



# **The outline of 2019 rule amendment**

Rules, such as vehicles manufacture, technical inspection, and examination (static and dynamic), are based on the Formula SAE rule.

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- 2. Conformity of the 2018 rule**
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**1. The rule revise outline in 2019**

2. Conformity of the 2018 rule

3. An item with much indication (every year)

4. About Evidence

5. Vehicle Safety

# T.1.5 Suspension

## (2018) T6.1 Suspension

T6.1.1 The car must be equipped with a fully operational suspension system with shock absorbers, front and rear, with usable **wheel travel of at least 50.8 mm (2 inches), 25.4 mm (1 inch) jounce and 25.4 mm (1inch) rebound**, with driver seated.

Only total distance

## (2019) T.1.5 Suspension

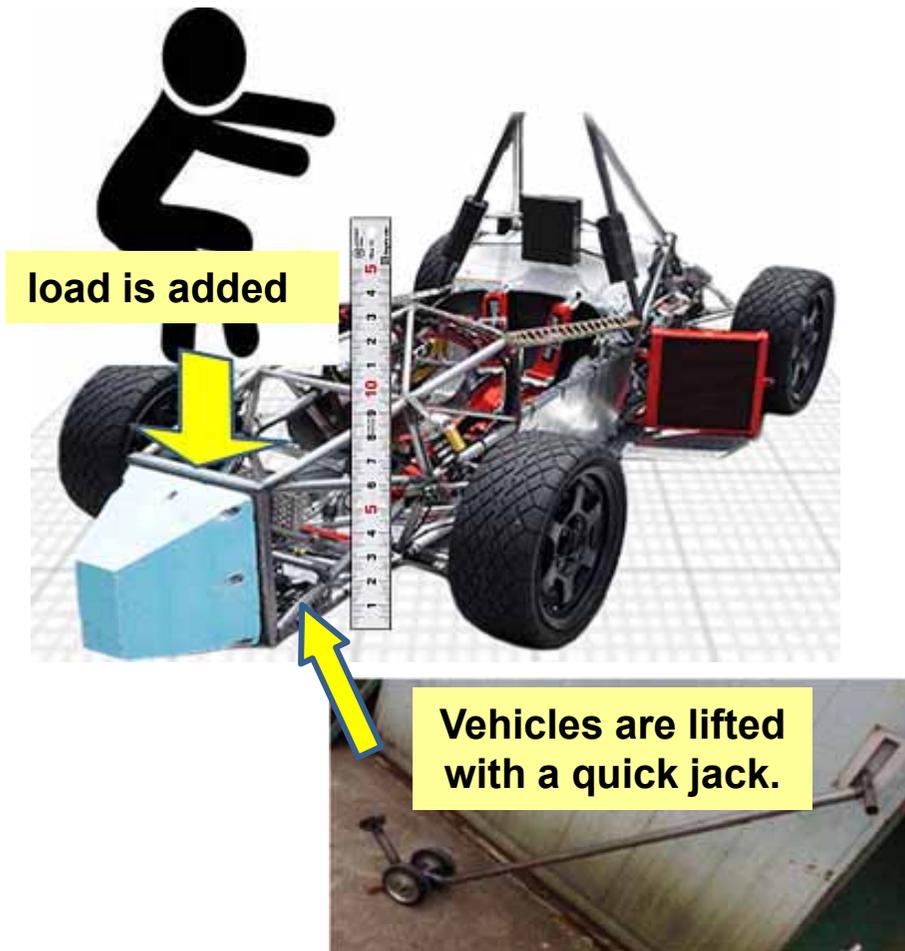
T.1.5.1 The vehicle must be equipped with a fully operational suspension system with shock absorbers, front and rear, with **usable wheel travel of at least 50 mm**, with a driver seated.

### The measuring method of a stroke

Jounce: As shown in a figure, load is added, and vehicles jounce is measured on a scale.

Rebound: Vehicles are lifted with a quick jack. Distance until a tire comes floating is measured.

About the additional load operation, we leave it to a team member.



# T.2.3 The Primary Structure

## (2018) T3.4.1 Baseline Steel Material

The Primary Structure of the car must be constructed of:

Either: Round, mild or alloy, **steel tubing (minimum 0.1% carbon)** of the minimum dimensions specified in the following table, Or: Approved alternatives per Rules T3.5, T3.6 and T3.7.

(2019) T.2.3.1 The Primary Structure must be constructed from one or a combination of the following:

- Baseline Tubing and Material
- Alternate Steel Tubing
- Alternative Tubing Materials
- Composite Material

**Expression of steel tubing (minimum 0.1% carbon) was deleted.**

## (2019) T.2.5 Baseline Tubing and Material

T.2.5.3 Properties for ANY steel material for calculations submitted in an SES must be:

a. Non Welded Properties for continuous material calculations:

Young's Modulus (E) = 200 GPa (29.0 ksi)

Yield Strength (Sy) = 305 MPa (44.2 ksi)

Ultimate Strength (Su) = 365 MPa (52.9 ksi)

**Tensile strength has no change.**

b. Welded Properties for discontinuous material such as joint calculations:

Yield Strength (Sy) = 180 MPa (26 ksi)

Ultimate Strength (Su) = 300 MPa (43.5 ksi)

**Use of steel tube STKM11A is permitted based on these rules.**

**J2019-02 is valid in only Japan.**

# T.2.5 Baseline Tubing and Material

## (2018) T3.4.1 Baseline Steel Material

ITEM or APPLICATION	OUTSIDE DIMENSION X WALL THICKNESS
Main & Front Hoops, Shoulder Harness Mounting Bar	Round 1.0 inch (25.4 mm) x 0.095 inch (2.4 mm) or Round 25.0 mm x 2.50 mm metric
Side Impact Structure, Front Bulkhead, Roll Hoop Bracing, Driver's Restraint Harness Attachment (except as noted above) EV: Accumulator Protection Structure	Round 1.0 inch (25.4 mm) x 0.065 inch (1.65 mm) or Round 25.0 mm x 1.75 mm metric or Round 25.4 mm x 1.60 mm metric or Square 1.00 inch x 1.00 inch x 0.047 inch or Square 25.0 mm x 25.0 mm x 1.20 mm metric
Front Bulkhead Support, Main Hoop Bracing Supports, Shoulder Harness Mounting Bar Bracing EV: Tractive System Components Protection	Round 1.0 inch (25.4 mm) x 0.047 inch (1.20 mm) or Round 25.0 mm x 1.5 mm metric or Round 26.0 mm x 1.2 mm

It was deleted from the list.

## (2019) T.2.5.1 Minimum Dimensions – Steel

T.2.5 Baseline Tubing and Material  
T.2.5.1 Minimum Dimensions – Steel Tubing

Application	Outside Diameter and Wall Thickness Options
Main Hoop, Front Hoop, Shoulder Harness Mounting Bar	Round 1.0 inch x 0.095 inch, Round 25.0 mm x 2.50 mm
Side Impact Structure, Front Bulkhead, Roll Hoop Bracing, Driver Restraint Harness Attachment (other than Shoulder Harness Mounting Bar), (EV) Accumulator Protection Structure	Round 1.0 inch x 0.065 inch, Round 25.0 mm x 1.75 mm, Square 1.0 inch x 1.0 inch x 0.047 inch, Square 25.0 mm x 25.0 mm x 1.20 mm
Front Bulkhead Support, Main Hoop Bracing Supports, Shoulder Harness Mounting Bar Bracing, (EV) Tractive System Component Protection	Round 1.0 inch x 0.047 inch, Round 25.0 mm x 1.5 mm
Bent Upper Side Impact Member	Round 1.375 inch x 0.047 inch Round 35.0 mm x 1.2 mm

φ25.4 t1.6 is OK.  
It has been issued at J2019-04.

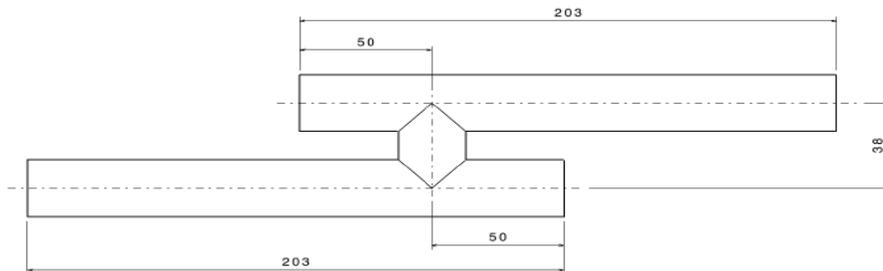
# T.2.6 Alternative Steel Tubing

## (2018) T3.6 Alternative Steel Tubing

**Do the physical test specified to T3.6.1-T3.6.4.**

Minimum Wall Thickness Allowed for teams satisfying physical testing requirements:

MATERIAL & APPLICATION	MINIMUM WALL THICKNESS
Steel Tubing for Front and Main Roll Hoops, and Shoulder Harness Mounting Bar	1.6 mm (0.065 inch)
Steel Tubing for Roll Hoop Bracing, Roll Hoop Bracing Supports, Side Impact Structure, Front Bulkhead, Front Bulkhead Support, Driver's Harness Attachment (except as noted above), Protection of HV accumulators, and protection of HV tractive systems	0.9 mm (0.035 inch)



- ✓ A physical test is unnecessary.
- ✓ The thickness of less than 1.2 mm is disregarded.
- ✓ Prove that it is equivalent at SES.

## (2019) T.2.6 Alternate Steel Tubing

**T.2.6.5 Any tubing with wall thickness less than 1.2 mm (0.047 inch) is not considered structural** and will be ignored when assessing compliance to any rule

**T.2.7.2** If any Alternative Materials are used, **the SES must include calculations demonstrating equivalent to** or better than the minimum requirements found in T.2.5 for yield and ultimate strengths in bending, buckling and tension, for buckling modulus and for energy dissipation.

*The Buckling Modulus is defined as  $EI$ , where,  $E$  = modulus of Elasticity, and  $I$  = area moment of inertia about the weakest axis.*

# T.2.9 Use of Composite Materials

(2018) T3.8.2 "Composite materials are not allowed for the Main Hoop or the Front Hoop." **This statement was deleted.**  
**However, the steel pipe is specified by each item.**

## (2019) T.2.9 Composite Materials

If any composite or other material is used, the team must:

- a. Present documentation of material type, (purchase receipt, shipping document or letter of donation) and the material properties.
- b. Submit details of the composite layup technique as well as the structural material used (cloth type, weight, and resin type, number of layers, core material, and skin material if metal).
- c. Submit calculations demonstrating equivalence of their composite structure to one of similar geometry made to the minimum requirements found in T.2.5. Equivalency calculations must be submitted for energy dissipation, yield and ultimate strengths in bending, buckling, and tension.



T.2.7.1 Alternative Materials may be used for areas other than the Main Hoop and Main Hoop Bracing.

T.2.11.1 The Main Hoop must be constructed of a single piece of uncut, continuous, closed section **steel tubing per T.2.5 Baseline Tubing OR T.2.6 Alternate Steel Tubing**

T.2.12.1 The Front Hoop must be constructed of closed section metal tubing per **T.2.5 Baseline Tubing OR T.2.6 Alternate Steel Tubing OR T.2.7 Alternative Tubing Materials**

# T.2.25 Impact Attenuator Data (IAD)

- (2019)** T.2.25.3 When using the standard Impact Attenuator, the IAD Report must meet the following:
- Test data will not be submitted
  - All other requirements of this section must be included.
  - Photos of the actual attenuator must be included
  - Evidence that the Standard IA meets the design criteria provided in the Standard Impact Attenuator specification must be appended to the report. This may be a receipt or packing slip from the supplier.

## **(Changing Point)**

- ✓ **Test data will not be submitted**
- ✓ **The format was changed into Excel.**

**[ The request from a Technical Inspection ]**

**A file name of 2019 is free.**

(2018) 087\_University of SAE\_FSAEM\_IAD.pdf



**2019: In order to prevent a judgment mistake, a file name recommends the following.**

***Car number \_ University name \_ IAD***

# IAD: No rule is changed.

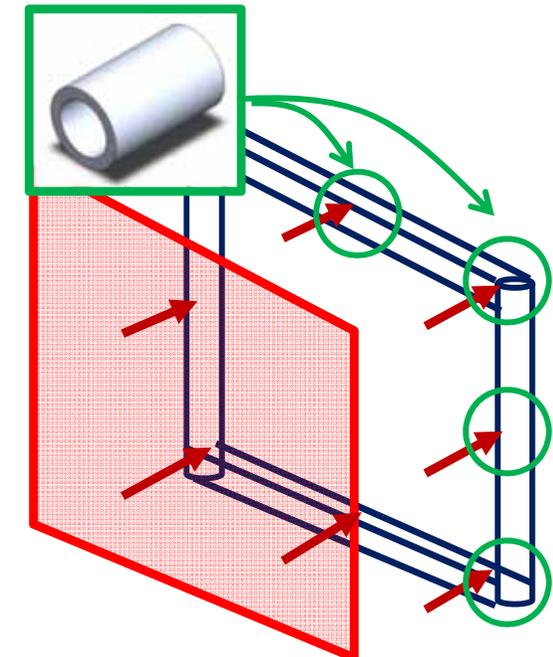
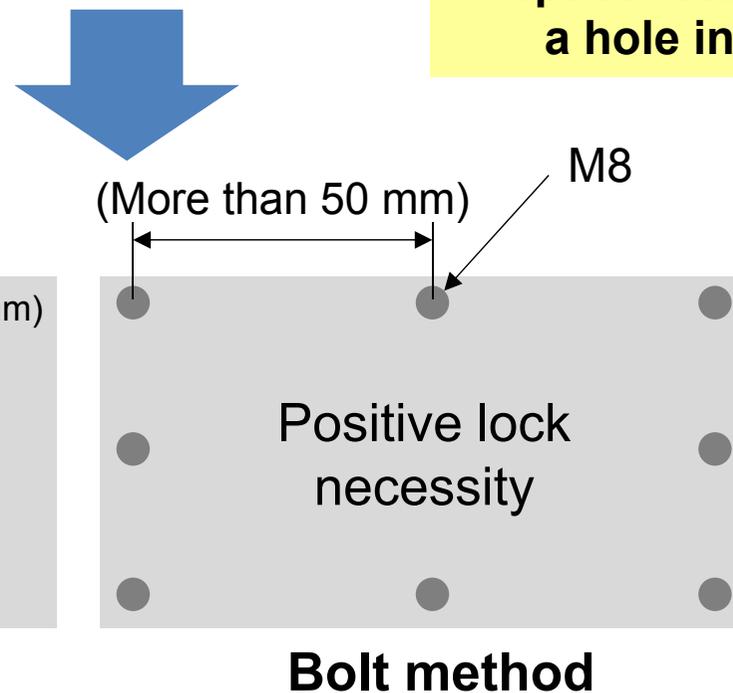
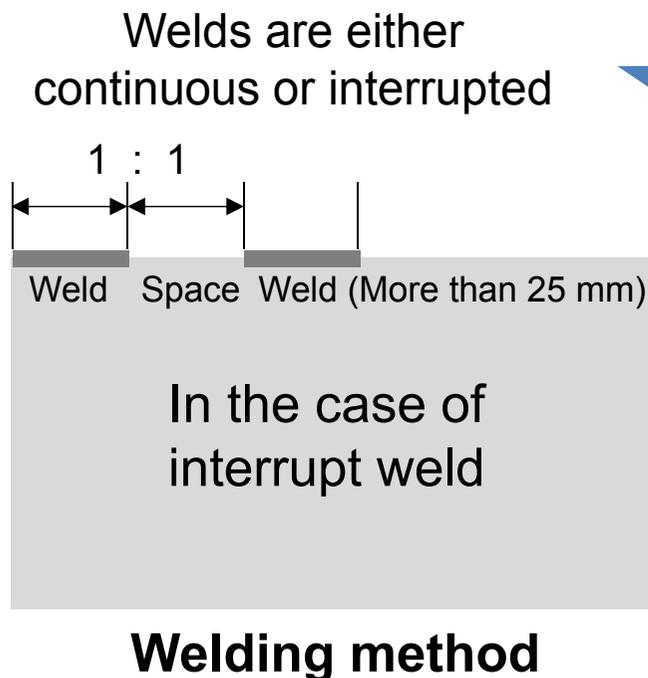
## The fixed method of a AIP and Bulk Head: Rule change is nothing.

(2019) T.2.22.3 For tube frame Front Bulkheads, the attachment of the Anti Intrusion Plate directly to the Front Bulkhead must be documented in the team's SES submission.

The accepted methods of attachment are:

- Welding, where the welds are either continuous or interrupted. **If interrupted, the weld/space ratio must be at least 1:1. All weld lengths must be greater than 25 mm.**
- Bolted joints, using no less than **eight 8 mm or 5/16"** minimum diameter **Critical Fasteners**, see **T.10.2 and T.10.3**. The distance between any two bolt centers must be at least 50 mm.

A spacer etc. are required, when making a hole in a Bulk Head and bolted.



