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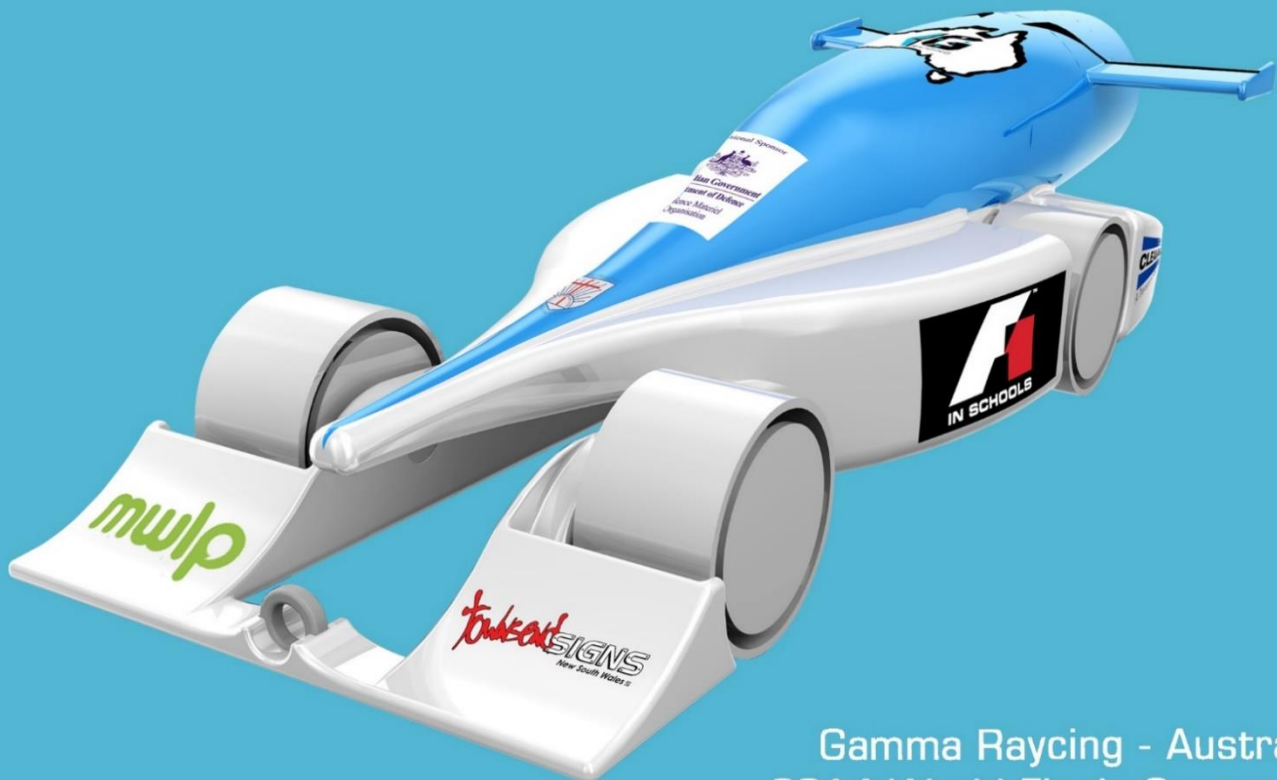


**IN SCHOOLS**

**THE FORMULA ONE™  
TECHNOLOGY CHALLENGE**

# **TECHNICAL REGULATIONS (AUSTRALIA)**

***2015/2016  
Season  
Version 1.0***



Gamma Raycing - Australia  
2014 World Finals Scorecard  
- 2nd Outright

[www.rea.org.au](http://www.rea.org.au)



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#### ACKNOWLEDGEMENT

In preparing the F1 in Schools™ Australian Technical Rules, certain wording and images have been adopted from the 2015 World Final Technical Regulations.

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#### ALTERATIONS

Re-Engineering Australia Foundation Ltd. reserves the right to alter any specifications and documentation associated with the 'Challenge' without prior notice.



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## **PREFACE – SUMMARY OF MAIN REVISIONS FROM 2014/2015 RULES**

There have been major formatting changes made to the 2015/2016 season's rules to bring it more in-line with the World Final format. This document only contains Technical Regulations. A separate document will encompass the Competition Regulations.

Due to the large restructure of the document, only significant changes will be listed here. It is each team's responsibility to thoroughly read this document in order to identify wording changes and to understand any impact this may have on their project.

Car diagrams and images used in this document are an illustrative representation only and do not necessarily constitute a 'legal' design.

These regulations will be valid for all 2015 State Finals and the 2016 National Final. In light of the release timing of this document, Regional Hubs in NSW and QLD may choose to use the 2014/2015 Rules and Regulations for 2015 Regional Finals.

### **ARTICLE T1 – DEFINITIONS**

A new section that provides information on common terms used throughout the document.

T1.4.2 Time Penalty: Changes to value.

T1.7 Vertical Reference Plane defined. The previous datum used was the Centre Line of the Car.

T1.9 Body: New/updated definition.

T1.12 Wing: Formerly known as aerofoil. New diagram and method of measuring span, chord & thickness.

T1.13 Wing Structure: New definition.

T1.20 Moving Components: New regulation.

T1.23 Surface Finish & Decals: New definition, decal size and type.

T1.26 Engineering Drawings: Updated to include indication of the wing surfaces.

### **ARTICLE T2 – GENERAL PRINCIPLES**

A new section governing the management and interpretation of, and compliance to the regulations.

T2.6 Compliance with Critical Regulations: New Regulation

T2.7 Rectification of Critical Regulation Infringements: New regulation and procedure.

T2.8.7 Measurements/Scrutineering throughout all configurations: New regulation.

### **ARTICLE T3 – GENERAL CAR REGULATIONS**

This section covers many of the general or overall car regulations.

T3.1.3 Design, Manufacture & Construction/Identically designed components: New regulation.

T3.11 Status During Racing: New regulation.

T3.12 Replacement Components: New regulation.

### **ARTICLE T4 – BODY & SIDE POD RULES**

T4.1 Body Construction: New regulation.

### **ARTICLE T5 – NOSE CONE RULES**

No Changes

### **ARTICLE T6 – WING RULES**

T6.2 Wing Identification: New regulation.

T6.5 Construction & Rigidity: New regulation.

T6.10 Span Segments: Updated definition.

T6.11 Front & Rear Wing Chord: Updated wording.

T6.12 Front & Rear Wing Thickness: New maximum dimensions.

T6.14 Rear Wing Height: Updated wording for measuring dimensions.

T6.16 Rear Wing Support Structure: Vertical Projected Volume requirement removed and new constraint defined.

### **ARTICLE T7 – WHEEL RULES**

T7.7 Freely Rotating Wheels: Updated wording includes 'forward'.

T7.9 Visibility from Top, Bottom & Side: Updated to include exclusion zone.

### **ARTICLE T8 – WHEEL SUPPORT RULES**

T8.2 Integration with Wing Support Systems: New regulation.

### **ARTICLE T9 – TETHER LINE GUIDE RULES**

T9.2 Separation: Maximum dimension removed.

T9.4.3 Strength & Fixing: New regulation for testing.

### **ARTICLE T10 – POWER PLANT PROVISIONS**

T10.4 Distance from Track Surface: Modification to minimum dimension for non-Cadet Class teams.

T10.5 Chamber Wall Thickness: Updated wording.

## ARTICLE T1 - DEFINITIONS

### T1.1 Australian Competition Season

The standard sequence of Australian competitions runs across two calendar years. The State Finals held Sept/Oct/Nov in one year will feed to the National Final in February/March/April of the following year. This encompasses a complete season, for which the rules **SHOULD** remain constant. REA Foundation Ltd reserves the right to update / revise the rules if deemed appropriate.

### T1.2 World Final Competition

The Australian National Final will feed into a World Final which is usually held anywhere from September through November each year depending on the country hosting this competition. For teams aspiring to represent Australia at the World Final, please be aware that the world final rules are different to the Australian rules.

### T1.3 Language Used

The language of the rules is tiered. Those clauses expressed as “**MUST**” are mandatory and failure to comply will attract objective penalties - points and/or racing and/or in the extreme, disqualification. Those expressed as “**SHOULD**” or “**MAY**” reflect some level of discretion and choice.

Some clauses will be satisfied through team registration processes or declarations signed as complied with as part of the Challenge Terms and Conditions, whilst others will be tested through a variety of objective and subjective judging.

### T1.4 Penalties

A range of penalties will be applied for non-compliance with identified regulations. These penalties include:

**T1.4.1 Point Penalty:** Invoked from non-compliance with technical regulations and some competition regulations governing portfolio or trade booth restrictions. These are identified as [Point Penalty].



**T1.4.2 Time Penalty:** Invoked from non-compliance with Technical Regulations which are identified as critical through the use of the danger symbol at left and listed in ARTICLE T2.6. These will be identified as [Time Penalty] and will be applied as 0.05 second to every run/lap for every critical regulation violated up to a maximum of 0.5 second.

**T1.4.3 Ballast Penalty:** 2 grams applied for every gram underweight or part there-of (rounded up) and applied to each car submitted. E.g. 2.1g underweight equals 3g x 2, totalling 6g of ballast. These will be identified as [Ballast Penalty].

**T1.4.4 Eligibility:** Teams need to meet certain eligibility criteria to compete at a State or National Final. Failure to comply with certain eligibility criteria **MAY** lead to disqualification from the competition, a judging element or class of competition. [Eligibility].

### T1.5 Competition Classes

There are three competition classes in the Australian F1 in Schools™ competition:

#### T1.5.1 Cadet Class (Years 5 – 12)

A simplified project with restricted pathway to state level competitions and no pathway to the world final. Maximum 1 – 3 team members

**T1.5.1.1** Junior: Years 5 – 9 only

**T1.5.1.2** Senior: Years 10 – 12

#### T1.5.2 Development Class (Years 5 – 9)

For first time entering students or those who have only participated in the Cadet Class previously. Students may only participate in this class once. This class provides a collaboration team pathway to the World Final. Maximum 3 – 5 team members.

**T1.5.2.1** Junior: Years 5 – 9 only

#### T1.5.3 Professional Class (Years 5 – 12)

Open to all students but usually only entered by students in Years 5-9 who have competed in the Cadet or Development classes previously. The National Champion Professional Class team will represent Australia at the World Final. Maximum 3 – 5 team members.

