Informal Document N° 18
(30th GRSP, 3-6 December 2001
Agenda item 1.3.4)

November 28th, 2001

Presentation of the draft Global Technical Regulation on Safety Belts

The draft global technical regulation (GTR) on safety belts was prepared by a group of experts from safety belts manufacturers from USA, Japan and Europe.
It is mainly based on the requirements of ECE R-16, FMVSS 209 and Japan SRRV 22-3. The last 6 pages of this document gives a comparison between these requirements and the Industry proposal.

Since the experts' experience showed that a dynamic test is the most decisive requirements to check strength performance of the entire assembly, this kind of test is proposed in the GTR without static testing requirements. It was also felt that including dynamic testing in the requirements would – with all restrictions linked to laboratory testing – reflect better real world accident.

The draft GTR stands as a component/technical unit regulation (FMVSS 209), therefore without occupant protection requirements. These requirements are covered by frontal and side impact collision protection requirements now in force. On the other hand, preference has been given in the GTR to ISO standards instead of specific ones, where possible.

RIGID PARTS

Corrosion Resistance and Exposure period

The experts found FMVSS 209 requirements more precise and accurate, not giving way to different interpretations.
It is also proposed for the purpose of good equipment administration to specify one corrosion cycle as 23 hours continuously in the salt spray environment followed by 1 hour period when the parts will be initially washed of any salt residue and then allowed to dry. One cycle will take 24 hours to complete so that the operation can be repeated daily at exactly the same time.

Weight and Shape changes of plastic parts

Specific requirements as in FMVSS 209 were not felt necessary as proposed requirements 3.2.1.1 and 3.1.3 cover the issue.

WEBBING

Width

Only one requirement is proposed whatever the type of the safety belt.

Breaking strength, elongation, energy absorption

The experts experience is that the dynamic test is determining the necessary values/or breaking strength, always above the minimum required in the existing regulations. In the same spirit, elongation and energy absorption requirements were not felt necessary and design restrictive in reducing the safety belt manufacturer's ability to balance energy absorption across different belt components.

Resistance to abrasion

It is proposed only one test, based on FMVSS 209 requirements, which can be carried out independently from other parts/components of the safety belts, which is the most severe and which is better reproducible.

Resistance to cold and heat

The most stringent requirements have been included in the GTR.

Resistance to light

Carbon–arc equipment no longer produced. Xenon-arc method proposed is regarded to be state-of-the-art.

Resistance to micro-organisms

Synthetic materials are inherently resistant.

Colour fastness to light

Colour fastness to light was not considered as a safety issue, no requirement is proposed.

Colour fastness to rubbing

Colour fastness to rubbing was not considered as a safety issue, no requirement is proposed.

Colour fastness to perspiration

Colour fastness to perspiration was not considered as a safety issue, no requirement is proposed

BUCKLE

Durability

Most severe requirements proposed.

Compressibility

Single handed tongue insertion requirements and the design requirement of modern automotive seats make this historic specific test not necessary. Issue is covered by § 3.2.1.3 of the GTR.

Cold impact test

ECE R-16 requirements are proposed

Partial engagement

ECE R-16 requirements are proposed which was found more clear than FMVSS requirements, they do not permit the buckle to be left in a partially closed position.

Releasing force

ECE R-16 requirements were found more complete, taking into account the checking of the buckle release after the dynamic test.

Static Tensile Test

Strength requirements are demonstrated during dynamic performance testing.

BELT ADJUSTING DEVICE

Force

Requirements in USA, Japan and ECE are very similar.
ECE R16 requirements are proposed.

Tilt lock angle

ECE R-16 (micro slip test) requirements are proposed.

ATTACHMENT HARDWARE

Strength and strength of bolts

The experts experience is that the dynamic test is determining the breaking strength, always above the minimum required in the existing regulations.

AUTOMATIC LOCKING RETRACTORS

Tensile strength

The experts experience is that the dynamic test is determining the breaking strength, always above the minimum required in the existing regulations.

