



COLLEGIATE ROAD SHOW

at IMIS

December 10th 2011

SAFETY

by

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Albion Associates LLC

SAE *International*[®]



SAFETY IS.....

- The responsibility of.....
- FSAE cars are designed for
 - Autocross and solo events
 - **NOT** for speed events like hill climbs or time trials



From the Tube to the Track – THINK SAFETY

- The Car
- The Shop
- Driver Equipment
- Practice/Testing
- Traveling to and from the Event
- At the Event



The Car

- Control arm anti-intrusion bars
- Human Factors aka Driver Ergonomics
 - Cockpit environment and driver comfort
 - Ingress/Egress
 - Roll bar down tubes
 - Seat design (mounting and proper driver support)



SAE *International*[®]

3.3.5.4 Other Side Tubes



OK



Not OK

If there is a roll hoop brace or other frame tube alongside the driver, at the height of the neck of any of the team's drivers, a metal tube or piece of sheet metal must be firmly attached to the Frame to prevent the drivers' shoulders from passing under the roll hoop brace or frame tube, and his/her neck contacting this brace or tube.



The Car – Cont'd

- Seat belts/safety harness
 - Choice
 - Installation



B.5.1 Belts - General

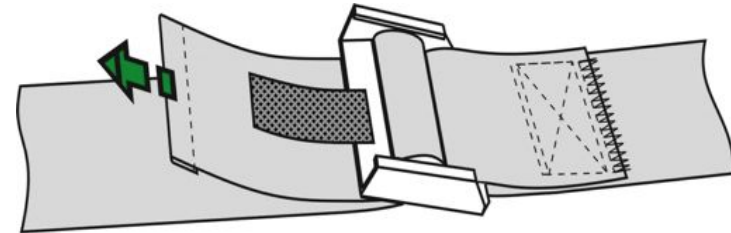
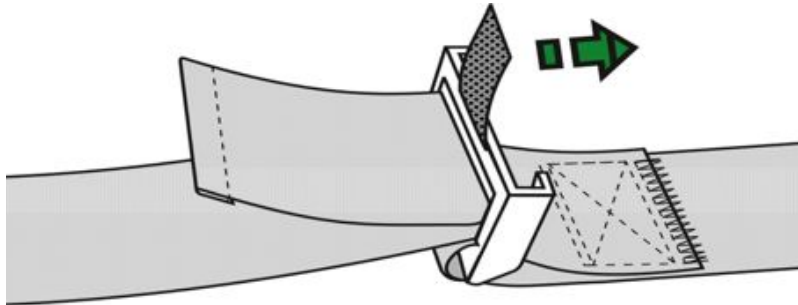
- B.5.1.2 Harness Requirements

All drivers must use a 5, 6 or 7 point restraint harness meeting the following specifications:

- a. All driver restraint systems must meet either SFI Specification 16.1, SFI Specification 16.5, or FIA specification 8853/98.
- b. The belts must bear the appropriate dated labels.
- c. The material of all straps must be in perfect condition.
- d. There must be a single release common to the lap belt and shoulder harness using a metal-to-metal quick release type latch.
- e. To accommodate drivers of differing builds, all lap belts must have a “quick adjuster” feature.

Lap belts with “pull-up” adjusters are recommended over “pull-down” adjusters.

Belts - “Quick Adjusters”, Tilt-Lock Adjusters or “Zip Adjusters”



B.5.1 Belts - General



- B.5.1.2 Harness Requirements
All drivers must use a 5, 6 or 7 point restraint harness

B.5.1 and 5.3 Belts - Upright vs Reclined Driver



B.5.1.1 Definitions

- d. An **upright driving position** is defined as one with a **seat back angled at 30 degrees or less from the vertical** as measured along the line joining the two 200 mm circles of the template of the 95th percentile male as defined in Rule B.3.9.3 and positioned per B.3.9.4.
- e. A **reclined driving position** is defined as one with a seat back angled at **more than 30 degrees from the vertical** as measured along the line joining the two 200 mm circles of the template of the 95th percentile male as defined in Rule B.3.9.3 and positioned per B.3.9.4.