**T1.5.3.1** Junior: Years 5 – 9 only

**T1.5.3.2** Senior: Years 10 – 12



## T1.6 F1 in Schools™ Car

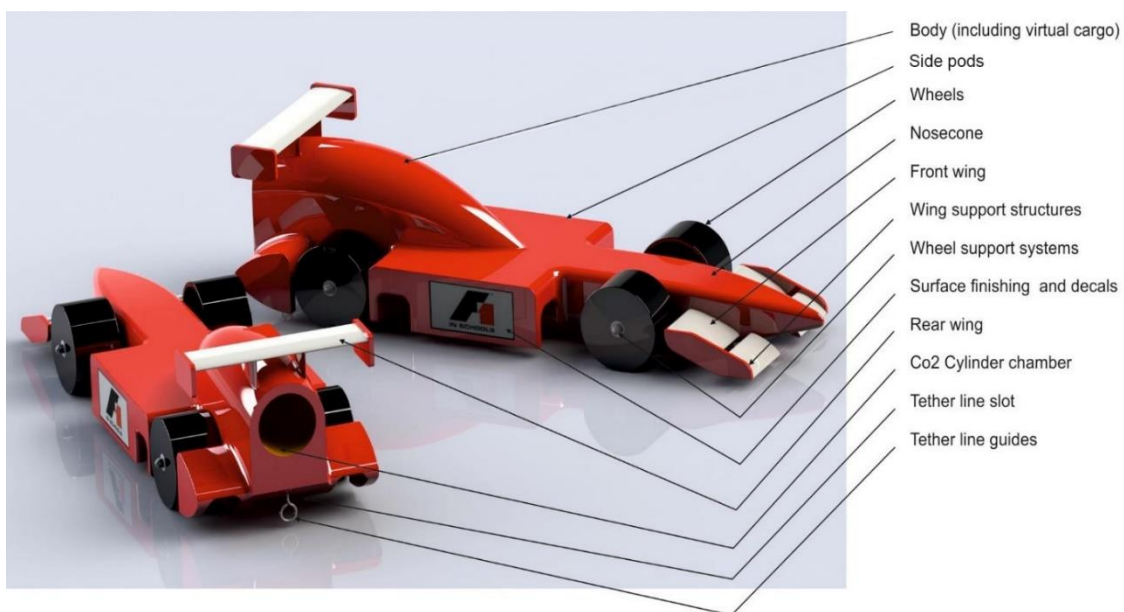
This is also referred to as 'the car', and **MUST** be designed and manufactured according to these regulations for the purpose of participating in races on the F1 in Schools™ track at a State or National Final event, powered only by a single gas cylinder containing 8 grams of pressurised CO<sub>2</sub>. 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 **mandatory** components and/or features:

- A body (which includes a virtual cargo)
- Side pods
- CO<sub>2</sub> cylinder chamber
- Front wing
- Rear wing
- Wing support structures (optional)
- Nosecone
- Wheels
- Wheel support systems
- Tether line guide support system (Cadet Class must comply with ARTICLE T9.5.1)
- Tether line guides
- Surface finishing and decals

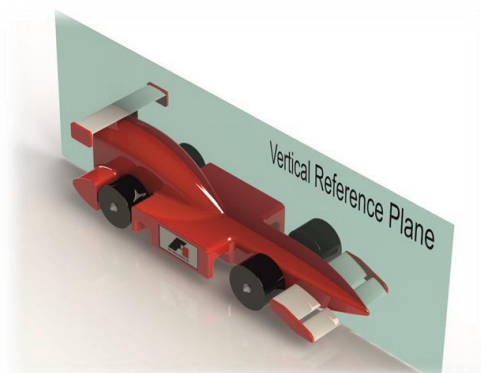
Adhesives are permissible for joining components.

Failure to have any of the listed mandatory components or features will result in all relevant penalties being applied.



## T1.7 Vertical Reference Plane

To assist with describing dimensions, it is assumed that a two dimensional invisible plane exists along the length of the CO<sub>2</sub> cylinder chamber centre axis and perpendicular to the track surface. This is known as the vertical reference plane.





## T1.8 Fully Assembled Car

An F1 in Schools™ car, without a CO<sub>2</sub> cylinder inserted, presented ready for racing, resting on the track surface, free of any external force other than gravity.

## T1.9 Body

The body is defined as the primary connective structure of the car. It is a **solid, uninterrupted** piece of balsa wood existing rear of the front axle centre line and encompassing both the virtual cargo and CO<sub>2</sub> cylinder chamber. For dimensional purposes the body also includes any attached decals and surface finishes. Any balsa wood forward of the front axle centre line is not defined as car body. The body can be thought of as the monocoque car chassis with which all other legal components are integrated.

## T1.10 Side Pod

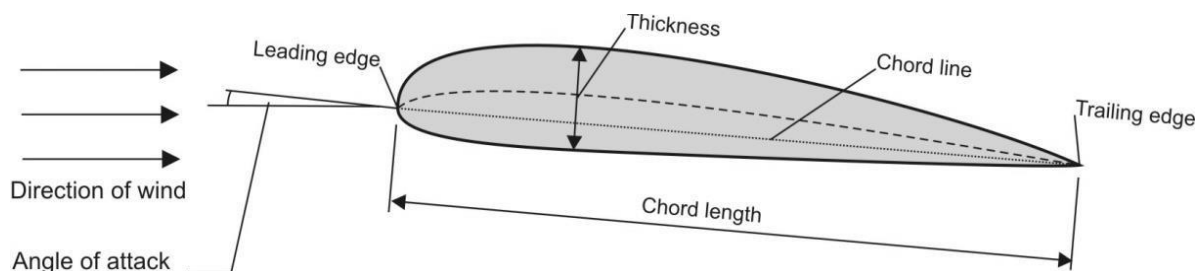
Defined as a feature of the car body between the front and rear wheels satisfying the side pod dimensional rules.

## T1.11 CO<sub>2</sub> Cylinder Chamber

A circular cylinder of clear space bounded along its side and one end by car body only. This is where the CO<sub>2</sub> gas cylinder is placed for racing. Extreme violations of ARTICLE T10 rules could lead to cars being deemed ineligible to race due to safety concerns or starting pod incompatibility resulting in zero points for racing.

## T1.12 Wing

A wing on an F1 in Schools™ car is an aerodynamic feature that permits airflow around ALL of its cross sectional boundary. It includes features of a leading and trailing edge. A wing is dimensionally defined by the maximum and minimum dimensions of span, chord and thickness.



**Wing cross-section / wing nomenclature**

## T1.13 Wing Support Structure

Is a feature, other than wing, car body or nosecone that joins a wing surface to another component of the car assembly. Wing end plates are deemed acceptable and will be classified as wing support structure.



**Wing Support Structure Examples**

### **T1.14 Span**

Measurement of a wing span is made parallel to the track surface, on the top or bottom surface of the wing (in the 'y' direction), whichever produces the shortest dimension. Intersecting the wing with other car parts including the body, nosecone or supporting structure reduces the effective span to the sum of the clear airspace envelope segments. An undersized span will lead to deeming the existence of an undersized chord and thickness.

### **T1.15 Chord**

A wing's chord is measured along the chord line from leading edge to trailing edge. Supporting structures are not included in the measurement. The wing chord min dimensions **MUST** be satisfied across the full dimensions that define the wing span. An undersized chord will lead to deeming the existence of an undersized thickness.

### **T1.16 Thickness**

The thickness of a wing is measured perpendicular to the chord line. Supporting structures are not included in the measurement. The wing thickness min/max dimensions **MUST** be satisfied across the full dimensions that define the wing span.

### **T1.17 Nosecone**

The nosecone is a component of the car, other than wheel, wheel support system, wing or wing support structure, that exists forward of the front axle centre line. This includes any balsa wood material that continues forward of the front axle centre line, or any other legal materials.

### **T1.18 Wheel**

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

### **T1.19 Wheel Support System**

The wheel support system is defined as the collection of components that connect the wheels to the car body. Legal components include items such as shafts, bushings, and bearings. Wheel support systems are single parts or an assembly of components that connect a wheel to any other part of the car. These may consist of a combination of manufactured or commercially available parts.

### **T1.20 Moving Components**

Moving components are permitted on a car. A moving component is defined as any part or assembly of parts that is attached to another part of the car via either sliding, rotational or flexible joints and is not prevented from moving by some locking feature. The range of motion of a moving component is defined as the full motion between features on the car which limit the motion of the moving component. The specific force required to move a moving component shall not be considered in determining the range of motion. A car must remain legal over the entire range of motion of any moving components. During scrutineering a car will be measured with moving components positioned at the extents of their range of motion and at any other location within their range of motion required to determine the compliance with rules over the full range of possible motion. Components intended to be "rigid" but exhibiting minor flexure will not be classified as "moving components".

### **T1.21 Tether Guide Support System**

A tether guide support system is a feature, other than tether guides, car body or nosecone that joins a tether guide to another component of the car assembly. An example of this is a tether line slot which is a rectangular prism of clear space (6mm x 6mm) that is bounded by solid material on three sides of its length. This slot features on the official REA balsa wood blank and this may be incorporated into the car's design as part of the tether guide support system. For security, the slot, must remain between the guides for Cadet Class teams. Refer to ARTICLE T9.5.1.

## T1.22 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.

## T1.23 Surface Finish & 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 a car 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. Refer to the Competition Regulations for more information.

### T1.23.1 F1 in Schools™ Logo Decal

This consists of the F1 in Schools™ logo graphic printed on either black or white with a horizontal dimension of 30mm and vertical dimension of 15mm. Teams choose to use either the black or the white background decal so as to provide **maximum contrast** with the colour of the surface the decal is being adhered to. Official decals are supplied by REA Foundation Ltd prior to event registration. A team can manufacture and fit their own decals, provided they are the correct size, colour and graphic design. Optionally, a thin black or white key-line border may be included on the black or white background decal. Refer to the Competition Regulations for more information.



### T1.23.2 REA Foundation® Logo Decal

This consists of the REA Foundation Ltd logo text and globe graphic printed on either black or white with a horizontal dimension of 30mm and vertical dimension of 15mm. Teams choose to use either the black or the white background decal so as to provide **maximum contrast** with the colour of the surface the decal is being adhered to. Official decals are supplied by REA Foundation Ltd prior to event registration. A team can manufacture and fit their own decals, provided they are the correct size and colour.



### T1.23.3 Australian Government - Department of Defence Logo Decal

This consists of the Australian Government Department of Defence logo text and coat of arms graphic. Teams choose to use either the black or the white background decal so as to provide **maximum contrast** with the colour of the surface the decal is being adhered to. Official decals are supplied by REA Foundation Ltd prior to event registration. A team can manufacture and fit their own decals, provided they are the correct size and colour. Sizing must be such that all text is clearly legible.



## T1.24 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 'scallop marks'.

## T1.25 REA Official Balsa Wood Blank

The REA official balsa wood blank is a homogenous piece of forested balsa wood, processed to the dimensional features as shown by diagrams in the appendix of this document. Balsa is the default material used for the Australian competition.

## T1.26 Engineering Drawings

CAD produced drawings which should be such that, along with relevant CAM programs, could theoretically be used to manufacture the fully assembled car by a third party. Such drawings should include all relevant dimensions, tolerances and material information. F1 in Schools™ engineering drawings include detail to specifically identify and prove compliance for the **virtual cargo** and **wing surfaces**

## ARTICLE T2 - GENERAL PRINCIPLES

### T2.1 Regulations Documents

REA Foundation Ltd. issues the regulations, their revisions and amendments made.

