RULES & REGULATIONS

09/10
CHAMPIONSHIP SEASON

F1™ IN SCHOOLS

THE FORMULA ONE™ TECHNOLOGY CHALLENGE

F1 in Schools 2009-10 Championship Rules and Regulations

This document has been ratified for release by the F1 in Schools National Rules Committee and the F1 in School, Inc. Board. Any approved revisions will be officially released as supplementary regulations through the F1 in Schools Web site www.f1inschools.us.

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ENSURE YOU READ AND CHECK THE RULES VERY THOROUGHLY BEFORE BEGINNING THE DESIGN AND CONSTRUCTION OF YOUR F1 CAR.

www.f1inschools.com

Questions regarding the rules? Email F1marketing@pitsco.com.

What Is the F1 in Schools Technology Challenge?

F1 in Schools, the Formula One Technology Challenge, is a competition open to all USA-based students aged 11-18, to design and manufacture CO_2-powered model racing cars. Student teams will compete against each other in State and National Championships to determine the best-engineered and fastest car in the USA.

Teams competing in the 08/09 Formula One Technology Challenge will compete at State Championships for a chance to compete at the National Championships to be held at the 2009 TSA National Conference in Denver, Colorado, June 28 through July 1, 2009.

The national middle school and high school teams will be invited to compete in the 2010 F1 in Schools World Championships. The location for the 2010 World Championships has not been announced.

Team Pulse from England receive the Bernie Ecclestone trophy from Mr. Ecclestone at the World Championships in Kuala Lumpur, March 2008.

Global Expansion

F1 in Schools has become active in 31 countries worldwide in just seven years. National Champions from all corners of the world compete annually for the Bernie Ecclestone trophy.

www.f1inschools.com

Why Was the F1 in Schools Technology Challenge Introduced?

The F1 in Schools Technology Challenge exists to raise the profile of engineering within our schools. An understanding of the relationship between Science, Technology, Engineering, and Mathematics (STEM) is critical to our students and our country.

CAD/CAM, CNC, and VR systems are now commonplace in the manufacturing industry, which is why it is so important for the engineers and designers of the future to interact with it early on. Students using CAD/CAM, CNC, and VR software are able to design, analyze, manufacture, and test their own creations using the very latest technology.

Primarily, F1 in Schools provides students with an ideal opportunity to experience the very latest developments in manufacturing technology:

- CAD (Computer-Aided Design) encourages students to think, explore, and visualize their ideas in three dimensions, using features such as complex curve modeling and surface rendering alongside more traditional orthographic presentations.
- CAM (Computer-Aided Manufacturing) packages create an environment where CAD designs can be developed and prepared for automated manufacturing processes. Some CAM packages, such as Denford's *QuickCAM Pro*, are wizard based and can be used to create cutter paths for machining parts on a CNC router.
- CFD (Computational Fluid Dynamics) packages, such as VRWT (Virtual Reality Wind Tunnel), allow computer models of car designs to be analyzed with regard to aerodynamics and efficiency and then modified to further increase performance.
- VR (Virtual Reality) packages allow complicated machining and processing tasks to be practiced in real time and total safety. Packages allow CNC machining to be experienced, even when you don't actually own the real CNC hardware!
- CNC (Computer Numerically Controlled) machines, such as the Denford range of routers, allow processed CAD drawings to be manufactured to high degrees of accuracy.

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THE FORMULA ONE™ TECHNOLOGY CHALLENGE

TIMELINE OF CHAMPIONSHIP SEASON 09/10

F1 in Schools Challenge Timeline 09/10	Sept 2009	Oct 2009	Nov 2009	Dec 2009	Jan 2010	Feb 2010	Mar 2010	Apr 2010	May 2010	Jun 2010	Jul 2010	Aug 2010
Registration												
Organizing Teams												
CAD Idea Development												
Design Testing												
Re-Design												
CAD Orthographics												
Race Car Manufacturing												
Car Graphics/Finishing												
Regional Finals												
State Finals												
National Finals												

How to Obtain Software, Hardware, and Consumables

If you would like to purchase any software, equipment, or consumables for the challenge, please contact:

- **CAD Software**
  A 3-D modeling CAD software package is necessary to compete. There are several CAD companies that offer educational pricing as well as free student versions of their software.

