

# FORMULA STUDENT GERMANY

INTERNATIONAL DESIGN COMPETITION

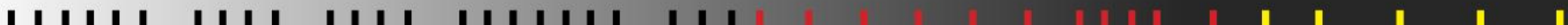
FSG Workshop 2016

Technical Inspection





- All information, documents and advices published on the FSG website ([www.formulastudent.de](http://www.formulastudent.de)) in the section “Rules & Important documents” are **OFFICIAL documents** for the FS Germany events.
- All advices given in this presentation are comparable to **rule-announcements** and are valid for the FS Event 2017.





## Parc Fermé 2016

- 7 vehicles were not compliant with the rules
  - Front wing height → 3 vehicles
  - Underdray sizing → 1 vehicles
  - Brake Over-Travel Switch (BOTS) → 2 vehicles
  - Voltage violation (600V) → 1 vehicle



## Parc Fermé 2017

- There will be one!
- Tests will again be the same for all vehicles



©fotolibra.com



### Driver Equipment ⇒ Article T12.3 of Rules 2017



Collected driver equipment during Formula Student Germany 2016





## Driver Equipment ⇒ Article T12.3 of Rules 2017

### Why is the driver equipment so important?

- All Formula Student cars are **PROTOTYPES**!
- At any time anything can go wrong (fire, broken chassis components, accidents)!
- The driver equipment is classified as fire resistant to protect the driver's skin!
- The harness system protects the driver from severe injuries in case of an accident!

**Please always remember:**  
**It is your and your team members LIFE and HEALTH**



### Facts about SCRUTINEERING (Article IN of FS Rules 2017)

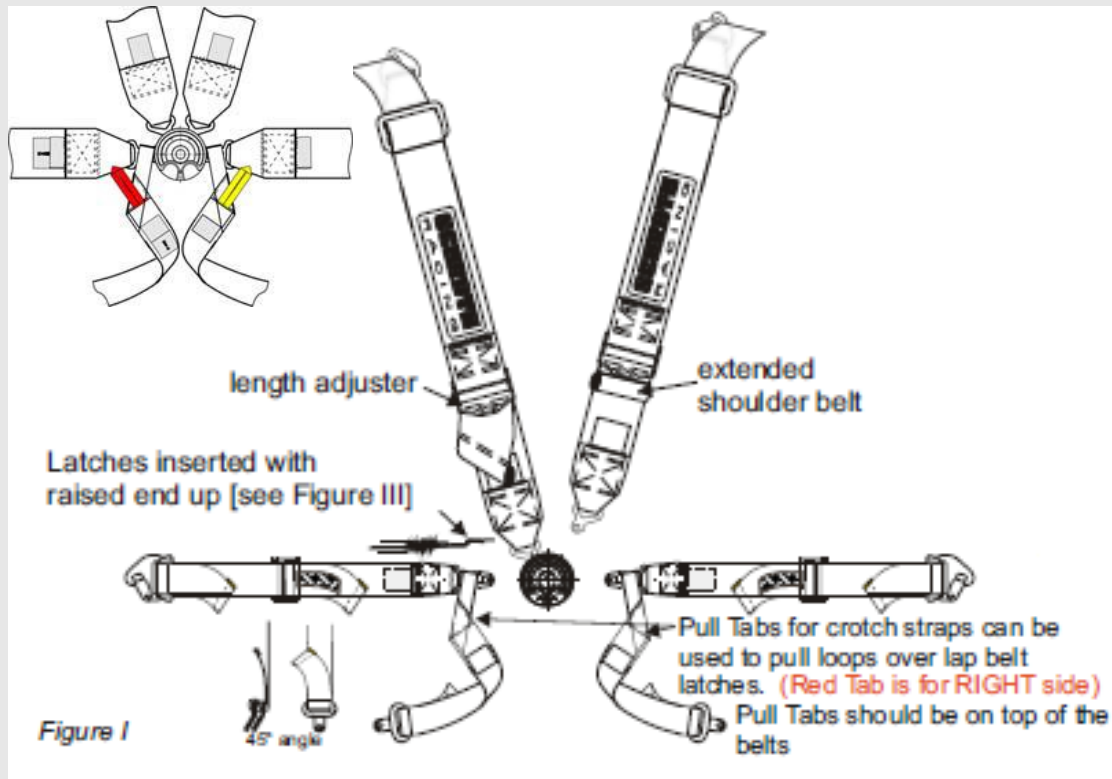
- Scrutineering is a SERVICE to the teams
  - to check if the car is safe and in racing condition
  - to verify the REQUIREMENTS given by the rules
- Scrutineering is **NOT** a **discussion** event.
- The technical inspection sticker **ONLY** shows that the car **at the moment** as presented at the technical inspection meets the REQUIREMENTS given by the rules.
- Scrutineers have the right to check the car during the event **at any time**.
- If scrutineers find a deviation from the rules **during a re-check** (e.g. after a dynamic event), the team will get a DNF for the last dynamic event and the team will lose the technical inspection sticker!