**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.

**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

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

**Text Clarification** - Any questions received that are deemed by REA Foundation Ltd. to be related to regulation text needing clarification will be answered by REA Foundation Ltd. The question received, along with the clarification provided by REA Foundation Ltd., will be published to all competing teams at the same time.

### T2.3 Design Ideas & Regulation Compliance Questions.

Teams are permitted to seek advice regarding a ruling from REA Foundation Ltd. before the event as to whether a design idea complies with the regulations. The advice provided by employees of REA Foundation Ltd and the Rules Committee will only direct teams back to relevant rule/s where non-compliance is evident. 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 sometimes controversial ways of creating design features by pushing the boundaries in order to get an extra competitive edge.

### T2.4 Amendments to the Regulations

Any amendments will be announced and released by REA Foundation Ltd. by email notification to all teachers nominated in the school registration, as well as the updated revision being uploaded to the website at <http://rea.org.au/f1-in-schools/>. Any amended text will be indicated thus (using red underlined text).

### T2.5 Safe Construction

**Specification Judging** - All submitted cars will be inspected closely to ensure that they are engineered and constructed safely for the purpose of racing. High importance is placed on ensuring that tether line guides are robust and secure. If the Judges rule an aspect of the primary race car to be unsafe for racing, the team will be required to use their back-up race car. If the back-up race car is also ruled to be unsafe, repairs / modifications can be carried out on the primary race car. Any such repair work or change of car will result in a penalty being applied as published in the Competition Regulations.

**During Racing** – The race Officials will routinely inspect cars for safety during scheduled races. If the Officials rule a car to be unsafe, the back-up race car will be used and a penalty imposed as published in the Competition Regulations.

The team may repair the primary and/or back-up race car as per the Competition Regulations.

## T2.6 Compliance with Critical Regulations

Points are deducted for non-compliance with the technical regulations. Both the primary and back-up race cars are scrutinised and points will be deducted for any infringements on either car. These penalties are only imposed once, per infringement.

**T2.6.1** Some of the more **critical** regulations will attract both a **4 Point Penalty** and a **0.05 second Time Penalty** as per ARTICLE T1.4. The critical regulations are:

**T3.5 / T3.6 / T3.7 / T3.10.1 / T4.1 / T4.2 / T4.5 / T4.7 / T6.3 / T6.9 / T6.14 / T6.15 / T6.16 / T7.1 / T7.2.1 / T7.3 / T7.4 / T7.7 / T7.8 / T7.9 / T10.4 / T10.7**

**T2.6.2** If a team's primary race car is judged as being NON-COMPLIANT with any critical technical regulation they will be INELIGIBLE for the awards of; State and National Champions, Grand Prix Race, Fastest Lap & Best Engineered Design awards.

**T2.6.3** If the back-up race car is used for any races, it must also comply with all critical technical regulations for the team to be eligible for these awards.

## T2.7 Rectification of Critical Regulation Infringements

Any team whose Primary or Back-up car has been deemed by Scrutineers to have infringed a regulation attracting a Time Penalty, will be given an opportunity to rectify this prior to racing with the effect of removing the time penalty. The original point penalty will stand. Teams unable to rectify at this time should refer to the Competition Regulations for more information.

## T2.8 Measurements

**T2.8.1** Tolerance when measuring all dimensions is +/- 0.5mm unless otherwise stated.

**T2.8.2** Tolerance when measuring weight is +/- 0.5g.

**T2.8.3** Dimensional measures - All car component dimensions 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.

**T2.8.4** Whilst your CAD design may comply with dimensional regulations, the process of machining, painting and assembly WILL individually impact on the final dimensions of the finished product submitted for scrutineering. It is the actual product that is measured in scrutineering. It is not the design intent that is judged in scrutineering.

**T2.8.5** Weight measures – all weight measurements will be made using the REA Foundation Ltd. electronic competition scales which are accurately calibrated to +/- 0.1g.

**T2.8.6** Scrutineering of cars will be conducted with a charged CO<sub>2</sub> cylinder inserted into the chamber. The mass of the cylinder will be 29g with a tolerance of +/- 0.5g.

**T2.8.7** Scrutineering of cars will be conducted by examining cars throughout all possible configurations. Refer to ARTICLE T1.20.

## ARTICLE T3 - GENERAL CAR REGULATIONS

### T3.1 Design, Manufacture & Construction

**[Eligibility]**

**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. 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** The primary and back-up race cars **MUST** have identically designed components and features.

**T3.1.4** Development Class Teams have two options as follows when manufacturing their cars on a CNC machine using only a 6mm diameter cutter.

**T3.1.4.1** Side Machining: 1 x mirrored NC code, executed twice; OR

**T3.1.4.2** Top/Bottom Machining: 2 x NC codes executed once each.



**T3.1.5** Cadet Class Teams **MUST** manufacture their cars on a CNC machine using only a side machining process with 1 x mirrored NC code and a 6mm diameter cutter.

**T3.1.6** Development Class and Cadet Class Teams **MAY** machine axle and/or axle grommet holes by an additional hand or CNC process.

**T3.1.7** For Cadet Class Teams, no balsa parts are to be separately formed and glued to the main body.

**T3.1.8** Cadet Class Teams **MUST** use balsa as the default material for all non-rotating components of the car including the body, side pods and wings. No other materials are permitted.

## T3.2 Finishing & Assembly

[Eligibility]

**T3.2.1** All cars are expected to be finished to a high standard and **MUST** reflect the features of the documented CAD design. Features of the machined car other than machining scallops **SHOULD NOT** be removed.

**T3.2.2** Hand finishing of the car assembly is permitted. Refer ARTICLE 1.24.

**T3.2.3** All team cars **MUST** be assembled, painted and finished by team members only. Documented supporting evidence must be submitted with signed declaration.

## T3.3 Car Decals

### T3.3.1 Entry Number Sticker

[2pt Penalty]

The unique number will be allocated by REA Foundation Ltd and sent to teams participating in State and National Finals only. This sticker **MUST** be clearly visible from the top view of the car and in place before each racing event. The size of the sticker will be a maximum of 25mm (length) by 15mm (height). Teams are **NOT** permitted to design their own entry number stickers.

### T3.3.2 REA Foundation Ltd. Corporate Logos

[2pt Penalty]

These stickers **MUST** be displayed on all cars at State and National Finals. A sticker sheet with appropriate instructions will be supplied to all State and National Final teams. Alternatively teams **MAY** download electronic versions of the sticker from the REA Foundation Ltd. website but **MUST** follow supplied instructions in using the electronic format. Each decal infringement attracts a 2pt penalty.

### T3.3.3 Minimum Dimensions

[2pt Penalty]

The REA Foundation Ltd. and F1 in Schools™ logo stickers must have minimum dimensions of 30mm long and 15mm high. Stickers **MUST** be positioned on opposing side-pods, that is, REA on one side and F1 in Schools™ on the other. All edges of the stickers **MUST** be visible in the side view. Refer to ARTICLE T1.23. Each decal infringement attracts a 2pt penalty.

### T3.3.4 Regional Sponsors

[Advice]

If your region is supported by a sponsor, corresponding sponsor recognition **MUST** be included in displays, portfolio and on the car.



F1 in Schools™ Logo Decal



REA Foundation Logo Decal

## T3.4 Undefined Features

[2pt Penalty]

The car assembly must only consist of components listed in ARTICLE 1.6.



## T3.5 Centre of Gravity

[0.05 Time Penalty | 4pt Penalty]

The centre of gravity **MUST** remain between the axles with the canister inserted.

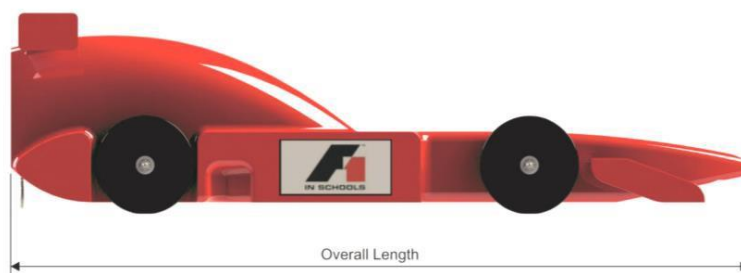




### T3.6 Overall Length

[0.05 Time Penalty | 4pt Penalty]

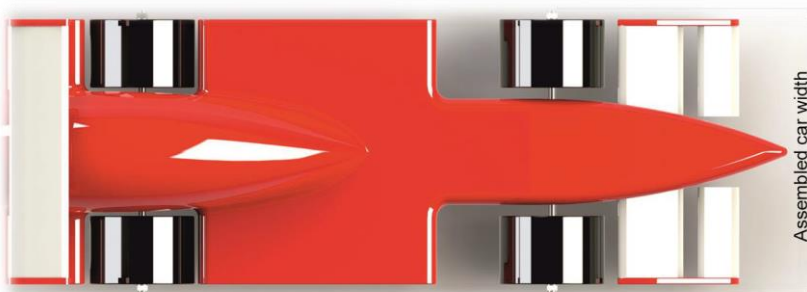
The overall length of the complete car measured between the front and rear extremes of the car product, including all components with the exception of the CO<sub>2</sub> cylinder, **MUST** be a minimum of 170mm and a maximum of 210mm.



### T3.7 Overall Width

[0.05 Time Penalty | 4pt Penalty]

The overall width of the complete car product including all components **MUST** be a minimum of 60mm.



### T3.8 Minimum Weight

[Ballast Penalty | 4pt Penalty]

The minimum weight of the complete car product, without the CO<sub>2</sub> cylinder fitted **MUST** be:

**T3.8.1** Cadet Class: 55 grams

**T3.8.2** Development Class: 52 grams

**T3.8.3** Professional Class: 52 grams

### T3.9 Track Clearance

[4pt Penalty]

The track clearance measured normal from the track surface to the lowest point of the car product (excluding the wheel volumes) **MUST** be a minimum of 2mm including the tether line guides. Cars with unsafe arrangements will be ineligible to race if unresolved.



### T3.10 Balsa Components

#### T3.10.1 Default Material

[0.05 Time Penalty | 4pt Penalty]

All balsa components for a completed car **MUST** be made from an REA supplied single standard balsa wood blank as defined in these rules. Balsa is the default material for all non-rotating components of the car including the body and side pods. Other materials can only be used as explicitly specified.

#### T3.10.2 Thickness

[1pt Penalty]

Balsa components **MUST** be a minimum of 3.5mm thick.

**T3.11 Status During Racing****[2pt Penalty]**

The car assembly **MUST** be designed so that no items other than those listed in T3.12, or CO<sub>2</sub> cylinders are removed, replaced or added to the assembly during scheduled race events.

**T3.12 Replacement Components****[2pt Penalty]**

Any spare / replacement components **MUST** be identical to those fitted to the car and must be submitted with the car. Only the following spare / replacement components are permitted:

- rear wing / support structure – maximum of three (3)
- front wing / support structure and / or nosecone – maximum of three (3)
- wheel / wheel support system – maximum of three (3) car sets

Submitted replacement components that are determined by the judges to not be identical to that which is fitted to the car will not be allowed to be used.

