FORMULA SAE & FORMULA STUDENT TECHNICAL INSPECTION/SCRUTINEERING

PART 5
ENGINE COMPARTMENT
FUEL SYSTEM
& ELECTRICAL

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IC1.1 Engines

Engine Limitation

• The engine(s) used to power the car must be a piston engine(s) using a four-stroke primary heat cycle with a displacement not exceeding 710 cc per cycle.

• Hybrid powertrains, such as those using electric motors running off stored energy, are prohibited.

Note: All waste/rejected heat from the primary heat cycle may be used. The method of conversion is not limited to the four-stroke cycle.
IC1.7 Turbochargers & Superchargers

- Turbochargers and superchargers are permitted.
- The restrictor must be placed upstream of the compressor and the throttle body must be placed downstream of the compressor. Thus, the only sequence allowed is restrictor, compressor, throttle body, engine as described in IC1.6.1 (b).
- The intake air may be cooled with an intercooler (a charge air cooler). Only ambient air may be used to remove heat from the intercooler system. Air-to-air and water-to-air intercoolers are permitted. The coolant of a water-to-air intercooler system must comply with Rule T8.1.
- If an intercooler/aftercooler is used, it must be located downstream of the throttle body.
- If pop-off valves, recirculation valves, or heat exchangers (intercoolers) are used, they may only be positioned in the intake system as shown in IC1.6.1 Figure 2.
- Plenums anywhere upstream of the throttle body are prohibited. For the purpose of definition, a “plenum” is any tank or volume that is a significant enlargement of the normal intake runner system.
- The maximum allowable ID of the intake runner system between the restrictor and throttle body is 60 mm diameter, or the equivalent area (i.e. 2827 mm^2) if non-circular.
IC1.7 Turbochargers & Superchargers - Cont’d
IC1.4.1 Air Intake System Rollover Protection

All parts of the engine air and fuel control systems (including the throttle or carburetor, and the complete air intake system, including the air cleaner and any air boxes) must lie within the surface defined by the top of the roll bar and the outside edge of the four tires (see figure 13).
Air Intake & Fuel System Rollover Protection - cont’d

All parts of the fuel storage and supply system, and all parts of the engine air and fuel control systems (including the throttle or carburetor, and the complete air intake system, including the air cleaner and any air boxes) must lie within the surface defined by the top of the roll bar and the outside edge of the four tires (see figure 13).
Air Intake & Fuel System Rollover Protection - cont’d

All parts of the fuel storage and supply system, and all parts of the engine air and fuel control systems (including the throttle or carburetor, and the complete air intake system, including the air cleaner and any air boxes) must lie within the surface defined by the top of the roll bar and the outside edge of the four tires (see figure 13).
IC1.4.2 Air Intake System Protection - Not OK

Any portion of the air intake system that is less than 350 mm (13.8 inches) above the ground must be protected by the same rules in Side Impact Structure built to T3.24 or T3.33 as applicable.
IC1.4.2 Air Intake Side Protection - Cont’d

OK

Not OK
IC1.5.4 Throttle Return Springs-TPS

• The throttle actuation system must use at least two (2) 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.

• Note: Throttle Position Sensors (TPS) are NOT acceptable as return springs.
IC1.6 Intake Restrictor

• The restrictor size is:
  – 20.0 mm for gasoline cars
  – 19.0 mm for E-85 fueled cars.

• For naturally aspirated engines, the sequence MUST be:
  – Atmosphere, throttle body, restrictor and then the engine.

• For turbocharged or supercharged engines, the sequence MUST be:
  – Atmosphere, restrictor, turbo or supercharger, throttle body and engine.

Presenter’s notes:
• Rotate the gauge to make sure the restrictor is not oval.
• Be gentle with the restrictor gauge, especially if the restrictor is “plastic”.
IC1.4.3 & IC1.4.4 Intake Systems

IC1.4.3 Intake Manifold

• The intake manifold must be securely attached to the engine block or cylinder head with brackets and mechanical fasteners.