- **CNC Equipment**
  Denford Inc.

  www.denford.com

- **Test and Race Equipment and Consumables**
  Pitsco, Inc.
  P.O. Box 1708
  Pittsburg, KS 66762
  Phone: 800-828-5787
  www.shop.pitsco.com

Note: While F1 in Schools encourages using our sponsors and supporters' products and services, any 3D CAD, CAM, and CNC software and equipment may be used to compete in the challenge.

Manufacturing, Testing, and Racing Centers

All details of accredited manufacturing, testing, and racing centers are posted on the resources page of the USA F1 in Schools Web site (www.f1inschools.us).

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Awards and Prizes

The 2010 National Championships are open to 11-18 year old students.

There will be separate awards/prizes for:

National Championships

- Judges' Choice Awards– Awarded to the top two overall teams based on points scored.
  First place overall will be invited to compete at the 2011 World Championships.
  Second place overall will be invited to form a collaborative team for the 2011 World Championships.
- 1st, 2nd, 3rd place high school teams – overall total points score
- 1st, 2nd, 3rd place middle school teams – overall total points score
- Pitsco Fastest Car Award – Race car must comply to regulations.
- Denford Manufacturing Award * – Both race and reserve cars must comply to regulations.
- Quick Trigger Award–Fastest driver's reaction time. *
- Innovative Thinking Award *
- Best Team Sponsorship and Marketing*
- Concours de Elegance–Best appearing car*
- Outstanding Sportsmanship Award *
- Rookie Team of the Year – overall total points score in each division.
  [Teams taking part in the Challenge for the 1st time]

**The above awards are at the discretion of the judges*

State/Regional Championships

- Overall Champion – overall total points score (optional)
- 1st, 2nd, 3rd place high school teams – overall total points score
- 1st, 2nd, 3rd place middle school teams – overall total points score
- Fastest Car

The F1 in Schools National Championship is an invitational event. The number of teams invited to compete from a given State/Regional competition is based on the number of teams registered at each level (MS and HS) in that State/Region. The following provides the criteria for invitation for both middle school and high school teams:

8 or more registered teams: 1st, 2nd, and 3rd place teams invited to the Nationals.
4 to 7 registered teams: 1st and 2nd place teams invited to the Nationals.
1 to 3 registered teams: 1st place team invited to the Nationals.

Inquiries and Questions

All questions and queries about the F1 in Schools Technology Challenge
should be e-mailed to the F1 coordinator at **F1Marketing@pitsco.com**.
For the very latest information, visit the F1 in Schools Web site: **www.f1inschools.us**.

The Brief

You are the Formula One Team commissioned to design, construct, and race the fastest Formula One Car of the Future driven by compact, compressed, reclaimed CO_2 (carbon dioxide gas) power plants. In order to enter the championship, you must allocate jobs to the members of your group. Ideally, one role should be allocated to each person. However, you may have to double up your roles and responsibilities, depending on the number of people you have available. The following job roles should be covered by members of your team:

- **Team Manager** (maximum 1 person)
  This person will be responsible for managing the team and ensuring that the primary and back-up cars are ready for the finals. The team manager works closely with all members of the team, offering assistance where necessary.

- **Resources Manager** (maximum 1 person)
  This person organizes time, materials, and equipment for designing and making cars. They are also responsible for developing ideas regarding team marketing (presentations). The resources manager will need to liaise with all members to check that tasks are progressing on time and offer additional help, if needed.

- **Manufacturing Engineer** (maximum 2 persons)
  These people are responsible for advising team members on the manufacture of the car and the constraints of the machining process. Manufacturing engineers will need to liaise with the design engineers to report and help solve any problems with the construction of the car.

