CO_2 Car Race

Grace College

2023 Car Regulations

Prospective & High School Students

CAR REGULATIONS

ARTICLE T1 – DEFINITIONS

T1.1 The Car

Designed and manufactured according to these regulations for the purpose of participating and are powered only by a single 8 grams compressed air cartridge. The cars are designed to travel the track distance as quickly as possible, whilst withstanding the forces of launch acceleration, track traversing and physical deceleration after crossing the finishing line.

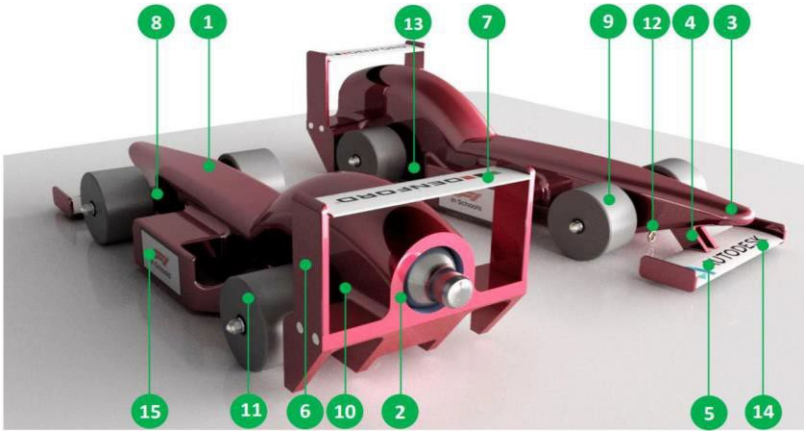
A car assembly must only consist of the following components:

1. A body encompassing a virtual cargo
2. A compressed air cartridge chamber
3. Nose cone
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 tether line guide
14. Surface finishing (Paint) and decals

Adhesives with no dimensional impact are permissible for joining components (magnets, glue, etc.).

Lego pieces and parts, including a Minifigure are permitted and legal.

The car can be created from wood or 3-D printed material. Axels & Wheel are provided by Grace Engineering or must meet the dimension listed in the Index.



ARTICLE T2 – GENERAL PRINCIPLES

T2.1 Classification of regulations

T2.4.1 If a race car is judged as being non-compliant with any regulations, adjustments may have to be made to the car.

T2.4.2 The adjustments will be made with staff supervision and must stay within rules if parts are added to cars.

T2.4.3 If any adjustments are made the car, it must go back through inspection. This is to clarify it meets rule standards.

CAR DESIGN:

Requirements & Standards

ARTICLE T3 – FULLY ASSEMBLED CAR

T3.1 Design and manufacture

T3.1.2 The cars must be manufactured from a 3-D Printer or out of balsa wood.

T3.2 Safe Construction

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).

T3.2.2 During racing – the race officials will routinely inspect cars for safety during scheduled races. If the staff rule a car to be damage, the car may be repaired with tape or hot glue, but must it must be weighed before racing again.

T3.2.3 The weight of the repaired car during "the re-weigh in" must be equal or more than the "weigh in" weight.

T3.3 Undefined features

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

T3.4 Total length

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

Absolute Min: 240.0mm / Absolute Max: 305.0mm

T3.4: Total length

T3.5 Total width

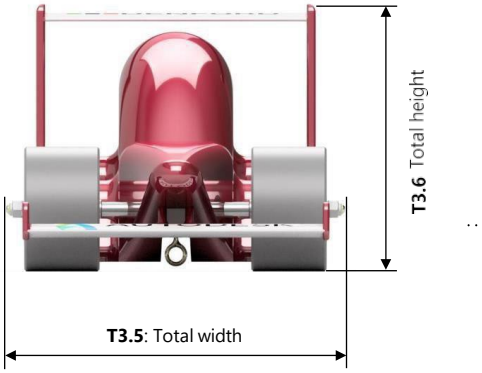
Total width is the maximum assembled car width, measured between the outer edges of the widest feature of the car assembly.