• This precludes the use of hose clamps, plastic ties, or safety wires. The use of rubber bushings or hose is acceptable for creating and sealing air passages, but is not considered a structural attachment.

IC1.4.4 Intake Systems

• Intake systems with significant mass or cantilever from the cylinder head must be supported to prevent stress to the intake system.

• Supports to the engine must be rigid.

• Supports to the frame or chassis must incorporate some isolation to allow for engine movement and chassis flex.

Note: The fasteners attaching the intake manifold are now considered “critical fasteners” and must have positive locking. This often requires safety wiring them.
IC1.4.3 Intake Manifold Attachment

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

Since 2015: intake manifold fasteners are considered “critical” and therefore require positive locking mechanisms!
Fuel Rail – The fuel rail must be securely attached to the engine cylinder block, cylinder head, or intake manifold with brackets and mechanical fasteners. This precludes the use of hose clamps, plastic ties, or safety wire.

**Since 2015: fuel rail fasteners are considered “critical” and therefore require positive locking mechanisms!**
High Pressure Hydraulic Pumps and Lines

- The driver and anyone standing outside the car must be shielded from any hydraulic pumps and lines with line pressures of 2100 kPa (300 psi) or higher. The shields must be steel or aluminum with a minimum thickness of 1 mm (0.039 inch).

- Brake lines are not classified as “hydraulic pump lines” and are excluded from T10.2.

Presenter’s note:
- This rule applies where there is a hydraulic pump with a reservoir such as a hydraulic wheel motor. It does not apply to hydraulic brake or clutch lines.
IC3.1 Exhaust System

- IC3.1.2 The exhaust outlet(s) must not extend more than 45 cm (17.7 inches) behind the centerline of the rear axle, and shall be no more than 60 cm (23.6 inches) above the ground.

- IC3.1.3 Any exhaust components (headers, mufflers, etc.) that protrude from the side of the body in front of the main roll hoop must be shielded to prevent contact by persons approaching the car or a driver exiting the car.

- IC3.1.4 The application of fibrous/absorbent material, e.g. “header wrap”, to the outside of an exhaust manifold or exhaust system is prohibited.
IC3.1.3 Exhaust Shielding Alongside Driver- OK

Exhaust Outlet

Any exhaust components (headers, mufflers, etc.) that protrude from the side of the body in front of the main roll hoop must be shielded to prevent contact by persons approaching the car or a driver exiting the car.
T8.4 Drivetrain Shields & Guards

- 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.

- The final drivetrain shield must cover the chain or belt from the drive sprocket to the driven sprocket/chain wheel/belt or pulley.

- The final drivetrain shield must end parallel to the lowest point of the chain wheel/belt/pulley. (See figure). Body panels or other existing covers are not acceptable unless constructed from approved materials per <>.

Comments: Scatter shields are intended to contain drivetrain parts which might separate from the car.

Watch out for brake lines crossing under the chain. They need protection.
T8.4 Drivetrain Shields & Guards - Cont’d

- Perforated material may not be used for the construction of scatter shields.
- Chain Drive - Scatter shields for chains must be made of at least 2.66 mm (0.105 inch) steel (no alternatives are allowed), and have a minimum width equal to three (3) times the width of the chain.
- The guard must be centered on the center line of the chain and remain aligned with the chain under all conditions.
- Non-metallic Belt Drive - Scatter shields for belts must be made from at least 3.0 mm (0.120 inch) Aluminum Alloy 6061-T6, and have a minimum width that is equal to 1.7 times the width of the belt.
- The guard must be centered on the center line of the belt and remain aligned with the belt under all conditions.
- Attachment Fasteners - All fasteners attaching scatter shields and guards must be a minimum 6mm grade M8, or stronger (1/4 inch SAE grade 5).
- Finger Guards – Finger guards are required to cover any drivetrain parts that spin while the car is stationary with the engine running. Finger guards may be made of lighter material, sufficient to resist finger forces. Mesh or perforated material may be used but must prevent the passage of a 12 mm (1/2 inch) diameter object through the guard.

