Getting Thru’ Mechanical Tech Inspection

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This presentation has been placed under the “FH, FSAE, FS Training” tab on Mrs. Royce’s web site for scrutineers, at:

http://www.scrutineering.net

Notes:

• The files on the above web site have been created by Albion Associates, LLC, and are reference materials only.

• All official documents for Formula SAE are provided by SAE International and can be found at www.fsaeforums.com
Outline

- General
- Before the Competition
- Preparations at the Competition
- In Tech Inspection
  - Some things that can trip you up
- After Tech Inspection
Before the Competition

• Tech Inspection preparation starts NOW!!
• Ask rules questions well in advance
  - For FSAE, IC & Electric, send the RQA at www.fsaeonline.com
  - F Hybrid, Formula Student and FS Germany have own sites
• Get your SES in early
• Stay on schedule!
• Have the car inspected by a qualified non-team member
  - An SCCA tech inspector (or ASN equivalent)
  - A team alum
  - Use a Tech Form
• Run Noise Tests
  - Aim for a maximum of 100 dBC at idle and 107 dBC at the test speed for FSAE IC (107 dBA for Formula Hybrid)
• Do Brake Tests
Driver’s Equipment VE.3

• Check all your driver’s safety gear BEFORE leaving for the competition
  - Remove ALL non-compliant gear from your bag/box
  - Wash all socks, balaclavas and underwear
  - Wash or dry clean all driver’s suits
  - Make sure ALL the suits have the SFI or FIA labels
  - Repair any torn suits with Nomex thread
  - Make sure all shoes have the FIA or SFI labels
  - Do NOT bring DOT helmets to Tech
• Check that BOTH fire extinguishers show a full charge
• If going to an overseas competition, check their web site for different rules, e.g.
  - FS UK does not accept M or K helmets without prior permission
  - All FS competitions require Nomex underwear.
At the Competition

- Timetable for Tech Inspection
  - On the 1st “statics” day, and often the day or 1/2 day preceding that
- Tech Inspection order:
  - Different depends on the competition:
    - FSAE US – is based on a rules quiz
    - FSG – quiz, then order assigned
    - FS - send in completed Tech Form with photos, then assigned
  - So read the competition’s “Supplementary Regulations”
- The Tech Inspection Process
  - Officially Tech Inspection has 3 parts (5 pages of Tech Form for Michigan)
    - Scrutineering (Pages 1-4)
    - Tilt Test (Page 5)
    - Noise, Master Switch and Brake Test (Page 5)
- FSAE North and FSAE California could have differences
- FH & FSAE Electric exceptions, extra Elec. Pre-inspection before Mechanical Inspection
- FS UK exception, MSA Safety Scrutineers
At the Competition – Cont’d

Going into Tech Inspection

• You will need:
  - Your (blank) Tech Form (normally in the Registration packet)
  - The actual IA that was tested (unless using the Standard FSAE Impact Attenuator)(by Rule)

• You should also have:
  - Your Structural Equivalency Spreadsheet (SES) (On laptop)
  - Copy of your Impact Attenuator Report (FH and FS UK)
  - Copies of any rules questions sent in and the answers

• Don’t leave these back in the pit box or the trailer
At the Competition – Cont’d

- Going into Tech Inspection you will also need:
  - The car (mounted on its “dry” tires)
  - Rain tires (if you have them)
  - ALL the drivers’ equipment
    - Helmets
    - Suits
    - Shoes, socks
    - Gloves
    - Balaclavas
    - Arm restraints
  - Fire extinguishers (both)
  - Push bar
  - All the drivers (at some point)
  - Tools to remove the bodywork and the throttle body
At the Competition – Cont’d

• Fill out the top portion of the Tech Form on page 1 & 5 with
  – Engine information, (for Noise Test volunteer)
  – Tire information, Dry and Rain tires
  – Transponder number (if applicable)

• Bodywork on
At the Competition – Cont’d

- First impressions
- Going into Tech Inspection you will need:
  - A polite attitude
  - A neat and clean car
    - Wiring
  - Keep your Faculty Advisor away!
  - Don’t argue with the inspector(s)
    - Move argumentative team members out of the area
    - If you disagree intensely, get Team Captain to ask to speak to the Chief Tech Inspector
Tech Inspection - General

- Tech Inspection is:
  - A “no points” activity, but
  - Stressful
Tech Inspection - General

• The tech inspector’s/scrutineer’s job is to:
  – Get the car out onto the track in a not unsafe condition, as quickly as possible

• He/she does this by:
  – Checking that the car meets the FSAE/FS/FH Rules
Instructions to the Tech Inspectors

• FSAE, FS and FH are educational programs
• Students have put many hours into their cars
• Our job is to get the cars out onto the track in a safe condition
• Know the Rules
• 95% of Rules are safety rules
• When in doubt, discuss with your partner
• Still in doubt, consult the Rules, read the rule exactly
• Still in doubt, go to the intent of the Rule
• Still in doubt, talk to the Chief Tech Inspector
Instructions to the Tech Inspectors - Cont’d

• Teach but don’t preach

• Keep moving, don’t gossip, there are many cars

• Don’t loose your “cool”

• Don’t get into an argument with the Faculty Advisor – call the Chief Tech Inspector over

• Be gentle with the Restrictor Gauge – don’t ram it down hard!

• Be courteous
The Tech Inspection Process

- The process likely to be different at each competition
- FSAE California likely to follow 2019 FSAE Lincoln with “assembly-line” format.
- FSAE North?
- Formula Hybrid & FSAE Electric add an Electrical Tech pre-inspection and then a full Electrical Inspection, and a Rain Test
- FS UK is a little different
  - Separate sheets for Chassis, Safety, Technical, Electrical
  - Structural, Percy and template checks done first
  - And a separate MSA “safety” scrutinising check
- For FSAE Michigan:
  - Usually 2 person teams of inspectors
  - Pages 1 through page 6 of Tech Form
  - Bodywork off after the page 1 checks
Some Things to Trip You Up

• Some things, but not all! (There are plenty of others!)
• Going through in the order they show on the Michigan Tech Form
• In general, the numbering on the following slides is that used in the 2020 FSAE Rules.
D.3.5 Driver’s Equipment

• D.3.5.1 All Driver Equipment and Harness must be worn by the driver anytime in the cockpit with:
  a. (IC) Engine running or (EV) Tractive System Active
  b. Anytime between starting a Dynamic run and finishing or abandoning that Dynamic run.