B.5.1 and 5.3 Belts – Reclined Driver



B.5.1.2.f Cars with a Reclined driving position (see B.5.1.1.e above) **must have:**

- either a **6 point or 7-point harness,**

AND

- have either **anti-submarine belts with “quick adjusters”** or
- have **two (2) sets of anti-submarine belts installed.**

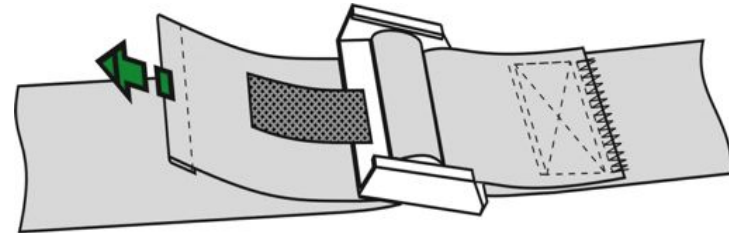
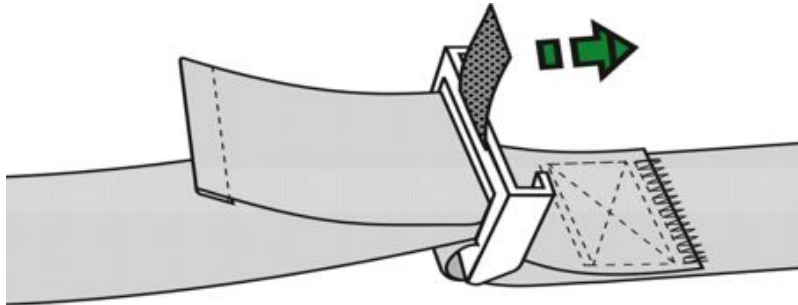
B.5.3.6 **With a reclined driving position, in side view the lap belt must be between an angle of 60 degrees and 80 degrees to the horizontal.**

B.5.1 Belts - General



- B.5.1.2 Harness Requirements
All drivers must use a 5, 6 or 7 point restraint harness

Belts - “Quick Adjusters”, Tilt-Lock Adjusters or “Zip Adjusters”





B.5.2 Harness Installation - General

- B.5.2.1 The lap belt, shoulder harness and anti-submarine strap(s) must be securely mounted to the Primary Structure. **Such structure and any guide or support for the belts must meet the minimum requirements of B.3.3.1.**
 - B.5.2.2 The tab to which any harness is attached must have:
 - a. A minimum cross sectional area of *60 sq. mms (0.093 sq. ins)* of steel to be sheared or failed in tension at any point of the tab, and
 - b. A minimum thickness of 1.6 mm (0.63 inches).
 - c. *Where lap belts and anti-submarine belts use the same attachment point, a minimum cross sectional area of 90 sq. mm (0.140 sq in) of steel to be sheared if failed in tension at any point of the tab.*
- Note: Double shear mounting is preferred.
- **B.5.2.3 Harnesses, belts and straps must not pass through a firewall, i.e. all harness attachment points must be on the driver's side of any firewall.**



B.5.3 Lap Belt Mounting

- B.5.3.1 The lap belt must pass around the pelvic area below the Anterior Iliac Spines (the hip bones).
- B.5.3.2 The lap belts should not be routed over the sides of the seat. The lap belts should come through the seat at the bottom of the sides of the seat to maximize the wrap of the pelvic surface and continue in a straight line to the anchorage point.
- B.5.3.3 Where the belts or harness pass through a hole in the seat, the seat must be rolled or grommeted to prevent chafing of the belts.



B.5.3 Lap Belt Mounting – Cont'd

- B.5.3.4 To fit drivers of differing statures correctly, in side view, the lap belt must be capable of pivoting freely by using either a shouldered bolt or an eye bolt attachment, i.e. mounting lap belts by wrapping them around a frame tube is no longer acceptable.

B.5.3 Lap Belt Mounting – Cont'd



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B.5.1 and 5.3 Belts - Upright vs Reclined Driver



