 in Schools™ STEM Challenge**

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