**ARTICLE T4 - Body & Side Pod Rule****T4.1 Body Construction****[0.05 /Time Penalty | 4pt Penalty]**

A **single continuous** piece of CNC manufactured balsa wood material **MUST** exist rear of the front axle centre line, encompassing both the virtual cargo and CO<sub>2</sub> cylinder chamber.

**T4.2 Implants, Foreign Objects or Voids****[0.05 Time Penalty | 4pt Penalty]**

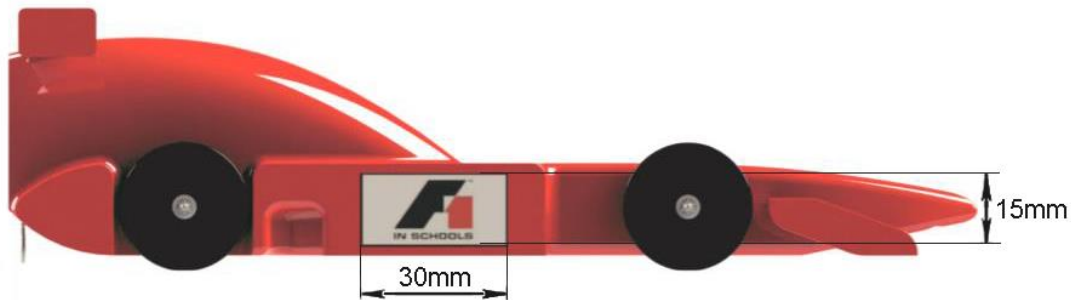
Implants, foreign objects or voids in or on the car body and side pods **MUST NOT** be incorporated

**T4.3 Width of Side Pod****[1pt Penalty]**

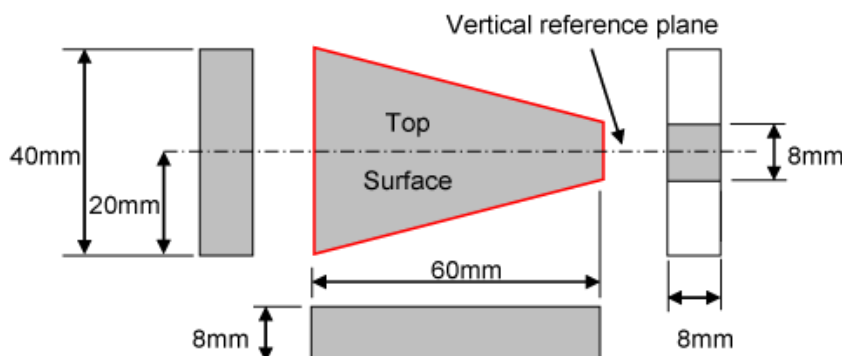
The overall width of the side pods measured transversely between the side-pod extremities **MUST** be a minimum of 50mm. Any part having a width less than 50mm is not considered a side pod.

**T4.4 Side Pod Projected Surface****[1pt Penalty]**

Each side pod **MUST** present a complete rectangular projected surface when viewed from the side measuring not less than 30mm wide x 15mm high

**T4.5 Virtual Cargo****[0.05 Time Penalty | 4pt Penalty]**

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 split symmetrical by the vertical reference plane of the car body. The virtual cargo **MUST NOT** be intersected by the FRONT wheel support system but **MAY** share common faces with the car body.

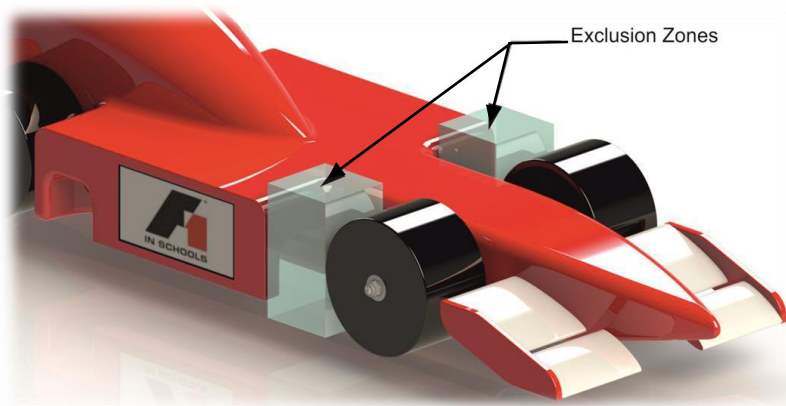


**[2pt Penalty]****T4.6 Virtual Cargo Identification**

The virtual cargo location and compliance **MUST** be clearly identified within the engineering drawings submitted for scrutineering judging

**T4.7 Exclusion Zones****[0.05 Time Penalty | 4pt Penalty]**

When viewed from the top, car body **MUST NOT** exist within a volume 15mm immediately rear of either front wheel. The volume width is equal to the wheel width, and height from track surface is equal to the wheel diameter. This is measured in the top view, parallel to the vertical reference plane and track surface.

**ARTICLE T5 - Nosecone Rules****T5.1 Construction Material****[Eligibility | 4pt Penalty]**

Professional Class and Development Class Teams **MAY** manufacture the nosecone or parts thereof from separate, non-metallic materials.

**T5.2 Positioning****[1pt Penalty]**

Alternative non-metallic materials forming the nosecone **MUST NOT** be present behind the centreline of the front axle.

**ARTICLE T6 - Wing Rules****T6.1 Visibility of Top Surfaces****[1pt Penalty]**

Both wing top surfaces **MUST** be 100% visible from the car top view.

**T6.2 Wing Identification****[1pt Penalty]**

The surfaces defining both the front and rear wings **MUST** be identified clearly within the engineering drawings submitted for scrutineering judging.



## T6.3 Clear Airspace

### T6.3.1 Front Wing

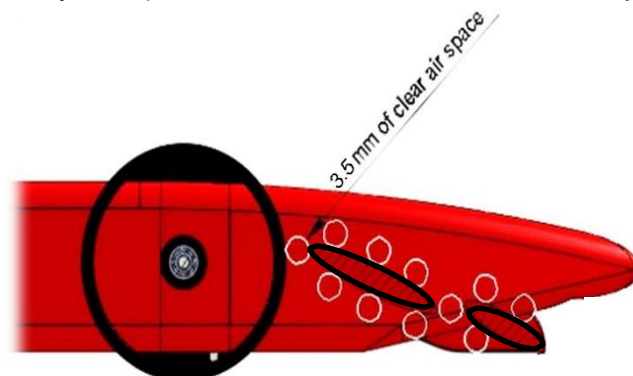
[0.05 Time Penalty | 4pt Penalty]

For a front wing to be deemed to exist, the wing surface **MUST** have a minimum of 3.5mm of clear 'air' space, to any other part of the car, measured normal from any part of the wings surface.

### T6.3.2 Rear Wing

[0.05 Time Penalty | 4pt Penalty]

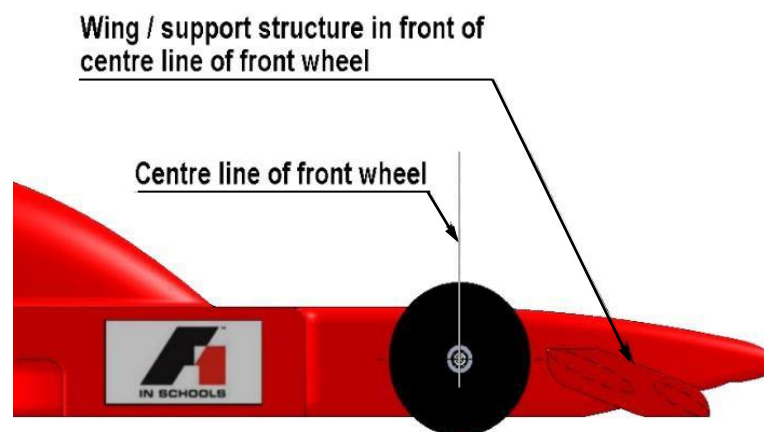
For a rear wing to be deemed to exist, the wing surface **MUST** have a minimum of 3.5mm of clear 'air' space, to any other part of the car, measured normal from any part of the wings surface.



## T6.4 Front Wing Positioning

[1pt Penalty]

The whole of the front wing and support structure when viewed from the side **MUST** be in front of the centre line of the front axle.



## T6.5 Construction & Rigidity

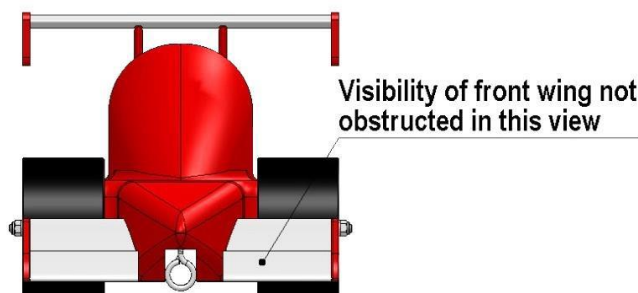
[2pt Penalty]

The wing span dimension **MUST** remain unchanged during races, i.e. wings must be rigid – ruled at the judge's discretion.

## T6.6 Visibility

[1pt Penalty]

Visibility of the front wing **MUST NOT** be obstructed by any other component when viewed in the front elevation.



FRONT ELEVATION

**T6.7 Front Wing Construction Material****[Eligibility | 4pt Penalty]**

Professional Class and Development Class Teams **MAY** manufacture the front wing and any supporting structure connecting it to the nosecone from separate, non-metallic materials.

**T6.8 Connection with Nosecone****[1pt Penalty]**

The front wing or its support structure **MUST** be connected only to the nosecone.

**T6.9 Front & Rear Wing span**

Where the wing span is intersected by another part of the car, the total span is the sum of each segment. The wing span is measured on the top or bottom surface of the wing, whichever is shortest, parallel to track surface and normal to the vertical reference plane.

**T6.9.1 Front wing span****[0.05 Time Penalty | 4pt Penalty]**

**T6.9.1.1** Made from balsa: Min. 34mm

**T6.9.1.2** Made from alternative material: Min. 40mm

**T6.9.2 Rear wing span****[0.05 Time Penalty | 4pt Penalty]**

**T6.9.2.1** Made from balsa: Min. 34mm

**T6.9.2.2** Made from alternative material: Min. 40mm

**T6.10 Span Segments**

The span of a wing can be intersected by the car body, nosecone or wing support structure to form span segments. All span segments **MUST** conform to the wing chord and thickness regulations. If intersected, at least two (2) of the front wing segments and two (2) of the rear wing segments must be no less than the minimum size in span.

Minimum segment span: 17mm

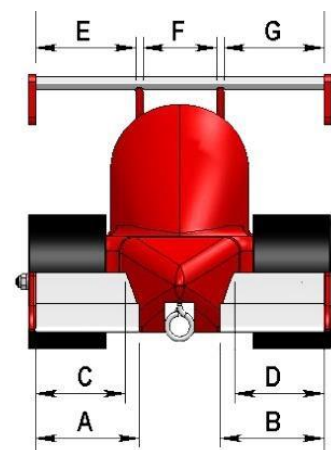
**Wing and Span Calculations Explained**

To be included in the judge's wing span calculation, a wing segment **MUST** be at least 17mm in span. If ANY of the segments A, B, C, D, E, F & G were less than 17mm, they would not qualify as wing segments, but would instead be treated as wing support structures. For example, if each of the segments C, D or F were less than 17mm, they would not count as wing segments.