The **RESPONSIBILITY** to comply with the rules is always with **the team**.

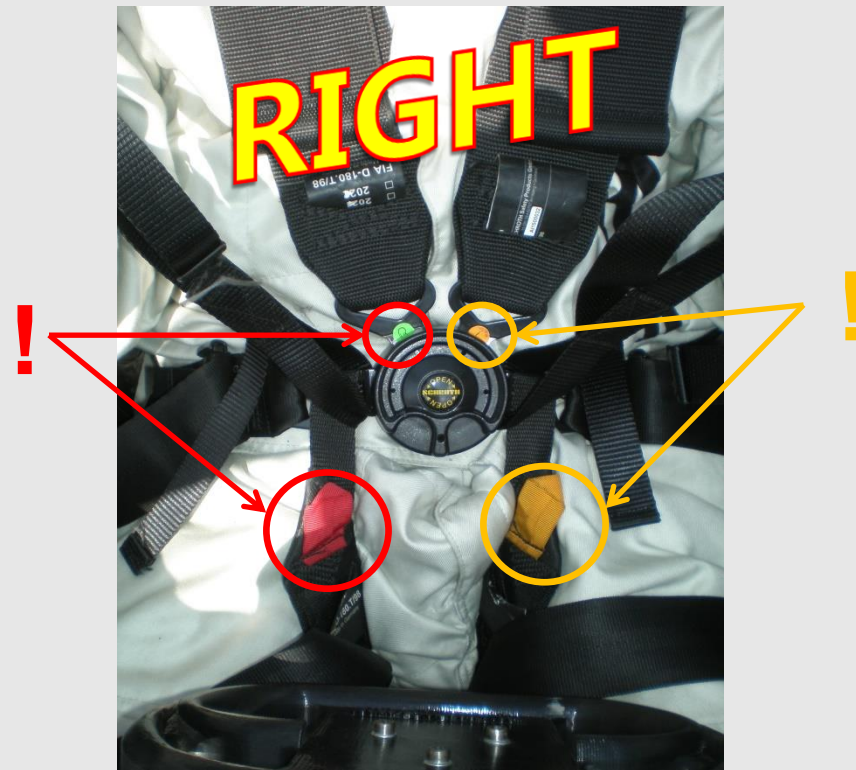


### Harness Installation

Please inform yourself about the installation in the user manual of your harness system!!



Picture 1: Example of a SCHROTH HYBRID II installation © Schroth®



Picture 2: Properly installed SCHROTH HYBRID II System



## Harness Installation

- T4.6.1 The anti-submarine belts of a 6-point harness must be mounted:  
[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.