- **Design Engineer** (maximum 2 persons)
  These people are responsible for the styling and aerodynamic performance of the car design. Design engineers will need to liaise with the manufacturing engineers to ensure their ideas can be realized.

- **Graphic Designer** (maximum 1 person)
  This person will be responsible for producing the color schemes applied to the vehicle, including any special sponsorship decals, together with the final graphic renderings and any additional team marketing materials. The graphic designer will need to liaise with the design engineer to ensure any schemes will fit the shape of the vehicle and with the resources manager for additional marketing development.

There are so many tasks that must be mastered in order to design, manufacture, prepare, and finally enter a car for racing that teamwork will be vital to your success. A real F1 team succeeds because all the people learn to work together and support each other.

Remember, no one person is more important than another.

Championship Criteria

Your team must comply with all the guidelines outlined below: *This is a student competition and the scoring by judges will reflect all aspects of the student content of the project.*

- Your team must contain a minimum of three and a maximum of six students.
- Your team must use 3-D CAD (Computer-Aided Design) software to produce your ideas and model them in 3-D. We recommend *SolidWorks*, which is included in your F1 Challenge Kit.
- Your team must use CAM (Computer-Aided Manufacturing) software.
- Your team must use a CNC machine, such as a Denford router, or an F1 in Schools-approved manufacturing center to produce the car body. Teams using a manufacturing center should still develop the machining files needed to produce the cars.
- Each car must be manufactured either at your school or at a designated manufacturing center.
- Each car body must be manufactured from a single block of balsa wood.
- Each car body must be completed with a high-quality painted finish. Note that only a limited amount of hand finishing of the body to remove machining artifacts is allowed.
- Each team must bring two identical cars to any race event – a primary race car and an identical spare backup car. BOTH of these cars will be scrutinized.
- Each team must produce a design portfolio including initial ideas, design development, manufacturing techniques (even if using a make center), and evidence of testing – maximum 20 pages (11" x 17").
- F1 teams are encouraged to develop partnerships and seek assistance from businesses and industry throughout this engineering process. However, all aspects of this engineering and industry partnership must be represented in the team's portfolio. This includes CAD designs, painting of the cars, and the creation/production of the portfolio, which is the responsibility of the students on the team. *This is a student competition and the scoring by judges will reflect all aspects of the student content of the project.*
- Each team must supply two (2) full-scale 11" x 17" dimensioned 3rd angle orthographic projections and one (1) graphic rendering (should represent the finished car) of their final design, both produced using a 3-D CAD package. One orthographic projection and the graphic rendering are to be included in the design portfolio. One of the orthographic projections must be submitted with the team cars at event registration.
- Each team must complete a specification sheet, as supplied by F1 in Schools, for EACH car, which must be turned in at registration.
- Each team must prepare and deliver a five-minute oral presentation on their work.
- *The marketing display criteria are subject to revision for this season. Please check the Web site for further information after December 1st.* Each team must prepare a tabletop marketing display that does not exceed 6' wide x 3' tall x 18" deep. This display should not reiterate the material in the portfolio, but should reflect the team's sponsors and engineering prowess.
- All cars will be checked for safety at event registration. If safety violations are found on the race and backup cars, the team will be given an opportunity to make corrections to cited safety violations prior to the end of registration for the event. Note that cars that are considered unsafe will not be raced. Safety issues that would prevent competition include a too thin wall around the CO_2 cartridge.

Design Considerations

Before beginning to design your car, you will need:

- A 3-D CAD solid modeling software package at your school.
- A design template suitable for the balsa wood blank.
- Hopefully, an endless supply of ideas.

Training:

CAD packages will help you draw and develop your ideas in 3-D. Of course, as with most drawing packages, it takes time to learn how to use them. Your teacher should be able to show you how the software works, but members of your team will need to spend some time exploring the software so you can see what it can do and how it can help you design your F1 car.

Research:

Investigate existing F1 car designs. Use the Internet to find out the latest developments occurring in the world of F1 design. Concentrate your research on areas that could help your team – for example, aerodynamics and car body designs – then try to apply the principles to your own ideas. Also consider researching how F1 teams market themselves and their sponsors.