In this situation:

**T6.9.1** Minimum front wing span would be A+B only

**T6.9.2** Minimum rear wing span would be E+G only

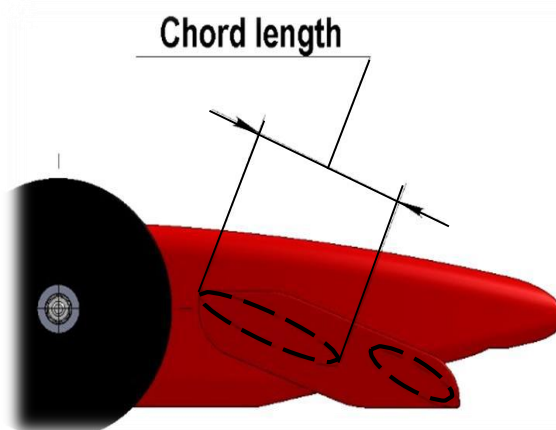
**T6.11 Front & Rear Wing Chord**

The wing chord requirements **MUST** be satisfied throughout the wing's full span. The chord is the distance between the leading edge and trailing edge measured parallel to the vertical reference plane.

**T6.11.1** Front wing chord - Min: 15mm

**[2pt Penalty]**

**T6.11.2** Rear wing chord – Min 15mm

**[2pt Penalty]**

## T6.12 Front & Rear Wing Thickness

The wing thickness requirements **MUST** be satisfied throughout the wing's full span, measured perpendicular to the chord line.

### T6.12.1 Front wing thickness

[2pt Penalty]

T6.12.1.1 Made from balsa: Min: 3.5mm / Max: 9mm

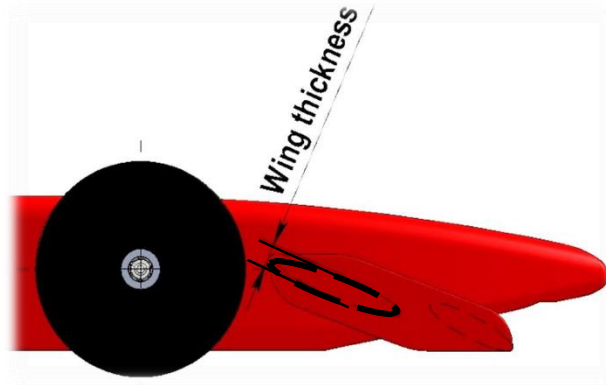
T6.12.1.2 Made from alternative material: Min: 1.5mm / Max: 9mm

### T6.12.2 Rear wing thickness

[2pt Penalty]

T6.12.2.1 Made from balsa: Min: 3.5mm / Max: 9mm

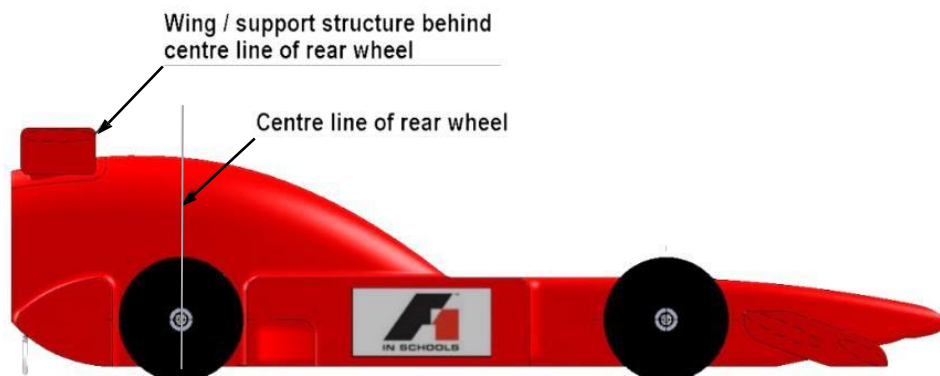
T6.12.2.2 Made from alternative material: Min: 1.5mm / Max: 9mm



## T6.13 Rear Wing Positioning

[1pt Penalty]

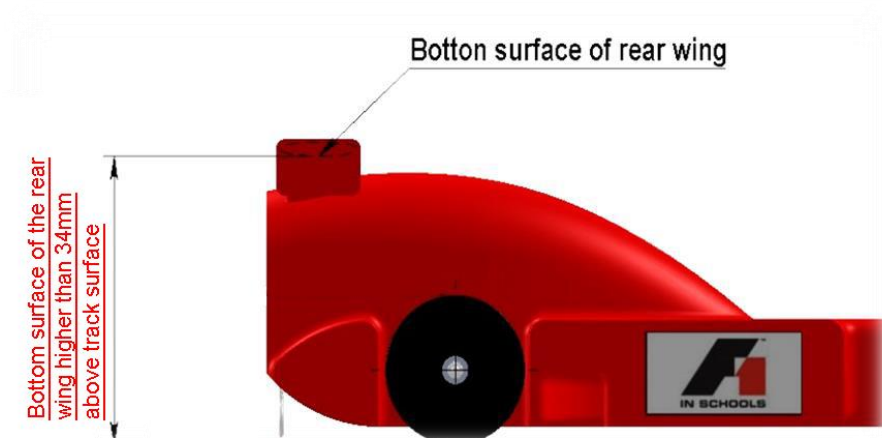
The whole of the rear wing when viewed from the side **MUST** be behind the centre line of the rear axle.



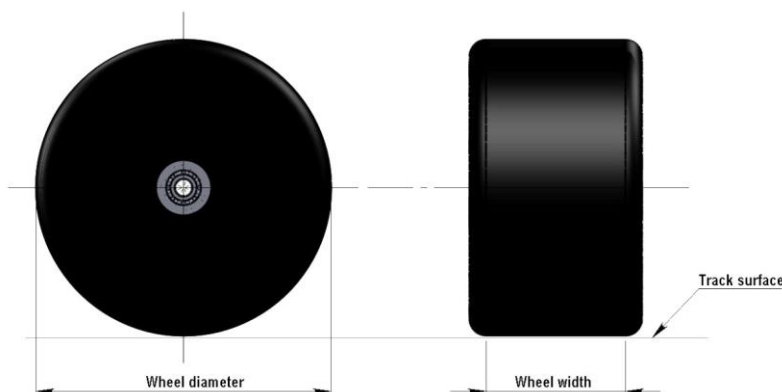
## T6.14 Rear Wing Height

[0.05 Time Penalty | 4pt Penalty]

The bottom surface of the rear wing **MUST** be higher than 34mm when measured from and normal to the track surface.





**T6.15 Rear Wing Construction Material****[0.05 Time Penalty | 4pt Penalty]**Development Teams **MUST** manufacture the rear wing and any supporting structure from balsa.**T6.16 Rear Wing Support Structure****[0.05 Time Penalty | 4pt Penalty]**If Professional Class Teams manufacture the rear wing and any supporting structure from separate, non-metallic materials, these materials **MUST** be completely contained behind the rear axle centre line.**ARTICLE T7 - Wheel Rules****T7.1 Number and location****[0.05 Time Penalty | 4pt Penalty]**The car assembly **MUST** include 4 cylindrical wheels, two at the front and two at the rear. The two front wheels **MUST** share a common centerline. The two back wheels **MUST** share a common centerline.**T7.2 REA Standard Wheels****T7.2.1 Cadet & Development Class Teams****[0.05 Time Penalty | 4pt Penalty]**Development and Cadet Class Teams **MUST** use any combination of four (4) unmodified REA standard wheels. No other parts can be added to the wheels. Removal of the spru remnant is acceptable.**T7.2.2 Professional Class Teams****[Advice]**Professional Class Teams **MAY** use any combination of four (4) unmodified REA standard wheels or manufacture their own. The wheel material used is unrestricted. (NOTE: Modified REA Standard Wheels are classified team manufactured.)**T7.3 Diameter****T7.3.1 Front Wheel****[0.05 Time Penalty | 4pt Penalty]**The front wheel diameter for “team manufactured wheels” as measured to the extreme outer edges of each wheel **MUST** be a minimum of 26mm.**T7.3.2 Rear Wheel****[0.05 Time Penalty | 4pt Penalty]**The rear wheel diameter for “team manufactured wheels” as measured to the extreme outer edges of each wheel **MUST** be a minimum of 26mm.**T7.4 Track Contact Width****T7.4.1 Front Wheel****[0.05 Time Penalty | 4pt Penalty]**The front wheel track contact width for “team manufactured wheels” as measured between the extreme outer edges along the contiguous contact line of each wheel **MUST** be a minimum of 15mm.**T7.4.2 Rear Wheel****[0.05 Time Penalty | 4pt Penalty]**The rear wheel track contact width for “team manufactured wheels” as measured between the extreme outer edges along the contiguous contact line of each wheel **MUST** be a minimum of 15mm.**T7.5 Full Contact Width****[2pt Penalty]**With a CO<sub>2</sub> cylinder loaded, all 4 wheels **MUST** touch the racing surface at the same time across the full contact width of the wheel (zero tolerance). That is, there **MUST** be no “camber”. (Tested using the thickness of a strip of 80gsm paper on a flat surface.).

**T7.6 No Tyre Tread****[2pt Penalty]**

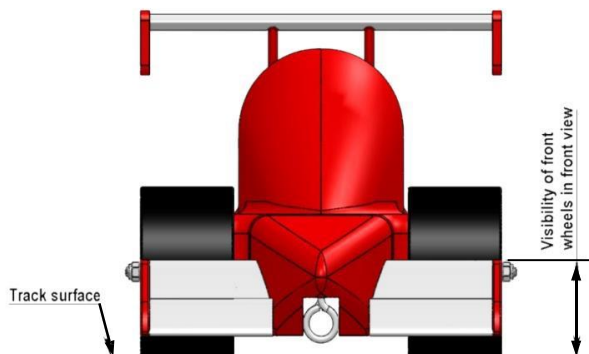
Wheel dimensions **MUST** be consistent in diameter and circumference across the contact width of the wheel (i.e., "tyre tread" is not allowed)

**T7.7 Freely Rotating Wheels****[0.05 Time Penalty | 4pt Penalty]**

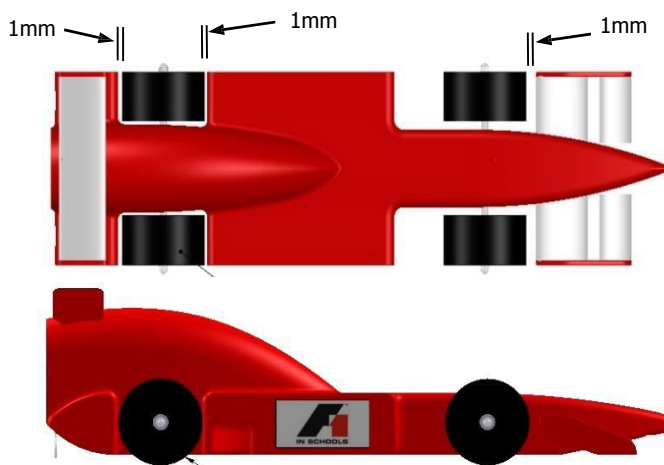
The track contact surface of all four wheels **MUST** rotate freely about their own centre axis to facilitate motion of the car during racing. The scrutineering judge **MUST** be able to validate forward ROLLING MOTION with reasonably minimal effort.