Absolute Max: 100.0mm

T3.6 Total height

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. 100.0mm



T3.7 Total weight

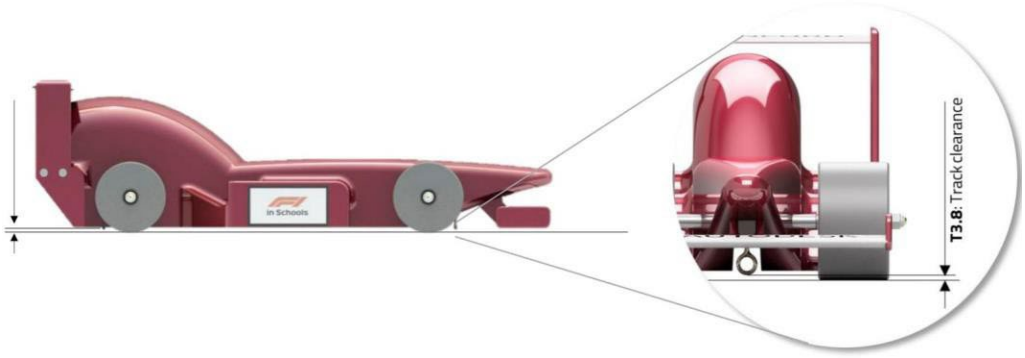
Total weight is the weight of the car excluding a compressed air gas cartridge. If ruled Underweight at check-in, the car will not race underweight. Ballast will be added to the car until it meets the minimum requirement plus a 2-gram penalty in ballasts.

Absolute Min: 100.0g

T3.8 Track clearance

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: 1.0mm



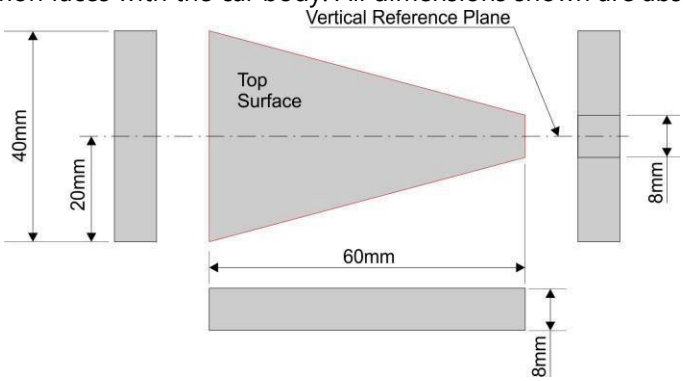
T3.9 Status during racing

The car assembly must be designed so that compressed air cartridges can be removed, replaced or added to the assembly during scheduled race events.

ARTICLE T4 – BODY

T4.1 Virtual cargo

A virtual cargo must be completely encompassed by the body and be wholly positioned between the front and rear wheel center lines. The virtual cargo must have minimum dimensions as shown below, with its top surface located symmetrical about and positioned 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.



T4.2 Lego Driver

T4.3.1 A Lego Minifigure must stay inside of the car throughout the duration of each race the car participates in.

T4.3.2 The Minifigure must also be able to see the track "drive" down the track. "See" meaning its eyes are visible front the front view of the car.

T4.3.3 The use of a Lego window and / or canopy pieces are considered legal.

T3.3.4 Lego bricks can also be used be used to hold a window or canopy in place as well as use of a brick for a Lego guy to sit on or to connect the window or canopy to the car.

T3.3.5 Lego bricks can be glued to the car, however the Lego driver cannot. We encourage making your own Lego studs (dimensions in the Index) to reduce weight and not use glue if possible.

ARTICLE 5 – COMPRESSED AIR CARTRIDGE CHAMBER

T5.1 Diameter

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

Absolute Min: 19.5mm / Absolute Max: 20.0mm

T5.2 Distance from 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, from the rear center of the compressed air cartridge to the track surface, measured normal to the track surface.

Absolute Min: 30.0mm / Absolute Max: 40.0mm

T5.3 Depth

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: 50.0mm / Absolute Max: 52.5mm

T5.4 Max angle of chamber

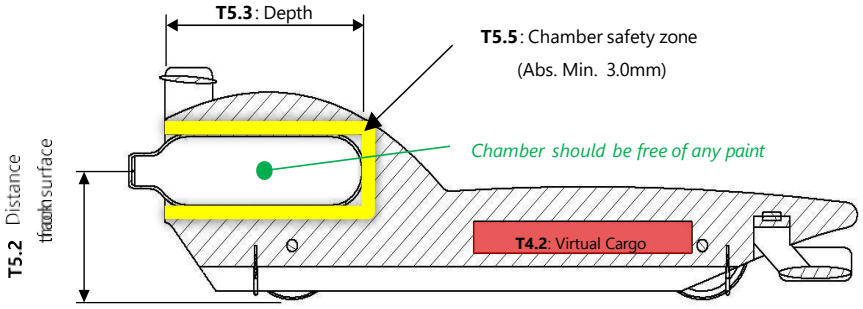
The angle of the chamber must be parallel to the track surface. This is measured with a full 8g compressed air cartridge inserted into the cartridge chamber with the car sitting on all four (4) wheels with no outside assistance. This is judged by the staff and how well the cartridge sits in the Pitsco firing mechanism.