Testing:

Your team may want to consider testing a variety of complete cars or car components using a wind/smoke tunnel or CFD software to evaluate their aerodynamic qualities. Roll and alignment testing are also important.

Manufacturing Considerations

In the F1 Car Kit, you will receive two balsa wood blanks, two sets of four wheels and two axles, and sandpaper and decals. These are the minimum supplies needed to enter the challenge.

Note that your car design template must be at least 10 mm shorter at one end compared to the actual balsa wood blank (we have accounted for this in the Rules and Regulations, point 2a). You will not be able to machine to the extreme ends of the balsa wood blanks, since they are sometimes used for attaching the CNC machine fixtures. Damage could occur if the cutting tool hits any of these fixtures.

The fixture is used to stop the balsa wood block from moving while being machined. It also allows the block to be accurately repositioned. Please note, however, that while some machines will process with only one cut, others may require two or more cuts. Therefore, you will need to take this into account when you are designing your car.

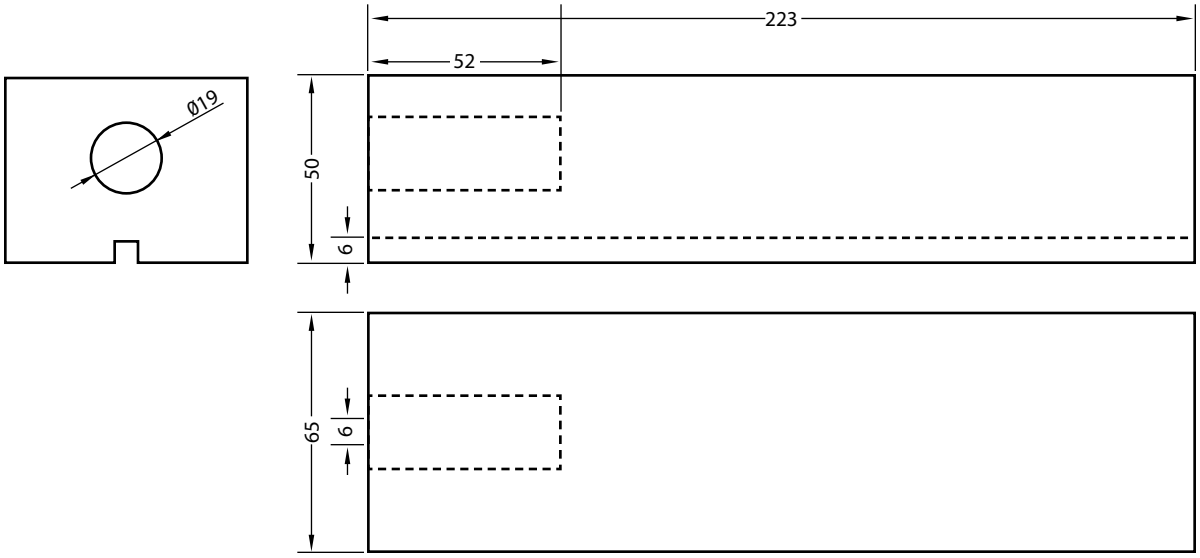
Once machined, you can smooth down the balsa wood design by hand and finish with primer and paint. You must consider that when you paint your car, you are adding dimension to the car body. If you machine your cars to the maximum size tolerances, there is a good chance that several coats of paint will make the car larger than the specifications allow and your team will lose scoring points.

Note that only a limited amount of hand finishing to the body is allowed. You could also decorate the car body with any sponsorship stickers, advertising, or color schemes.

Balsa Block Dimensions

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

Below: Third angle orthographic projection of the blank balsa wood block used for construction of the F1 race car. All dimensions listed are in mm (millimeters). **Note**: the drawing is **NOT TO SCALE**.



Seeking Sponsorship

Though not a direct requirement of entry, it may help finance your team. Sponsorship is very much a part of the "ethos" of Formula One. It would be prudent of any F1 in Schools team to seek sponsorship from local companies.