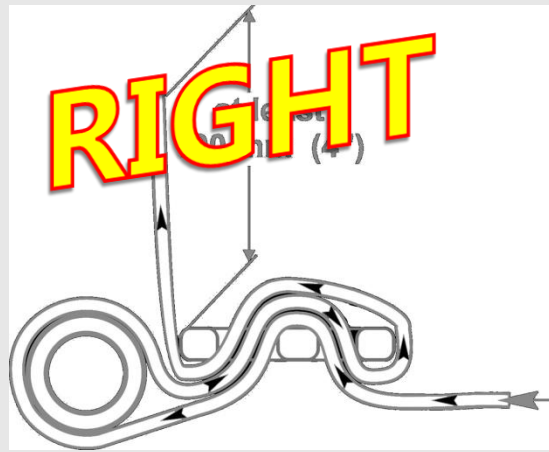
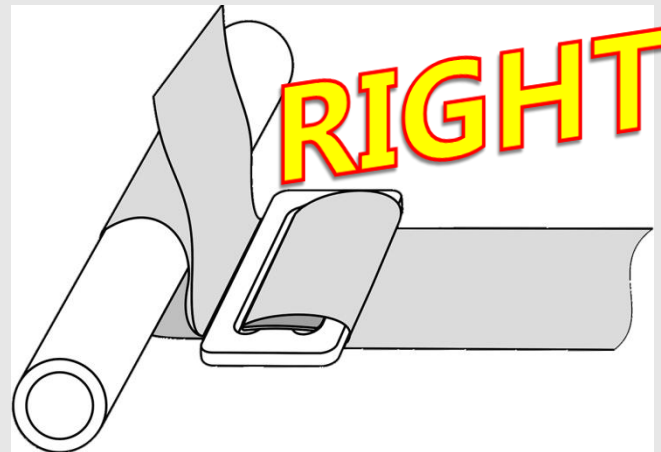
A routing of the anti submarine belt below the seat in this case is not permitted!



### Shoulder harness attachment (e.g. wrap around)



Picture 3: Wrong shoulder belt attachment



Please inform yourself about the installation in the user manual!!

Picture 4: Belt Weave with 3 Bar Slide  
© Schroth



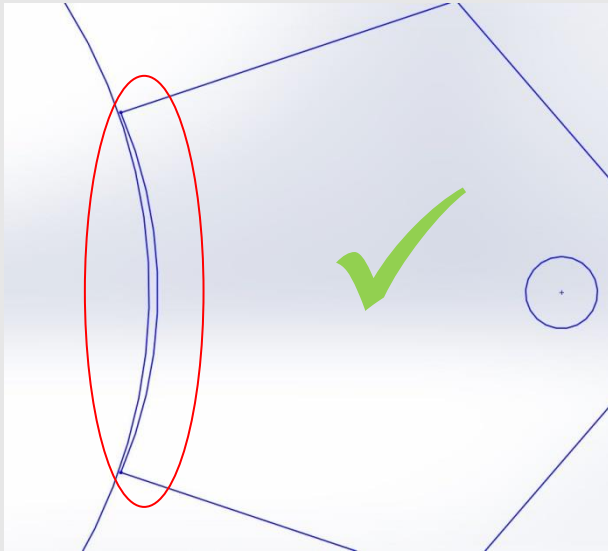
### Radii on Bodywork (T 1.2.2 of Rules 2017) ⇒ Clarification