• D.3.5.2 Removal of any Driver Equipment during a Dynamic event will result in Disqualification.
VE.3.2 Helmets

Helmet
A well-fitting, closed face helmet complying with:
- SFI 31.1/2005
- FIA 8860-2204, FIA 8860-2010, FIA 8860-2018 or FIA 8859-2015

And labeled as such.
Open faced or off-road/moto-cross helmets are not approved.

Notes:
• British Standards Institution BS 6658-85 type A/FR rating are no longer accepted.
• Snell M and K helmets only approved at FS with special permission. See event supps.
• 2020 is the last year for Snell 2005 helmets
Helmets - cont’d

ANNEXE C / APPENDIX C

MARQUAGE
MARKING

FIA Standard 8860-2004
Manufacturer: Helmet Inc
Model: ysomus
Size: 56

Taille minimum: 64x20 mm
Police de caractère: Arial Gras - taille:2.5mm
Logo FIA Sport: 17x18.5 mm (fichier image disponible sur demande)

Minimum dimensions 64x20 mm
Font: arial bold size 2.5mm
FIA Sport logo size 17x18.5 mm (image file available on request)

Figure 6. Positionnement de l’étiquette FIA sur le casque (sur l’arrière et en bas)
Figure 6. Location of the FIA label on the helmet (at the bottom back of the helmet)
VE.3.3 Driver’s Suits

A fire resistant **one piece suit**, made from a **minimum of two (2) layers**, that covers the body from the neck down to the ankles and the wrists.

The suit must be in good condition, i.e. it must have no tears or open seams, or oil stains that could compromise its fire resistant capability.

The suit must be certified to one of the following standards and be labeled as such:

- SFI 3-2A/5 (or higher)
- FIA 8856-1986
- FIA 8856-2000

Presenter’s Note: SFI 3-2A/1 (single layer) suits are no longer acceptable for FSAE or FS even with FR underwear. They are still OK for FH with FR underwear.
VE.3.3 Driver’s Equipment

VE.3.3.3 Balaclava
• Balaclava (head sock) which covers the driver’s head, hair and neck, made from Flame Resistant Material (See VE.3.1.2)

Note: The balaclava requirement applies to drivers of either gender, with any hair length.

VE.3.2.1.b Eye Protection
• An impact resistant helmet face shield, made from approved impact resistant materials supplied with approved helmets (see VE.3.2.2), i.e. No goggles.

VE.3.3.4 Socks
• Socks made from acceptable Fire Resistant material (as defined in VE.3.1.2) that cover the bare skin between the driver’s suit and the shoes.

Note: Socks must be Nomex or equivalent. Cotton or wool no longer acceptable.

No “socklets”, i.e. no bare skin!
Driver’s Equipment - cont’d

VE.3.3.5 Shoes
- Shoes or boots made from acceptable Flame Resistant material. The shoes must be certified to the standard and labeled as such.
  - SFI 3.3
  - FIA 8856-2000

VE.3.3.6 Gloves
- Gloves made from acceptable Flame Resistant material (as defined in VE.3.1.2).
- Gloves of all leather construction or Flame Resistant gloves constructed using leather palms with no insulating Flame Resistant material underneath are not acceptable.
VE.3.3.7 Arm Restraints

- Arm restraints are required and must be worn such that the driver can release them and exit the vehicle unassisted regardless of the vehicle’s position. **Arm restraints must be commercially manufactured.**

Note: Arm restraints certified to SFI standard 3.3 and labeled as such meet this requirement, although certification is not mandatory.
VE.3.3.2 Underclothing

- It is strongly recommended that all competitors wear flame resistant underwear (long pants and long sleeve t-shirt) under their approved driving suit.

Notes:

- This underwear should be made from acceptable flame resistant material as listed in VE.3.1.2 and should cover the driver's body completely from neck down to ankles and wrists.

- If you do not wear flame resistant underwear it is strongly recommended that you wear cotton underwear (t-shirt and long underpants) under your approved driving suit.

VE.3.1.2 Flame Resistant Material

- For the purpose of this section some, but not all, of the approved flame resistant materials are: Carbon X, Indura, Nomex, Polybenzimidazole (commonly known as PBI) and Proban.

VE.3.1.3 Synthetic Material – Prohibition

- T-shirts, socks or other undergarments (not to be confused with flame resistant underwear) made from nylon or any other synthetic material which will melt when exposed to high heat, are prohibited.
VE.2.3 Fire Extinguishers

• Each team must have a minimum of two (2) 2 lb dry chemical/dry powder fire extinguishers.

• The following are the minimum ratings, any of which are acceptable at any Formula SAE Series event:
  - USA, Canada & Brazil: 10BC or 1A 10BC (No 5BC!)
  - UK, Italy & Europe: 34B or 5A 34B
  - Australia: 20BE or 1A 10BE

• Extinguishers of larger capacity (higher numerical ratings) are acceptable.

• All extinguishers must be equipped with a manufacturer installed pressure/charge gauge. (And be at full charge)

• One extinguisher goes with the car and the other stays in the paddock.

• Both extinguishers are to be presented at Tech Inspection.

Note: Aqueous Film Forming Foam (AFFF) and Halon extinguishers and systems are prohibited at Formula SAE or Formula Student competitions.
VE.2.2 Push Bar

Push Bar

Each car must have a removable device that attaches to the rear of the car that allows two (2) people, standing erect behind the vehicle, to push the car around the event site.

This device must also be capable of decelerating, i.e. slowing and stopping the forward motion of the vehicle and pulling it rearwards.

It must be presented with the car at Technical Inspection.
VE.1.5 Transponder

• VE.1.5.1 Each vehicle must have a functional, properly mounted transponder of the specified type.

• VE.1.5.2 Vehicles without a transponder may not be allowed to compete in any event for which a transponder is used.

• VE.1.5.3 The approved transponder type(s) and mounting details will be provided on the FSAE Online Website or by the organizer.

Presenter’s note: The transponder location is usually given as “On the right hand side of the car, forward of the Front Roll Hoop with a clear view of the ground.”

For the US competitions, SAE is using RFID tags that are mounted on the left hand upright of the Main Roll Hoop. These are for identification and do NOT replace the MYLAPS transponder.
VE.1.5 Transponder Type & Mounting

Transponders – North American FSAE Competitions

Each team is responsible for having a functional, properly mounted transponder of the specified type on their vehicle. Vehicles without a specified transponder will not be allowed to compete in any event for which a transponder is used for timing and scoring.

Transponder Type

The usual types are MYLAPS Car/Bike Rechargeable or MYLAPS Car/Bike Direct Power transponder.