Comment: Finger guards are intended to prevent finger intrusion into rotating equipment while the vehicle is at rest.
T8.2 System Sealing & Catch Tanks

System Sealing

• The engine and transmission must be sealed to prevent leakage.

• **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.

• Catch cans must be capable of containing boiling water without deformation, and be located rearwards of the firewall below driver’s shoulder level, and be positively retained, i.e. no tie-wraps or tape.

• 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.

• Any crankcase or engine lubrication vent lines routed to the intake system must be connected upstream of the intake system restrictor.

• Crankcase breathers that pass through the oil catch tank(s) to exhaust systems, or vacuum devices that connect directly to the exhaust system, are prohibited.

Presenter’s comments:

• **Every** engine will require a catch can for its engine/crankcase breather. 1 per engine.

• Dry sump oil systems require a catch can on the breather of the oil tank.

• Water cooled engines need a catch can/overflow bottle.

• Differentials usually do not have vents, hence do not need a catch can.
T8.1 Coolant

Coolant Fluid Limitations

- Water-cooled engines must only use plain water. Glycol-based antifreeze, water wetter, water pump lubricants of any kind, or any other additives is strictly prohibited.

(At the competition.)
Compressed Gas Cylinders and Lines

• Any system on the vehicle that uses a compressed gas as an actuating medium must comply with the following requirements:

a. Working Gas-The working gas must be nonflammable, e.g. air, nitrogen, carbon dioxide.

b. Cylinder Certification- The gas cylinder/tank must be of proprietary manufacture, designed and built for the pressure being used, certified by an accredited testing laboratory in the country of its origin, and labeled or stamped appropriately.

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

h. Insulation- The gas cylinder/tank must be insulated from any heat sources, e.g. the exhaust system.

i. Lines and Fittings- The gas lines and fittings must be appropriate for the maximum possible operating pressure of the system.
T10.1 Compressed Gas Cyls & Lines - cont’d

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

e. Cylinder Location - The gas cylinder/tank and the pressure regulator must be located either rearward of the Main Roll Hoop and within the envelope defined by the Main Roll Hoop and the Frame, or in a structural side-pod that meets the requirements of T.3.24 or T3.33 side impact. It must not be located in the cockpit.

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

g. Cylinder Axis - The axis of the gas cylinder/tank must not point at the driver.
IC 2.4 Fuel Tanks

Fuel Tanks

• The fuel tank is defined as that part of the fuel containment device that is in contact with the fuel. It may be made of a rigid material or a flexible material.

• Fuel tanks made of a rigid material cannot be used to carry structural loads, e.g. from roll hoops, suspension, engine or gearbox mounts, and must be securely attached to the vehicle structure with mountings that allow some flexibility such that chassis flex cannot unintentionally load the fuel tank.

• Any fuel tank that is made from a flexible material, for example a bladder fuel cell or a bag tank, must be enclosed within a rigid fuel tank container which is securely attached to the vehicle structure. Fuel tank containers (containing a bladder fuel cell or bag tank) may be load carrying.

• Any size fuel tank may be used.

• The fuel system must have a provision for emptying the fuel tank if required.

• The fuel tank, by design, must not have a variable capacity.
IC2.5 Fuel System Rollover Protection

All parts of the **fuel storage and supply system** must lie within the surface defined by the top of the roll bar and the outside edge of the four tires (see figure 13).
IC 2.5 Fuel Tank Location

- All parts of the fuel storage and supply system must lie within the surface defined by the top of the roll bar and the outside edge of the four tires. (See Figure 13).
- In side view, no portion of the fuel system must (is allowed to) project below the lower surface of the frame or monocoque.
- All fuel tanks must be shielded from side or rear impact collisions. Any fuel tank which is located outside the Side Impact Structure must be shielded by structure built to T3.24 or T3.33, side impact structure.
- A firewall must be incorporated to separate the fuel tank from the driver, per Rule T4.5.
IC2.7.3 Belly pans

- Belly pans must be vented to prevent accumulation of fuel. At least 2 holes, each of a minimum diameter of 25 mm, must be provided in the lowest part of the structure in such a way as to prevent accumulation of volatile liquids and/or vapours.