**T7.8 Visibility in Front View****[0.05 Time Penalty | 4pt Penalty]**

Visibility of the front wheels in the car's front view **MUST** only be obstructed to a height of 15mm from the track surface.

**T7.9 Visibility from Top, Bottom & Side****[0.05 Time Penalty | 4pt Penalty]**

The view of the wheels **MUST NOT** be obscured in any way, by any component of the car, in the car's top, bottom and side elevation views. A minimum of a 1 mm vertical exclusion zone **MUST** be present in front of each wheel and behind each rear wheel and in the top view, the track surface **MUST** be visible immediately in front and behind the wheel width.

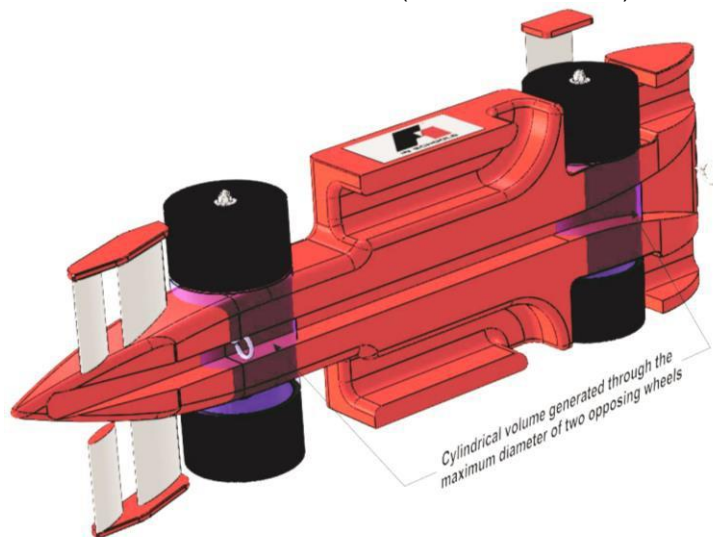


## ARTICLE T8 - Wheel Support Rules

### T8.1 Projected Cylinder Volume

[2pt Penalty]

The wheel support system **MUST** be fully contained within the volume of the cylinder formed by the projection of the wheel circumference (from the side view).



### T8.2 Integration with Wing Support Systems

[2pt Penalty]

Wheel support systems **MUST** not be integrated with wing support systems.

### T8.3 REA Standard Grommets

[2pt Penalty]

Development and Cadet Class Teams **MUST** use four (4) unmodified REA axle grommets.

### T8.4 REA Standard Axles

#### T8.4.1 Development Class Teams

[2pt Penalty]

Development Class Teams **MUST** use two (2) REA standard axles or axles from a different material with the same diameter.

#### T8.4.2 Cadet Class Teams

[2pt Penalty]

Cadet Class Teams **MUST** use two (2) standard brass axles supplied by REA. No other axle material can be used.

### T8.5 Modifications

#### T8.5.1 Development and Cadet Class Teams

[2pt Penalty]

Development and Cadet Class Teams **MUST NOT** use any other parts or make any other modifications to the wheel support system.

#### T8.5.2 Professional Class Teams

[Advice]

Professional Class teams **MAY** manufacture their own wheel support system and the wheel support system materials are unrestricted.

## ARTICLE T9 - TETHER LINE GUIDE RULES

### T9.1 Location

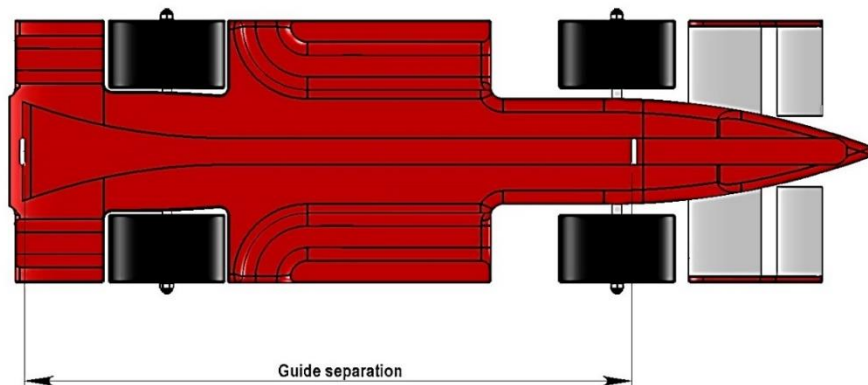
[1 Pt Penalty]

Each car **MUST** have 2 (essentially circular) tether line guides firmly secured toward the front and rear of the car, located on the underside along the car body centre line. The track tether line passes through these two tether line guides. An adhesive **MAY** be used to help secure the tether line guides.

## T9.2 Separation

[1 Pt Penalty]

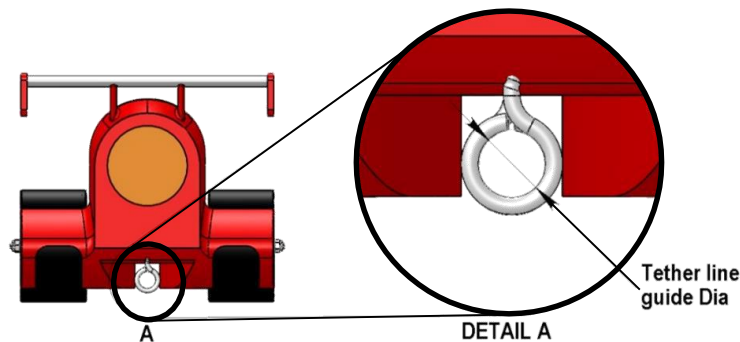
The longitudinal separation of the tether line guides as measured between the outside edges of the guides **MUST** be a minimum of 120mm.



## T9.3 Inside Diameter

[2 Pt Penalty]

The inside diameter of the tether line guide (referring to the size of the hole) **MUST** be a minimum of 3.5mm



## T9.4 Safety

### T9.4.1 Closed Guides

[Eligibility | 4 Pt Penalty]

The tether line guides **MUST** be closed to prevent the tether line from coming out of the tether line guide. This is considered a safety issue. Cars **WILL** be ineligible to race if unresolved.

### T9.4.2 Sharp Edges

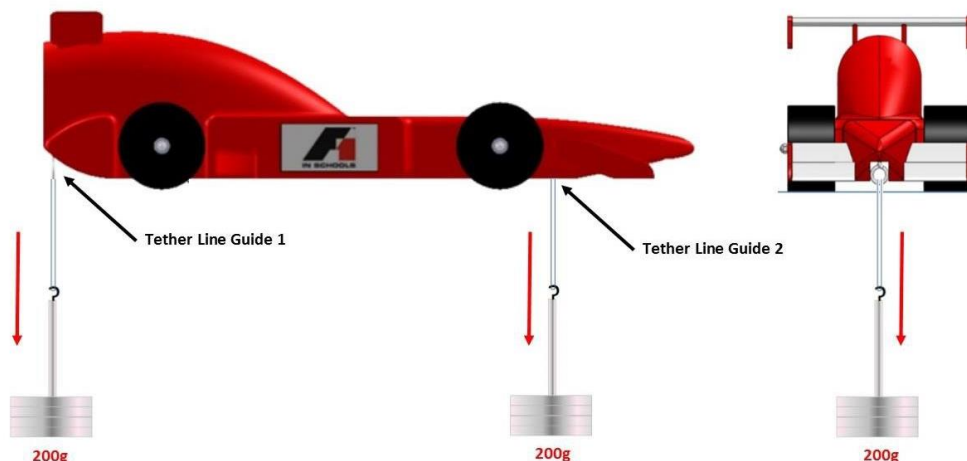
[Eligibility | 4 Pt Penalty]

Tether guide arrangements with sharp edges **WILL** be prevented from racing.

### T9.4.3 Strength & Fixing

[Eligibility | 4 Pt Penalty]

Adequate strength and fixing of the tether line guides **MUST** be considered a safety issue and cars with unsafe arrangements will be ineligible to race if unresolved. The guides must be robust so as to prevent the diameter or shape changing during racing. A tether line guide test will be conducted during scrutineering using a 200g mass to check the guides are securely fitted to the car and safe to race.



## T9.5 Cadet Class Restrictions

### T9.5.1 REA Standard Tether Line Guides

[1 Pt Penalty]

Cadet Class Teams **MUST** use the REA supplied Tether Line Guides.

### T9.5.2 Positioning of REA Standard Tether Line Guides

[1 Pt Penalty]

Cadet Class Teams **MUST** place Tether Line Guides within the 6mm x 6mm tether slot feature on the standard balsa blank.

## ARTICLE T10 - POWER PLANT PROVISIONS

### T10.1 Interfacing with Launch Pod

[Eligibility]

The cylinders provide the car propulsion and all cars **MUST** interface directly with the standard track starting pod mechanism without the use of additional launch equipment.

### T10.2 Diameter

[1 Pt Penalty]

The CO<sub>2</sub> cylinder chamber diameter **MUST** be 19mm.

### T10.3 Depth

[1 Pt Penalty]

Depth of chamber measured parallel to the vertical reference plane anywhere around the chamber circumference from opening to chamber end **MUST** be a minimum 50mm and maximum 60mm.



### T10.4 Distance from Track Surface

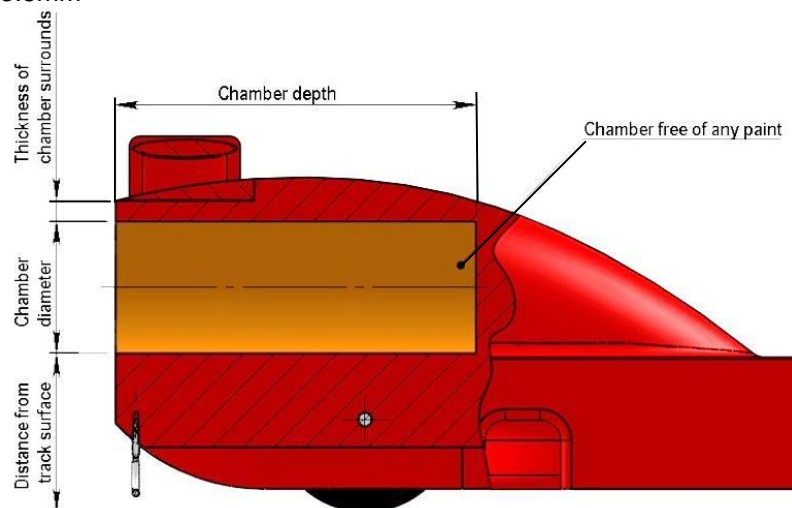
[0.05 Time Penalty | 4pt Penalty]

The vertical height of the lowest point of the CO<sub>2</sub> cylinder chamber above the race track surface **MUST** be a minimum of 22mm for the Cadet Class and 20mm for Development and Professional Classes.