Note:

Except for their name, AMB TranX260 transponders are identical to MYLAPS Car/Bike Transponders and fully comply with this rule. If you own a functional AMB TranX260 it does not need to be replaced. The MX (orange) or X2 MX transponders used at the Baja SAE events will not work with the FSAE timing equipment.
Transponders - cont’d

Transponder mounting

The transponder mounting requirements are:

a. **Orientation** – The transponder must be mounted vertically and orientated so the number can be read “right-side up”.

b. **Location** – The transponder must be mounted on the driver’s right side of the car forward of the front roll hoop. The transponder must be no more than 60 cm (24 in) above the track.

c. **Obstructions** – There must be an open, unobstructed line between the antenna on the bottom of the transponder and the ground. **Metal and carbon fiber may interrupt the transponder signal.** The signal will normally transmit through fiberglass and plastic. If the signal will be obstructed by metal or carbon fiber, a 10.2 cm (4 in) diameter opening can be cut, the transponder mounted flush with the opening, and the opening covered with a material transparent to the signal.

d. **Protection** – Mount the transponder where it will be protected from obstacles.
VE.1.1 Car Numbers

Car numbers must appear on the vehicle as follows:

a. Locations: In three (3) locations: the **front** and **both sides**;

b. Height: At least 150 mm minimum

c. Font: **Block numbers** (i.e. sans-serif characters). **Italic, outline, serif, shadow, or cursive numbers are prohibited.**

d. **Stroke width and Spacing** between Numbers: 18 mm minimum.

e. Color: Either **white numbers on a black background** OR **black numbers on a white background**. (Except electrics)

f. Background shape: **round, oval, square or rectangular**.

g. 25 mm minimum between the edge of the numbers and the edge of the background.

h. Clear: The numbers **must not be obscured by parts of the car**, e.g. wheels, side pods, exhaust system, etc.
VE.1.1 Car Numbers - OK
VE.1.1 Car Numbers - Not OK
VE.1.2 School Name

Each car must clearly display the school name (or initials – if unique and generally recognized) in Roman characters at least 5.08cm, (2 inch) high on both sides of the vehicle.

The characters must be placed on a high contrast background in an easily visible location.

The school name may also appear in non-roman characters, but the roman character version must be uppermost on the sides.
VE.1.3 SAE Logo/Decal(s)

The SAE logo must be displayed on the front and/or both sides of the vehicle in a prominent location. SAE logo stickers will be provided to the teams on site.
VE.1.3 & VE.1.4 Sticker Spaces & Locations

- Technical inspection stickers will be placed on the upper nose of the vehicle. Cars must have a clear and unobstructed area at least 25 cm wide x 20 cm high (10” x 8”) on the upper front surface of the nose along the vehicle centerline.
- The SAE logo must be displayed on the front and/or both sides of the vehicle in a prominent location.
- SAE logo stickers will be provided to the teams on site.
VE.2.5 Cameras

- VE.2.5.1 The mounts for video/photographic cameras must be of a safe and secure design.

- VE.2.5.2 All camera installations must be approved at Technical Inspection.

- VE.2.5.3 Helmet mounted cameras and helmet camera mounts are prohibited.

- VE.2.5.4 The body of a camera or recording unit that weighs more than 0.25 kg must be secured at a minimum of two points on different sides of the camera body. (Typical Go-Pro cameras are less than 0.25 kg (9 oz.))

- VE.2.5.5 If a tether is used to restrain the camera, the tether length must be limited so that the camera cannot contact the driver

Presenter’s comment: Make sure that the helmet is not going to hit the camera mounts (especially those for a GoPro). If the driver rolls the car - the belts WILL stretch.
T.3.3 Brake Lights

- LED “tape” is becoming very common. It is sold in flexible strips as shown to the right.

- When LED lights are used without a diffuser, they may not be more than 20mm apart. If a single line of LEDs is used, the minimum length is 150mm. (This was enforced in 2014)

- It must be "red on black", a single, “rectangular, triangular or near round shape,” of 15 sq. cms min., on the centerline of the vehicle.
F.5.12 Other Side Tubes

- If there is a Roll Hoop Brace or other frame tube alongside the driver, at the height of the neck of any of the team’s drivers, a metal tube or piece of sheet metal must be firmly attached to the Frame

*This is intended to prevent the drivers’ shoulders from passing under the Roll Hoop Brace or frame tube, and the driver’s neck contacting this brace or tube.*
All vehicle controls, including the shifter, must be operated from inside the cockpit without any part of the driver, e.g. hands, arms or elbows, being outside the planes of the Side Impact Structure defined in F.6.4 and F.7.6.
T.1.4 Vehicle Controls - cont’d

All vehicle controls, including the shifter, must be operated from inside the cockpit without any part of the driver, e.g. hands, arms or elbows, being outside the planes of the Side Impact Structure defined in F.6.4 and F.7.6.
# Driver Checks

**FORMULA SAE - DRIVER COCKPIT CHECKS**

<table>
<thead>
<tr>
<th>Car #</th>
<th>University:</th>
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<tr>
<th>Driver's Name</th>
<th>Helmet Line</th>
<th>Head Rest Fore &amp; Aft</th>
<th>Head Rest-To Edges</th>
<th>Lap Belt</th>
<th>Shoulder Belts</th>
<th>Sub Belts</th>
<th>Egress</th>
<th>Inspector</th>
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- Helmet 50 mm (2 ins) min. below lines between Main & Front Hoops and between Main Hoop & rear attachment point of Main Hoop Bracing

- Head Restraint - Fore & aft, 25.4 mm (1 inch) max. to back of helmet.

- Head Restraint - Helmet contact point 50 mm minimum from any edge.

- Lap Belt - Over hip bones and tight.

- Shoulder Belts - 10 deg. up & 20 deg. down to horizontal and tight.

- Sub Belts - Tight.

- Less than 5 secs. "go" to BOTH feet on ground.
T.2.8 Head Restraint

The head restraint must:

• Be vertical or near vertical in side view.

• Be padded with an energy absorbing material that meets either SFI Standard 45.2, or is listed in the FIA Technical List No. 17 as a “Type B Material for single seater cars”, i.e. CONFOR foam CF-42 (pink) or CF-42M (pink). CF-42AC (pink) is acceptable.

• Have a minimum thickness of 38 mm (1.5 inches)

• Have a minimum width of 15 cms (6 inches)

• Have a minimum area of 235 sq. cms (36 sq, ins) AND have a minimum height adjustment of 17.5 cms (7 ins) OR have a minimum height of 28 cms (11 ins).

• Be covered with a thin, flexible material that contains a 20 mm diameter inspection hole in a surface other than the front surface. (New for 2020).
T.2.8 Head Restraint – Cont’d

T.2.8.4 The restraint must:
• Be located so that:
  - It is no more than 25 mm (1 inch) away from the back of the driver’s helmet in the uncompressed state, with the driver in his/her normal driving position.
  - The contact point of the back of the driver’s helmet on the head restraint is no less than 50 mm (2 inch) from any edge of the head restraint.