T5.5 Chamber safety zone

A safety zone of 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 judge's discretion.

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

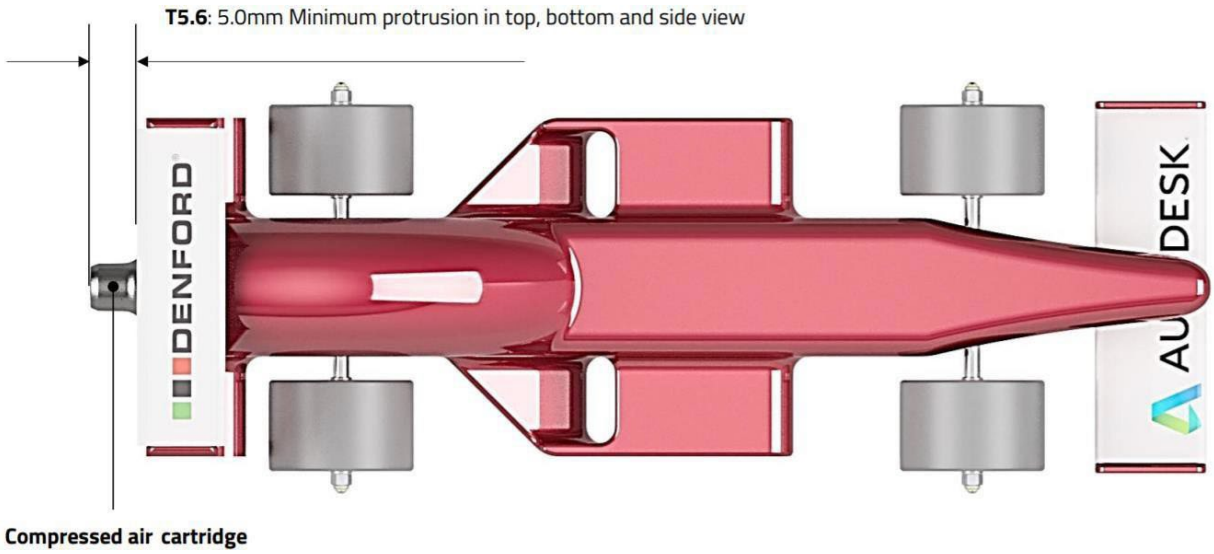
Absolute Min: 3.0mm



T5.6 Compressed air cartridge visibility

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

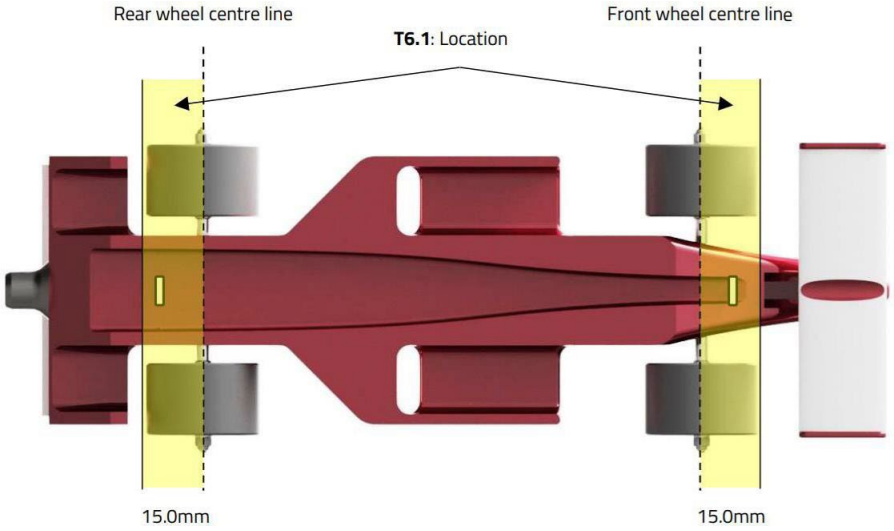
Absolute Min: 5.0mm



ARTICLE T6 – TETHER LINE GUIDES

T6.1 Location

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 center line and one on or up to 15.0mm behind the rear axle center line of the car. The track tether line must pass through both tether line guides during racing.