Retraction force

The maximum force requirements addressed by US, ECE and Japanese requirements were cancelled by the fact that the comfort oriented demands on the market will drive this value.

Lock position

FMVSS209 requirements are proposed.

Durability

FMVSS209 requirements are proposed.

EMERGENCY LOCKING RETRACTORS

Tensile strength

The experts experience is that the dynamic test is determining the breaking strength always above the minimum required in the existing regulations.

Retraction force

The maximum force requirements addressed by US, ECE and Japanese requirements were cancelled by the fact that the comfort oriented demands on the market will drive this value.

The minimum force requirements are in line with the proposal in formal document GRSP/2001/23 forwarded to the 30th GRSP.

Lock position

FMVSS209 requirements are proposed.

Durability

FMVSS209 requirements are proposed.

Web sensitivity

It is the consent of the experts that the proposed limits between 3g and 4g are appropriate for dual sensing systems addressing comfort and belt usage.

Tilt lock angle

FMVSS209 requirements are proposed.

PRE-TENSIONING DEVICE

ECE R-16 requirements are proposed.

LOAD LIMITER

Dynamic testing is proposed, without displacement measurements.

BELT ASSEMBLY

Only dynamic testing is proposed, without displacement measurements. See the introduction to this document.
Two alternatives are proposed to check requirements, to take into account the testing capabilities existing around the world.
First alternative is the ECE R16 test method.
Second alternative is also a dynamic test, using vehicle pulse derived from ISO requirements 6487:1987.

GTR (Global Technical Regulation) for Safety Belts
Comparison Table Industry Proposal/ECE R16-04/FMVSS 209/SRRV22-3

12/11/2001

ITEM	Industry Proposal	ECE	USA	Japan	Remark
Subject		ECE R16-04	FMVSS 209	SRRV 22-3	
Vehicle Application	M1 and N1 vehicles Passenger cars and light trucks	Vehicles of categories M and N	Passenger cars, MPVs, trucks and busses	Ordinary-sized motor vehicles, small-sized motor vehicles or mini-sized motor vehicles	
Definitions	Lap belt Diagonal belt Three point belt Harness belt	Lap belt Diagonal belt Three point belt Harness belt	Type 1 (lap belt) Type 2 (combination of pelvic and torso belt) Type 2a (upper torso belt in conjunction with lap belt	Type 1 seat belt Type 2 seat belt Type 2 seat belt class A (Not shoulder-to lap continuous) Type 2 seat belt class B (shoulder-to lap continuous)	
Corrosion Resistance	ISO 9227:1990 48h (2 periods of 23h + 1h drying) 1 period for parts which are not located near the vehicle floor	50h salt spray test	B117-73 50h salt spray test 25h for parts which are not located near the vehicle floor	48h salt spray test 24h for parts which are not located near the vehicle floor	
Weight and shape change of plastic parts	- No use of materials with properties of PA 6 with respect to water retention in all mechanical parts - Determination of weight and shape changes of plastics under accelerated service conditions according to ASTM D756-78	No use of materials with properties of PA 6 with respect to water retention in all mechanical parts	Temperature resistance according to ASTM D756-78	No requirement	