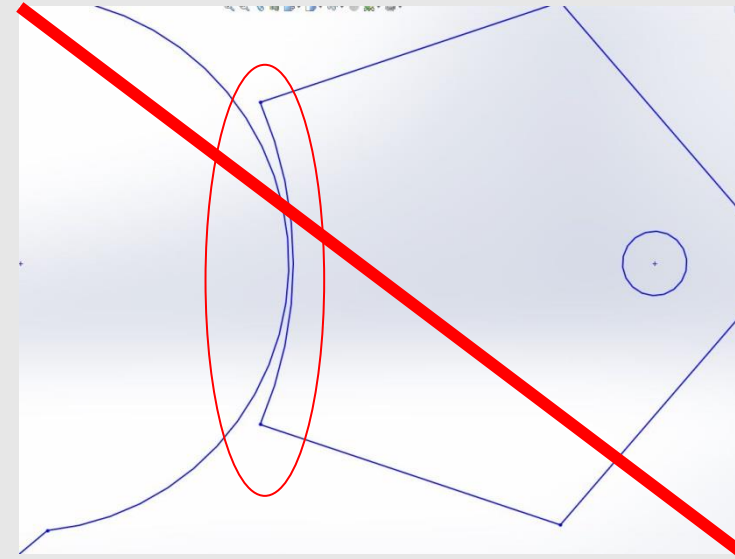
Picture 5: Examples of wrong front body work radii seen at FS Germany 2016

### Radii on Bodywork (T1.2.2) ⇒ Clarification

- ➔ All forward facing edges on the bodywork that could impact people, e.g. the nose, must have forward facing radii of at least 38 mm.



Picture 6: **Left: Nose radii is more than 38mm**



**Right: Nose radii is less than 38mm**



### Impact Attenuator

- No crushable objects in the IA Zone
- IA Testing dynamic only





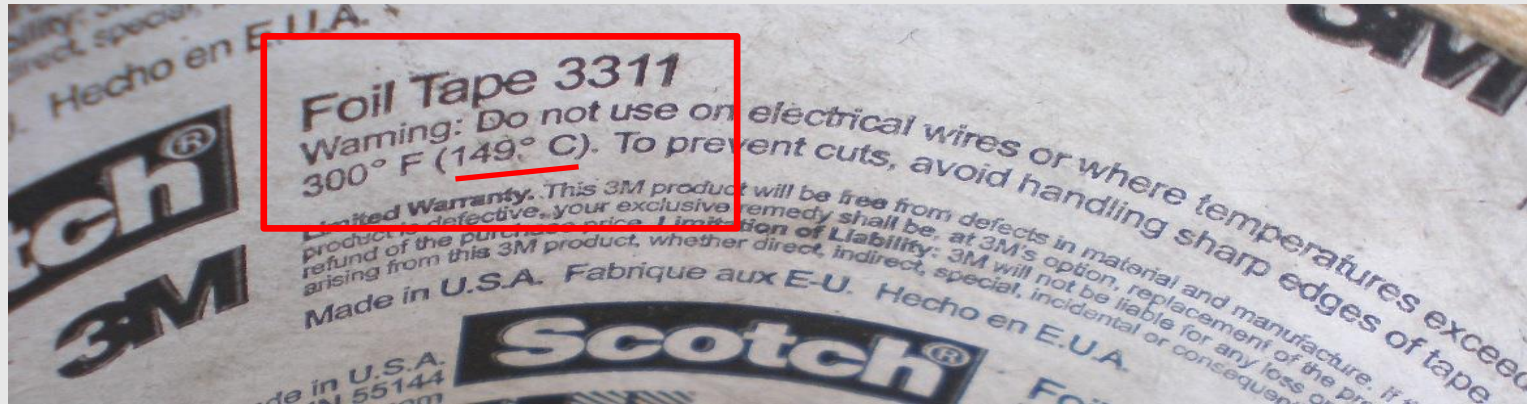
### Firewall / Heat shield -> E-Cars



**NOT PERMITTED AS A FIREWALL** : flammable materials

### Firewall

At FS Germany aluminium tape shown below is only accepted to close small gaps ( $\leq 3\text{mm}$ ).  
Using tape is no rigid mounting method (T3.8.2 of Rules 2017).