Notes:
(1) The head restraint must meet the above requirements for all drivers.
(2) Head restraints may be changed to accommodate different drivers (See IN.14.2.2)

Note: Head restraint on the right is NOT OK.
T.1.3 Foot & Toe Protection

T.1.3.1
The driver’s feet and legs must be completely contained within the Major Structure of the Frame.

T.1.3.2
While the driver’s feet are touching the pedals, in side and front views no part of the driver’s feet can extend above or outside of the Major Structure of the Frame.
V.1.1 Body & Styling

- V.1.1.1 Open Wheel vehicles must satisfy all of the following criteria:
  a. The top 180° of the wheels/tires must be unobstructed when viewed from vertically above the wheel.

  b. The wheels/tires must be unobstructed when viewed from the side.

  c. No part of the vehicle may enter a keep out zone defined by two lines extending vertically from positions 75 mm in front of and 75 mm behind, the outer diameter of the front and rear tires in the side view elevation of the vehicle, with tires steered straight ahead. This keep out zone will extend laterally from the outside plane of the wheel/tire to the inboard plane of the wheel/tire.
T.7.1.2 Front Bodywork

Sharp edges on the forward facing bodywork or other protruding components are prohibited.

All forward facing edges on the bodywork that could impact people, including the nose, must have forward facing radii of at least 38 mm (1.5 inches).

This minimum radius must extend to at least 45 degrees relative to the forward direction, along the top, sides and bottom of all affected edges.
All forward facing edges on the bodywork that could impact people, including the nose, must have forward facing radii of at least 38 mm (1.5 inches).

This minimum radius must extend to at least 45 degrees relative to the forward direction, along the top, sides and bottom of all affected edges.
VE.2.1 Jacking Point

Jacking Point
• A Jacking Point must be provided at the rear of the vehicle
• The Jacking Point must be:
  a. Capable of supporting the vehicle weight and of engaging the organizer Quick Jacks
  b. Visible to a person standing 1 m behind the vehicle
  c. Color: Orange
  d. Oriented horizontally and perpendicular to the centerline of the vehicle
  e. Made from round, 25 - 30 mm OD aluminum or steel tube
  f. Exposed around the lower 180° of its circumference over a minimum length of 280 mm
  g. Access from the rear of the tube must be unobstructed for at least 300 mm of its length
  h. The height of the tube must allow 75 mm minimum clearance from the bottom of the tube to the ground
  i. When the vehicle is raised to where the bottom of the tube is 200 mm above ground, the wheels do not touch the ground when they are in full rebound

Presenter’s Note: Parts “b” and “g” are because of the long (12 ins behind rear tires) undertrays.
Rear Jacking Point / Quickjack
VE.2.1 Jacking Point:
A Quick Jack will be present in the Tech garage - try to use it to lift the rear wheels off the ground, if concerned about the jacking point.
T.1.5 Seat - Not OK

T.1.5.1. Seat

a. In side view, the lowest point of the driver’s seat must be no lower than the \textbf{UPPER} surface of the lower frame rails or by having

b. A \textit{longitudinal tube} (or tubes) that meets the requirements for Side Impact tubing, passing underneath the lowest point of the seat.

\textbf{Note:} The smallest tube would be 1.00” OD X 0.065” wall
T.1.8 Firewall

- A firewall must separate the driver compartment from all components of the fuel supply, the engine oil, the liquid cooling systems, any lithium batteries and any high voltage system.
- It must extend sufficiently far upwards and/or rearwards such that any point less than 100 mm (4 ins.) above the bottom of the helmet of the tallest driver shall not be in direct line of sight with any part of the fuel system, the cooling system or the engine oil system.
- The firewall must be a non-permeable surface made from a rigid, non-flammable material.
T1.8 Firewall – Cont’d

- Any firewall must seal completely against the passage of fluids, especially at the sides and the floor of the cockpit.

- Pass-throughs for wiring, cables, etc. are allowable if grommets are used to seal the pass-throughs.

- Multiple panels may be used to form the firewall but must be sealed at the joints.

- Seat belts must not pass through the firewall.
T.1.3 Driver’s Leg Protection

• To keep the driver’s legs away from moving or sharp components,

• T.1.3.3 All moving suspension and steering components, and other sharp edges inside the cockpit between the front roll hoop and a vertical plane 100 mm (4 inches) rearward of the pedals, must be shielded with a shield made of a solid material.

• Moving components include, but are not limited to springs, shock absorbers, rocker arms, anti-roll/sway bars, steering racks and steering column CV joints.

• T.1.3.4 Covers over suspension and steering components must be removable to allow inspection of the mounting points.
F.8.6 Non-Crushable Objects

For 2017, this was expanded to separate the requirements inside and outside the primary structure.

• **F.8.6.1 Now reads:**

“All non-crushable objects (such as batteries, master cylinders, hydraulic reservoirs) inside the primary structure must have 25 mm (1”) clearance to the rear face of the Impact Attenuator Anti-Intrusion Plate.”

This 25mm minimum clearance inside the primary structure is to account for the allowable anti-intrusion plate deflection.

• **F.8.6.2 covers how a front wing must be accounted for in the IA test and the IAD Report (now part of the SES for FSAE).**
T.3.2 Brake Overtravel Switch

T.3.2.2 The BOTS must be a mechanical, single pole, single throw switch (push-pull or flip type).
V.4.1 - Wheel Mounting

• V.4.1.2 Any wheel mounting system that uses a single retaining nut must incorporate a device to retain the nut and the wheel in the event that the nut loosens. A second nut (“jam nut”) does not meet these requirements.

• V.4.1.3 Teams using modified lug bolts or custom designs will be required to provide proof that good engineering practices have been followed in their design. (Standard wheel lug bolts are considered engineered fasteners and any modification will be subject to extra scrutiny during technical inspection.)

• V.4.1.4 If used, aluminum wheel nuts must be hard anodized and in pristine condition.
T.2.2 Belts - General

T.2.2 Harness Requirements
The vehicle must use a 5, 6 or 7 point restraint harness meeting the at least one of the following specifications:

- The belts must have the original manufacturer’s labels showing the specification and expiration date.
- The harness must be within the year of expiration shown on the labels. Harnesses expiring on or before Dec 31 of the competition year are permitted.
- SFI belts now have “good through” dates showing 2 years after the date of manufacture (or Dec. 31st of the 2nd year).
- The harness must be in new or like new condition, with no signs of wear, cuts, chaffing or other issues.
- All harness hardware must be threaded in accordance with manufacturer’s instructions.
- All harness hardware must be used as received from the manufacturer. No modification (including drilling, cutting, grinding, etc) is permitted.
T.2.3 Harness Requirements

- T.2.3.1 Vehicles with a Reclined Driving Position must have:
  a. A 6 point or 7 point harness
  b. Anti submarine belts with tilt lock adjusters ("quick adjusters")
     OR two sets of anti submarine belts installed.