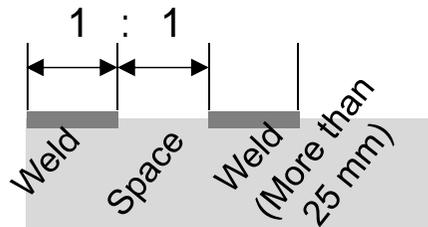
# IAD: No rule is changed.

## The fixed method of a IA and AIP: Rule change is nothing.

T.2.23.3 The attachment of the Impact Attenuator to the Anti Intrusion Plate must be documented in the IAD submission. The accepted methods of attachment are:

- Welding**, where the welds are either continuous or interrupted. If interrupted, the weld/space ratio must be at least 1:1. All weld lengths must be greater than 25 mm.
- Bolted joints**, using no less than four 8 mm or 5/16" minimum diameter Critical Fasteners, see T.10.2 and T.10.3, where the distance between any two bolt centers must be at least 50 mm. Foam IA's must not be solely attached by the bolted method.
- By the use of a structural adhesive.** The adhesive must be appropriate for use with both substrate types. The appropriate adhesive choice, substrate preparation, and the equivalency of this bonded joint to the bolted joint in T.2.23.3b above must be documented in the team's IAD report.

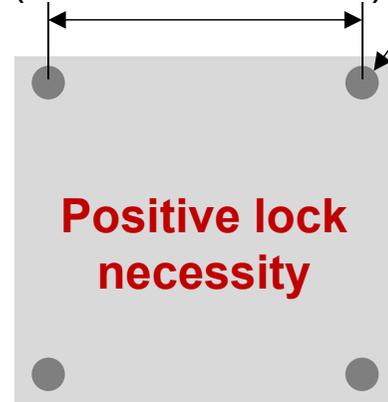
Welds are either continuous or interrupted



In the case of interrupt weld

**Welding method**

(More than 50 mm) M8



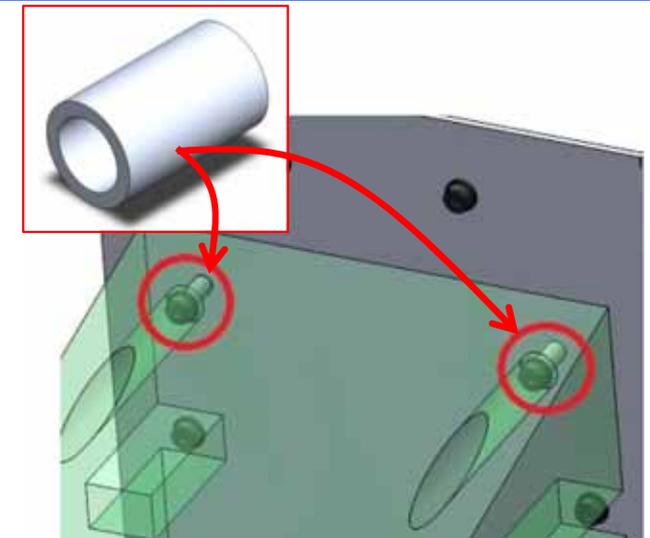
**Positive lock necessity**

**Bolt method**

**An equivalent proof with bolted is required.**

**Structural Adhesive**

**A spacer etc. are required, when making a hole in a Standard IA and bolted.**



# Cautions : STD Impact Attenuator

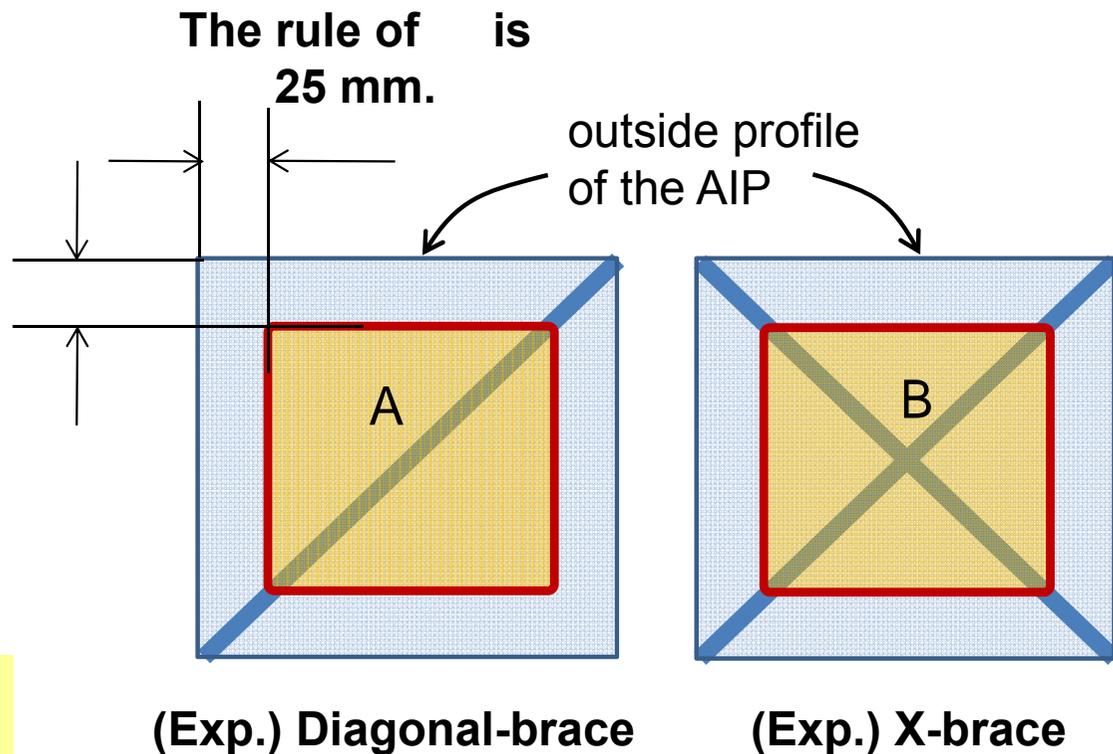
**T.2.23.4 If a team uses the Standard Impact Attenuator, and the outside profile of the Anti Intrusion Plate extends beyond the Standard Impact Attenuator by more than 25 mm on any side, then one of the following must be met:**

- The Front Bulkhead must include a diagonal or X-brace meeting the requirements for a Front Bulkhead Support tube per T.2.5, or an approved equivalent per T.2.6 OR T.2.7, must be included in the Front Bulkhead.
- Physical testing must be performed to prove that the Anti Intrusion Plate does not permanently deflect more than 25 mm.

**No more than 25mm  
-> it is NG.**



**Be careful of size change  
by deterioration.**



# T.2.31 Monocoque Laminate Testing

**A test condition and an item are the same last year.**

**The sample submission by technical inspection was exempted.**

## T.2.31 Monocoque Laminate Testing

### T.2.31.1 Primary Structure Laminates

Teams must build representative test panels for each ply schedule used in the regulated regions of the monocoque as a flat panel and perform a 3 point bending test on these panels.

**a. Test panels must:**

- Measure 275 mm x 500 mm
- Be supported by a span distance of 400 mm
- Have equal surface area for the top and bottom skin.
- Have bare edges, without skin material.

**b. The SES must include:**

- Data from the 3 point bending tests
- Pictures of the test samples
- A picture of the test sample and test setup showing a measurement documenting the supported span distance used in the SES.

**A test condition and an item are the same 2018.**

**c. Test panel results must be** used to derive stiffness, yield strength, ultimate strength and absorbed energy properties by the SES formula for the purpose of calculating laminate panels equivalency corresponding to Primary Structure regions of the chassis.

**d. Test panel results for the Side Impact Laminate must** show by calculation, using the embedded SES formula, equivalence to two (2) Side Impact tubes (T.2.5) tested per T.2.31.2 below, for buckling modulus, ultimate strength and absorbed energy.

# T.5.1.7 Braking Systems Protect

**If brake piping passes along the bottom of a chain, T.5.1.7 will be applied.**

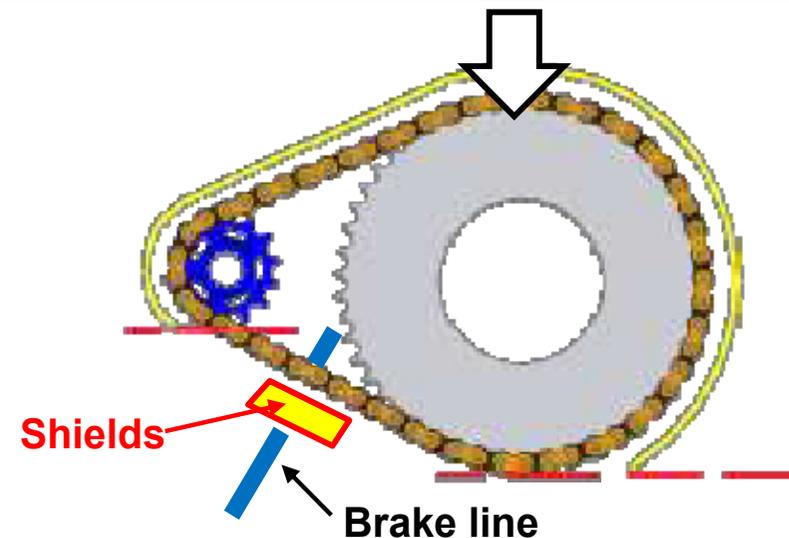
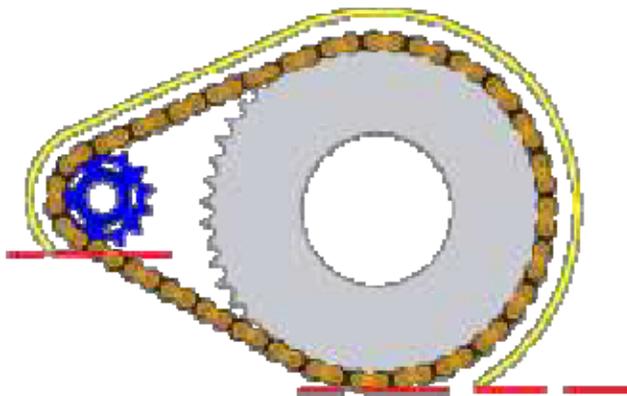
**(2019) T.5.1.7** The braking systems must be protected with scatter shields from failure of the drive train (see T.7.2) or from minor collisions.

**The following is applied to a shield.**

T.7.2.5 Chain Drive - Scatter shields for chains must:

- Be made of 2.66 mm (0.105 inch) minimum thickness steel (no alternatives are allowed)
- Have a minimum width equal to three times the width of the chain
- Be centered on the center line of the chain and
- Remain aligned with the chain under all conditions

**A brake line passes under a chain.  
The same shield is required above the brake line.**



# T.7.2.7 Attachment Fasteners

**The regulation of scatter shields and guards was changed severely.**

## **(2019) T.7.2.7 Attachment Fasteners –**

**All fasteners attaching scatter shields and guards must be 6mm or 1/4” minimum diameter**

**Critical Fasteners, see T.10.2 and T.10.3**

## **T.10.2 Critical Fastener Requirements**

**T.10.2.1** Any Critical Fastener must meet, at minimum, one of the following:

- a. SAE Grade 5
- b. Metric Grade 8.8
- c. AN/MS Specifications

**T.10.2.2** All Critical Fasteners must be one of the following:

- Hex head
- Hexagonal recessed drive (Socket Head Cap Screws or Allen screws/bolts)

**T.10.2.3** All Critical Fasteners must be secured from unintentional loosening by the use of Positive Locking Mechanisms.

**T.10.2.4** Some Critical Fastener applications have additional requirements that are provided in the applicable section.

## **T.10.3 Positive Locking Mechanisms**

**T.10.3.1** Positive Locking Mechanisms are defined as those which:

- a. The Technical Inspectors (and the team members) are able to see that the device/system is in place (visible).
- b. The Positive Locking Mechanism does not rely on the clamping force to apply the locking or anti vibration feature.

(If it loosens a bit, it still prevents the nut or bolt coming completely loose)

**T.10.3.2** Acceptable Positive Locking Mechanisms include:

- a. Correctly installed safety wiring
- b. Cotter pins
- c. Nylon lock nuts (where temperature does not exceed 80 ° C)
- d. Prevailing torque lock nuts

*Lock washers, bolts with nylon patches and thread locking compounds (Loctite®), DO NOT meet the positive locking requirement.*

# T.9 Aerodynamic Device

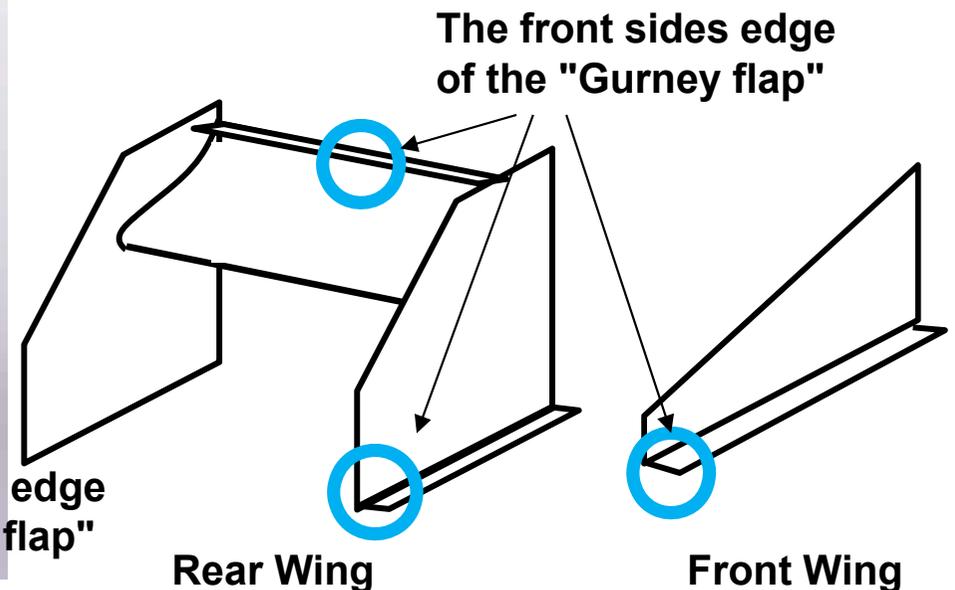
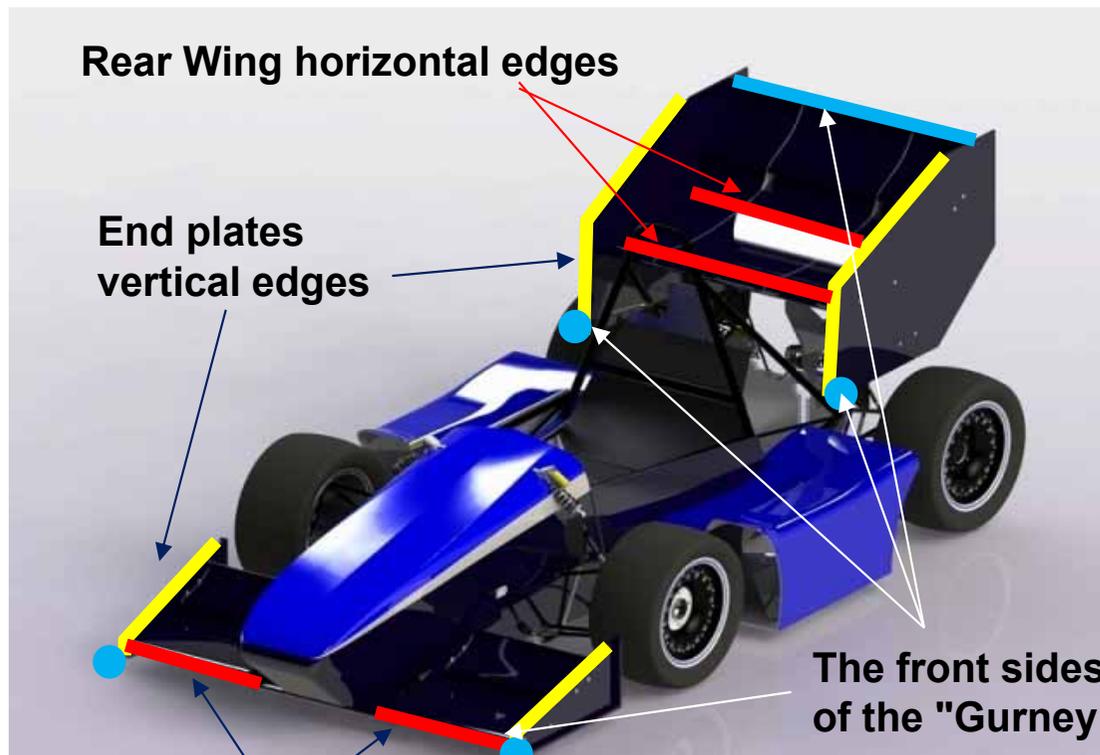
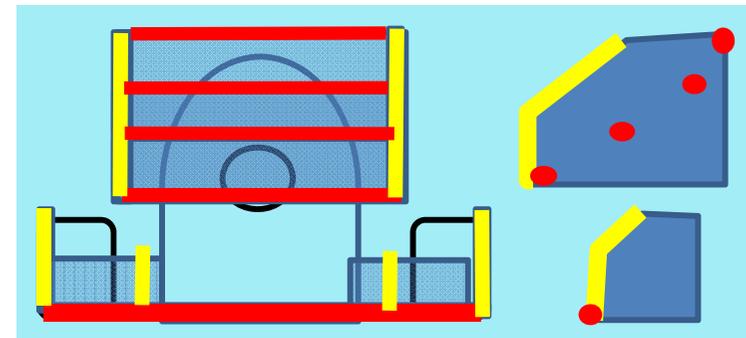
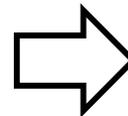
Protections of aerodynamic devices should be described in illustrations below.