ARTICLE T7 – WHEELS AND WHEEL SUPPORT STRUCTURES

T7.1 Number and location

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 center line / axis.

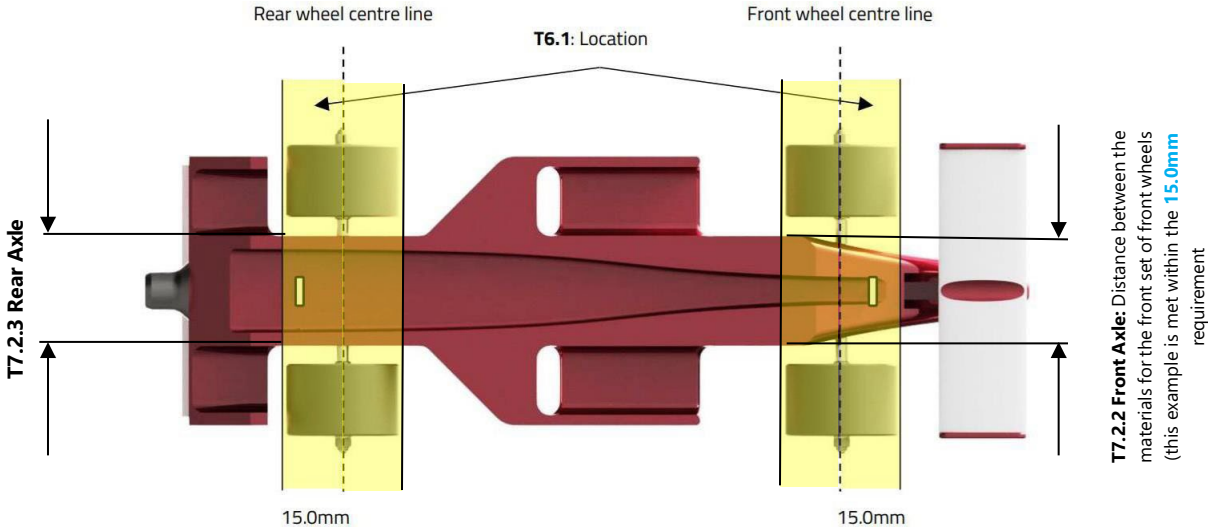
T7.2 Distance between opposing wheels

This is measured as the width of the car material between the front and rear sets of wheels, measured parallel to the track surface.

T7.2.1 Measurement Point - The material must be able to meet the absolute minimum requirements (T7.2.2-3) **within 15.0 mm** from the center line of the wheel in either direction.

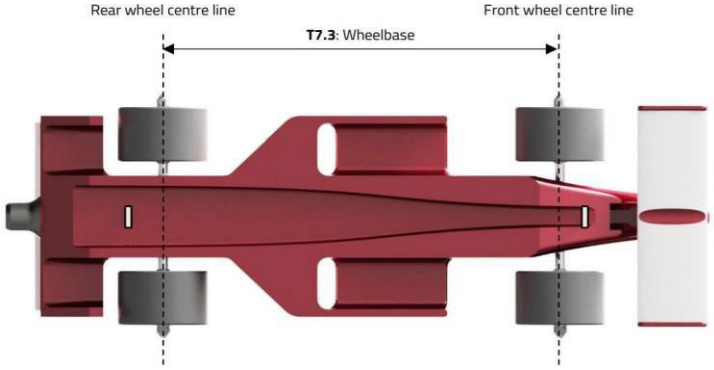
T7.2.2 Front Axle - **Absolute Min: 30.0 mm**

T7.2.3 Rear Axle - **Absolute Min: 30.0 mm**



T7.3 Wheelbase

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



Absolute Min: 100.0mm

T7.6 Racetrack contact

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. Racetrack contact must be maintained prior to car launch and during racing