Presenter’s note:
- A “belly pan” is defined as any panel that is under the fuel tank, fuel pumps or fuel lines that could accumulate fuel if there was a leak or from filling the fuel tank. Much as we dislike putting fuel down onto the track, we prefer that to happen instead of having it accumulate under the driver.
- If the car is a monocoque, it may require holes in the floor of the monocoque.
IC2.7.3 Belly pans must be vented to prevent accumulation of fuel.

But:
We need to avoid accumulation of oils also, which become a fire hazard especially near the exhaust headers.

For teams that have an undertray or under-engine bodywork panels, there must not be any absorbant or fibrous materials directly under the engine compartment.

Installing absorbent pads underneath the engine is appealing to teams because it reduces the visibility of oil leaks and associated DNF’s during Endurance. These pads are not acceptable, please look for them and reject them when found.
IC1.9.1 Fuel Injection Systems

Low Pressure Injection (LPI)
• Low pressure fuel injection systems are those functioning at a pressure below 10 Bar (145 psi). Most Port Fuel Injected (PFI) fuel systems are low pressure.

• (A) Fuel Lines – On low pressure fuel injected systems, any flexible fuel lines must be either (i) metal braided hose with either crimped-on or reusable, threaded fittings, or (ii) reinforced rubber hose with some form of abrasion resistant protection with fuel line clamps per IC1.8.2.

   Note: Hose clamps over metal braided hose will not be accepted.

• (B) Fuel Rail – The fuel rail must be securely attached to the engine cylinder block, cylinder head, or intake manifold with mechanical fasteners. This precludes the use of hose clamps, plastic ties, or safety wire.

• (C) Intake Manifold – On engines with port fuel injection, the intake manifold must be securely attached to the engine block or cylinder head.
IC1.9.1 Fuel Lines for LPI Systems

Fuel Lines – On low pressure fuel injected systems, any flexible fuel lines must be either

(i) Metal braided hose with either crimped-on or reusable, threaded fittings, or
(ii) Reinforced rubber hose with some form of abrasion resistant protection with fuel line clamps per IC1.8.2.

Note: Hose clamps over metal braided hose will not be accepted.
IC1.8.2 Fuel Lines - Non-Aeroquipt Type

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,

(i) a full 360 deg. wrap,
(ii) a nut and bolt system for tightening, and
(iii) rolled edges to prevent the clamp cutting into the hose. Worm-gear type hose clamps are not approved for use on any fuel line.
IC1.9.1 Fuel Lines & Fuel Rails

• Plastic Fuel Fittings
  - Plastic fuel lines ARE prohibited per IC1.8.1
  - Plastic fuel FITTINGS are not specifically prohibited, but should not be used. (Some fuel pumps have plastic fittings and are OK.)

• Plastic Fuel Rails IC1.9.1.b
  - Plastic fuel rails ARE allowed IF they are unmodified OEM.
  - Student designed & built plastic fuel rails are prohibited.

• “Quick Connect” Fuel Line Connectors
  - Not specifically prohibited by rule, except possibly by IC1.8.1 and IC1.9.1.a
  - But are subject to failure with repeated connections/disconnection and high vibration, hence are NOT suitable for FSAE/FS usage
Fuel Lines General

- Fuel lines and fittings are a “system”. Aeroquip hose goes with Aeroquip fittings, Goodridge hose with Goodridge fittings, and reinforced rubber hose with the fuel line clamps called out in in IC1.8.2. Systems should NOT be mixed.
- Fuel hose. Rubber fuel hose should be marked either:
  - SAE 30R9 (it is reinforced for LPI usage)
  - Or DIN 73379
  - Or ISO 19013
  - Or marked “For Fuel Injection”
- Note:
  - SAE J 30R6 and J 30R7 are for low pressures, e.g. for carburetors and NOT suitable between the fuel pump and injectors.
  - SAE J 30R10 is suitable where the hose is submerged in fuel, e.g. in the tank.
IC1.9.2 Fuel Injection Systems - cont’d

High Pressure Injection (HPI) / Direct Injection (DI)

- High pressure fuel systems are those functioning at 10 Bar (145 psi) pressure or above. Direct injection fuel systems are those where the injection occurs directly into the combustion system.