- T.2.3.2 All lap belts must incorporate a tilt lock adjuster ("quick adjuster").
  (To accommodate drivers of differing builds.)
  Lap belts with "pull-up" adjusters are recommended over "pull-down" adjusters.
T.2.2 Belts - General

5 point Harness

6 point Harness
A tilt-lock adjuster must not to be confused with a 3-bar adjuster.
Belts - “Quick Adjusters”, Tilt-Lock Adjusters or “Zip Adjusters”

Tilt-lock on Lap or Shoulder Belt

Tilt locks on Sub-belts
Driver’s Harness & Mounting

• T.2.4.4.b. Where a single shear tab is welded to the chassis, the tab to tube welding must be on both sides of the base of the tab.

Note: Double shear attachments are preferred. (Where possible) the tabs and brackets for double shear mounts should also be welded on both sides.

• T.2.4.3.c. The bracket or tab must be aligned such that it is not put in bending when that portion of the harness is put under load.

• T.2.5.2 The lap belts must NOT be routed over the sides of the seat. The belts must come through the seat at the bottom of the sides of the seat to maximize the wrap of the pelvic surface and continue in a straight line to the anchorage point. (Was “should” in both cases).
Harness Mounting Bolts

- T.2.5.8 Any bolt used to attach a lap belt, either directly to the chassis or to an intermediate bracket, is a Critical Fastener, ..., with a minimum diameter that is the smaller of:
  - The bolt diameter specified by the manufacturer
  - 10mm or 3/8 inch

- T.2.6.3 Any bolt used to attach a shoulder harness belt, either directly to the chassis or to an intermediate bracket is a Critical Fastener, ..., with a minimum diameter that is the smaller of:
  - The bolt diameter specified by the manufacturer
  - 10mm or 3/8 inch

- T.2.7.4 Any bolt used to attach an anti-submarine belt, either directly to the chassis or to an intermediate bracket, is a Critical Fastener, ..., with a minimum diameter that is the smaller of:
  - The bolt diameter specified by the manufacturer
  - 8mm or 5/16 inch
T.2.5.4 Lap Belt Mounting

To fit drivers of differing statures correctly, “in side view, the lap belt must be capable of pivoting freely by using either a shouldered bolt or an eye bolt attachment”, i.e. mounting lap belts by wrapping them around a frame tube is not acceptable.”
T.2.7 Sub-Belt Mounting

T.2.7.1 The anti-submarine belt of a 5-point harness must be mounted in line with, or angled slightly forward (up to twenty degrees (20°)) of, the driver’s chest-groin line.

T.2.7.2 The anti-submarine belts of a 6-point harness must be mounted either:
   a. With the belts going vertically down from the groin, or angled up to twenty degrees (20°) rearwards. The anchorage points should be approximately 100 mm (4 inches) apart. Or
   b. With the anchorage points on the Primary Structure at or near the lap belt anchorages, the driver sitting on the anti-submarine belts, and the belts coming up around the groin to the release buckle.

"Must" was “should” for 2019.
T.2.7.1 The anti-submarine belt of a 5-point harness must be mounted in line with, or angled slightly forward (up to twenty degrees (20°)) of, the driver’s chest-groin line.
T.2.7.2 Sub-Belt Mounting, 6 Point

The anti-submarine belts of a 6-point harness **must** be mounted either:

a. With the belts going vertically down from the groin, or angled up to twenty degrees (20°) rearwards. The anchorage points should be approximately 100 mm (4 inches) apart. Or
b. With the anchorage points on the Primary Structure at or near the lap belt anchorages, the driver sitting on the anti-submarine belts, and the belts coming up around the groin to the release buckle.
T.2.7.3 Sub-Belt Mounting
2018 Rules Change

All anti-submarine belts must be installed so that they go in a straight line from the anchorage point(s) without touching any hole in the seat or any other intermediate structure until they reach:

- Either the harness release buckle for the 5-point mounting per T.2.7.1,
- Or the first point where the belts touch the driver’s body for the 6-point mounting per T.2.7.2.
V.3.2.7 Steering

Joints between all components attaching the steering wheel to the steering rack must be mechanical and be visible at Tech Inspection. Bonded joints without a mechanical backup are not permitted.

No bonded joints
V.3.3.4 Steering Wheels

Not OK

OK
T.8 Fasteners - FSAE

T.8.2.2 All Critical Fasteners must be one of the following:
- Hex head
- Hexagonal recessed drive (Socket Head Cap Screws or Allen screws/bolts)

“Critical Fasteners” include those used in:
  a) Primary Structure attachments
  b) Impact attenuator attachment
  c) Driver’s harness attachment
  d) Steering system
  e) Brake system
  f) Suspension system
  g) Intake manifold attachment
  h) Fuel rail attachment
T11.1.2 Fasteners - FH

T11.1.2 The use of button head cap, countersunk head, pan head, flat head or round head screws or bolts in ANY location in the following systems is prohibited:

a) Driver's cell structure
b) Impact attenuator attachment
c) Driver’s harness attachment
d) Steering system
e) Brake system
f) Suspension system

Note; Hexagonal recessed drive screws or bolts (sometimes called Socket head cap screws or Allen screws/bolts) are permitted.
T.8.3 Securing Fasteners

• Loose jam nuts
• Positive locking
  - Since the 2015 Rules, the securing system must be:
    1. Be visible to team members AND tech inspectors
    2. Does not rely on clamping force
T.8.2 & T.8.3 Securing Fasteners

All critical bolt, nuts, and other fasteners on the steering, braking, driver’s harness, and suspension must be secured from unintentional loosening by the use of positive locking mechanisms. Positive locking mechanisms are defined as those that:

a. The Tech Inspectors (and the team members) are able to see that the device/system is in place, i.e. it is visible.

b. The “positive locking mechanism” does not rely on the clamping force to apply the “locking” or anti-vibration feature. In other words, if it loosens a bit, it still prevents the nut or bolt coming completely loose.

Positive locking mechanisms include:

a. Correctly installed safety wiring.

b. Cotter pins.

c. Nylon lock nuts (Except in high temperature locations where nylon could fail, approximately 80 degrees Celsius or above).

d. Prevailing torque nuts.