(2019) T.9.1.3 All forward facing wing edges including **wings, end plates, Gurney flaps, wicker bills and undertrays** that could contact a pedestrian must have **a minimum radius of 5 mm for all horizontal edges and 3 mm 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.

horizontal edges -> red R5 mm,  
vertical edges -> yellow R3mm

The front sides edge of the "Gurney flap" attached to end plates also Applicable



Front Wing horizontal edges

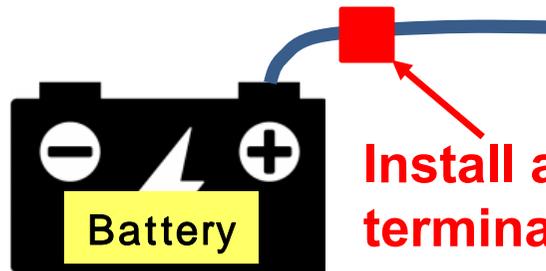
Ref. : KOBE Univ.

# T.11.1 Low Voltage Batteries

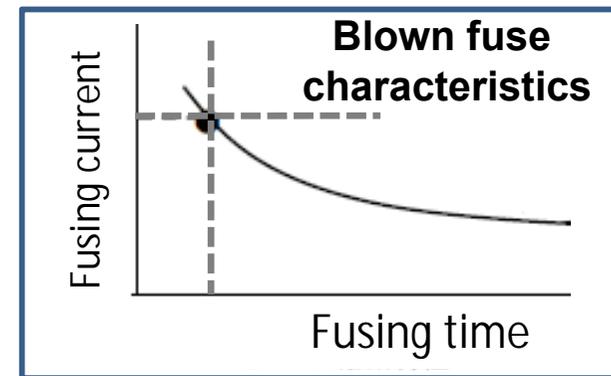
**All the vehicles are objects.**

**Overcurrent protection was required of a lead battery.**

(2019) T.11.1.2 All Low Voltage batteries must have overcurrent protection that trips at or below the maximum specified **discharge current** of the cells.



**Install a fuse between a plus terminal and the first electronic component.**



**An example of a graph demanded on evidence**

**A Lithium battery needs overcurrent protection as before.**

- (2019) T.11.1.5 Battery packs based on Lithium Chemistry must:
- Have a rigid, sturdy and fire retardant casing
  - Be separated from the driver by a firewall as specified in T.3.5

**Presentation of evidence is requested.**

- The maximum current value**
- The characteristic figure of a fuse**

**Charge and discharge**

**In the case of Lithium**

1. The rule revise outline in 2019
- 2. Conformity of the 2018 rule**
3. An item with much indication (every year)
4. About Evidence
5. Vehicle Safety

# Support of a Bent Tube

The support tube addition to a bend tube is the same as 2018.

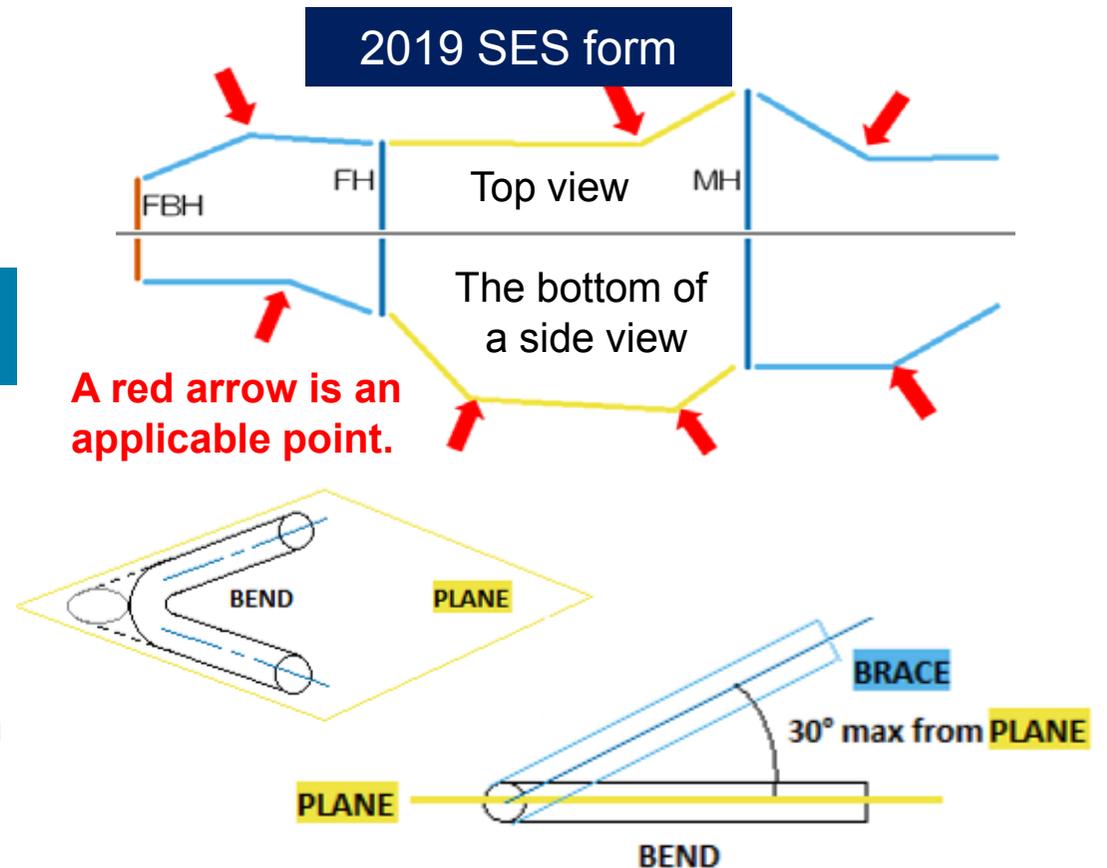
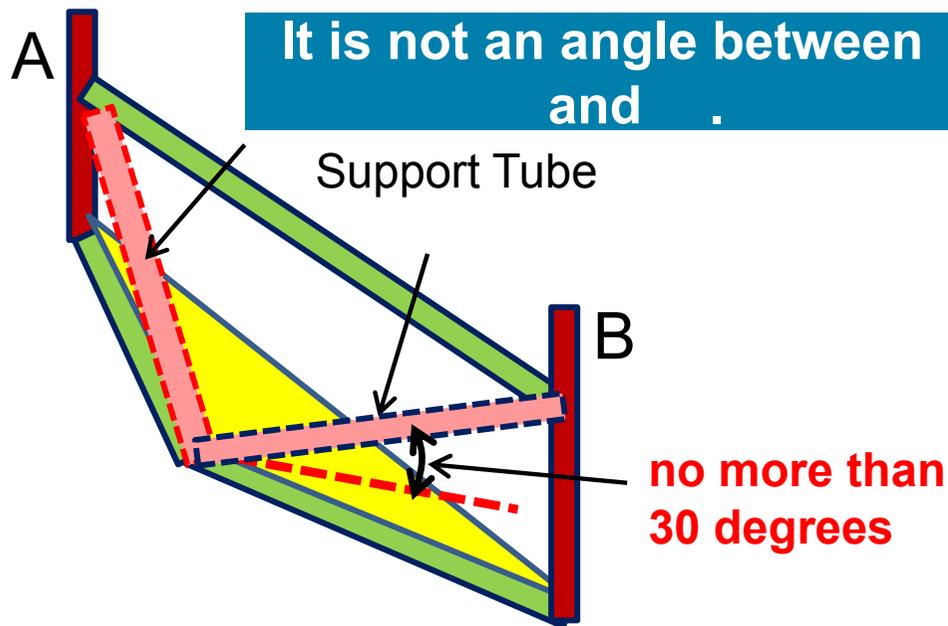
## (2019) T.2.8.3

If a bent tube (or member consisting of multiple tubes that are not in a line) is used anywhere in the Primary Structure other than the Roll Hoops, an additional tube must be attached to support it.

- The attachment point must be the position along the tube where it deviates farthest from a straight line connecting both ends.
- The support tube must have the same diameter and thickness as the bent tube, terminate at a node of the chassis, and be angled no more than  $30^\circ$  from the plane of the bent tube.
- Braces for a bent Upper Side Impact Member are not required to meet the  $30^\circ$  from the plane of the bent tube requirement.

If pipe has bent to pipe A-B, support tube or is required.

The meaning of attaching a support tube to no more than 30 degrees to a node to the yellow field which consists of and .



# The insertion method of a template

## T.3.1 Cockpit Opening

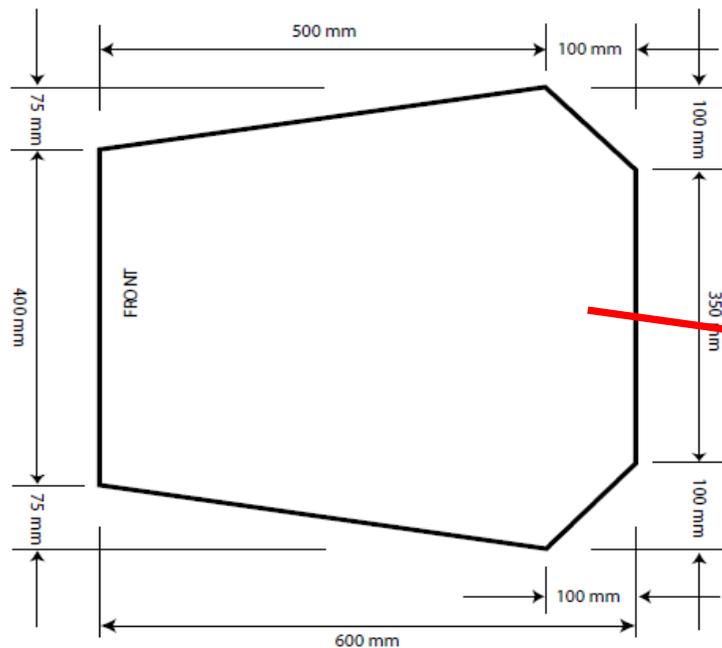
### (2019) T.3.1.2

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:

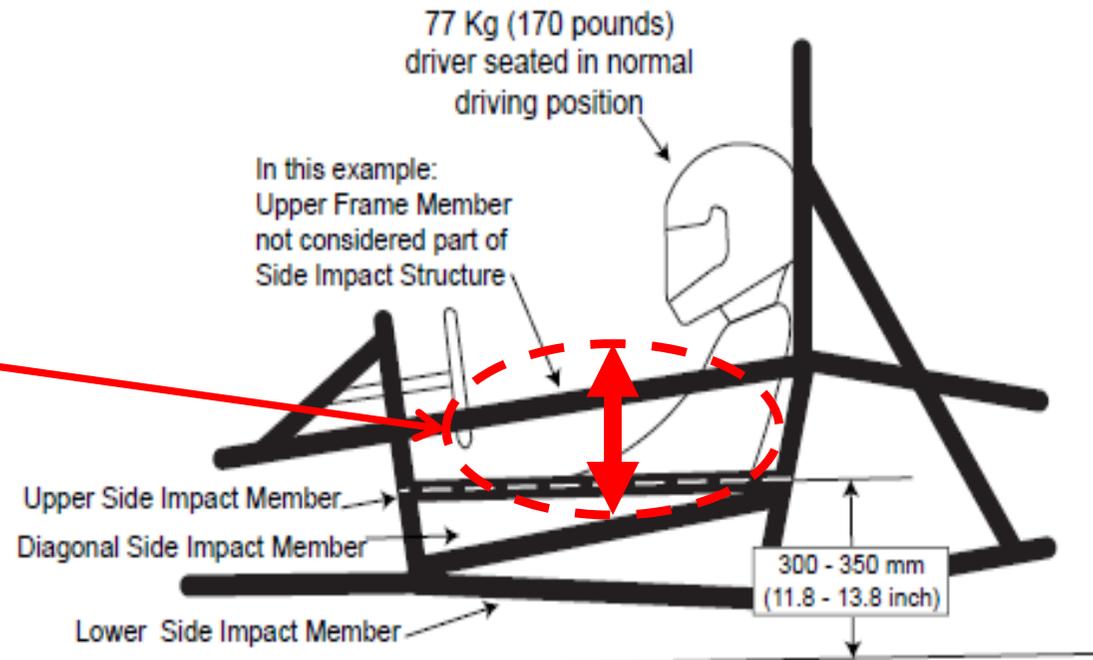
- Has passed below the top bar of the Side Impact Structure
- Is 350 mm above the ground for monocoque designs

T.3.1.3 Fore and aft translation of the template is permitted during insertion.

**(Note) We do not insert the template diagonally along a firewall.**



T.3.1.1 figures



**O.K.: Pass the tangent of Upper Side Impact Member.  
(It is a central line in the case of an angle pipe)**

# The insertion method of a template

## T.3.2 Cockpit Internal Cross Section

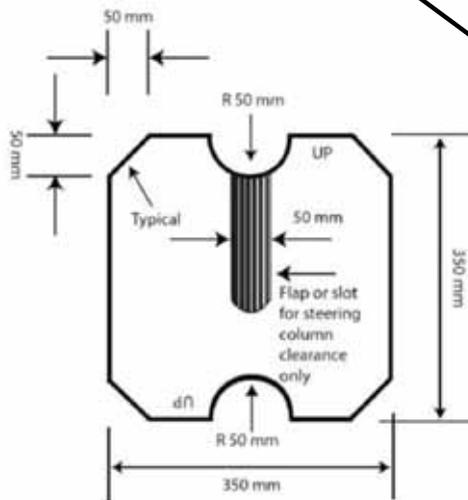
**There is no change from 2017**

### (2019) T.3.2.2 Conduct of the test:

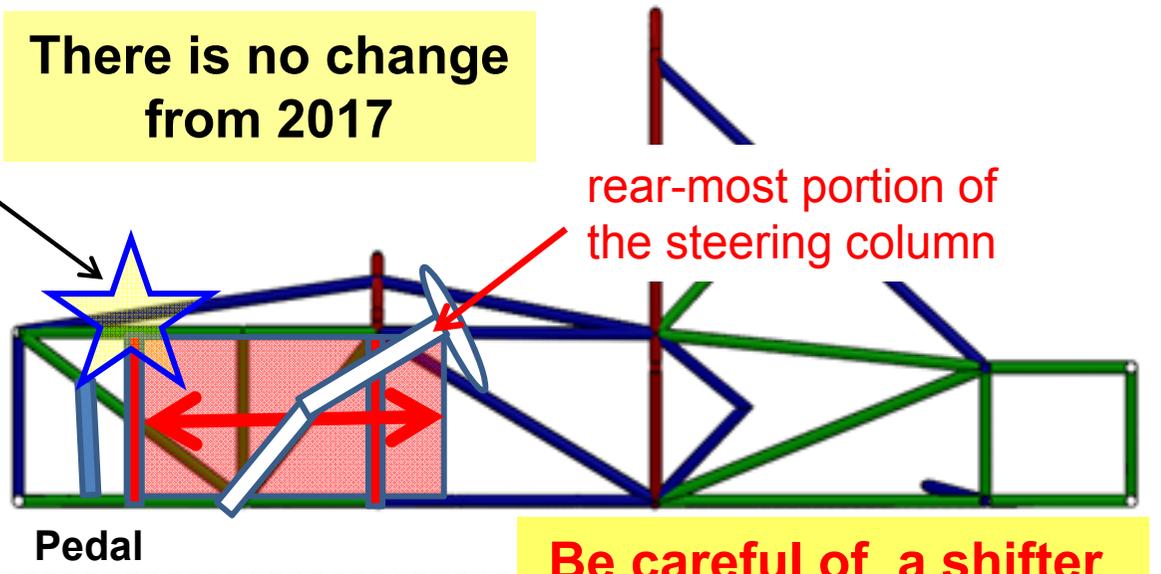
- The template will be held vertically and inserted into the cockpit opening rearward of the rearmost portion of the steering column.
- The template will then be passed horizontally through the cockpit to a point 100 mm rearwards of the face of the rearmost pedal when in the inoperative position

### The insertion point of a template

The template through the cockpit to a point 100 mm rearwards of the face of the rearmost pedal