Approach 1

- Write a letter to several companies in your area, requesting sponsorship for your F1 in Schools team. In the letter, perhaps include some background information about the Challenge, your team, and what the company can gain from sponsoring your team.
- Follow up the letters with a telephone call inquiring about the letter that you sent and the possibility of arranging a meeting. It is often much easier to sell your ideas to a potential sponsor face-to-face.
- Prepare a presentation using presentation software, an overhead projector, or handouts for use at your meeting. If you need any special equipment (such as a screen or projector), don't forget to organize these beforehand.
- Be professional at all times.
- Be clear about your expectations and what the sponsors will receive from their investment.

Approach 2

- Explore potential sponsors through parents, teachers, your school, business, or industrial links. You might find a suitable contact through a parent, a parent's friend or work colleague, a teacher's friend, or a team member's current employer.
- Ask the contact whether it would be possible to write and/or telephone the potential sponsor. Before making contact, ensure that you prepare yourself thoroughly, and don't forget to mention to your potential sponsor how you became aware of their possible interest.
- Again, it might be worth asking your contact if they could arrange a meeting for you. If this happens, always send a confirmation letter to the potential sponsor indicating you (and the members of your team) will be attending the meeting.
- Prepare a presentation as outlined in Approach 1.

Important Considerations

- Always approach companies in a professional manner.
- Keep written documentation, such as proposals or team reports, fairly short (no more than one page front and back).
- Check the spelling before using any documents.
- Practice presentations before visiting a sponsor. Organize equipment beforehand.
- Keep presentations concise and to the point, usually no longer than 10 minutes.
- Feel free to take any extra materials to meetings. If the sponsor shows interest in a particular area, you can expand your presentation or leave information or work for closer inspection.
- Before attending a meeting, try to develop a piece of work specific to the sponsor such as a drawing of your car with the company logo already in position.
- If a company sponsors your team, try to provide them with copies of any work, possibly a duplicate model of your car for display in their headquarters.
- Invite your sponsors to any events at your school, maybe to see your design being developed or manufactured.
- At the end of the season, always remember to thank your sponsors for their valuable support.

1. General Regulations

IMPORTANT!

Read and check rules carefully before design and construction. Review the specification sheet for point deductions for each rule.

A team will only qualify for the following awards:
State/Regional/National Champion
Fastest Car
Manufacturing Award
If their car complies to all of the following specifications:

1a/2a/2c/2d/2e/2g/2h/2i/3a/3b/3c/3d/3e/3f/4a 4b/7a/7b/7g/7h/7i

Important note about car weight! Teams will lose 2 points per gram or part of a gram that each car is underweight. 2 grams of ballast will be added for each gram that the car is underweight before the car is raced.

1a. All cars must be designed using a CAD/CAM package. This package must satisfy all the Challenge entry criteria and allow students to produce a 3-D graphic rendering and 3rd angle orthographic projection. The CAM package should allow students to simulate CNC processes so students can show evidence of the process in their portfolio. Your car must be manufactured on a CNC machine, such as a Denford router, either at your school or at an F1 in Schools-approved manufacturing center. All car bodies entered into the Challenge must be manufactured using balsa wood blocks.

1b. All cars must be designed considering the specified dimensions and regulations. Only a limited amount of hand finishing is allowed – for example, removal of machining scallops. All cars should be complete and finish-painted to a high standard.

1c. Only the top teams per age group (middle school and high school) from each State/Regional and/or those teams invited by the National Competition Committee are permitted to attend the National Championships (if officially registered).

1d. Each team must consist of a minimum of three members and a maximum of six. Mixed-gender teams are preferred and positively encouraged.

1e. The cars must be produced during the academic year of the Challenge. The same car design cannot be entered more than once. In other words, one design per team per school year. No design from any school may ever be repeated.