- DI systems often utilize a low pressure electric fuel pump and high pressure mechanical “boost” pump driven off the engine.

- The high pressure lines are those between the boost pump and injectors, and the low pressure lines lead from the electric supply pump up to the boost pump.
IC1.9.2 HPI/DI Systems - cont’d

• **(A) High Pressure Fuel Lines** – All high pressure fuel lines, normally those downstream of the high pressure pump on Direct Injection systems, must be stainless steel rigid line or Aeroquip FC807 smooth bore PTFE hose with stainless steel reinforcement and visible Nomex tracer yarn. Equivalent products may be used with prior Rules Committee approval. Use of elastomeric seals is prohibited.

• Lines must be rigidly connected every 100mm by mechanical fasteners to structural engine components such as cylinder heads or block.

• **(B) Low Pressure Fuel Lines** – Low pressure lines, normally those upstream of the high pressure pump, that are flexible must be either (i) metal braided hose with either crimped-on or reusable, threaded fittings, or (ii) reinforced rubber hose with some form of abrasion resistant protection with fuel line clamps per IC1.8.2.

**Note:** Hose clamps over metal braided hose will not be accepted.
IC1.9.2 HPI/DI Systems - cont’d

- **(C) Fuel Rail** – The fuel rail must be securely attached to the engine cylinder head with mechanical fasteners. This precludes the use of hose clamps, plastic ties, or safety wire. The fastening method must be sufficient to hold the fuel rail in place with the maximum regulated pressure acting on the injector internals and neglecting any assistance from in-cylinder pressure acting on the injector tip.

- **(D) High Pressure Fuel Pump** – The fuel pump must be rigidly mounted to structural engine components such as the cylinder head or engine block.

- **(E) Pressure Regulator** – A fuel pressure regulator must be fitted between the high and low pressure sides of the fuel system in parallel with the DI boost pump. The external regulator must be used even if the DI boost pump comes equipped with an internal regulator.

- **(F) Required Test** – Prior to the tilt test specified in T8.5, engines fitted with mechanically actuated fuel pumps must be run to fill and pressure the system downstream of the high pressure pump.
IC2.6 Fuel Tank Filler Neck & Sight Tube

- All fuel tanks must have a filler neck:
  - (a) at least **38 mm (1.5 inches)** inner diameter,
  - (b) at least **125 mm (4.9 inches)** vertical height and
  - c) angled at no more than 30 degrees from the vertical.

- The 125 mm of vertical height must be above the top level of the fuel tank, and must be accompanied by a clear, fuel resistant sight tube for reading the fuel level (Figure).

- The sight tube must have at least **125 mm (3 inches)** of vertical height and **a minimum inside diameter of 6 mm (0.25 inches)**. 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.
IC2.6.1, 2, 3 Fuel Filler

- Fuel filler must be within 30° of vertical
- Sight tube vertical span must be 4.9” minimum (was 3” in 2014)
IC 2.6 Tank Filler Neck & Sight Tube - OK
Fuel Tank Filler Neck & Sight Tube - cont’d

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Fuel Tank Filler Neck & Sight Tube - cont’d

Not OK
per IC2.6.4

Not OK
IC2.1 Fuel

Fuel

• The basic fuel available at competitions in the Formula SAE Series is unleaded gasoline with an octane rating of 93 (R+M)/2 (approximately 98 RON). However, the basic fuel may be changed at the discretion of the organizing body. Other fuels may be available at the discretion of the organizing body.

• **Note 2:** The fuels provided at Formula SAE Michigan and FSAE Lincoln are expected to be 93 and 100 octane (R+M)/2 gasoline and E-85. Fuel types are subject to change. Consult the individual competition websites for fuel types and other information.

Presenter’s note:

• The fuel at the USA competitions contains 10% ethanol. The fuel system components, e.g. pumps and lines, must be suitable for ethanol.
IC4.4 Batteries

- IC4.4.1 All batteries, i.e. on-board power supplies, must be attached securely to the frame.