**There is no change from 2017**



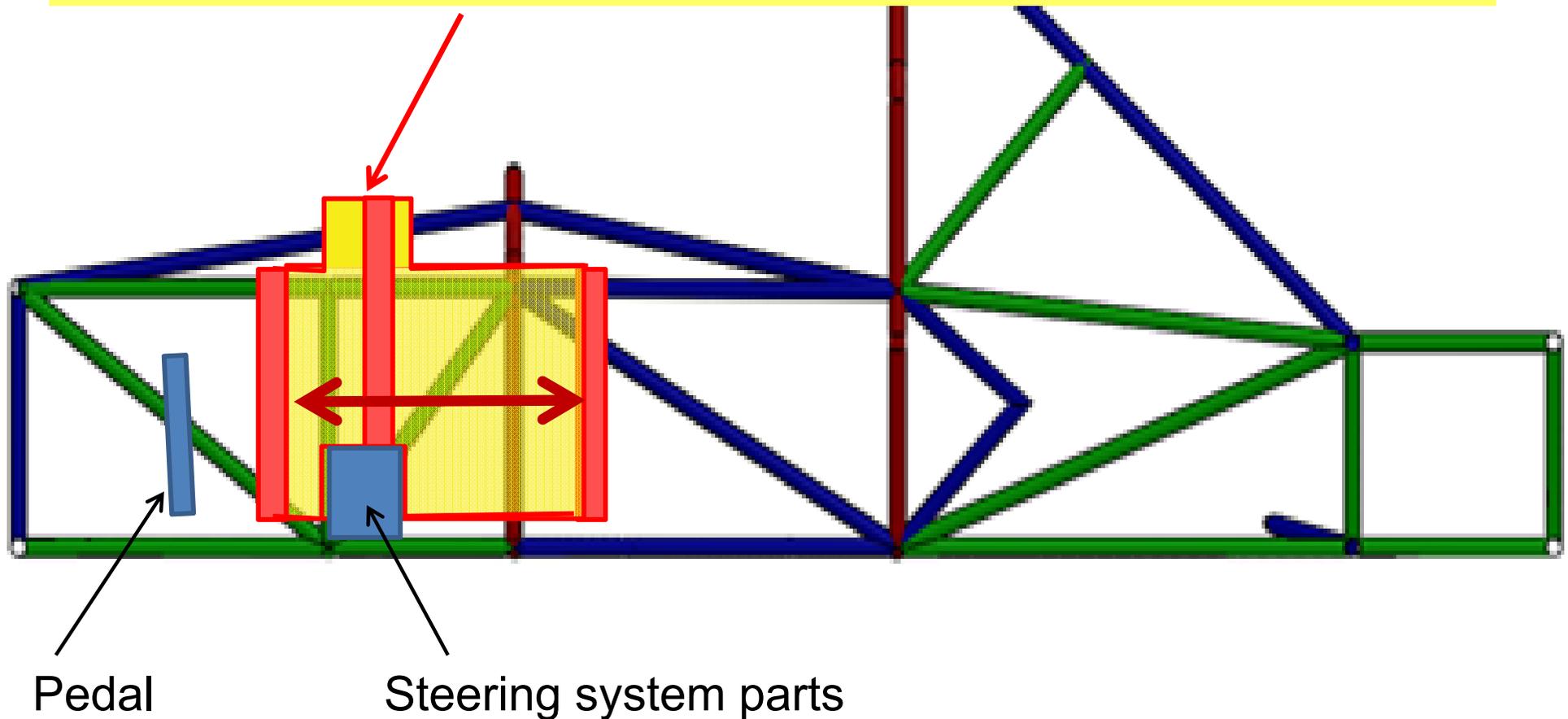
**Be careful of a shifter and seat in the cockpit.**

# Addition: A template sticks up

(Note) The up-and-down motion for avoiding steering system parts etc. by template insertion is allowed.

Stick up a Front Hoop Brace approves in that case.

However, sticking up of “real foot” is forbidden.



# Harness Attachment

## T.4.3 Belt, Strap and Harness Installation is the same as 2018.

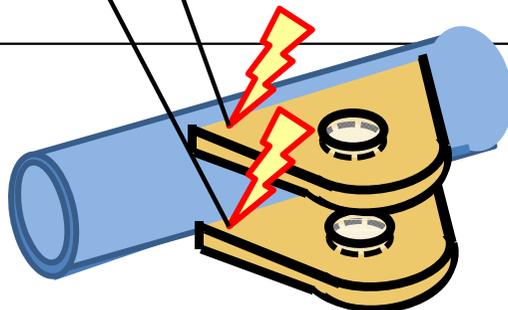
### (2019) T.4.3.3 The tab or bracket to which any harness is attached must:

- Have a **minimum cross sectional area of 60 sq mm** of steel to be sheared or failed in tension at any point of the tab
- Be **1.6 mm (0.063 inch) minimum thickness**
- Be aligned such that it is not put in bending when the attached part of the harness is put under load.
- Where lap belts and anti submarine belts use the same attachment point, there must be a minimum cross sectional area of 90 sq mm of steel to be sheared or failed in tension at any point of the tab.
- Not cause abrasion to the belt webbing

### T.4.3.4 Attachment of tabs or brackets must meet the following:

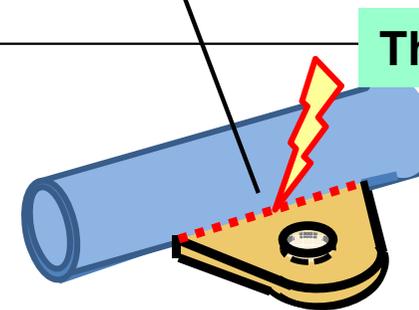
- Where brackets are fastened to the chassis, **no less than two 6 mm or 1/4" minimum diameter Critical Fasteners**, see T.10.2 and T.10.3 or stronger must be used to attach the bracket to the chassis.
- Where a single shear tab is welded to the chassis, the tab to tube welding must be **on both sides of the base of the tab.**

**Double shear attachments are preferred. Tabs and brackets for double shear mounts should be welded on both sides.**



**Double shear attachments**

**Both side welding is required of this portion.**



**This portion**

# T.4.4 Lap Belt Mounting

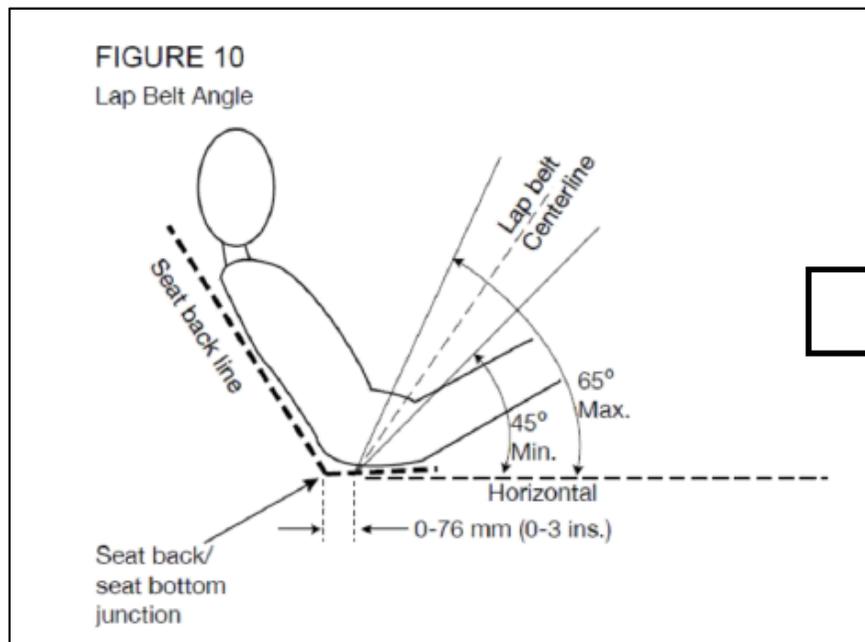
The lap belt position in the upright position, the illustration was clarified.

## (2019) T.4.4.6

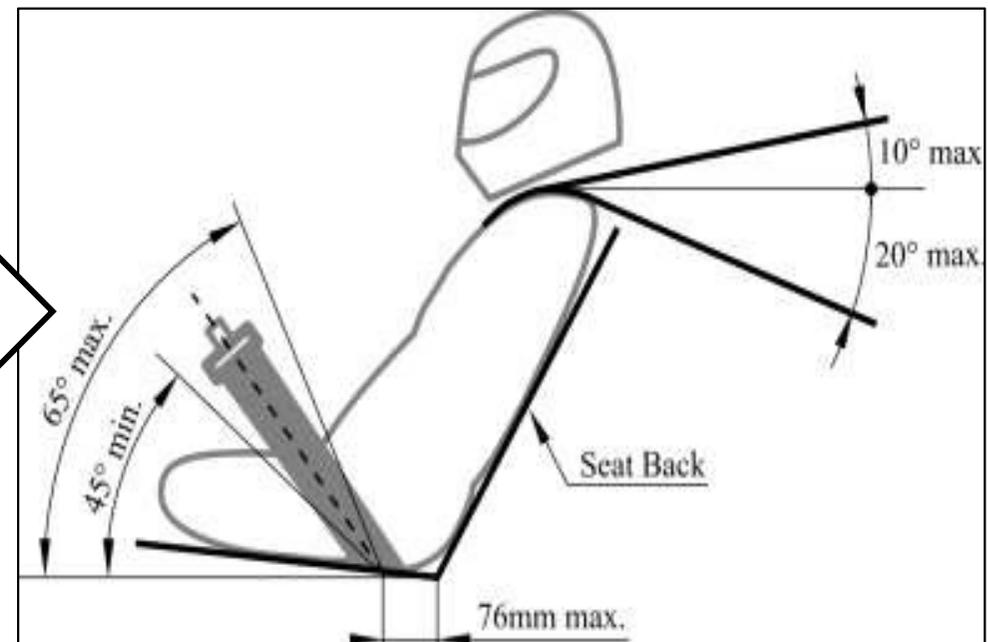
With an Upright Driving Position, in side view the lap belt must be at an angle of **between 45 ° and 65 °** to the horizontal. The centerline of the lap belt at the seat bottom should be **between 0 – 75 mm forward of the seat back to seat bottom junction**.

The contents are the same.

2018



2019



# T.4.5 Shoulder Harness

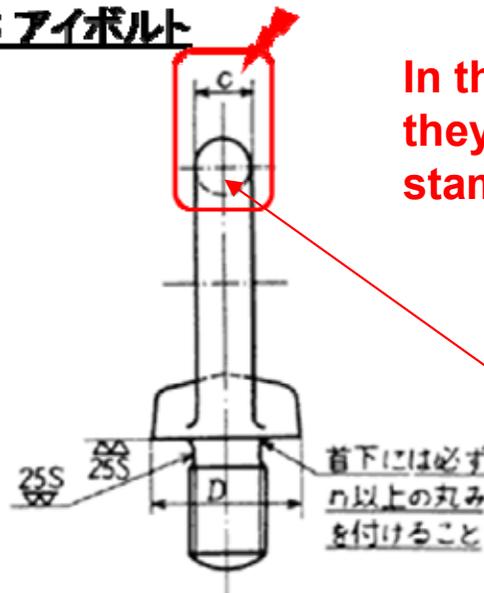
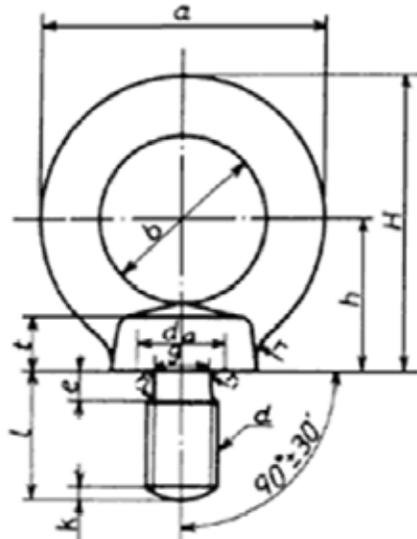
## (2019) T.4.5.6

Any bolt used to attach a shoulder harness belt, either directly to the chassis or to an intermediate bracket, is a **Critical Fasteners**, see T.10.2 and T.10.3, with a minimum diameter that is the smaller of:

- **The bolt diameter specified by the manufacturer**
- **10 mm or 3/8"**

The Eyebolt made from "UNIQLO" is easy to get in DIY center. However, it is the shortage of intensity. -> NG. We demand 8.8 or more in intensity classification.

JIS B1168 アイボルト



In the case of M10, they are mold stamp "10".



A general Eyebolt

Registered to J2019-07

M10 eyebolt used for attachment of a shoulder harness belt and a lap belt should fulfill a JIS standard. **M10 is checked when the path of a hook part is 8 mm of a JIS standard.**

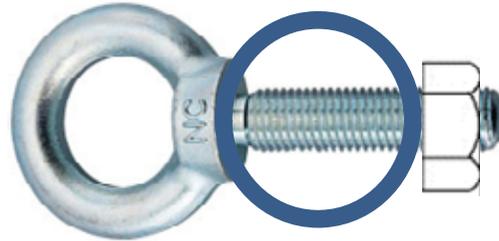
サイズ	a	b	c	D	h	H(参考)	l	e	垂直吊	45度吊 り	自重 g
M8	32.6	20	6.3	16	17	33.3	15	3	80	80	35
M10	41	25	8	20	21	41.5	18	4	150	150	70
M12	50	30	10	25	26	51	22	5	220	220	140

Since we cannot check that it is M10 in the case which cuts and welds a thread part.

# T.4.5 Shoulder Harness

By the fixed method of an Eyebolt, we recommend two type below.

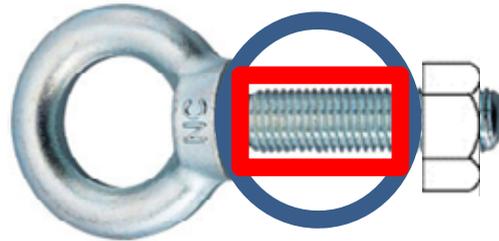
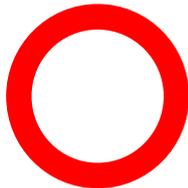
NG



**Without insertion**

A pipe is distorted by bolting without an insertion.

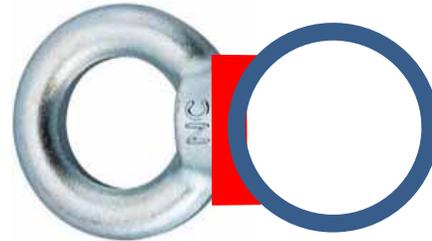
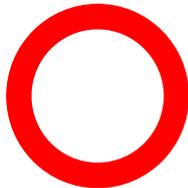
OK



**With insertion**

However, simple screw insertion (without positive lock) is prohibition.

OK



**Perimeter welding**

Prepare evidence, if M10 size display cannot be checked by welding.

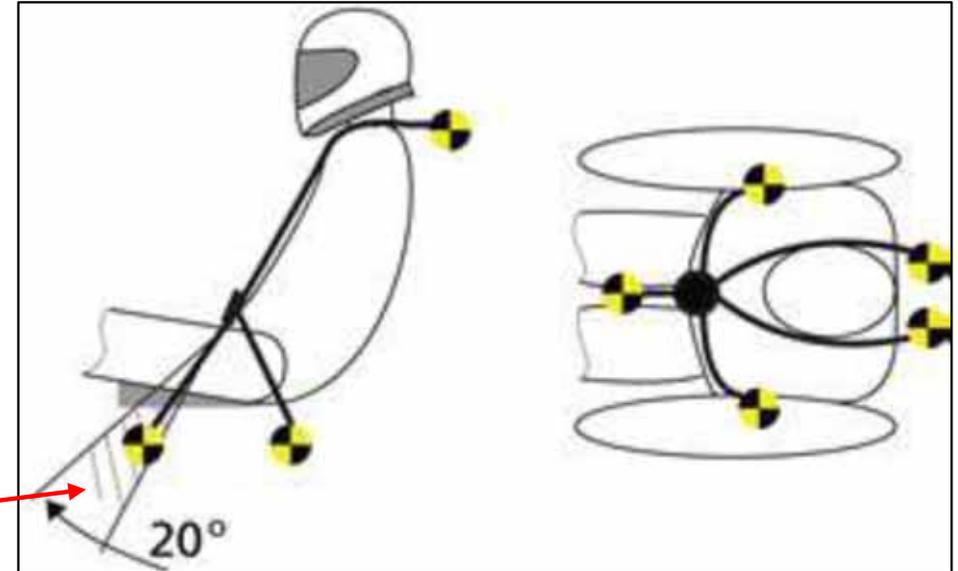
# T.4.6 Anti Submarine Belt Mounting

The contents are the same.