### T10.5 Chamber Wall Thickness

[Eligibility | 1 Pt Penalty]

The CO<sub>2</sub> cylinder chamber **MUST** be completely surrounded by balsa car body only. The chamber surrounds and connection to the car body will be accessed and if determined below the minimum thickness, may be considered a safety issue at the judge's discretion. Minimum thickness is measured through any line of the chamber radius. **IMPORTANT:** The entire circumference and length of the cylinder chamber must not be punctured by any object. Min: 3.5mm



### T10.6 Finishing of Chamber Surrounds

[1 Pt Penalty]

Paint and other foreign materials **MUST NOT** be present inside the CO<sub>2</sub> cylinder chamber. This is considered a measure of manufacturing quality control.



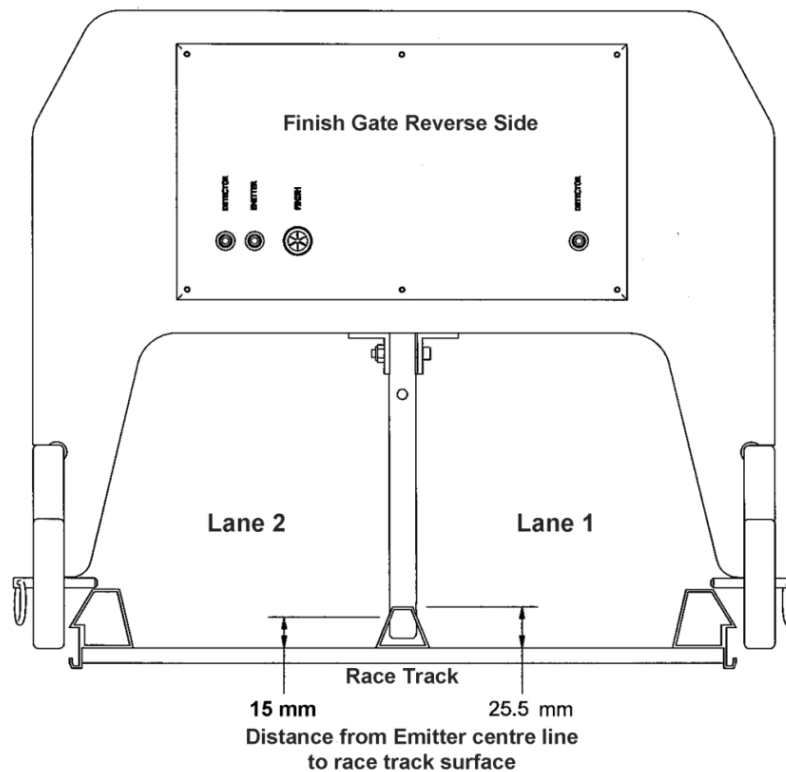
### T10.7 Interaction with Cylinder

[0.05 Time Penalty | 4pt Penalty]

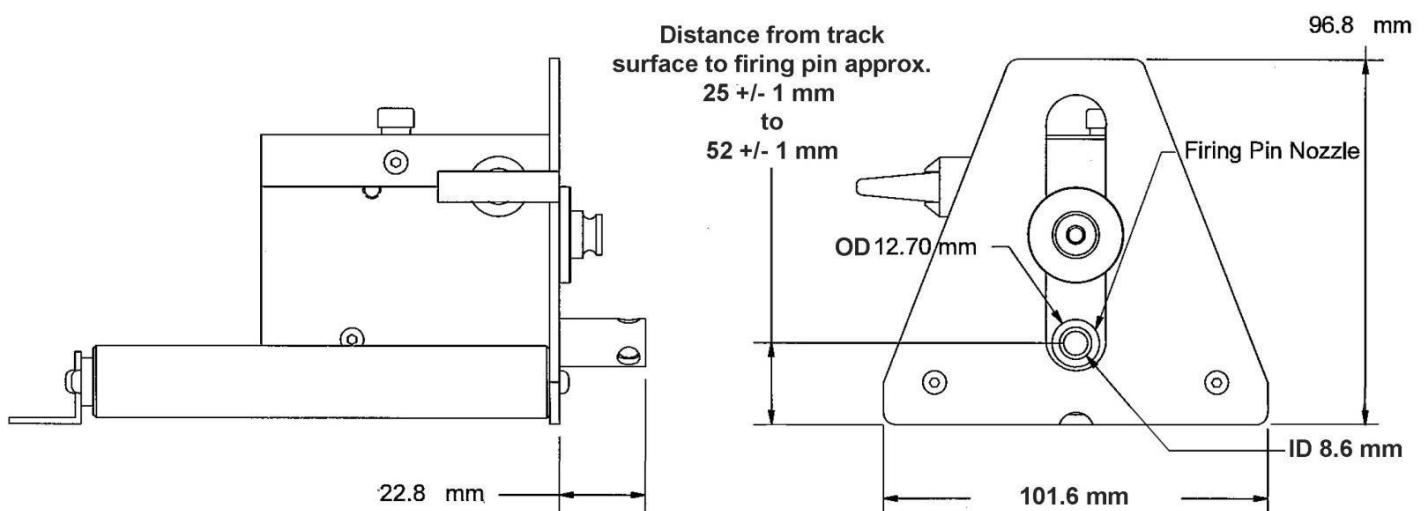
The cylinder **MUST** be able to be inserted and withdrawn without removal and replacement of car parts.

## ARTICLE T11 - APPENDICES

### T11.1 Finish Gate and Race Track Section View from Rear



### T11.2 Launch Pod Side and Front Views



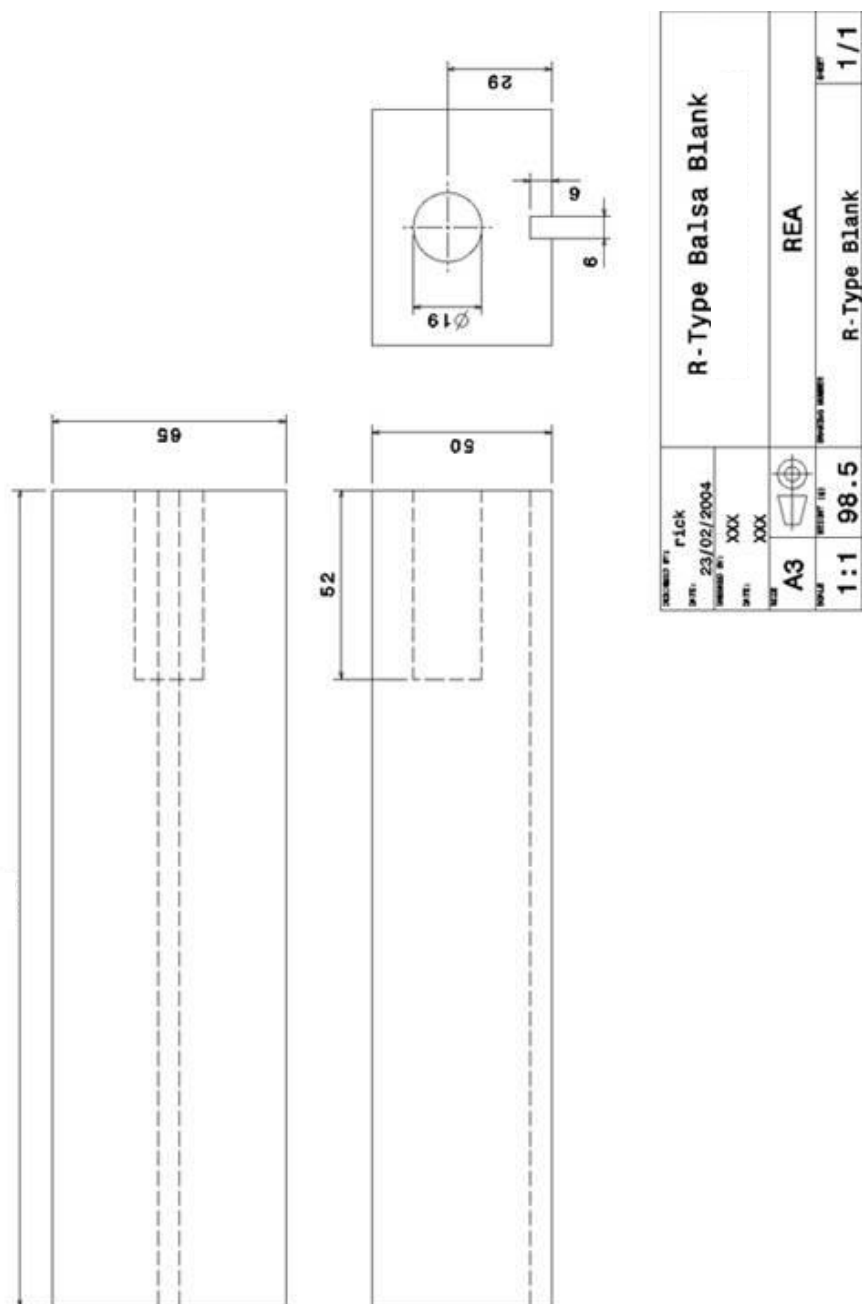
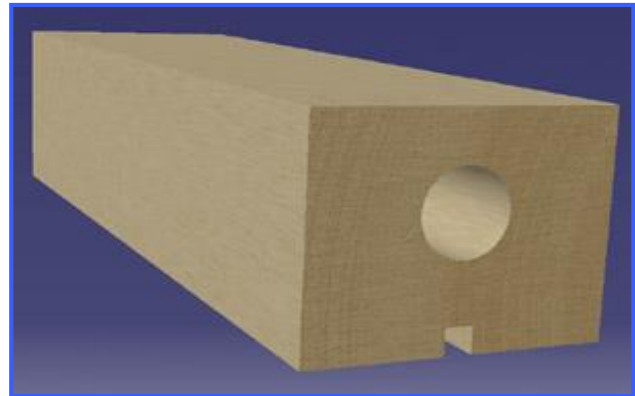