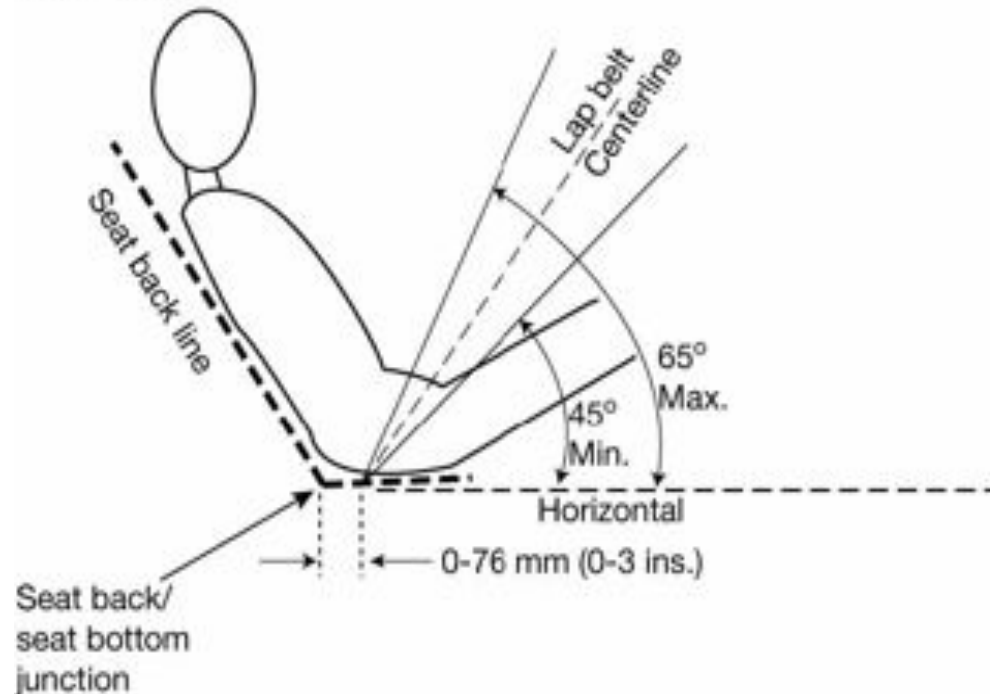
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- d. An **upright driving position** is defined as one with a **seat back angled at 30 degrees or less from the vertical** as measured along the line joining the two 200 mm circles of the template of the 95th percentile male as defined in Rule B.3.9.3 and positioned per B.3.9.4.
- e. A **reclined driving position** is defined as one with a seat back angled at **more than 30 degrees from the vertical** as measured along the line joining the two 200 mm circles of the template of the 95th percentile male as defined in Rule B.3.9.3 and positioned per B.3.9.4.

B.5.3.5 Lap Belt Mounting - Upright Driver

With an “**upright driving position**”, in side view, the lap belt must be at an **angle of between 45 degrees and 65 degrees to the horizontal**. This means that the centerline of the lap belt at the seat bottom should be approximately 0-76 mm (0-3 inch) forward of the seat back to seat bottom junction (see Figure 6a).

FIGURE 6 a
Lap Belt Angle



B.5.1 and 5.3 Belts – Reclined Driver



B.5.1.2.f Cars with a Reclined driving position (see B.5.1.1.e above) **must have:**

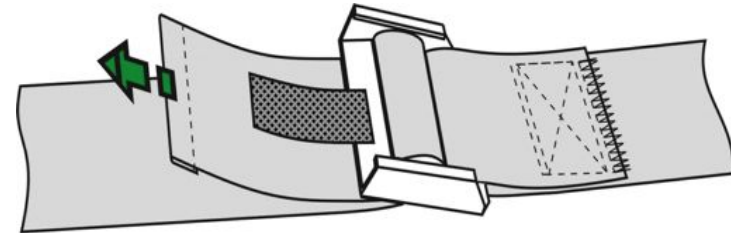
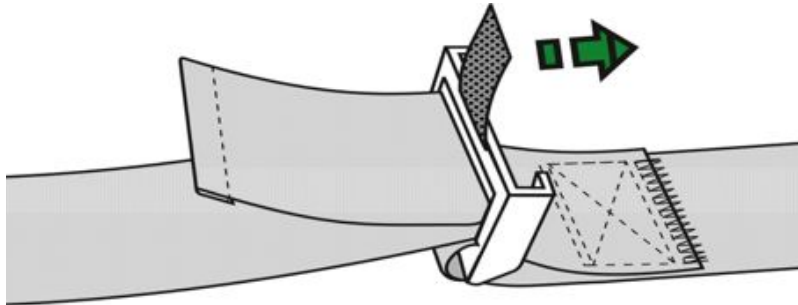
- either a **6 point or 7-point** harness,

AND

- have either **anti-submarine belts with “quick adjusters”** or
- have **two (2) sets of anti-submarine belts installed.**

B.5.3.6 **With a reclined driving position, in side view the lap belt must be between an angle of 60 degrees and 80 degrees to the horizontal.**

Belts - “Quick Adjusters”, Tilt-Lock Adjusters or “Zip Adjusters”



B.4.5.3 Firewall & B.5.2.3 Seat Belt Mounting

- B.4.5.3 Any firewall must seal completely against the passage of fluids, **especially at the sides and the floor of the cockpit, i.e. there can be no holes in a firewall through which seat belts pass.**
- B.5.2.3 Harnesses, belts and straps must not pass through a firewall, **i.e. all harness attachment points must be on the driver's side of any firewall.**

This basically means that the seat cannot be used as a “firewall”!!