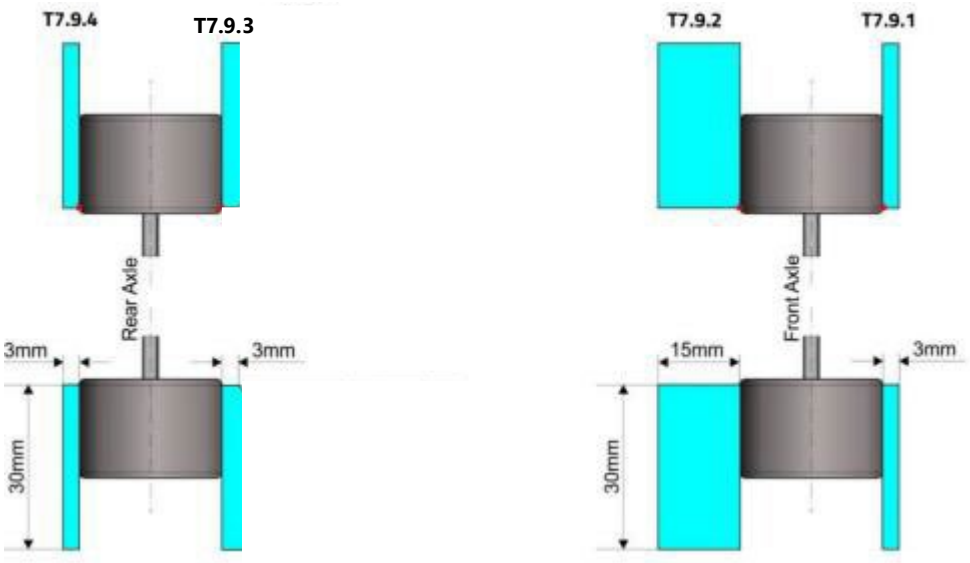
T7.8 Rotation

All four (4) wheels must rotate freely about their own center axis to facilitate forward motion of the car during racing.

T7.9 Visibility in top and bottom views

The visibility of all wheels must not be physically obscured by any component of the car in the car's top and bottom views. Car body or any other components must not exist within the dimensions illustrated below. This is measured, parallel to the track.

T7.9.1– In front of front wheels |
Absolute Min: 3.0mm
T7.9.2– Behind front wheels |
Absolute Min: 15.0mm
T7.9.3– In front of rear wheels |
Absolute Min: 3.0mm
T7.9.4– Behind rear wheels |
Absolute Min: 3.0mm



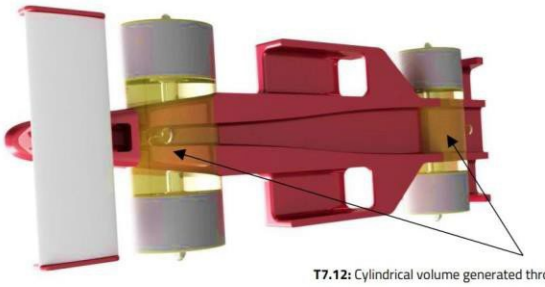
T7.10 Visibility in side views

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)

T7.12 Wheel support

T7.12.1 Wheel support systems: Wheel support systems may only consist of a axle connecting the two (2) opposing wheels.



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

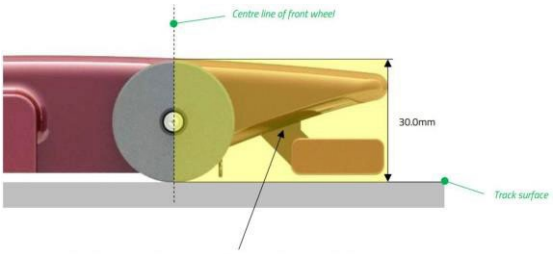
ARTICLE T9 – FRONT WING

T9.1 Front wing(s) description and placement

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. To be considered a wing section it must have a leading edge and a trailing edge across its required span.

T9.2 Front wing and wing support structure location

The whole of the front wing(s) and any support structure and nose cone must be in front of the center line of the front wheel.

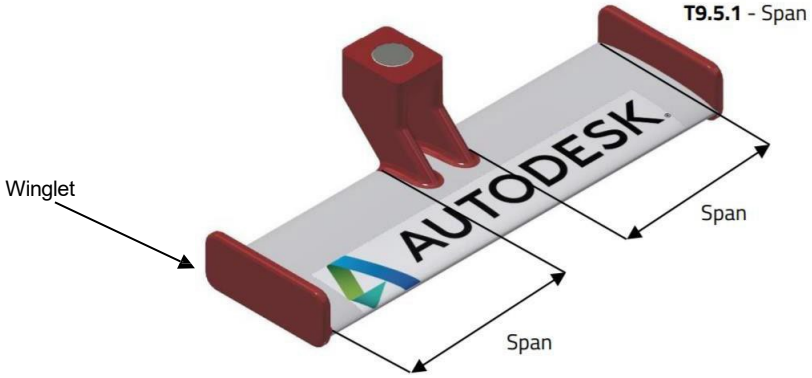


T9.3 Front Wing Dimensions

T9.5.1 Front wing span

The front wing span will be measured from the outside winglet to where the front wing is intersected by a part of the car. The two wings must add up to a minimum of 12.0mm on each side of the car.