- IC4.4.2 Any wet-cell battery located in the driver compartment must be enclosed in a nonconductive marine type container or equivalent.

- IC4.4.3 The hot (ungrounded) terminal must be insulated.

- “Hot” terminal insulated, IC4.4.3
  - FS UK also requires “ground wire” to be tagged with yellow tape.

Presenter’s note:
- Normal interpretation of IC4.4.1 is that a metal strap, e.g. a long hose clamp or clamps, is required. As a minimum, a nylon strap with a minimum width of ¾ inch (2 cms) and a buckle is needed. Holding the battery down with zip ties/cable ties or a bungee is NOT acceptable.
IC4.4-5 Batteries – Cont’d

IC4.4.4 Battery packs based on **Lithium Chemistry**:
  a. Must have overcurrent protection that trips at or below the maximum specified discharge current of the cells.
  b. Must have a rigid, sturdy and fire retardant casing.
  c. Must be separated from the driver by a firewall as specified in T4.5

IC4.4.5 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.
IC4.1 Master Switches

• IC4.1.1 The vehicle must be equipped with two (2) master switches which form part of the shutdown system.

• Actuating either switch must stop the engine.

• IC4.1.2 The international electrical symbol consisting of a red spark on a white-edged blue triangle must be affixed in close proximity to each switch.

• Any alternator field wire must also be disabled by each master switch to prevent any possible feedback through the field coil circuit.
IC4.2 Master Switch

- IC4.2.1 The primary master switch must:
  a. Be located on the (driver's) right side of the vehicle, in proximity to the Main Hoop, at shoulder height and be easily actuated from outside the car.
  
b. Disable power to **ALL** electrical circuits, including the battery, alternator, lights, fuel pump(s), ignition and electrical controls.
  c. All battery current must flow through this switch.
  d. Be of a rotary type and must be direct acting, i.e. it must not act through a relay.

Presenter’s note:
- Check this switch by listening for the fuel pump and checking that the brake light goes out when the switch is turned. This switch will be re-checked at Noise Test
IC4.2 Master Switch

• An example of a typical switch that meets these requirements is shown below.

• Per IC4.2.2 The master switches must be mounted so that the rotary axis of the key is near horizontal and across the car. The “ON” position of the switch must be in the horizontal position and must be marked accordingly. The “OFF” position of the primary master switch must also be clearly marked.
IC4.3 Cockpit Mounted Master Switch

- The cockpit-mounted master switch:
  a. Must be located to provide easy actuation by the driver in an emergency or panic situation.
  b. Must be located within easy reach of the belted-in driver, alongside the steering wheel, and unobstructed by the steering wheel or any other part of the car. It is suggested that it be placed on the same side of the steering wheel as the shifter mechanism.
  c. Must be a push/pull Emergency switch with a minimum diameter of 24 mm. The switch must be installed such that:
     i. From the ON position, pushing on the switch will disable power to the ignition and all fuel pumps, and
     ii. From the OFF position, pulling on the switch will enable power to the ignition and fuel pump(s). Switches that require a twist or twist and pull to enable power are acceptable.
  d. May act through a relay.

Presenter’s note: Check this switch by listening for the fuel pump.
IC4.5 Brake Over-travel Switch

- The Brake-Over-Travel-Switch forms part of the shutdown system and as defined in T7.3 must remove power from the engine and fuel pumps.
T7.3 & IC4.5 Brake Over-travel Switch

- **T7.3.4** Must be a mechanical, single pole, single throw switch, push-pull or flip type
- **IC4.5** The Brake-Over-Travel-Switch forms part of the shutdown system and as defined in T7.3 must remove power from the engine and fuel pumps.

Note: Have it set up so that there is about 1 cm clearance to the brake pedal with maximum force on the brake pedal, i.e. team’s biggest driver pushing as hard as he can!
T7.4 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 a **single**, “rectangular, triangular or near round shape,” on the centerline of the vehicle.