### T11.3 Official REA Balsa Blank Dimensions

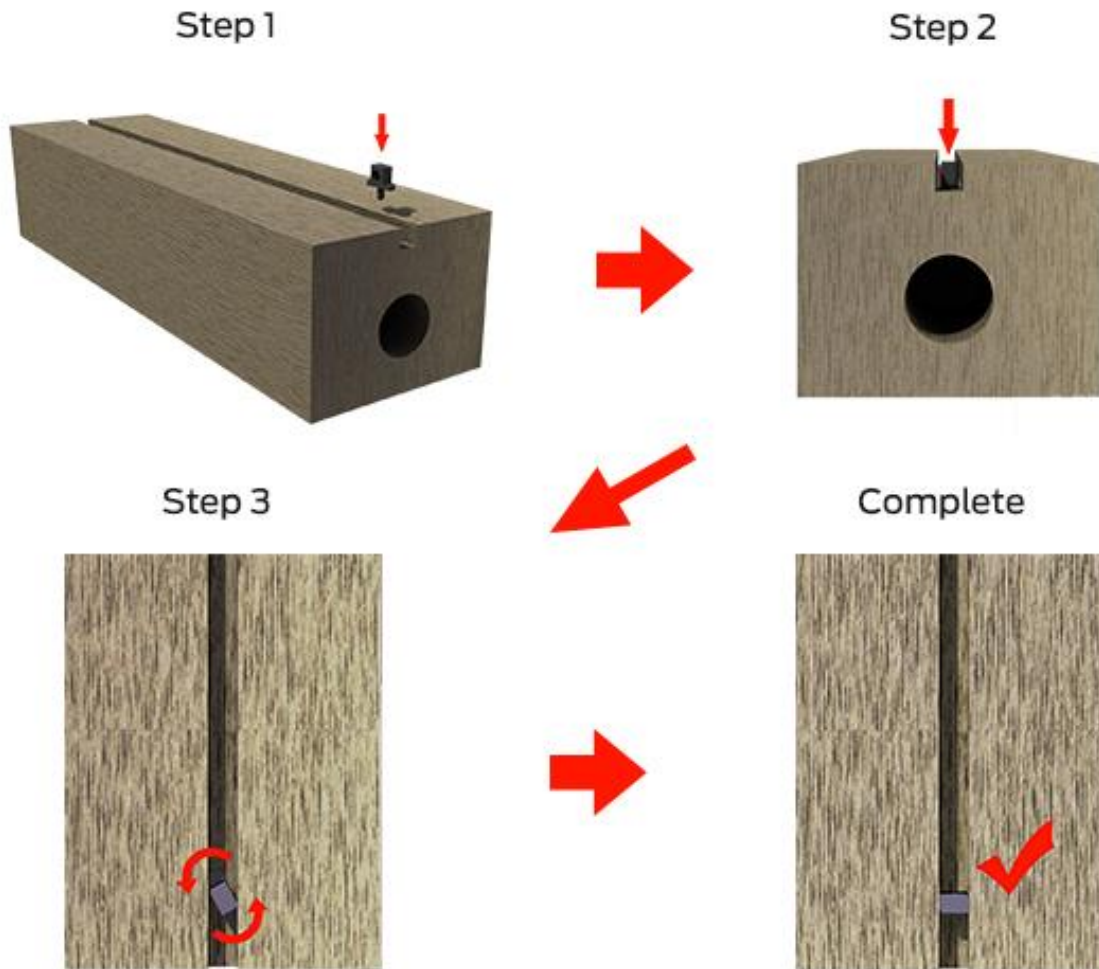
The following is provided as a guide for the dimensions of the REA Standard Balsa Wood Blank

**Right:** Three dimensional rendering of the balsa wood blank used for construction of the F1 type racing cars

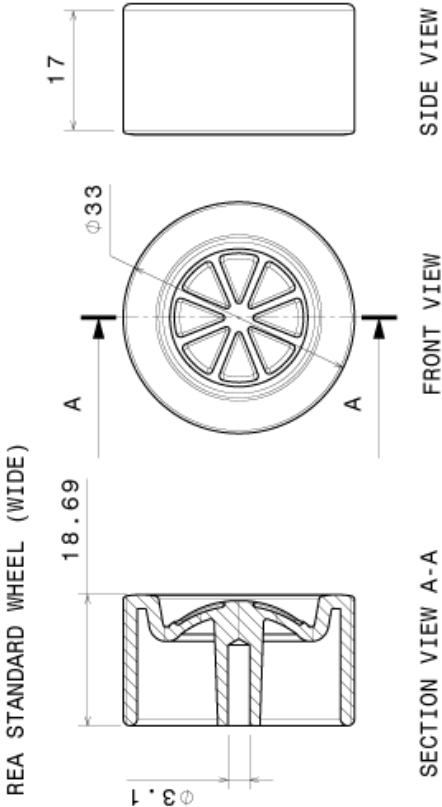
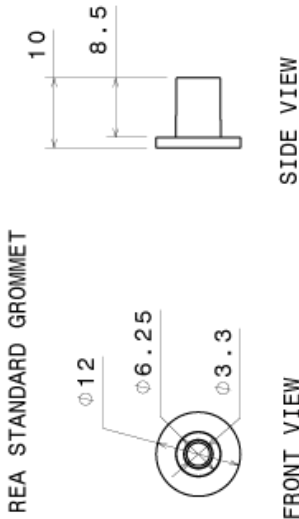
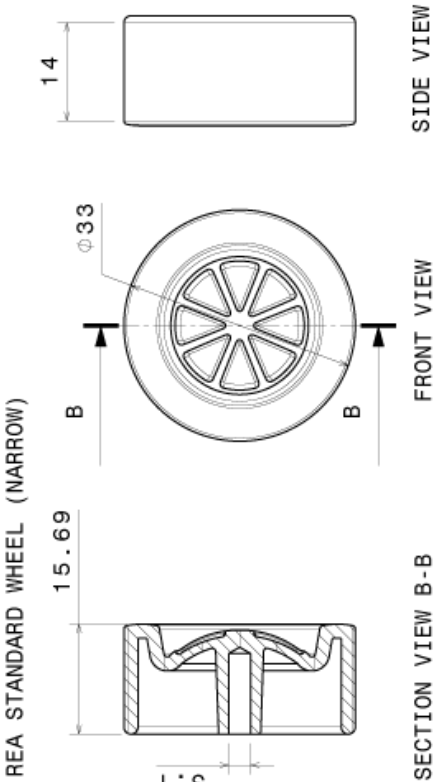
**Below:** Orthographic drawing of the balsa wood blank All dimensions listed are in mm  
Note – this is not reproduced to scale



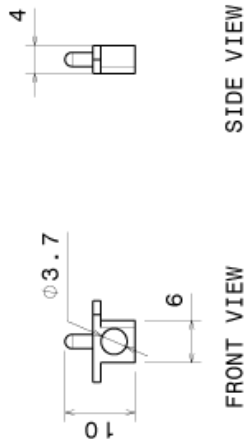
## T11.4 REA Standard Tether Guide Insertion Instructions



T11.5 Official REA Standard Wheel Kit



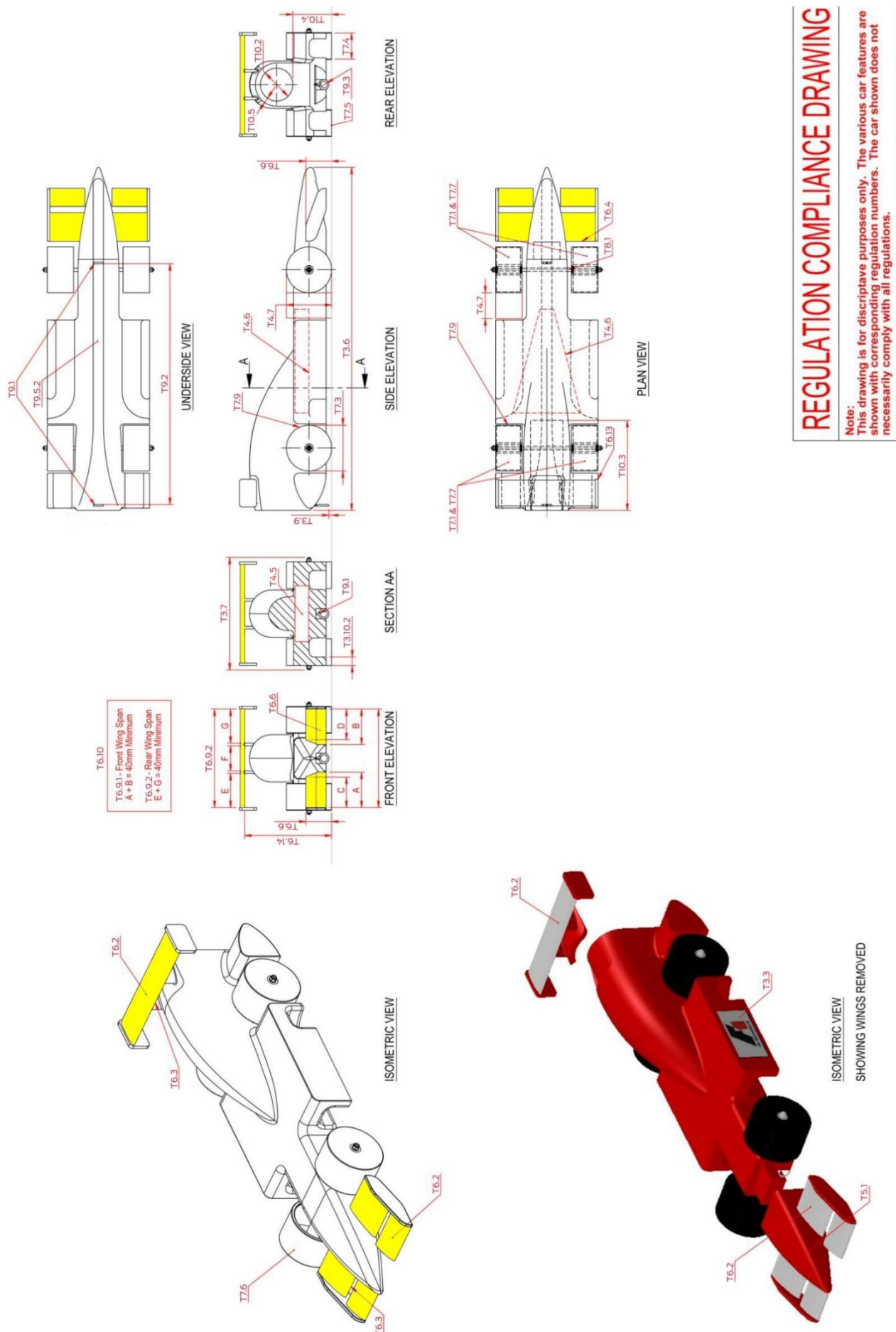
REA STANDARD TETHER GUIDE



DESIGNED BY: B.SIZELAND		REA STANDARD WHEEL KIT	
DATE:	20/05/2015		
CHECKED BY:	W.SMITH		
DATE:	20/05/2015	Re-Engineering Australia Foundation	
SIZE	A4		
SCALE	NB 0.00	DRAWING NUMBER	SHEET
		REA - WK	1/1

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## T11.6 Example Orthogonal Drawing







# WHERE WILL REA TAKE YOU?



RE-ENGINEERING AUSTRALIA  
FOUNDATION



*Yas Marina Circuit*



*Tour the F1 Pit Lane*



*Meet Daniel Ricciardo*



*Sheikh Zayed Grand Mosque - Abu Dhabi*