**PLEASE use high quality products only (not flammable by itself)**



### Firewall / Heat shield

- Please use for the firewall and all components of fuel and exhaust system **ONLY** appropriate isolation material



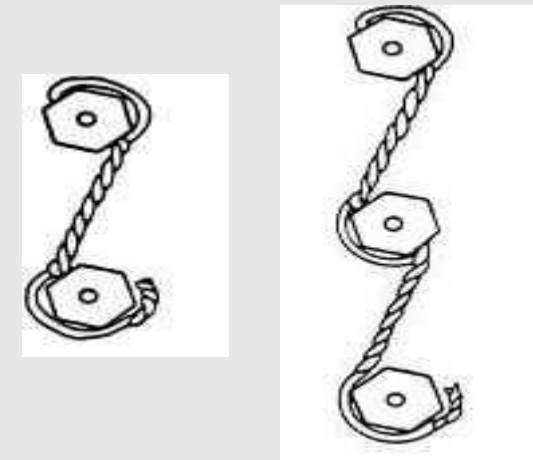
Picture 7: Examples of right and accepted fire wall materials



### Safety wiring

- Teams have to use a special lock wire AND a special tool for safety wiring !
- Please read a user manual for creating perfect safety wiring !

YouTube movie: [www.youtube.com/watch?v=OwFjUX6SaY8](http://www.youtube.com/watch?v=OwFjUX6SaY8)

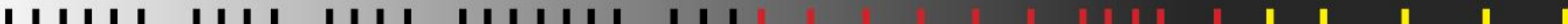


Picture 8: Safety wire , wiring tools and proper wiring



## Safety wiring

- **FS Germany Scrutineers will NOT accept improper safety wiring**
- **Make sure that your wiring is of high quality and done with the right tools**



### Self made fasteners ⇒ Clarification

Self made fastener are **NOT** prohibited, **BUT**:

### Formula Student is an Engineering Design Competition

→ The first question is: How can we proof it?

At the Technical Inspection a team **has to be able to show** that the design and material of the fasteners is according to requirements of article 9 of Rules 2017

### How? (3 things)

- Design documentation / material certification (**calculations**) and
- Mechanical tests (**test documentation + test samples**) and
- Delivery note / invoice of the manufacturer







## Accumulator Container

EV 3.5.12 The mounting of the accumulator container must be designed to withstand the following accelerations:

- 40 g in the longitudinal direction (forward/aft)
- 40 g in the lateral direction (left/right)
- 20 g in the vertical direction (up/down)