## T.4.6.1 5 point harness

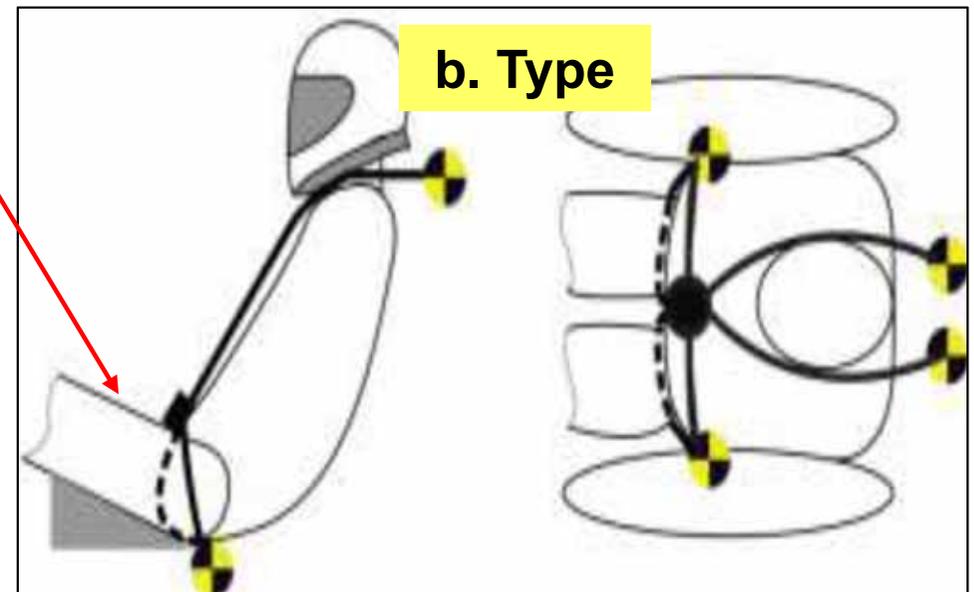
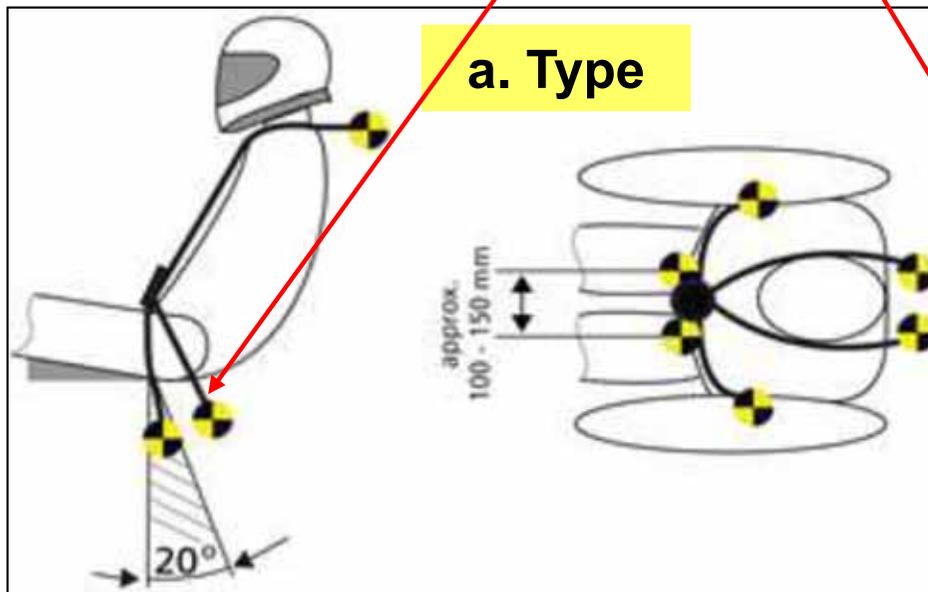
The belt must be mounted so that the mounting point is in line with, or angled slightly forward (up to  $20^\circ$ ) of, the driver's chest to groin line.

These angle measurement is difficult actually.  
We judge in the direction from a line.



## T.4.6.2 6 point harness

- With the belts going vertically down from the groin, or angled up to  $20^\circ$  rearwards. The anchorage points should be approximately 100 mm apart.
- 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.



# Expiration date of SFI spec harness

The contents are the same of the SFI Spec Harness.

## (2018) T5.1.3 Harness Replacement

SFI spec harnesses must be replaced following **December 31st of the second year after the date of manufacture**, or after the date of expiration, as indicated by the label.

## (2019) T.4.2.1

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

- a. [SFI Specification 16.1](#)
- b. [SFI Specification 16.5](#)
- c. [FIA specification 8853/98](#)
- d. [FIA specification 8853/2016](#)

**Although the expiration date is not specified...**

**T.4.2.2** The belts must have the original manufacturers labels showing the specification and expiration date

**T.4.2.3** 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.

**T.4.2.4** The harness must be in new or like new condition, with no signs of wear, cuts, chaffing or other issues.

[https://www.sfifoundation.com/wp-content/pdfs/specs/Spec\\_16.1\\_022614.pdf](https://www.sfifoundation.com/wp-content/pdfs/specs/Spec_16.1_022614.pdf)

[https://www.sfifoundation.com/wp-content/pdfs/specs/Spec\\_16.5\\_122914.pdf](https://www.sfifoundation.com/wp-content/pdfs/specs/Spec_16.5_122914.pdf)

**Please check these address.**



**Racequip**  
The example of SFI specification

# Shoulder Harness Mounting Bars

Clarification of the harness mount bar fixed method is the same as 2018.

## (2019) T.4.5 Shoulder Harness

**T.4.5.1** The shoulder harness must be mounted behind the driver to a single piece of uncut, continuous, closed section steel tubing per **T.2.5** OR **T.2.6**.

**T.4.5.2** The Shoulder Harness Mounting Bar must attach to the Main Hoop on both sides of the chassis.

**T.4.5.3** Bent Shoulder Harness Mounting Bars must:

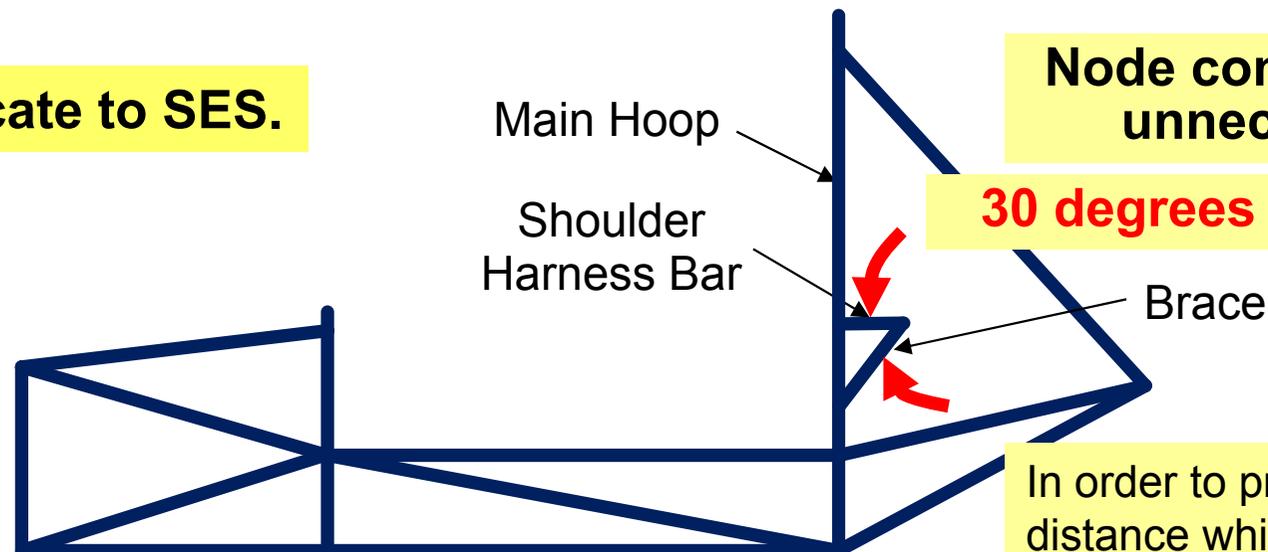
a. Meet **T.2.8.1** and **T.2.8.2**

b. **Have bracing members attached at the bend(s) and to the Main Hoop.**

- Material for this Shoulder Harness Mounting Bar Bracing must meet the requirements of **T.2.5** OR **T.2.6** OR **T.2.7**

- **The included angle in side view between the Shoulder Harness Bar and the braces must be no less than 30 °.**

Indicate to SES.



Node connection is unnecessary.

30 degrees or more

In order to prevent guarantee of the distance which a belt fastens, and eyebolt contact, we recommend securing much distance between a mount bar and a driver.

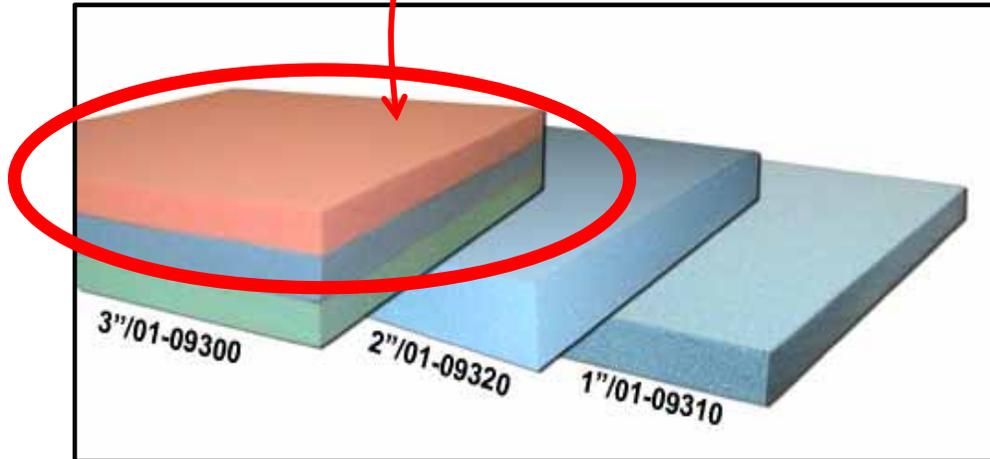
# T.4.7 Head Restraint

Material specification is the same as 2108.

## (2019) T.4.7 Head Restraint

T.4.7.3 The head restraint padding must:

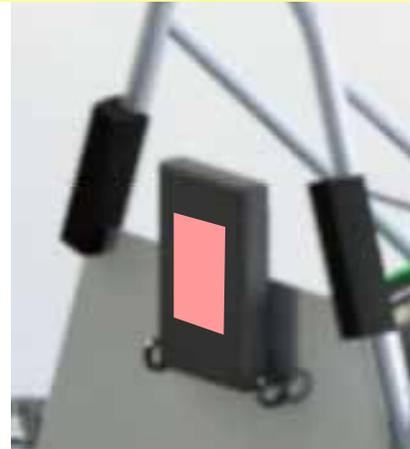
- Be an energy absorbing material that meets either **SFI Spec 45.2, or is listed in the FIA Technical List No. 17 as a "Type B Material for single seater cars": CONFOR M foam CF-42 (pink) or CF-42M (pink). CF-42AC (pink) is acceptable.**
- Have a minimum thickness of 38 mm
- Have a minimum width of 15 cm
- Have a minimum area of 235 sq cm AND have a minimum height adjustment of 17.5 cm, OR have a minimum height of 28 cm



**O.K. is only pink.**

**Please search for a Web.  
You're available.**

## The request from a Technical Inspection



Exposure of helmet contact area



It covers with a soft material.

- Don't spoil the function of a low rebounding material.
- That it is the specified material must be able to check.

# Intake and Fuel System Mounting

**Intake and Fuel line mounting are specified as the critical fastener.**

## IC.2.3 Intake System Mounting

**IC.2.3.1** 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 a structural attachment.

**IC.2.3.2** Threaded fasteners used to secure the intake manifold must have a positive locking feature, see T.10.3, or be an OEM fastener.

**IC.2.3.3** Intake systems with significant mass or cantilever from the cylinder head must be supported to prevent stress to the intake system.

- a. Supports to the engine must be rigid.
- b. Supports to the frame or chassis must incorporate some isolation to allow for engine movement and chassis flex.

## IC.6.2.4 Fuel rail mounting requirements:

- a. The fuel rail 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.
- b. 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 cylinder pressure acting on the injector tip.

**c. Threaded fasteners used to secure the fuel rail are Critical Fasteners, see T.10.2 and T.10.3**

**In the case of OEM, it is exclusion.**

# Fuel Tank Filler Neck & Sight Tube

## (2019) IC.5.5 Fuel Tank Filler Neck & Sight Tube

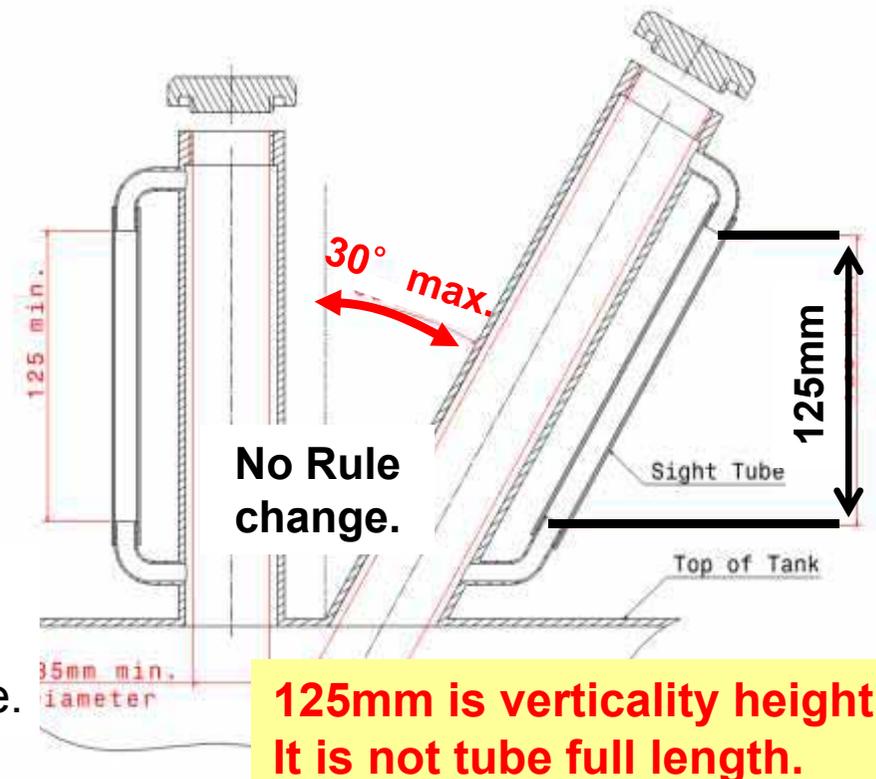
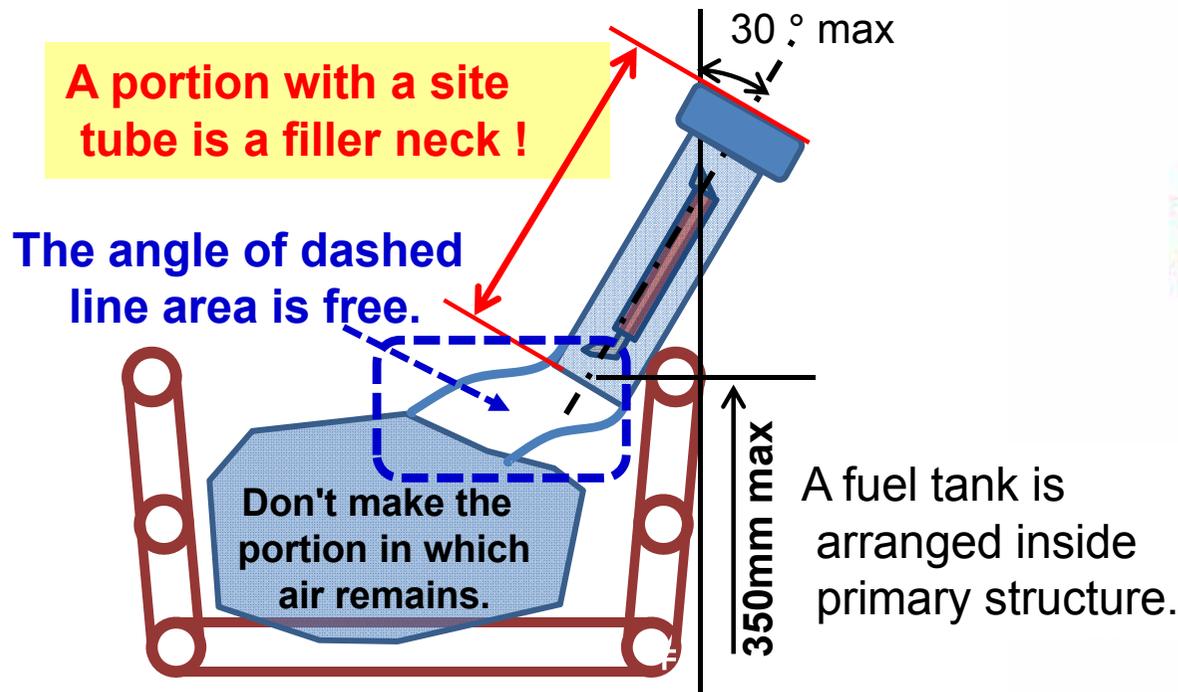
**Minimum 35 mm inner diameter ← the same as 2108**