NOTE: Lock washers, bolts with nylon patches and thread locking compounds, e.g. Loctite, DO NOT meet the positive locking requirements.
T.8.3 Securing Fasteners - Safety Wire
T.8.3 Securing Fasteners - Safety Wire

Good examples
All spherical rod ends on the steering or suspension must be in double shear or captured by having a screw/bolt head or washer with an O.D. that is larger than spherical bearing housing I.D.

Adjustable tie-rod ends must be constrained with a jam nut to prevent loosening.
Positive Locking - Examples
IC.1.2 Air Intake and Fuel System Rollover Protection

All parts of the engine air and fuel control, delivery and storage systems (including the throttle or carburetor, and the complete air intake system, including the air cleaner and any air boxes) must lie within the Tire Surface Envelope, F.1.1.m, as shown below.
IC.1.2 Air Intake & Fuel System Rollover Protection - cont’d

All parts of the engine air and fuel control, delivery and storage systems (including the throttle or carburetor, and the complete air intake system, including the air cleaner and any air boxes) must lie within the Tire Surface Envelope, F.1.1.m, as shown below.
IC.2.2.2 Intake System Impact Protection

- Any portion of the air intake system that is less than 350 mm above the ground must be shielded from side and rear impacts by structure built per F.6.4/F.7.6 as applicable.
IC.2.3.1 Intake Manifold Attachment

Not OK

**Intake Manifold** – The intake manifold must be securely attached to the engine block or cylinder head with **brackets and mechanical fasteners**. Hose clamps, plastic ties, or safety wires do not meet this requirement. The use of rubber bushings or hose is acceptable for creating and sealing air passages, but is not considered a structural attachment.

NOTE: These fasteners are considered “critical fasteners”, and must have “positive locking” per T.10.
IC.3.3.2 Throttle Return Springs

• The throttle actuation system must use at least two return springs located at the throttle body, so that the failure of any component of the throttle system will not prevent the throttle returning to the closed position.

• Throttle Position Sensors (TPS) are NOT acceptable as return springs.
T.5.4, T.5.5 and IC.2.6 System Sealing & Catch Cans

- T.5.4.1 Any cooling or lubrication system must be sealed to prevent leakage.

- T.5.5.1 Separate catch cans must be employed to retain fluids from any vents for the coolant system or the crankcase or engine lubrication system. Each catch-can must have a minimum volume of ten (10) percent of the fluid being contained or 0.9 liter (one U.S. quart) whichever is greater.

- T.5.5.3 Catch cans must be:
  a. Capable of containing boiling water without deformation,
  b. Located rearwards of the firewall below driver’s shoulder level,
  c. Positively retained, i.e. no tie-wraps or tape.

- T5.5.4 Any catch can on the cooling system must vent through a hose with a minimum internal diameter of 3 mm (1/8 inch) down to the bottom levels of the Frame.

- IC.2.6 Any crankcase or engine lubrication vent lines routed to the intake system must be connected upstream of the intake system restrictor.
T.5.4 Bellypans, Etc.

- T.5.4.3 Flammable liquid leaks must not be allowed to accumulate.

- T.5.4.4 At least 2 holes, each of a minimum diameter of 25 mm, must be provided in the lowest part of the structure or belly pan in such a way as to prevent accumulation of volatile liquids and/or vapors.

- T.5.4.5 Absorbent material and open collection devices (regardless of material) are prohibited in compartments containing engine, drivetrain, exhaust and fuel systems below the highest point on the exhaust system.
IC.7.2.4 Header Wrap

- Use of any fibrous/absorbent material, (such as header wrap), on the outside of an exhaust manifold or exhaust system is prohibited.
T.5.2 - Drivetrain Shields & Guards

- T.5.2.1 Exposed high-speed final drivetrain equipment such as Continuously Variable Transmissions (CVTs), sprockets, gears, pulleys, torque converters, clutches, belt drives and clutch drives, must be fitted with scatter shields in case of failure.

- T.5.2.2 The final drivetrain shield must:
  a. Be made with solid material (not perforated)
  b. Cover the chain or belt from the drive sprocket to the driven sprocket/chain wheel/belt or pulley.
  c. Start and end parallel to the lowest point of the chain wheel/belt/pulley. (See figure).

- T.5.2.3 Body panels or other existing covers are not acceptable unless constructed per T.5.2.5/T.5.2.6.

- T.5.2.6 If equipped, the engine drive sprocket cover may be used as part of the scatter shield system.
T.6.1 Gas Cylinders

T.6.1 Compressed Gas Cylinders and Lines
Any system on the vehicle that uses a compressed gas as an actuating medium must meet the following:

T.6.1.2 Cylinder Certification - The gas cylinder/tank must be commercially manufactured, certified by an accredited testing laboratory, and labeled or stamped appropriately.

T.6.1.3 Pressure Regulation - The pressure regulator must be mounted directly onto the gas cylinder/tank.

T.6.1.4 Protection – The gas cylinder/tank and lines must be protected from rollover, collision from any direction, or damage resulting from the failure of rotating equipment.

T.6.1.5 Cylinder Location - The gas cylinder/tank and the pressure regulator must be:
   a. Located either rearward of the Main Hoop and within the Primary Structure Envelope aft of the Main Hoop, or in a structural side-pod
   b. Located outside the cockpit.
   c. Protected by structure that meets F.6.4/F/7.6

T.6.1.6 Cylinder Mounting - The gas cylinder/tank must be securely mounted to the Frame, engine or transmission.

T.6.1.7 Cylinder Axis - The axis of the gas cylinder/tank must not point at the driver.

T.6.1.8 Insulation - The gas cylinder/tank must be insulated from any heat sources, such as the exhaust system.
IC.5.7 & IC.6.1. Fuel Lines for LPI Systems

**Fuel Lines** – Any Low Pressure (< 10 Bar) flexible fuel lines must be either:

- Metal braided hose with either crimped-on or reusable, threaded fittings, or
- Reinforced rubber hose with some form of abrasion resistant protection.

Presenter’s Note: Even with fuel line clamps per IC.5.8.4.b, hose clamps over metal braided hose will not be accepted.
IC.5.7.4 Rubber Fuel Lines

If rubber fuel line or hose is used, the components over which the hose is clamped must have annular bulb or barbed fittings to retain the hose.

Also, clamps specifically designed for fuel lines must be used. These clamps have three (3) important features,
- a full 360 deg. wrap,
- a nut and bolt system for tightening, and
- rolled edges to prevent the clamp cutting into the hose.