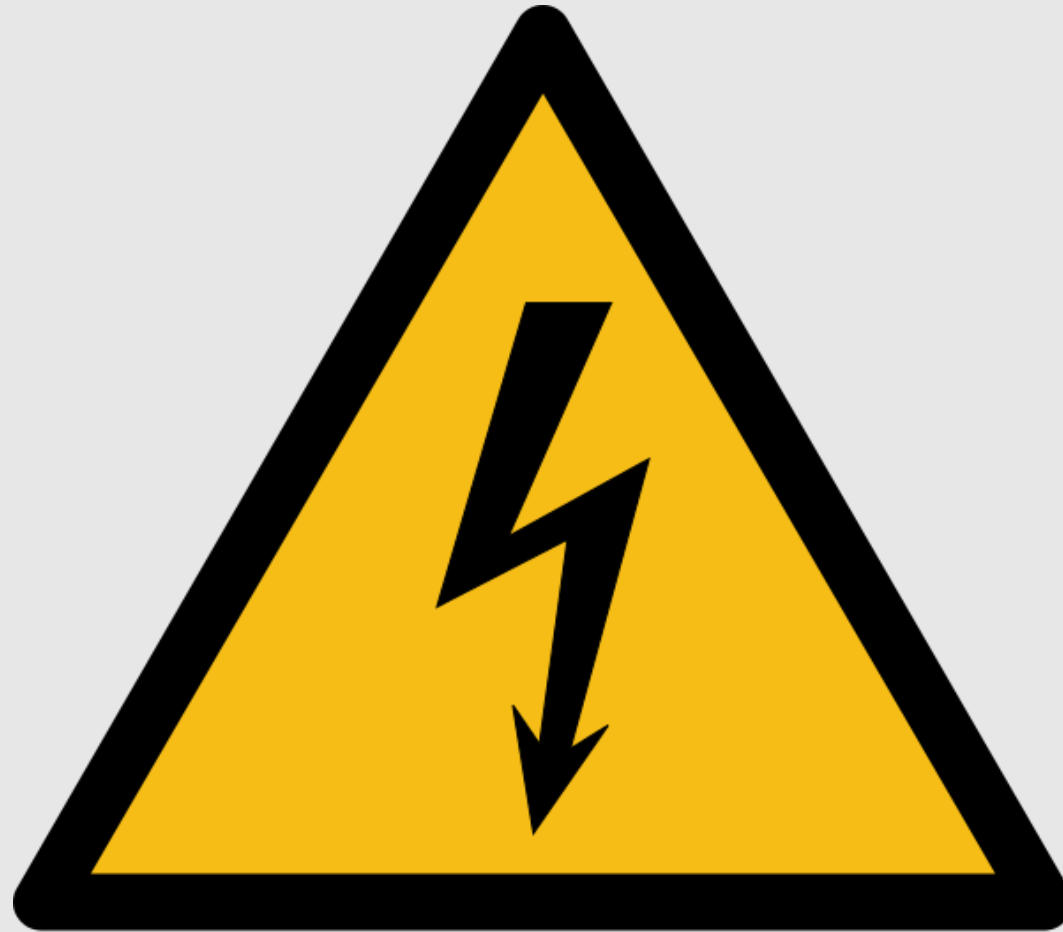
Calculations and/or tests must be included in the SES.

### Low Voltage Batteries

- Must be protected from roll-over situations
- Must be separated from the driver by a firewall
- Must have an overcurrent protection



### Electrical Inspection 2017





### HVD and Tractive System Wiring (EV4.2.1)

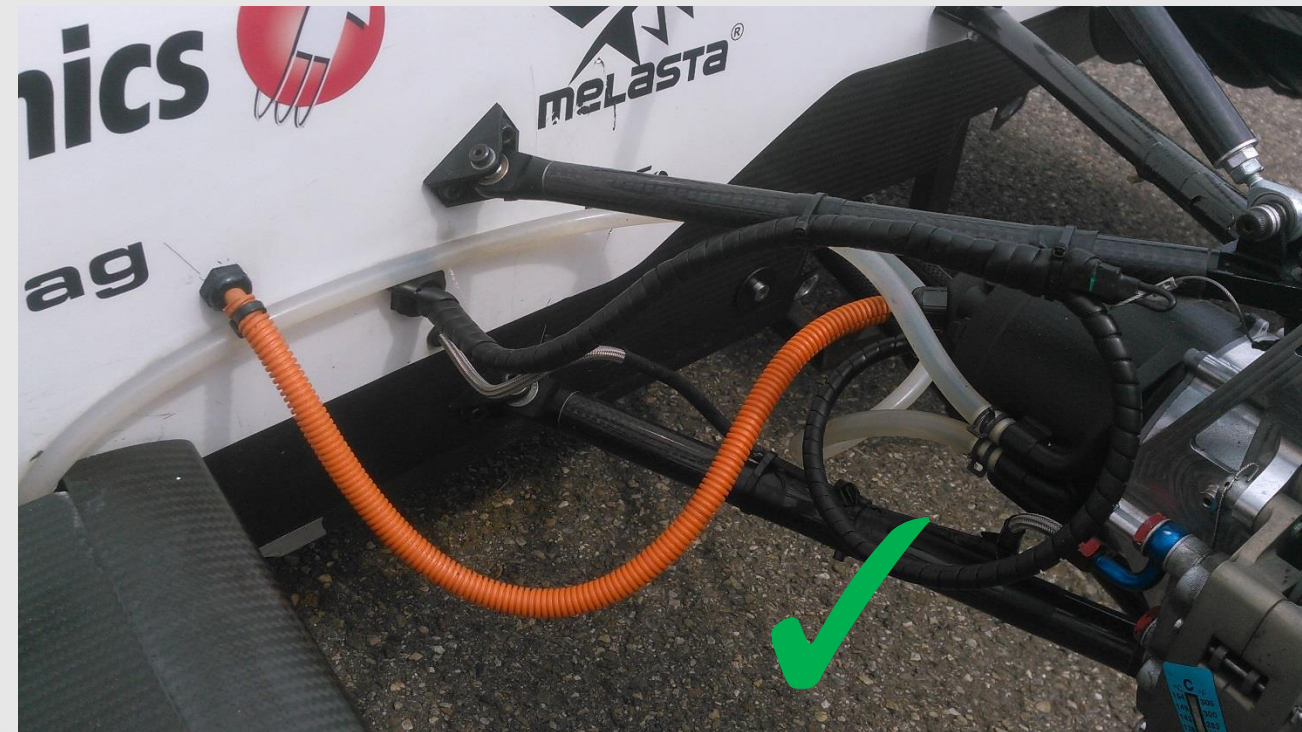
- All HV parts need to be protected from roll-over situations
- Rule did not change but has been clarified
- Whole HVD is a HV part!
- HVD must be protected for touching live contacts even if removed electrically (EV 4.5) → Dummy HVD might be necessary