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12/11/2001

Buckle					
Partial engagement	No partially latch	No partially latch	Shall separate when partial engaged by a force of ≤ 22N	No requirement	
Minimum opening force	≥ 10N	≥ 10N	no requirement	No requirement	
Area of button	Enclosed: ≥4.5cm², ≥15mm Non-enclosed: ≥2.5cm², ≥10mm	Enclosed: ≥4.5cm², ≥15mm Non-enclosed: ≥2.5cm², ≥10mm	min. 4.52cm² ≥10mm	Enclosed: ≥4.5cm² ≥15mm Non-enclosed: ≥2.5cm², ≥10mm	
Durability	5,000 cycles	5,000 cycles	200 cycles	5,000 cycles	
Releasing force	≤60N under preload after dynamic test	≤60N under preload after dynamic test	133N or less	14 kgf / 137 N or less	
Compressibility	Cold impact test for rigid items and plastic parts which can be trapped: @ -10°C with a mass of 18kg from 300mm high	Cold impact test for rigid items and plastic parts which can be trapped: @ -10°C with a mass of 18kg from 300mm high	Compressibility test for buckle: shall not release under a load of 1779N	No requirement	
Belt adjusting device					
Microslip	≤25mm @ 50N	≤25mm @ 50N	Tilt lock angle: ≥30°	No requirement	
Adjusting Force	≤50N	≤50N	≤49N	49 N / 5 kgf or less	
Automatically locking Retractor					
Locking Position	≤25mm	≤30mm	≤25mm	≤25mm	
Durability	10,000 cycles	10,000 cycles	10,000 cycles	10,000 cycles	
Tensile strength	defined by dynamic test	9,800 N with D-Ring 14,700 N directly pulled	Assembly test with 11,120N for pelvic components, 6,627N for torso components	Assembly test with 11,150N for lap components, 6,650N for shoulder components 13,350N for common components	

GTR (Global Technical Regulation) for Safety Belts
Comparison Table Industry Proposal/ECE R16-04/FMVSS 209/SRRV22-3

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Emergency locking Retractor					
Vehicles sensitivity:	Passenger cars: ≤50mm (≥0.45g) Light Trucks: ≤50mm (≥0.85g)	M1 vehicles: ≤50mm (≥0.45g) Other vehicles: ≤50mm (≥0.85g)	must lock ≤25mm @ 0.7g	≤ 25 mm (0.7 G or 1.5 G)	
Webbing sensitivity	≤50mm (0.8-3.5g)	M1 vehicles: ≤50mm (0.8-2g) Other vehicles: ≤50mm (1.0-2g)	no lock ≤51mm @ 0.3g must lock ≤25mm @ 0.7g (only if no vehicle sensitivity)	> 50 mm (0.3 G) ≤ 25 mm (0.7 G) ≤ 50 mm (2.0 G)	
Tilt lock angle	15°-45°	M1 vehicles: 12°-27° Other vehicles: 12°-40°	15°-45°	> 12°	
Durability	50,000 cycles	45,000 cycles	50,000 cycles	50,000 cycles	
Tensile strength	defined by dynamic test	9,800 N with D-Ring 14,700 N directly pulled	Assembly test with 11,120N for pelvic components, 6,627N for torso components	Assembly test with 11,150N for lap components, 6,650N for shoulder components, 13,350N for common components	
Retracting Force	≥1N and ≥0,5N buckled with tension-reducing device according to proposal WP.29/GRSP/2001/23	≥2N, ≤7N (Proposal: ≥1N, ≤7N, and ≥0,5N, ≤7N buckled with tension-reducing device)	≥3N (pelvic) ≥1N, ≤5N (upper torso) ≥1N, ≤7N (both)	≥ 2.6 N (lap) 1 N ≤ RF ≤ 7 N (shoulder / shoulder-to-lap continuous)	
Measuring	At contact point of dummy on setup of dynamic test. Optionally at 45° inboard and 45° downward from the guide.	At contact point of dummy on setup of dynamic test.	Lowest force within 51mm @ 75% extension. The webbing shall pass through guide/D-Ring.	At 25% webbing retraction point.	