Worm-gear type hose clamps are NOT approved for use on any fuel line.
Things to Trip You Up - Fuel Lines

- Plastic Fuel Fittings
  - Plastic fuel lines between the tank and the engine ARE prohibited per IC.5.7.3
  - Plastic fuel FITTINGS are not specifically prohibited
  - But don’t!!

- Plastic Fuel Rails, IC.6.1.2
  - Student designed & built plastic or carbon fiber fuel rails are prohibited
  - Plastic OEM fuel rails ARE allowed if unmodified

- “Quick Connect” Fuel Line Connectors
  - Not specifically prohibited by rule,
  - Except possibly by IC.5.7.3 and IC.6.1.1
  - But are NOT suitable for FSAE usage
  - So, don’t use!
IC.5.4 Fuel Tank Filler Neck & Sight Tube

All fuel tanks must have a filler neck:
- Minimum \textbf{35 mm (1.375 inches)} inner diameter at any point between the tank and the fuel filler cap,

- The portion next to the Filler Cap must be:
  a. minimum of 125 mm (4.9 inches) vertical height above the top level of the tank
  b. Angled at no more than 30 degrees from the vertical.

- The Filler Neck must be accompanied by a clear, fuel resistant sight tube for reading the fuel level with.
  a. Visible vertical height 125 mm min.
  b. A minimum inside diameter of 6 mm (0.25 inches).
  c. The sight tube must not run below the top surface of the fuel tank.

A clear filler tube may be used, subject to approval by the Rules Committee or technical inspectors at the event.
IC.5.4 Fuel Tank Sight Tube & Filler Cap

- IC.5.4.5 Fuel Level Line - A permanent, non movable fuel level line must be located between 12 mm and 25 mm below the top of the visible portion of the sight tube.  
  This line will be used as the fill line for the Tilt Test, and before and after the Endurance Test to measure the amount of fuel used during the Endurance Event.

- IC.5.4.6 The sight tube and fuel level line must be clearly visible to two individuals (one to fill the tank, the other to visually verify fill) without the need of assistance (artificial lighting, magnifiers, etc) or the need to remove any parts (body panels, etc).

- IC.5.4.7 The individual filling the tank must have complete direct access to the filler neck opening with a standard two gallon gas can assembly.

- IC.5.4.8 The filler neck must have a fuel cap that can withstand severe vibrations or high pressures such as could occur during a vehicle rollover event.
IC.5.4 Fuel Tank Filler Neck & Sight Tube - OK
IC.5.4 Fuel Tank Filler Neck & Sight Tube - cont’ d

Not OK
IC.5.4 Fuel Tank Filler Neck & Sight Tube - cont’d
**IC.6.1.2.c Fuel Rail Attachment**

**Fuel Rail** – The fuel rail must be securely attached to the engine cylinder block, cylinder head, or intake manifold with brackets and mechanical fasteners. Hose clamps, plastic ties, or safety wires do not meet these requirements.

*Note: These fasteners are considered “critical fasteners”, and require “positive locking” per Article 10.*
Things to Trip You Up
- Electrical
Low Voltage Batteries

• Battery Attachment
  - Per T.9.1.1, “Must be attached securely to the frame.”
  - Normal interpretation – metal hold down, no bungees!

• T.9.1.2 All low voltage batteries must have overcurrent protection that trips at or below the maximum specified discharge current of the cells.

• “Hot” (ungrounded) terminal must be insulated, T.9.1.3

• T.9.1.4 Any wet cell battery located in the driver compartment must be enclosed in a nonconductive marine type container or equivalent.
Things to Trip You Up
T.9.1 Low Voltage Batteries

T.9.1.5 Battery packs based on Lithium Chemistry:
  a. Must have a rigid, sturdy and fire resistant casing.
  b. Must be separated from the driver by a firewall as specified in T.1.8

T.9.1.6 All batteries using chemistries other than lead acid must be presented at technical inspection with markings identifying it for comparison to a datasheet or other documentation proving the pack and supporting electronics meet all rules requirements.
T.7.2.3 & T.8.2 Aero Device Stability & Strength

• T.7.2.3 All aerodynamic devices must be designed such that the mounting system provides adequate rigidity in the static condition and such that the aerodynamic devices do not oscillate or move excessively when the vehicle is moving.

• IN.8.2 In Technical Inspection this may be checked by pushing on the aerodynamic devices in any direction and at any point.

The following is guidance as to how this rule will be applied but actual conformance will be up to technical inspectors at the respective competitions. The intent is to reduce the likelihood of wings detaching from cars.

• If any deflection is significant, then a force of approximately 200N (45-50 lbs.f) may be applied and the resulting deflection should not be more than 25mm and any permanent deflection less than 5mm.

• If any vehicle on track is observed to have large, uncontrolled movements of aerodynamic devices, then officials may Black Flag the car for re-inspection.
T.7.2.3 & T.8.2 Aero Devise Stability & Strength

Wings must not wobble around.
IN.8.2 Aerodynamic Device Stability

Comment from FSAE Michigan Chief Scrutineer

If any deflection is significant, a force of approximately 200N (45-50 lbs.f) can be applied and the resulting deflection should not be more than 25mm and any permanent deflection less than 5mm.

This was a new requirement for 2015, intended to reduce the occurrence of wings coming loose during dynamic events.

Non-structural parts of the wings (end plates, outermost edges) single-finger-type forces can certainly damage the vehicle. But this is not what we are interested in – instead, we want to evaluate the robustness of the mounting system between the wing and the frame.

If the wing mounting system seem too flexible, get the chief scrutineer before using the above test.
T7.1.3 & GR.1.4 Edge Radii of Aero Devices

• T.7.1.3 - All **forward-facing** wing edges including wings, end plates, Gurney flaps, wicker bills, splitters and undertrays that could contact a pedestrian must have minimum edge radii of at least **5 mm (0.2 inch)** for all horizontal edges and **3mm (0.12 inches)** for vertical edges (end plates).

If the edges themselves do not meet this requirement, additional permanently attached pieces designed to meet this requirement must be used.

Note:
This means at least a **10 mm (3/8 inch)** or **6 mm (1/4 inch)** thick edges, respectively. Pushed-on pieces of split tube relying on friction for retention are not a satisfactory engineering method of achieving the radii.