### HVD and Tractive System Wiring (EV4.2.3)

- HV wires outside the roll-over protected envelope must be reduced to a minimum
- If the wiring brakes anywhere, it must not be possible to reach the driver or the cockpit opening!







### Positive Locking of Tractive System Connections (EV4.5.13)

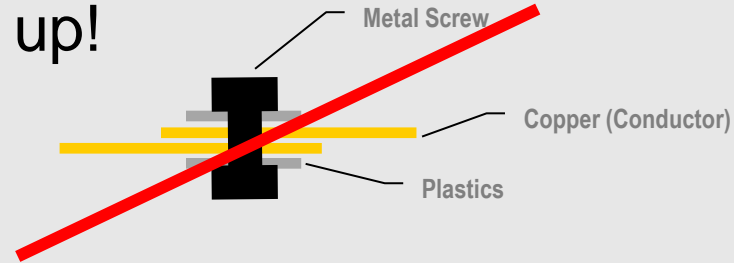
- For Automotive Certified Components, the certified method of connection is accepted (e.g. M5 bolt, lockwasher and washer torque: 3.4 to 4.5 Nm with a thread engagement of...) if done exactly as certified.
- **DO NOT USE Helicoils in AIRs! Don't do it! Really!**
- Nylocs are in general NOT rated for the needed temperature range.





### Tractive System Connections

- Do not use plastics in stack up!
  - E.g. this is not allowed →
- For connectors:



**Withstanding Voltage  $\neq$  Rated Voltage**

### Maintenance Plugs

- Must separate both poles of the segments. Even for the first and the last segment.
- It must not be possible to connect them wrong
- Must have proper current rating at all time



### TSAL

- Must be red blinking XOR green illuminated XOR off
- May be supplied by the GLV system
- “Single Light” is defined by housing
  - Multiple LEDs in one housing is a single light
  - Multiple LEDs right next to each other is a single light

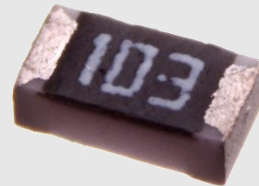
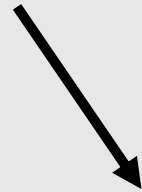






## System Critical Signals

Will be your best friend



CC-BY SA - oomlout

Banana for scale

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See you at the Hockenheimring

8<sup>th</sup> until 13<sup>th</sup> of August 2017