**IC.5.5.1 All fuel tanks must have a filler neck which must be:**

- Minimum 35 mm inner diameter at any point between the fuel tank and the fuel filler cap
- Minimum 125 mm vertical height above the top level of the fuel tank
- Angled no more than 30 ° from the vertical

**IC.5.5.2 The fuel filler neck must be** accompanied by a clear fuel resistant sight tube for reading the fuel level which must be:

- Visible vertical height: 125 mm minimum
- Inside diameter: 6 mm minimum
- Above the top surface of the fuel tank



# Fuel Level Line

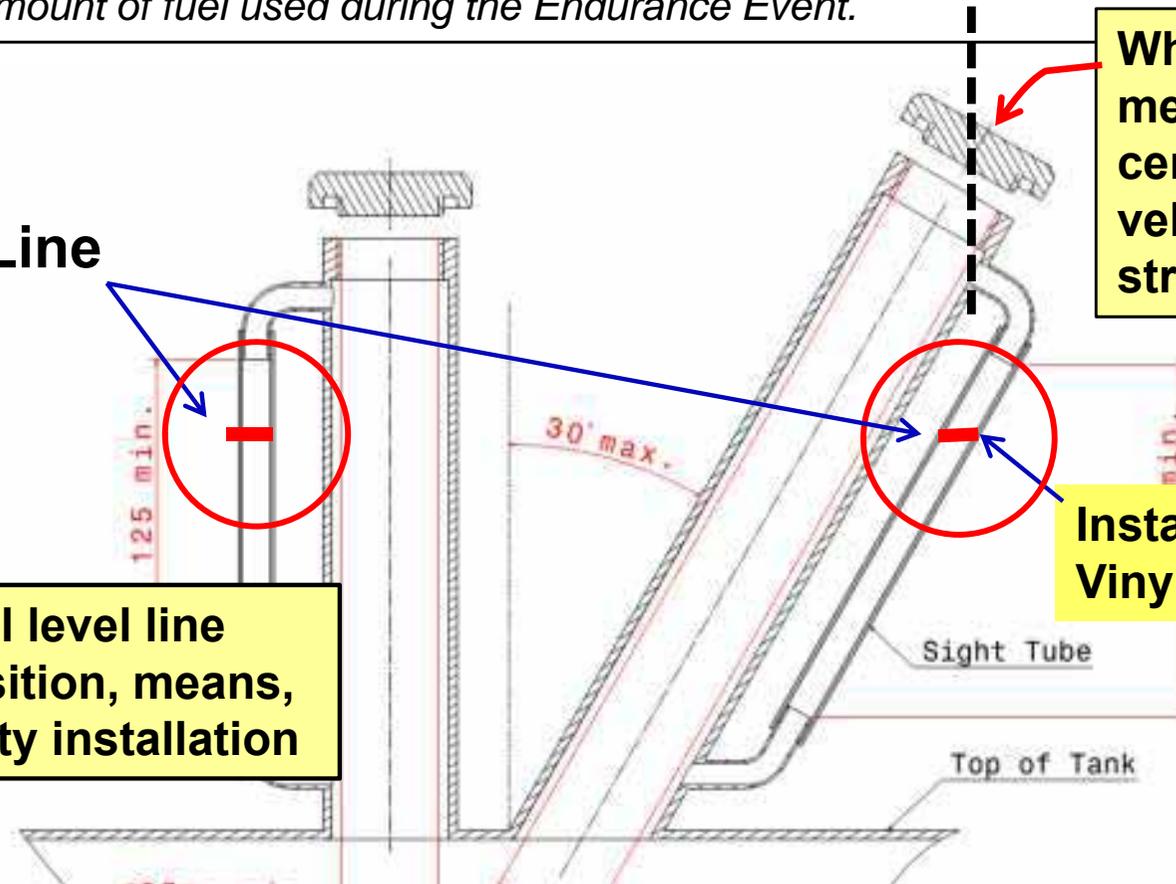
## (2019) IC.5.5 Fuel Tank Filler Neck & Sight Tube

### IC.5.5.4 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.*

Fuel Level Line



When a cap has a vent mechanism, take out a center to the outside of vehicles main structures at least.

Install horizontally.  
Vinyl tapes are prohibited.

We check a fuel level line installation position, means, and horizontality installation

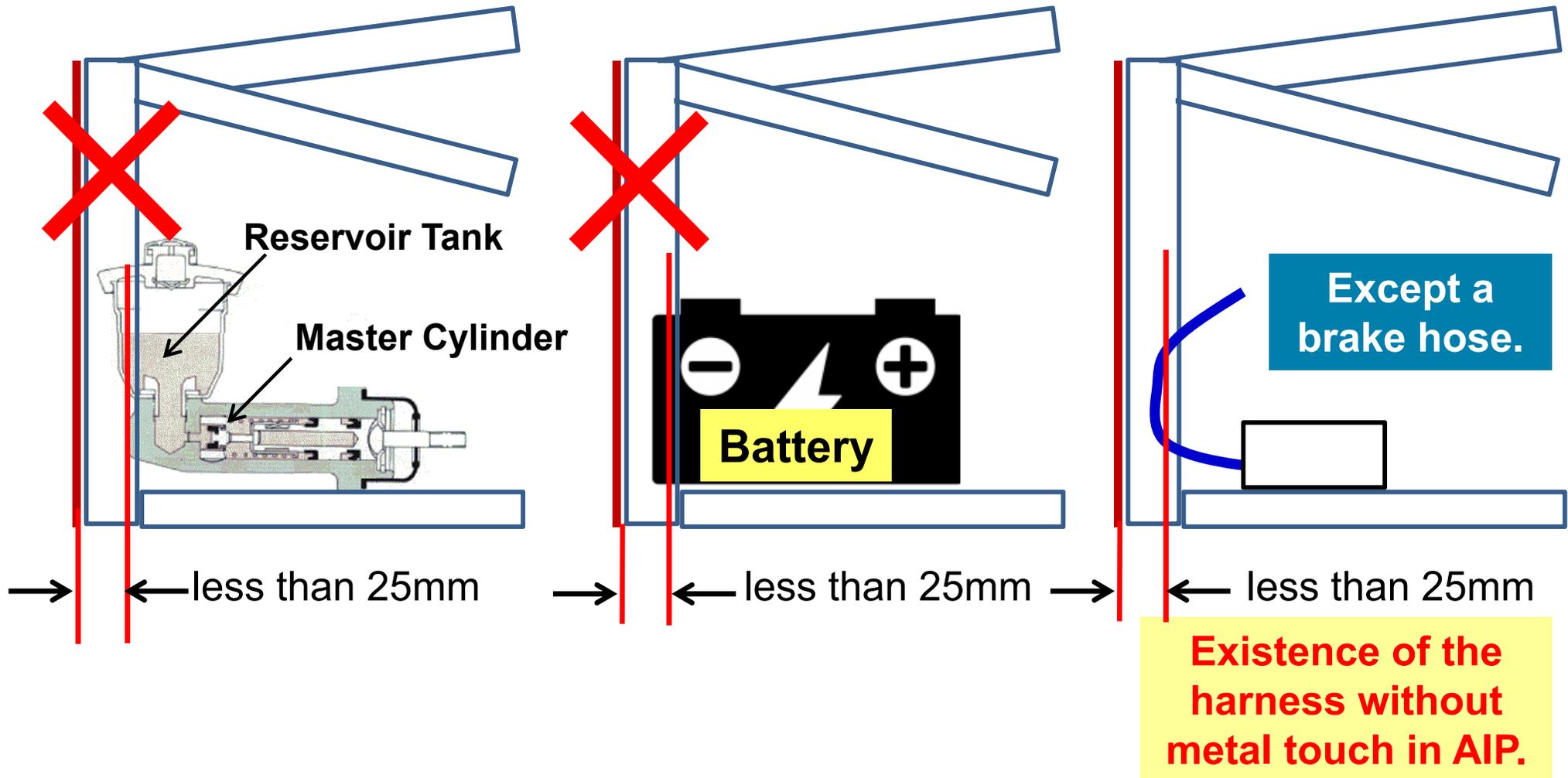
IC.5.7.3 All fuel vent lines must exit outside the bodywork.  
In case of fuel cap internal organs, the cap is a target.

# Non Crushable Objects

## (2019) T.2.24 Non Crushable Objects

### T.2.24.1 Inside Primary Structure

All non crushable objects (such as batteries, master cylinders, hydraulic reservoirs) inside the Primary Structure must have a minimum 25 mm clearance to the rear face of the Anti Intrusion Plate.



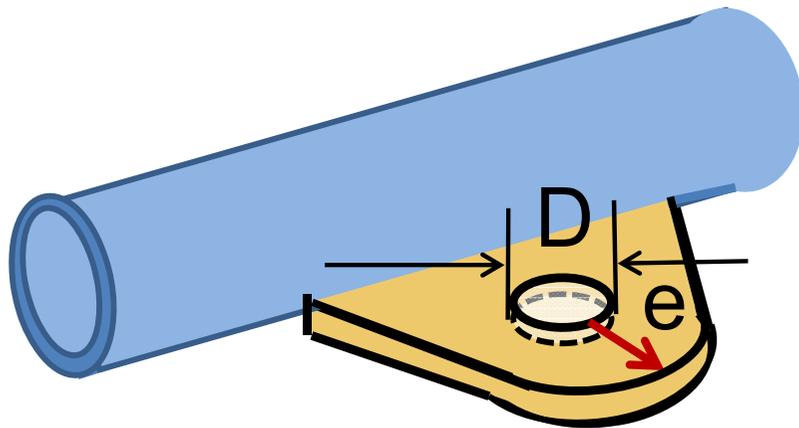
$$e / D \quad 1.5$$

**When important parts are attached on the plate directly welded to main structures.  
(A steering, a brake, a driver harness system)**

**(2017) T.2.17 Fasteners in Primary Structure**

**T.2.17.3** Any bolted joint in the Primary Structure using either tabs or brackets (other than tabs attaching suspension to the primary structure), must have an edge distance ratio "e/D" of 1.5 or greater.

*"D" equals the hole diameter. "e" equals the distance from the edge of the hole to the nearest free edge.*



**"D" = hole diameter**

**"e" = Distance of the nearest free end from bolt hole**

**"e/D" of 1.5 or greater**

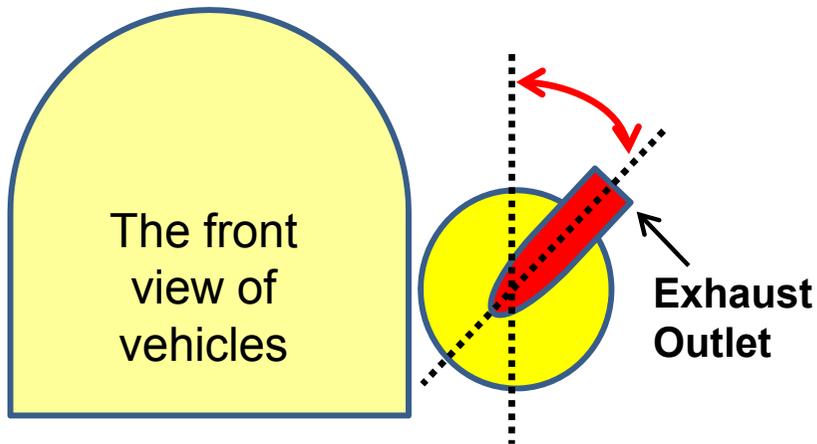
# The direction of Exhaust Outlet

In the layout of an Exhaust Outlet, we judge on the following standard.

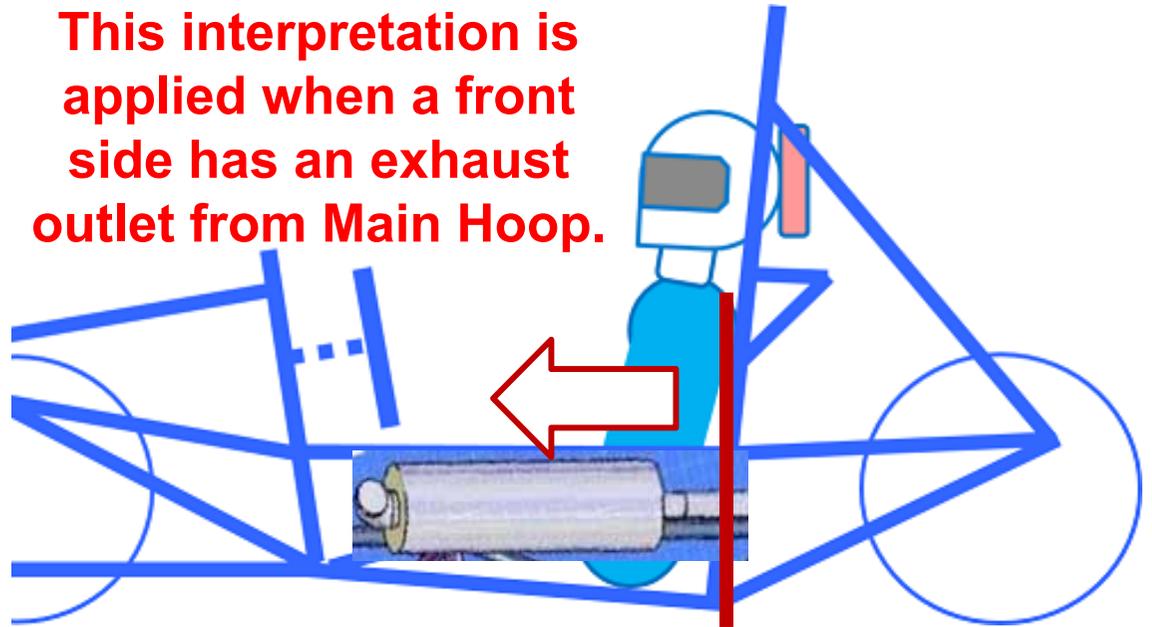
## (2019) IC.7.2 Exhaust Outlet

IC.7.2.1 The exhaust must be routed so that the driver is not subjected to fumes at any speed considering the draft of the vehicle

45 degrees or less are NG.



This interpretation is applied when a front side has an exhaust outlet from Main Hoop.



It does not apply, when the backside has an exhaust outlet from Main Hoop.



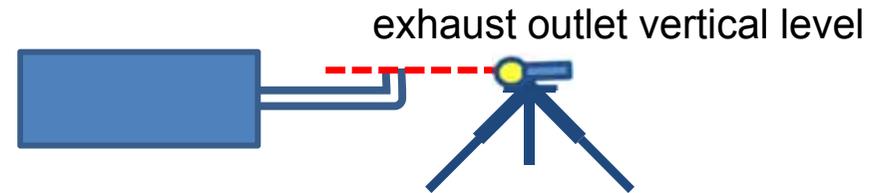
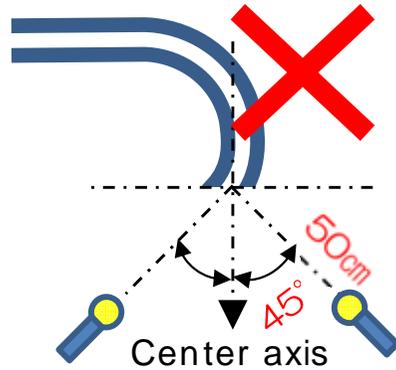
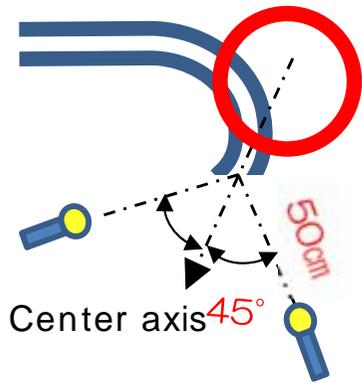
An upward layout like a photograph is NG.  
(A severe judgment is done)

# Sound Level Measurement

The rule applied by sound level measurement is the same as 2018.