Absolute Min: 12.0mm

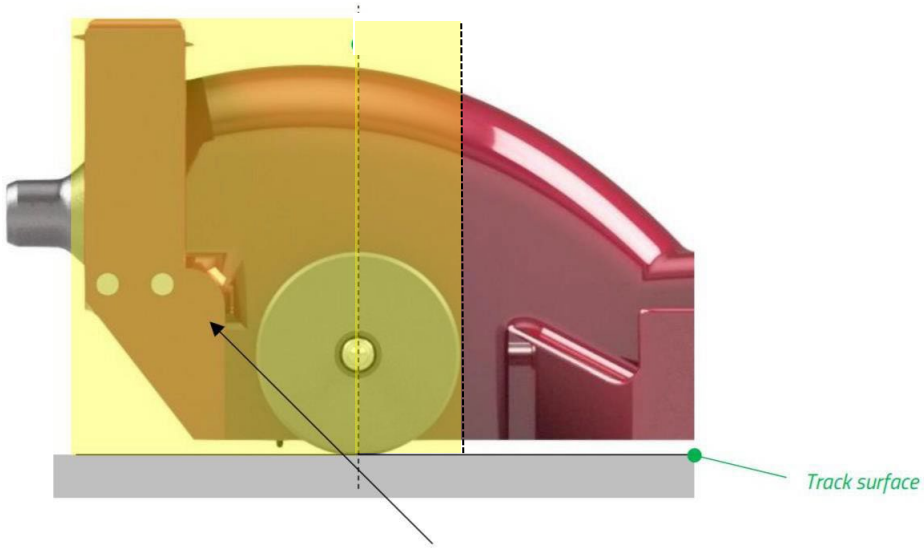


ARTICLE T10 – Rear wing

T10.1 Rear wing description and placement

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.

T10.2 Rear wing and wing support structure and location



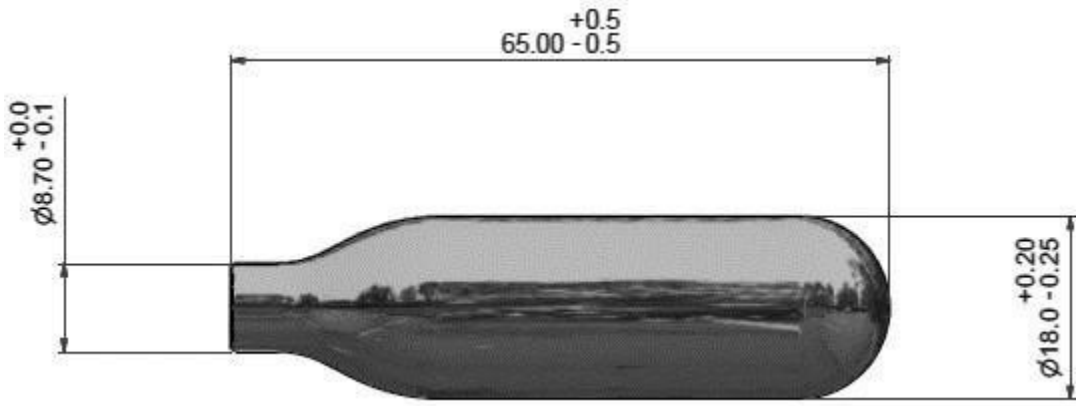
T10.4: Rear wing and wing support structure location, shown highlighted yellow

APPENDIX

OTHER INFORMATION & ILLUSTRATIONS

APPENDIX – OTHER INFORMATION / ILLUSTRATIONS

i. Power Pack dimensions



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

ii. Our CAD File of the base Grace College Engineering Car

Below: orthographic Grace College Engineering Model Block. All dimensions shown in millimeters

This file will be available to download at a later date. New iterations of the rules will be sent out at a later date with minor, non-rule modifications.

Please make sure you have also read the Competition Regulations!

Work hard, good luck, and we'll see you at the competition!