1f. Each team must provide two (2) identical cars to enter the Challenge. The cars must be registered at the Challenge on the day and time designated by the Challenge organizers. Each team must also submit a dimensioned 3rd angle orthographic projection (11" x 17" full scale) and a completed specification sheet for each car at the time of registration. Dimensions should correlate to the individual rules and should be so labeled. Failure to submit the specification sheets or the orthographic projection drawing will result in point penalties in the design category.

1g. Each team must produce a design portfolio of work including initial ideas, design development, manufacturing, and evidence of testing. There should be evidence of CAM and CNC within the portfolio. These must be presented in an 11" x 17" format and displayed in the "Pits." One orthographic projection and a graphic rendering are to be included in the design portfolio.

1h. *The marketing display criteria are subject to revision for this season. Please check the Web site for further information after December 1st.* Each team must prepare a tabletop marketing display that will fit into a tabletop area that does not exceed 6' wide x 3' tall x 18" deep. This tabletop area is known as the "Pits". A tablecloth may be used as well as signage hanging down from the tabletop. Availability of A/C electricity may be limited in the display area. Laptop computers are allowed as well as battery-powered items. ONLY team members are allowed to set up displays. Coaching from advisors during display setup is not permitted.

1i. The official length of the track, from start to finish, is 20 meters.

1j. All cars will be checked for safety, that screw eyes/plastic line guides are secure, and that minimum body thickness is adhered to, especially around the CO_2 cylinder chamber. If the judges/marshal are unhappy with the safety of the vehicle or a rule infringement has occurred, a team can submit their spare car. Otherwise the team may be disqualified or points deducted from the overall team score.

Note: The cars will be checked at registration for safety and weight, and the team will be given an opportunity to rectify these issues if necessary prior to the car being impounded at registration.

1k. Judging will assess areas such as safety, aerodynamics, engineering, aesthetics, quality and accuracy of manufacture, race times, and team presentation. Please refer to the marking criteria. Overall winners will be determined by combining point scores from each category in the Challenge.
PLEASE NOTE:
THE JUDGES' DECISION IS FINAL

1l. Cars will be handed into race control and held in 'Parc Ferme' for the duration of the event. This will include both the race and backup car. If a car is needed for the oral presentation, you must manufacture a third car. (Cars can only be released from "Parc Ferme" with the National Event Coordinator's permission.)

1m. Teams will be required to deliver an oral presentation about their project to the judges. The presentation must not last longer than five minutes.

1n. Tolerances for all specifications:
Dimension tolerance is +/-0.1 mm.
Weight tolerance is +/-0.5 gram.

1o. All teams must be registered with F1 in Schools prior to, or by the start of, any initial Challenge event.

2. Body and Side Pod Regulations

2a. Full body length
Min: 170 mm / **Max:** 210 mm

2b. Body to track clearance
Min: 3 mm / **Max:** 15 mm
Excluding tether line guides, but including side pods and aerofoils. Measured normal from track surface to the lowest point.

2c. Width at side pods
Min: 50 mm / **Max:** 65 mm
The completed design must include two side pods. These are measured from side to side of the car body. The side pods are defined as a feature on the car between the front and rear wheels that exists between the 50 mm minimum and 65 mm maximum tolerances. Any part less than the width of 50 mm is considered to be car body only. Viewed from the side, a side pod must present a surface measuring not less than 30 mm wide by 15 mm high. A decal of this size – see below – must be applied to the car's side pods and must be 100% visible from the side view. This decal will be provided at check-in.

Note: Actual size

2d. Total car width, including wheels
Min: 60 mm / **Max:** 85 mm
Measured between outside edges of the wheels or body, whichever is widest.

2e. Car weight
Min: 55.0 grams without the CO_2 cartridge/max.

2f. No part of the body can be less than 3.5 mm thick. Body edges can have a minimum radius of 1.5 mm when the adjoining surface angle is less than 90 degrees.

2g. Maximum body height
60 mm including aerofoils

2h. The car body, including side pods, must be machined from a single piece of balsa wood. Body may not be an assembly of multiple pieces from the same block.