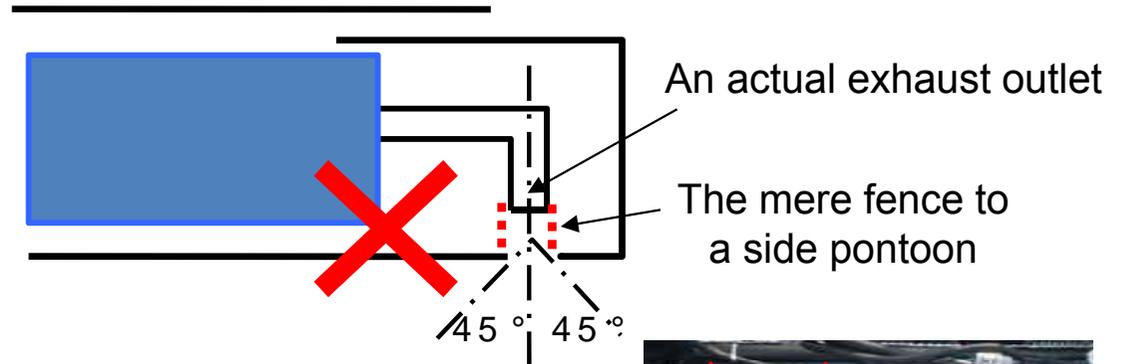
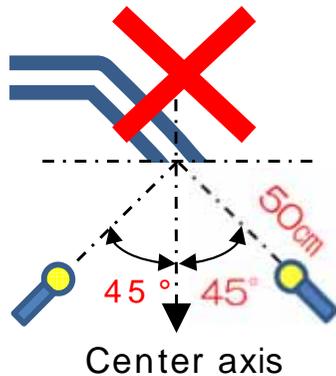
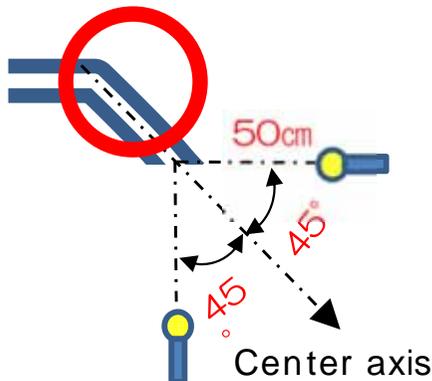
(2019) IN.10.1.2 Measurements will be made with a free field microphone placed:

- free from obstructions
- at the exhaust outlet vertical level
- 0.5 m from the end of the exhaust outlet
- at an angle of 45 ° with the outlet in the horizontal plane



An exhaust outlet is perpendicular up. 45 ° cannot be specified. Only distance is specified.

A slanting cut side is not standard. The central axis of an exhaust pipe is standard.



It is NG if an exhaust outlet cannot be viewed from a microphone.



# Requirements of Technical Inspection

## **(2019) IN.1.6 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 may be provided by removing body panels or by providing removable access panels.

**Strictness: It is especially a fuel tank.**

**When a Fuel tank and a Battery are covered up perfectly on a composite wall by the monocoque structure, and we can't check, technical inspector would do the directions from which ENG is removed.**

## **(2019) IN.1.7 Marked Items**

IN.1.7.1 Officials may mark, seal, or designate items or areas which have been inspected to document the inspection and reduce the chance of tampering

IN.1.7.2 Damage or lost marks or seals require Re-inspection.

# Tilt Test Additional Requirements

## IN.9 TILT TEST

### IN.9.1 Tilt Test Requirements

- The vehicle must contain the maximum amount of fluids it may carry
- The tallest driver must be seated in the normal driving position
- Tilt tests may be conducted in either or both directions in order to pass

**(IC only) Engines fitted with mechanically actuated fuel pumps must be run** to fill and pressure the system downstream of the High Pressure pump. [See IC.6.2](#)

### IN.9.2 Tilt Test Criteria

**IN.9.2.1** No fluid leakage of any type when the vehicle is tilted to a 45 ° angle to the horizontal

**IN.9.2.2** The vehicle does not roll when tilted at an angle of 60 ° to the horizontal, corresponding to 1.7 g.

## IC.6.2 High Pressure Injection (HPI) / Direct Injection (DI)

### IC.6.2.1 Definitions

- High Pressure fuel systems - those functioning at 10 Bar pressure or above**
- Direct Injection fuel systems - where the injection occurs directly into the combustion system

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

- High Pressure Fuel Lines - those between the boost pump and injectors
- Low Pressure Fuel Lines - from the electric supply pump to the boost pump



# Fire Extinguishers

## (2019) VE.2.3 Fire Extinguisher

### VE.2.3.1 Each team must have at least two fire extinguishers.

- a. One extinguisher must readily be available in the team's paddock area
- b. One extinguisher must accompany the vehicle when moved using the push bar

A commercially available on board fire system may be used instead of the fire extinguisher that accompanies the vehicle

### VE.2.3.2 Hand held fire extinguishers must NOT be mounted on or in the vehicle

### VE.2.3.3 Each fire extinguisher must meet the following:

- a. Capacity: 0.9 kg (2 lbs)
- b. Working Medium: Dry chemical/dry powder. Aqueous Film Forming Foam (AFFF) and Halon extinguishers and systems are prohibited.
- c. **Equipped with a manufacturer installed pressure/charge gauge.**



**A pressure gauge is unnecessary.  
=> It registers J2019-13.**

**There is confiscation of about four every year!**

- Expiration
- There is no seal tape



**Halon  
extinguishers**

1. The rule revise outline in 2019
2. Conformity of the 2018 rule
- 3. An item with much indication (every year)**
4. About Evidence
5. Vehicle Safety

# Technical Items with frequent pionted-up

## Engine, Suspension & Steering & Brake, Fuel

- **The size of fire wall is not enough.**
- **Fuel leak, Oil leak**
- **Positive locking nut usage**
- **Interference of brake hose, fuel hose.**
- **The suspension stroke is not enough.**
- **Bad hose clamp.**
- **There is no evidence for Lithium battery.**

**These are very important articles to avoid collision and fire accident.  
The top priority is the safety of your driver.  
Therefore it's being checked severely.**

# About a Fire Wall

There is very much indication of a firewall.

## T.3.5 Firewall

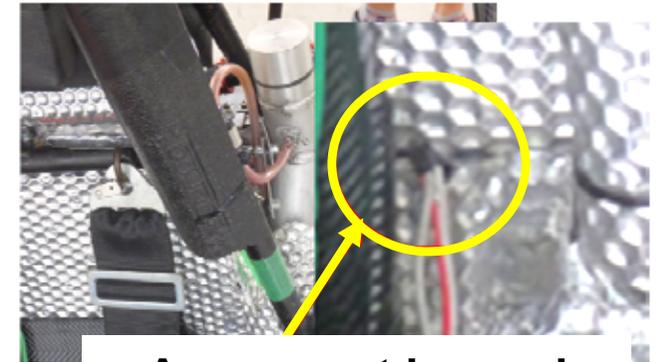
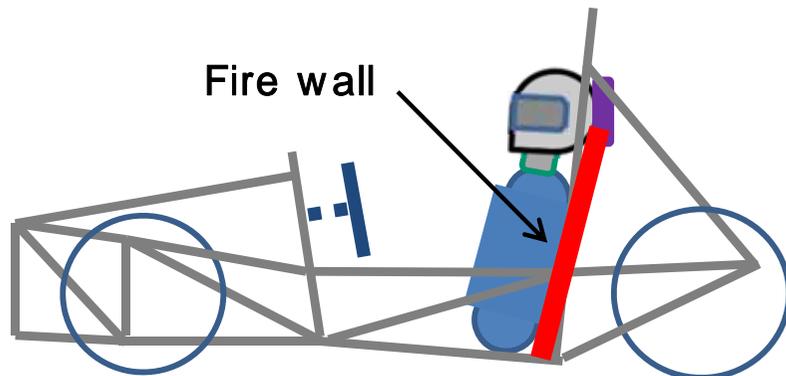
### T.3.5.2 The firewall must meet the following:

- A non permeable surface made from a rigid, fire resistant material.
- Extend sufficiently far upwards and/or rearwards such that any point less than 100 mm above the bottom of the helmet of the tallest driver must not be in direct line of sight with any part of the fuel system, the cooling system or the engine oil system.
- Seal completely against the passage of fluids (the firewall itself and edges)
- Pass through for wiring, cables, etc. may be used if grommets are used to seal the pass through.
- Seat belts must not pass through the firewall
- Multiple panels may be used to form the firewall but must be sealed at the joints.

**In many cases, that have not protected to cooling / exhaust system.**

**Protect a driver from "all heat sources."  
(Recommend)  
Aluminum =t0.7mm or more,  
Steel =t0.5mm or more**

**It must not be visible from a driver.**



**A grommet is used when passing through harness.**



# About a Fire Wall

As for "enbrella," only multiple layer ones are accepted to be used as firewalls without fire-resistant tests.

Protect a driver from "all heat sources."

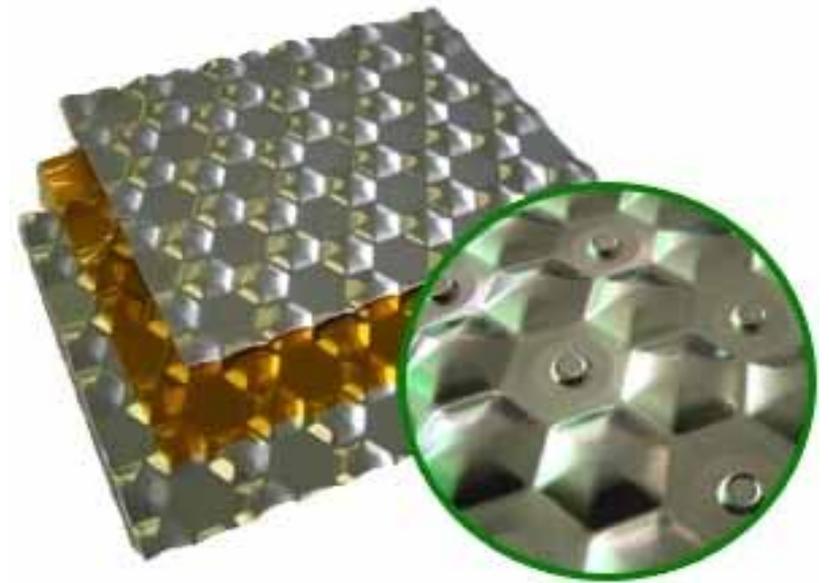
(Recommend)

Aluminum =t0.7mm or more, Steel =t0.5mm or more

In case of 0.3/0.5mm thick monolayer "enbrella," the fire-resistance must be tested.

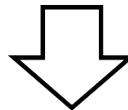
It it is 1.0mm thick, no test is required.

(Since it is 0.7 mm of aluminum , and more than equivalent)



**T.3.5.2 The firewall must meet the following:**

- a. A non permeable surface made from a rigid, fire resistant material.



**Firewalls without stiffness or made by soft materials are not accepted.**

# The Fixed Method of a Fuel Tank

## IC.5.4 Fuel Tanks

### IC.5.4.2 Fuel tanks made of a rigid material must:

- a. Be securely attached to the vehicle structure with mountings that allow some flexibility such that chassis flex cannot unintentionally load the fuel tank.
- b. Not be used to carry any structural loads; from roll hoops, suspension, engine or gearbox mounts

At the attachment (between fuel tank and chassis), some rubber bushings will be installed with some gap, because the load should not be transferred from chassis to the fuel tank. (Both of X-Y axes)

Make sure to take measures to not lower the shaft torque of the mounting bolts.

Fragile bracket makes easily crack.



### Many indication

- Fixation is too legit.
- We cannot view a fixed portion.
- Evidence is also deficient.

# Critical Fastener

## (2019) T.7.2.7 Attachment Fasteners –

All fasteners attaching scatter shields and guards must be 6mm or 1/4" minimum diameter  
Critical Fasteners, see T.10.2 and T.10.3

From 2015, **the intake manifold and the fuel rail** were also added to the important screw item.

**A steering, braking and a suspension system request the SAE G5 grade and metrics grade more than 8.8.**

-> Lower grades are prohibited for vehicles.

**It's locked certainly. The mechanism can be checked by sight.**

-> When a nut is between the hub and the uprightness, we can't check by sight.

-> Show a drawing as evidence.

**There must be a minimum of 2 full threads projecting from any lock nut.**

-> There is many unacceptable cases  
(Especially suspension)

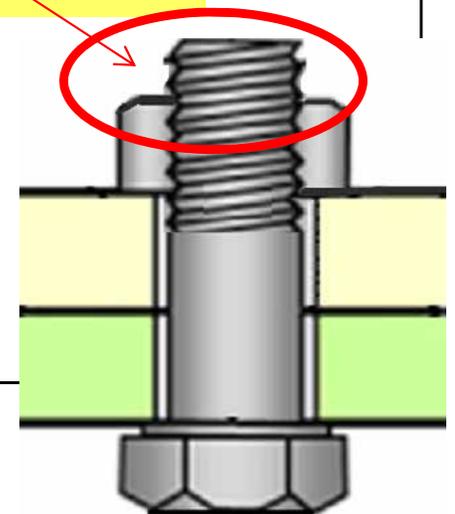
-> The technical inspection of the team which is not acceptable requires time.

**Minimum 2 full threads !**

**Use as a double nut the rod which can be adjusted.**

-> A single nut is NG

-> There is a case loosened by hand in technical inspection.



# Securing Fasteners <OK>

## T.10.2 Critical Fastener Requirements

### Hard Lock Nuts for Bearing / Fine U Nuts

● CADデータフォルダ名: 14\_Bearings\_with\_Holder

■ ハードロックナット

Type	材質	硬度	表面処理
HLBM	SS400相当	-	パーカー
HLBC	S45C鋼質	22~28HRC	パーカー
HLBS	SUS304	-	-

\*第2ナット凸部（ボス）の中心とねじの中心には所定のスレが設けてあります。

① 薄型タイプ (HLBU) は第2ナット (上ナット) より取り付けてください。

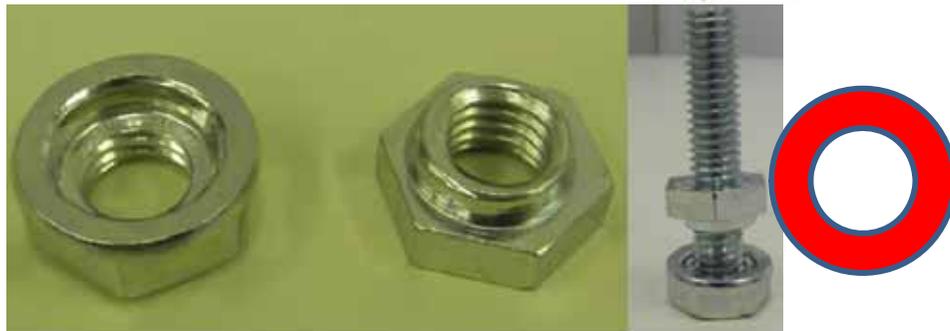
ねじ精度 JIS B0211 6H (2級)

### Castle Nuts



We cannot check it by sight.  
A team must show the Evidence, such as a photograph of a manufacture process.

### Hard lock Nuts



### Helicoil

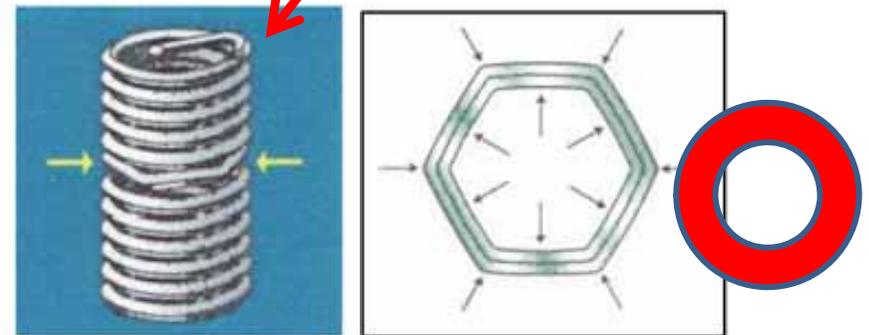


図.1 ヘリコイル全体図 図.2 緩み止め機構

雄ナット、雌ナット二つ一組で使用

詳細 <http://www.hardlock.co.jp/hl/02.php>

# Securing Fasteners <OK>



**U Nuts**

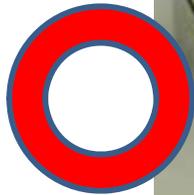
[http://www.yht.co.jp/ctlg/01.asp?pf\\_id=04041002200&category=](http://www.yht.co.jp/ctlg/01.asp?pf_id=04041002200&category=)



**Wedge lock nuts**

<http://www.>

**The team must present the Evidence to be checked by sight.**



**Super slit nuts**

<http://www.mitsubishi-chemical.com/chemproc/chemproc.html>



**Muscle nuts**

<http://www.mitsubishi-chemical.com/chemproc/chemproc.html>

## Technical inspection

- The device/system can be checked by sight.
- 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.

1. The rule revise outline in 2019
2. Conformity of the 2018 rule
3. An item with much indication (every year)
- 4. About Evidence**
5. Vehicle Safety

# About Evidence

[The top priority is safety operation of vehicles. ]

[Teams have the responsibility in their vehicles. ]

**In a technical inspection, we require the presentation of Evidence.**

**Exp.1: The contents are shown when remodeling the engine main part  
(Especially : lubricous system including oil pan)**

**Exp. 2: The heat resistance of a catch tank etc.  
(What was O.K. last year is not acceptable completely)**

**Exp. 3: The drawing or photograph in which the structure of the part which is  
not in sight by a technical inspection.**

**Exp. 4: The detail data of a battery.**

**Exp. 5: The photograph in which a manufacture process is shown in the case  
of a carbon monocoque body.**

**Exp. 6: The drawing which can be shown when required of an inspector.  
-> the outer diameter and thickness of a frame  
-> Details of IA Anti-Intrusion Plate**

**Exp. 7: The specifications + invoice as a proof which is purchased.**

# About Evidence

## [When major parts are OEM products]

If an intake manifold, a fuel rail, and a brake (caliper) are OEM products, we accept the conclusion in an original bolt etc. and permit those without additional conclusion, such as a wire ring.