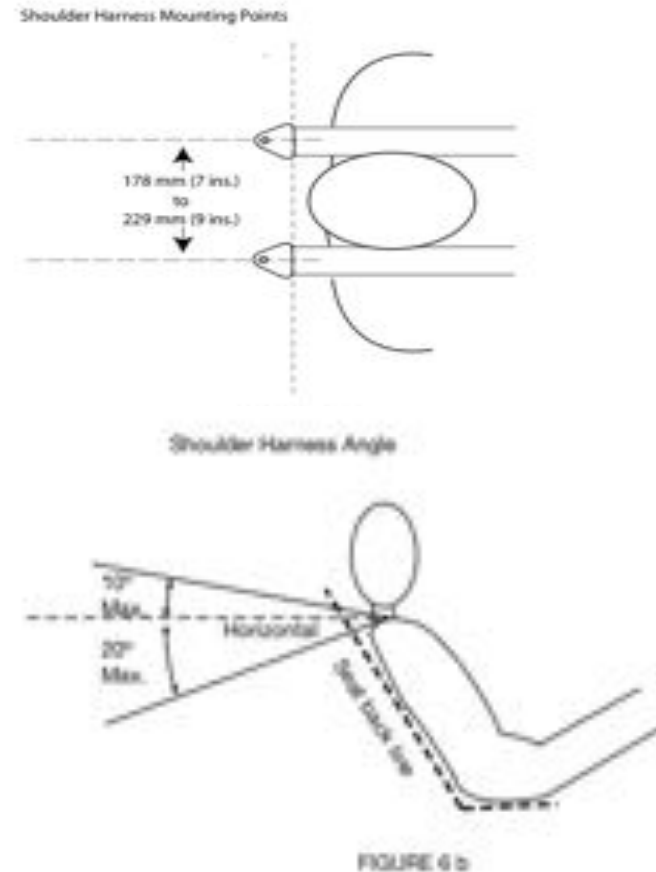
And what is on the right is NOT OK!!



B.5.4 Driver Restrain System - Shoulder Harness Mounting

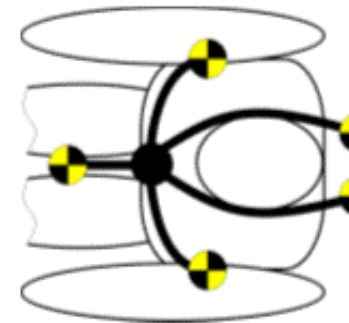
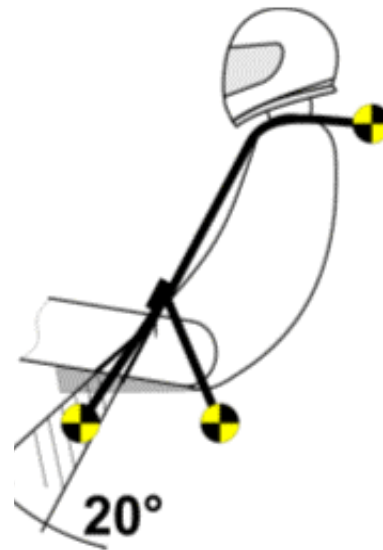
The shoulder harness mounting points must be **between 178 mm (7 inches) and 229 mm (9 inches) apart**.

From the driver's shoulders rearwards to the mounting point or structural guide, the shoulder harness must be **between 10 degrees above the horizontal and 20 degrees below the horizontal**.



B.5.5 Anti-Submarine Belt Mounting 5 Point System

- B.5.5.1 The anti-submarine belt of a 5 point harness should be mounted **in line with, or angled slightly forward of (up to 20 deg)**, the driver's chest-groin line.
- B.5.1.1.f The chest-groin line is the straight line that in side view follows the line of the shoulder belts from the chest to the release buckle.