2i. No implants or hidden voids in the car body are allowed.

2j. *Viewed from the top, a projected rectangular surface of 30 mm x 50 mm must exist in the area bounded by the side pod extremities.*

3. Wheel Regulations

3a. All F1 cars must have four wheels – two at the front, two at the rear – and all wheels must be cylindrical and must fit the following criteria.

3b. Front wheel diameter
Min: 26 mm / **Max:** 34 mm
Measured from the extreme outer edges of each wheel

3c. Front wheel width
Min: 15 mm / **Max:** 19 mm
At surface contact point. Measured between the extreme edges

3d. Rear wheel diameter
Min: 26 mm / **Max:** 34 mm
Measured to the extreme outer edges of each wheel

3e. Rear wheel width
Min: 15 mm / **Max:** 19 mm
At surface contact point. Measured between the extreme edges

3f. All four wheels must touch and roll on the racing surface at the same time.

3g. Wheel dimensions must be consistent with the whole diameter/circumference of the wheel.

3h. Teams may manufacture their own wheels as long as they meet specifications.

4. Wheel-to-Body Regulations

The wheels are not allowed to be inside the car body, and 100% of the wheel must be visible from the wheel's plane and side view.

4a. Front wheel visible *from the plane/side view*

4b. Rear wheel visible *from the plane/side view exclusive of rear wing/aerofoil*

5. Power Plant Regulations

The event organizers will provide all CO_2 for Regional, State, and National Championships. Cylinders will be matched for weight within 0.25 g.

5a. **CO_2 cartridge chamber diameter**
Min: 19.1 mm / **Max:** 19.9 mm

5b. Lowest point of chamber to the track surface
Min: 22.5 mm / **Max:** 30 mm
Measured from track surface to lowest surface of the CO_2 chamber.

5c. Depth of hole
Min: 50 mm / **Max:** 60 mm
For safety purposes, less than minimum will disqualify the car from racing.

5d. Wall thickness around cartridge
Min: 3.5 mm/max
A cylinder wall thickness less than the 3 mm of balsa at any point is a safety concern and will result in the judges disqualifying the car from racing. Pay careful attention to machined pockets for the aerofoils.

5e. No paint is allowed inside the chamber. Please seal off or protect the chamber while painting.

6. Tether Line Guide Regulations

6a. Each car must have two (2) screw eyes/plastic inserts/tether line guides firmly secured at the front and rear of the car body, running along the car body base centerline. The track tether line must pass through the screw eyes/plastic inserts.

6b. Tether line guides must not make contact with the racing surface.

6c. Inside diameter of screw eyes/plastic inserts
Min: 3.5 mm / **Max:** 5 mm
(Referring to the hole in the screw eye/plastic insert itself. Teams can make their own inserts if required).

6d. Distance apart (at furthest point)
Min: 120 mm / **Max:** 190 mm

6e. Glue may be used to secure the screw eyes/plastic inserts.

6f. Teams must make sure that the screw eye/plastic insert holes are tightly closed to prevent the tether line from slipping out of the screw eyes/plastic inserts. This should be done prior to registration at the event.

7. Aerofoil Regulations

7a. The design of the completed car should resemble an actual F1 car through inclusion of an aerofoil on the front nose of the car and an aerofoil on the rear of the car. To assist with scrutineering, the surface defining both the front and rear aerofoils could be painted in a different color from the rest of the car. The aerofoils must be clearly identified on the orthographic drawing.

7b. The front and rear aerofoil and their supporting structures may be machined or produced from a separate non-metallic material, e.g. ABS. This also applies to supporting structures. The car body must be manufactured from a single piece of balsa wood as referenced in rule 2h.

The front aerofoil and any part of the car forward of the vertical centerline of the front axle can be made from a separate non-metallic material.

7c. **Front / Rear Aerofoil Span**
Min: 40 mm / **Max:** 65 mm
Where the aerofoil is intersected by the car body, the span is the sum of the two parts, each measured from aerofoil tip to point of joining the car body and/or center of any fillet at this point. The measurement is made in the plane parallel to the track surface. The aerofoil's span must meet specifications on both its top and bottom surfaces.