- > Show Evidence which we can understand that it's a OEM product.
- > A team ensures torque management of a bolt etc.



# Addition: Battery

## The notes of a battery

**A Gell Type battery "is not a dry."  
We judge it as a wet battery.**

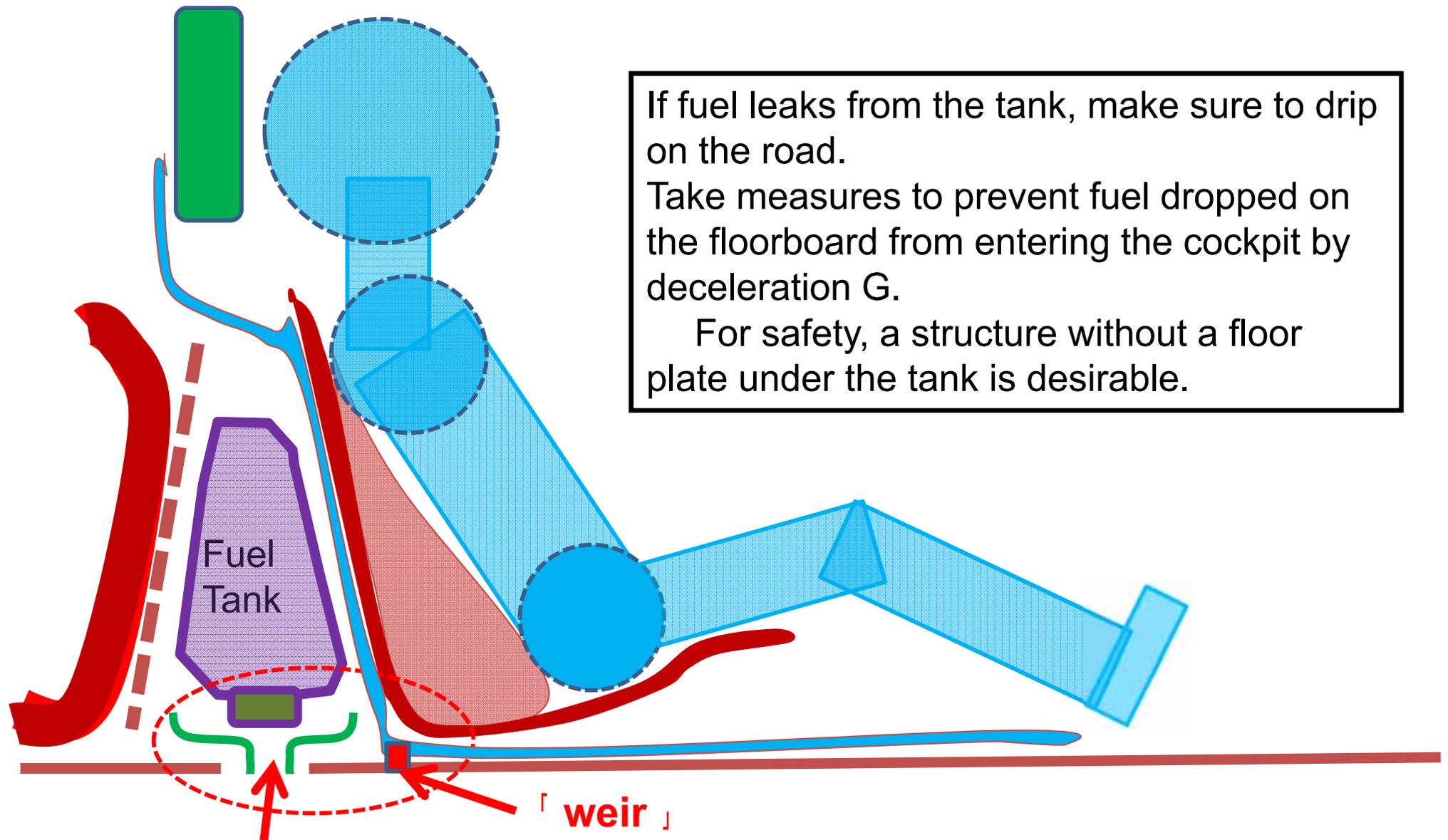


**For a general battery, falling-sideways is prohibited.  
We can only permit, if you present the evidence what shows  
"falling-sideways is approved."**

**If falling sideways of the type which you seal also with a shield  
battery after putting in liquid by yourself, it may leak.**

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# Prevention : Fuel Tank (Beripan)



If fuel leaks from the tank, make sure to drip on the road.

Take measures to prevent fuel dropped on the floorboard from entering the cockpit by deceleration G.

For safety, a structure without a floor plate under the tank is desirable.

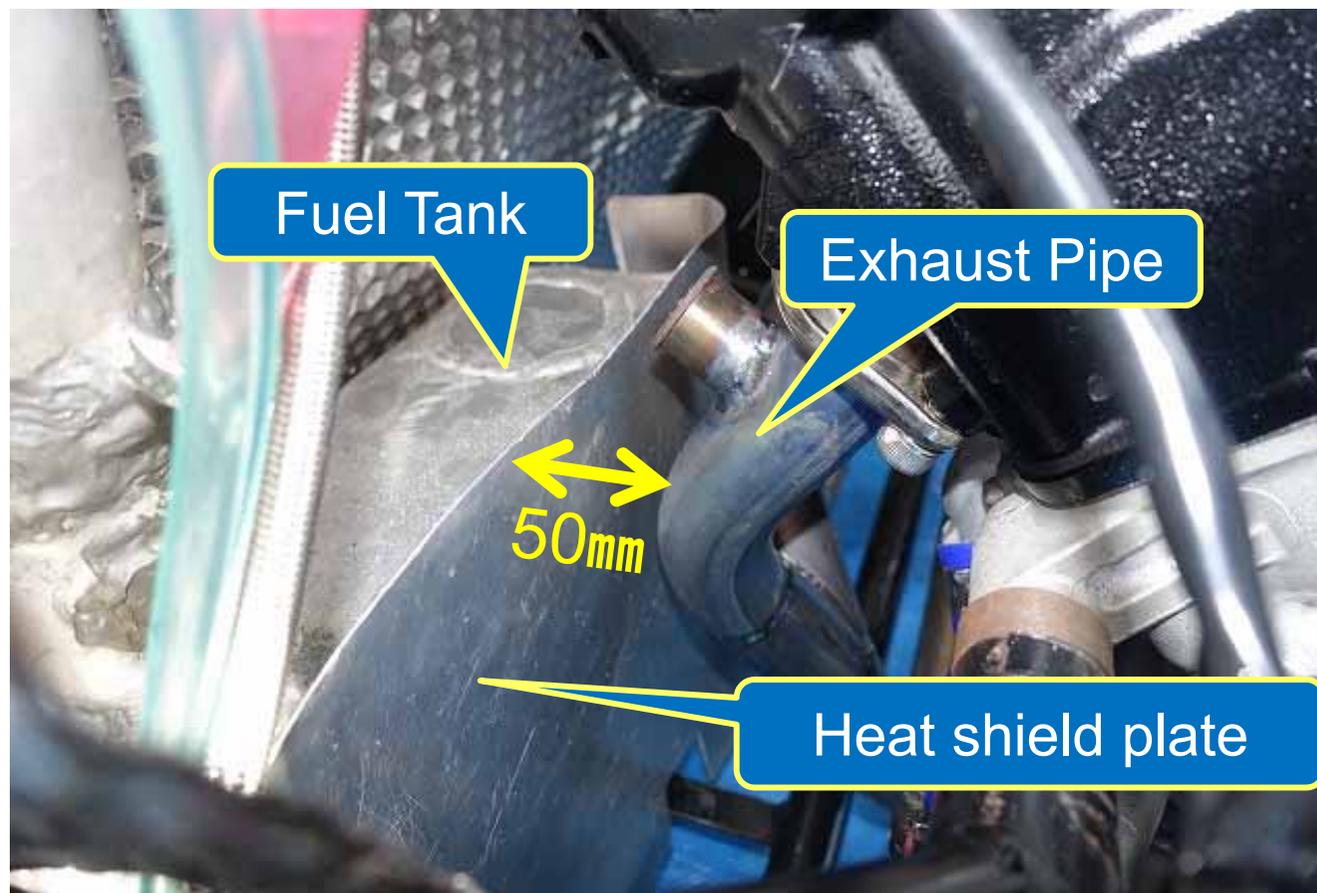
**When the under floor is covered, it is desirable to install a beripan having a diameter of 25 mm and a drain of 2 or more holes. If the floorboard has only holes, use "weir" etc. to prevent inflow into the cockpit.**

# Prevention: Fuel Tank

Distance of a fuel tank and the exhaust pipe

The clearance of fuel tank and exhaust pipe shall not be less than 50mm. **Local rule J2019-17.**

However, if 50 mm can not be secured, a heat shield plate having fire resistance equivalent to that of a fire wall is added so that the fuel temperature during traveling will not exceed the 50% distillation temperature of JIS K 2202-2012, Submit evidence to prove this.



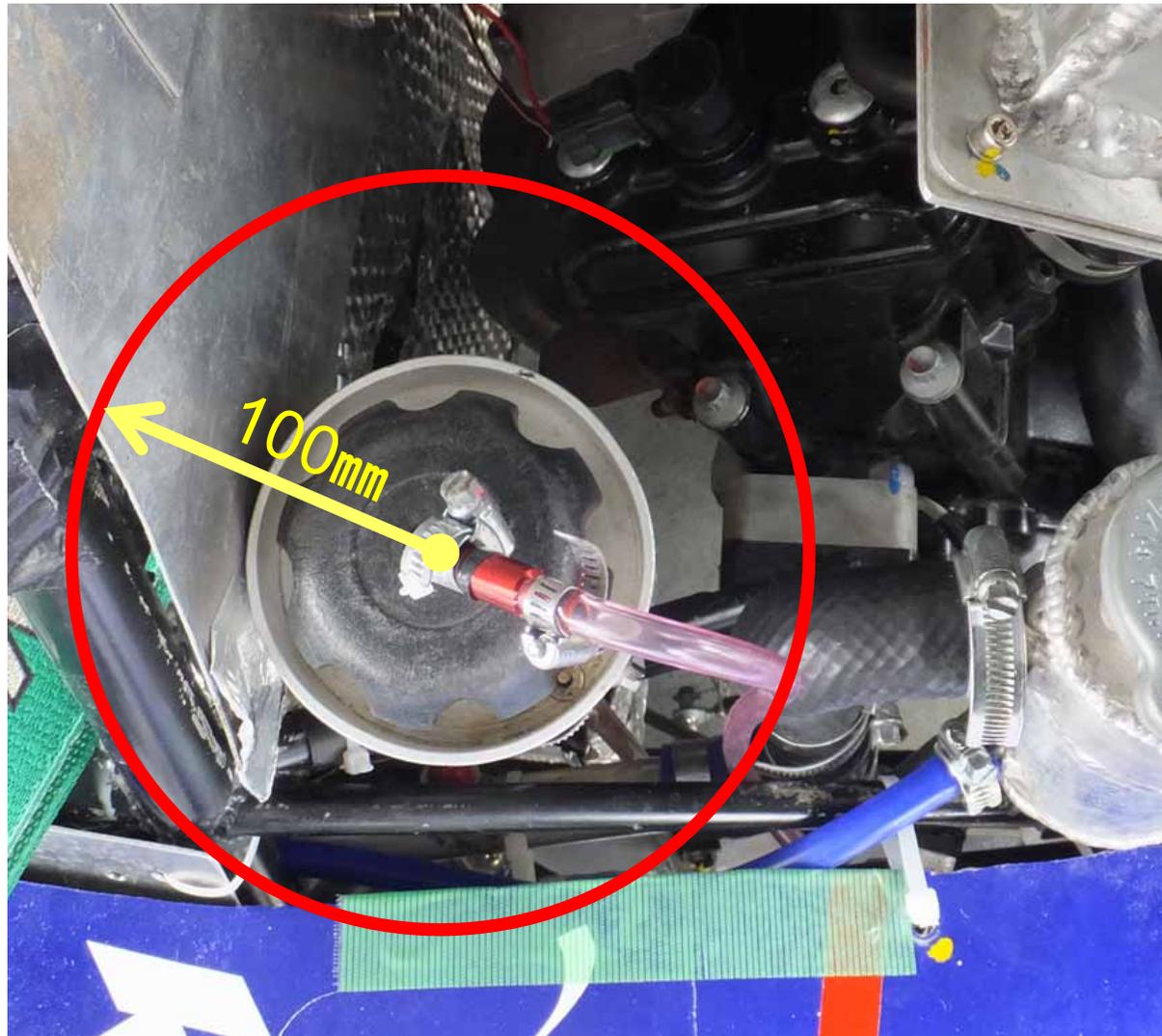
# Prevention : Fuel Tank

Position of the fuel supply port

IC.5.1.1 The fuel system must be designed so that:

- c. Spillage during refueling cannot contact the driver position, exhaust system, hot engine parts, or the ignition system.

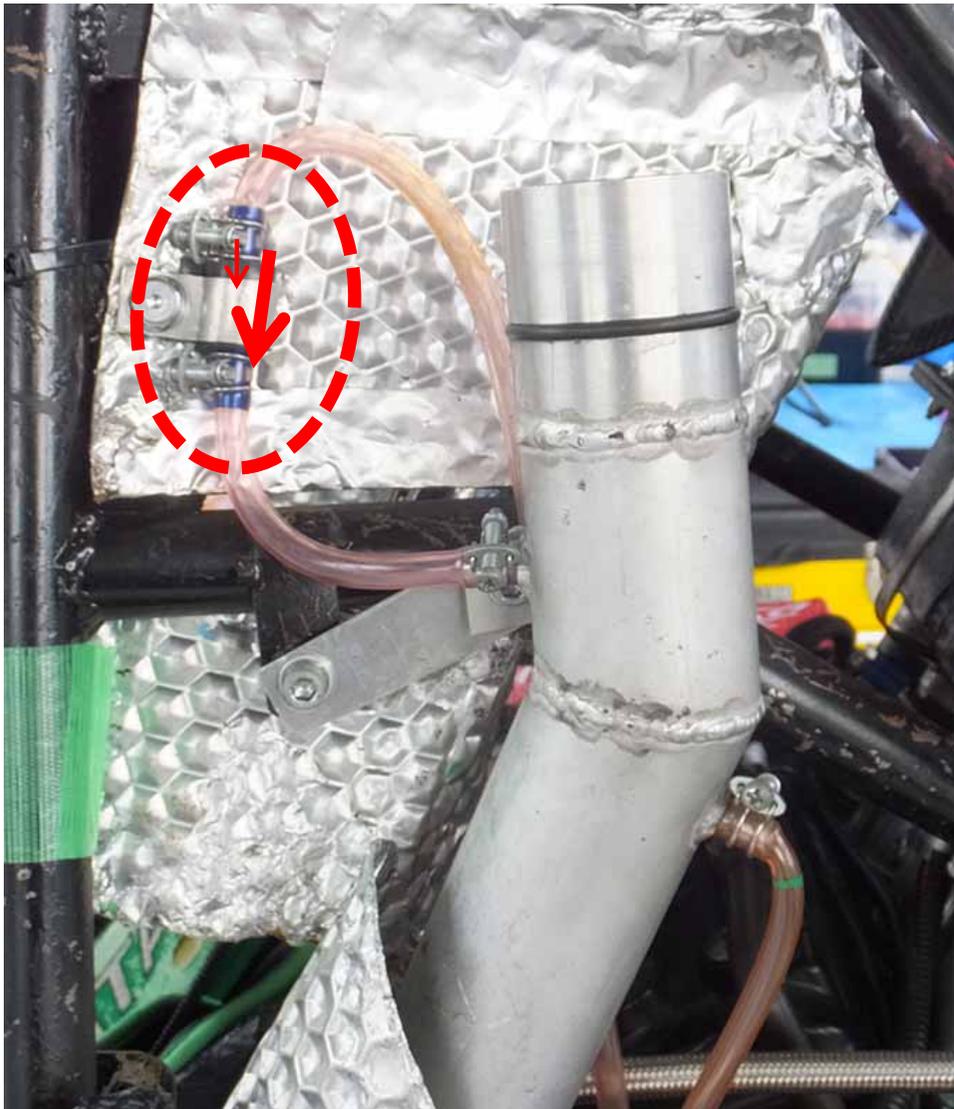
**Range of red circle. (Reference: radius of about 100 mm)**



# Prevention : Fuel Tank Vent hole / tube

## - How to use vent hole (check valve)

- Securely fix in the vertical direction Note, direction
- Extend the tube to the bottom of the frame



## - (Site) Tube

Prohibition of use of oil proof tube  
(Prove gasoline resistance)



## Examples of notes

It can not be used for gasoline.

- 使用液体：軽油、灯油、重油、一般作動油  
(有機溶剤、ガソリン、食用油には使用できません。)
- 使用雰囲気温度：-20~60℃
- 常用使用圧力 (23℃)：1kgf/cm<sup>2</sup> (0.1MPa) 以下で