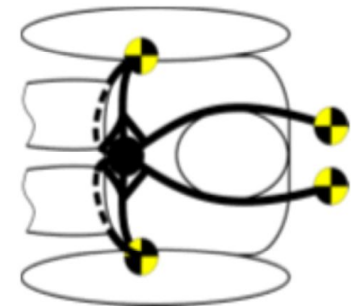
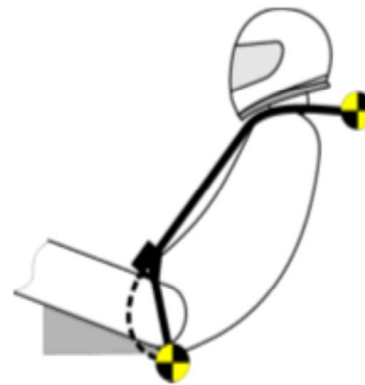
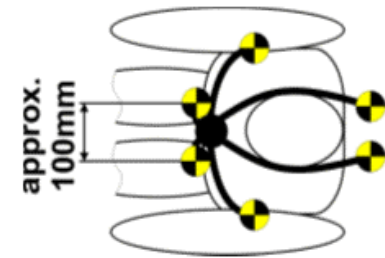


B.5.5 Anti-Submarine Belt Mounting 6 Point System

B.5.5.2 The anti-submarine belts of a 6 point harness should be mounted either:

a. With the belts going **vertically down from the groin, or angled up to 20 deg. rearwards. The anchorage points should be approximately 100 mm (4 inches) apart.** Or

b. With the anchorage points on the Primary Structure at or near the lap belt anchorages, **the driver sitting on the anti-submarine belts, and the belts coming up around the groin to the release buckle.**





The Shop

- Material and parts storage
- Special storage for flammable fluids
- Waste disposal
- Fans/Ventilation
- Eye flush station
- Cutting and welding equipment
- Tools
- Gloves
- Fire extinguishers and proper use



In the Shop

- Training in proper use of machine equipment
- Long hair/loose clothing
- Buddy system in shop, never work alone
- Safety glasses/shields (grinding, drilling, welding, compressed air)
- Fatigue
- Proper lifting techniques
- Housekeeping and exit plan
- Team member emergency contact information
- Fire/EMS contact information



In the Shop- Cont'd

- Brake cleaner = phosgene
 - <http://www.brewracingframes.com/id75.htm>
- MSDS sheets
 - Material Safety Data Sheets
 - <http://www.ilpi.com/msds/#Misc>



Keep Shop and Car Clean

- Stuff on the floor (parts, oil dry, liquids, metal chips, trash)
- Tools and equipment
- Minimize slipping/tripping on shop floor
- Minimize vehicle systems contamination and potential damage
- Keep the car clean
 - Easier to diagnose leaks/parts fatigue and breakage
 - Potential sponsors may be watching

Driver's Equipment

- Helmets
 - SA vs M vs DOT
 - Care of
- Driver's suit





Driver's Equipment

- Underwear
 - Nomex/Carbonex vs natural vs man-made
 - NO man made “on’s”
- Gloves
- Shoes
- Socks
- Arm restraints
- Safety harness
 - Care
 - Wearing



Practice and Testing

- Find a safe area (permission/other traffic/obstacles)
- Course layout with adequate runoffs
- Safety assignments and procedures
 - No sitting
 - No cell phones on course
- In case of a testing accident (first aid kit, Red Cross first aid training)
- Bring fire extinguishers
- Driver/crew safety equipment (wear it, use it!)
- Spotters for photographers, video & still
- Communications
 - Emergency contact phone numbers
 - Working radios and/or cell phones



Traveling to and from the Event

- Remember the FSAE team of Minnesota State University
- Plan trip with time to spare
- Trailer versus straight truck?
- Tow vehicle
- Trailer loading
- Proper trailer towing techniques
- Driver distractions, fatigue, and towing experience
- Save your speeding for the event
- Drugs/alcohol and common sense



At the Event

- Watch out for competitors, spectators in paddock area
- Safety assignments and procedures
- Bring fire extinguishers
- Driver/crew safety equipment (wear it, use it!)
- Support vehicle
- Spotters
- Communications
 - Emergency contact phone numbers
 - Working radios and/or cell phones
 - Message board on trailer door



Summary

- Safety is everyone's responsibility
- You have a responsibility!
- You are NOT invincible!
- Plan ahead
- Keep each other "honest" (and safe)
- Being safe is NOT being a wimp!
- Consequences



Questions?

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