Straps					
Width	≥46mm @9,800N	≥46mm @9,800N	≥46mm @22N for Type1, ≥46mm @9,786N for Type2 seat belt	≥46mm @ 9,810N	
Breaking strength	defined by dynamic test. Difference between two samples shall not exceed 10% of the greater breaking load measured	≥14,700N Difference between two samples shall not exceed 10% of the greater breaking load measured	≥26,700N for lap belts, ≥22,200N for lap part and ≥17,800N for shoulder part of 3-point belts.	≥26,700N for lap belts, ≥17,700N for shoulder belts, ≥22,300N for shoulder-to-lap continuous belts	
Elongation	No requirement	No requirement	≤20% for lap belts, ≤30% for lap part and ≤40% for shoulder part of 3-point belts. Load: 11,120N	≤20% for lap belts, ≤40% for shoulder belts, ≤30% for shoulder-to-lap continuous belts Load: 11,100N	
Energy absorption	May have energy-absorbing and energy-dispensing capacities	Shall have energy-absorbing and energy-dispensing capacities	No requirement	Hysterisis: ≥ 50 % for lap belts ≥ 60 % for shoulder belts ≥ 55 % for shoulder-to-lap continuous belts Energy per meter: ≥ 539 N m for lap belts ≥ 1080 N m for shoulder belts ≥ 784 N m shoulder-to-lap continuous belts	
Resistance to abrasion	≥75% of original breaking strength after Hex bar abrasion	≥75% of original breaking strength after abrasion test with components	≥75% of required breaking strength after Hex bar abrasion	Hex bar and/or adjusting device ≥60 % of dry breaking strength.	
Resistance to light	≥75% of original breaking strength after light conditioning according to ISO 105-B02 (1978) contrast grade 4 on grey scale Standard Blue Dye No. 7 (Xenon light)	≥75% of original breaking strength after light conditioning according to ISO 105-B02 (1978) contrast grade 4 on grey scale Standard Blue Dye No. 7 (Xenon light)	≥60% of original breaking strength after light conditioning with carbon arc light	≥60 % of dry breaking strength after carbon arc.	
Resistance to cold	≥75% of original breaking strength after 1.5h @ -30°C	≥75% of original breaking strength after 1.5h @ -30°C	No requirement	≥60 % of dry breaking strength.	

	-30°C	-30°C			
Resistance to heat	≥75% of original breaking strength after 3h @ 65°C	≥75% of original breaking strength after 3h @ 65°C	No requirement	≥60 % of dry breaking strength.	
Resistance to water	No requirement since water has no effect to polyester webbing	≥75% of original breaking strength after 3h to water	No requirement	≥60 % of dry breaking strength.	
Pyrotechnic Pretensioning device	Shall operate normally after conditioning 24h @ 60°C, 2h @ 100°C, 24h @ -30°C	Shall operate normally after conditioning 24h @ 60°C, 2h @ 100°C, 24h @ -30°C	No requirement	Shall not activate by the ambient temperature 24h @ 60°C, 2h @ 100°C, 24h @ -30°C	
Elongation	No requirements	No requirements		180 mm for lap belts 250 mm for shoulder belts and for shoulder-to-lap continuous belts	
Load limiters	No requirements	In case of an frontal airbag the chest displacement in the dynamic test can be ≥24km/h @ 300mm	Elongation requirements for seating positions approved according to FMVSS 208 must not be fulfilled.	Elongation requirements can be omitted if the seat belt is subject to the dynamic test. Also, the requirement must not be fulfilled if the seat belt is to be installed on seating positions that satisfy the frontal collision requirements specified in Attachment 13.	

Dynamic test (Assembly)					
First method	Sledge test with 50km/h, 400mm stopping distance, ECE dummy. Requirement: No part of the assembly shall break and no buckle unlock	Sledge test with 50km/h, 400mm stopping distance, ECE dummy. Requirement: Dummy displacement 80 (40)-200mm pelvic 100 (50)-300mm chest or 24km/h @ 300mm chest velocity	No requirement	Sled test @48 km/h using a dummy with a mass of 75 kg. Requirement: Pelvic level 80 (40) - 200 mm Chest level 100 (50) - 400 mm These requirements must not be fulfilled if the seat belt is to be installed on seating positions that satisfy the frontal collision requirements specified in Attachment 13.	
Second method	Sledge test with 50+0-1.7km/h, reinforced vehicle body, steel seat, 95th percentile adult male dummy. Requirement: No part of the assembly shall break and no buckle unlock.				