Also:
• GR.1.4 Requires “Good Engineering Practices”. The sharp edges of the sides of undertrays and diffuser strakes need to be made “sneaker-proof”!
F.6.5.1 & F.6.5.2 Shoulder Harness Bar

- F.6.5.1 The Shoulder Harness Mounting Bar must:
  a. Be a single piece of uncut, continuous, closed section steel tubing that meets F.3.1.1.k.
  b. Attach to the Main Hoop on both sides of the chassis.
- F.6.5.2 Bent Shoulder Harness Mounting Bars must:
  a. Meet F.5.2.1 (radius of 3xOD) and F.5.2.2 (be smooth with no crimping or wall failure).
  b. Have bracing members attached at the bend(s) and to the Main Hoop.
- Material for this bracing must meet F.3.1.1 (1.00” x 0.047”),
- The included angle in side view between the Shoulder Harness Bar and the braces must be no less than 30 degrees.
F.5.10 Mechanically Attached Roll Hoop Bracing

F.5.10.4 All double lug joints, whether fitted at the top or bottom of the tube, must include a capping arrangement
F.5.3.2 Inspection Holes

F.5.3.2 Inspection Holes
• The Technical Inspectors may check the compliance of all tubes. This may be done by the use of ultra sonic testing or by the drilling of inspection holes at the inspector’s request.

Presenter’s comment:
We recommended that teams drill inspection holes in the Main and Front Hoops in case the ultra sonic equipment is not available or is malfunctioning.
Percy’s Placement - F.5.5.5

The bottom 200 mm circle will be placed on the seat bottom with the center of the circle ("Percy’s" hips and buttocks) no less than 915 mms (36 inches) from the rear face of the pedals in their most forward position.
T.1.1 Cockpit Opening Template

T.1.1.2 Cockpit Opening
The template will be held horizontally, parallel to the ground, and inserted vertically from a height above any Primary Structure or bodywork that is between the Front Hoop and the Main Hoop until it:

a. Has passed below the top bar of the Side Impact Structure
b. Is 320 mm (13.8 inches) above the lowest point of the upper surface of the floor for monocoque designs, F.7.6.1.

T.1.1.3 Fore and aft translation of the template is permitted during insertion.

T.1.1.4 During this test:

a. The steering wheel, steering column, seat and all padding may be removed.

b. The shifter or shift mechanism may not be removed unless it is integral with the steering wheel and is removed with the steering wheel.

c. The firewall must not be moved or removed.

b. The shifter or shift mechanism may not be removed unless it is integral with the steering wheel and is removed with the steering wheel.

c. The firewall must not be moved or removed.

d. Cables, wires, hoses, tubes, etc. must not impede the template.

During inspection, the steering column, for practical purposes, will not be removed. The template may be maneuvered around the steering column shaft, but not the steering column supports.
T.1.2 Cockpit Templates-cont’d

T1.2.1 Cockpit Internal Cross-Section
A free vertical cross section to allow the template shown to pass through must be maintained through the cockpit.

T1.2.2 Conduct of the Test
a. The template will be held vertically and inserted into the cockpit opening rearward of the rearmost portion of the steering column.
b. The template will then be passed horizontally through the cockpit to a point 100 mm rearwards of the face of the rearmost pedal when in the inoperative position.

c. If the pedals are adjustable, they must be in their most forward position.
d. The steering wheel may be removed.
e. Padding may be removed if it can be easily removed without the use of tools with the driver in the seat.
f. The seat and any seat insert(s) that may be used must remain in the cockpit.
g. Cables, wires, hoses, tubes, etc. must not impede the template.
T.1.1, T1.2 & IN.7 Cockpit Templates

- New starting locations for the templates from 2017 –
  - Above any Primary Structure or bodywork between the Front Hoop and the Main Hoop for the Cockpit Opening template, and
  - Rearwards of the steering column for the Cockpit Internal Cross Section

Failing the templates OR Percy means no Tech Sticker and no competing in the dynamic events!

Do NOT design line-to-line to the templates. Frames twist during welding, and there are things like wires, cables and brake lines that have to be routed past the Front Hoop.
IN.1.7 Visible Access

Visible Access

All items on the Inspection Form must be clearly visible to the technical inspectors without using instruments such as endoscopes or mirrors. Visible access can be provided by removing body panels or by providing removable access panels.

Note: This example is the reason for the Rule! Bad visibility.
# Driver Checks

**FORMULA SAE - DRIVER COCKPIT CHECKS**

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<tr>
<th>Driver’s Name</th>
<th>Helmet Line.</th>
<th>Head Rest Fore &amp; Aft</th>
<th>Head Rest To Edges</th>
<th>Lap Belt</th>
<th>Shoulder Belts</th>
<th>Sub Belts</th>
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- Helmet 50 mm (2 ins) min. below lines between Main & Front Hoops and between Main Hoop & rear attachment point of Main Hoop Bracing.
- Head Restraint - Fore & aft, 25.4 mm (1 inch) max. to back of helmet.
- Head Restraint - Helmet contact point 50 mm minimum from any edge.
- Lap Belt - Over hip bones and tight.
- Shoulder Belts - 10 deg. up & 20 deg. down to horizontal and tight.
- Sub Belts - Tight.
- Less than 5 secs. “go” to BOTH feet on ground.
After Scrutineering - Tilt Test – IN.9

45 degrees for Fluid Leaks

60 degrees for Stability
After Scrutineering – IC Cars
Noise Test IN.10

• Noise Test
  – Simple test
  – Test speeds at:
    o [link](https://www.sae.org/binaries/content/assets/cm/content/attended/2018/student-events/fsae/michigan/noise-test-speeds-2015.pdf)
      - Properly tuned exhaust does not rob power
    – Get inexpensive meter and have it calibrated
    – No ambient corrections
    – Aim for max. of 100 dBC at idle and 107 dBC at the test speed.

• IN.10.2.3 & IN.10.2.4 Noise Test – Restrictions on active or adjustable tuning devices.
After Scrutineering – Cont’d

- Check of the Master Switch, at a higher engine speed, not just at idle. Done at or immediately after Noise Test (IN.10.7)

- IC.8.4.2 – Alternator field wire *must* be cut by master switch.

- Brake Test
  - Very high stresses on car.
  - Known to break suspensions!
  - Must test before going to Competition!!
After Scrutineering – Electric Cars Ready–to–Drive Sound

• Both FSAE Electric (EV.7.12) and Formula Hybrid (EV.9.2) mandate that, when the car is about to move, it emits a “distinctive sound”:
  - That is between 1000 and 3500 Hz
  - That lasts for between 1 and 3 seconds
  - With a minimum sound level of 80 dBA

• FSAE says “fast weighting”
• FH says “at 3 places at a 2 meters radius from the emitter”

• Aim for a minimum of 83 dBA!
Summary, Do’s and Don’ts

• Do start NOW!
• Do have all team members look at our web site at:
  – www.scrutineering.net
• Do have your car inspected by a qualified outside party well before the Competition
• Do test, test, test!
• Do including brake, noise and master switch tests!
• Do think safety ALL the time!
• Don’t miss your dates
Questions?
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