7d. **Front / Rear Aerofoil Chord**
Min: 15 mm / **Max:** 25 mm
The aerofoil chord minimum/maximum dimensions must be within the dimensions that define the aerofoil span.

7e. **Front Aerofoil Thickness**
Min: 1.5 mm / **Max:** 12 mm
The aerofoil thickness minimum/maximum dimensions must be within the dimensions that define the aerofoil span and wing chord/width.

7f. **Rear Aerofoil Thickness**
Min: 1.5 mm / **Max:** 12 mm
The aerofoil thickness minimum/maximum dimensions must be within the dimensions that define the aerofoil span and aerofoil chord.

7g. The whole of the front aerofoil when viewed from the side must be in front of the vertical centerline of the front axle.

7h. The whole of the rear aerofoil when viewed from the side must be behind the vertical centerline of the rear axle.

7i. The bottom surface of the rear aerofoil must be higher than the highest point of the rear wheel when measured parallel to the track surface.

8. Car Repair Regulations

8a. No repair or maintenance on cars will be allowed after the entries have been placed in "Parc Ferme," without permission. Team members must be present during racing. This penalty can be applied to both time trials and reaction time racing.

8b. If an entry becomes damaged and the damage is determined by the officials to be related to engineering deficiencies, the car may be repaired or an identical backup car used. Any repair or change of car during racing for this reason will result in a single five (5) point penalty. This penalty is applied against total points awarded for the race event category and can only be incurred once. If the officials determine the damage is not related to engineering deficiencies, repairs or replacement with an identical backup car will be allowed without penalty.

8c. Damage incurred during a race (e.g. wheel, wing, screw eye, or any other part of the car separating from the entry), before the car crosses the finish line will result in a DNF race result.

8d. All damage issues and related decisions are to be decided by the race track officials/scrutineers and referred to the chair of judges if necessary.

9. Grievances

Any grievance issues must be lodged with the chair of judges by the time and date stated at the event. All grievances must be lodged in writing via the official grievance form available from the National Event Coordinators. The chair of judge's decision related to any grievance is final.

10. Race Regulations

10a. Race Procedures
At State/Regional Finals and National Championships there will be two (2) types of racing conducted.

1. Time Trials (Automatic Launch Mode)
2. Reaction-time Racing
   (Manual/Driver Launch Mode)

10b. Time Trials [70 Points]
These will be conducted over the course of the event as per the judging schedule. Team members need to be at the race track during their scheduled race times. The penalty for a team not being present during their scheduled race times will be a five (5) point penalty applied against total points awarded for that race event. Each car will be raced twice in each lane of the race track. The single fastest time recorded by each team during racing (Time Trials and Reaction Time Racing) will be used to determine the marks they are awarded for time trials, up to a maximum of 70 points.

10c. Reaction-time Racing [20 Points]
These races will be conducted over the course of the event as per the judging schedule. Team members need to be at the race track during their scheduled race times. The penalty for a team not being present during their scheduled race times will be a five (5) point penalty applied against total points awarded for that race event. Drivers will be permitted to practice during the race time at the discretion of the race marshal. Each car will be raced once in each lane of the race track. The single fastest total race time recorded (reaction time PLUS actual car start line to finish time) by each team will be used to determine the points they are awarded for reaction-time racing.

11. Event Scoring and Final Placement

The F1 in Schools Championship is scored on a 300-point scale. The following shows the number of points available in each category:

Specifications: 40 points
Time Trials: 70 points
Reaction-time racing: 20 points
Design Portfolio and Team Design: 70 points
Use of CAD, CAM, and ICT (Integrated Computer Technology): 20 points
Manufacturing Quality: 20 points
Oral Presentation: 60 points

Following are examples of the marking sheets that will be used by the judges. Raw scores will be scaled to the point values in the above chart for each judge. The judges' scores will be averaged to determine a team's score in a given category.

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10-09